BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

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RSK GENERAL NOTES

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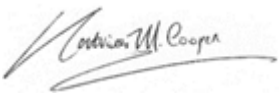
Authors: Biodiversity: Corin Simmonds; Fraser Wilkinson; Matthew Richmond
Social: Johan Van Der Walt; Hilde Van Vlaenderen; Corinne Kennedy
Stakeholder Engagement: Grace Rigby; Frankie Bailey; Sebastien Essaye
Ecosystem Services: Ellie Cooper
Cumulative Impact: Helen O'Neil; Richard Appleyard
Legal: Rachel Bendell
Marine and general: Rebecca Heath

Technical reviewer: Katrina Cooper Date: 26/07/2022



Project Manager: Rebecca Heath Date: 26/07/2022

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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A more detailed Table of Contents is provided at the start of each separate chapter.

ABBREVIATIONS

Acronym	Definition
AE	Accidental event
AIS	Alien invasive species
AIS MP	Alien Invasive Species Management Plan
ALARP	As low as reasonably practicable
ANPN	Agence Nationale des Parcs Nationaux - National Agency of National Parks
AOA	Area of Analysis
AOI	Area of Influence
AOO	Area of Occupancy
ASF	Aventures Sans Frontiéres
BAMP	Biodiversity Action and Management Plan
BAP	Biodiversity Action Plan
BAT	Best available techniques
BAU	Business as usual scenario
bbl/d	Barrels per day
BID	Background information document
BOD	Biological oxygen demand
BOP	Blowout preventor
BWE	BW Energy Gabon
BWM Convention	Ballast Water Management Convention
°C	Celsius
CCPAP	Centre Communautaire de Pêche Artisanale – Artisanal Fishing Community Centre
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEMAC	Central African Economic and Monetary Community
CEPE	Certificat d'Etudes Primaires Elémentaires - Certificate of Elementary Primary Studies
CEPP	Contrat d'Exploration et de Partage de Production – Exploration and Production Sharing Agreement

Acronym	Definition
CGSL	Gabonese Confederation of Free Trade Unions
CH	Critical Habitat
CH_4	Methane
CHA	Critical Habitat Assessment
CIA	Cumulative Impact Assessment
CIA	Central Intelligence Agency
CNAP	Centre of National Anti-Pollution
CNDIO	Centre National de Données et Informations Océanographiques – National Oceanographic Data and Information Centre
CNSS	Caisse Nationale De Security Sociale – National Social Security Fund, Gabon
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
COVID 19	Coronavirus
CR	Critically Endangered (IUCN Red List)
CSG	Gabonese Trade Union Confederation
CSI	Corporate Social Investment
dB	decibel
DD	Data deficient (IUCN Red List)
DGEA	La Direction Générale des Ecosystèmes Aquatiques - General Directorate for Aquatic Ecosystems
DGEPN	La Direction Génerale de l'Environnement et de la Protection de la Nature - General Directorate for the Environment and Nature Protection
DGFAP	Directrice Générale de la Faune et des Aires Protégées - General Directorate for Fauna and Protected Areas
DGH	Direction General des Hydrocarbures - General Directorate of Hydrocarbons
DGPA	La Direction Génerale des Pêches et de l'Aquaculture - General Directorate for Fisheries and Aquaculture
DNA	Deoxyribonucleic acid
DP	Dynamic positioning
EBSA	Ecologically or Biologically Significant Area

Acronym	Definition
EDGE	Evolutionarily Distinct and Globally Endangered Database
E&S	Environmental and Social
EEA	Exclusive Exploitation Area
EHSS	Environment, Health, Safety and Social
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
ELMO	South African Elasmobranch Monitoring
EN	Endangered (IUCN Red List)
EOO	Extent of Occurrence
EP	Equator Principles
EPFIs	Equator Principles Finance Institutions
ERM	Environmental Resources Management
ESAP	Environmental and Social Action Plan
ESDD	Environmental and Social Due Diligence
ESG	Environmental, Social and Governance
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
EU	European Union
EEZ	Exclusive Economic Zone
FAD	Fish Aggregation Device
FAQs	Frequently Asked Questions
FCFA	Central African francs
FFI	Fauna & Flora International
FGDs	Focus Group Discussions
FHG	Functional Hearing Group (marine mammals)
FPIC	Free, prior and informed consent
FPSO	Floating Drilling, Production, Storage and Offloading facility
FPSO	Floating Production, Storage and Offloading facility
FSC	Forest Stewardship Council
GBIF	Global Biodiversity Information Facility
GCLME	Guinea Current Large Marine Ecosystem

Acronym	Definition
GDP	Gross Domestic Product
GHG	Greenhouse gas
GIIP	Good international industry practice
GN	Guidance Note
GPH	Good Practice Handbook
GPM	Gabon Port Management
GPS	Global Positioning System
GSEZ	Gabon Special Economic Zone
GWP	Global warming potential
HA OI	Hibiscus Alpha Offshore Installation
HF cetacean	High frequency cetacean
HIV	Human Immunodeficiency Virus
HQ	Hazard quotient
Hz	Hertz
IALA	International Association of Lighthouse Authorities
IEG	Independent Evaluation Group
IEG	Impact Environnement Gabon (IEG) - waste management facility
IFC	International Financial Corporation
IFC PS	International Financial Corporation Performance Standard
IFIs	International Financial Institutions
IGCC	Interim Guinea Current Commission
ILO	International Labour Organisation
IMR	Infant mortality rate
INDC	Intended Nationally Determined Contribution (related to greenhouse gases)
IOGP	International Association of Oil & Gas Producers
IPCC	Intergovernmental Panel on Climate Change
IPIECA	International Petroleum Industry Environmental Conservation Association
IRAF	Institute for Agronomic and Forestry Research (Gabon)
IRD	Institute for Research and Development
IUCN	International Union for Conservation of Nature

Acronym	Definition
IUCN-CEM	International Union for Conservation of Nature - Commissions on Ecosystem Management
IWC	International Whaling Commission
JNCC	Joint Nature Conservation Committee (UK)
kHz	Kilohertz
KIIs	Key Informant Interviews
km	Kilometres
kW	Kilowatt
LAT	Lowest astronomical tide
LC	Least Concern (IUCN Red List)
LDC	Least Developed Countries
LF cetacean	Low frequency cetacean
LPG	Liquefied petroleum gas
LUCF	Land Use Change and Forestry
m	meters
MARPOL	International Convention for the Prevention of Pollution from Ships
MMO	Marine Mammal Observer
MMSCFD	Million standard cubic feet per day
MODU	Mobile Offshore Drilling Unit
MPA	Marine Protected Area
$MtCO_2e$	Metric tonnes of carbon dioxide equivalent
N/A	Not applicable
NADF	Non aqueous drilling fluid
NAVAID / NAVAREA	Navigation warnings
NDC	Nationally Determined Contribution (related to greenhouse gases)
NE	North East
NEIA	Notice of Environmental Impact
NG	Net gain
NGO	Non-Governmental Organisation
nm	Nautical miles
NMFS	National Marine Fisheries Service

Acronym	Definition
N_2O	Nitrous oxide
NOAA	National Oceanic and Atmospheric Administration
NOCPG	National Oil Contingency Plan for Gabon
NOx	Nitrogen oxides
NP	National Park
OCNS	Offshore Chemical Notification Scheme
OGP / IOGP	International Association of Oil and Gas Producers
OI	Offshore Installation
OOC	Oil on cuttings
OPRAG	Office des Ports et Rades du Gabon - Office of Ports and Harbours of Gabon
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSRL	Oil Spill Response Limited
PACs	Project affected communities
PAHs	Polycyclic aromatic hydrocarbons
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PDG	Gabonese Democratic Party
PLONOR	Poses little or no risk to the environment
POB	Persons on board
PS	Performance Standard (IFC)
PSC	Production Sharing Contract
PSGE	Plan Stratégique Gabon Emergent
PSU	Practical salinity units
PTS	Permanent threshold shift
PW	Produced water
rms	Root mean square
RoC	Republic of Congo
RPA	Routine planned activity
RSK	RSK Environment
SCI	Sources of Cumulative Impact

Acronym	Definition
SDNI	Schéma Directeur National d'Infrastructures
SEEG	Société d'électricité et d'eau du Gabon – Electricity and Water Company of Gabon
SEL	Sound exposure level
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SME	Small and medium enterprise
SMIG	Salaire Minimum Interprofessionnel Garanti – minimum wage Gabon
SMP	Social Management Plan
SOPEP	Shipboard Oil Pollution and Emergency Plan
SOx	Sulphur oxides
SPP	Suspended Particulate Phase
SRIMP	Social Risk and Impact Management Procedure
SSC	Species Survival Commission
STI	Sexually transmitted infection
TB	Tuberculosis
TDA	Transboundary Diagnostic Analysis
TEREA	Terre Environnement Aménagement
TGMP	Third-party Grievance Management Plan
TTS	Temporary threshold shift
TVET	Technical and vocational education and training
UDHR	Universal Declaration of Human Rights
UKCS	United Kingdom Continental Shelf
UN	United Nations
UNEP-CBD	United Nations Environment Program - Convention on Biological Diversity
UPEGA	Association of Petroleum Companies (Gabon)
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollars
USFWS	The United States Fish and Wildlife Service
UNHRC	United Nations Human Rights Council
VCoC	Vessel Code of Conduct

Acronym	Definition
VECs	Valued Environmental and Social Components
VHF cetacean	Very high frequency cetacean
VMS	Vessel Monitoring System
VOCs	Volatile Organic Compounds
VU	Vulnerable (IUCN Red List)
WBDF	Water based drilling fluid
WBG	World Bank Group
WCS	Wildlife Conservation Society
WHO	World Health Organisation
WRI	World Resource Institute
WWF	World Wildlife Fund

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 1: Introduction

80834

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1 INTRODUCTION

1.1 Project Overview

BW Energy Gabon (BWE) is an exploration and production company in the oil and gas sector. It is a subsidiary of BW Offshore and forms part of the BW Group.

BWE has acquired a majority interest in the Dussafu Block located off the east coast of Gabon, adjacent to Basse-Banio Department (Nyanga Province), see Figure 1.1.

The Dussafu Block encompasses the 850 km^2 Ruche Exclusive Exploitation Area (Ruche EEA) that contains six oil discoveries: Tortue, Hibiscus, Ruche, Ruche North East, Moubenga and Walt Whitman Fields, together containing a total of 112 million barrels of oil based on current development plans. BWE is focusing its development efforts on the Tortue, Hibiscus, Ruche and Ruche North East (NE) Fields.

The Ruche EEA is located approximately 50 km offshore in water depths of 70–650 m.

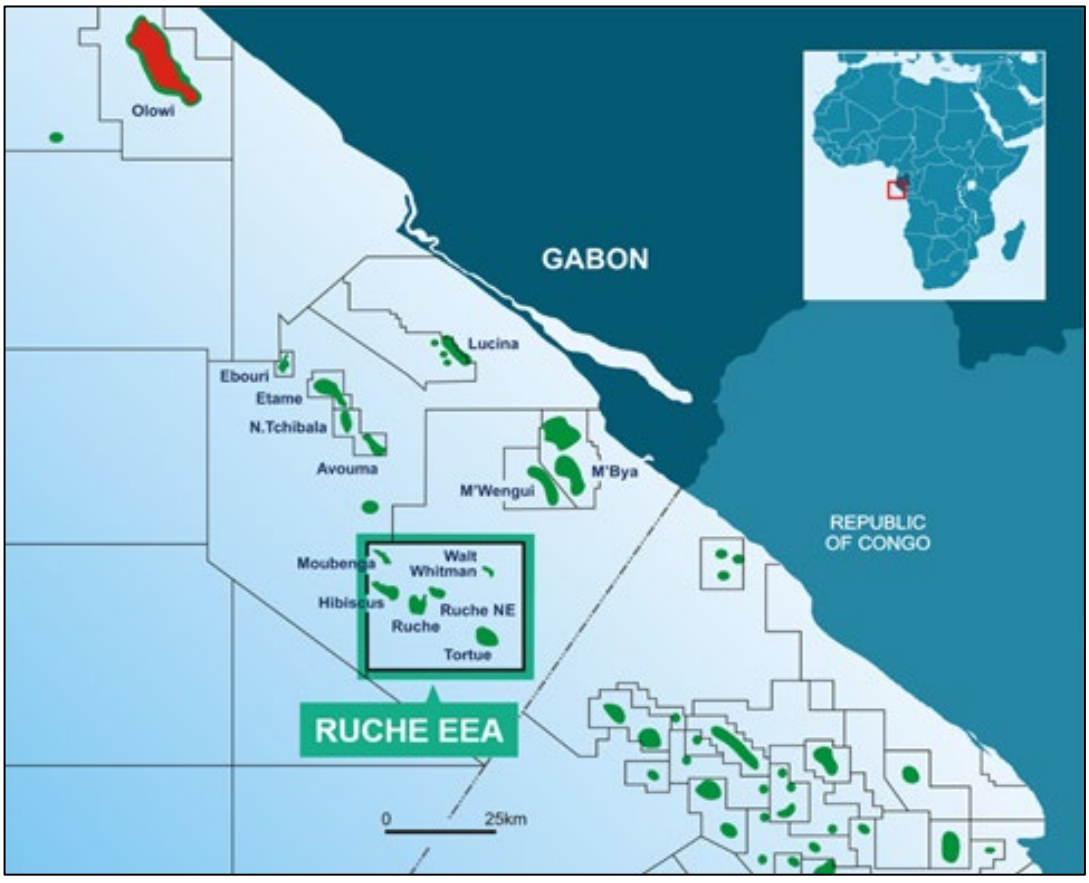

Figure 1.1 Dussafu Block, Ruche EEA and fields

Source: BW Energy (2019)

BWE has successfully initiated development activities in the Ruche EEA and reached first oil in October 2018 (Tortue Phase 1). Subsequent phases of the development are Tortue Phase 2 and Ruche Phase 1 (more information on the development phases is provided in Chapter 2).

The full field development consists of multiple wells, producing from a combination of the Gamba and Dentale formations, tied back through flowlines to the BW Adolo Floating Production Storage and Offloading (FPSO) unit, with a manned Offshore Installation (the Hibiscus Alpha OI) between the Hibiscus and Ruche Fields.

1.2 Impact Assessments Conducted to Date

BWE appointed a Gabonese environmental and social consultancy 'Enviropass', to undertake environmental and social impact assessments to meet national regulations for Tortue Phase 1 and 2 and Ruche Phase 1. The following documents have been submitted to, and approved by, the national regulator (Ministere des Eaux, des Forets, de la Mer, de l'Environnement, Charge du Plan Climat et du Plan d'Affectation des Terres (Ministry of Water, Forests, Sea, Environment, charged with Climate Change and Land-use Planning)):

- Etude d'impact Environnemental et Social Développement Phase I du champ Tortue Marine (Environmental and Social Impact Assessment (ESIA) of the Phase 1 Development Project in the Tortue Field)
- Notice d'Impact Environnemental Project de Developpement du Champ Tortue Phase 2 (Notice of Environmental Impact (NEIA) of the Phase 2 Development Project in Tortue Field)
- Notice d'Impact Environnemental Projet de forage du puits d'appréciation Ruche NE (DRNEM-1) dans le champ Ruche de l'AEE Ruche Marine CEPP Dussafu Marin n°G4-209 (NEIA for Appraisal Drilling in the Ruche North East Field)
- Etude d'impact Environnemental et Social Project de Développement du champ Ruche Phases 1 et 2 (ESIA of the Ruche Field Development Project Phases 1 and 2).

1.3 Requirement for ESIA Addendum

BWE is expanding its development and production activities in the Ruche EEA. RSK Environment (RSK) has been contracted to provide support to help ensure BWE meets the environmental and social requirements of International Financial Institutions (IFIs) on the Project. RSK has been assisted in this work by their local Gabonese partner Terre Environnement Aménagement (TEREA).

Lenders generally require that activities being funded are compliant with the environmental and social requirements stipulated in the following:

- Applicable national laws and regulations
- Equator Principles IV (dated July 2020 and effective 1 October 2020)
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012) (the IFC Performance Standards)
- World Bank Group General Environmental, Health and Safety (EHS) Guidelines (April 2007)

- World Bank Group EHS Guidelines for Offshore Oil and Gas Development (June 2015).

An Environmental and Social Due Diligence (ESDD) conducted for the Project by ERM identified a number of gaps in the content of the national ESIA / NEIA documents in relation to Lender requirements. The measures to address the gaps identified during the ESDD process are documented in an Environmental and Social Action Plan (ESAP).

1.4 ESIA Addendum Scope

The aim of this ESIA Addendum is to address some of the gaps as documented in the ESAP and to supplement the existing ESIA / NEIA documents so that the documentation and processes are collectively compliant with the Lenders' environmental and social requirements, as far as is practicable.

Many of the gaps identified are being addressed in-house by BWE, other actions / deliverables have been outsourced to RSK. It should be noted that the scope of this ESIA Addendum is mainly limited to the deliverables compiled by RSK[1], as follows:

- Critical habitats screening[2] and assessment
- Social baseline and social impact assessment
- Ecosystem services screening[3] and assessment
- Cumulative impact assessment
- Environmental and social management – Biodiversity Action & Management Plan; Alien Invasive Species Management Plan; Stakeholder Engagement Plan; Third-Party Grievance Management Procedure; Social Risk and Impacts Management Procedure; and stakeholder input to Emergency / Oil Spill Response Plans.

In addition, RSK has prepared a Legal Register (environmental, health, safety, and social (EHSS) requirements). This is a separate standalone deliverable due to its size and complexity and is referred to in more detail in Section 3.1.

The field development activities covered by this Addendum are as follows:

- Tortue Phase 1 (currently at operational phase)
- Tortue Phase 2 (currently at operational phase)
- Ruche Phase 1 (currently at execute phase (detailed design and construction / conversion are running in parallel)).

It should be noted that the BW Adolo FPSO is classed as an associated facility (see cumulative impact assessment in Chapter 10) and has been included in the impact assessments listed above as it is an integral part of the operations.

[1] Outputs from some ESAP deliverables being addressed in-house by BWE are also captured in this ESIA Addendum (e.g., mitigation measures from ESAP deliverables, revised GHG emissions).

[2] The critical habitats screening has been submitted previously as a standalone document, but key findings are summarised in this report.

[3] The ecosystem services screening has been submitted previously as a standalone document, but key findings are summarised in this report.

Ruche Phase 2, and transhipment of oil from the FPSO, are outside the scope of the impact assessments, however, they have been considered in the cumulative impact assessment in Chapter 10.

1.5 Area of Influence

The area of influence (AOI) for the impact assessments in this Addendum has been determined taking into consideration the IFC definitions[4], as follows:

Primary AOI

The primary AOI consists of the area where the main routine / planned activities of the Project take place and comprises an offshore and an onshore component.

The offshore component includes:

- the Ruche EEA, where the field development activities take place
- the expected route of the support / supply vessels between the Ruche EEA and the onshore logistics base in the port of Port Gentil
- the helicopter flight path between the Ruche EEA and the onshore heliport in Port Gentil.

The onshore component includes:

- the logistics base in the port of Port Gentil and its immediate surroundings
- the heliport in Port Gentil and its immediate surroundings
- the coastal communities in the vicinity of the Ruche EEA.

The various components of the primary AOI are presented in Figure 1.2.

Unplanned / accidental events AOI

This AOI takes into account the potential impacts of a large-scale accidental oil spill in the Ruche EEA and is based on the results of Project-specific oil spill modelling[5]. It includes the Gabonese coastline and coastal and offshore waters between the Ruche EEA and Port Gentil.

The AOI for the accidental events is shown in Figure 1.3.

Country context

A third AOI includes the entire country of Gabon and serves to provide the national context for the socio-economic baseline, identify human rights sensitivities, and support the assessment of any potential national (often indirect) socio-economic impacts.

Exceptions

There are two exceptions to the above:

- the critical habitat assessment (CHA) (Chapter 6) uses the primary AOI and unplanned / accidental events AOI described above, however, an Area of

[4] Project area of influence defined in IFC Performance Standard 1.

[5] Limited to areas mostly frequently affected by sheens (5 – 50 µm) and thicker in oil spill trajectory modelling (see Appendix 6c).

Analysis (AOA) is also used to focus the analysis of critical habitat triggering biodiversity and includes a broad suite of habitats from the shore to the abyssal plain and associated species (it includes the entirety of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park and fully encompasses the Ruche EEA)

- the Cumulative Impact Assessment (CIA) (Chapter 10) uses the primary AOI described above, however, reference is also made to a 50 km radius study area in which information on third-party developments has been collected. This larger area is defined to help ensure that all developments that may have an AOI that overlap with the Ruche AOI are identified.

Figure 1.2: Primary area of influence

Note: The alignment of both the support / supply vessel and helicopter routes are approximate as the exact alignment was not known at the time of writing

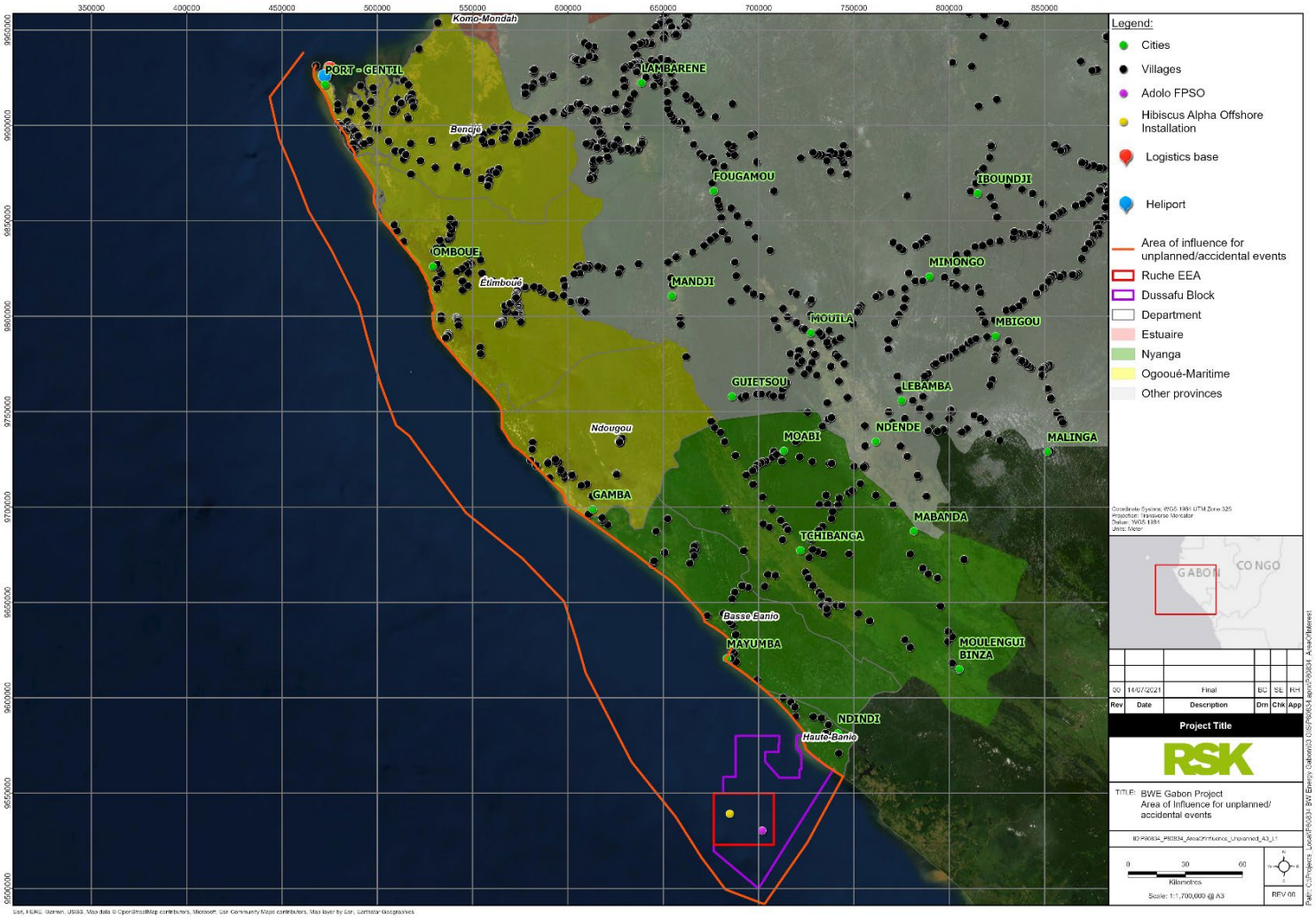

Figure 1.3: Unplanned / accidental events area of influence

1.6 Summary of Identified Gaps

Table 1.1 outlines the Table of Contents of this ESIA Addendum and the ESAP action item addressed in each chapter (more detail on each action item is provided in the BWE Pre-Financial Close Environmental and Social Assessment, February 2021).

Table 1.1: ESAP action item signposting

Chapter heading	ESAP action items addressed and description in brackets
1 Introduction	-
2 Project description	-
3 Legal and other requirements	1.1 Regulatory Action Plan (Develop a Legal Register (EHSS regulatory requirements) as part of BWE's Regulatory Action Plan stating how compliance to the conditions of issuance of the Gabon Ministry of Petroleum and Hydrocarbons will be achieved).
4 Stakeholder engagement	3.2 Stakeholder Engagement (Develop and implement a Stakeholder Engagement Plan for the Project). 3.3 Address Gaps in the National ESIAs (Develop an ESIA Addendum to supplement the Gabon national ESIA reports to meet Lenders' E&S requirements – national ESIA reports do not provide details on how stakeholder analysis, engagement, and consultation and disclosure of relevant information will take place over the duration of the Project).
5 Impact Assessment Methodology	-
6 Critical Habitat Assessment	11.2 Critical Habitat (Conduct a Critical Habitat Assessment for the Project). 3.3 Address Gaps in the National ESIAs (Develop an ESIA Addendum to supplement the Gabon national ESIA reports to meet Lenders' E&S requirements – national ESIA reports do not include a CH Assessment).

Chapter heading	ESAP action items addressed and description in brackets
7 Social Baseline	3.3 Identification of Risks and Impacts (Develop an ESIA Addendum to supplement the Gabon national ESIA report to meet Lenders' E&S requirements – national ESIA report has social impact assessment gaps).
8 Social Impact Assessment	
9 Ecosystem Services Assessment	11.1 Ecosystem Services (Conduct an assessment on ecosystems services that may be impacted by the Project).
10 Cumulative Impact Assessment	3.3 Identification of Risks and Impacts (Develop an ESIA Addendum to supplement the Gabon national ESIA report to meet Lenders' E&S requirements – national ESIA report does not include a cumulative impact analysis).
11 Environmental and Social Management	3.1 Social Risks and Impacts Identification, Assessment and Mitigation Procedure (Develop a corporate procedure for the identification, assessment and mitigation of social risks and impacts associated with all BW Energy/Offshore operations). 6.1 & 10.1 Updated Emergency Response Plan based on SEP results (Based on the outcomes of the stakeholder identification and analysis process, update the existing oil spill and emergency preparedness and response procedures / plans to include community health and safety considerations and mitigations). 7.2 Grievance Management Procedure (Develop a third-party grievance management procedure). 11.2 Critical Habitat – Biodiversity Action Plan (Develop a Biodiversity Action Plan as part of the Critical Habitat Assessment). 11.3 Alien Invasive Species Management Plan (Develop an Alien Invasive Species MP, if required, as a result of findings of the Critical Habitats Assessment).

REFERENCES

BW Energy (2019) Dussafu Marin License Offshore Gabon. CEPP Nº G4-209. Ruche EEA Ruche Platform Field Development Plan (December 2019).

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 2: Project Description

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2 PROJECT DESCRIPTION

2.1 Ruche EEA Field Development

BWE has successfully initiated development activities in the Ruche EEA and reached first oil in October 2018 (Tortue Phase 1). Subsequent phases of the development are Tortue Phase 2 and Ruche Phase 1. Figure 2.1 shows the oil fields within the Ruche EEA and existing and planned associated infrastructure.

Table 2.1 provides a summary of the development phases and more information is provided in Sections 2.1.1 to 2.1.3.

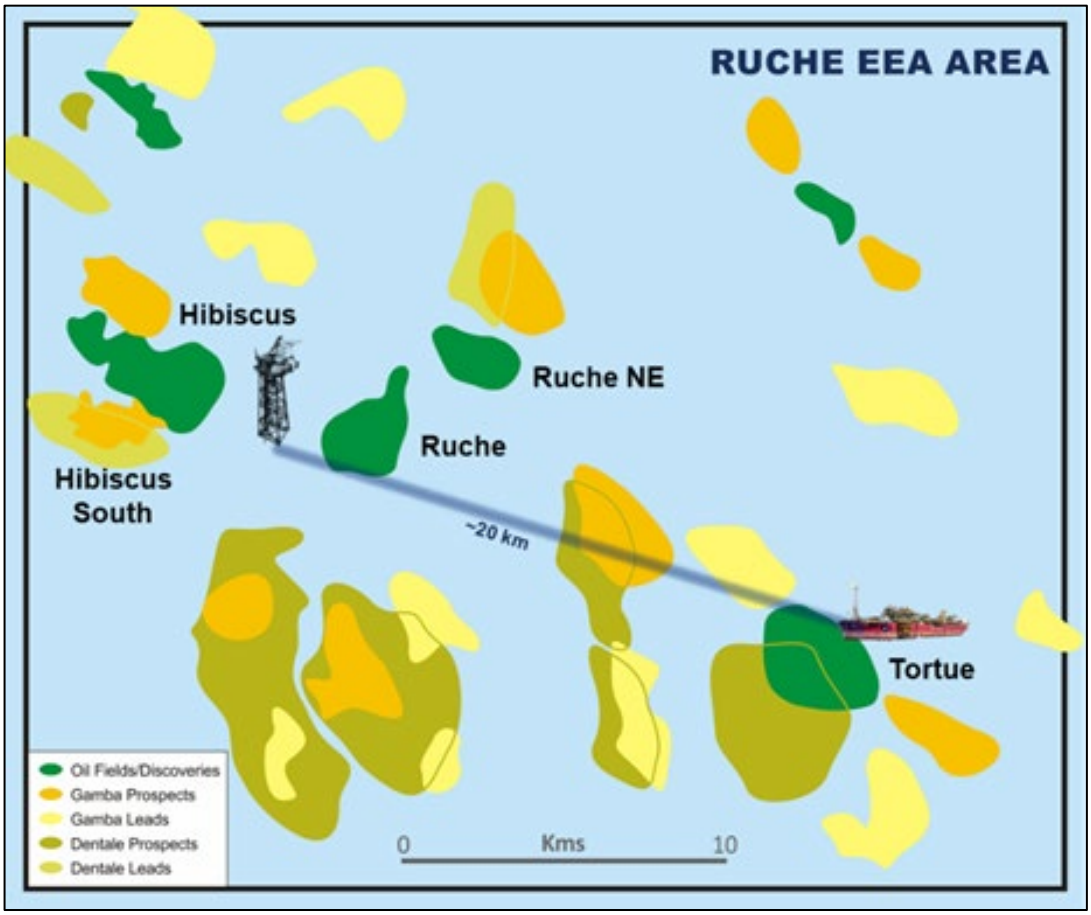

Figure 2.1: Ruche EEA offshore oil fields and existing / planned associated infrastructure

Source: BW Energy (2019)

Table 2.1: Summary of Ruche EEA development phases

	Tortue Phase 1	Tortue Phase 2	Ruche Phase 1
No. of wells	Two subsea development wells in Tortue Field • DTM-2H targeting Dentale reservoir • DTM-3H targeting Gamba reservoir Appraisal well in Ruche NE area	Four additional subsea development wells in Tortue Field • DTM-6H targeting Dentale reservoir • DTM-4H, DTM-5H and DTM-7H targeting Gamba reservoir Appraisal well in Hibiscus UpDip area	Six production wells in Hibiscus and Ruche Fields • (2) Hibiscus Gamba (1) Ruche Gamba (2) Ruche NE Gamba (1) Ruche Dentale
Supporting infrastructure	Drilled from jack-up rig Subsea wells tied back to BW Adolo FPSO Appraisal well plugged and abandoned	Drilled from jack-up rig Subsea wells tied back to BW Adolo FPSO Appraisal well plugged and abandoned	Drilled from jack-up rig nested in Hibiscus Alpha OI Production wells tied back to manned Hibiscus Alpha OI with ~ 20 km subsea flowline to BW Adolo FPSO
Progress	Production commenced September 2018 Current production 12,500 barrels per day (bbl/d)	First two wells came on-line in 2020, remaining wells came on-line in 2021 Production expected to peak at 25,000 bbl/d	Installation of Hibiscus Alpha OI expected late 3Q 2022 Drilling second half of 2022 First oil end of 2022 / beginning of 2023 Anticipated production 40,000 bbl/d

2.1.1 Tortue Phase 1

The Tortue Field is located in the southeast part of the Ruche EEA. Production commenced from the Tortue Phase 1 development in September 2018, therefore it is already in operational phase. Current production is 12,500 bopd.

The construction and installation stage of the development consisted of the following:

- Drilling of two subsea development wells in the Tortue Field using a jack-up rig. The drilling programme was supported by support / supply vessels operating from the Project logistics base at Port-Gentil and a shuttle helicopter operating from Port-Gentil heliport.
- Installation of a seabed manifold and two 6” inch subsea flowlines from the development wells to the FPSO over a length of approximately 750 m.
- Installation of two umbilical lines for well control and monitoring from the FPSO.

- Installation of the BW Adolo FPSO (Figure 2.2) and commissioning.

Figure 2.2: BW Adolo FPSO

Source: BW Energy (2019)

The operational stage of Tortue Phase 1 consists of the following:

- Storage and processing of hydrocarbons on the FPSO (oil / gas / water separation)[1] and marketing of crude oil by transhipment to oil transportation tankers (hydrocarbon transfer operations carried out once a month with the assistance of two vessels).
- Well production is enhanced by gas lift that is provided by a discharge compression unit and a gas lift manifold control unit on the FPSO.
- Helicopters used for crew change on the FPSO and support vessels for materials and waste transfer. These operational activities are managed from the FPSO.

In addition to the above, an appraisal well was drilled in the Ruche North East area in 2018 as part of Tortue Phase 1. Well testing demonstrated that it was a successful well, however it was plugged and abandoned as it was not intended to be a producer.

2.1.2 Tortue Phase 2

Tortue Phase 2 is now at operational phase. The construction and installation stage consisted of the following:

[1] The BW Adolo FPSO has a processing capacity of 40,000 barrels of oil per day (bopd), 18 million standard cubic feet of gas per day (mmscfd) and 60,000 barrels liquids production capacity per day (blpd). The FPSO is designed for 15 years of uninterrupted operation without the need for mooring disconnection or dry-docking.

- Drilling of four development wells in the Tortue field using a jack-up rig. The drilling programme was supported by support / supply vessels operating from the Project logistics base at Port-Gentil and a shuttle helicopter.
- Installation of subsea manifolds and flowlines to connect the development wells to the BW Adolo FPSO.

Tortue Phase 2 was sanctioned in late 2018, however, owing to the Covid-19 pandemic the drilling campaign was suspended in early 2020. As a result, two wells came on-line in 2020 and the remaining two wells came in-line in 2021.

The operational stage of Tortue Phase 2 is the same as that for Tortue Phase 1, production is expected to peak at 25,000 bopd.

An appraisal well was drilled in the Hibiscus UpDip area in 2019 as part of Tortue Phase 2. Well testing demonstrated that it was a successful well, however it was plugged and abandoned as it was not intended to be a producer.

2.1.3 Ruche Phase 1

The Ruche Field in the central part of the Ruche EEA (see Figure 2.1). Ruche Phase 1 is currently in execute phase with detailed design, construction / conversion currently underway. Drilling of the first production well is expected to take place in the second half of 2022, with first oil expected end of 2022 / beginning of 2023.

The construction and installation stage of this phase will consist of the following:

- Installation of a manned offshore installation (OI) (converted mobile offshore drilling unit (MODU))[2] between the Hibiscus and Ruche Fields in approximately 117 m water depth (expected installation late 3Q 2022). The Hibiscus Alpha OI will support the on-deck wellheads and there will be primary oil and water processing on the installation. A schematic of the Hibiscus Alpha OI is presented in Figure 2.3 and design parameters are provided in Table 2.2.
- Installation of a 12” insulated subsea flowline between the Hibiscus Alpha OI and the BW Adolo FPSO in Tortue Field (approximately 20 km) (see Figure 2.1). Final processing, storage and cargo offtake will take place at the FPSO.
- Drilling of four horizontal production wells in the Hibiscus Field and two horizontal production wells in the Ruche Field from a jack-up rig nested in the Hibiscus Alpha OI. Table 2.3 provides summary information on the development wells. The drilling programme will be supported by support / supply vessels operating from the Project logistics base at Port-Gentil and a shuttle helicopter.

The operational stage of Ruche Phase 1 will be the same as that for Tortue Phase 1 and Phase 2 along with operation of the Hibiscus Alpha OI. Production is expected to peak at 40,000 bopd. Due to the expected reservoir decline and water cut increase over the production lifecycle, the wells will have electrical submersible pumps for lifting fluids from the wellbores.

[2] The MODU rig conversion will be completed in a shipyard in Dubai (United Arab Emirates).

The Hibiscus Alpha OI will have 12 conductor slots in order to accommodate a further six additional wells planned over the western part of the Ruche EEA as part of Ruche Phase 2 Project.

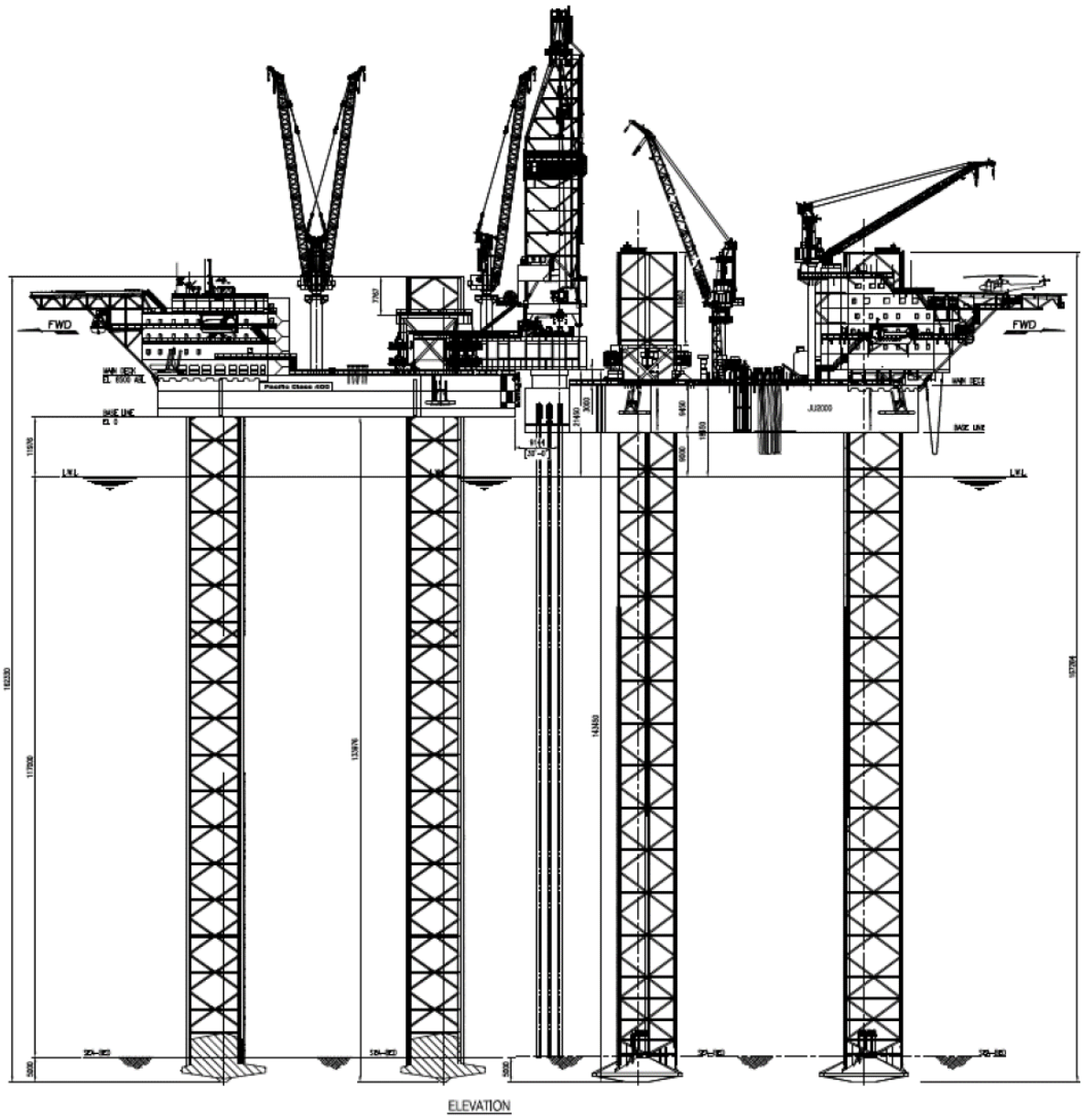

Figure 2.3: Hibiscus Alpha Offshore Installation Schematic

Source: BW Energy (2021)

Table 2.2: Summary of Hibiscus Alpha Design Parameters

Description	Design parameters
Location (tentative)	X 684 911 Y 9 539 187 + 117 m water depth lowest astronomical tide (LAT)
Facility description	Converted from 400 ft jack-up MODU (3 leg triangular) to an Offshore Installation On location to support twelve wells Reserve deck space / riser and umbilical slots for future subsea tiebacks Manned facility (POB 20)
Design life	20 years
Simultaneous drilling and production	Possible with cantilevered rig
Well bay	12 production dry tree wells
Vent / flare boom	Provided
Power generation	Main power: diesel generator (6 units – each 910 kW)[3] Emergency power: diesel generator Topsides power genset: fuel gas

Source: Adapted from BW Energy (2021)

Table 2.3: Ruche 1 development wells – summary information

Hole section	Length	Drilling fluid system	Discharge depth and treatment
26”	62 m	Water-based drilling fluid (WBDF) seawater / high viscosity sweep mud system	Discharged at seabed during riserless drilling
17 ½“	938 m	WBDF seawater / bentonite mud system	Discharged from rig -15 m below sea level, treatment on rig to minimise fluids on cuttings (shale shakers, desander, desilter)
12 ¼“	1400 m	WBDF seawater / bentonite mud system	
	1000 m	Non-aqueous drilling fluid (NADF) Versaclean (OGP Group III)	Discharged from rig -15 m below sea level, treatment on rig to minimise fluids on cuttings (shale shakers, desander, desilter and Verti-G centrifugal cuttings drier)
8 ½“	495 m	NADF Versaclean (OGP Group III)	

Source: Adapted from Enviropass (2020)

[3] Gas fired generators will be used during early field life when fuel gas is readily available, however, production profiles indicate that available associated gas is likely to drop below the quantities required to meet Hibiscus Alpha OI power demand. At this point the facility will switch to diesel powered generators.

2.2 Logistics Base

The offshore fields are supported by the logistics base, which is located in the existing commercial port of Port Gentil, see Figure 2.4.

Activities at the base include loading and offloading of Project supply vessels; casing and tubing inspection; delivery of equipment from freight forwarder / workshop to BWE; equipment storage; temporary small-scale storage of chemicals before they go offshore[4]; and waste transfer (no waste treatment).

Facilities at the logistics base include:

- pipe / storage yard (5225 m^2)
- 80 m long quay (draft 7 m)
- warehouse (1900 m^2).

These facilities are shown in Figure 2.4.

Discharges from the logistics base are limited to rainwater runoff. These are only permitted from non-contaminated areas. For other areas, where there is the potential for spillages, containment is in place. Sanitary discharge from the site goes to septic tank.

The logistics base is connected to the electrical grid of the port. In addition, there is one back-up generator present on site (to be used only in case the electrical grid power supply is unavailable).

In terms of water supply, the logistics base is connected to the Port Gentil water supply and a 200 m^3 storage tank is utilised on site.

[4] Project related chemicals are stored off site at service contractor's warehouses. Drilling fluid mud plant is at service contractor's premises.

Figure 2.4: Location of logistics base and layout

Source: Provided by BW Energy

2.3 Emissions, Discharges and Sources of Impact

Table 2.4 provides a summary of the emissions, discharges and sources of impact generated by the current and future phases of the Ruche EEA field development Project (i.e., operational phase of Tortue Phase 1; operational phase of Tortue Phase 2; and construction / installation, drilling, and operational phase of Ruche Phase 1; and decommissioning of all phases of the Project).

Table 2.4: Overview of emissions, discharges and sources of impact generated by the Ruche EEA field development

Activities	Emissions / discharges / sources of impact
Drilling programmes (Ruche Phase 1)	
Installation of the jack-up rig	Physical disturbance of seabed Uptake and discharge of seawater for preloading foundation
Physical presence of rig	500 m safety exclusion zone
Drilling of upper well sections with water-based drilling fluid (WBDF)	Discharge of cuttings and associated WBDF to sea, see Table 2.3 735 t cuttings generated per well according to Ruche Phase 1 ESIA (containing 99 t WBDF)
Drilling of lower well sections with non-aqueous drilling fluid (NADF)	Discharge of cuttings and associated NADF to sea, see Table 2.3 NADF Versaclean system - base fluid Escaid 120 classified as OGP Group III. Contains less than 0.001% Polycyclic Aromatic Hydrocarbons (PAHs) Maximum allowed oil on cuttings 3%, in line with World Bank guidelines for existing facilities[5] (non-compliant cuttings returned to Port-Gentil)[6] 248 t cuttings generated per well according to Ruche Phase 1 ESIA (containing 6 t NADF) No discharge to sea of whole NADF (backloaded after use in well). Untreatable slops either placed in abandoned wellbores (between cement plugs) or transferred for treatment and / or disposal onshore. Small volumes of slops can be treated and then put back into the reconditioned mud systems for further use

[5] 'World Bank EHS Guidelines – Offshore Oil and Gas Development' (2015) stipulate that for existing facilities: Use of Group III NADF and treatment in cuttings dryers, maximum residual NADF 6.9% on wet cuttings. Definition of existing facilities includes 'offshore drilling rigs deployed for development well drilling programmes'. Drilling rig for Ruche Phase 1 classed as an existing facility in line with this definition.

[6] According to the Ruche Phase I and 2 ESIAs, BWE evaluated the Best Practicable Environmental Option (BPEO) for cuttings management for the Ruche and Hibiscus development wells (offshore reinjection, onshore treatment and disposal and offshore discharge). The BPEO approach took into account the environmental sensitivity of the area concerned, the feasibility of possible technical options in the country, the cost, and health and safety considerations. After a review of previous studies in southern Gabon, BWE concluded that offshore discharge of cuttings is the best possible environmental option, taking into account feasibility, costs, and HSE risks; providing that the oil content of the cuttings is within the required limits.

Activities	Emissions / discharges / sources of impact
Other drilling discharges	During cementing of the surface hole section some excess cement will be displaced into the water column and onto seabed Pipe dope[7] not discharged but small quantities may enter water column during drilling of 26" hole section Blowout preventors (BOPs) will be tested every 21 days, however, as these are surface BOPs there will be no discharge of hydraulic control fluids to sea
Drilling rig operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), cooling water	Sanitary wastewater treated onboard in accordance with MARPOL 73/78 Annex IV, chlorine concentration of effluent < 1 mg/l Food waste macerated and discharged > 12 nm from shore in accordance with MARPOL 73/78 Annex V Deck drainage and bilge water ≤ 15 ppm oil in water in accordance with MARPOL 73/78 Annex I. Use of low toxicity biodegradable detergents in deck wash Cooling water temperature discharge limit not stipulated in ESIA / NEIA documents. According to the World Bank Group effluent limits, cooling water discharged should result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution take place
Emissions from power generation on rig	GHG calculations for the Borr Norve drilling rig are provided in Table 2.5 (emissions based on rig diesel combustion up to Q2 2021 and projected emissions thereafter) No well testing of Tortue Phase 2 or Ruche 1 production wells
Underwater noise from drilling rig operations	Continuous low-level underwater noise generated from jack-up rig operation
Lighting of rig	Light spill
Hibiscus Alpha OI – installation & commissioning (Ruche Phase 1)	
Installation and jack-up of OI	Physical disturbance to seabed Uptake and discharge of seawater for preloading foundation (no piling involved)
Hibiscus Alpha OI – operation & maintenance (Ruche Phase 1)	
Physical presence of OI	1 km safety exclusion zone
OI operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), cooling water	See above for 'drilling rig operational discharges' Cooling water discharge from steam turbine generators 458 m^3/s at 34.5°C (salinity 20 PSU)
Discharge of separated produced water (PW)	PW discharge maximum of 54,000 bbl/d at 92.2°C (salinity 279 PSU) Discharged to sea if oil content < 30 mg/l (non-compliant produced water diverted to slops tank and retreated until back within specification) Figure 2.5 presents the predicted PW production for the Ruche EEA field development

[7] Pipe dope is a thread lubricant that is used to make a pipe thread joint leak proof and pressure tight.

Activities	Emissions / discharges / sources of impact
Emissions from power generation and flaring on OI	Separated LP gas sent to gas compression unit. HP gas used for power generation on the OI (supplemented by diesel power generation) and activation of electrical submersible pumps, portion flared off (production flaring and fuel gas consumption for flare pilot and purging 3.4 t / m). Also commissioning flaring when wells are connected to process facility Projected GHG calculations for the Hibiscus Alpha are provided in Table 2.5 (fuel gas / diesel combustion emissions and flaring)
Underwater noise from OI operations	Underwater noise generated by OI anticipated to be negligible
Lighting of OI	Light spill
Chemical injection into oil stream	Demulsifiers and asphaltene inhibitors injected into production fluids, small quantity of production chemicals may end up in PW stream, concentrations will be low
Subsea flowlines and umbilicals – installation & commissioning (Ruche Phase 1)	
Installation of pipelines and cables	Physical disturbance of seabed
Subsea pipeline commissioning	Discharge of hydrostatic test water will be carried out in line with BWE's 'Environmental Performance Requirements in Selection of Chemical Products for Offshore Use' (in draft)
Subsea flowlines & umbilicals – operation & maintenance (Tortue Phase 1, 2 and Ruche Phase 1)	
Flowline pigging operations	Pigging waxes generated from subsea pipeline commissioning and maintenance. Chemicals used to soften paraffin (e.g., ALCO's Flotron WD 1000). HA OI and FPSO able to launch and receive pigs Pigging waxes collected on HA OI and FPSO transferred to shore for treatment / disposal
BW Adolo FPSO upgrades (Ruche Phase 1)	
Modifications to FPSO to accommodate increased production	No emissions or discharges anticipated
BW Adolo FPSO – operation & maintenance (Tortue Phase 1, 2 and Ruche Phase 1)	
Physical presence	1 km safety exclusion zone around FPSO
FPSO operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water	See above for 'drilling rig operational discharges' plus ballast water uptake and discharge Cooling water discharge from process 1089 m^3/h at 30°C (salinity 20 PSU) Cooling water discharge from steam turbine generators 2,875 m^3/hr at 33°C (salinity 20 PSU)
Discharge of separated produced water	PW discharge maximum of 60,000 bbl/d at 46.11°C (salinity 279 PSU). Current discharge 32,000 bbl/d Discharged to sea if oil content < 30 mg/l (non-compliant produced water diverted to slops tank and retreated until back within specification) Figure 2.5 presents the predicted produced water production for the Ruche EEA field development

Activities	Emissions / discharges / sources of impact
Emissions from power generation and flaring on FPSO	Design philosophy is to utilise HP associated gas from the inlet production and test separators as fuel gas (until 2025 when an alternate fuel source will be required as associated gas no longer sufficient) and to flare associated gas that is surplus to the FPSO power and heating needs (projected flaring estimate 2 MMSCFD) GHG calculations for the BW Adolo FPSO are provided in Table 2.5 (emissions based on mainly fuel gas combustion emissions and flaring up to Q2 2021 and projected emissions based on fuel gas / diesel combustion emissions and flaring thereafter).
Underwater noise from FPSO operations	Continuous low-level underwater noise generated from FPSO operation
Lighting of FPSO	Light spill
Support / supply vessel and construction vessel operations Drilling operations (Ruche Phase 1) - 2 support vessels to mobilise jack-up rig, 2 vessels (1 support vessel, 1 supply vessel) supporting drilling operations Construction vessels (Ruche Phase 1) - 1 installation vessel and 2 support vessels for installation of Hibiscus Alpha OI, pipelay barge for installation of flowline and possible second pipelay barge for installation of umbilical Operation (Tortue Phase 1, 2 and Ruche Phase 1) - vessel support during operation (supply vessel visits to HA OI and FPSO from logistics base), 2 vessels assisting hydrocarbon offloading activities at the FPSO Support / supply vessel transfers - 3 transfers per month from logistics base to Ruche EEA during operations, 15 transfers per month from logistics base to Ruche EEA during drilling periods	
Vessel operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water	See 'FPSO operational discharges'
Emissions to air from vessel engine exhausts	GHG estimates for support vessel operations are provided in Table 2.5 (based on diesel combustion emissions up to 2021 and projected thereafter)
Underwater noise from vessel movements	Continuous underwater noise generated by support / supply vessel transfers and construction vessel movements
Lights on vessels	Light spill
Helicopter support activities (Tortue Phase 1, 2 and Ruche Phase 1) Helicopters used for drilling, OI and FPSO crew changes 20 flights / month during operations 40 flights / month during drilling periods	
Emissions to air from helicopter exhausts	GHG estimates for helicopter operations are provided in Table 2.5 (based on kerosene jet fuel combustion emissions up to 2021 and projected thereafter)
Airborne noise from helicopter transfers	Increased noise levels along helicopter flight path to heliport in Port Gentil

<table>
<tr><th>Activities</th><th>Emissions / discharges / sources of impact</th></tr>
<tr><td colspan="2">Logistics base operation</td></tr>
<tr><td>On-site power generation emissions</td><td>Power at logistics base sourced from SEEG (Societe d’electricite et d’eau du Gabon), gas oil generator used as back-up source</td></tr>
<tr><td>Discharges</td><td>Discharge of rainwater drainage from uncontaminated areas</td></tr>
<tr><td colspan="2">General</td></tr>
<tr><td>Waste management</td><td>Onshore disposal of wastes. Waste volumes (m^3) provided below:
<table>
<tr><th></th><th colspan="2">2019</th><th colspan="2">2020</th><th colspan="2">2021 (to Aug)</th></tr>
<tr><th></th><th>Haz</th><th>Non-haz</th><th>Haz</th><th>Non-haz</th><th>Haz</th><th>Non-haz</th></tr>
<tr><td>Drilling</td><td></td><td></td><td>266</td><td>238</td><td>114</td><td>395</td></tr>
<tr><td>Prod / Projects</td><td>381</td><td>1079</td><td>5</td><td>613</td><td>63</td><td>637</td></tr>
<tr><td>Office</td><td></td><td></td><td>0</td><td>36</td><td>0</td><td>24</td></tr>
<tr><td>Total</td><td>381</td><td>1079</td><td>271</td><td>957</td><td>177</td><td>1056</td></tr>
</table></td></tr>
<tr><td>Local employment</td><td>Estimated that 426 employees will be involved in BWE’s activities in Gabon
The upcoming Ruche Phase 1 will bring an additional number of positions (approximately 40), which will require skilled, semi-skilled, and unskilled personnel</td></tr>
<tr><td colspan="2">Decommissioning</td></tr>
<tr><td>Decommissioning of facilities</td><td>A Site Abandonment and Rehabilitation Plan will be developed for the Project, anticipated that:
static flowlines will be abandoned in place (plugged and matted)
flexible risers disconnected at seabed and vertical section recovered, subsea end plugged and matted
flexible jumpers cut in sections and removed
pipeline end manifolds and subsea umbilical termination assemblies removed
control umbilical abandoned in place cut at touch-down point and vertical section removed, subsea end crimped and matted
hydraulic and electrical flying leads disconnected, spooled and recovered</td></tr>
</table>

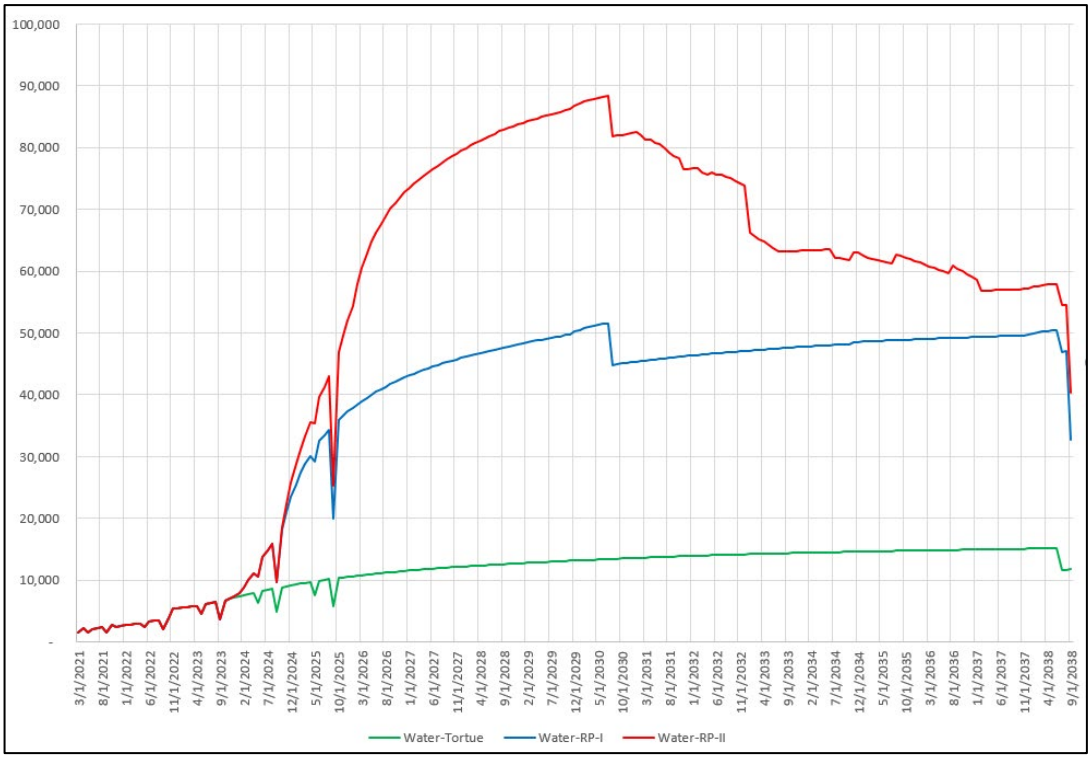

Figure 2.5: Ruche EEA predicted produced water production (bbl/d)

Source: BW Energy (2021)

Note: Only the produced water from Tortue (green line) and Ruche Phase 1 (blue line) are applicable to the impact assessments in Chapters 6, 8 and 9. Produced water from Ruche Phase 2 (red line) is only considered in the cumulative impact assessment in Chapter 10.

	2018	2019	2020	2021	Jan 2022 - Dec 2038	Totals	Scope*
BW Adolo	29847.24	97500.97	123618.29	122107.39	2048085.04	2421159	1
Hibiscus Alpha	0.00	0.00	0.00	0.00	533226.67	533227	1
Borr Norve/Drill Rig	17673.43	10930.56	6317.01	5670.26	19819.80	60411	3
Support Vessels	21193.40	10956.21	10448.74	17621.84	236047.01	296267	3
Helicopters	1385.44	1490.32	953.88	1261.51	25012.84	30104	3
Purchased Electricity	25.59	43.34	38.72	49.28	1675.56	1832	2
Scope 1, 2 & 3 (tCO_2e):	70125.11	120921.40	141376.64	146710.29	2863866.92	3343000	
Scope 1 only (tCO_2e):	*29847.24*	*97500.97*	*123618.29*	*122107.39*	*2581311.71*	*2954386*	

2018 - 2038	
Emissions from Flare combustion sources:	1144565 tCO_2e
Flaring as % of Scope 1 emissions:	38.7 %
Emissions from Diesel combustion (Scope 1 sources):	893033 tCO_2e
Combustion of Diesel as % of Scope 1 emissions:	30.2 %
Emissions from Fuel Gas combustion (Scope 1 sources):	916788 tCO_2e
Combustion of FG as % of Scope 1 emissions:	31.0 %
Emissions from Diesel combustion (Support Vessels & Drilling):	336858 tCO_2e
Scope 3 Diesel emissions as % of total emissions:	10.1 %
Emissions from Kerosene combustion (helicopters):	30104 tCO_2e
Scope 3 Kerosene emissions as % of total emissions:	0.90 %
Scope 2 (purchased electricity):	1832 tCO_2e
Scope 2 emissions as % of total emissions:	0.05 %

* Scope 1: direct emissions; Scope 2: indirect emissions from energy consumption; Scope 3: other indirect emissions (as defined in IPIECA / API / IOGP, 2011)

Table 2.5: Dussafu Block GHG emissions (based on actual emissions up to 2021 and projected thereafter)

Source: BW Energy, 2022

REFERENCES

BW Energy (2022) Dussafu Block GHG Emission Calculations (Rev07, July 2022).

BW Energy (2021) BW Energy Gabon – Ruche / Hibiscus Development Update (February 2021).

BW Energy (2019) Dussafu Marin License Offshore Gabon. CEPP Nº G4-209. Ruche EEA Ruche Platform Field Development Plan (December 2019).

Enviropass (2020) Etude d'impact Environnemental et Social Project de Développement du champ Ruche Phases 1 et 2 (ESIA of the Ruche Field Development Project Phases 1 and 2).

IPIECA / API / IOGP (2011) Petroleum industry guidelines for reporting greenhouse gas emissions guidelines (2nd edition, 2011).

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 3: Legal & Other Requirements

80834

RSK GENERAL NOTES

Project No.: 80834

Title: ESIA Addendum – Dussafu Block Development, Gabon
Chapter 3

Client: BW Energy Gabon

Date: 26 July 2022

Office: Helsby

Status: Rev_02

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TABLES

3 LEGAL & OTHER REQUIREMENTS

3.1 National Regulatory Requirements

The legal hierarchy in Gabon is understood to consist of the following:

- the constitution
- ratified conventions and treaties
- laws
- regulations (including decrees and orders).

A standalone Legal Register has been developed and issued separately for the Dussafu Project that pulls together environmental, health, safety and social requirements from applicable national legislation and conventions and treaties ratified by Gabon (RSK document reference: P80834/04/04_Rev00). RSK utilised national consultancy TEREA to assist with this work scope. Available national legislation and international conventions were sourced, translated where necessary, and requirements that BWE must action / implement were identified and consolidated into an Actionable Items Matrix for use in compliance assurance activities.

3.2 Lender Standards and Guidelines

Lenders generally require that the activities being funded are compliant with the environmental and social requirements stipulated in the following:

- applicable national laws and regulations (see above)
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012) (the IFC Performance Standards)
- Equator Principles IV (dated July 2020 and effective 1 October 2020)
- World Bank Group General Environmental, Health and Safety (EHS) Guidelines (April 2007)
- World Bank Group EHS Guidelines for Offshore Oil and Gas Development (June 2015).

These are discussed in more detail below.

3.2.1 IFC Performance Standards

The IFC's Performance Standards (PS) offer a comprehensive and practical approach to managing environmental and social risks for private investments in emerging markets and are considered an international benchmark.

The following PSs are considered most applicable to this ESIA Addendum:

- PS 1: Assessment and Management of Environmental and Social Risks and Impacts
- PS 2: Labour and Working Conditions

- PS 4: Community Health, Safety, and Security
- PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

In addition, parts of other IFC standards, such as 'PS 3: Resource Efficiency and Pollution Prevention' are relevant. IFC PS requirements for each of the deliverables are discussed below.

3.2.1.1 Stakeholder Engagement

Stakeholder engagement activities conducted during the studies have been aligned with the requirements of IFC PS 1 (IFC, 2012). This establishes various requirements for stakeholder engagement:

- Stakeholder engagement must establish and maintain a constructive relationship with a variety of external stakeholders over the project's lifecycle. The engagement process should allow the views, interests, and concerns of different stakeholders, particularly of the local communities directly affected by the project (affected communities) to be heard, understood, and considered in project decisions and the creation of development benefits.
- Affected communities are defined as any people or communities located in the geographical proximity of the project, particularly those contiguous to the existing or proposed project facilities who are subject to actual or potential direct project-related risks and/or adverse impacts on their physical environment, health, or livelihoods.
- Stakeholder engagement may involve the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, a grievance mechanism, and ongoing reporting to affected communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development (e.g., planning, construction, operation, and closure).
- The project sponsor (BWE in the case of this Project) will develop and implement a Stakeholder Engagement Plan (SEP) that is scaled to the project risks and impacts / development stage and tailored to the characteristics and interests of the affected communities. Where applicable, the SEP will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable.
- Consultation should focus inclusive engagement on those directly affected, as opposed to those not directly affected, including men, women, the elderly, youth, displaced persons, and vulnerable and disadvantaged persons or groups.
- The consultation process should capture both men's and women's views, if necessary, through separate forums or engagements, and reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate.

- If a project is likely to engender risks to, or adverse impacts on, affected communities, a grievance mechanism must be established.

IFC PS 1 underlines that the disclosure of relevant project information helps affected communities and other stakeholders understand project risks, impacts, and opportunities. The project sponsor must provide stakeholders with access to relevant information on:

- the project's purpose, nature, and scale
- the duration of proposed project activities
- any risks to, and potential impacts on, such communities, and relevant mitigation measures
- the envisaged stakeholder engagement process
- the grievance mechanism.

The timing and method of disclosure is not specified, as IFC PS 1 deems that this may vary according to national legal requirements, the characteristics and needs of the affected communities, the type of assessment involved, and the stage of the project's development or operation. IFC PS 1 does, however, specify that disclosure should be as early as possible.

In addition to the requirements of IFC PS 1, specific requirements for grievance mechanisms are outlined in other Performance Standards, including IFC PS 2 (on Labour and Working Conditions) and IFC PS 4 (on Community Health, Safety and Security).

3.2.1.2 Critical Habitat Assessment

The Critical Habitat Assessment has been conducted in accordance with the requirements and criteria of IFC PS 6 (IFC, 2012).

IFC PS 6 provides five criteria to follow with definitions and thresholds set out for each criterion. If there are features within the project area that match the definitions and thresholds provided, then they will trigger critical habitat. Species and habitats can be considered features and can trigger more than one criterion. The criteria are listed under the following headings:

- Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species
- Criterion 2: Endemic or restricted-range species
- Criterion 3: Migratory or congregatory species
- Criterion 4: Highly threatened and/or unique ecosystems
- Criterion 5: Key evolutionary processes.

IFC PS 6 requires clients to not implement any project activities in areas of critical habitat unless all of the following are demonstrated:

- no other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
- the project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;

- the project does not lead to a net reduction in the global and/or national/regional population of any CR or EN over a reasonable period of time; and
- a robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management programme.

In areas of critical habitat, the client will be expected to demonstrate net gains in biodiversity values for which the critical habitat was designated, as stated in paragraph 18 of IFC PS 6. A Biodiversity Action Plan (BAP) is required for projects located in critical habitat. The BAP should describe how the project will meet the specific requirements for critical habitat.

3.2.1.3 Social Impact Assessment

The social impact assessment has been conducted in line with IFC PS 1, PS 2, and PS 4 (IFC, 2012).

IFC PS 1 underscores the importance of managing social and environmental performance throughout the life of a project by using a dynamic social and environmental management system. Specific objectives of this PS are to:

- identify and evaluate environmental and social risks and impacts of the project
- adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise, and, where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment
- promote improved environmental and social performance of clients through the effective use of management systems.

IFC PS 2 requirements have been in part guided by a number of international conventions negotiated through the International Labour Organization (ILO) and the United Nations (UN). Specific objectives are to:

- establish, maintain and improve the worker-management relationship
- promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws
- protect the workforce by addressing child labour and forced labour
- promote safe and healthy working conditions, and to protect and promote the health of workers.

IFC PS 4 recognises that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase risks arising from accidents, releases of hazardous materials, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this PS addresses the project sponsor's responsibility in respect of community health, safety and security.

3.2.1.4 Ecosystem Services Assessment

Ecosystem services is a transdisciplinary topic; hence, it is covered under several of the IFC Performance Standards.

IFC PS 6 is the most relevant and requires the conducting of “a systematic review to identify priority ecosystem services”. Priority ecosystem services are two-fold and refer to:

- Type 1 ecosystem services: those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts on affected communities and/or
- Type 2 ecosystem services: those services on which the project is directly dependent for its operations (e.g., water).

When affected communities are likely to be impacted, they should participate in the determination of priority ecosystem services in accordance with the stakeholder engagement process as defined in IFC PS 1.

With respect to impacts on priority ecosystem services of relevance to affected communities, and where the client has direct management control or significant influence over such ecosystem services, adverse impacts should be avoided. If these impacts are unavoidable, the client will minimise them and implement mitigation measures that aim to maintain the value and functionality of priority services. With respect to impacts on priority ecosystem services on which the project depends, clients should minimise impacts on ecosystem services and implement measures that increase the resource efficiency of their operations, as described in IFC PS 3.

3.2.1.5 Cumulative Impact Assessment

The cumulative impact assessment (CIA) has been conducted in accordance with the requirements and criteria of IFC PS 1 (IFC, 2012).

This PS requires that cumulative impacts are taken into account in defining the area of influence of a project. It also states that “where the project involves specifically identified physical elements, aspects and facilities that are likely to generate environmental and social impacts, the identification of risks and impacts will take into account the findings and conclusions of related and applicable plans, studies, or assessments prepared by relevant government authorities or other parties that are directly related to the project and its area of influence. These include master economic development plans, country or regional plans, feasibility studies, alternatives analyses, and cumulative, regional, sectoral, or strategic environmental assessments where relevant”.

Performance Standard 1, footnote 16, limits the cumulative impacts to be addressed to “those impacts generally recognized as important on the basis of scientific concerns and/or concerns from affected communities”.

3.2.2 Equator Principles

The Equator Principles is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making.

In line with the Equator Principles, the Dussafu Project has been classified as Category A – “Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented”.

A revision to the Equator Principles, known as EP4, came into effect on October 1, 2020, reflecting increased focus on sustainability and sustainable finance, and environmental, social and governance (ESG) issues globally. A summary of the key differences between EP3 and EP4 is provided in Table 3.1.

Table 3.1: Summary of Key Differences Between EP3 and EP4

Area	EP3	EP4
Scope and applicability	• Applies to project-related corporate loans over and including US$100 million • Project-related refinancing and project-related acquisition financing are out of scope	• Applies to project-related corporate loans over and including US$50 million • Project-related refinancing and project-related acquisition financing are within scope
"Designated Countries"[1]	• Projects located in countries on the Designated Countries list are deemed to satisfy Principles 2, 4, 5, and 6 if they are in compliance with host-country laws	• All Category A and Category B projects will be reviewed for compliance with the EPs • Projects located in Designated Countries will be separately evaluated for specific project-related risks to determine if IFC PS could be applied to address those risks
Human Rights and Indigenous Peoples	• Preamble acknowledges a responsibility to respect human rights • No necessity for Environmental and Social Impact Assessments to consider human rights impacts • Projects must obtain Free, Prior, and Informed Consent (FPIC) of Indigenous Peoples who may potentially be affected	• Preamble includes a statement that Equator Principles Finance Institutions (EPFIs) will abide by the UN Guiding Principles on Business and Human Rights • Projects' Environmental and Social Impact Assessments to include an assessment of potential adverse impacts to human rights • For all projects (including those in Designated Countries), Indigenous Peoples who may potentially be affected must be consulted in a manner compliant with IFC PS 7, including where applicable obtaining FPIC of such peoples in relation to the project. This compliance will be assessed by an independent consultant

[1] The Equator Principles define "Designated Countries" as "countries deemed to have robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment."

Area	EP3	EP4
Climate change	• Climate change is "recognised as important", but specific actions in relation to climate change are not considered • Alternative analyses of greener solutions to be carried out for Projects above a certain threshold of Scope 1 and Scope 2 GHG emissions	• Preamble includes a recognition of EPFIs' role in achieving targets under the 2015 Paris Agreement • Climate Change Risk Assessments necessary for Category A and, as appropriate, Category B Projects • Requirements to: (i) consider transition risks; (ii) conduct alternative analyses of greener solutions; and (iii) annually report emissions levels and the GHG efficiency ratio, for projects above a certain threshold of Scope 1 and Scope 2 GHG emissions

EP4 requirements for each of the deliverables are discussed below.

3.2.2.1 *Stakeholder Engagement*

Principle 5 requires that the project sponsor demonstrates effective stakeholder engagement as an ongoing process in a structured and culturally appropriate manner with affected communities, workers and, where relevant, other stakeholders.

Principle 6 calls for the establishment of an effective grievance mechanism designed for use by affected communities and workers, as appropriate, to received and facilitate resolution of concerns and grievances about the project's environmental and social performance.

3.2.2.2 *Critical Habitat* Assessment

EP 4 uses a similar definition of critical habitats as IFC PS 6 and indicates that they should be identified, assessed and protected.

3.2.2.3 *Social Impact Assessment*

Principle 2 requires that an appropriate assessment is conducted to address the relevant environmental and social risks and scale of impacts of the proposed project (full Environmental and Social Impact Assessment (ESIA) required for Category A projects). The assessment documentation should propose measures to minimise, mitigate, and where residual impacts remain, to compensate / offset / remedy for risks and impacts to workers, affected communities, and the environment, in a manner relevant and appropriate to the nature and scale of the proposed project.

The assessment documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A and, as appropriate, Category B projects, the assessment documentation includes an ESIA. One or more specialised studies may also need to be undertaken. For other Category B and potentially C projects,

a limited or focused environmental or social assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorisation process.

3.2.2.4 Ecosystem Services Assessment

There are no specific requirements related to ecosystem services in EP4.

3.2.2.5 Cumulative Impact Assessment

Exhibit II states that the assessment documentation may include, where applicable "cumulative impacts of existing projects, the proposed project, and anticipated future projects".

3.2.3 World Bank Group Guidelines

The World Bank Group's Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of good international industry practice.

The General EHS Guidelines (2007) and the EHS Guidelines for Offshore Oil and Gas Development (2015) are both applicable to this offshore field development Project.

3.3 Other Guidance Documents

The deliverables included within this addendum document were prepared with reference to a number of other guidance documents, as detailed below.

3.3.1.1 Stakeholder Engagement

The following guidance document was used as input to the stakeholder engagement process:

- IFC Guidance Note 1: Assessment and Management of Environmental and Social Risks and Impacts (IFC, 2012)

3.3.1.2 Critical Habitat Assessment

The following guidance documents were used as input to the CHA:

- IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC, 2019)
- Biodiversity and Ecosystem Services Fundamentals, Guidance Document for the Oil and Gas Industry (IPIECA/IOGP, 2016).

3.3.1.3 Social Impact Assessment

The following guidance documents were used as input to the social impact assessment:

- IFC Guidance Note 1: Assessment and Management of Environmental and Social Risks and Impacts (IFC, 2012)
- IFC Guidance Note 2: Labour and Working Conditions (IFC, 2012)

- IFC Guidance Note 4: Community Health, Safety and Security (IFC, 2012).

3.3.1.4 *Ecosystem Services* Assessment

The following guidance documents were as input to the ecosystem services assessment:

- Biodiversity and Ecosystem Services: Good Practice for Oil and Gas Operations in Marine Environments (Flora & Fauna International, 2017)
- Biodiversity and Ecosystem Services Fundamentals, Guidance Document for the Oil and Gas Industry (IPIECA/IOGP, 2016)
- Ecosystem Services Guidance, Biodiversity and Ecosystem Services Guide and Checklists (IPIECA/IOGP, 2011).
- The Corporate Ecosystem Services Review: Guidelines for Identifying Business Risks and Opportunities Arising from Ecosystem Change, Version 2.0 (WRI, 2012)
- Weaving Ecosystem Services into Impact Assessment, A Step-by-Step Method (WRI, 2013).

3.3.1.5 *Cumulative Impact* Assessment

The following guidance document was used as input to the cumulative impact assessment:

- Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2013).

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 4: Stakeholder Engagement

80834

RSK GENERAL NOTES

Project No.: 80834

Title: ESIA Addendum – Dussafu Block Development, Gabon
Chapter 4

Client: BW Energy Gabon

Date: 26 July 2021

Office: Helsby

Status: Rev_02

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4 STAKEHOLDER ENGAGEMENT

4.1 Introduction

Stakeholder engagement is an integral part of the ESIA process and the foundation for developing and maintaining a project's social licence to operate. Stakeholder engagement helps to develop and sustain relationships and build a project's reputation as a venture that is socially responsible and acts with integrity.

Stakeholder engagement for this Project has been undertaken in accordance with the applicable legal requirements of the Gabonese Republic and good international industry practice (GIIP), as established by the IFC Performance Standards (2012) (see Chapter 3).

A standalone Project-specific Stakeholder Engagement Plan (SEP) has been developed to support meaningful and effective engagement (see Appendix 11C) and forms the basis of this chapter.

The following sections describe how stakeholder engagement activities have been undertaken since the outset of the Project and how stakeholder engagement will be continued after the ESIA Addendum studies. They include:

- objectives of the stakeholder engagement
- stakeholder analysis
- activities undertaken
- analysis of issues and concerns raised by stakeholders
- lessons learnt and recommendations.

4.2 Objectives of the Stakeholder Engagement

The objectives of the stakeholder engagement, as stated in the SEP, are to:

- inform stakeholders about the Project and the studies, stakeholder engagement activities, and grievance management procedure, in an accessible and culturally appropriate manner
- ensure that stakeholders understand how they might be affected by the Project, including potential Project benefits, and understand their potential role in impact identification and management
- obtain the input of stakeholders into the studies with regards to impact identification and to discuss how best to avoid, mitigate, or offset impacts in addition to those previously identified during the preparation of the ESIA / NEIA documents for the Project by Enviropass (2017; 2019; and 2020)
- provide opportunities for stakeholders to express their opinions, concerns, and recommendations about the Project and the studies, and ensure that these are considered in the studies and related management decisions.

The main objectives for BWE are to:

- ensure that stakeholders understand the Project's aims and requirements and have confidence in the management of environmental and social risks
- build stakeholders' concerns into Project design and execution, as appropriate
- provide consistency of messaging
- manage stakeholder expectations
- supplement baseline information necessary to meet lender requirements
- meet international standards of environment and social performance for stakeholder engagement to secure international financing.

4.3 Activities Undertaken

This section describes the activities undertaken as part of the ESIA Addendum stakeholder engagement programme.

It should be noted that, as part of the critical habitat / biodiversity studies, some additional ex-situ stakeholder engagement was undertaken, as detailed in Section 6.3.1.2.

4.3.1 Stakeholder engagement preparation

Preparation for the meetings comprised several steps, including:

- arrangement of stakeholder meetings
- development of stakeholder materials to be used during the meetings
- preparation of reporting templates and the stakeholder engagement database.

4.3.2 Arrangement of meetings

Letters of invitation were hand-delivered by TEREA to the head office of the relevant authority to arrange meetings with government authorities and agencies at national, provincial and departmental / local level (see example in Appendix 4A). When invitation letters were not acknowledged, follow-up phone calls were made by TEREA to confirm receipt.

For meetings with Project Affected Communities (PACs), phone calls were made to the Prefect of Basse Banio Département and the Mayor of Mayumba to arrange meetings in Mayumba and mobilise the chiefs of nearby villages and chiefs of quartiers. For other community meetings, including Malembé 2 and Mambi, telephone calls were made to community leaders who then arranged the meetings and mobilised communities and groups on the proposed date, time, and location.

4.3.3 Information material used for the meetings

Information for the consultation meetings comprised presentation materials and reference materials, as described below.

4.3.3.1 Presentation materials used to facilitate the meetings

Materials included:

- a background information document (BID) in French which was distributed to all attending stakeholders
- posters, in French, describing the Project, the studies undertaken, stakeholder engagement and the grievance management procedure.

4.3.3.2 Reference materials for the stakeholder engagement team

The stakeholder engagement team used a frequently asked questions (FAQ) document to ensure accuracy and consistency in responses to stakeholder questions.

4.3.4 Undertaking the stakeholder meetings

Stakeholder meetings were carried out as described below.

It should be noted that RSK personnel were unable to attend the in-country field visit due to travel restrictions associated with the COVID-19 pandemic. In-country stakeholder engagement was conducted by RSK's local Gabonese partner TEREA.

Additional measures were taken during the conduct of stakeholder engagement activities in Gabon to minimise the risk of COVID-19 transmission and protect the health and safety of all those involved. These measures are described in detail in the SEP (Appendix 11c).

4.3.4.1 Meetings with government authorities

Two consultants from TEREA conducted meetings with government authorities; one consultant facilitated the meetings and the other ensured that attendance sheets (see Appendix 4B) were completed, and meeting minutes taken. A representative of BWE also attended the meetings to answer any Project-related technical questions from stakeholders.

Meetings started with introductions and opening remarks by the consultants about the purpose and format of the meeting. The facilitator highlighted that participation from stakeholders was voluntary. All meetings were held in French and permission was sought to take photographs (see Appendix 4C) during the meetings as proof of attendance.

The stakeholder team then gave an overview of the Project, the studies, and stakeholder engagement activities, using the BID and posters. The Project grievance management procedure was also clearly outlined during the meetings, including the contact details.

Following the presentations, a question-and-answer session was conducted.

4.3.4.2 Meetings with Project Affected Communities (PACs)

Meetings at PAC level were undertaken using the same process as government authorities (see Section 4.3.4.1).

Following on from the stakeholder engagement meetings, a series of data collection focus group discussions (FGDs) and key informant interviews (KIIs) were carried out and this information was used to inform the socio-economic baseline in the ESIA Addendum.

4.3.5 Recording the meetings

Sufficient time was allocated to the question-and-answer sessions and efforts were made to ensure that all stakeholders present had their concerns heard. All stakeholder

questions, suggestions, comments, and responses from the stakeholder team, were recorded on the RSK meeting minutes template, and photographs were taken after seeking permission from the participants.

Meeting records, including attendance lists and minutes, were forwarded to RSK's stakeholder engagement database manager and entered in an Office 365 database using four entry forms: stakeholders (individuals), organisations, events and interventions.

The following information was recorded in the database: name of the stakeholders; organisational affiliation; issues, questions and concerns raised by stakeholders; category of issue; responses provided; and an indication of the need for follow-up.

In addition to the above, stakeholder engagement materials (BID, posters), minutes of the meetings with stakeholders (including attendance sheets) and photographs of stakeholder events were saved in a separate folder.

4.3.6 Stakeholder engagement with vulnerable groups

During stakeholder identification, vulnerable groups were identified. Youth, women, the elderly, widows, persons with physical and / or mental impairments, and persons experiencing unemployment were identified as the main vulnerable groups. Efforts were made to engage these groups in meetings.

4.3.7 Meetings held

Stakeholder meetings were held at government and PAC level between 31 March 2021 and 1 July 2021. In total, 15 meetings were held involving over 225 stakeholders. A diverse group of stakeholders were met. These are presented by stakeholder groups in Table 4.1. A record of all meetings held by date can be found in Appendix 4D.

It should be noted that letters of invitation were also delivered to the General Directorate of Hydrocarbons (La Direction Générale des Hydrocarbures); the General Directorate of Merchant Marine (Direction Générale de la Marine Marchande); and the National Centre for Oceanographic Data and Information (Centre National de Données et Informations Océanographiques (CNDIO). However, due to lack of response these meetings did not take place.

Table 4.1: List of stakeholders consulted by group

Stakeholder group	Stakeholders and date(s) of meetings

Government authorities / agencies – national level	• Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan
	  ○ General Directorate for the Environment and Nature Protection (DGEPN): 02/04/21
	  ○ General Directorate for Wildlife and Protected Areas (DGFAP): 29/06/21
	  ○ General Directorate for Aquatic Ecosystems (DGEA): 18/06/21
	• Ministry of Agriculture Livestock and Fisheries
	  ○ General Directorate for Fisheries and Aquaculture (DGPA): 28/05/21

Government authorities / agencies – provincial level	• Ogooué-Maritime Province
	  ○ Provincial Directorate for Fisheries and Aquaculture: 18/05/21
	  ○ Provincial Directorate of the Merchant Marine: 20/05/21
	• Nyanga Province
	  ○ Governor of Nyanga province: 26/04/21

Government authorities / agencies – departmental / local level	• Ogooué-Maritime Province
	  ○ Prefect, President of the Departmental Council for:
	  ▪ Bendjé Department: 18/05/21
	  ○ Municipality of Port-Gentil
	  ▪ Office of Ports and Harbours of Gabon (OPRAG): 19/05/21
	• Nyanga Province
	  ○ Prefect, President of the Departmental Council for:
	  ▪ Basse Banio Department: 28/04/21
	  ▪ Haute Banio Department: 27/04/21
	  ○ Municipality of Mayumba
	  ▪ Mayumba Fisheries Brigade: 30/04/21

Stakeholder group	Stakeholders and date(s) of meetings

Project-Affected Communities (PACs), including groups such as men, women, authority figures (e.g., village chiefs, customary chiefs, religious chiefs, elected leaders), fisherfolk and other natural resource users	• Mayumba: 27/04/21
	  ○ Local leaders, women and fisherfolk of quartier Mabounda: 27/04/21
	  ○ Local leaders, women and fisherfolk of quartier Tchiole-Ndembe: 01/05/21
	• Ndindi: 28/04/21
	• Mambi: 29/04/21
	• Malembé 2: 29/04/21

Civil society organisations (including non-governmental organisations (NGOs))	• Mayumba:
	  ○ Fishing cooperatives: Bana Pêche and Ibengounou: 01/05/21
	• Port-Gentil:
	  ○ Competency centre for artisanal fishing in Port-Gentil (CCPAP): 19/05/21
	  ○ Fishing cooperatives: Senegalese Cooperative and Gabonese (Itchoni-Nkala) Cooperative: 20/05/21
	• Gabon Bleu: 31/03/21
	• World Wildlife Fund (WWF) Gabon: 01/07/21

Private sector	• Mayumba: ○ Local businesses – tourism-related (e.g., hotels including Likoualé Lodge, restaurants, tour operators): 30/04/21
Education and research institutions	• Agricultural and Forestry Research Institute (IRAF):15/06/21

4.4 Analysis of the Stakeholder Engagement

This section analyses the information gathered during the consultation meetings.

4.4.1 Stakeholder analysis

The SEP (Appendix 11C) sets out the detailed methodology for stakeholder analysis, which is summarised below.

Analysis is based on the:

- level of *influence* that stakeholders have on the Project, rated as low, medium or high
- level of *interest* that stakeholders have on the Project, rated as low, medium or high (see Figure 4.1),

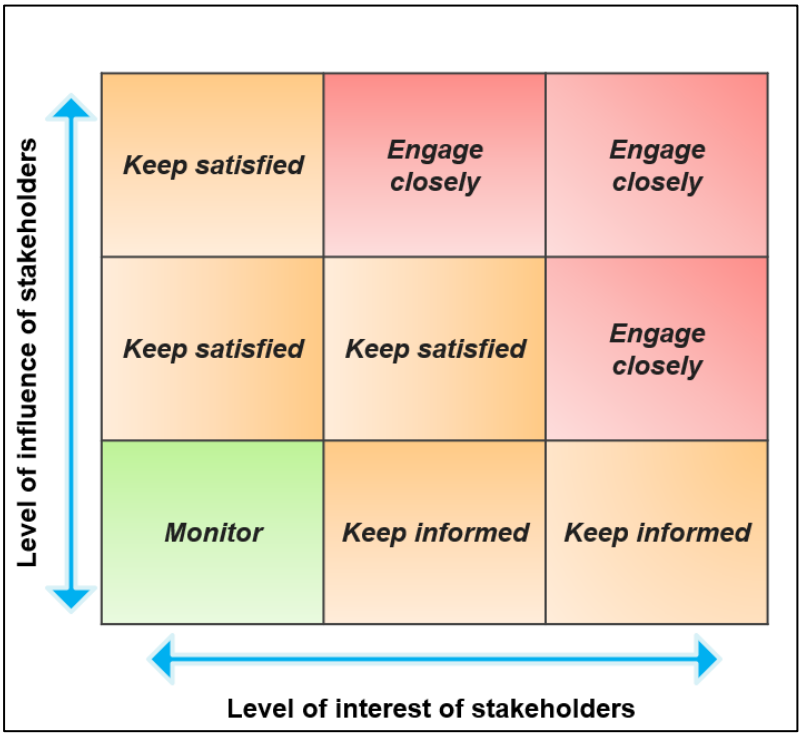


Figure 4.1: Example stakeholder analysis matrix

In addition, stakeholders are further characterised by:

- level of potential *impact* the Project has on stakeholders, rated as low, medium or high.

It should be noted that stakeholder analysis is to a certain extent subjective, depending on personal experience with different stakeholders. To reduce individual subjectivity, the process was carried out as a collaborative exercise.

Stakeholder mapping is an ongoing exercise, as stakeholders' relationships to the Project may change at any time.

4.5 Analysis of Stakeholder Issues and Opportunities

This section presents the analysis of issues raised by stakeholders.

Appendix 4E provides a detailed question and answer trail raised by stakeholders during engagement meetings. Appendix 4F summarises the issues and questions raised by stakeholders by topics across all meetings held.

The issues are first categorised in terms of topics and subtopics (Table 4.2)[1] and secondly in terms of differences between stakeholder groups.

Table 4.2: Stakeholder topics and subtopics

Topics	Subtopics
Project characteristics	Project infrastructure Safety and security
ESIA studies	Baseline studies ESIA related Project related Request for further involvement Request for data collection
Stakeholder engagement	Stakeholder engagement
Environmental	Biodiversity Climate Water Air quality Soil
Socio-economic	Water-based livelihoods Community development and infrastructure Project benefits and impacts Employment opportunities Land-based livelihoods Economy Health
Other	Company information Other

In total, 130 comments, questions and concerns were raised by stakeholders at stakeholder engagement meetings.

Figures 4.2 and 4.3 summarise the issues and questions raised by stakeholders by topic across all meetings held.

[1] It should be noted that the allocation of issues and concerns to subtopics is not mutually exclusive. In some cases, an issue or concern has been allocated to more than one category.

4.5.1 Stakeholder issues raised

Figure 4.2 shows the frequency of which specific issues were raised during stakeholder engagement meetings. The largest number of issues were raised in the socio-economic category, the second and third most frequent comments were related to the ESIA studies and stakeholder engagement.

The socio-economic category was analysed further in terms of its sub-topics (see Figure 4.3). This shows that the sub-topic of 'employment opportunities' had the largest number of questions and comments, with most stakeholders commenting on the rate of unemployment and enquiring about the availability of job opportunities, particularly for youths in the local communities. Comments were also prevalent in the 'community development and infrastructure' category, with questions relating to supporting the development of communities and providing infrastructure such as communication pylons, electricity, and medical dispensaries.

Comments and questions raised regarding ESIA studies included the types of studies being undertaken and questions about what were expected in terms of findings. Other stakeholders offered to provide information to be used when undertaking the studies. Questions were also raised about studies that had taken place previously in relation to the Project.

Questions relating to stakeholder engagement included the process in which stakeholders were being met and the types of stakeholders being met. Other stakeholders that could be engaged were also suggested.

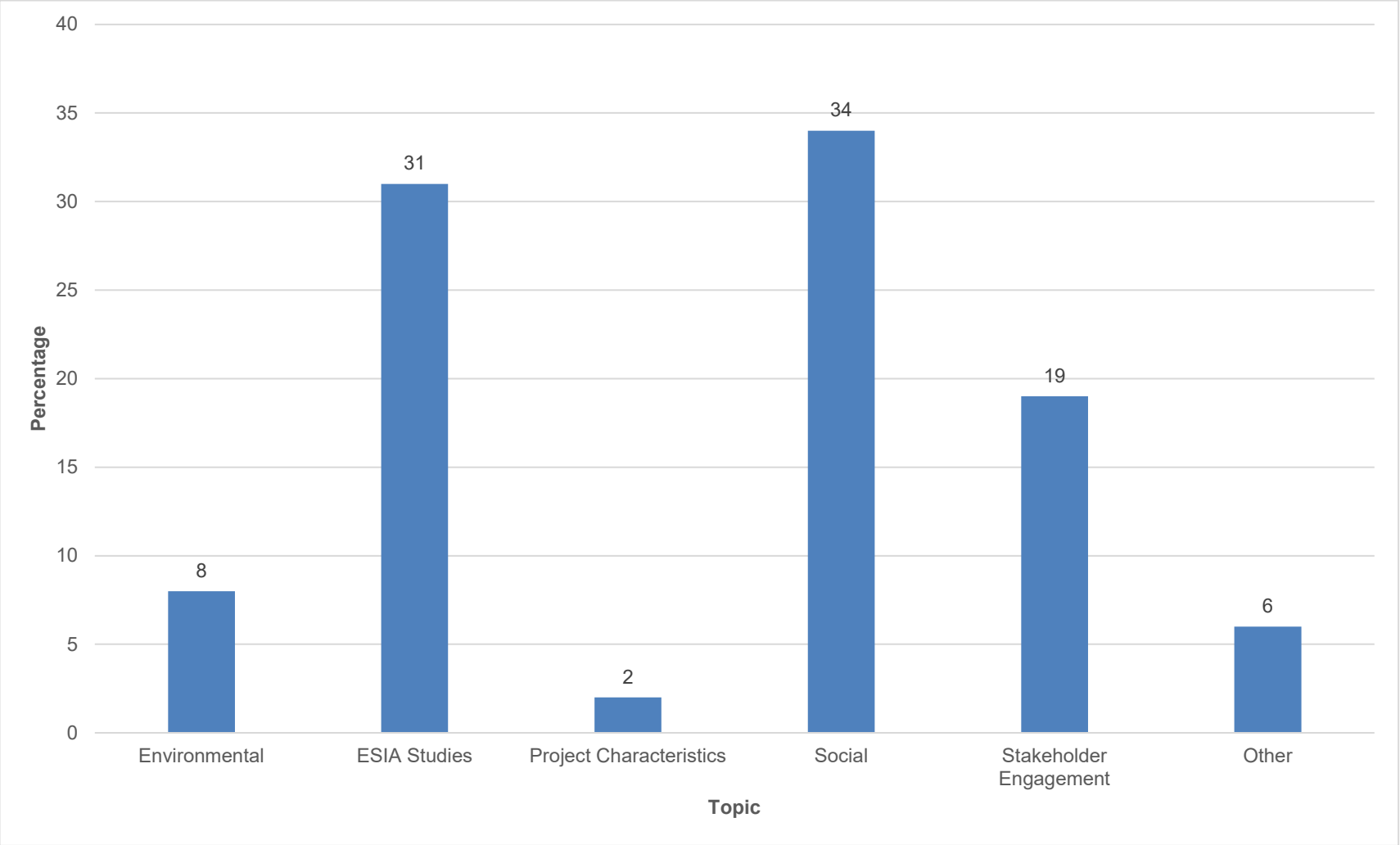


Figure 4.2: Frequency of issues raised by topic

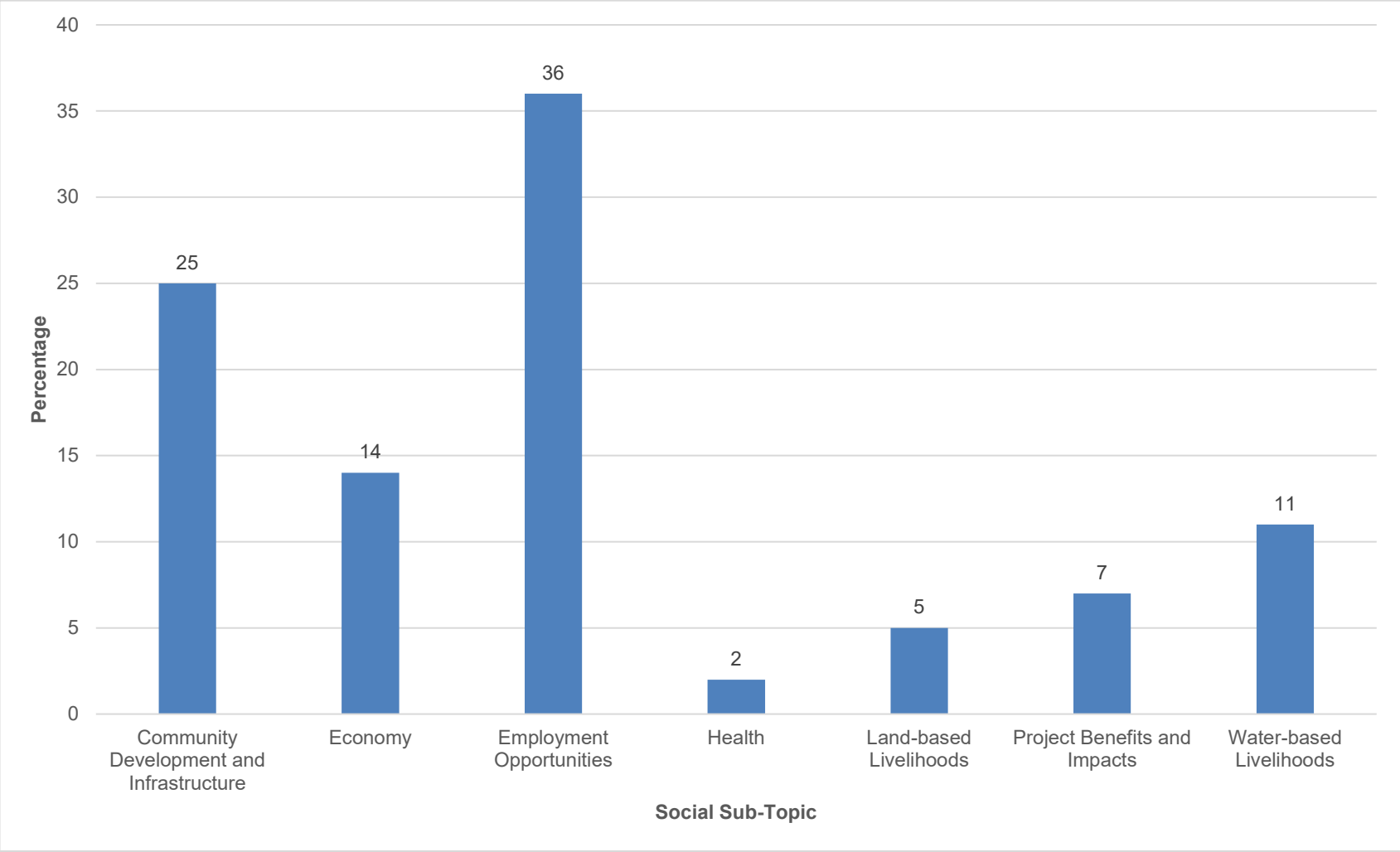


Figure 4.3: Frequency of different socio-economic issues raised

4.6 Lessons Learnt

This section presents the lessons learnt from the stakeholder engagement process.

4.6.1 Meeting preparations

As a result of the COVID-19 pandemic, a curfew was put in place across Gabon and meetings could not take place after 16:00 hours. Due to this, some meetings had to be completed earlier or cut short, and others could not take place due to scheduling.

The posters and BID used during stakeholder meetings with government representatives and communities were welcomed and understood by all.

4.6.2 Stakeholder participation at the meetings

Some meetings did not take place as planned or were rescheduled for various reasons. For example, an attempt was made to meet with the governor of Ogooué-Maritime Province (Port Gentil). This meeting couldn't be held because the governor was in Libreville and his general secretary was recovering at home.

The density of information requested in the questionnaires for baseline data collection proved a challenge. Data collection meetings often required a minimum of two hours to complete. Stakeholders began to lose interest and the level of detail provided for some answers was as a result minimal.

4.7 Conclusion

The stakeholder engagement process was undertaken in line with the Project-specific SEP. Stakeholders were met and any issues, questions and comments raised were recorded and analysed.

Socio-economic topics were prominent among stakeholder comments and issues, comments and questions raised have been addressed in this ESIA Addendum.

Going forward stakeholder engagement will be undertaken by BWE on an ongoing basis to provide stakeholders with updates on the Project as described in the SEP.

APPENDIX 4A -
EXAMPLE LETTER OF INVITATION

BW ENERGY GABON SA
Member of BW Energy Group

Libreville, le 25 Mars 2021

A l'Attention de :
Monsieur le Directeur Général de la
Marine Marchande
BP : 803 Libreville

N° 0 6 9 BWE/25/3/21/GE/UB

Objet : Développement du bloc Dussafu – Informations

Monsieur le Directeur Général,

BW Energy a mandaté Terea Ltd et RSK Environment Ltd pour entreprendre une étude d'impact cumulatif (CIA) pour le projet de développement d'hydrocarbures du bloc Dussafu, au large du Gabon.

A cet effet, RSK effectuera les mises à jour nécessaires en collaboration avec Terre Environnement Aménagement (Terea), un cabinet de conseil environnemental local basé à Libreville. Le document d'information de base (BID) ci-joint fournit de plus amples informations sur le développement des champs pétrolifères de Hibiscus/Ruche, ainsi que sur les travaux qui seront entrepris par RSK et Terea pour mettre à jour les évaluations d'impact.

BW Energy souhaite recevoir vos commentaires et les questions liés au développement des champs pétrolifères et aux mises à jour de l'analyse d'impact. Veuillez utiliser les coordonnées fournies dans le BID.

Veuillez agréer, Monsieur le Directeur Général, l'expression de ma parfaite considération.

COURRIER ARRIVÉE
25 MARS 2021
D.G.M.M.

BW Energy GABON SA (BWEGSA) NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

Pièce jointe : Document d'Information de Base (BID)

APPENDIX 4B - ATTENDEE LISTS

Stakeholder Engagement Meeting in Bendjé (Port-Gentil), 18 May 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
KANARA Eugeni Nani Carolini	Eugeni Nani Carolini.	F.		Préfet du Département Bendjé.		
TCHANGO	GABRIEL	M	YAIRE			
OBANE	SATURNIN	M	CDB	1er Vice Président		
Junior	Bouliko	M	SG Préfecture MPAGA	Sous-Préfet		RBK
NZE ONDO MICHEL	CÔME	M	DRPU-FPN	Officier CAB DRPU		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NGOBOU	ANGE	M	DIRECTION PROVINCIALE PECHE	DIRECTEUR		
AZUGHO	Jean François	M	Brigade Environnement Sud	CB		
NGUEMA	GUSTAVE	M	TERA	Resp. Agence		
NGOMA	STEVE Léandre	M	MARINE MARCHANDE	Contrôleur des AFFAIRES MARITIM		
ALEKO	BAMAS Alain	M	Contrôle Budgétaire	Agent Adm		
ASSELE	Andréa	F	Contrôle budgétaire	Agent Vérificateur		
ABOUGUELOUOLO	Marnie	F	Contrôle Budgétaire	S P		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
KIENOS	~~Go~~ Godefroy	M	Mairie Commune du Pot	Conseiller Culminant du Mairie		
ASSELE	Andréa	F	Contrôle budgétaire	Agent Vérificateur		
ABOUGUELOUONO	Mannie	F	Contrôle Budgétaire	SP		
ESSONGUE ~~Annie~~	Annie	F	Préfecture de Bendje	Agent d'état-civil		
NGUIMBI	LEON	M	TEREA	Sociologue		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
Bantsiva Bantsiva Burney V	Burney Vacilli	Masculin	Contrôle Budgétaire	Agent Administratif	[redacted]	Burney

Stakeholder Engagement Meeting in Quartier of Mayumba (Tchiole-Ndembe), 1 May 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
TCHISSAMBA	Jean Robert	M	Tchiole - Ndembe	Adjoint du chef		
MAKAYA	Maurice	M	-11-	Sans		
Koumba	Jean Baptiste	M	-11-	-		
AMOUSSOU	K. MARTIN	M	-11-	pêcheur		
KAKPO	Frederic	M	-11-	pêcheur		
Kouassi	M. Pépé	M	-11-	Pêcheur		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
KOUMBA	SIRYA	F	— 11 —	Sans		
BACOUDOU COMLAN	FRANCKY	M	— 11 —	BACHELIER		
SOUZA DIMITRI	DIMITRI HERBERT	M	— 11 —	ELEVE		
BACOUDOU-COCOU	GILBERT	M	— 11 —	BACHELIER		
KOUMBA MAKAYA	PATRICK	M	— 11 —	SANS		
BACOUDOU COMLAN	DOSSOU Medard	M	11	Menuisier		
NOUTCHET SOKEO	YAO SAMSON	M	— 11 —	ELEVE		SAMSON

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
AHLONKO	COMLON	MASCULIN	OFFICE	ELEVE		
IBOUANGA	KOFFI	— 1 7 —	— 1 1 —	MECANICIEN		
MBAMBA	TCHIBOTA	F	— 11 —	Commerçante		
DAMBA	APHONSINE	F	— 11 —	MAÇON		
MOUVANGUI	STEPHANIE	F	— 11 —	Sans		MmS
SAFOU	Fatima	F	— 11 —	Retraité privé		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
Soumda	Jacqueline	F	— 11 —	Commerçante		
PADOU	PELAGIE	F	TCHIBOLE DENBET (OFFICE)	1er MAIRE ADJOINT MAYUMBA		
MOUSSOGOU	Marie Sophie	F	— 11 —	Commerçante		
TWE	Friman	M	— 111 —	pêcheur		
CADJO. MOSYAMA MBINA	FRANCIS	M	— 11 —	PÊCHEUR		
MBOUMBOU	RODRIGUE	M	— 11 —	PECHEUR		
MAKAYA	Joyce	M	— 11 —	ELEVE		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
KOUMBA MANVOU	KARL CHANCY	M	— // —	EX: agent schlumberger		
KAMPO	CYRille	M	— // —	EX agent Recherche		
BACOUDOU YAO	Gildas	M	— // —	Etudiant		
NIOTOME ALFRED	MATT	M	— // —	Etudiant		
MANFOUMBI	Wilfran	M	— // —	Directeur d'école		
NGUMBI	Léon	M	TERRA	Sociologue		
NGUEMA	CONSTANCE	F	TERRA	Rep Agence		

Stakeholder Engagement Meeting in Ndindi, 28 April 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NDZIAMI	Guy-Norel	M	BW Energy	Resp. QHSE	[redacted]	
Eugene MBANA GUISSASSAKOU	Eugene	M	/	Préfet	[redacted]	
NGUEMA	Gustave	M	TEREA	Resp. adjoint	[redacted]	
LEKOUNDOU Hugues	Hugues	M	—	COMMANDANT DE BRIGADE DE NDINDI	[redacted]	
SAFOU KOUMBA	ANTOINE	M	Comité Logip de la S.H.B	Président du Comité	[redacted]	
Denise Mathenge Safou	Denise	F		1er Maire Adjt Commune	[redacted]	
MAVOUNGOU	Nestor	M	—	2e Adjoint au Maire	[redacted]	
NGUIMBI	Léon	M	TEREA	Sociologue	[redacted]	

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
Koumba Tchibinda	Parfait	M	Conseil départemental CDHB	1er Vice President		
Makanga NGOMA		F	Chef de quartier	Chef		
Pamboa	Amilie	F	CDHB	2ème Vice Presidente		
NGOMA NGOMA	Vincent	M	Ndindi	Conseiller Municipal		
MAVOUNGOU	Wilfried Ariel	M	Ndindi	Représentant de Communauté Haute Tension		
Kokolo	Rodrigue	M	Ndindi	chef de quartier		

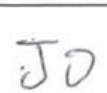
Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
PAMBOU	ROMUALD	M	village ICHIANZI	Gar -		
WENDA	BOUKA	H	YOYO	CHef.		
N Cocua	MBioka	H	YOYO	Secretaire fd		
Mainga	Pierre	M	Kala boubté	chef		
MOUTSINGA	Léandre	M	MALEMBE1	Conseiller départemental		
MBATCHI	ANTOINE	M	RINA-NZALA	MEMBRE		
SAFOU KOUMBA	Léa	F	YOYO	Infirmière auxiliaire au CDHB		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NIABOU	Jacques	M	KALA-Boubou ti	chef de Canton		
KALI	ERNEST	M	NKOKA	A Bitout		
[illegible]	[illegible]	M	[illegible]	SANS		
PANZOU	EUGENE	M.	NIKOKA	PECHEUR		
Mankaga	Leticia	F	Tiya	Sans		
NGOMA NGOMA	Amour Fleur	M	Yoyo	Etudiant		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
TCHIDUNGO	Jonathan	M	Commune de NDJOLE	Agent Trésor		
MAKAYA	EDGARD	M	DEPARTMENT - CHEF			
MBOUMBA TCHIBINDA	Hamet Bertrand	M	Département	Chef Regroupement		
PAKA	Renaud	M	Département	Chef Regroupement		
MAVoungou Bonkoni	Robert	M	~~Département~~	Canton		
Jean Pierre MBOUMBA - MAVOUNGOU			conseiller Municipal			
MAKANGA Dominique		M	chef de Terre.			

Stakeholder Engagement Meeting in Malembe, 29 April 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MABOUMBA	elodie	F	— 11 —	Commerçante	[redacted]	
Mountou	Hermine	F	— 11 —	Benevole a l'ecole		
MAKAYA	christian	M	— 11 —	pêcheur		
VANDji	FABIOLA	F	— 11 —	Sans		
Bouanga	Jacqueline	F	— 11 —	Sans		
BINZA	Louria	F	— 11 —	Sans		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
HOPE	KWASSI ZIWAH	M	Mallembé	pêcheur	[redacted]	
MOUSSOUMI	Béatrice	F	— 11 —	Commerçante		
BOUANGA	Jean Dare	F	— 11 —	Sans		
NGOMA	Samuel	M	— 11 —	pêcheur		
SOUMBOU T	FABRICE	M	— 11 —	pecheur		
SIAKA	NADIA	F	— 11 —	Sans		
Tchibinda	Christelle	F	— 11 —	Commerçante		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NDEMBI	Brunette	F	— 11 —	Commerçante		
MBANDINGA	Nacy	F	— 11 —	Commerçante		
MOUSSAVOU MABIALA	Flore	F	— 11 —	Sans		
NZAOU MABIALA	Ruth	F	— 11 —	Sans		
MOUSSOUNDA MAKANGA		F	— 11 —	Sans		
MOUTSINGA	Léandre	M	— 11 —	Conseiller départemental		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MBOUMBA TCHIBINDA	Armel Bertrand	M	Département Haut Banio	Chef Regroupement	[redacted]	
PGIRY	Jeatcave	M	Département Haute Banio	Sans	[redacted]	
Mabiala	Jean	M		MaBaSiGNiER	[redacted]	
NGUIMBI	Léon	M.	TERTEA	Sociologue	[redacted]	

Stakeholder Engagement Meeting in Tchibanga, 26 April 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NOUHANDO	Nicole	Feminin	Gouvernorat Tchibanga	Gouverneur		
GNOUNDOU	F. Kandie	F	Tchibanga	chargée du Protocole		
NGUENA	GUSTAVE	M	Tchibanga TERECA	Expert ENV		
NDZIAMI	Guy-Marcel	M	Tchibanga BW Energy	Resp. QHSE		
NGUMAH	LEON	M.	Tchibanga TERECA	Sociologue		
MOUPENGA	Louis. D.	M	TERECA	Technicien		

Stakeholder Engagement Meeting in Mayumba, 27 April 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NGOMA	Victor	M	Préfecture	Préfet		
Poutaplier	George	M	MAIRE	MAIRE		
NDEMBER	Jean Joseph	M	Président du Conseil Départemental	Président		
DOUMA MAVOUNGOU	Jean Joseph	M.	Maire Adjoint	Maire Adj 2		
NDZIANI	Guy Marcel	M	~~Resp QHSE~~ BWE	Resp QHSE		
NGUEMA	GUSTAVE	M	TERRA	Resp. adjoint		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MOIMEDIBE Abel	Abel	M	Gendarmerie	Commandant de Brigade		
MBOKOU	Wilfrid	M	GENDARMERIE	Commandant de compagnie Adjoint		
NGOMA-NGOUA	Jean-Claude	M	Mairie	SG		
MAKAY	GIRESSE			PILOTE		
Priam Mamfoumby		M	CRMD	Délégué à l'emploi		
MAKAYA VIAN MARIELI		M	CRMD	Délégué Environ		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MAKANGA	D D	M	MABOUNDA MAYUMBA	chef de quartier		
SOUAMI NZASSI	-	M	Kouango Mayumba	chef de quartier		
Mavoungou	Felicien	M	Mambi village	chef de regroupement Mambi		
Mabounda	Guy Poulin	M.	Bilanga	Chef de regroupement de Bilanga		
TATY Mavoungou	Joseph	M.	Ste-Antoine Mayumba	chef de quartier		
NGOMA Gi	GILDAS	M.	CRMS	Conseil en Assurance		
FOUTY	Frida	F	Bana Aviation	secrétaire		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
SOUNGOU	Jean	M	Village Malembe 2	Chef Village Malembe 2 (Basse BANIO		
LOEMBE FONTI	Celestin	M	village MANGALI	chef de village mangali		
MBAKIBIBA	JEAN BERNARD	M	Brigade des Pêches MAYUMBA	Enquêteur		
PAMBOU MAKAYA	J.CLAUDE EBOUE	M	CHEF Bana-avial	Chef		
MAGALIMA TCHAMA	JOSEPH	M	village PILAKOUMBI	NOTABLE		
MAVOUNGOU MBOUADI Edouard	Edouard	M	Commune MYB	Notable		
MAVOUNGOU MBATCHI	JUSTIN	M	Commune MyB	Secrétaire Départemental P.D.C		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NGOULOU	ARMAND	M	DGDI	CHEF D'ANTENNE		
NGOURA NGOURA	Olivier	M	Ministère Com chargés mission	Chargés des missions		
MOUBA MANGOYE	GUY Albert	M	Prefecture	SG de la Prefecture		
MAMBOU	Patrick Yvon Ridge	M	Chargé des missions 1	Ministère de la Fonction Publique		
DOUMA MAVOUNGOU J-J.	Jean Joseph.	M	Adjoint au Maire 2.	Maire Adj.		
Mbadoumou	Alain	M	prefecture	Chauffeur		
MAKAYA	Antoine Serge	M	Mairie	Adjoint au Maire		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MAKAYA	MAURICE	M	TCHIOLE NDEMBET	SANS	[redacted]	
PADOU	PELAGIE	F	MAIRIE MAYUMBA	1er MAIRE ADJOINT		
MAVOUNGOU TATY	JEAN BAPTISTE	M	MARINE MARCHANDE	CONTRÔLEUR DES AFFAIRES MARITIMES		

Stakeholder Engagement Meeting in Quartier of Mayumba (Mabounda), 27 April 2021

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
NDZIAMI	Guy-Marcel	M	BWE	Resp. QHSE	[redacted]	
MAKANGA	DIEU DONNÉ	M	MAYUMBA	CHEF		
NGUINGI	Loïm	M	TERRA	Sociologue		
NGUEMA	GUSTAVE	M	TERRA	Resp Agence		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MAKAYA	ALAIN	M	MABOUNDA	SANS		
LOEMBET TCHIAMA	IDRISS BERANGER	M	MABOUNDA	Sans		
MANOUNGOU MBOUADI	Edouard	M	MABOUNDA	Ens. Retraité		
NGOMBA	Gisèle	F	MABOUNDA	Ménagère		
MOUITY MAKAYA	Marly Julain	M	MABOUNDA	Elève		
Loembe	Sylviane	F	MABOUNDA	Ménagère		
KOUMBA	Cedric	M	MABOUNDA	Pisteur		

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
MAKOUNDI Koumba	M. Louis	F	GABONNANA Comerçant	Commerçante	[redacted]	
BOMBO Ol.	Benoît	M'	Ebeniste	← OTABOUNDA	[redacted]	
N'GOYANZ	ANTOINE	M	-//-	R–	[redacted]	
BOULINGUI	LANBORY	M	-//-	Conducteur Bulle	[redacted]	
KOUMBA	Pierre	M	-//-	électricien en bâtiment	[redacted]	
NGOUTA	CLAINCY	M	-//-	S	[redacted]	
Nabicka	NDOUMBOU	F	-//-	Comerçante	[redacted]	

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
OGOMBE	PATRICK	M	~~Peintre~~ MABOUNDA	Peintre	[redacted]	
MOUSSOUNDA	FRANÇOIS	F	MABOUNDA	couturière	[redacted]	
MILEBOU	ODETTE	F	-//-	Secrétaire	[redacted]	
NDJOINTHI	[illegible]	F	-//-	[illegible]	[redacted]	
Mbissi	Shelie	F	-//-	Commerçante	[redacted]	
MatouBa	annie	~~Store~~ F	-//-	Commerçante	[redacted]	
Mboumba Marlène	marlène	F	-//-	Commerçante	[redacted]	

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature
[illegible]	Boundi	F	Mabounda	Commerçante	[redacted]	
MBOUTOU	ALBERT	M	—//—	Pêcheur		
MPEMBA	MBATCHI	F	—//—	Commerçante		
Mouanga	Barnabé	M	—//—	Chauffeur		
SIASSIA NZAMBA	Ancet Steeom	M	—//—	Eaux et forêts		
KOUMBA	Christian	M	Mabounda	Pêcheur		
TCHISSAMBOU	NICO	M	Mobounba	Élève		

APPENDIX 4C -
SELECTED MEETING PHOTOGRAPHS

Community meeting with stakeholders in Mayumba, 27 April 2021

Community meeting with stakeholders in Mabounda Quarter, Mayumba, 27 April 2021

Community meeting with stakeholders in Mambi, 29 April 2021

Community meeting with stakeholders in Tchiole-Ndembe Quarter, Mayumba, 1 May 2021

APPENDIX 4D - MEETINGS HELD

Date	Stakeholder engagement meetings	Data collection activities - focus group discussion (FGD) or key information interview (KII)
Engagement in and near Mayumba		
26/04/21	• Meeting with the governor of Nyanga Province (Tchibanga)	
27/04/21	• Meeting with the prefect of Haute Banio department including departmental council, mayor and chiefs of quartiers of Mayumba and other community stakeholders (Mayumba) • Meeting with the Quartier of Mayumba (Mabounda)	• FGD with local leaders, women and fisherfolk (Quartier of Mayumba = Mabounda) • Data collection meeting with the Prefect of Basse Banio
28/04/21	• Meeting with the prefect of Basse Banio department including departmental council, mayor and chiefs of quartiers of Mayumba and other community stakeholders (Ndindi)	• FGD with local leaders, women and fisherfolk and KII with health and hotel staff (Ndindi) • Data collection meeting with the Prefect and Mayor of Ndindi
29/04/21	• Meeting with local leaders and community members of Malembé 2 (Malembé 2) • Meeting with local leaders and community members of Mambi (Mambi)	• FGD with local leaders, women and KII with health staff, fish wholesalers and natural resource users (Malembé) • FGD with local leaders, women and fisherfolk and KII with fish wholesalers and natural resource users (Mambi) • Data collection meeting with the President of Mayumba Departmental Council
30/04/21		• KII with health staff and tourism (Mayumba) • Data collection meeting with fisheries brigade (Mayumba) • Data collection meeting with the mayor of Mayumba
01/05/21	• Meeting with the Quartier of Mayumba (Tchiole-Ndembe)	• FGD with local leaders, women and fisherfolk and KII with fish wholesalers (Quartier of Mayumba = Tchiole-Ndembe)

Date	Stakeholder engagement meetings	Data collection activities - focus group discussion (FGD) or key information interview (KII)
		• Data collection meetings with fishing cooperative: Bana Pêche and Ibengounou (Mayumba)
Engagement in Port-Gentil		
18/05/21	• Attempt to meet with the governor of Ogooué-Maritime Province (Port-Gentil). Meeting couldn't be held because the governor was in Libreville (to deal with urgent matters about fishermen's strike) and his general secretary was recovering at home • Meeting with the prefect of Bendjé department including departmental council, mayor and provincial Directorate for Fisheries and Aquaculture	• Data collection meeting with Gabon Port Management
19/05/21		• Data collection meeting with the Provincial Directorate of the Merchant Marine of Ogooué-Maritime Province. Because the Director General was not available for this first meeting, a second meeting was held the next day • Data collection meeting with Office of Ports and Harbours of Gabon (OPRAG) • Data collection meeting with artisanal Fisheries POG (CCPAP)
20/05/21	• Attempt to meet with the Director General of the Provincial Directorate for Fisheries and Aquaculture of Ogooué-Maritime Province.	• Data collection meeting with the Director General of the Provincial Directorate of the Merchant Marine of Ogooué-Maritime Province. • Data collection meetings with Cooperatives in the fisheries sector: Senegalese Fisheries Cooperative and Gabonese (Itchoni-Nkala) Fishing Cooperative
Engagement in Libreville		
31/03/21	• Meeting with Gabon Bleu	
02/04/21	• Meeting with the DGEPN	
28/05/21	• Meeting with the DGPA	

Date	Stakeholder engagement meetings	Data collection activities - focus group discussion (FGD) or key information interview (KII)
29/05/21	• Meeting with the DGFAP	
15/06/21	• Meeting with IRAF. Because the director of IRAF was expected to attend another meeting by videoconference, this meeting was adjourned after 15 minutes.	
18/06/21	• Meeting with the DGEA	
01/07/21	• Meeting with the WWF	

APPENDIX 4E -
DETAILED QUESTION AND ANSWER TRAIL ORGANISED BY DATE

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
26 April 2021	Tchibanga	Formal meeting / interview	Meeting with the Governor of Nyanga Province (Tchibanga)	How will you settle sustainably the conflicts between ANPN / Fisheries and fishermen in connection with the presence of the marine parks of Mayumba and the mouth of the Banio). Some expatriate fishermen who have been living in Mayumba for several decades are planning to return to their country of origin due to the suspension of fishing activities (restriction of access to certain areas)	The National Sea Council is entitled to solve this problem because it brings together most of the institutions having a role to play in territorial waters (DGEPN, ANPN, Gabon Bleu, Pêche, Merchant navy etc.)
27 April 2021	Mayumba		Meeting with the Prefect of Haute Banio Department, including Departmental Council, Mayor and Chiefs of Quartiers of Mayumba and other community stakeholders (Mayumba)	What does BWE intend to accomplish for the population, a population that has many expectations relating to the improvement of their living conditions?	Using the posters pasted on the panels and the leaflets distributed to the participants, the BWE Project was re-explained. He then informed the populations about the other objectives of the meeting which are, the collection of fears, concerns, expectations and recommendations formulated by the local populations, in connection with the oil exploitation activities carried out by BWE off the coast of Mayumba. To achieve this, it was, therefore, necessary for BWE to into the field in order to communicate with the populations. On this point, additional explanations were given, based on the leaflet distributed to participants before the meeting.
				At the first meeting in 2019, the representative of BWE informed participants that the company produces 12,000 barrels of oil per day and aims to produce 40,000 barrels per day, has this target been met?	No, this goal has not been reached because of the Covid-19 pandemic. However, projections have been made for this goal to be reached in 2021-2022.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				In ESIAs, of all the elements that are taken into account, the most impacting is the social aspect. What is the base of BWE on the social impact of Mayumba?	BWE's oil production is only two years old, one year of which was affected by Covid-19, the impacts of this situation have had repercussions on social aspects. However, in two years of production, actions in favour of the populations have been carried out, in particular the installation of lampposts in the town of Mayumba, support for students for the baccalaureate exam and the delivery of school bags to students. Also, he specified that these actions were financed from their funds. Indeed, in the oil sector, companies are now subjected to an Exploitation and Production Sharing Contract (CEPP) with the Gabonese state. This contract contains an agreement which establishes a fund for actions in favour of local populations. But in the case of BWE, the agreement has not yet been validated and signed. As a result, funds are not available. In this process, it is the economic operator who pays the funds, but it is the quadripartite commission that will validate the projects intended for the local communities.
				BWE's strategy is to consult the local populations to gather their opinions and project ideas. He recommends that BWE reports back to the populations when the funds are available.	The development of BWE's activities is taking place in stages. Currently, there has been a lag in production and the 2020 targets have been postponed to 2021, and those for 2021 will be postponed to 2022. At each phase of the Project, ESIAs are carried out to comply with national legislation. It is, therefore, necessary to go into depth in the collection of social indicators, expectations and recommendations of stakeholders including local populations.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				Is BWE's environmental watch already active? Also, he asks if the social activities already carried out by BWE are in phase with its level of oil production? What is the balance sheet of BWE's social activities?	In terms of the review of activities, particularly in the social field, BWE remains open to everyone to communicate what it does in favour of communities. However, from the point of view of the Production-Actions correlation, he recalls that BWE is linked to the Gabonese State by an Exploitation and Production Sharing Contract, and therefore all Projects and expenses must be previously validated by the State via the General Directorate of Hydrocarbons. Also, he asks stakeholders not to compare BWE with other economic operators who have been in the area for decades. It was assured that at the end of the ESIA, a report containing the Environmental and Social Management Plan will be submitted to the General Directorate of Nature Protection (DGEPN) and to other administrations concerned by the activities of BWE. These administrations carry out checks on the ground to watch the execution of the ESMP by BWE. Likewise, international institutions have a look at the activities of operators, particularly in terms of respecting the environment.
				Asked BWE to develop strategies that allow him to get to the same level as the senior people (the old ones) of the national oil sector, in terms of supporting the department even if the company is young.	Comment noted.
				What response was given to the job application filed with the company? Is there a possibility to create a BWE branch in Mayumba?	In terms of employment, the current context does not make the task easier. Indeed, before Covid-19, 100 people worked for BWE on the boat, but currently, there are only 50-60 people left because of the Covid-19 pandemic. Moreover, the oil sector requires highly qualified people, profiles that are not always well represented in the area. For offshore projects, the need for unskilled or poorly qualified profiles is rare. For now, the employment file is on

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
					hold until the health situation related to Covid-19 improves significantly. Regarding the installation of a BWE branch in Mayumba, the idea is not ruled out, it is under study, BWE has a development plan over several years. Indeed, BWE wishes to engage in the long term with the populations of Mayumba.
				What criteria were used to select the six district and village heads who took part in the meeting? If the expectations of the local populations gained approval with BWE, would the selected actions be extended to villages whose chiefs did not participate in the meeting?	For reasons relating to compliance with barrier measures against Covid-19, the number of participants in the meeting was limited. The choice of village chiefs was made via a random draw. This involves entering information that can be transposed to other villages. For the actions to be carried out, they could be extended to all the villages of the departments of Basse Banio and Haute Banio and are not limited to the villages/districts represented and/or consulted.
				The idea to create the CRDM arose from the public consultation meeting held in Mayumba in 2019 by BWE. The statutes and internal rules have been sent to BWE but so far no response has been received from BWE. What is the reason? What will be the role of the CRDM in the realization of community projects? BWE's initiative to come and collect information at the local level and report it back to the top is welcomed, but the existence of the CRDM should not be forgotten.	The CRDM is very important and will not be forgotten.
				Formulated the expectations of the CRDM which can be summed up in the provision of tools and operating materials for the CRDM (multimedia room, computers, copiers, printers). He asks BWE	Comment noted.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				to differentiate CRDM's expectations from those of the population.	
	Mabounda		Meeting with the Quartier of Mayumba (Mabounda)	Further comment on employability of young people even in the position of versatile staff i.e handymen.	Comment noted.
				He asked whether the team remembered the first meeting relating to the Dussafu Marin oil permit and the specifications that had been sent to BWE?	This meeting is a continuation of the previous one. The difference is that the first time around, only a public consultation meeting was held. For this part of engagement, stakeholders at various levels of the population of the department of Basse Banio are met with to obtain their opinions and expectations, to have a better knowledge of their living environment and activities. These meetings will allow for an ongoing process of communication with stakeholders.
				He expressed his encouragement to BWE for this initiative to have a direct and deep look at the population. However, he underlines that the population has lots of difficulties in conducting income-generating activities, particularly in agriculture (where elephants devastate plantations) and in fisheries where activities are suspended by the manager of the Mayumba Marine Park. Therefore, they want to be an active stakeholder in the BWE Project by supplying food products, fishing (sea and lagoon) and market gardening, he requests the support of BWE in the granting of equipment to do so.	BWE has the will to support the population but today in the oil sector actions in favour of the population are no longer carried out as in the past. Oil operators are now working under a production sharing contract with the state. All actions in favour of communities must first be validated by the Hydrocarbons Department before being carried out in the field. However, some actions may be financed with funds by BWE as has already been done in the department. The existence of fishermen's associations is an element that facilitates the financing of certain actions. The economic operator prefers in terms of CSR to support groups with an effect on a larger number of people and by limiting individual support as much as possible. It is also possible to include this support in cooperatives/associations of farmers.

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				He underlines that whenever economic operators have a look at the population, their interventions do not meet the real needs of the communities. He, therefore, asks what was the real cause of the non-recruitment of young people (Covid-19, no need, absence of a BWE office in Mayumba)? For him, before considering future phases of development, the first step is to honour the hiring of young people, 95% of whom are unemployed. Indeed, no oil company employees come to Mayumba to recruit. Apart from a few state agents, there are not many employees in Mayumba commune who can constitute outlets for agricultural and fishing products to support its sectors. He insists on the need to hire young people from the departments of Basse and Haute Banio.	Recognized that the issue of youth employment was a major concern for the community. He recalled that the current context does not facilitate the task. Indeed, before Covid-19, 100 people worked for BWE, but currently, there are only 50-60 people left because of the Covid-19 pandemic. Not everyone can work on the boat, in Gabon, there is a need for only 2 or 3 people but with very specific skills. Indeed, the oil sector requires highly qualified people. For example, if there are petroleum engineers in Mayumba among the candidates for the job, they will be given priority in recruiting with equal skills. When it comes to food supplies, you need reliable suppliers. How can the commune of Mayumba guarantee a supply of tankers in the absence of a wharf where boats can dock: "Help us to help you". The observation made after a tour of the city is that everything is deteriorating in the town and it is necessary to make Mayumba attractive to economic operators.
				Following the response given by the representative of BWE. For him, he believes that since the creation of BWE in 2016, that not only engineers have been recruited. Does washing the plates or the equipment of the employees require a high qualification? Why are there no jobs that do not require specific qualifications reserved for young people from the Basse Banio department?	Any job carried out in the oil industry is likely to generate risks (safety, health, etc.). For example, washing the dishes requires a minimum of qualification in terms of hygiene. In fact, badly washed dishes can cause gastric problems for workers. However, in terms of youth employment, BWE will see how to insert some when employment opportunities arise, in any case, training to be allowed to work will always be necessary.

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				He returns to the issue of employment. According to him, there are the sectors of agriculture and fishing that can be employment alternatives, but young people do not have the necessary tools to carry out these activities. Taking his case, he is a pastry chef by training but lacks the necessary tools to exercise his profession. As a result, we seek material support and capacity building for young people in income-generating activities. Finally, he asks the question of whether BWE could help young people outside giving paid jobs.	All the grievances and expectations formulated by the local populations will be examined. BWE will not make false promises and will do what they can within their means. BWE hopes for lasting cooperation with communities, and that it be based on transparency
01 May 2021	Tchiole-Ndembe		Meeting with the Quartier of Mayumba (Tchiole-Ndembe)	He said he was happy to see an economic operator come and explain its activities to the "base". This is the first time in the economic life of the locality. Faced with the emergence of diseases that originate from who knows where, BWE's approach is to be welcomed. Since the ESIAs have been validated and the operating permits have been given to BWE, today's session should focus only on the complaints of the populations.	It was explained that in terms of the economic development of a locality, there are economic operators and public authorities, that is to say the State. These two entities support the local populations in improving their living conditions. Moreover, there are issues falling within the sovereign power of the State and those on which economic operators can intervene.

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				Welcomed the delegation led by BWE and presented the needs of the local population: public lighting leading to the city centre, rubbish bins, public pumps, the better the quality of drinking water and youth unemployment. For her, the first concern is that of youth employment.	In terms of the quality of the neighbourhood's water, it may be the treatment of the water coming into the pump. Regarding street lighting, he explained that the streetlights (solar panels) installed in downtown Mayumba are one of the actions of BWE. And the question will be examined in order to see the possibility of extending the radius of this action. In terms of youth employment, the grievance is the same in all the localities where the mission has passed. He reminded the participants that recruitment in a company is done according to its needs. In Mayumba, BWE job application files are located at the Departmental Directorate of Labor, but the recruitment process is currently on hold due to the Covid-19 pandemic. This pandemic has resulted in a downsizing at the company level. In the long term, the operator will review files when employment opportunities arise. In all cases, recruitment will be based what is required to fill the positions available. Also, given the magnitude of job demands in the departments of Haute and Basse Banio, it will not be possible to hire everyone, especially as the number of jobs may be limited.
				What is BWE's social policy? Does this consist in giving out donations?	Faced with the scarcity of employment, BWE's ambition is to provide materials to the population in order to support them in the exercise of their respective activities. However, recipients must be motivated and grouped by area of activity in order to benefit, depending on the possibilities and support BWE can give. The current phase is that of collecting expectations and opinions, followed by the selection of the most relevant expectations (prioritization) and decision-

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					making. Priority will be given to causes of collective interest.
				Employment remains the main concern of young people. Despite the role of the state, is it not possible for BWE to support young people in this area? For example, to reduce unemployment, BWE can provide fishing equipment for the young people gathered in associations. Since these young people lack the qualifications that would allow them to hope for a job at BWE. In addition, is it possible for BWE to provide paint in order to redo the walls of the school and to provide this establishment with computer equipment.	Took note of all expectations and those regarding jobs are not excluded. However, priority will be given to the empowerment of populations through support for Income Generating Activities (IGA). BWE will come back with proposals and work with the Mayumba Development Reflection Framework (CRDM). This is in order to retain the priority actions and examine the modalities of their possible financing and their implementation.
				Is the oil exploited off Mayumba the same as that sold at petrol stations? What justifies the increase in prices at the pump for an oil-producing country? What justifies the rise in sea level?	The oil sold at the pump in Mayumba is not the same as that exploited offshore. The oil produced by BWE is unrefined. It is directly exported. The one sold at the Mayumba pump is refined and comes from SOGARA. As for the fluctuation of prices at the pump, it remains subject to the economic policy of the State. At the time, prices were fixed because they were subsidized by the state, which is no longer the case today, since the price is now pegged to the fluctuation in the price of a barrel. Regarding the rise in sea level, it was explained that it is a worldwide natural phenomenon. BWE cannot individually deal with this phenomenon which is the responsibility of the Gabonese state. Rising sea level is a phenomenon linked to climate change. In some parts of the world, there are floods while in others droughts are on the rise. The solution envisaged by the State can be found in its Climate Change Adaptation Strategy, the answers are given on a case-by-case basis by the State

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				She asked if BWE will help women traders. And what were the actions planned for this social category. In addition, it raises the difficulties generated by the presence of national parks at the level of the department with the regulation (or even the ban) of fishing and hunting activities. The populations are in a dilemma: impossible fishing, food crops are devastated by wild animals.	The “gender” issue is part of BWE's concern. Indeed, women are an active stakeholder in the actions taken in favour of the communities and must be supported. He invites women to form cooperatives in order to pool their efforts. With regard to agricultural activities, the presence of parks poses the problem of “Man-Fauna” conflicts. He recommended that local and traditional authorities present these difficulties during the various meetings with provincial and government authorities. The same is true for the fishing sector in which he recommends discussing regularly with the departmental fisheries management. In terms of fishing techniques, he encourages local populations to work with their Beninese brothers who have extensive experience in the field of fishing. Fishing is a job like any other which requires prior training. Young people need to be motivated to learn from others.
				Why send young people who have the baccalaureate to trainman camps; what does it consist of?	It is a lack of long-term strategy of the department. In fact, since the economic operators have settled in the area, the local authorities have not encouraged young people to train in oil trades. As a result, their profiles are not attractive to oil companies. There is the problem of the match between training and employment. Local authorities often do not know what profiles requested by the economic operators. He recommends BWE sends the types of profiles it needs of the Department of Labor management so that they can launch a call for applications from young people. It was replied that for their part these profiles had been transmitted to the authorities.

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28 April 2021	Ndindi		Meeting with the Prefect of Basse Banio Department, including Departmental Council, Mayor and Chiefs of Quartiers of Mayumba and other community stakeholders (Ndindi)	Since the main concerns of the population lie in the social field; What can the population receive from BWE, in particular in terms of employment?	Refrained from making promises that cannot be kept. The current mission focuses on collecting data, collecting opinions, expectations, possible fears and complaints from the population. Prioritization will be established to provide relevant answers.
				He asked that the population go out so he could consult them on the expectations they wanted to present BWE.	It was replied that the main purpose of the meeting was to allow everyone to express themselves publicly. Global complaints can be sent to the BWE communications unit, the telephone numbers are given out in the brochure. The response finished by re-explaining the main objectives of the meeting. Expectations can be discussed during the main meeting, but other more specific expectations can be formulated during focus group meetings.

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				His intervention focused on the geographic location of BWE's oil permits. These permits are more located off the department of Haute Banio, unfortunately, in their name, it is the names of the department of Basse Banio that are attributed to them: • For example, we are talking about the Mayumba marine park, while the latter is located opposite the Haute Banio department. • The example of the potash mine, which is in its exploration phase, is attached to Mayumba while the Project is located in the Haute Banio. However, he thanked BWE for taking the initiative to include Haute Banio in the information and communication process. Also, in the area of employment, the young people of Ndindi should be recruited from the start to benefit from the development of oil activities (12,000 barrels/today). The economics prioritise the municipality of Mayumba.	The municipality has been identified as a stakeholder in the Project, which is why they are being met with. Young people will not be forgotten about if recruitment opportunities arise. However, recruitment in the oil sector requires prerequisites (in terms of training and security) on the part of the candidate. In terms of jobs, the current situation of BWE is not pleasant. The company has seen its workforce shrink from 100 employees before the Covid-19 pandemic to 50 employees at the time of Covid-19. Also, the company being in the first years of its creation, the recruitments (jobs) will be done gradually with the development of the Project. It was explained how the area of impact studies is defined in the realisation of a project. For example, in the case of BWE, the Municipality of Port-Gentil has been considered by the fact that the boats transporting BWE's equipment pass through this locality while the oil exploitation site is very far away. It is the potential impacts of the Project that make it possible to define the study area in an EIES, hence the inclusion of Port-Gentil which is far away and also of the Lower Banio and the municipality of Mayumba which are closer although not located directly opposite the development area of BWE.

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				Often economic operators give priority to the municipality of Mayumba. He asks BWE that this injustice be corrected in the future. In addition, he asks BWE to invest in the commune of Ndindi where the population has lots of expectations. He also indicated whether it was planned for BWE to set up a quadripartite commission to support the development of communities, like what is being done by the oil operator Maurel & Prom also present in the department.	The quadripartite commission can only be set up when the hydrocarbons administration has given the green light for the establishment of the local development fund in connection with the activities of BWE.
				He focused his intervention on the fact that Ndindi has been forgotten by the economic operators operating in the department and who favour the commune of Mayumba over that of Ndindi in carrying out actions in favour of the local population. Coming back to jobs, he asked BWE to recruit “enforcement agents” (labourers) in the villages of the Haute Banio department. He ends his remarks by presenting the grievances of the populations, the main ones of which are: • the electrification of the villages, • the installation of communication relay pylons • the supply of medical dispensaries • the delivery of chainsaws and brush cutters as well as outboard motors with a power of 15 horses to each village in the department	Took note of the grievances formulated which will be transmitted to his hierarchy for decision-making. In any case, not all expectations and grievances will be answered positively. Indeed, some actions fall under the sovereign role of the State and those which are likely to be financed by economic operators. BWE is governed by an exploitation and production sharing contract with the Gabonese State, for the moment, the agreement which gives the economic operator the possibility of making an allocation available for the financing of actions in favour of communities is not yet signed. BWE's current approach is to anticipate the collection of the expectations of local populations to better react when the agreement is signed.
				He asked the question relating to the opening up of the Haute Banio department, the only way to access the area is via the lagoon. Knowing that the road is the first factor of development, is it not possible to redo the Ndindi Mayumba road which is important to supply Ndindi with food, produce etc.	It was recalled that there are actions that fall under the sovereign role of the State and those that are likely to be financed by economic operators.
				Congratulates BWE for its initiative: visiting Ndindi. He blessed BWE and asked the ancestors to help this new company find new oil wells in the department of Haute Banio.	The assembly was informed that the established program plans to stop in one of the villages of Haute Banio to work and discuss with the population.

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				In addition, he asks the delegation accompanying the representative of BWE to travel through their villages to soak up the realities of the department.	
				He expressed his regret that the commune of Ndindi is landlocked. He asks that the Ndindi Mayumba road be rehabilitated because the department of Haute Banio has lots of natural resources (gold, diamonds, wood, oil, etc.) but they are not exploited because there is no road. Likewise, he asks for the asphalting of the Ndindi road network. In addition, he encourages BWE to continue exploring the area because according to him BWE will find new oil wells.	Took note of the concerns expressed by the land chief and thanked the participants for accepting the invitation to the meeting. Indeed, BWE wishes to have an honest relationship and promises regular visits to ensure that their partnership is fruitful.
29 April 2021	Malembé		Meeting with local leaders and community members of Malembé	He pointed out the communication difficulties that his village is experiencing due to the lack of an ICT relay antenna. To make a phone call, the population is forced to go to the hills to have a signal. And even then, the network is unstable. What to do in an emergency to call for help? Also, at the dispensary, there is a lack of medication.	Re-explained that this mission was put in place to collect expectations, possible fears and opinions on the Project under development. Also, it will be impossible to respond favourably to all the grievances formulated by the populations.
				He also came back to the network issues. His intervention was also focused on the question of oil which has been exploited for many years in the Haute Banio, but their villages are still deprived of ICTs and electricity, we have difficulties preserving the fish we catch which constitutes our main activity.	Re-explained that this mission was put in place to collect expectations, possible fears and opinions on the Project under development. Also, it will be impossible to respond favourably to all the grievances formulated by the populations.

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				We drink non-treated water from the lagoon. Is it possible for BWE to help us get clean water? Also, in the event of pollution caused by oil exploitation, are there measures in place that will allow us to have access to drinking water?	In the event of accidental pollution, which would then be an exceptional situation, the reaction will be swift to limit the extent of the effects of the oil spill. BWE has emergency procedures and works in collaboration with state-ordered national emergency procedures and international response methods that involve recognized structures and other oil operators equipped and trained for these situations. In day-to-day operations, in the ESIAs carried out by BWE, there is the Pet validated by the administration, there is the ESMP which provides for several measures to protect the environment (including water control before the discharge) and these measures are controlled by the environment and petroleum administrations.
				He asked about the jobs of the young people in the village. According to him, all of the economic operators who are in the Haute Banio department do not employ young people. How will BWE do to show its difference at this level?	It was reassured that youth employment is a recurring problem raised during all the meetings and is currently being considered. But there are no easy answers. Indeed, apart from the technicality required by the oil sector, it is impossible to recruit all the young people from the different villages. He hoped that when BWE's activities resume their normal pace, recruitment opportunities will arise, but they will be very limited. Currently, the Covid-19 pandemic has generated a decline in activity resulting in a reduction in the number of BWE staff. Also, the boat that BWE uses belongs to a service provider who uses its employees. BWE can't impose on this service provider the recruitment of agents if this does not meet its needs in terms of profiles and number of hires.

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				The population is too solicited in terms of data collection and the formulation of expectations and this by the political decision-makers and the economic operators. However, no favourable response is given to these grievances. This situation generates discouragement among the population which reduces their enthusiasm in participating in meetings. People are really discouraged.	It was clarified that the economic activities of a country are governed by the state in which they are carried out. Economic operators, after having paid their compulsory levies (taxes and various taxes), are not obliged to carry out additional actions in favour of local populations. It is in their CSR approach that they support village communities for better collaboration between different stakeholders. We must avoid discouragement; the population should always get involved in the communication process and projects in the area. In general, the economic operator studies the grievances and will intervene to the extent of their possibilities, but not all grievances can be solved.
29 April 2021	Mambi		Meeting with local leaders and community members of Mambi	He wanted a prior consultation of the population before coming to decline their complaints. This proposal was not validated by the assembly, preferring that each participant speak freely.	It was explained that BWE came to the village to discuss and exchange with the population. It is not just a question of coming and taking a catalogue of complaints, but above all seeing together how to respond favourably to some of the expectations, to the extent of BWE's possibilities.
				The hydraulic pump is not functional, the population collects water in the Banio for domestic use: • How will the population be able to use the water in the event that the Banio is polluted? • Besides, doesn't offshore oil activities also affect the air quality?	The presence of BWE off the coast of Mayumba implies that the Gabonese state has given its consent and that BWE has met the requirements of the public authorities and international organisations in terms of the environment. With regard to water pollution and discharges into the air, measures have been taken to avoid this pollution. Also, mitigation mechanisms for this pollution are put in place. In the impact studies, commitments have been made by BWE to avoid air and water pollution via treatment systems before discharge. The Environment and Hydrocarbons administrations regularly ensure through inspections that the commitments are respected in terms of

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					environmental protection. The vessels used are the latest generations.
				He asked BWE's representative what were the expectations identified by BWE in relation to the population.	It was explained that it is up to the people to express their expectations and not the other way around.
				How many people from the village has BWE recruited since its creation?	No one from the village works at BWE. The current operation of BWE does allow for too many possibilities for employment. BWE rents the boat from a service provider who comes with his crew. The number of direct employees of BWE is just around 20 people. The question of employment is asked in every village in the department. Assuming that BWE starts recruiting a person, even at the level of unskilled jobs, in each village we will see at the end that the number of people recruited will be double or three times the company's current workforce. However, as it grows, it will according to its needs see how to recruit the young people of the department. It should also be noted that in this case, priority will be given to the most qualified candidates.
				He objected to the response in relation to the minimum training required of any candidate for employment. Does cleaning plates require a training course? Since the dawn of time, people have washed the plates in their villages and have not die. The population is ready to be trained to come and work at BWE.	When the plates we use to eat in are poorly cleaned, it can lead to illness. Also, we work in companies that have international ramifications and we are obliged to comply with their hygiene requirements. He completed the answer by explaining that one should not compare the realities of villages to those of boats where there is a concentration of large numbers of people in a small space. The risk of proliferation and spread of microbes is higher in boats (closed environment) than in villages (open environment). Hence the need to be good in all activities that take place in the boats.

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				You carry out your activities 47 km from our villages. In the near future, is the extraction of oil not going to cause an upheaval in the soil, in particular the appearance of volcanoes	The oil industry has greatly improved its operating systems. The boreholes are 30 km deep at sea and have no impact on the mainland. At this level, it is rather the operator who is subject to a risk of eruption. It was also explained that the borehole has a very small size. While BWE is a newly established company in Gabon, its parent company and its international partners have several years of experience in oil exploitation. There is no correlation between the appearance of volcanoes and oil exploitation. Also, precautions are taken to avoid pollution accidents. For example, the discharges and emissions made by BWE are regularly checked by the DGEPN. This control is one of the requirements that BWE must meet.

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				He asked if BWE is doing onshore exploration and looking into the possibility of having a terminal at the mainland level? He then asked whether there was a water pollution monitoring group in view of the fact that people use the water from the Banio Lagoon?	Onshore or offshore installations depend on permits. Generally, the explorations are carried out by the Gabonese state, which makes permits available to economic operators. Operators often specialize either at sea or on land, so the operation is done according to the specialties and the choices of the economic operators. BWE at the moment focuses on exploration and exploitation at sea. In terms of monitoring possible water pollution, there are water control mechanisms before discharging them into the sea. The quality of the discharged water must comply with national and international standards. For example, there is an automatic mechanism for stopping discharges and reprocessing the water in order to reach the right concentration before it can be discharged. This is to avoid possible pollution during everyday operation. The example of water resulting from BWE's activities which is first treated before being discharged into the sea, as provided for in the impact studies, was provided. If an accident does occur, BWE has the means to intervene and halt the effects urgently by collaborating with the State (National Emergency Plan) and other national and international partners. For surveillance, it is the domain of the DGEPN, the Merchant Navy, national and international NGOs and everyone to give the alert.

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18 May 2021	Bendjé (Port-Gentil)		Meeting with the Prefect of Bendjé Department, including Departmental Council, Mayor of POG and Provincial Directorate for Fisheries and Aquaculture	Why is POG taken into account in BWE's approach? For her, economic operators are mainly linked to departmental and municipal authorities through community projects and these are under the responsibility of departmental councils. If there are projects in favour of local populations how can these be implemented? In addition, she asked where the premises of BWE were located and how many people were employed by BWE.	The premises of BWE are located at the new port of POG and this company has about 100 employees distributed between POG, Libreville and the license area.
				The approach is good because it already allows BWE to come and present itself after local and administrative authorities, although this could have been done earlier in the consultation process knowing that the activity of BWE is effective since 2018. He then highlighted the reasons for taking POG into account in BWE's approach. For him, the logistical arsenal contained in POG obliges oil operators to settle in this locality for the conduct of their activities. He is not surprised to see economic operators setting up their bases in his commune. Not only does their presence generate jobs but also tax gains through the compulsory levies to which companies are subject.	Comment noted.
				After thanking the Mayor for his details regarding the choice of POG, he asked whether today's meeting was a public consultation meeting. He also drew attention to the fact that his brigade covers all 4 provinces (including Ogooué Maritime and Nyanga).	It was not a public consultation, but rather a meeting with stakeholders. The public consultation had taken place in Mayumba before the validation of the ESIA and the obtaining of certificates of conformity by BWE.

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				Throughout the development of a project like the one led by BWE, ESIAs remain dynamic. They are often updated as the Project evolves. BWE's oil production activities having started in 2018, there is a question during this meeting of making ourselves known. About the expectations of local populations, since 1998 economic operators must contribute to the economic development of the localities in which they carry out their activities. To do this, they must recruit local labour (POG and Nyanga) and consume locally, to allow the local economy to develop. The Mayor makes a recommendation according to which: The General Management of BWE must tour the various administrations based at POG to make themselves known.	Comment noted.
				Focused his intervention on the fact that POG fishermen often meet in Mayumba. And within the framework of these interactions, it is also important that the population of POG and in particular the fishermen be consulted as foreseen by BWE and TEREA	Comment noted.
				There is an exclusion zone around which fishing is prohibited. Also, he welcomes the initiative of BWE to have settled in POG and encourages the employability of the populations of POG and Nyanga.	Comment noted.

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				Asked whether BWE considered the occupation of the maritime domain in its activities. This involves considering the potential impacts, in particular marine pollution and security risks, which requires determining the navigation zones.	The Mayor replied that in terms of marine pollution, Gabon is the best-monitored country in Central Africa. And in its acceptance, all the administrative requirements have been fulfilled by BWE by going to the various administrations before obtaining the authorizations. Affirmed the words of the Mayor and reiterated that in the current process, meetings are held with the various administrations identified as stakeholders in the Project. Also, BWE keeps watching to anticipate pollution risks under international recommendations, and in particular MARPOL.
				The administrative and municipal authorities want the General Management and the Operations Department of BWE to meet them.	Comment noted.

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02 April 2021	Libreville		DGEPN	He summarized in a few lines the purpose of the visit as presented by the team (complementary approach to data collection, information, resumption of activities). Not being the one who followed the BWE files at the DGEPN, he asked the delegation to clearly specify what the operator expects from the DGEPN since the EIES have been validated and they already contain basic information.	It was indicated that the current approach is part of a logic of information and resumption of contact with all the major stakeholders involved in the Project. In addition to this, data collection is done, always from stakeholders in order to meet the requirements of the donors who support BWE in the development of the Project. It was clarified that in addition to the legal steps taken by carrying out the impact studies and validating them, it was for BWE to renew contacts with stakeholders for opinions/ recommendations and to collect data that will make it possible to consolidate environmental knowledge (biophysical environment and human environment) and thus meet the specific expectations of donors and BWE for a good environmental and social management of the Project. It is important for the proper execution of the Project activities that the administration can make available updated and relevant data from their database, which also makes it possible to cross-check the information available on the different subjects.

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				The field team provided a comment concerning in general the request for data collection?	DGEPN pointed out that there is a lot of information at the level of the DGEPN services, provided by operators operating in the Mayumba area. It should be noted, however, that for EIES, as soon as the operator files its reports with the DGEPN, these documents, as well as the data they contain, become the property of the Administration and are not freely accessible. In addition, they have carried out or participated in the work of certain initiatives: • Coastal profile of Gabon • Coastal Erosion Project He indicated that he would send the Delegation the digital versions of those two studies mentioned above.
				Following the request of the donors, he clarified that among other sovereign missions of the DGEPN is to ensure that the implementation of the Environmental and Social Management Plan is in accordance with what the operator wrote in its documents. FnsaD shall monitor Project activities in accordance with the EIES,in line with the requirements and budget set out in the GGP. To this end he referred to Article 35 of the Environment Code in the Gabonese Republic. Wished to have clarifications on the following points; • Considering the transport of hydrocarbons between the platform and the FPSO in the EIES (ensure this aspect is included)	The points identified by the representative on the EIES will be checked. As EIES and PGES have been validated, activities are carried out in accordance with commitments.
				He indicated 1 to 2 months after the start of the mobilization phase of the teams, it will be necessary for BWE to invite the DGEPN to carry	The platform is under construction in Dubai. Actions will be taken in accordance with the GGP

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				out the follow-up of the GGP in the mobilization phase.	
				He stresses that in order to reassure donors, if it is not possible for the DGEPN to be on the ground during the collection of data, this administration has the possibility of certifying the data before their transmission.	The engagement process as planned with RSK includes a collection of primary and secondary data in Mayumba without the administration (social surveys done by the research firms)
				The field team enquired about information regarding populations in the park/biodiversity in the park?	DGEPN recalled that the ANPN has a large amount of data on the study area.
				The field team enquired about tourism and recreation at the park?	DGEPN indicated that there are three hotel structures on Mayumba that may be involved for this component.
				The field team enquired about priorities and recommendations?	DGEPN indicated that there are no major environmental impacts in the Project area, but one of the problems raised by DGEPN at the community level is that of the lack of communication between oil operators and local populations. Local populations reproach oil operators for often ignoring them after public consultations have been carried out. Recommendation to BWE to strengthen cooperation with local riparian communities; To show the difference with other operators by carrying out small actions in favour of local populations (example: repair of painting in schools) and this, despite the contribution of BWE to the local development fund.
				On the question of showing at the social level the difference with other operators by carrying out small actions in favour of local populations.	An update on the actions carried out in recent years as part of BWE's societal commitment (development of a linear kilometre of electricity, support program for students who pass the baccalaureate (teachers for support, transport of students to pass the exam), support for fishermen was provided.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
31 March 2021			Gabon Bleu	Requested BWE to provide details of current or future activities (exploration/exploitation, phases, timetable etc.)	Provided some answers on this point by specifying that the Project had started since 2018 with phase 1 which it is currently completed. However, phase 2 had started but is incomplete due to the emergence of Covid-19 in 2020. Phase 2 is being relaunched, which justifies the need to update certain data. A leaflet summarising the Project's activities was produced for this purpose and accompanied the interview request letter.
				After reviewing the maps presented by the delegation recommended that the boundaries of the Marine Protected Areas off Mayumba be superimposed on the contours of the permits and activity areas of BWE. This overlay operation will make it possible to better visualise the Project's area of influence and to understand the potential effects on the water reserve and the marine park.	Overlay areas will be added to future maps.
				Indicated that it is also possible for BWE to share the geographical coordinates of the permit and well areas with the ANPN so that their geomatics department can integrate them into their matrix. Important in the context of surveillance and communication with the actors of the PC maritime crisis	The transmission of Project area coordinates is possible and would be discussed internally and validated by BWE.
				Asked to provide them with a timetable of activities in order to allow the ANPN-Gabon Bleu to carry out surveillance activities, including the fight against illegal fishing in the exclusion zone established within the perimeter of the oil installations.	Given the effects induced by Covid-19, activities have been slowed down, but the Projects are being redefined, the revised timetables can be transmitted.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				He recalled that a first meeting had already taken place with the management of BWE in February 2019 during which BWE had presented the Project, but no report on the implementation of oil activities on the ground has been produced so far. Also, since this meeting, the two parties have not met to discuss the progress of the Project and the memorandum of understanding that was to be signed between BWE and the ANPN. The information related to the planning of activities and the estimated budget to be included in the memorandum had already been presented at the last meeting in 2019. Since some wells have already gone into production, it is necessary for the agreement to be signed between the two parties in order to work better together. This approach is identical to that of other economic operators operating within the perimeters of protected areas.	He replied that communication between the two parties had been interrupted due to Covid-19. However, the information will be sent back to the hierarchy so that exchanges can resume as soon as possible.
				The intervention of the ANPN / Gabon Bleu is as beneficial for the nation as for the activities of BWE. He illustrated by mapping before and after the implementation of the Gabon Bleu program (2013) that the program's monitoring activities have made it possible to reduce, for example, the use of trawlers along the coasts and in particular in the mouths. He also recalled that the majority of aquatic areas have been created in areas of petroleum activity because of the particular ecosystems that exist around oil platforms. The wealth of fish products in these territories attracts illegal fishermen, and the role of the Blue Gabon programme is, among other things, to combat this prohibited fishing and to protect oil installations.	This support would be integrated into the convention, the information would be relayed to the hierarchy.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				The field team wished to collect data, in particular on the management plans of the marine protected areas concerned by the Project	Several prerequisites were set by the Technical Director: • No formal request has been made by BWE, but this data exists and can be shared when the time comes • The Project must meet two levels of requirement. Firstly, the requirements of Gabonese law, within which the EIES and associated PGES have been validated by the DGEPN. Secondly, the requirements of the donors vis-à-vis BWE and for which the ANPN/Gabon Bleu wishes to have clarification (what requirements? What actions are expected in terms of cooperation/support for BWE's activities? Note that the ANPN can produce compliance reports if necessary). To make progress on the data collection part, a technical meeting between TEREA and the ANPN/Gabon Bleu can be carried out but first of all, the DG of BWE Gabon must refer the matter to the Executive Secretary of the ANPN to signify the resumption of communication.
18 June 2021			DGEA	Are BWE's activities offshore or onshore?	It is offshore.
				Does BWE take water samples for quality monitoring?	It is necessary to have a clear typology in terms of surveillance. At the marine level, Gabon has many weaknesses. In the absence of up-to-date data, EIES consultancy firms are obliged to refer to international publications. This is the particular case of aquatic ecosystems where recent data do not exist for Gabon.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				For the CEO, it is necessary to update the data of the impact studies. It found that the experts specialising in the EIES often use data from the bibliography and do very little field data collection. However, the field data allow the DGEA to be reassured about the consideration of marine fauna and flora in the conduct of oil exploitation activities. Also, operators must provide the restoration methodology provided in case of risk of pollution. This method must be effective. The GDA insists that for the mission of knowledge of the resource, its management needs the EIES carried out with updated data in order to proceed to the valorisation of aquatic ecosystems.	It is necessary to have a clear typology in terms of surveillance. At the marine level, Gabon has many weaknesses. In the absence of up-to-date data, EIES consultancy firms are obliged to refer to international publications. This is the particular case of aquatic ecosystems where recent data do not exist for Gabon.
				He notes the absence of the DGEA during the exploration campaigns that the operators carry out together with the agents of the Ministry of Oil. Indeed, these campaigns would be an opportunity to associate the experts of the DGEA in order to establish the initial state of the Project area and to follow the evolution of the situation. In oil extraction activities, it is more than necessary to follow the evolution of the environment. How in 2021, can we continue to use the 1960 data as a reference base. This data had to change and needs to be updated.	Comment noted.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				Is BWE's environmental watch already active? Also, he asks if the social activities already carried out by BWE are in phase with its level of oil production? What is the balance sheet of BWE's social activities?	In terms of the review of activities, particularly in the social field, BWE remains open to everyone to communicate what it does in favour of communities. However, from the point of view of the Production-Actions correlation, he recalls that BWE is linked to the Gabonese State by an Exploitation and Production Sharing Contract, and therefore all Projects and expenses must be previously validated by the State via the General Directorate of Hydrocarbons. Also, he asks stakeholders not to compare BWE with other economic operators who have been in the area for decades. At the end of the ESIA, a report containing the Environmental and Social Management Plan is submitted to the DGEPN and to other administrations concerned by the activities of BWE. These administrations carry out checks on the ground to watch the execution of the ESMP by BWE. Likewise, international institutions have a look at the activities of operators, particularly in terms of respecting the environment.

				Criticised the way in which economic operators worked, particularly with regard to aquatic ecosystems. The RD is concerned about improving knowledge and monitoring in this area. It considers that economic operators are not investing enough in sea based EIES in Gabon. He cites the example of Mauritania, where the operators are launching numerous studies in the marine environment. To this end, the DG is setting up consultancy firms to show operators the importance of financing studies in the marine environment. We need an inventory of where drilling is carried out. It is not always a question of seeing things on the wrong side. Indeed, drilling can enrich biodiversity. With regard to data, the DG notes that the data for the Gabonese marine environment are data from 1960 at the time of ORSTOM. Which is a real drawback. That data is over. In the context of oil exploitation off Mayumba, all the elements of pollution often found are attributed to operators located in neighbouring Congo; while there are many platforms installed off Mayumba. No operator on the Gabonese side wants to take responsibility. To do this, the DG calls for transparency. The DG's concerns are articulated in the following areas: • Development of a monitoring model; it involves making a simulation in the event of an accidental oil spill, indicating the areas of leakage and/or and how to intervene. At this level the DGEA does not have too many answers provided by economic operators • The colonization of fish around the platform: How is it done? Indeed, platforms are fish concentration devices; they are also indicators of the state of the resource • Monitoring around oil installations: Need to make projections in the event of an accident; modelling of intervention areas.	Confirms the observation made by the CEO that during the validation sessions of the EIES, the DGEA is not often represented. It was agreed that the intervention and the requests of DG MVE BHE. However, it calls for there to be a genuine synergy between all the oil operators present in the area where BWE exploits the oil. He asserts that BWE is not against field observations. Also, DG MVE BHE has observation projects BWE remains open to any form of proposals. However, it deplores the multiplicity of administrations in which each of them brings its grievances. It would like to see consultation between the administrations in order to carry out joint field missions to collect data.

				However, the DG clarified that this message is not only addressed to BWE but to the entire Gabonese oil industry.	

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				What is the BWE development Project? And what is the monitoring?	The question was an opportunity for the BWE representative to go into more detail in the presentation of the Project. He insisted on two main activities: Drilling by boat, and Platform with 6 wells.
				He asks BWE to do things differently compared to the former operators who have been established in the area for a long time. From the beginning of the exploration of the site, an operator can already make an inventory of the situation. For monitoring water quality, the operator may place a monitoring device. In this case, BWE can regularly monitor through periodic sampling, the evolution of the quality of the water around its site. The collected data can be shared with the DGEA, so BWE will contribute to the knowledge of the resource.	The TEREA design office for which he is responsible can contribute to the development of monitoring. It also stresses that in the event of accidental pollution, apart from the restoration of the environment, compensation must also be made. He notes that in the process of identifying critical habitats, it is necessary to involve all users of the marine environment, for example, oil tankers, transporters and trawlers. Moreover, it was noted that the Gabonese State often makes requests that fall within its sovereign role. This way of doing things unnecessarily scatters the resources. Hence the need to formulate needs properly.
				In other countries, oil operators contribute enormously to improving knowledge of the resource in the field of aquatic ecosystems, in particular the marine environment. But in Gabon this contribution is slow to come. Even at the level of monitoring the temperature of the water, no action is visible. To this end, it asks BWE to place a thermometer in its installations if possible in order to measure the evolution of the water temperature.	He explained that BWE works in complete transparency with the administration. For example, the position of its oil facilities was sent to the Merchant Navy. It is up to that administration to share the information with others. With regard to complaints, whether administrative or technical, he advises the DEA to send an official letter to the Director-General of BWE. BWE will always respond.
29 June 2021			GDFAP	How can the DGFAP as a stakeholder be involved in the Project?	This is an international procedure that requires consultation with all stakeholders who work or have an interest in the aquatic field. To this end, he raises the question of whether the DGFAP had activities in the marine field.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				He explains that most of the activities of the DGFAP are done in the continent but its field of intervention extends to the sea. However, at the level of carrying out the EIES, the DGFAP is consulted only at the end, i.e. during the validation of the studies. In this situation, it is often impossible to make relevant proposals that can be taken into account in the implementation of the Project. Similarly, when it comes to studies relating to the oil sector, very often the Directorate-General for Hydrocarbons and the DGEPN designate the stakeholders to be consulted without first carrying out a real identification of the said stakeholders.	Took the floor to explain that in the choice of stakeholders, the fault does not rest with the economic operator because it is the administration in particular the DGEPN, which is in charge of the EIES, to make recommendations on this subject. In the event that the DGEPN made a list of stakeholders to be consulted, the operator will take care to call them in order to consult them. According to him, the identification of stakeholders should be fair when the Project notice is submitted to the DGEPN. Indeed, the purpose of stakeholder consultation is not only to involve them but also to inform them about the Project or programme. Stakeholders are also a source of information needed to feed into the EIES document.
				He notes a low involvement of the DGFAP. Rather, it is the ANPN that takes over activities related to the marine domain. This is linked to its strong capacity to mobilise financial resources and its prerogatives. As a result, when it comes to data on marine aquatic fauna, it is better to contact the NNPC.	Comment noted with thanks.
28 May 2021			GDPA	Asked whether specifically BWE had obtained the opinion of APD. Even if the DGEPN issued the certificate of conformity to the BWE, the most appropriate and effective approach would be that of ensuring that economic operators meet each stakeholder separately according to their specialty. The majority of operators do not always come to consult the DGPA while there is a law on fisheries (Fisheries Code) which obliges them. It calls for economic operators to step up meetings with stakeholders, in particular the DGPA. DGPA technicians must go to the field where the activities are carried out in order to issue opinions that are in line with reality.	The team is not aware of a previous visit by BWE to the GDPA and has obtained an independent opinion from this directorate. However, at the public consultation meeting held in Mayumba, APD was represented. It is the public administrations that set the conditions for economic operators. These administrations need to agree to form a single team to carry out the site visits. It is difficult for an economic operator, in view of the large number of administrations concerned by his project, to invite them to visit the sites separately. It states that economic operators are not hostile to the quick operation of their sites by public administrations.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				The two APD officers are not informed about the EIES conducted by BWE.	
				He recalled that the agents of the DGPA have a good knowledge of the problems that arise in the departments of Upper and Lower Banio. Also, it would be better to consider them before going down to the field. Sometimes the local populations we meet do not have the technical knowledge to measure the stakes of the activities carried out by economic operators. He cites the example of an oil operator located in the area who wanted to transit his "pipeline" in the Banio lagoon that DGPA agents recommended to make it pass through the sea. To this end, he praises BWE's approach (stimulated by donors) to consult widely with the PPs because of the pollution risks presented by oil activity. Reaffirmed the DGPA's readiness to support economic operators in the development of their activities. However, economic operators must comply with the law and the design offices (councils) are well aware of the procedure to be followed.	Acknowledged that the ideal would have been to consult the DGPA before going to the field but the program did not allow it. Indeed, it is necessary first to send a letter to the DGPA and to seek a response. This procedure extends the time taken to carry out the mission that RSK has entrusted to TEREA. Indicated to the agents of the DGPA, that BWE remains open to requests for visits to its site. The main thing is to send a letter to the general management of BWE.
			WWF	Presented WWF's areas of intervention in Gabon. These are all trades working for sustainable development (landscape, forest, etc.). Who were BWE and RSK?	It was explained that that BWE is a department of BW Offshore and RSK the design office based in England which accompanies BWE in the establishment of the environment of its activities. A brief presentation of the BWE company from its inception to the present day was provided. It relied on the brochure given to the WWF representative beforehand, which details the project and its activities. BWE's current approach which consists of making a broad consultation of stakeholders in order to collect their opinions, concerns and recommendations but also to collect the necessary data to feed the environmental baseline of the Project.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
01 July 2021				He returns to the follow-up process. According to him, given the weakness of the means (human and financial), the DGEPN and the DGH do not follow up too much on the PGES. It notes that the monitoring reports are not transmitted to economic operators. To this end, he proposes that the monitoring of the PGES should be carried outby NGOs that have the capacity to mobilize external funding in this area. In the follow-up, there must be control tools that make it possible to make corrections in the event of non-compliance. In the event of serious misconduct, the Penal Code must be applied, which now takes certain aspects into account.	It is believed that the introduction of legal control tools is a good thing. However, the question arises as to whether the judicial institution has the necessary expertise in specific areas such as oil exploitation.
				Responding to the answer provided, it existed and in case of lack, the judicial administration calls on external expertise. He cites the example of the implementation of contractual specifications in the CFAD. In the process of monitoring the PGES, it affirms WWF's readiness to carry out this activity and specifies that the funding will be done by the funds of this International NGO mobilizes itself and not from funding from economic operators. In the case of the WWF development project, he recommended that BWE and TEREA should go and consider their WCS colleagues because the location of the project was in their intervention area. It considers that WCS holds important data from the Mayumba area.	Comment noted.

Meeting Date	Location	Meeting Type	Meeting name	Questions and Concerns	Response Provided
				As for the approach taken by BWE to carry out a broad consultation of stakeholders, this is to be welcomed and encouraged. Indeed, it is necessary to pacify relations between economic operators and local populations located in the areas where the various projects are to be held. It recommends that BWE as an economic operator often collect data during the implementation of its Project. These data are necessary for all stakeholders as they allow for better monitoring of the GGP.	Comment noted.
				As part of the migration monitoring of sea turtles BWE can help collect this data and share it with the administration and NGOs including WWF.	Comment noted.
				By way of closing words, it was reaffirmed the will of his institution to position itself in the follow-up process.	Comment noted.

APPENDIX 4F - SUMMARY OF CONCERNS AND QUESTIONS ACROSS TOPICS

Topic	Concerns, issues, and questions raised	Relevant stakeholders	Responses
Project characteristics	Questions relating directly to the Project, including what will be undertaken, how the Project will be operated and clarification as to where the Project is located.	Meetings in Mambi and Bendje.	It was explained that both onshore and offshore installations in Gabon depend on permits. Explorations are carried out by the Gabonese state, which makes permits available to economic operators.
ESIA Studies	Questions relating to what studies have already been undertaken and what studies are currently being undertaken, including environmental monitoring. Emphasis on the expectations of the CRDM. Comments that BWE's approach to this Project was good and requests to be further involved in the Project were noted. Requests were made for BWE to provide details of current and future activities in the area. Request for BWE to provide geographical coordinates of the permit and well areas in order to provide effective surveillance and communication should there be an emergency in the area.	Meetings in Mayumba, Mabounda, Ndindi, Malembe, Mambi, Bendje. Meetings with DGEPN, Gabon Bleu, DGEA, DGFAP, DGPA, WWF.	It was explained that a report containing the Environmental and Social Management Plan will be submitted to the DGEPN and to other administrations concerned by the activities of BWE. These administrations will carry out checks on the ground to watch the execution of the ESMP by BWE. Furthermore, international institutions have a look at the activities of operators, particularly in terms of respecting the environment. It was explained that the CRDM is very important and will not be forgotten. It was explained that a leaflet explaining the current Project and its phases had been provided. It was explained that the transmission of Project area coordinates is possible and would be further discussed internally and validated by BWE.
Stakeholder engagement	Questions relating to the first round/initial meetings held in 2019. Questions relating to what is expected of stakeholders and the outcome of these meetings. Questions as to how stakeholders can be further involved in the Project.	Meetings in Mabounda, Tchiole-Ndembe, Malembe, Mambi, Bendje.	It was explained that the current meetings are a continuation of the previous meetings held. These meetings allow for the stakeholders to express their concern, opinion and raise questions about the Project. It was explained that these would be considered in the final ESIA report.

Topic	Concerns, issues, and questions raised	Relevant stakeholders	Responses
	The approach taken by BWE to carry out these consultations for stakeholders is welcomed and encouraged for future projects.	Meetings with DGEPN, Gabon Bleu, DGEA, DGFAP, GDPA, WWF.	It was explained that the Project requires consultation with all stakeholders who work or have an interest in the Project.
Environmental	Questions relating to the justification of the Project and the impact on sea level rise. Questions relating to the impact on air quality and soil.	Meetings in Tchiole-Ndembe, Ndindi, Mambi. Meetings with Gabon Bleu, DGEA.	It was explained that there are several measures in place to protect the environment and that these are controlled by the environment and petroleum administrations. Mitigation measures will be put in place to reduce these impacts. In relation to impact on soil, it was explained that the boreholes are small in size and will be drilled 30 km deep at sea and will have no impact on the mainland.
Social	Questions relating to the employment of people from local communities, particularly young local people. Questions about what can be done for communities in terms of infrastructure (roads, water infrastructure, medical dispensaries, communication pylons etc.) Concerns over the exclusion zone interrupting fishing grounds in the area. Question as to whether BWE could help women traders.	Meetings in Tchibanga, Mayumba, Mabounda, Tchiole-Ndembe, Ndindi, Malembe, Mambi, Bendje.	It was recognised that the issue of youth unemployment in local communities was a concern. In the long term, the operator will review files when employment opportunities arise. It was explained that BWE will come back with proposals and work in communities with the Mayumba Development Reflection Framework (CRDM). It was explained that this mission was put in place to collect expectations, possible fears and opinions on the Project under development. It was encouraged that women are an active stakeholder in the actions taken in favour of the communities and must be supported. It was put forward that women form cooperatives in order to pool their efforts.

Topic	Concerns, issues, and questions raised	Relevant stakeholders	Responses
Other	Questions relating to who BWE as a company, including how they help communities, where their premises are located, and how many people they employ.	Meetings in Tchiole-Ndembe, Ndindi, Bendje. Meetings with DGEPN, DGEA, WWF.	It was explained that BWE's premises are located at the new port of POG ad the company currently employs around 100 people located between POG, Libreville and in the Project licence area. Information was provided on BWE's social commitment and work they have done to help communities in recent years.

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 5: Impact Assessment Methodology

80834

RSK GENERAL NOTES

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5 IMPACT ASSESSMENT METHODOLOGY

5.1 Overall Approach

The assessment of potential environmental and social impacts from the Project used in this report is a systematic process that involves:

- identifying Project activities and associated aspects or sources of impact
- identifying related environmental and social receptors
- assessing the significance of the impacts on receptors based on the **magnitude** of the impact and the **sensitivity** of the receptors.

Mitigation measures are then applied to reduce the magnitude of the impacts.

The significance of the 'residual' impacts (subsequent to application of mitigation measures) is then determined using the same criteria.

This process is outlined in Figure 5.1 and discussed in more detail in this chapter.

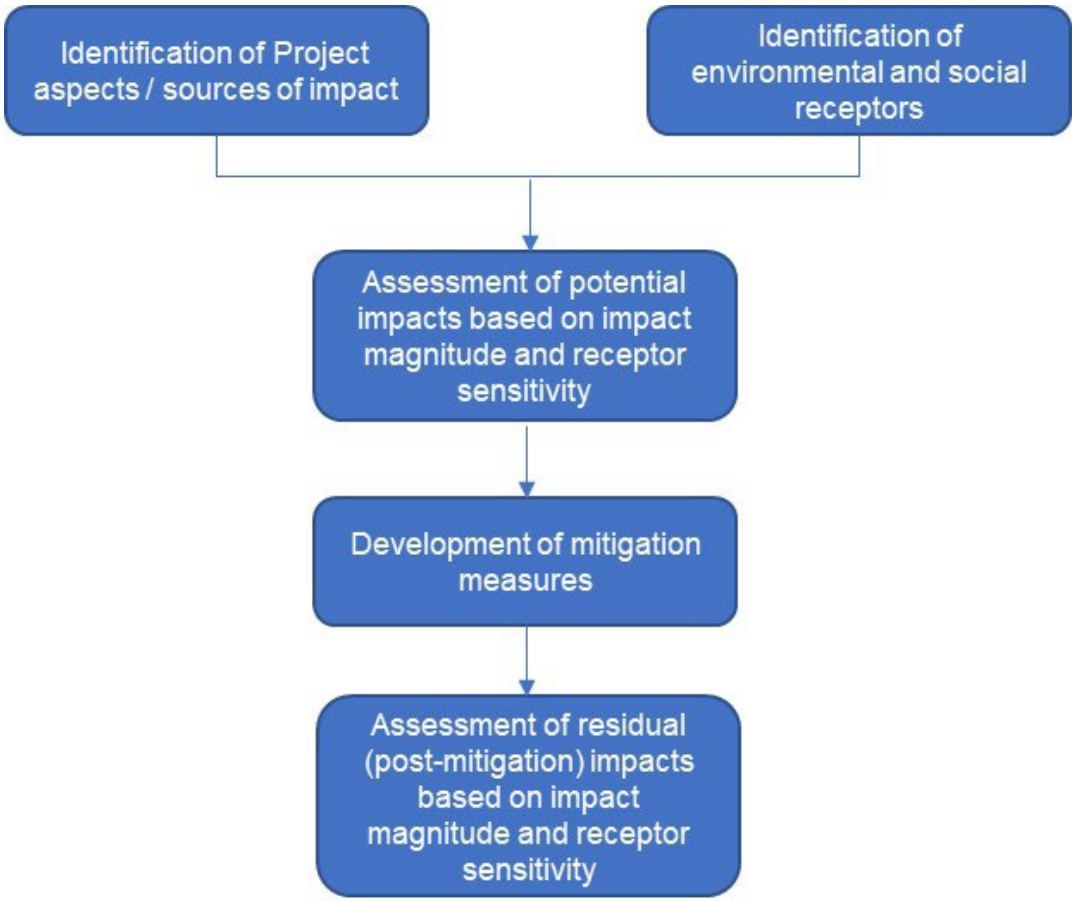

Figure 5.1: Process for assessing significance of impacts

5.2 Types of Impact

Impacts arise when activities and associated aspects interact with environmental and social receptors. Impacts may be described in several ways, as follows:

- positive - an impact considered to represent an improvement to the baseline environmental or social conditions, or that introduces a new desirable factor
- negative - an impact considered to represent an adverse change from the baseline conditions, or that introduces a new undesirable factor
- direct - an impact that results from a direct interaction between a planned project activity and the receiving environment
- indirect - an impact between the proposed activity and the environment as a result of subsequent interactions within the environment
- induced – impact resulting from other non-project activities that happen as a consequence of the project activities
- cumulative - an impact that acts together with other impacts (including from other third-party project or projects) to affect the same receptor(s)
- perceived – activities and aspects that stakeholders believe would change baseline social and / or environmental conditions even when there is no factual basis for the concern.

5.3 Impact Significance

The significance of impacts is determined based on the magnitude of the impact and the receptor sensitivity using the matrix presented in Figure 5.2.

Significance			Sensitivity rating			
			Very low	Low	Medium	High
		0 Positive	1	2	3	4
Magnitude rating	Very low	1	1 Negligible	2 Negligible	3 Minor	4 Minor
	Low	2	2 Negligible	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

Figure 5.2: Impact significance matrix

The criteria for scoring / rating impact magnitude and receptor sensitivity are explained in more detail in Sections 5.4 and 5.5 respectively and in Tables 5.1 and 5.2.

5.4 Impact Magnitude

For each Project activity/aspect, the magnitude of impact is evaluated according to the following criteria:

- the geographical extent of the impact
- the duration of the impact
- the scale of impact
- the frequency of impact.

Definitions / criteria to assist in determining impact magnitude are provided in Table 5.1 and scoring is allocated from 1 (very low) to 4 (high). A rating of 0 is provided for beneficial (positive) effects.

Impact frequency relates to the constancy or periodicity of the impact. Where possible this is expressed quantitatively, where this is not possible terms such as ‘once-off’, ‘temporary’ or ‘continuous’ are used.

Additionally, for unplanned events only, magnitude incorporates the likelihood factor. The likelihood of an unplanned event occurring is designated using a qualitative scale:

- possible - unplanned event that occurs during such projects
- unlikely - unplanned event that happens occasionally
- very unlikely - unplanned event that is very unlikely to occur
- extremely unlikely - unplanned event that would occur only in exceptional circumstances.

5.5 Receptor Sensitivity

The evaluation of receptor sensitivity takes into account its local, regional, national and international designations, its importance to the local or wider community and its economic value. The assessment of the sensitivity of human receptors, for example, a household, community or wider social group, takes into account their likely response to change and their ability to adapt to and manage the effects of the impact.

Stakeholder concerns associated with the type of receptor and the potential for cumulative and/or transboundary impacts to occur are also taken into consideration.

Sensitivity of the receptors is scored from 1 (very low) to 4 (high) as described in Table 5.2

Table 5.1: Definitions / criteria to assist with scoring impact magnitude

Score	Geographical extent of impact	Duration of impact	Examples to assist with determining scale of impact	
			Environmental (physical and biological)	Social (socio-economic, health, cultural heritage)
0 Positive	-	-	Beneficial impacts on habitats and species	Beneficial impacts on local communities, health, resources, or cultural heritage sites
1 Very low	**Immediate**: within the project footprint	**Temporary**: impact very short-term, likely to be mitigated through natural processes (or project mitigation measures) immediately (within one month of impact occurring)	Disturbance to the environment limited to the immediate area, with rapid recovery without intervention Planned activity or accident causes disturbance to individuals of a species that is similar in effect to the random changes in population due to normal environmental variation No discernible effect of disruption of behaviour or species interactions of nationally/internationally important species of conservation concern No protected areas affected Emissions and effluent discharges do not breach licence limits, or national/international standards and have negligible impact due to rapid dilution and dispersion Spill or accidental event (onshore or marine) that causes immediate area damage only and can be restored to an equivalent capability in a period of days up to one month	Changes to demographics, employment, social service provision or lifestyle are neutral Very limited / intermittent interference, may be noticed by users of resources Incidence of chronic and acute illness and reduction of wellbeing stays within normal variation in baseline levels Negligible degradation of cultural heritage sites

Score	Geographical extent of impact	Duration of impact	Examples to assist with determining scale of impact	
			Environmental (physical and biological)	Social (socio-economic, health, cultural heritage)
2 Low	**Local**: within the project footprint and up to 3 km from site	**Short-term**: impact likely to be mitigated through natural processes (or mitigation measures) within 1 year of cessation of activities	Disturbance of habitat on a local scale, restoration within a year requiring minimal or no intervention Localised short-term disturbance of individuals of a species that does not affect other trophic levels or the integrity of the population Potential disruption of behaviour or species interactions of nationally/internationally important species of conservation concern but effects confined to minor disturbance of current generation Activities may temporarily disturb protected areas but not lead to any long-term effects on the ecological integrity of the protected area Emissions and effluent discharges do not breach licence limits, or national/international standards Spill or accidental event (onshore or marine) leading to immediate area or localised damage to water resources or soil that may take up to six months to restore to pre-existing capability/function Environmental incident typically resolved with on-site response equipment	Activity that causes minor interference with other users of resources. Direct or indirect impacts will be discernible but use and value of resource not impacted. Rapid return to baseline conditions on completion of project activities Planned activity resulting in a short-term increase in incidence of acute or chronic illnesses in the local community Activity that causes minor disturbance and / or superficial damage to cultural heritage site that is easily rectified

Score	Geographical extent of impact	Duration of impact	Examples to assist with determining scale of impact	
			Environmental (physical and biological)	Social (socio-economic, health, cultural heritage)
3 Medium	**Regional**: effects of impact experienced up to 50 km from site	**Medium-term**: impact likely to be mitigated through natural processes (or mitigation measures) within a few (up to 5) years of cessation of activities	Impacts on a unique habitat, or regional scale, resulting in medium term damage and a restoration time of several years that may require intervention Disturbance of a population of species resulting in a change of abundance over one or more generations, but that does not change the integrity of the population of the species, or populations of dependent species Potential for small-scale pathological damage of nationally/internationally important species of conservation concern Occasional minor non-compliances with emission and effluent discharge licence limits or national/ international standards Spill or accidental event (onshore or marine) leading to damage to water resources, soil or habitat over a larger geographical area (not localised), or that cannot be restored to pre-existing capability/function within one year Environmental incident typically requiring mobilisation of in-country response resources	Planned activity that causes changes to demographics, employment, social service provision or lifestyle that may affect groups of local stakeholders Activity or accident that causes moderate interference with other users of resources Planned activity resulting in short-term increase in incidence of acute or chronic illnesses in local community and long-term increase in vulnerable groups, e.g., children, elderly Activity or accident that damages a site of cultural heritage importance that requires immediate repair by existing project resources

Score	Geographical extent of impact	Duration of impact	Examples to assist with determining scale of impact	
			Environmental (physical and biological)	Social (socio-economic, health, cultural heritage)
4 High	**International / transboundary**[1]: experienced >50 km from site	**Long-term**: impact and its effects will continue for up to five years or more following cessation of activities, potentially irreversible	Impacts on a unique habitat, or national scale, resulting in long-term damage and a restoration time of more than five years and requiring substantial intervention Activity or event disturbing a sufficient portion of the biogeographic population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population of the species, and several species dependent on it, to former levels within several generations Potential for large-scale pathological damage of nationally/internationally important species of conservation concern Numerous non-compliances with emission and effluent discharge licence limits, or national / international standards Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources	Activity or event causing substantial interference to other users of resources, change to demographics, employment, social services provision or lifestyle that is out of line with international guidelines or national policy affecting a large number of people and lasting considerably beyond project lifetime Planned activity resulting in increased long-term mortality, long-term chronic illness, permanent disability or significant reduction in wellbeing in a large number of people Activity or accident that seriously damages a site of cultural heritage importance, notifiable to the relevant authority and requiring specialist skills to repair

[1] Transboundary impact – an impact that occurs across and beyond the national boundary of a neighbouring state / nation.

Table 5.2: Definitions / criteria to assist with scoring receptor sensitivity

Score	Physical	Biological	Social, health, and cultural heritage
1 Very low	• Surface waters (including marine) with no community use or only used for low grade industrial use	• Commonly occurring habitats and species, not subject to significant decline • Habitats that are already disturbed / modified with little biodiversity value • Fauna present not particularly susceptible to noise and vibration	• Study area and potential zone impacted includes very few inhabitants and / or resources that are not used or protected • No human receptors for air emissions and noise apart from work force • Highly skilled and experienced labour pool • No cultural heritage assets or activities, or artefacts of low archaeological importance
2 Low	• Surface waters (including marine) with some pre-existing pollution that limit their use or value for wildlife or communities	• Low sensitivity or local ecosystem value • Sites of local biodiversity value but not intact, fragile or unique • Habitats that recover quickly following disturbance (e.g., habitats comprising species that rapidly re-colonise disturbed areas) • Species present are widespread common species (e.g., IUCN Red List[2] 'near threatened' or 'least concern') with low biodiversity value • Fauna present has low susceptibility to noise and vibration	• Study area and potential zone impacted include a low number of inhabitants and / or resources that are used but not protected • Individuals or households in local communities have access to alternative resources, the use of which may cause limited adverse indirect impacts • Human receptors for air quality and noise limited to individuals from local community that may pass through the area, but exposure for extended periods unlikely • Skilled labour pool but lacks relevant experience • Designated and undesignated cultural heritage assets and activities of local importance

[2] The International Union for Conservation of Nature (IUCN) Red List provides taxonomic, conservation status and distribution information on species that are facing a high risk of global extinction.

Score	Physical	Biological	Social, health, and cultural heritage
3 Medium	• Surface waters (including marine) of moderately high quality, e.g., in its natural state, or supports an area or species valued or designated for its importance at national level. Waters used for drinking or domestic use by a small number of users. Waters that support commercial or subsistence fishery	• Medium sensitivity or regional / national ecosystem value • Sites of regional importance, or designated for protection at national level, e.g., national parks • Internationally recognised areas such as key biodiversity areas and important bird areas • Natural habitat as defined in IFC Performance Standard 6 (IFC PS6)[3]. • Habitats providing important feeding or breeding grounds • Habitats of high species or habitat diversity or 'naturalness', or recognised as intact or unique, or areas recognised by non-governmental organisations as having high environmental value • Species listed as 'vulnerable' on the IUCN Red List • Keystone species and species with long life histories, reflecting the inability of localised populations to recover from significant disturbance • Habitats that are unlikely to return to natural conditions without some intervention, but which are capable of assisted recovery • Fauna and flora with moderate susceptibly to noise and vibration	• Study area and potential zone impacted include a moderate number of inhabitants and / or resources of regional importance (e.g., fisheries). Some individuals / households depend on the affected resource with no nearby alternatives • Human receptors for air quality and noise include residential buildings where longer periods of exposure may occur • Some households and business owners / operators perceive that the change will affect their ability to maintain their livelihood or quality of life for a significant time period (<1 year) • Limited skills and experience in labour pool • Cultural heritage assets and activities of regional or national importance

[3] Natural habitats are defined as areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

Score	Physical	Biological	Social, health, and cultural heritage
4 High	• Surface waters (including marine) of very high quality, e.g., in natural state or supports an area or species valued or designated for importance at international level. Waters used for drinking or domestic use by a large number of users. Waters that support very productive fisheries	• High sensitivity or international ecosystem value • Sites of international importance, designated for protection at international level, e.g., World Heritage Area, Ramsar wetlands • Areas internationally recognised as Areas for Zero Extinction sites • Species listed as 'critically endangered' or 'endangered' on the IUCN Red List • Habitat and species triggering Critical Habitat as per IFC PS6[4] • Habitats that are very difficult to restore to natural conditions, such as coral reefs • Fauna with high susceptibly to noise and vibration	• Study area and potential zone impacted include a significant number of inhabitants and / or resources of national or global importance. Communities depend on the affected resource(s) with no nearby alternatives • Human receptors for air quality and noise include residential buildings, schools, hospitals where near-constant presence of people is possible and long-term exposure likely • Many households and business owners / operators perceive that the change will affect their ability to maintain their livelihood or quality of life to an unacceptable extent and may have to leave the area / community • Lack of skilled and experienced labour pool • Cultural heritage assets and activities of international importance such as UNESCO World Heritage Sites

[4] Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and / or Endangered species; (ii) habitat of significant importance to endemic and / or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and / or congregatory species; (iv) highly threatened and / or unique ecosystems; and / or (v) areas associated with key evolutionary processes.

5.6 Mitigation Measures

Mitigation measures are proposed to eliminate or reduce potential negative impacts ranked moderate or major, and enhancement measures recommended to maximise potential positive impacts where possible. The following mitigation hierarchy is followed:

- avoid at source/reduce at source
- abate on-site
- abate off-site/at receptor
- repair or remedy
- compensate in kind.

The above hierarchy is aimed at ensuring that, wherever possible, potential negative impacts are reduced at the source rather than mitigated through restoration after the impact has occurred.

5.7 Residual Impacts

Any impacts that remain after mitigation measures have been applied are considered residual impacts. Mitigation recommendations are explored as part of the impact assessment process for 'moderate' or 'major' effects. Impacts are reassessed as described above until either the significance is reduced to acceptable levels ('negligible' or 'minor'), or no more mitigation can be applied, and impacts are 'as low as reasonably practicable' (ALARP).

5.8 Cumulative Impacts

The cumulative impact assessment in Chapter 10 uses a modified approach to assign impact significance based on the 'IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets' (2013). This considers the sensitivity of the receptor (or valued environmental and social component (VEC)), however, the significance of the cumulative impact is determined qualitatively based on a predicted exceedance of VEC thresholds, limit of acceptable change or preferred condition (based on professional judgement). Mitigation measures are proposed to eliminate or reduce potentially negative cumulative impacts based on the mitigation hierarchy, the scale of the contribution of the Project to the overall cumulative impact and the level of influence that BWE has on third-party operators.

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 6: Critical Habitat Assessment

80834

RSK GENERAL NOTES

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6 CRITICAL HABITAT ASSESSMENT

6.1 Purpose

This chapter provides a technical assessment of the extent of natural and critical habitats of relevance to the proposed Ruche EEA field development programme. Critical habitats are areas of high biodiversity value where stringent requirements must be met if project activities are to be permitted. Where compliance with these requirements is not possible, project activities should be reconsidered.

The identification of critical habitat has been undertaken for the Project using a seascape approach, as described in Section 6.2.1.1. The Area of Analysis (AOA) has been defined as the entirety of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park.

This chapter also includes an assessment of Project-related impacts to critical habitat-qualifying features arising from the Ruche EEA field development programme (Section 6.4). Measures have been applied to avoid or minimise residual impacts to receptors.

This assessment should be read in conjunction with the 'Critical Habitat Screening Report – Dussafu Development, Gabon' (RSK, 2019) (P80834/04/01_Rev01), although the findings from this document have been summarised in the chapter below.

Applicable standards relevant to this critical habitat assessment (CHA) are included in Chapter 3.

6.2 Critical Habitat Screening

Detailed guidance on CHA is available from the IFC (Guidance Note 6, 2018 'Biodiversity Conservation and Sustainable Management of Living Natural Resources'). The determination of critical habitat is initially undertaken in isolation of any proposed project activities.

6.2.1 Criteria 1 to 3

The following steps were followed in assessing candidate species against Criteria 1 to 3:

1. define the overall area of analysis, ensuring a seascape approach
2. prepare a list of candidate species to include in the assessment and
3. obtain or calculate the global extent of occurrence[1] (EOO), area of occupancy[2] (AOO), population size and/or number of known sites for candidate species

   Obtain or calculate:

[1] EOO is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a species, excluding cases of vagrancy (IUCN, 2001).

[2] AOO is defined as the area within a species extent of occurrence which is occupied by that species, excluding cases of vagrancy. This measure reflects the fact that a species will not usually occur throughout the full area of its EOO, which may contain unsuitable or unoccupied habitats (IUCN, 2001).

a. the EOO, AOO, population size and/or number of known sites of each candidate species within the area of analysis
b. for Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species that are wide-ranging and/or whose population distribution is not well understood, an assessment of the importance of the broader landscape/seascape was made based on literature review and professional judgement

4. calculate the proportion of the global or national EOO, AOO and/or population represented by these results
5. screen outputs against significance thresholds.

It is noted that while recommendations in Guidance Note 6 have been referenced as far as possible, this methodology cannot always be easily applied to wide-ranging, data deficient marine species. Efforts have been made to overcome these limitations through the application of best available information, expert judgement and, where required, a precautionary approach.

The methods used at each step are described in more detail below.

6.2.1.1 Step 1 – Define the Area of Analysis (AOA)

Guidance Note 6 encourages the determination of critical habitat in the marine environment at a seascape scale (IFC, 2019). The term 'seascape' does not necessarily correspond to any one pre-defined unit of geographical space, rather it is a broadly defined term that might correspond to an ecoregion, a biome, or any other ecologically significant unit of space on a regional level. Seascape analysis is a fundamental step in determining ecologically appropriate mitigation options that align with broader conservation efforts in the region. The external boundaries of marine seascapes are challenging to define due to the wide ranging; highly mobile species present that often have poorly understood population distributions.

For the purposes of this report, the Area of Analysis (AOA) has been defined as the entirety of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park (see Figure 6.1). This area fully encompasses the Ruche EEA, the administrative area delineated by the Field Development Plan approved by the General Directorate of Hydrocarbons (DGH) within which all of BWE's exploration and production activities will take place. The alignment of the AOA with the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park is in line with Paragraph 17 of Guidance Note 6 (IFC, 2019) which states that "*the landscape/seascape unit might be defined in terms of an administrative or territorial boundary or a particular zoned area within international waters. The intention of the requirement is that clients identify project-related impacts, especially those on habitat connectivity and/or on downstream catchment areas, outside the boundaries of the project site*".

The continental slope of Gabon is uniform and gentle up to the 100 m isobath (40-60 km offshore), beyond which depth increases rapidly (Enviropass, 2017). The continental shelf therefore forms a distinct boundary between the shallow in-shore waters to the east and the deep offshore waters to the west.

Given the above, two broad seascapes, including the entire water column and seabed have been defined within the AOA:

- shallow water up to 100 m depth, comprising an area of 3,376 km^2

- deep water > 100 m, comprising an area of 25,105 km^2.

The coverage of these seascapes is presented in Figure 6.1. The majority of the Ruche EEA is within the deepwater seascape. The CHA has been undertaken for the full extent of both seascapes. Considering a broader seascape than just the Project site demonstrates that the Project is taking a precautionary approach to biodiversity so that all Project risks are taken into consideration.

Each species in the candidate list for critical habitat screening was considered separately using professional judgement and publicly available scientific information to determine in which seascape(s) it is known or could occur. For example, Atlantic humpback dolphin are confined to the shallow seascape favouring waters less than 30 m in depth close to the shore, whereas leatherback turtles are present in both seascapes using the whole of the AOA (Aquatic Reserve of the Grand South of Gabon and Mayumba National Park) as a migration route to the coastal nesting beaches (*pers. comm.* Tim Collins, 2022). Where little or no information was available on depth distribution, a conservative estimate was made of occurrence in both seascapes.

The AOA discussed above was used to focus the analysis of critical habitat triggering biodiversity and includes a broad suite of habitats from the shore to the abyssal plain and associated species. The results of that analysis are shown in Table 6.7 and includes almost exclusively highly mobile species of fish, marine mammals and turtles. Because of the general uniformity of the coast between the Ruche EEA and Port Gentil with respect to coastline and continent shelf topography the assumption is made that the presence and distributions of critical habitat triggering species are likely to be similar throughout this portion of the EEZ, mindful that there will inevitably be differences over time and space.

The primary AOI and the unplanned / accidental events AOI are the same as that described in Section 1.5.

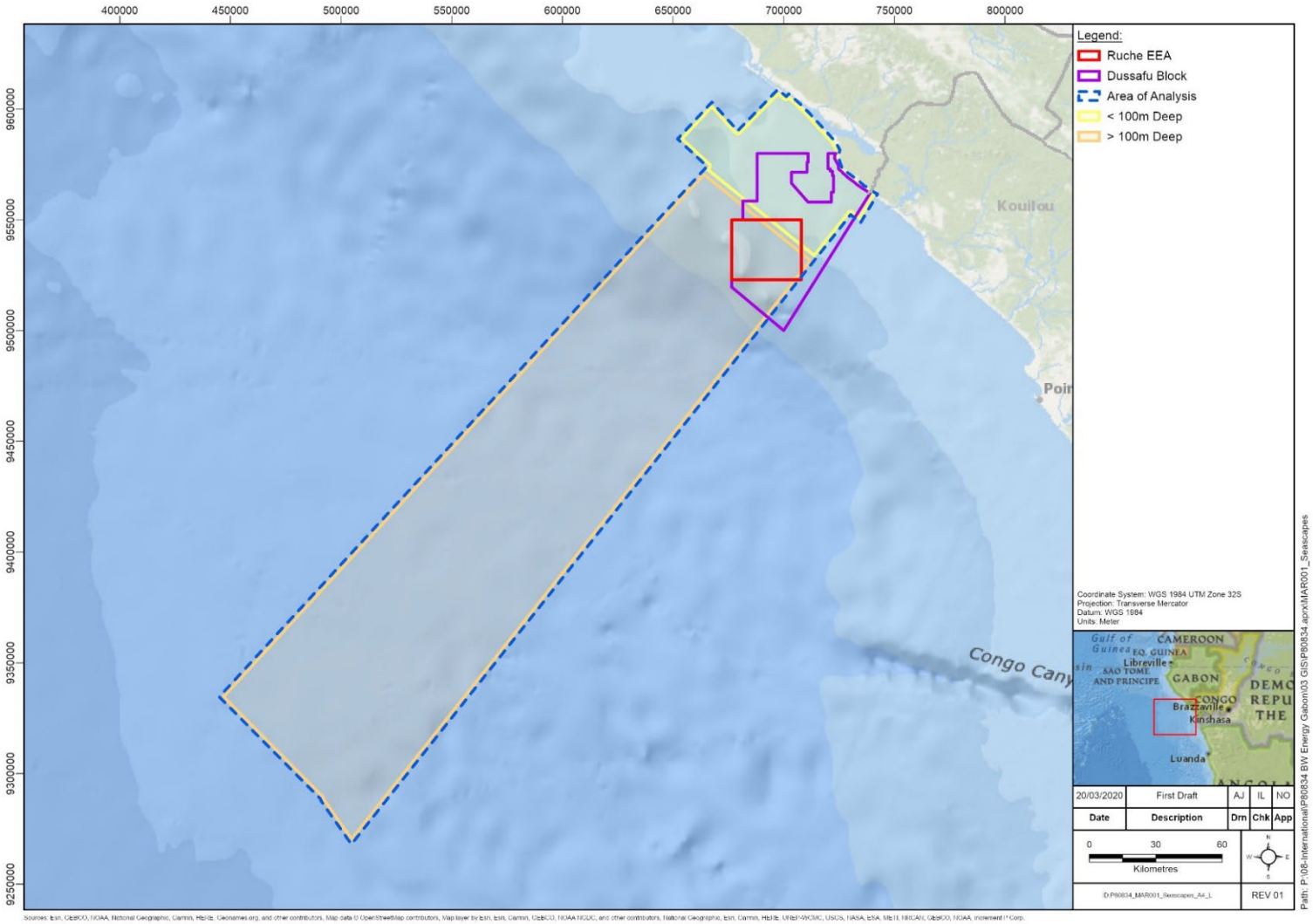

Figure 6.1: Extent of Area of Analysis (AOA) and shallow and deepwater seascapes

NB: The AOA on this figure reflects the boundaries of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park

6.2.1.2 *Step 2 – Prepare a Long List of Candidate Species*

A large number of species use habitats that are found within the AOA. Consequently, the first step was to screen all those species present to identify candidate species that could potentially trigger critical habitat. The full list can be found in the Critical Habitat Screening Report (RSK, 2019).

Species that are purely terrestrial or purely freshwater were automatically screened out.

Criterion 1

In relation to threatened species, footnote 11 of IFC PS 6 defines threatened species as those listed as such on the IUCN Red List of Threatened Species (2019), with consideration also given to the national threat status where known. There is currently no National Red List for Threatened Species in Gabon.

The following were reviewed to identify those species that were identified as CR, EN or VU at a global, regional or national level, and which were known or considered likely to be present within the region:

- National ESIA / NEIA documents compiled for Tortue Phase 1 and 2 and Ruche Phase 1 and 2
- IUCN Red List of Threatened Species (2019)
- Gabon country profile under the Convention on Biological Diversity
- Gabon country profile by BirdLife International
- Citation sheets and other published data relating to protected and/or designated areas within the region
- Previously completed ESIAs for projects in the same region
- State of the World's Sea Turtles (an online database created and maintained by a partnership between the Oceanic Society, the IUCN-SSC Marine Turtle Specialist Group, Duke University's OBIS-SEAMAP and an international network of institutions and individuals)
- Fishbase (a global online database of over 33,000 fish species)
- Scientific and grey literature, as referenced throughout.

Criterion 2

Paragraph 72 of Guidance Note 6 (IFC, 2019) defines restricted-range species for marine systems provisionally as those with an extent of occurrence (EOO) of less than 100,000 km^2. Species' EOO was obtained from the IUCN Red List of Threatened Species.

Criterion 3

IFC Guidance Note 6 defines migratory and congregatory species in the following way:

- **Migratory species**: any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem).

Migratory species were identified by review of literature and online databases (such as the Global Register of Migratory Species3), and through professional judgment and/or expert opinion.

- **Congregatory species**: species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis, such as:
  - species that form colonies
  - species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes (e.g., foraging, roosting)
  - species that move through bottleneck sites where significant numbers of individuals of a species pass over a concentrated period of time (e.g., during migration)
  - species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed (e.g., wildebeest distributions)
  - source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere (especially important for marine species).

Congregatory species were identified by review of literature and online databases, and through professional judgment.

6.2.1.3 Step 3 – Screening

Where possible, the following information was collected on the biodiversity features identified in Step 2:

- estimates of population size at the global and national levels
- estimates of population density at the global and national levels
- ranges of extent of occurrence (EOO) at the global and national levels
- distribution maps of species ranges
- area of occupancy (AOO) at the global and national levels
- reproductive units of a species at the global and national levels (i.e., number of breeding pairs)
- reliable records of species distribution and numbers and reproductive units within known protected areas relevant to the area of analysis and the surrounding landscapes.

Candidate features were then screened against the IFC critical habitat criteria to determine critical habitat (see Table 6.1).

When considering the threshold criteria relevant to a species, the proportion of the global (or national) population represented by the units of analysis was based on the estimates of population size and/or its geographical extent and, for some criterion, the number of reproductive units. The output value is a percentage of the extent of the species' global or national population (and reproduction units) potentially supported by the AOA. For the majority of marine species (with the exception of birds and some marine mammals),

[3] groms.de

population data is lacking and so the EOO was used as a surrogate for population size[4]. For species likely to be found only in the deep seascape, an AOA of 25,105 km^2 was used. For species likely to be found only in the shallow seascape, an AOA of 3,376 km^2 was used. For species likely to be found in both, the total, 28,481 km^2, was used.

Table 6.1: IFC PS6 Criteria and Thresholds for the Determination of Critical Habitat (IFC, 2019)

IFC criterion type	Definition	Threshold values
Criterion 1: Critically Endangered and Endangered Species	Species threatened with global extinction and listed as CR and EN on the IUCN Red List of Threatened Species shall be considered as part of Criterion 1. Critically Endangered species face an extremely high risk of extinction in the wild. Endangered species face a very high risk of extinction in the wild.	(a) Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population and ≥ 5 reproductive units of a CR or EN species); The IUCN KBA Standard (IUCN 2016) definition of reproductive unit: "the minimum number and combination of mature individuals necessary to trigger a successful reproductive event at a site (Eisenberg 1977). Examples of five reproductive units include five pairs, five reproducing females in one harem, and five reproductive individuals of a plant species." (b) Areas that support globally-important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a). (c) As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
Criterion 2 Endemic and Restricted-range Species	The term endemic is defined as restricted-range. Restricted range refers to a limited extent of occurrence (EOO). For terrestrial vertebrates and plants, a restricted-range species is defined as those species that have an EOO less than 50,000 km^2. For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km^2.	(a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.

[4] AOA/EOO * 100 = overlap (%)
Overlap * population = expected population

IFC criterion type	Definition	Threshold values
	For coastal, riverine and other aquatic species in habitats that do not exceed 200 km width at any point (e.g., rivers), restricted range is defined as having a global range less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).	
Criterion 3: Migratory and Congregatory Species	Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem). Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis. For example: Species that form colonies. Species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes (e.g., foraging, roosting). Species that move through bottleneck sites where significant numbers of individuals of a species pass over a concentrated period of time (e.g., during migration). Species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed. Source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere (especially important for marine species).	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle. (b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

IFC criterion type	Definition	Threshold values
Criterion 4: Highly Threatened or Unique Ecosystems	The IUCN is developing a Red List of Ecosystems, following an approach similar to the Red List for Threatened Species (see https://iucnrle.org). This should be used where possible. Where an IUCN assessment has not been performed, an assessment should be made using systematic methods at the national/regional level, carried out by governmental bodies, recognised academic institutions and/or other relevant qualified organisations (including internationally recognised NGOs).	(a) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. (b) Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
Criterion 5: Key Evolutionary Processes	Maintaining physical or spatial features which are of importance for evolutionary and ecological processes. Such features are often associated with species diversification. By conserving species diversity within a landscape, the processes that drive speciation, as well as the genetic diversity within species, ensures the evolutionary flexibility in a system, which is especially important in a rapidly changing climate.	No thresholds.

6.2.2 Criterion 4

The IUCN is developing a Red list of Ecosystems (IUCN-CEM, 2016), following a similar approach to the IUCN Red List of Threatened Species (2019). Where formal IUCN assessments of ecosystems have been undertaken these should be used to assess habitats for Criterion 4.

No formal IUCN assessments have been undertaken for marine habitats in Gabon, as such, determination of critical habitat was based on areas considered to be of high priority for conservation by regional or national systematic conservation planning.

6.2.3 Criterion 5

The structural attributes of a region, such as its topography, geology, soil, temperature and vegetation and combinations of these variables can influence the evolutionary processes that give rise to regional configurations of species and ecological properties (IFC, 2019). Guidance Note 6 provides the following examples of spatial features associated with evolutionary processes include:

- landscapes with high spatial heterogeneity, which are a driving force in speciation as species are naturally selected on their ability to adapt and diversify
- environmental gradients, or ecotones, which produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity
- edaphic interfaces which are specific juxtapositions of soil types (e.g., serpentine outcrops and limestone deposits) which have led to the formation of unique plant communities characterised by both rarity and endemism
- connectivity between habitats ensures species migration and gene flow
- sites of demonstrated importance to climate change adaptation for either species of ecosystems.

Guidance Note 6 (paragraph 81) notes that in the majority of cases, this criterion will be triggered in areas that have been previously investigated and that are already known or suspected to be associated with unique evolutionary processes. It is further noted that while systematic methods to measure and prioritise evolutionary processes in a landscape do exist, they are typically beyond a reasonable expectation of studies conducted by the private sector.

6.2.4 Critical Habitat Screening Results

A total of 19 species and 3 habitats / ecosystems were identified with the potential to trigger critical habitat through the screening stage. The 19 species between them potentially trigger criteria 1 to 3, and the habitats have the potential to trigger criterion 4. In addition, criterion 5 may be triggered by the proximity of Mayumba National Park.

Table 6.2 provides a summary of the critical habitat features identified and which criteria and threshold values they have the potential to trigger. Some species may trigger more than one criterion, such as the humpback whale and the leatherback turtle. Full details can be found in the Critical Habitat Screening Report (RSK, 2019).

Table 6.2: Summary findings critical habitat screening

IFC PS6 criteria	IFC PS6 criterion threshold numbers	Critical habitat-qualifying features (IUCN Red List evaluation in brackets)
Habitats of significant importance to endangered or critically endangered species	1a:	African wedgefish *Rhynchobatus luebberti* (CR) Blackchin guitarfish *Glaucostegus cemiculus* (CR) Daisy stingray *Fontitrygon margarita* (EN) White skate *Rostroraja alba* (EN) Common guitarfish *Rhinobatos rhinobatos* (EN) Atlantic humpback dolphin *Sousa teuszii* (CR) Cape gannet *Morus capensis* (EN)
	1b	Leatherback turtle *Dermochelys coriacea* (VU)
	1c	Atlantic humpback dolphin *Sousa teuszii* (CR)
Habitats of significant importance to endemic or geographically restricted species	2	West African pygmy skate *Neoraja Africana* (DD) Sea cucumber *Holothuria sinefibula* (DD) Sea cucumber *Holothuria suspecta* (DD) Goby *Lesueurigobius koumansi* (LC OR LR/LC) Eel *Hemerorhinus opici* (DD) Eel *Xyrias guineensis* (DD) Eel *Uroconger drachi* (DD)
Habitats supporting globally significant (concentrations of) migratory or congregatory species	3a	Ruddy turnstone *Arenaria interpres* (LC OR LR/LC) Common ringed plover *Charadrius hiaticula* (LC OR LR/LC) Cape gannet *Morus capensis* (EN) Bonga shad *Ethmalosa fimbriata* (LC OR LR/LC) Atlantic humpback dolphin *Sousa teuszii* (CR)

IFC PS6 criteria	IFC PS6 criterion threshold numbers	Critical habitat-qualifying features (IUCN Red List evaluation in brackets)
		Humpback whale *Megaptera novaeangliae* (LC) Leatherback turtle *Dermochelys coriacea* (VU)
	3b	Humpback whale *Megaptera novaeangliae* (LC) Leatherback turtle *Dermochelys coriacea* (VU)
Highly threatened or unique ecosystems	4a	None identified
	4b	Mayumba Ecologically or Biologically Significant Area (EBSA) North-western Continental Shelf EBSA Equatorial Tuna Production EBSA
Areas associated with key evolutionary processes	N/A	None identified
Protected areas and internationally recognised areas of high biodiversity value	N/A	Mayumba National Park

Notes: CR critically endangered; EN endangered; VU vulnerable; LC least concern; LR lower risk; DD data deficient.

6.3 Critical Habitat Assessment

An in-depth analysis of the potential critical habitat features was undertaken as part of the CHA phase to refine the findings of the CH screening. This refinement involved stakeholder liaison and a detailed literature review.

6.3.1 Stakeholder Liaison

The stakeholder engagement was conducted in two parts: in-situ and ex-situ engagement.

6.3.1.1 In-situ Stakeholder Engagement

One of the aims of the stakeholder engagement conducted for the Project was to supplement existing baseline information (see Chapter 4). The engagement (conducted in Gabon by RSK's in-country subcontractor TEREA) focused primarily on social issues,

but also provided useful biodiversity data. Local fishermen were consulted and presented with an information factsheet with photographs of the species that have the potential to trigger critical habitat. They were asked questions about these species, including whether they were regularly seen (or caught) and where / when sightings typically occurred. There were some limitations to this method of data collection as information was limited for some species and some species were difficult to distinguish from others without specific scientific expertise. Information gathered during this process was used to inform the CHA and to determine the likelihood of finding each species within the AOA.

6.3.1.2 Ex-situ Stakeholder Engagement

Ex-situ stakeholders were identified by conducting online searches of academic literature and institutions with an interest in the species that potentially trigger critical habitat.

Stakeholder engagement was conducted through correspondence with relevant academics, experts, and NGOs between March and April 2021. An initial e-mail provided a brief background to the Project, along with a list of priority species that the person or institution had expertise in, and a list of questions. Communication was continued via e-mail or phone call, as appropriate. Table 6.3 provides a list of the ex-situ stakeholders engaged in the process.

Table 6.3: Ex-situ stakeholder engagement

Person / Role	Organisation	Subject matter / expertise
Grant Abel Ex-situ Coordinator	IUCN Species Survival Commission (SSC) Cetacean Specialist Group	Cetaceans
Paolo Casale Co-chair	IUCN SSC Marine Turtle Specialist Group	Leatherback turtle
Roderic Mast Co-chair	IUCN SSC Marine Turtle Specialist Group	Leatherback turtle
Brian Hutchinson Programme Officer	IUCN SSC Marine Turtle Specialist Group	Leatherback turtle
Erich Hoyt Co-chair	IUCN SSC Marine Mammal Protected Area Specialist Group	Marine mammals
Giuseppe Notarbartolo Di Sciara Co-chair	IUCN SSC Marine Mammal Protected Area Specialist Group	Marine mammal protected areas
Info email address	IUCN SSC Shark Specialist Group	Rays
BirdLife Africa Regional Office	BirdLife International	Avifauna
Igor Akendengue Aken	Omar Bongo University	Environmental science
Christy Achtone Nkollo Aganga	Omar Bongo University	Fisheries, marine mammals
Jean Bernard Mombo	Omar Bongo University	Environmental science

Person / Role	Organisation	Subject matter / expertise
Peter Wirtz Researcher	n/a	Gabonese marine invertebrates
Rob Crawford Researcher	University of Cape Town	Avifauna
Gavin Naylor Researcher	Florida Museum of Natural History	Rays
Godefroy de Bruyne	TEREA	Biodiversity specialist
Matthew Gollock Group Chair / Red List Authority Coordinator	IUCN SSC Anguillid Eel Specialist	Eels
Kent Carpenter Red List Authority Coordinator	IUCN Marine Fishes Red List Authority	Marine fish
Beth Polidoro Red List Authority Coordinator	IUCN Marine Fishes Red List Authority	Marine fish
Ian Burfield IUCN SSC Red List Authority Coordinator	IUCN Bird Specialist Group	Avifauna
Tim Collins	WCS / National Geographic / IUCN SSC Cetacean Specialist Group	Cetaceans
Wynand Viljoen	Mayumba National Park	National Park Management
Angela Formia	WCS	Turtles

6.3.2 Literature Review

In order to determine the presence of the species identified during the screening process within the AOA, RSK conducted a more detailed desk-based literature review using a range of published materials including journals, online resources, and the national ESIAs prepared for the Project (see Section 1.2). Additional secondary data sources were provided by experts contacted during the stakeholder liaison process. During this process, expert stakeholders also gave their insights into the species' presence, potential impacts, and mitigation measures that could be used.

Below is a list of resources used frequently throughout the process:

- Existing ESIA / NEIA documents for the Project (see Section 1.2)
- IUCN Red List of Threatened Species
- BirdLife International Data Zone
- Global Biodiversity Information Facility
- EDGE of Existence programme: Evolutionarily Distinct and Globally Endangered Database.

Table 6.4 provides a summary of the key reference documents for each species.

Table 6.4: Key reference documents for each species that potentially trigger critical habitat

Species	Key reference documents
Cape gannet	Crawford et al. (1983) Klages (1994) Oatley et al. (1992)
Ruddy turnstone	Angehr et al. (2005)
Common ringed plover	Angehr et al. (2005)
African wedgefish	Kyne et al. (2020) Moore (2017)
Blackchin guitarfish	Newell (2017)
White skate	No further literature was found.
Common guitarfish	Newell (2017)
Daisy stingray	Bianchi (1992)
West African pygmy skate	Stehmann and Seret (1983)
Bonga shad	Charles-Dominique and Albaret (2003) Durand et al. (2013)
Goby *Lesueurigobius koumansi*	Miller (1990)
Eel *Hemerorhinus opici*	Polidoro et al. (2016)
Eel *Xyrias guineensis*	Polidoro et al. (2016)
Eel *Uroconger drachi*	Polidoro et al. (2016)
Sea cucumber *Holothuria sinefibula*	Thandar and Mjobo (2014
Sea cucumber *Holothuria suspecta*	Thandar and Mjobo (2014)
Atlantic humpback dolphin	Collins (2015) WCS Gabon (2021) Weir and Collins (2015)
Humpback whale	Razafindrakoto et al. (year not stated) Strindberg et al. (2020) UNEP-CBD (2015a) WCS Gabon (2021)
Leatherback turtle	Billes et al. (2006) Kouerey Oliwana et al. (2020) SWOT (2021) Witt et al. (2009)

6.3.3 Determination of Critical Habitat Triggering Species

This section provides a summary of each species included in the analysis and the reasoning behind the decision to include them / discount them from the critical habitat impact assessment.

6.3.3.1 Cape gannet

The cape gannet is listed as Endangered by IUCN and is a congregatory species that may trigger criteria 1a and 3a. The screening process determined that the presence of the species in the Project area is uncertain but that the AOA theoretically represents approximately 9% of the population, equivalent to approximately 21,500 individuals[5], and so the species was included for analysis owing to the precautionary principle.

Crawford et al. (1983) reported the cape gannet from a number of locations along the Gabonese coast, including Iguela (*c*.250 km away), Sette Cama (*c*.150 km away), Mayumba, as well as in Pointe-Noire (*c*.100 km away) in neighbouring Congo. However, there are few recent records of birds moving north of southern Angola, suggesting possible change in dispersal pattern (Oatley et al. 1992; Klages, 1994).

BirdLife International lists the cape gannet's occurrence in Gabon as 'presence uncertain'. The feedback from ex-situ stakeholder engagement with BirdLife International was that they had no specific data in the area, but that the data was limited and so the species may still be found in the AOA. During the in-situ stakeholder engagement with local fishermen, the respondents stated that they had never seen this species in the local area. This was true for all locations.

This species is unlikely to be found in AOA and so will not be included for impact assessment.

6.3.3.2 Ruddy turnstone

The ruddy turnstone is a migratory and congregatory species that may trigger criterion 3a because the AOA represents approximately 16% of the population, equivalent to approximately between 48,273 and 80,455 individuals[6]. The species was included for analysis owing to the precautionary principle.

The ruddy turnstone has been identified in Loango National Park (Angehr et al. 2005), approximately 150 km away from the AOA.

During the in-situ stakeholder engagement with local fishermen, the respondents stated that they had never seen this species in the local area. This was true for all locations. None of the ex-situ or in situ experts expressed concern regarding this species and potential impacts from the Project.

This species is unlikely to be found in AOA and so will not be included in the impact assessment.

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[5] 28,481 / 326,000 = 8.74%
8.74 / 100 * 246,000 = 21,491.79

[6] 28,481 / 177,000 = 16.09%
16.091 / 100 * 300,000 = 48,273
16.091 / 100 * 500,000 = 80,455

6.3.3.3 *Common ringed plover*

The common ringed plover is a migratory and congregatory species that may trigger criterion 3a because the AOA represents approximately 7% of the population, equivalent to approximately between 28,550 and 96,313 individuals[7]. The species was included for analysis owing to the precautionary principle.

The common ringed plover has been identified in Loango National Park (Angehr et al. 2005), approximately 150 km away from the AOA.

A more in-depth analysis of this species resulted in a re-calculation of criterion 3a with only the shallow seascape being used due to the species' preference for coastal and inland habitats. As such the AOA represents approximately 0.8%[8] of the global EOO. During the in-situ stakeholder engagement with local fishermen, some respondents stated that they had seen this species in the AOA before. The two locations where this species was reported were Quartier Tchiole-Ndembe (Mayumba) and Mambi.

Taking these factors into consideration, bearing in mind that this species has a very large global range, it is considered that it does not trigger under criterion 3a and will not be included in the impact assessment.

6.3.3.4 *African wedgefish*

The African wedgefish is a Critically Endangered species that may trigger criterion 1a because the AOA represents approximately 3%[9] of the global EOO.

This species has been recorded at different times in the last decade in Mayumba National Park, but it has not been recorded by trawlers along the Gabonese coast or in Port-Gentil (Kyne et al. 2020). Due to heavy exploitation, this species is in decline in West Africa and has not been recorded recently in areas where it was previously known to occur (idem). The disappearance of this species from parts of its original range drove calls for the IUCN status to be changed from Endangered to Critically Endangered (Moore, 2017).

Stakeholder engagement provided evidence of this species' presence within the AOA. It was found to be caught and consumed by fishermen in Quartier Tchiole-Ndembe (Mayumba). The fishermen said it was seen infrequently in the sea. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

The fact that this species is likely to be found in the AOA, whereas it has declined in other areas, suggests that the AOA may be a key habitat for the species. Therefore, this species is likely to trigger critical habitat as the Project area provides habitat for a significant proportion of the species' population. The original estimate of 3% of the population being found in the AOA may be an underestimate as the species is in decline elsewhere.

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[7] 28,481 / 414,000 = 6.88%
6.8795 / 100 * 415,000 = 28,549.925
6.8795 / 100 * 1,400,000 = 96,313

[8] 3,376 / 414,000 = 0.82%

[9] 3,376 / 130,949 = 2.58%

This species is found within the AOA and the AOA represents an estimated proportion of the population[10] above the 0.5% threshold for criterion 1a, qualifying it as a critical habitat trigger. This species will therefore be included in the impact assessment.

6.3.3.5 Blackchin guitarfish

The blackchin guitarfish is a Critically Endangered species that may trigger criterion 1a. The AOA represents 0.48%[11] of the global EOO, slightly less than the 0.5% trigger threshold. Due to uncertainties surrounding the data, and adopting a precautionary approach, it is considered likely that the shallow seascape qualifies as critical habitat for the blackchin guitarfish under Criterion 1a.

This species is reported along the West African coast and has been identified in an artisanal fishery in Mayumba (Newell 2017). Data has proven sparse for the rest of the West African coastline (Newell 2017), suggesting that the Gabonese population may represent a significant proportion of the overall population, likely over the 0.5% threshold.

Stakeholder engagement provided evidence of this species' presence within the AOA. It was found to be caught and consumed by fishermen in Quartier Tchiole-Ndembe and Quartier Mabounda (both in Mayumba). The fishermen in both locations described sightings as infrequent and occurring in the sea and the lagoon. Those in Quartier Mabounda stated this species was more likely to be found there during the dry season; those in Quartier Tchiole-Ndembe stated it was found in all seasons. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

This species is found within the AOA and the AOA represents an estimated proportion of the population above the 0.5% threshold for criterion 1a, qualifying it as a critical habitat trigger. This species will therefore be included in the impact assessment.

6.3.3.6 White skate

The white skate is an Endangered species that may trigger criterion 1a because the AOA theoretically represents 0.6%[12] of the global EOO.

The white skate is only found in isolated patches (EDGE, 2021) and the literature review found no sources confirming the species in the Project area. However, stakeholder engagement provided evidence of this species' presence within the AOA. This species was found to be caught and consumed by fishermen in Quartier Tchiole-Ndembe and Quartier Mabounda (both in Mayumba), and in Mambi. The fishermen in all locations described sightings as infrequent and occurring in the sea and the lagoon. Those in Quartier Mabounda stated this species was more likely to be found there during the dry season; those in Quartier Tchiole-Ndembe stated it was found in all seasons, and those in Mambi stated it was found in all seasons. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

[10] Where population numbers are unavailable, EOO is used as a proxy to provide an estimate.

[11] 3,376 / 704,567 = 0.48%

[12] 28,481 / 4,774,800 = 0.6%

As this species is found in isolated patches, it is likely that the population in the AOA represents an estimated population greater than the original estimate and therefore is above the threshold for triggering critical habitat under criterion 1a. This species will therefore be included in the impact assessment.

6.3.3.7 Common guitarfish

The common guitarfish is a Critically Endangered species that may trigger criterion 1a because the AOA theoretically represents approximately 2%[13] of the global EOO.

This species can be found along the Gabonese coast but has not been reported in Mayumba and so is considered to not be extant in the area (Newell, 2017). The literature review found no records of the species in the Project area. However, stakeholder engagement provided evidence of this species' presence within the AOA. This species was found to be caught and consumed by fishermen in Quartier Tchiole-Ndembe and Quartier Mabounda (both in Mayumba). The fishermen in both locations described sightings as infrequent and occurring in the sea and the lagoon. Those in Quartier Mabounda stated this species was more likely to be found there during the dry season; those in Quartier Tchiole-Ndembe stated it was found in all seasons. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

The literature review data and engagement data contradict of each other, and there is the possibility that this species was misidentified by fisherman. However, the precautionary approach will be used and so this species is assumed to be present within the AOA and therefore qualify as a critical habitat feature under criterion 1a. This species will therefore be included in the impact assessment.

6.3.3.8 Daisy stingray

The daisy stingray is an Endangered species that may trigger criterion 1a. The AOA represents 0.48%[14] of the global EOO, slightly less than the 0.5% trigger threshold. Due to uncertainties surrounding the data and adopting a precautionary approach, it is considered likely that the daisy stingray qualifies as a critical habitat feature under Criterion 1a.

Bianchi (1992) reported this species as common in a sample near the coast just off Sette Cama, a village approximately 150 km northwest of the AOA. The Global Biodiversity Information Facility reported two observations in 1964 of this species within the AOA and several others along the Gabonese and Congolese coastline (GBIF, 2021). The literature review revealed that this species is known under different names. IUCN lists the scientific name as *Fontitrygon margarita* and the common name as daisy whipray, whereas other academic sources use *Dasyatis margarita* and daisy stingray (Bianchi, 1992).

Stakeholder engagement provided evidence of this species' presence within the AOA. This species was found to be caught and consumed by fishermen in Quartier Tchiole-Ndembe (Mayumba), and in Mambi. The fishermen in both locations described sightings

[13] 28,481 / 1,642,930 = 1.73%

[14] 3,376 / 700,217 = 0.48%

as infrequent and occurring in the sea and the lagoon. Those in Mambi stated this species was more likely to be found there during the rainy season; those in Quartier Tchiole-Ndembe stated it was found in all seasons. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

This species is Endangered and likely to be found within the AOA. A lack of data makes it difficult to determine the proportion of the population likely to be found there and so the precautionary approach will be applied and this species will be assumed to trigger critical habitat under criterion 1a. This species will therefore be included in the impact assessment.

6.3.3.9 West African pygmy skate

The West African pygmy skate is classed as Data Deficient by IUCN and may trigger criterion 2. The limited reports suggest that the species is rare and so may be classed as regionally endemic. Approximately 28%[15] of the global EOO for the West African pygmy skate theoretically occurs within the deep-water seascape of the AOA.

This species was collected at a depth of around 1,000 m off the coast of Gabon and reported by Stehmann and Seret (1983). No other records from the AOA were found during the literature review. The 1,000 m isobath is approximately 80 km from the shoreline and so this species could be found within the AOA. IUCN lists this species as benthic and occurring between 900 m and 1,550 m water depth.

Stakeholder engagement provided evidence of this species' presence within the AOA. It was reported as being caught and consumed in Mambi, but not seen in any other location. Residents of Mambi recalled this species as being seen in the mouth of the lagoon in the rainy season. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

As it is found at a minimum depth of 900 m, it is likely that the deep seascape represents a larger area than this species inhabits. Therefore, the original estimate of 28% is likely an overestimate.

Overall, there is limited yet contradictory evidence of this species' presence within the AOA. A precautionary approach should be applied and so it should be assumed that this species may be found and therefore qualifies as a critical habitat feature. This species will therefore be included in the impact assessment.

6.3.3.10 Bonga shad

The bonga shad is a migratory species that may trigger criterion 3a because the AOA theoretically represents approximately 3%[16] of the global EOO.

It is a pelagic, catadromous species occurring in inshore waters, coastal areas, estuaries, lagoons and rivers (Entsua-Mensah, Lalèyè & Moelants, 2010). This species' range reportedly extends along the West African coastline, including Gabon and the species is

[15] 25,105 / 90,101 = 27.86%

[16] 28,481 / 876,547 = 3.25%

said to be abundant throughout most of this range (Durand et al. 2013). Charles-Dominique and Albaret (2003) reported a catch of 12,500 fish per year from 1985 to 1997 for this species in Gabon. The catches were mostly in lagoons and estuaries.

This species was reported as being caught, consumed, and frequent by all four groups of fishermen during the in-situ stakeholder engagement. The species was reported as avoiding salty water and being present in the area during the dry season, although this is contradictory to the IUCN description of the species' range as occurring in both salty and fresh water. Additionally, the presence of this species in the Project area was reported by Igor Akendengue Aken, an academic in the geography department of Omar Bongo University in Libreville, via e-mail.

Whilst this species is found in rivers for about half the year and shallow waters for the rest, its maximum depth range is reported as 200 m (IUCN, 2021). Having conducted a more detailed literature review, which shows that this species exists mostly in shallow waters (coastal waters down to 45 m (FIRMS, 2021)), a reassessment against criterion 3a was undertaken using the shallow seascape only. This re-evaluation led to a value of 0.4%[17] of the population being found within the AOA. However, as this species is migratory, the proportion of the population found within AOA during certain seasons is likely to be far higher than this and thus over the threshold value of 1% for criterion 3a.

Whilst exact numbers are uncertain, it is clear that this species is found within the AOA and its migratory status qualifies it as a critical habitat feature under criterion 3a. This species will therefore be included in the impact assessment.

6.3.3.11 Goby species Lesueurigobius koumansi

L. koumansi is a species that may trigger criterion 2 as a restricted range species. Approximately 24%[18] of the species' global EOO is represented by the AOA. The species' range has been reported from Gabon to Angola, potentially extending into Northern Namibia (Miller, 1990). Observations close to the AOA are recorded by GBIF (2021), however, the most recent is from 1964. The species is known from museum records, suggesting it is not uncommon (IUCN, 2021). The literature review could identify no more recent records of the species in the AOA.

Stakeholder engagement provided evidence of this species' presence within the AOA. This species was reported as being caught and consumed by fishermen in Mambi. They stated that it was seen infrequently and could be found in the mangrove habitat in all seasons. It was not reported elsewhere. The reports of this species' presence in mangrove habitats are contradictory to the information gathered by the IUCN, and so it is possible that this species was mis-identified during the in-situ stakeholder engagement.

The estimate of 24% of the EOO being represented by the AOA is likely an overestimate. This species is reportedly found up to depths of 135 m and so the shallow and deep seascapes were used in analysis. Applying the calculation to the shallow seascape alone

[17] 3,376 / 876,547 = 0.39%

[18] 28,481 / 118,581 = 24.02%

would represent 2.9%[19] of the EOO. Due to a lack of data, it cannot be stated with certainty what the overlap with the EOO is.

The threshold for marine species to be considered range-restricted according to criterion 2 in IFC's Guidance Note 6 is to have an EOO below 100,000 km^2. The reported EOO for *L. koumansi* is only 18,581 km^2 larger. Due to uncertainty around the data, a precautionary approach will be used, and this species will be assumed to trigger criterion 2. This species will therefore be included in the impact assessment.

6.3.3.12 Eel species Hemerorhinus opici

H. opici may trigger criterion 2. Approximately 35%[20] of the global EOO for the species theoretically occurs within the AOA.

This species' IUCN status is Data Deficient and is known only from three specimens collected from Congo, Ghana and Senegal (IUCN, 2021). It has been classed as endemic to the Eastern Central Atlantic (Polidoro et al. 2016).

Stakeholder engagement provided evidence of this species' presence within the AOA. This species was reported to be caught and consumed by fishermen in Quartier Tchiole-Ndembe (Mayumba). They stated that it was found in the sea in the dry season, but sightings were infrequent. This species was not reported as being seen in other areas.

It is likely that this species is found within the AOA and that the AOA represents an estimated proportion of the species' population greater than the 10% threshold required for criterion 2 to trigger critical habitat. This species will therefore be included in the impact assessment.

6.3.3.13 Eel species Xyrias guineensis

X. guineensis may trigger criterion 2. Due to the lack of data, it was difficult to determine the overlap of this species' EOO with the AOA. This species burrows into soft substrate, which is likely to be found in the AOA.

This species is classed as Data Deficient and is known from only a few specimens, including Pointe Noire in Congo (IUCN, 2021), which is approximately 100 km away from the AOA. This species has been classed as endemic to the Eastern Central Atlantic (Polidoro et al. 2016). The most recent observation near the AOA listed by GBIF dates from 1974.

Stakeholder engagement provided evidence of this species' presence within the AOA. This species was reported to be caught and consumed by fishermen in Quartier Tchiole-Ndembe (Mayumba). They stated that it was found in the sea in the dry season, but sightings were infrequent. This species was not reported as being seen in other areas.

It is likely that this species is found within the AOA and that the AOA represents an estimated proportion of the species' population greater than the 10% threshold required for criterion 2 to trigger critical habitat. This species will therefore be included in the impact assessment.

[19] 3,376 / 118,581 = 2.85%

[20] 28,481 / 81,577 = 34.91%

6.3.3.14 *Eel species Uroconger drachi*

U. drachi may trigger criterion 2. Due to the lack of data, it was difficult to determine the overlap of this species' EOO with the AOA. This species is classed as Data Deficient and is known from only one specimen collected off Congo (IUCN, 2021), which borders the AOA.

There is limited information around the habitat and ecology of this species and so it cannot be said whether there is suitable habitat in the AOA. This species has been classed as endemic to the Eastern Central Atlantic (Polidoro et al. 2016). The literature review could identify no further recorded observations of this species.

Stakeholder engagement provided evidence of this species' presence within the AOA. This species was reported to be caught and consumed by fishermen in Quartier Tchiole-Ndembe (Mayumba). They stated that it was found in the sea in the dry season, but sightings were infrequent. This species was not reported as being seen in other areas.

It is likely that this species is found within the AOA and that the AOA represents an estimated proportion of the species' population greater than the 10% threshold required for criterion 2 to trigger critical habitat. This species will therefore be included in the impact assessment.

6.3.3.15 *Sea cucumber species Holothuria sinefibula*

H. sinefibula may trigger criterion 2. Due to the lack of data, it was difficult to determine the overlap of this species' EOO with the AOA. This species is classed as Data Deficient and is known from only one specimen collected off Congo in 1969 (IUCN, 2021).

There is no recorded information around the habitat and ecology of this species and so it cannot be said whether there is suitable habitat in the AOA. There is some debate in the literature as to whether this is a separate species or a misidentified juvenile specimen of *H. lentiginosa* (Thandar and Mjobo, 2014). The literature review could identify no further recorded observations of this species.

Stakeholder engagement did not provide any evidence of this species' presence within the AOA. It had not been seen by local fishermen in any of the areas where consultation was conducted.

Overall, it is unlikely that this species will be found within the AOA and so it will not be included in the impact assessment.

6.3.3.16 *Sea cucumber species Holothuria suspecta*

H. suspecta may trigger criterion 2. Approximately 52%[21] of the global EOO for the species theoretically occurs within the AOA. This species is classed as Data Deficient and is known from only two reports, one in Sierra Leone and one in Congo, both in the late 1950s (IUCN, 2021).

There is no recorded information around the habitat and ecology of this species and so it cannot be said whether there is suitable habitat in the AOA. There is some debate in the literature as to whether this is a separate species or a misidentified juvenile specimen of

[21] 28,481 / 54,276 = 52.47%

H. lentiginosa (Thandar and Mjobo 2014). The literature review could identify no further recorded observations of this species.

Stakeholder engagement did not provide any evidence of this species' presence within the AOA. It had not been seen by local fishermen in any of the areas where consultation was conducted.

Overall, it is unlikely that this species will be found within the AOA and so it will not be included in the impact assessment.

6.3.3.17 Atlantic humpback dolphin

The Atlantic humpback dolphin is classed as an IUCN Critically Endangered species that also exhibits migratory behaviour that may trigger criteria 1a, 1c, and 3a. The AOA theoretically represents approximately 2%[22] of the global EOO and the species has been identified in Mayumba National Park so is considered likely to trigger critical habitat.

Weir and Collins (2015) identified Mayumba National Park as a hot spot for Atlantic humpback dolphins in Gabon, noting that fieldwork produced more observations in that area than elsewhere along the Gabonese coast. The IUCN state that clusters of the species in Central Africa are limited to Gabon and the northern section of the Republic of the Congo, which borders the AOA. Conkouati-Douli National Park in the Republic of Congo is recognised as a potential spot for a cluster of this species (Collins, 2015). WCS Gabon (2021) recognise the transboundary protected area of Mayumba-Conkouati as "one of the most important areas of all for the Atlantic humpback dolphin."

Based on the above information, it is likely that the AOA provides habitat for a proportion of the species greater than the threshold. Weir and Collins (2015) recorded 102 observations along the southern Gabonese coast during their fieldwork. This is not a confirmation of the exact numbers in the area as observations could be repeat sightings and not all individuals would have been sighted. However, it arguably shows that the proportion of the global population found in the AOA is likely to be above the appropriate thresholds as 102 individuals would theoretically represent approximately 7% of the 1,500 population.

Stakeholder engagement provided evidence of this species' presence within the AOA. Local fishermen reported sightings of this species, but sightings were infrequent or very rare (see Table 6.5).

The data show that the population of Atlantic humpback dolphins in the AOA is above the 0.5% threshold for criterion 1a and the 1% threshold for criterion 3a. This species will therefore be included in the impact assessment.

[22] 3,376 / 183,584 = 1.84%

Table 6.5: Summary stakeholder engagement output - Atlantic humpback dolphin sightings by local fishermen in AOA

Location	Caught	Consumed	Sightings
Quartier Mabounda (Mayumba)	N	Y*	Very rare
Quartier Tchiole-Ndembe (Mayumba)	Y	N	Infrequent
Ndindi	N	N	N
Mambi	N	N	N

* Assumed accidental catch

6.3.3.18 Humpback whale

The humpback whale is a migratory species that may trigger criteria 3a and 3b. The UNEP-CBD (2015a) reports that the waters of Mayumba National Park regularly support > 10% of the global population and so the species was considered likely to trigger critical habitat.

Strindberg et al. (2011) identified 1,200 individuals off the coast of Gabon, which would represent approximately 1.4% of the reported global population of 84,000 (IUCN, 2021). They were unable to conduct surveys near Mayumba due to bad weather, but sightings were made of humpback whales in the AOA. The waters off Gabon are a recognised breeding ground for this species who migrate there during the southern hemisphere winter, with numbers peaking in August (WCS Gabon, 2021; Razafindrakoto et al.).

Stakeholder engagement provided evidence of this species' presence within the AOA. Sightings of humpback whales were reported as frequent in Quartier Tchiole-Ndembe, but very rare, or not at all, in other locations (see Table 6.6).

Table 6.6: Summary stakeholder engagement output - humpback whale sightings by local fishermen in AOA

Location	Caught	Consumed	Sightings
Quartier Mabounda (Mayumba)	N	Y*	Very rare
Quartier Tchiole-Ndembe (Mayumba)	Y	N	Frequent
Ndindi	N	N	N
Mambi	N	N	N

* Assumed accidental catch

The data shows that the population of humpback whales in the AOA is above the 1% threshold for criterion 3a and Mayumba National Park regularly supports more than 10% of the global population triggering criterion 3b. This species will therefore be included in the impact assessment.

6.3.3.19 *Leatherback turtle*

The leatherback turtle is classed as IUCN Vulnerable and is both migratory and congregatory, as such it may trigger criteria 1b, 3a, and 3b. According to UNEP-CBD, it is likely that 30% of the world's population of these turtles pass through Gabon, the majority of them in Mayumba National Park (UNEP-CBD, 2015a).

Gabon has been described as having the largest leatherback population in the world (Witt et al. 2009). Two major nesting beaches have been identified in Mayumba National Park (Kouerey Oliwana et al. 2020) and turtles can be tracked crossing the Atlantic from South America to nest on specific beaches within the AOA (Billes et al. 2006; SWOT, 2021). In order to access nesting beaches in Mayumba National Park, these turtles would have to migrate through the AOA.

Sightings of leatherback turtles were reported as infrequent, very rare or non-existent by local fishermen during the in-situ stakeholder engagement. However, the evidence from academic literature outweighs these assertions.

The data show that the estimated population of leatherback turtles in the AOA is above the 1% threshold for criterion 3a and Mayumba National Park regularly supports >30% of the global population triggering criteria 1b and 3b. This species will therefore be included in the impact assessment.

6.3.4 Determination of Critical Habitat Triggering Habitats

6.3.4.1 *Highly threatened and unique ecosystems (criterion 4b)*

The marine biodiversity importance of the waters of southern Gabon is reflected in the designation of three EBSAs which overlap with or are in close proximity to the primary AOI. These are illustrated in Figure 6.2 (top) and their characteristics summarised as follows:

- Mayumba Marine and Coastal EBSA: this site is recognised as one of the most important sites globally for leatherback turtle nesting (UNEP-CBD, 2015a), with at least 500 females laying eggs within the NP each year. Mayumba is also on the migratory pathway of a number of species of baleen whale. Exceptional primary productivity in offshore Gabonese waters is driven by the discharge of nutrients from the Congo River as well as seasonal upwelling (Cofrepeche, 2010). Evaluation undertaken by Cofrepeche (2010) indicates eight times the biomass in waters south of Cap Lopez as compared with areas to the north.
- Northwest Continental Shelf EBSA (Congo): this is the only known ecosystem to support a number of deep-water shrimps: *Parapenaeus longistris, Aristeus varidens* and *Plessiopenaeus edwardsia* (UNEP-CBD 2015b). The continental shelf is approximately 20 km wide, with uniformly cold waters beyond 200 m.
- Equatorial Tuna Production Area EBSA: supports the partial or complete lifecycle of migratory aquatic species such yellowfin tuna, bigeye tuna, albacore tuna, frigate tuna, sailfish and swordfish, among others (UNEP-CBD 2015c). Such is the productivity of this vast area, that annual tuna capture exceeds 200,000 tonnes and the European Union negotiates fishing agreements with the relevant African nations (including Gabon) every three years (idem). This area is also important for sharks and rays, red crabs and a number of polychaetes (idem).

Based on the above information, the primary AOI is considered to trigger critical habitat under Criterion 4b on a precautionary basis.

6.3.4.2 *Other criteria – protected areas and internationally recognised areas of high biodiversity value*

The primary AOI overlaps with one legally protected area and is adjacent to another as illustrated in Figure 6.2 (bottom):

- the Aquatic Reserve of the Grand South of Gabon, a large (27,518 km^2) MPA designated in 2017 to promote biodiversity conservation and the recovery of fish stocks. Protected Planet (2020) lists this area as 'management type unassigned' and a management plan is under development. Based on RSK's current understanding of the intent and implementation of this MPA designation and using the IUCN Guidelines for Applying Protected Area Management Categories (Dudley, 2008), the Aquatic Reserve of the Grand South of Gabon would most likely fall into management category VI – protected area with sustainable use of natural resources. The MPA would therefore not be considered to trigger critical habitat under paragraphs GN53 and GN54 of the IFC Guidance Note 6 (IFC, 2019).
- Mayumba National Park (NP) (870 km^2) abuts the southern Gabon coast and roughly correlates with the shallow seascape within the critical habitat screening. It was established in 2002 and could be considered an IUCN Category II site based on its designation (it is currently listed by Protected Planet as 'management type unassigned' and a management plan is under development). Category II sites have for their primary objective "to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation" (Dudley, 2008). This would indicate that Mayumba NP triggers critical habitat under the 'other criteria'. It includes 60 km of pristine beach that provide important nesting sites to leatherback turtles (Mayumba National Parks, 2021).

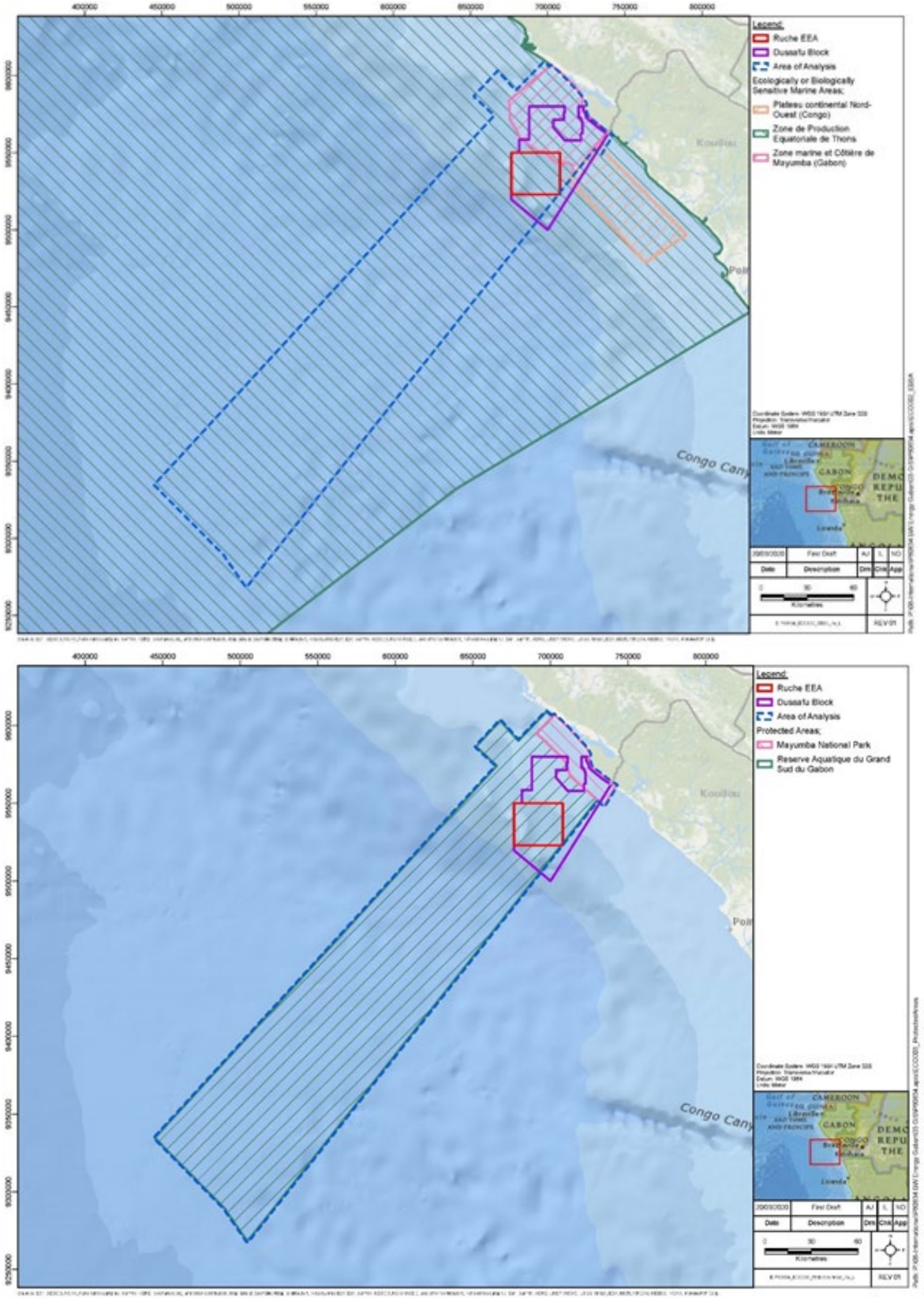

Figure 6.2: EBSAs in vicinity of primary AOI (top) and protected areas in vicinity of primary AOI (bottom)

6.3.5 Critical Habitat Features Taken Forward to Critical Habitat Impact Assessment

Based on the analysis of critical habitats features in the 'Critical Habitat Screening – Dussafu Development, Gabon' report (RSK, 2019) (P80834/04/01_Rev01) and the additional data presented in Sections 6.3.1 to 6.3.4 the shallow and deepwater seascapes adjacent to the primary AOI have been identified as critical habitat. The final list of critical habitat features that will be taken forward into the assessment are included in Table 6.7.

Table 6.7: Final list of critical habitat-qualifying features

Critical Habitat-qualifying features	IFC PS6 criterion threshold numbers
CH species (shallow seascape)	
African wedgefish	1a
Blackchin guitarfish	1a
Daisy stingray	1a
Atlantic humpback dolphin	1a, 1c, 3a
CH species (deep seascape)	
West African pygmy skate	2
CH species (both seascapes)	
White skate	1a
Common guitarfish	1a
Bonga shad	3a
Goby *Lesueurigobius koumansi*	*2*
Eel *Hemerorhinus opici*	*2*
Eel *Xyrias guineensis*	*2*
Eel *Uroconger drachi*	*2*
Humpback whale	3a, 3b
Leatherback turtle	1b, 3a, 3b
Other CH features	
Mayumba NP and EBSA – shallow seascape	4b and 'other'
Northwestern continental shelf EBSA – deepwater seascape	4b
Equatorial tuna production EBSA – deepwater seascape	4b

6.4 Critical Habitat Impact Assessment

The assessment of potential impact on critical habitat features uses a systematic process that involves:

- identifying Project aspects (activities) or sources of impact (these are listed in Table 2.4)
- identifying related environmental receptors (for this assessment it is the critical habitat features in Table 6.7)
- evaluating Project effects on those receptors (an impact interaction table for the Project is provided below, see Table 6.8).

The impacts interactions identified in Table 6.8 are discussed further in Sections 6.4.1 - 6.4.5 and the significance of the impact assessed based on the magnitude of the impact and the sensitivity of the receptor, as described in Chapter 5.

As stated previously, the critical habitat screening / assessment sections above use an AOA to focus the screening of critical habitat triggering species as a proxy to understand the distribution and abundance in the wider EEZ. The following impact assessment uses the primary AOI and the unplanned / accidental events AOI as described in Section 1.5.

Table 6.8: Critical habitat triggering species impact interactions with Project activities within the AOI (primary AOI and unplanned / accidental AOI)

Activities	African wedgefish	Blackchin guitarfish	White skate	Common guitarfish	Daisy stingray	West African pygmy skate	Bonga shad	*Lesueurigobius koumansi* (goby)	*Hemerorhinus opici* (eel)	*Xyrias guineensis* (eel)	*Uroconger drachi* (eel)	Atlantic humpback dolphin	Humpback whale	Leatherback turtle
Routine / Planned Activities														
Drilling Programmes														
Installation of the jack-up rig			X					X						
Physical presence of rig (500 m safety exclusion zone)			X	X			X	X	X	X	X			
Drilling of top hole section with WBDF sweep mud – discharge of cuttings and WBDF to sea (discharged at seabed during riserless drilling)			X	X				X	X	X	X			
Drilling of 17 ½" and upper part of 12 ¼" hole sections with WBDFs (discharged from rig following treatment)			X	X			X	X	X	X	X			
Drilling of lower part of 12 ¼" hole and 8 ½" hole sections with NADFs – discharge of cuttings and NADF to sea (discharged from rig following treatment)			X	X			X	X	X	X	X			
Other drilling discharges – cement, pipe dope			X	X			X	X	X	X	X			
Drilling rig operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water			X	X			X	X	X	X	X			
Underwater noise from drilling rig operations			X	X			X	X	X	X	X		X	X
Lighting of rig – light spill							X							X

Activities	African wedgefish	Blackchin guitarfish	White skate	Common guitarfish	Daisy stingray	West African pygmy skate	Bonga shad	*Lesueurigobius koumansi* (goby)	*Hemerorhinus opici* (eel)	*Xyrias guineensis* (eel)	*Uroconger drachi* (eel)	Atlantic humpback dolphin	Humpback whale	Leatherback turtle
Hibiscus Alpha OI – Installation & Commissioning														
Installation and jack-up of HA OI			X					X						
Underwater noise from HA OI installation			X	X			X	X	X	X	X		X	X
Hibiscus Alpha OI – Operation & Maintenance														
Physical presence (1km safety exclusion zone around HA OI)			X	X			X	X	X	X	X			
HA OI operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water			X	X			X	X	X	X	X			
Discharge of separated produced water from HA OI			X	X			X	X	X	X	X			
Underwater noise from HA OI operations			X	X			X	X	X	X	X		X	X
Lighting and flaring on HA OI – light spill							X							X
Subsea Flowlines and Umbilicals – Installation & Commissioning														
Installation of pipelines and cables			X					X						
Subsea pipeline commissioning discharges – hydrotest discharges			X	X			X	X	X	X	X			
FPSO – Operation & Maintenance														
Physical presence (1km safety exclusion zone around FPSO)			X	X			X	X	X	X	X			

Activities	African wedgefish	Blackchin guitarfish	White skate	Common guitarfish	Daisy stingray	West African pygmy skate	Bonga shad	*Lesueurigobius koumansi* (goby)	*Hemerorhinus opici* (eel)	*Xyrias guineensis* (eel)	*Uroconger drachi* (eel)	Atlantic humpback dolphin	Humpback whale	Leatherback turtle
FPSO operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water			X	X			X	X	X	X	X			
Discharge of separated produced water			X	X			X	X	X	X	X			
Underwater noise from FPSO operations			X	X			X	X	X	X	X		X	X
Lighting and flaring on FPSO – light spill							X							X
Support/Supply Vessel and Construction Vessel Operations														
Vessel operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water	X	X	X	X	X		X	X	X	X	X			
Underwater noise from vessel movements	X	X	X	X	X		X	X	X	X	X	X	X	X
Lights on vessels – light spill							X							X
Helicopter Support Activities														
Airborne noise from helicopter transfers														X
Logistics Base Operation														
Discharges of rainwater drainage	X	X		X	X		X		X		X			

Activities	African wedgefish	Blackchin guitarfish	White skate	Common guitarfish	Daisy stingray	West African pygmy skate	Bonga shad	*Lesueurigobius koumansi* (goby)	*Hemerorhinus opici* (eel)	*Xyrias guineensis* (eel)	*Uroconger drachi* (eel)	Atlantic humpback dolphin	Humpback whale	Leatherback turtle
Potential Unplanned / Accidental Event Scenarios														
Project vessel collision with marine fauna												X	X	X
Introduction of alien invasive species	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bunkering spill - small spill or leak / release during hose disconnection							X						X	X
Collision with FPSO resulting in loss of oil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Well blowout (expected reservoir crude oil)	X	X	X	X	X	X	X	X	X	X	X	X	X	X

6.4.1 Critical Habitat Qualifying Fish Species

6.4.1.1 Sensitivity Summary

Section 6.3.5 identifies eleven species of fish that trigger critical habitat along with the seascapes in which they are found and the criteria they trigger.

Pelagic species

Of the eleven species only one is pelagic (the bonga shad). The bonga shad is migratory and undertakes a spring migration towards the coast, including lagoons, estuaries, and rivers (IUCN, 2021). It breeds throughout year in waters of salinity 3.5 to 38°/$_{oo}$, but with peaks in some areas, e.g., November to June off Ivory Coast and Nigeria (FAO, 2019). During the autumn, it migrates to the open sea. Its maximum depth range is 200 m but tends to favour water depths of less than 45 m. Numbers of bonga shad in the Ruche EEA are therefore anticipated to be low, with the majority likely to be found in the shallow seascape.

Benthic species

The remaining critical habitat qualifying fish species are demersal, spending most of the time on or near the seabed.

The African wedgefish, daisy stingray and blackchin guitarfish are coastal, shallow water species and are therefore only anticipated to be present in the shallow seascape. Sensitivity information on these shallow water species is summarised below:

- African wedgefish - likely to be found in the year-round as non-migratory. Species from this genus give birth to live young, with most being born between March and April (ELMO, 2016) which make these months times of relatively high sensitivity. It is generally restricted to water depths of less than 35 m.
- Daisy stingray - little is known about this species; it is not migratory so can be expected to be present year-round. Associated with estuarine habitats.
- Blackchin guitarfish - gives birth to live young in the shallow waters of West Africa during August and September (NOAA, 2021) which make these months times of relatively high sensitivity. It is generally restricted to water depths of less than 80 m.

The white skate, common guitarfish, goby (*Lesueurigobius koumansi)* and the three eel species (*Hemerorhinus opici, Xyrias guineensis* and *Uroconger drachi*) have a larger depth range and are anticipated to inhabit both seascapes. Sensitivity information on these species is summarised below:

- White skate - there is little information available about this species' lifecycle such as spawning locations and timings (Defra, 2010) and so it is difficult to determine when it is likely to be most sensitive to impacts. In general skate species deposit their eggs cases in sandy or muddy flats and the eggs develop for a number of months before hatching. Approximate depth range 40 – 400 m.

- Common guitarfish - give birth to live young in shallow waters between May and September (Ismen et al. 2007) making this a time of peak sensitivity for this species. According to IUCN, fishing is the main threat to this species, which are used for their fins and meat. Approximate depth range 0-180 m.
- Goby (*L. koumansi)* - little information available regarding this species therefore difficult to determine its seasonality, but the species is not thought to be migratory and so can be expected to be present year-round. Another species of the same genus has been recorded as spawning in April to May in Namibia (Olivar, 1989) and so this may be a time of heightened sensitivity for *L. koumansi*. Approximate depth range 50-135 m.
- Eel species (*H. opici, X. guineensis* and *U. drachi*) - considered range restricted as they are endemic to the Eastern Central Atlantic. There is little information available about these species. A study on eel larvae in the Gulf of Guinea (Miller and Robinet, 2018) found that most eel species spawn over or near the continental shelf during the warm water season of November to May.

The West African pygmy skate is a deep-water species with a depth range of 900-1500 m so is only anticipated to be present in the deepwater seascape and in water depths greater than those in the Ruche EEA. Sensitivity information on this species is summarised below:

- West African pygmy skate - considered range-restricted as three of the four specimens known to science have been collected off Gabon.

The sensitivity of all these species is considered to be high (4), as they trigger critical habitat as per IFC PS6.

Potential impacts on these species from Project routine / planned activities and accidental / unplanned accidental event scenarios are discussed below.

6.4.1.2 Impacts from installation of facilities and their physical presence

Potential Impacts

Impacts could result from the following Project aspects:

- installation of the facilities
- physical presence of the facilities
- light spill from the facilities (from lighting and flaring).

*Installation of facili*ties

The feet of the Hibiscus Alpha OI and the installation of the subsea flowline will permanently remove some benthic habitat in the immediate area and cause direct physical disturbance of the seabed ecosystem. The jack-up rig will also nest within the Hibiscus Alpha OI and cause temporary disturbance of the seabed during drilling activities. These activities may cause disturbance of benthic fish spawning sites. The majority of the cartilaginous critical habitat triggering fish species present give birth to live young in the shallow waters of the Gulf of Guinea (African wedgefish, blackchin guitarfish and common guitarfish) therefore these species are unlikely to be impacted by facility installation. Similarly, bonga shad and the critical habitat triggering eel species have

pelagic eggs and larvae so are not anticipated to be impacted by facility installation. Only the goby (*Lesueurigobius koumansi*) and white skate carry out benthic spawning and these species are therefore anticipated to be the most sensitive to seabed impacts. However, the installation of the proposed infrastructure is a discrete event and habitat loss is considered negligible compared to the extent of the sea floor available (20 km of 12" subsea flowline laid on seabed (no trenching), plus <40 m^2 for the Hibiscus Alpha OI feet, plus temporary impacts < 30m^2 from jack-up rig feet). It is also anticipated that the flowline is likely to self-bury over time in the soft sediment, therefore, it is unlikely that there will be a discernible disturbance effect on demersal spawning grounds in the Project area within a year of installation activities ceasing.

Physical presence of facilities

Safety exclusion zones around offshore facilities can reduce fishing pressure allowing biomass to increase. Friedlander et al., 2014 conducted studies on oil platforms in Gabon and found this to be the case with fish biomass dominated by pelagic species (barracuda, rainbow runner, jacks) and large snappers in deeper water, with top predators accounting for a large part of it, as on pristine reefs. In addition, much of the observed species richness consisted of demersal fish species, many of which had distinct and unique assemblages. As the Ruche EEA is within the Aquatic Reserve of the Grand South of Gabon, fishing pressure is likely to be limited, though it is acknowledged that illegal fishing may take place. As such any positive impacts are anticipated to be limited, although the facilities may provide some form of reef effect.

Light spill from facilities (from lighting and flaring)

Light spill from the facility lighting and from production flaring on the HA OI[23] and BW Adolo FPSO may attract planktonic organisms and subsequently larger marine fish, which may result in increased predation. Little information is available regarding the potential impacts of light spill from offshore structures and vessels on marine communities (Marchesana, 2005) however, it is anticipated that light spill will only impact a small area, with insignificant impacts on critical habitat triggering fish species. Barker & Cowan (2018) studied the effect of artificial light on the community structure of reef-associated fishes at oil and gas platforms in the Gulf of Mexico. More fish were seen at lit platforms than at unlit platforms, with the majority of individuals identified near the surface. While fish abundance at the surface remained high during the day, the numbers declined at night. This suggests that though fishes are attracted to the vertical relief of the structure, they may be avoiding the artificial light field at the surface either to escape nocturnal predation or to forage away from the platform.

Of the critical habitat triggering fish species being considered, bonga shad is considered the most sensitive to light spill impacts as it is the only pelagic species. It should be noted that this species is mainly found in coastal waters down to 45 m so its presence in the Ruche EEA is unlikely.

[23] This will include commissioning flaring when the Ruche 1 wells come online.

Impact assessment of installation of facilities and their physical presence on critical habitat-triggering fish species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Installation of facilities – direct impact on fish from disturbance of demersal spawning sites	Very low (1) Extent: Immediate, within Project footprint Duration: Temporary – limited to installation period Scale: Disturbance limited to the immediate area with rapid recovery without intervention Frequency: Once off impact	High (4) Critical habitat trigger (Goby (*Lesueurigobius koumansi*) and white skate considered most sensitive as they are benthic spawners)	Minor (4)
Physical presence of the facilities – direct impact on fish from small reduction in fishing pressure due to safety exclusion zones	Positive (0) Potential for beneficial impacts on fish species	High (4) Critical habitat trigger	Positive (0) (positive effect limited)
Light spill from facilities (from lighting and flaring) – direct impact, attraction of fish / predators	Very low (1) Extent: Immediate, within Project footprint Duration: Ongoing throughout operations Scale: Disturbance limited to the immediate area with rapid recovery without intervention Frequency: The frequency of the impact will be continuous (during hours of darkness) but very low level	High (4) Critical habitat trigger	Minor (4)

Mitigation Measures

Mitigation measures relating to facility installation and physical presence of the facilities are not proposed as potential impacts on critical habitat triggering fish species are considered minor, or positive.

Mitigation measures relating to light spill are limited to the following:

- Area and work lighting will be limited to the amount and intensity necessary to maintain worker safety. Directional lighting will be used to minimise light spill onto the sea.
- In terms of flaring, gas flow rates will be reduced as far as practicable; any maintenance activities requiring flaring will be scheduled outside of turtle hatchling season; and the flame will be shielded behind a containment structure.

Residual Impacts

The residual impact significance scores provided below are the same as the pre-mitigation impact scores. Although the impact magnitude is anticipated to be very low (particularly taking into consideration the mitigation above) residual impacts are minor

due to the high receptor sensitivity. The exception to this is the positive residual impact resulting from reduction in fishing pressure due to the safety exclusion zones around the facilities.

Residual impact assessment of facility installation and physical presence of facilities on critical habitat-triggering fish species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Installation of facilities – disturbance of demersal spawning sites	Minor (4)	Minor (4)
Physical presence of the facilities – reduction in fishing pressure due to safety exclusion zones	Positive (0)	Positive (0)
Light spill from facilities (from lighting and flaring) – attraction of fish / predators	Minor (4)	Minor (4)

6.4.1.3 Impacts from Underwater Noise

Potential Impacts

Underwater noise from the Ruche field development programme is generated from a number of sources, as follows:

- drilling activities
- facility installation activities (operation of large construction vessels, e.g., installation vessels, pipelay barge)
- operation of the BW Adolo FPSO
- support / supply vessel movements (operation of medium sized vessels).

It should be noted that underwater noise from operation of the Hibiscus Alpha OI has been scoped out of the assessment as the hull of the converted jack-up MODU will not be in contact with the water column and noise sources of significance on this facility are anticipated to be minimal.

In order to determine impacts to marine fauna from underwater noise generated by the above sources, acoustic propagation modelling has been carried out in order to determine the potential distances from each noise source at which noise decreases to below thresholds for injury, hearing and behavioural impacts (the full study is provided in Appendix 6A).

Published literature was reviewed in order to obtain representative acoustic source levels and frequency spectra of each of the noise sources listed above (see Appendix 6A), a summary is provided in Table 6.9.

Table 6.9: Acoustic source levels for key activities

Noise activity	Acoustic source level (dB re 1 @ Pa at 1 m)	Representative frequency range (Hz)
Drilling	146	2500-8000
FPSO	183	20-2500
Vessel (medium sized)	180	60-200
Vessel (large sized)	191	60-200

Physiological impacts

Popper *et al*. (2014) reviewed a number of studies and subsequently suggested various noise thresholds related to potential acoustic impacts that were a function of the hearing sensitivity of fish species. The functional hearing groups refer back to studies of either the internal physiology of the fish, or else to their auditory sensitivity. The latest categories, along with key characteristics of each group, are defined in Table 6.10.

Table 6.10: Fish hearing groups

Functional hearing group	Description	Characteristics
Group 1	Fish with no swim bladder	Generally, these fish have no swim bladder or other gas chamber. They are relatively unsusceptible to barotrauma and are sensitive only to particle motion rather than sound pressure. This class includes flatfish, sharks and rays.
Group 2	Fish with swim bladders in which hearing does not involve the swim bladder	Although fish in this class have a swim bladder and thus the organ is able to respond to sound pressure, the swim bladder is not connected to the inner ear hence the hearing ability of fish depends only on particle motion. Fish in this class are relatively sensitive to only a narrow range of frequencies. This group includes salmonids and some tunas and mackerels.
Group 3	Fishes with swim bladders that are close, but not intimately connected, to the ear	Fish in this class are sensitive to both particle motion and sound pressure. They are sensitive to a wider range of frequencies compared with Groups 1 and 2. This group includes members of the cod fishes (Gadidae), eels (Anguillidae) and some drums and croakers (Sciaenidae) families.
Group 4	Fish where hearing involves a swim bladder	Fish in this class have a connection between the swim bladder and the inner ear and are sensitive to both particle velocity and sound pressure. Species in this class are sensitive to sounds over a wide frequency range (~several kHz) and have a higher sensitivity than fish in the preceding groups. The group includes some of the squirrelfishes (Holocentridae), drums and croakers (Sciaenidae), herrings (Clupeidae) and the large group of otophysan fishes.

Source: Southall et al. (2019)

Subsequently, Popper *et al*. (2014) provided threshold levels of continuous-type noise for fish of all functional hearing groups and these are given in Table 6.11.

Table 6.11: Summary of acoustic impact threshold criteria for fish functional hearing groups exposed to continuous type noise

Functional hearing group	Mortality and Potential Mortal Injury	Recoverable Injury	TTS	Masking	Behavioural
Group 1	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Group 2	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Group 3	(N) Low (I) Low (F) Low	170 dB re 1 µPa rms for 48 hr exposure	158 dB re 1 µPa rms for 12 hr exposure	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Group 4	(N) Low (I) Low (F) Low	170 dB re 1 µPa rms for 48 hr exposure	158 dB re 1 µPa rms for 12 hr exposure	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Source: Popper et al. (2014)

It is noted that threshold levels representing the onset of 'mortality and potential mortal injury'; 'recoverable injury'; and 'temporary threshold shifts (TTS)'[24] for most of the fish subgroups do not currently exist due to insufficient data. Popper *et al*. (2014) acknowledges the difficulty in ascribing specific distances or a range of distances to the risk of an impact given the number of variables that underpin such a decision. They suggest that "… "near" might be considered to be in the tens of metres from the source, "intermediate" in the hundreds of metres, and "far" in the thousands of metres".

Due to the general lack of appropriate threshold level data representing physiological damage in most of the fish functional hearing groups, it is not possible to determine suitable distances over which each impact criterion may be met. Some limited data are available for Group 3 and Group 4 fish (i.e., fish with swim bladders close to or connected to the ear) where impact distances for recoverable injury and TTS assessed using SPL rms (sound pressure levels using root mean squared metrics) are summarised in Table 6.12. It will be seen that for all noise types, the impact criteria are met at distances extending no further than 40 m from the source.

[24] TTS is a relatively short-term reversible loss of hearing, often resulting from cellular fatigue and metabolic changes (Saunders et al., 1985; Henderson et al., 2008).

Table 6.12: Distances in metres at which SPL has fallen to recoverable injury and TTS threshold levels for fish exposed to each noise source

Functional hearing group	Impact	Threshold	Noise source			
			Drilling	FPSO	Vessel Medium	Vessel Large
Group 3 Group 4	Recoverable Injury	170 dB re 1 µPa rms for 48 hr exposure	<1 m	<1 m	<1 m	4 m
	TTS	158 dB re 1 µPa rms for 12 hr exposure	<1 m	6 m	4 m	40 m

It should be noted that most of the critical habitat-qualifying fish species present are considered to have low sensitivity to underwater noise as they are included in the families of sharks, skates or rays (namely, African wedgefish, blackchin guitarfish, white skate, common guitarfish, daisy stingray, and West African pygmy skate). These species lack a swim bladder so are classed as Group 1.

Exceptions to the above are the goby *L. koumansi* which is considered to be Group 2 (Lu and Xu, 2002); the eel species (*H. opici, X. guineensis* and *U. drachi*)) which are considered to be either Group 2 (JerkØ et al. 1989) or Group 3 (Popper et al. 2019); and the bonga shad which is part of the herring family and is therefore anticipated to be Group 4.

Table 6.12 demonstrates that the eel species and bonga shad could potentially suffer recoverable injury within 4 m of the large construction vessels and within 1 m of the other noise sources, and TTS within 40 m of the large construction vessels and 6 m of the other noise sources. However, it should be noted that eels are generally benthic in nature and will therefore not be in close proximity to the noise sources and bonga shad are generally more coastal in distribution and therefore are unlikely to be out in the Ruche EEA. Even if individuals are present, they are highly mobile species and are anticipated to take evasive action if elevated noises levels are causing discomfort. Based on this, physiological impacts to the critical habitat triggering fish species present are not anticipated.

Behavioural impacts

Threshold levels may be assigned to the onset of behavioural response in fish species, but current guidance appears somewhat ambiguous. The US Fish and Wildlife Service (USFWS) works with a level of 150 dB re 1 µPa as a threshold for behavioural responses in fish (Stadler & Woodbury, 2009). Popper *et al*. (2014) state that it is not clear whether this is a peak or rms metric. They also affirm that the corresponding criterion does not specify a particular behavioural response or whether it merely assumes that at that sound level, there is the potential to experience a behavioural reaction. Further, Hastings (2008) declares that the scientific origin of this threshold is unknown and thus the validity of the criterion is uncertain. However, in the absence of any data in addition to the guidelines provided by USFWS and for the purpose of continuing the analysis contained in the current study, it is decided that a 150 dB re 1 µPa (rms) threshold be used to represent the onset of low-level behavioural responses in fish.

Due to the relative audiological insensitivity of fish, behavioural impact criteria are generally met at short distances from each of the noise sources considered (see Table

6.13). Of all noise sources, large-sized construction vessels are considered to have the most impact. The behavioural impact criterion is met at distances of 100 m from the source.

Table 6.13: Distances in metres at which SPL has fallen to behavioural threshold levels for fish exposed to all noise sources

Functional hearing group	Impact	Threshold	Noise source			
			Drilling	FPSO	Vessel Medium	Vessel Large
All fish groups	Behavioural	150 dB re 1 µPa rms	<1 m	40 m	20 m	100 m

A review of published literature was carried out to ascertain behavioural effects of underwater noise on the critical habitat-triggering fish species present (elasmobranchs, shad, goby, and eel species); the results are presented below.

A review of anthropogenic impacts on cartilaginous fish (Francis and Lyon, 2013) found that elasmobranchs (sharks, rays and skates) hear underwater sound best in low frequency bands (less than 1,000 Hz). The review found that loud sounds in their audible range may repel elasmobranchs whereas low sounds may attract them (perhaps because they may mimic the sounds of struggling or injured prey). Thus, the response of an elasmobranch may depend on its distance from the source and the volume of the source. Chapuis et al. (2019) studied the effect of underwater sounds on shark behaviour. A baited camera rig was used to record the behavioural response of eight shark species to artificially generated sounds. When sounds were playing, reef and coastal sharks were less numerous in the area, were responsible for fewer interactions with the baited test rigs, and displayed less 'inquisitive' behaviour, compared to during silent control trials.

Blom et el (2019) working in aquaria, experimentally tested the impact of broadband noise exposure (added either continuously or intermittently), compared to a control, on the behaviour and reproductive success of the common goby (*Pomatoschistus microps*), a vocal fish with exclusive paternal care. Compared to the intermittent noise and control treatments, the continuous noise treatment increased latency to female nest inspection and spawning and decreased spawning probability.

Research into behavioural effects of underwater noise on eels (European eel *Anguilla anguilla* in particular) has shown that they can be negatively impacted by marine noise pollution. A decrease in anti-predator response and an increase in startle latency was reported as a behavioural reaction to boat noise in adult European eel (Bruintjes et al., 2016). Purser et al. (2016) also investigated the anti-predatory response and ventilation rate in juveniles of European eels. Their results were similar to those reported by Bruintjes et al. (2016), but only when the fish were in bad body condition.

Shad species have a very broad hearing range, with the American shad *Alosa sapidissima* detecting signals from 50 Hz to over 180 kHz in the ultrasound range. However, this species shows relatively poor hearing sensitivity at low frequencies (Mann et al. 2001). Behavioural studies on shad species are generally focused on their response to ultrasound (O'Keeffe et al, 2009; Plachta & Popper, 2003; Wilson et al. 2008) rather than behavioural studies with lower frequency underwater noise.

Impact assessment of behavioural effects from underwater noise on critical habitat-triggering fish species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Drilling activities (rig noise) – direct impact on fish, behavioural effects from underwater noise	Very low (1) Extent: Immediate-behavioural effects <1m from rig Duration: Temporary – only for period of drilling activities / installation activities Scale: Behavioural effects limited to proximity of noise source and rapid return to normal following cessation of activities Frequency: The frequency of the impact will be continuous but low level for the duration of these activities	High (4) Critical habitat trigger	Minor (4)
Facility installation (large construction vessels) – direct impact on fish, behavioural effects from underwater noise	Very low / Low (1/2) Extent: Local - behavioural effects up to 100m from vessel Duration: Temporary – only for period of installation activities Scale: Behavioural effects limited to proximity of noise source and rapid return to normal following cessation of activities Frequency: The frequency of the impact will be continuous but low level for the duration of these activities	High (4) Critical habitat trigger	Minor / Moderate (4/8)
Operation of FPSO and support / supply vessels – direct impact on fish, behavioural effects from underwater noise	Very low / Low (1/2) Extent: Local - behavioural effects up to 40 m from FPSO Duration: Short-term - ongoing operation, mitigated relatively rapidly following cessation of activities Scale: Behavioural effects limited to proximity of noise source and rapid return to normal following cessation of activities Frequency: The frequency of the impact will be continuous but low level for the duration of these activities	High (4) Critical habitat trigger	Minor / Moderate (4/8)

Mitigation Measures

It should be noted that the underwater noise impacts associated with the Ruche EEA field development activities are significantly less intensive than those associated with seismic survey activities and there are several measures inherent in the Project design than minimise underwater noise, namely:

- The Hibiscus Alpha OI design (converted jack-up MODU) allows facility installation without the requirement for high noise impulsive piling activity
- The FPSO is moored so propeller and thruster usage will be minimised
- Large construction vessels will only be used during the facility installation period, medium sized support / supply vessels will be utilised for ongoing operations and maintenance.

In order to further minimise behavioural impacts on critical habitat triggering fish species the following mitigation measures will be implemented:

- Support / supply vessel transfers from the logistics base at Port Gentil to the Ruche EEA will be optimised (3 transfers per month during operations)
- The drilling rig support vessel will drift around the rig site to minimise engine use
- Vessel speeds will be reduced to minimise underwater noise radiation (particularly effective if speed reduction reaches less than cavitation inception speed)
- Gradual start-up of engines and thrusters where possible (particularly on large construction vessels), to provide opportunity for species to take evasive action
- Vessel engines and generators will be operated according to manufacturer's instructions and maintenance programme will be in place to minimise noise emissions.

Residual Impacts

With the implementation of the above mitigation measures the residual impacts are considered to be as follows:

Residual impact assessment of physical injury from underwater noise on critical habitat-triggering fish species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – behavioural effects from underwater noise	Minor (4) / Moderate (8)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Minor (4) / Moderate (8)	Minor (4)

6.4.1.4 *Impacts from discharges to the marine environment*

Potential Impacts

Discharges to sea from the Ruche Field Development Project are generated from a number of sources, as follows:

- drilling activities – drill cuttings and associated WBDFs and NADFs, cement, pipe dope
- supply / support vessel and construction vessel operational discharges – sanitary wastewater, food waste, drainage water, desalination unit discharges, cooling water, ballast water
- drilling rig operational discharges – same as vessels, with the exception of ballast water
- Hibiscus Alpha OI – same as vessels, with the exception of ballast water and the addition of produced water
- BW Adolo FPSO – same as vessels, with the addition of produced water
- flowline installation – hydrotest discharges
- logistics base – rainwater drainage.

The majority of the above discharges are relatively small-scale, will be treated before release (see mitigation measures below), and will be rapidly diluted in the offshore environment of the Ruche EEA with minimal impacts on the fish populations present.

The most significant discharges that will be discussed in more detail below are discharge of produced water; discharge of cuttings and associated drilling fluids; and discharge of hydrotest water.

Potential impacts from ballast water discharges are discussed in more detail in the unplanned / accidental events sections of this chapter.

Drill cuttings discharge

Water based drilling fluids (WBDFs) are used in the upper well sections of the Ruche EEA wells and non-aqueous drilling fluids (NADFs) in the lower well sections. Cuttings and associated drilling fluids are discharged to sea following treatment on the rig (with the exception of the riserless top hole section which is discharged at the seabed), see Table 2.4.

Impacts from cuttings discharge primarily affect the sessile benthic sediment community in the vicinity of the well site and effects include physical burial of organisms; elevated suspended particulate matter and turbidity of the water column near the seabed; sediment grain size changes; oxygen depletion in the sediment; and toxicity effects.

Discharge of cuttings also produces a visible plume that moves through the water column with the current as the materials dilute, disperse and settle to the seafloor. This plume may extend a considerable distance from the rig, however, chemical risk to the water column is generally temporary (number of days) with the main impact being turbidity effects from the release of insoluble components such as barite and bentonite. These turbidity effects could result in clogging of fish gills and asphyxiation, however, the short-term increase in turbidity is unlikely to result in such effects. Critical habitat triggering

pelagic fish species (bonga shad) are highly mobile and have the ability to temporarily leave the area. Benthic fish species closely associated with the seabed at the water depths of the well sites are also either highly mobile (white skate and common guitarfish) or can generally withstand high suspended sediment levels (goby species *L. koumansi* and eel species *H. opici, X. guineensis* and *U. drachi)* (Wilber and Clarke, 2001).

It is notoriously difficult to study effects of cuttings discharges on populations (e.g., fish stocks) and the structure and function of marine ecosystems. According to Bakke et al (2013), all evidence suggests that the effects of discharges are local and that the risk of widespread impact from the operational discharges is low. However, it is also important to stress that, apart from studies on the effects of drilling waste on sediment macrofauna community structure, there is nearly no published information on the effects on populations or communities.

Studies on the Norwegian Continental Shelf of multi-well discharge sites and unimpacted reference sites do not indicate that past and present cuttings discharges are causing accumulative or long-lasting effects on the macrofauna structure at a wider scale. Feral haddock and cod caught in the North Sea Tampen region have shown biomarker effects which may reflect exposure to cuttings when the fish are foraging on the piles but may also stem from produced water exposure. (Balk et al., 2011; Grøsvik et al., 2010).

As stated previously, the goby (*L. koumansi*) and white skate carry out benthic spawning and are therefore considered more sensitive to seabed impacts. The cuttings piles from Ruche Phase 1 will be centred around the Hibiscus Alpha OI. The extent of the cuttings piles is difficult to determine without site-specific modelling, however, biological effects have been recorded out to 2000 m from some well sites (Ellis et al 2012). This area is considered relatively small in relation to the extent of the sea floor available with similar types of sediments and sea depths.

Produced water

Produced water can be defined as water from the formation which is produced together with oil and gas. It may contain residues of reservoir hydrocarbons as well as chemicals added during the production process (in this case demulsifiers and asphaltene inhibitors), along with dissolved organic and inorganic compounds that were present in the geological formation. In addition, produced water can have elevated temperature and salinity, as is the case in the Ruche EEA.

First stage separation of the produced fluids will take place on the Hibiscus Alpha OI and the BW Adolo FPSO, with the produced water treated and discharged overboard. At the start of field production, produced water discharges are anticipated to be low, with an increase in water cut as the field matures. Current produced water discharge is 32,000 bbl/d, the predicted produced water discharge as the field matures is presented in Figure 2.5.

Hydrodynamic modelling of the produced water discharge from the BW Adolo FPSO has been carried out using DHI's Mike 3 software platform to analyse the effluent dilution into ambient seawater (see Appendix 6B). The modelling was based on the design capacity of the BW Adolo FPSO (60,000 bbl/day of produced water) using the parameters of temperature (46.11°C) and salinity (279 practical salinity units (PSU)). The results show

that the plume of produced water released at the sea surface remains in the top 20 m of the water column and dilutes quickly with ambient temperature and salinity conditions being reached approximately 300 m from the FPSO[25]. Given that the majority of the critical habitat triggering fish species present in the vicinity of the BW Adolo FPSO or Hisbiscus Alpha OI are benthic in nature (white skate, common guitarfish, goby species *L. koumansi* and eel species *H. opici, X. guineensis* and *U. drachi*) they are highly unlikely to significantly interact with the rapidly diluted and buoyant plume of produced water. Bonga shad is the only pelagic critical habitat triggering fish species anticipated to be present and this is considered to generally be more coastal in distribution.

Results of monitoring the ecological effects of oil and gas activities indicate that effects of discharges of produced water are not probable (Research Council of Norway, 2012) while the risk of widespread, long term ecological impact from operational discharges can be considered low (Bakke et al., 2013), although evidence in the available literature is lacking in this regard (Blanchard et al., 2013; Bakke et al, 2013). Because of the rapid dilution, dispersion and transformation rates of most chemicals in produced water in open-ocean conditions, harmful biological effects of produced water discharges are expected to be minimal and localised (Neff, 2005)[26]. Furthermore, although several substances potentially harmful to the reproductive success of fish may be present in some produced water discharges, the concentrations that have given rise to adverse effects are normally only found within a few kilometres of the discharge sites and extensive and long-term reproductive effects of produced water on fish are not very probable (Research Council of Norway, 2012). Other effects of the components of produced water include alteration in fish enzyme activity, liver oxidative metabolism and cell death, deoxyribonucleic acid (DNA) damage, impaired immunity and gene modification which can affect overall fish health (Research Council of Norway, 2012; Gagnon, 2011; Hamoutene et al., 2011). However, ecological effects that have been detected have typically been associated with a dilution of produced water of 0.1% to 1% or higher which is found very close to discharge points indicating that effects are usually local (Research Council of Norway, 2012).

Most of the laboratory and field studies described above support the conclusion that significant biological effects on pelagic organisms will be limited to a distance of less than 1 km due to rapid effluent dilution and very short exposure time. Most fish species have a much wider distribution than the documented produced water impact zones. Hence, for a significant impact to occur either harmful exposure to produced water has to be sufficiently wide scale or the population influence from locally affected individuals has to be large enough. None of these are likely. It is also inherently difficult to make reliable extrapolation to the population level since effects on individuals may be masked by other factors acting on populations e.g., distribution patterns, seasonality, species interaction,

[25] Combined modelling of produced water and cooling water from the BW Adolo FPSO and Hibiscus Alpha OI showed ambient temperature and salinity conditions being reached at approx. 300 m from the FPSO and almost ambient conditions at 500 m from the HA OI. All discharges were in line with the World Bank Group standard for cooling water, i.e., the temperature of the discharge was within 3°C of ambient seawater temperature within 100 m of the discharge point (World Bank Group, 2015). See Appendix 6B.

[26] According to the 'UK Risk Based Approach to the Management of Produced Water Discharges from Offshore Installations' (Department for Business, Energy and Industrial Strategy, 2020) dilution of produced water at 500 m is primarily dependent on discharge rate. Annual discharges of 1,000,000 – 8,000,000 m^3 (which are applicable to this Project) in water depths of 50-125 m of water are conservatively considered to have a dilution rate of 400. Based on this produced water discharged at 30 ppm oil in water will be diluted to 0.75 ppm at 500 m.

density dependent functions, other stressors, and the complex and dynamic physical conditions in the offshore pelagic ecosystem (Hjermann et al., 2007).

Hydrotest water

Flowline pre-commissioning operations will involve subsea inspection, hydrotesting and leak testing operations. Pre-commission of the flowlines and other components is necessary to prove integrity prior to production. These operations currently involve filling the flowline with seawater from the FPSO firewater system dosed with hypochlorite to maintain a residual concentration of 3 ppm by volume. This water will be discharged to sea following hydrotest activities.

Impact assessment of discharges to sea on critical habitat-triggering fish species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Cuttings and associated fluids discharge – direct impact on fish from turbidity impacts on adult fish, smothering of benthic eggs	Low (2) Extent: Local – extent of cuttings plume Duration: Temporary – turbidity effects only last for number of days Scale: Localised impact to individuals of a species Frequency: Discharges limited to duration of drilling programme	High (4) Critical habitat trigger (Goby (*Lesueurigobius koumansi*) and white skate considered most sensitive as benthic spawners)	Moderate (8)
Produced water discharge – direct impact on water quality from elevated temperature, salinity and chemicals, indirect impacts on fish	Low (2) Extent: Local – extent of produced water plume Duration: Short-term - continuous throughout operations but impact mitigated relatively rapid following cessation of activities Scale: Localised impact to individuals of a species Frequency: Operational discharge throughout the Project lifetime	High (4) Critical habitat trigger	Moderate (8
Hydrotest water discharge – direct impact on water quality from hydrotest chemicals, indirect impacts on fish	Low (2) Extent: Local – extent of hydrotest water plume Duration: Temporary – rapid dilution and dispersion anticipated Scale: Localised impact to individuals of a species Frequency: Once off during hydrotest water discharge	High (4) Critical habitat trigger	Moderate (8)

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Other operational discharges (drilling rig, vessels, Hibiscus Alpha OI and FPSO) – direct impact on water quality from turbidity, increased BOD and chemicals, indirect impacts on fish	Very low (1) Extent: Immediate Duration: Temporary – rapid dilution and dispersion Scale: Localised impact to individuals of a species Frequency: Operational discharges throughout the Project lifetime (for rig and construction vessels limited to drilling and facility installation period)	High (4) Critical habitat trigger	Minor (4)

Mitigation Measures

Mitigation measures addressing cuttings discharge are as follows:

- Chemicals used in the WBDF well sections will be PLONOR (poses little or no risk to the environment), HQ Band Gold, or OCNS Group E or D chemicals. These chemicals have low toxicity, high biodegradability and low bioaccumulation potential.
- No discharge of whole WBDF to sea except if in compliance with 96 hr. LC-50 of Suspended Particulate Phase (SPP)-3% vol. toxicity test for drilling fluids, or alternatively testing based on standard toxicity assessment species (preferably site-specific species).
- NADF well sections will utilise the Versaclean system - base fluid Escaid 120 classified as IPIECA OGP Group III, contains less than 0.001% Polycyclic Aromatic Hydrocarbons (PAHs).
- There will be no discharge to sea of whole NADF. It will be backloaded after use for re-use in future wells. Untreatable slops will either be placed in abandoned wellbores between cement plugs or transferred for treatment and / or disposal onshore. Small volumes of slops will be treated and returned to the reconditioned mud system.
- Maximum allowed oil on cuttings (OOC) for well sections drilled with NADF is 3% (non-compliant cuttings will be returned to Port Gentil). Cuttings are treated using a cuttings dryer that incorporates a high-speed centrifuge. OOC properties will be measured and recorded every 12 hours. Where mud properties become sub optimal then drilling will be stopped, and the mud system conditioned before drilling goes ahead. In the case of equipment failure if OOC levels cannot be met then drilling will be stopped until the equipment is repaired.
- Barite in drilling fluids will meet World Bank Group heavy metals concentration standards, i.e., mercury <1 mg/kg and cadmium <3 mg/kg dry weight (total) (World Bank Group, 2015). A certificate will be provided for each batch prior to shipment to Gabon.

Mitigation measures addressing produced water discharge are as follows:

- The oil in water content of the produced water discharge will be less than 30 mg/l, in line with OSPAR Recommendation 2001/1 amended by 2006/4 and 2011/8. Non-compliant produced water diverted to slops tank and retreated until back within specification. It should be noted that according to the BWE Annual Report 2020, the average monthly oil in water content for produced water discharged to

sea in 2020 was only 9.9 ppm. Available data for produced water discharges in 2021 has monthly oil in water content of 4.6 - 18.7 ppm.

- Production chemicals (e.g., demulsifiers and asphaltene inhibitors) will be selected according to the following criteria: lowest toxicity, lowest bioaccumulation potential and highest biodegradation (preference for PLONOR, HQ Band Gold, OCNS Group E or D).
- BWE will undertake an assessment of best available techniques (BAT) covering produced water. To manage the environmental risk posed by added and naturally occurring chemicals in the produced water discharge, a risk-based approach will be used in line with those described in OSPAR Recommendation 2012/5 and appropriate measures taken to reduce the risk. BWE has drafted a procedure based on compliance with the OSPAR/CEFAS UKCS OCNS approach and are currently undertaking due diligence to ascertain the level of compliance for the chemical products deployed on BW Adolo FPSO as well as those being considered for use on the Hibiscus Alpha OI.

Mitigation measures for hydrotest water are as follows:

- BWE will conduct a risk assessment in respect of the current management and disposal of hydrostatic testing water for the Project and will develop a documented management plan for this waste stream. The management plan will take into consideration the pollution prevention and control measures set out in the EHS Guidelines for Offshore Oil and Gas Developments (World Bank Group, 2015) for the management of hydrotest waters.

Mitigation measures for other operational discharges:

- Sanitary waste, food waste, deck drainage and bilge water will be discharged in line with requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).
- Chorine content of sanitary waste will be <1 mg/l.
- Low toxicity biodegradable detergents will be used in deck wash.
- Cooling water discharge will result in a temperature increase of no more than 3°C within 100 meters of the discharge point in accordance with World Bank Group effluent limits (World Bank Group, 2015).

Residual Impacts

With the implementation of the above mitigation measures the residual impacts are as considered to be as follows:

Residual impact assessment of discharges to sea on critical habitat-triggering fish species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Cuttings and associated fluids discharge – turbidity impacts on adult fish, smothering of benthic eggs	Moderate (8)	Minor (4)
Produced water discharge – impacts from elevated temperature, salinity and chemicals	Moderate (8)	Minor (4)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Hydrotest water discharge – impacts from hydrotest chemicals	Moderate (8)	Minor (4)
Other operational discharges (drilling rig, vessels, Hibiscus Alpha OI and FPSO) – impacts from turbidity, increased BOD and chemicals	Minor (4)	Minor (4)

6.4.1.5 *Impact of Unplanned / Accidental Events*

Potential impacts

Accidental event scenarios that have the potential for impacts on critical habitat triggering fish species include:

- introduction of alien invasive species
- accidental release of hydrocarbons.

Alien invasive species (AIS)

Alien invasive species are non-native species that are deliberately or unintentionally introduced by human action outside their natural habitats where they establish, proliferate and spread in ways that cause damage to biological diversity (e.g., by competing with native organisms for limited resources and altering habitats).

There are three main pathways for the introduction of AIS associated with the Project vessels / FPSO, drilling rig, Hibiscus Alpha OI and equipment, namely:

- ballast (water and sediment)
- biofouling
- direct physical introduction through other means such as intact plant particles or sediment on anchors.

The critical habitat triggering fish species present could be significantly affected by the introduction of AIS and there are numerous cases in literature of this type of event. The American comb jelly (*Mnemiopsis leidyi*) was introduced, presumably in ballast water, into the Black Sea in 1982. It quickly dominated the Black Sea ecosystem due to its tolerance of a wide range of salinity, temperature and water quality conditions, its high reproduction rate and the fact that it had no natural predators in the Black Sea. The introduction of *Mnemiopsis* caused a dramatic decrease in local pelagic fisheries due to predation on eggs and larvae, and reduction in food stocks for adult fish (IPIECA, 2010).

Whilst the impacts of AIS may be considered local for an individual species, they have the potential to become much more extensive if unmanaged (FFI, 2017).

Accidental release of hydrocarbons

Fish are not generally affected by hydrocarbon slicks on the sea surface and have been shown to detect and exhibit avoidance behaviour to hydrocarbon products. This avoidance may, however, cause disruption to migration or spawning patterns. Mature fish of most species can tolerate water-soluble oil fractions of about 10 mg/l. Some species

can survive much higher levels unless whole oil or dispersed oil droplets coat the gills and cause asphyxiation.

Although various development disorders in fish, as well as mortalities, are believed to occur to some degree under oil slicks, so far it has proved impossible to detect consequential effects on adult populations. Potential sublethal effects of spilled oil on fish include impairment of reproductive processes and increased susceptibility to disease and predators.

Fish eggs and larvae are more vulnerable to oil pollution than adult fish, as demonstrated in numerous laboratory toxicity tests (Kühnhold 1977; Tilseth et al, 1984; Serigstad and Adoff 1985; Falk-Petersen and Kjørsvik 1987). In many fish species, these stages float to the surface where contact with spilt oil is more likely.

However, in several studies effects on pelagic fish eggs and larvae were not observed in the field following oil spills. One reason for this may be that toxic concentrations of oil components are generally confined to the uppermost parts of the water column immediately beneath an oil slick and that fish eggs and larvae are encountered below the toxic water layers (Clark, 2001). Other studies have demonstrated massive kills of fish eggs and larvae near oil spills without causing any significant effect on fish populations in the open sea. For example, studies following an oil spill from the *Argo Merchant* in the USA in 1976 (25,000 t of fuel oil spilled) found 20% of cod eggs and 46% of pollock eggs and larvae in the spill area to be dead or moribund. However, the same fish stocks studied in 1977 and 1978 showed no major impacts (Longwell, 1977, 1978; IPIECA, 1997). The lack of effects on numbers in subsequent adult populations following massive kills of eggs and larvae is probably because most fish species produce vast numbers of eggs and larvae and have extensive spawning grounds (IPIECA, 1997). Certain fish stocks may be more affected than others, particularly if the spill is very large, coincides with spawning periods, or enters the grounds of species with restricted spawning areas.

The most likely spill event during the Ruche field development programme is the accidental release of fuel during at-sea bunkering operations. Spill volumes for this kind of unforeseen event are typically small, ranging from 2 m^3, to the unlikely event of a decoupling of the fuel supply line (potentially up to 50 m^3). It is anticipated that marine gas oil will be used as fuel by the Project vessels. This is a middle petroleum distillate that undergoes rapid dispersion and evaporation in the marine environment when subjected to wave action, winds, currents, light and bacteria. Consequently, small releases are likely to break up and disperse in a short space of time. A bunkering spill from the FPSO could result in a small-scale release of reservoir crude oil which is likely to be more persistent. Potential impacts on adult critical habitat triggering fish species are likely to be limited to those on bonga shad as this is the only pelagic species present. It should be noted, however, that the distribution of this species is generally more coastal. In terms of impacts on eggs and larvae, bonga shad and the critical habitat triggering eel species *H. opici, X. guineensis* and *U. drachi* have pelagic eggs and larvae therefore small-scale impacts could potentially occur if the spill was to coincide with key spawning periods. As detailed in the studies above, however, significant effects on fish populations in the open sea are unlikely and these species have extended spawning periods over large geographical areas.

In the case of a large-scale crude oil hydrocarbon release in the Ruche EEA (worst case scenarios considered to be a well blowout, or a collision with the FPSO) significant areas could be impacted. Oil spill modelling of a well blowout scenario was conducted as part of the Ruche Field Development Oil Spill Contingency Plan (7,000 bbls/day for 30 days using SINTEF's Oil Spill Contingency and Response (OSCAR) model). Stochastic modelling (maximum emulsion thickness) predicts that the slick would move in a northerly direction from the well site (particularly in the wet season) with Gabonese offshore and nearshore waters impacted and oiling of significant tracts of the coastline (Appendix 6C – Figure 1). Trajectory modelling (most oil ashore) in the wet and dry season predicted slicks of 5-200 µm thickness affecting offshore waters, coastal waters and the shoreline up to Port Gentil (Appendix 6C – Figures 2 and 3) with sheens (0.3 – 5 µm) further north.

In this scenario critical habitat triggering fish species in both seascapes have the potential to be affected. As stated previously, potential impacts on pelagic fish species (bonga shad) are anticipated to be the most significant as they are most likely to encounter the slick in surface waters. However, impacts on benthic fish species could also occur through dissolution of oil droplets into the water column and from oil reaching the coast and affecting sediment communities along the shoreline.

In terms of impacts on eggs and larvae, the majority of the cartilaginous critical habitat triggering fish species present give birth to live young in the shallow waters of the Gulf of Guinea (African wedgefish, blackchin guitarfish and common guitarfish). As these juveniles are unlikely to be in the surface waters, and are highly mobile, they are considered less vulnerable to spill impacts. Likewise, the goby (*L. koumansi*) and white skate carry out benthic spawning therefore eggs and larvae of these species are also considered less vulnerable to surface hydrocarbon slicks, although dissolution of oil droplets into the water column could affect them. Bonga shad and the critical habitat triggering eel species have pelagic eggs and larvae and are therefore considered the most sensitive to a large-scale release of hydrocarbons.

The magnitude and significance of these adverse impacts to critical habitat-qualifying fish would be dependent on the composition and volume of the hydrocarbons released, the wind and weather conditions at the time of the incident, and whether the spill event coincides with key spawning periods.

Impact assessment of unplanned accidental events on critical habitat-triggering fish species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Introduction of AIS – competition, alteration of habitats, potential for direct impacts on fish	Medium (3) Extent: Potential for regional impacts Duration: Medium to long term Scale: Activity or event disturbing a sufficient portion of a population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population to former levels within several generations. Restoration may require substantial intervention. Frequency: Unplanned / accidental event Likelihood: Unlikely	High (4) Critical habitat trigger	Major (12)
Accidental spill, small scale bunkering spill – direct impacts of hydrocarbon contamination on adult fish and eggs/larvae	Low (2) Extent: Local - considered that slick would be limited Duration: Short-term – impact likely to be mitigated through natural processes (evaporation, dispersion, dissolution) Scale: Spill or accidental event leading to immediate area or localised damage to water resources Frequency: Unplanned / accidental event Likelihood: Possible	High (4) Critical habitat trigger	Moderate (8)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts of hydrocarbon contamination on adult fish and eggs/larvae	High (3/4) Extent: International / transboundary Duration: Medium to long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources Frequency: Unplanned / accidental event Likelihood: Very unlikely	High (4) Critical habitat trigger	Major (12/16)

Mitigation Measures

Mitigation measures with respect to AIS focus on the prevention of introduction as very little can be done by the operator retrospectively once AIS have become established in a new marine area. Key measures include:

- Compliance with the requirements of the 'International Convention for the Control and Management of Ship's Ballast water and Sediments' (BWM Convention).

- Implementation of the biofouling management practices outlined in the 'Guidelines for the control and management of ship's biofouling to minimise the transfer of invasive aquatic species - Resolution MEPC.207(62) 2011'.
- Pre-use and post-use inspection of submersible equipment (e.g., ROVs, inspection equipment, survey equipment, etc) including checks for the presence of marine growth. All equipment is required to be free of marine growth prior to mobilisation.
- Routine removal of marine growth (with high-pressure water) as part of day-to-day activities and maintenance before departing from a site from anchors / chains; ropes, cables, fenders and buoys; anchor wells and chain lockers and submersible equipment.

An Alien Invasive Species Management Plan has been developed for the Project which details the mitigation measures above in more detail (see Appendix 11B).

Mitigation measures with respect to small-scale spills, such as bunkering releases, are listed below.

In built control measures that will reduce the likelihood of occurrence include:

- Bunkering procedures in place - rigorous monitoring during offloading / refuelling operations.
- Transfer operations only conducted in calm weather conditions.
- Use of certified and pressure tested transfer hoses that are visually inspected before use and allow spill free connection and disconnection.
- Maintenance of storage tanks.

Mitigations measures to reduce magnitude include:

- Vessel Shipboard Oil Pollution and Emergency Plan (SOPEP) on FPSO, drilling rig and Project vessels in line with MARPOL requirements.
- Tier 1 spill response equipment on all offshore facilities, vessels and at logistics base and relevant key personnel trained in spill response.

Mitigation measures with respect to a larger-scale spill event, such as a well blowout or collision with offshore facility, are listed below.

In built control measures that will reduce the likelihood of occurrence (well blowout) include:

- Pore pressure will be closely monitored (flow checks).
- Drilling fluid weight and properties will be controlled.
- Integrity of cementing operations will be checked.
- BOP and well control equipment testing will be conducted.
- Critical personnel will be trained and certified in well control.
- Rig audit will be carried out.
- Well shut in and well control procedure will be in place.
- Frequent kick drills will be conducted.

Additional mitigation measures specific to this Project include the following:

- During the rig special periodic survey in Port Gentil, prior to the Ruche Phase 1 drilling campaign, the current 18 ¾" BOP will be replaced with a new 13 5/8" BOP improving safety, equipment handling and suitability for the Ruche 1 well design.
- Contingency well control equipment and procedures will be in place at the Hibiscus Alpha OI location that are appropriate to the Ruche Phase 1 surface wellheads (capping stacks more relevant to subsea wellheads).
- In case of a loss of well control scenario, all equipment will be in place (surface wellhead, conductor, casing, drilling fluid, cement) to drill a standalone relief well at an offset location to the platform. A Relief Well Planning document will be developed detailing surface locations and relief well profiles specific to the Ruche Phase 1 drilling campaign.

In built control measures that will reduce likelihood of occurrence (collision) include:

- 1 km safety exclusion zone in place around the FPSO and Hibiscus Alpha OI. 500 m safety exclusion zone around the drilling rig.
- A support vessel will be at the well site during drilling operations providing security and safety and will alert any vessels on a collision course.
- There will be 24/7 radio communication and watches from the FPSO and Hibiscus Alpha OI.
- A Notice to Mariners (NAVAID/NAVAREA system) will be issued regarding the location of the temporary drilling rig. Permanent facilities and their exclusion zones will be indicated on new versions of published navigation charts.
- Facility and vessel warning lighting will be in accordance with the IALA international standard (International Association of Lighthouse Authorities) and Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs).

Mitigation measures in place to reduce large-scale spill magnitude include:

- Oil Spill Contingency Plan in place for Ruche Field Development that is aligned with the National Oil Contingency Plan of Gabon (NOCPG) and details Tier 1, 2 and 3 responses. BWE has agreements in place with Oil Spill Response Limited (OSRL) and the Association of Petroleum Companies (UPEGA) for assistance in the event of a Tier 2/3 spill.
- Spills will be notified to the Director of the Direction Générale des Hydrocarbures (DGH) and the Technical Director of the Centre National Anti-Pollution (CNAP). (The National Coordinator or Director of CNAP will make the decision to either grant or refuse permissions to use dispersants as a response strategy[27]).
- BWE will work with local agencies and environmental groups to identify marine coastal areas sensitive to spills and develop strategies to protect these areas. In line with this work, more detailed mitigation measures to address impacts of oil

[27] Chemical dispersion is only authorised on or in the immediate vicinity of ecologically vulnerable or sensitive zones and in settings where the possibilities for renewal and agitation of the water offer conditions that allow for speedy dilution of the dispersed pollutant. The use of dispersants is prohibited on a pollutant with viscosity greater than 5,000 centistokes (cSt). The use of the dispersants shall only be authorised at depths greater than 18 m and more than 15 km from the coast, in the direction of the current.

on critical habitat triggering species will be developed (additional information provided in Section 4.5 of the Biodiversity Action and Management Plan (Appendix 11A)).

Residual Impacts

With the implementation of the above mitigation measures, and the development of a Project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of introduction of AIS is substantially reduced from unlikely, to extremely unlikely. This is considered to reduce the residual impact significance to minor (4).

With the implementation of the above mitigation measures the likelihood of a spill event is also reduced from possible to unlikely for small-scale spills, e.g., bunkering, and from very unlikely to extremely unlikely for a major spill event. This is considered to reduce the residual impact significance to minor (4) and moderate (8), respectively.

Residual impact assessment of unplanned accidental events on critical habitat-triggering fish species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Introduction of AIS – competition, alteration of habitats	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination on adult fish and eggs/larvae	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) - impacts of hydrocarbon contamination on adult fish and eggs/larvae	Major (12/16)	Moderate (8)

6.4.2 Critical Habitat Qualifying Marine Mammals

6.4.2.1 Sensitivity Summary

Section 6.3.5 identifies two species of marine mammal that trigger critical habitat along with the seascapes in which they are found and the criteria they trigger.

Atlantic humpback dolphin

The Atlantic humpback dolphin is not considered to be a migratory species and typically does not travel very far (IUCN, 2021) and so can be expected year-round. The calving period for this species is thought to occur in March and April, with calves likely to be present until October (idem), meaning that the period of March to October is when this species is likely to be most sensitive to negative impacts.

The Atlantic humpback dolphin is a Critically Endangered species with a decreasing population. The most recent IUCN estimate puts the population at 1,500 individuals and a high proportion of this likely lives in Mayumba National Park and the southern half of Gabon (Weir and Collins, 2015). An impact on this population may have significant impacts for the species as a whole and so this species can be considered highly sensitive.

Their preferred habitat is shallow, warm waters of less than 20 m depth (Weir and Collins, 2015) with the majority of sightings recorded 3 m to 13 km from land, they are therefore only anticipated to be present in the shallow seascape.

Humpback whale

Humpback whales migrate to Gabonese waters from colder waters further south, arriving in June with a peak in August and migrate south again in October/November (WCS Gabon, 2021; Rosenbaum and Collins, 2006). Adult females' mate or give birth to the calves conceived during the previous mating season (Parnell, 2010) with cow and calf pairs making up five percent of humpback whale sightings in Gabon (Rosenbaum and Collins 2006, Walsh et al., 2000, Weir, 2010). Peak calving occurs in July and August (IUCN, 2021). Adult males are present in large numbers to compete for mates. During this period, there is also a peak in the level of whale song recorded (Razafindrakoto et al., undated). Boat-based and aerial surveys along the coast of Gabon show that large groups of animals congregate along the continental shelf each year (Rosenbaum & Collins, 2006). The area around Port Gentil headland is particularly important for mothers and calves, with large numbers congregating in the area and using the sand banks in this area to protect young from predation. Peak number of mothers and calves are usually observed in October (*pers. comm* Tim Collins, 2022).

As much as 10 percent of the world's humpback whales may be involved in the migration along the western coast of Africa (Parnell, 2010). The humpback whale is listed as Least Concern and has an increasing population (IUCN 2021), but the importance of the AOI to this species mean that it is a critical habitat-qualifying species.

Humpback whales are considered to be more sensitive to impacts during their time in the Gulf of Guinea owing to the strain put on them from migrating with little food intake, and from breeding (ANPN, 2015).

The sensitivity of all these species is considered to be high (4), as they trigger critical habitat as per IFC PS6.

6.4.2.2 Impacts from Underwater Noise

Potential Impacts

A description of the underwater noise sources associated with the Ruche EEA field development programme is provided in Section 6.4.1.3.

In order to determine impacts to marine fauna from underwater noise generated by the above sources, acoustic propagation modelling has been carried out in order to determine the potential distances from each noise source at which noise decreases to below thresholds for injury, hearing and behavioural impacts (the full study is provided in Appendix 6A).

Physiological impacts

Southall et al. (2007) reviewed earlier work on animal audiology and noted that marine mammals could be assigned to one of a number of functional hearing groups (FHG) where each group depended on differences and similarities in the animal's audiological

physiology and behavioural psychophysics. The latest hearing group classification (Southall et al. 2019) for cetacean species is given in Table 6.14.

Table 6.14: Functional hearing groups for marine mammal species

Functional hearing group	Marine mammals
Low-frequency cetaceans (M_{lf})	Mysticetes including the critical habitat triggering humpback whale
High-frequency cetaceans (M_{hf})	Odontocetes including sperm whale; beaked whale species; dolphin species; and the critical habitat triggering Atlantic humpback dolphin
Very high-frequency cetaceans (M_{vhf})	Odontocetes including pygmy sperm whale; dwarf sperm whale

It is acknowledged that, like humans, marine mammals do not hear equally well across all frequencies. In order to account for this, Southall et al. (2019) proposed a series of frequency-dependent weightings that were derived from the hearing sensitivity curves for animals in each FHG. These have the effect of emphasising the frequencies over which the animals are most sensitive and de-emphasising the remaining frequencies. The frequency-weighting curves (collectively known as M-weightings), for each FHG representing marine mammals found in and around the Project Area, are shown in Figure 6.3. The M-weightings curves are used to modify the frequency spectrum of the impacting noise so that it more closely represents the noise as perceived by the target species.

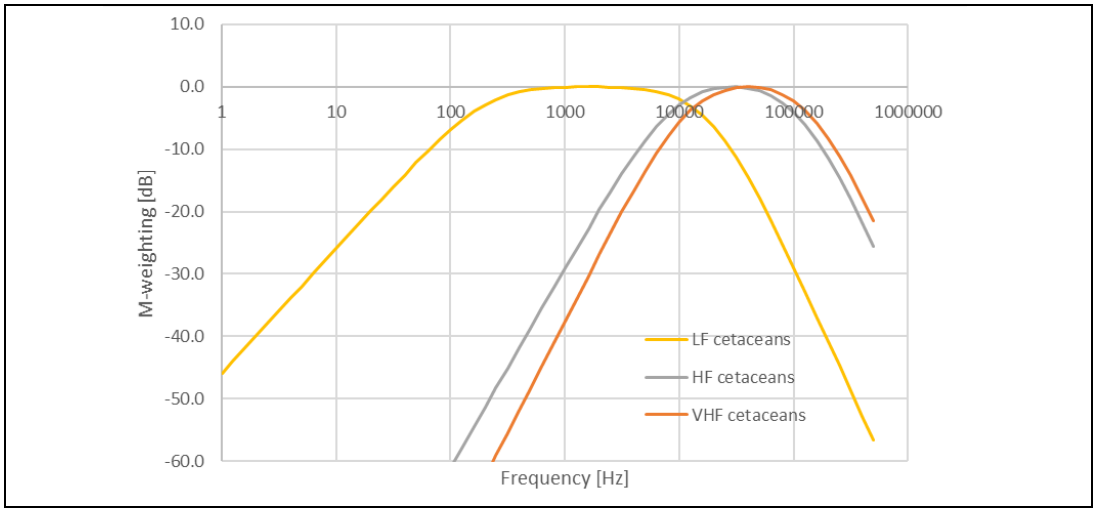

Figure 6.3: M-weighting curves for low-, high- and very high-frequency cetaceans

From reviewing available data derived from extensive tests involving marine mammals, Southall *et al*. (2019) proposed thresholds representing the onset of permanent threshold shift (PTS) for marine mammals (based on measurements relating to the onset of temporary threshold shift (TTS)) which were expressed in terms of sound pressure level (SPL) and sound exposure level (SEL), where the latter metric (expressed as dB re 1 $\mu Pa^2.s$) takes note not only of the period of time over which the receptor is exposed but also the sensitivity of the animal to the impacting sound. For continuous-type noise, the thresholds are given using SEL metrics where the appropriate M-weightings have been

applied across the noise source spectrum. The resulting impact thresholds for both PTS and TTS are given in Table 6.15.

Table 6.15: Summary of acoustic impact threshold criteria for PTS and TTS for each functional hearing group when exposed to continuous-type noise, using the Southall *et al.* (2019) thresholds

Functional hearing group	M-weighted SEL thresholds dB re 1 @ Pa^2 s	
	PTS	TTS
Low-frequency cetaceans (M_{lf})	199	179
High-frequency cetaceans (M_{hf})	198	178
Very high-frequency cetaceans (M_{vhf})	173	153

Given the nature of the M-weighting curves above, and the fact that the noise sources associated with the Project are all predominantly low-frequency in content, it may be ascertained that LF-cetaceans are likely to be most sensitive to the underwater noise generated by each activity. By contrast, the least sensitive FHG are the VHF-cetaceans.

A summary of the distances over which the PTS and TTS threshold conditions are met for each noise generating activity is given in Table 6.16 to Table 6.19. In these tables results for exposure durations of 0.5 – 24 hours are provided. However, in reality it is assumed that that any marine mammal experiencing high sound levels would move out of the area causing it discomfort, thus minimising its exposure duration. Based on this, the following discussion focuses on the results for 0.5 hour exposure durations.

Values of interest for the discussion on critical habitat triggering marine mammal species are shaded in grey.

Table 6.16: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to drilling noise

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 mPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	179 dB re 1 mPa^2.s	<1 m	<1 m	3 m	6 m
HF cetaceans	PTS	198 dB re 1 mPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 mPa^2.s	<1 m	<1 m	<1 m	<1 m
VHF cetaceans	PTS	173 dB re 1 mPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	153 dB re 1 mPa^2.s	<1 m	3 m	7 m	13 m
All groups	Behavioural	160 dB re 1 mPa rms	<1 m			
		140 dB re 1 mPa rms	<1 m			
		120 dB re 1 mPa rms	7 m			

Table 6.17: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to FPSO noise

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 µPa^2.s	6 m	14 m	60 m	100 m
	TTS	179 dB re 1 µPa^2.s	140 m	360 m	880 m	1840 m
HF cetaceans	PTS	198 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 µPa^2.s	<1 m	<1 m	3 m	6 m
VHF cetaceans	PTS	173 dB re 1 µPa^2.s	<1 m	<1 m	2 m	3 m
	TTS	153 dB re 1 µPa^2.s	5 m	11 m	40 m	80 m
All groups	Behavioural	160 dB re 1 µPa rms	4 m			
		140 dB re 1 µPa rms	120 m			
		120 dB re 1 µPa rms	2200 m			

Table 6.18: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to noise from medium-sized vessels

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 µPa^2.s	2 m	4 m	10 m	40 m
	TTS	179 dB re 1 µPa^2.s	40 m	100 m	240 m	480 m
HF cetaceans	PTS	198 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
VHF cetaceans	PTS	173 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	153 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
All groups	Behavioural	160 dB re 1 µPa rms	3 m			
		140 dB re 1 µPa rms	80 m			
		120 dB re 1 µPa rms	1500 m			

Table 6.19: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to noise from large-sized vessels

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 µPa^2.s	8 m	40 m	80 m	140 m
	TTS	179 dB re 1 µPa^2.s	220 m	540 m	1340 m	2760 m
HF cetaceans	PTS	198 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
VHF cetaceans	PTS	173 dB re 1 µPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	153 dB re 1 µPa^2.s	<1 m	<1 m	3 m	5 m
All groups	Behavioural	160 dB re 1 µPa rms	15 m			
		140 dB re 1 µPa rms	420 m			
		120 dB re 1 µPa rms	8740 m			

The acoustic impact modelling shows that drilling noise is likely to be the most benign of all the activities considered. The results show that the PTS impact criterion is not met, even for a continual exposure of 24 hours (see Table 6.16). The TTS impact criterion is not met for LF cetaceans (critical habitat triggering humpback whale) or HF cetaceans (critical habitat triggering Atlantic humpback dolphin) over a 0.5 hour exposure duration.

In terms of FPSO noise, the PTS impact criterion for LF cetaceans (critical habitat triggering humpback whale) is 6 m, and The TTS impact criterion is met at a distance of 140 m for the 0.5 hour exposure duration considered. For HF cetaceans (critical habitat triggering Atlantic humpback dolphin) the PTS and TTS criteria are not met within a 0.5 hour exposure duration.

For medium sized vessels, the PTS impact criterion is met at 2 m when LF cetaceans (critical habitat triggering humpback whale) receive a 0.5-hour exposure duration, while the TTS impact criterion is met at a distance of 40 m. When exposed to noise from medium-sized vessels, neither the PTS nor TTS impact criteria are met for HF cetaceans (critical habitat triggering Atlantic humpback dolphin).

Large sized vessels are likely to generate higher noise levels but, given the generally low frequency content of the noise, these are not likely to impact HF cetaceans (critical habitat triggering Atlantic humpback dolphin). By contrast, for a 0.5-hour exposure duration, the PTS impact criterion on an LF cetacean (critical habitat triggering Atlantic humpback dolphin) is 8 m, while the TTS impact criterion is 220 m.

Behavioural impacts

Behavioural impacts were defined using the Level B Harassment[28] criterion as given by the US National Marine Fisheries Service (NMFS) for exposure to continuous-type noise of 120 dB re 1 µPa (rms). NMFS regards a Level B Harassment as a response that occurs "*to a point where such behavioural patterns are abandoned or significantly altered*."

It is subject to interpretation as to how long a given behaviour (e.g., foraging) should be interrupted before meeting the definition of being "*abandoned*". Similarly, the term "*significantly altered*" could be interpreted in a statistically significant sense or in a biologically significant sense. Despite this, and for the purpose of the current study, a threshold level of 120 dB re 1 µPa (rms) is proposed as representing a noise which results in the onset of a strong behavioural reaction in marine mammals when exposed to continuous-type noise. Additional thresholds at 140 dB re 1 µPa (rms) and 160 dB re 1 µPa (rms) are included for comparison.

Behavioural impacts are quantified in terms of SPL rms metrics and are independent of exposure-duration. For continuous noise, the NMFS Level B Harassment is set at a threshold value of 120 dB re 1 mPa rms and this is applied to all FHG regardless of audiological sensitivity.

[28] Level B Harassment is defined as having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

When exposed to drilling noise, the Level B Harassment threshold extends to a maximum distance of 7 m. The distance increases to 2200 m when exposed to FPSO noise. The noise from medium-sized and large-sized vessels results in the threshold extending to distances of 1500 m and 8740 m respectively (see Tables 6.16 – 6.19).

Research indicates that marine mammals can react differently to the introduction of additional noise into the marine environment. Reactions may vary depending on sound source level, propagation conditions and ambient noise, in addition to species, age, sex, habitat, individual variation, and previous habituation to noise (Richardson et al., 1995). It should also be noted that marine mammals react differently to stationary noise, compared to sudden bursts of noise and noises that appear to be coming towards them. Studies suggest that most cetaceans will alter their course or display avoidance reactions to a noise that appears to be moving directly towards them. Stationary noises, such as drilling noises, outwith an immediate zone of discomfort to the animal, seem to have a lesser effect in disturbing migration patterns and animal feeding, although data and observations on this matter are limited (Davis et al., 1990).

The impacts of noise pollution on humpback whales have been studied more so than most other marine species, with impacts being well-established in the literature, although study sites are concentrated around developed nations (Erbe et al. 2019). There is strong evidence showing that humpback whales react to noise from ships (idem). Reactions vary with place and type of vessel, with reactions including avoidance, singing louder, or ceasing to sing (idem). Whale song appears to be an important part of mating rituals and so interruptions to the humpback whales' song could interrupt their breeding success (idem). Reductions in the success of breeding for humpback whales would be highly detrimental as the coast of Gabon is typically home to large numbers of breeding humpback whales between June and October.

The reactions of HF cetaceans (i.e., dolphin species and toothed whales, and in this case the critical habitat triggering species Atlantic humpback dolphin) to non-pulsed sounds were much more varied and did not lead to a clear conclusion about received sound levels coincident with various behavioural responses (Southall et al., 2007). The Atlantic humpback dolphin's preferred habitat is water depths of less than 20 m that are close to the shore (within 13 km of land). This species is therefore highly unlikely to be impacted by underwater noise from activities in the Ruche EEA. Supply vessel transfers to the logistics base through the coastal zone (medium vessels) would be the only source of underwater noise potentially affecting this species from the Project activities.

Impact assessment of behavioural effects from underwater noise on critical habitat-triggering marine mammal species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Drilling activities (rig noise) – direct impact, behavioural effects from underwater noise	Very low (1) Extent: Immediate - behavioural effects limited and only in very close proximity to jack-up rig - up to 7 m Duration: Temporary – only for period of drilling activities Scale: No discernible effect due to disruption of behaviour Frequency: The frequency of the impact will be continuous but low level for the duration of the drilling activities	High (4) Critical habitat trigger (Only applicable to humpback whale, Atlantic humpback dolphin not anticipated this far offshore)	Minor (4)
Facility installation (large construction vessels) – direct impact, physiological effects and behavioural effects from underwater noise	Low (2) Extent: Local / Regional – physiological effects within 220 m, behavioural effects up to 9 km Duration: Temporary –large construction vessels only present during facility installation Scale: Potential disruption of behaviour or species interactions of nationally/internationally important species of conservation concern (coast of Gabon important humpback breeding area) Frequency: The frequency of the impact will be continuous but transient as the construction vessels move along the flowline route	High (4) Critical habitat trigger (Only applicable to humpback whale, Atlantic humpback dolphin not anticipated this far offshore)	Moderate (8)
Operation of FPSO and support / supply vessels – direct impact, physiological effects and behavioural effects from underwater noise	Low (2) Extent: Local - physiological effects within 140 m, behavioural effects up to just over 2 km Duration: Short-term - ongoing operation, mitigated relatively rapidly following cessation of activities Scale: Potential disruption of behaviour or species interactions of nationally/internationally important species of conservation concern (coast of Gabon important humpback breeding area) Frequency: Operational noise throughout the Project lifetime	High (4) Critical habitat trigger (FPSO operations only applicable to humpback whale, Atlantic humpback dolphin not anticipated this far offshore. Support / supply vessel transfers applicable to humpback whale and Atlantic humpback dolphin)	Moderate (8)

Mitigation Measures

Mitigation measures listed in Section 6.4.1.3 (applicable to noise impacts on fish) are also applicable to cetaceans. In addition:

- Project vessels will follow the BWE Vessel Code of Conduct (see Biodiversity Action and Management Plan (Appendix 11A – Appendix A)). This Code of Conduct includes provision for Marine Mammal Observers (MMOs) onboard the construction vessels during facility installation (Hibiscus Alpha OI and flowline to FPSO) in order to record wildlife sightings and any interactions between the installation activities and marine mammals / turtles.

Residual Impacts

With the implementation of the above mitigation measures the residual impacts are as considered to be as follows:

Residual impact assessment of physical injury from underwater noise on critical habitat-triggering marine mammal species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – physiological effects and behavioural effects from underwater noise	Moderate (8)	Minor (4)
Operation of FPSO and support / supply vessels - physiological effects and behavioural effects from underwater noise	Moderate (8)	Minor (4)

6.4.2.3 Impacts of Unplanned / Accidental Events

Potential impacts

Accidental event scenarios that may have the potential for an impact on critical habitat cetacean species include:

- Project vessel collision with marine fauna
- introduction of alien invasive species
- accidental release of hydrocarbons.

Project vessel collision with marine fauna

Collisions of vessels with whales and dolphins are increasingly recognised as an international conservation issue. The most commonly identified casualties are larger whales, and the more serious incidents occur with very large vessels and those going at speeds of 14 knots or more (Sea Watch Foundation, 2009). However, signs of direct injury to bottlenose dolphins from vessel strikes (i.e., propeller wounds) have been recorded by several studies and are often associated with collisions with high-speed leisure craft.

Ship strikes have been recorded as causing injury and fatality to humpback whales, but data on the issue are limited (IUCN, 2021). Laist el al. (2001) reported that direct mortality

of humpback whales from vessel strikes is low. Rosenbaum et al. (2014) studied the long-range movement of humpback whales in the South Atlantic Ocean. Satellite monitoring of tagged whales showed a high degree of range overlap with anthropogenic activities (offshore oil and gas development) in the EEZ of Gabon (see Figure 10.9) with large numbers migrating along the coast and congregating along the continental shelf to breed. Significant number of humpback whales (and calves) could therefore be present in the Ruche EEA and along the transfer routes to the logistics base, particularly between June and October, increasing the risk of collision.

Which animal-related factors affect the risk of collision is not well-understood. One important factor is the amount of time a species spends at or near the surface. Lactating female humpback whales in Exmouth Gulf (Australia) spent 53% of their time within 3 m of the surface (Bejder et al., 2019). Animals at or near the surface are at risk of collision because they are within reach of a vessels' hull and propeller (Schoeman et al, 2020).

It should be noted that the area around Port Gentil headland (on the supply vessel transfer route to the logistics base) is particularly important for mothers and calves, with large numbers congregating in the area and using the sand banks in this area to protect young from predation. Peak number of mothers and calves are usually observed in October (*pers. comm* Tim Collins, 2022).

Vessel collisions have also been known to cause fatalities in humpback dolphin populations (Jefferson and Curry, 2015) and are considered a threat to the conservation status of this species (Collins 2015; IUCN 2021). However, as these species are smaller and more mobile the collision risk is considered lower. It should also be noted that the Atlantic humpback dolphin is typically found only in water depths of up to 20 m very close to the shore.

Introduction of alien invasive species

Alien species can become invasive in a new environment and out-compete native species (FFI, 2017). This can have a knock-on effect, leading to disturbances in the ecological balance, such as reducing the amount of available prey for predatory species. Whilst AIS are not listed as a specific threat to the critical habitat triggering cetacean species identified, the potential impacts of AIS on higher trophic levels of the food chain are well documented.

When *Mnemiopsis* was introduced into the Caspian Sea, reportedly via the ballast water of large commercial vessels, ecosystem effects were faster and stronger than in the Black Sea (see Section 6.4.1.5). In 2001, repercussions were felt at all levels, including that of the top predator the Caspian seal, due to the significant impact on fisheries (IPIECA, 2010).

Accidental release of hydrocarbons

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5.

Hydrocarbons may affect marine mammals through various pathways: direct contact, inhalation of volatile components, and ingestion (directly or indirectly through the consumption of fouled prey species) (Geraci and St. Aubin, 1987; Loughlin et al., 1996).

Cetacean skin is highly impermeable and not seriously irritated by brief exposure to hydrocarbons, therefore direct contact is not likely to produce a significant impact. Whales and dolphins apparently can detect slicks on the sea surface but do not always avoid them; therefore, they may be vulnerable to inhalation of hydrocarbon vapours, particularly those components that are readily evaporated. Ingestion of the lighter hydrocarbon fractions found in diesel fuel can be toxic to marine mammals. Ingested diesel fuel can remain within the gastrointestinal tract and be absorbed into the bloodstream and, thus, irritate and/or destroy epithelial cells in the stomach and intestines. Certain constituents of diesel fuel (i.e., aromatic hydrocarbons, polycyclic aromatic hydrocarbons) include some well-known carcinogens. These substances, however, do not show significant biomagnification in food chains and are readily metabolised by many organisms. Released hydrocarbons may also foul the baleen fibres of mysticete whales (such as humpback whale), thereby impairing food-gathering efficiency or result in the ingestion of hydrocarbons.

The magnitude and significance of these adverse impacts to critical habitat triggering marine mammals would be dependent on the composition and volume of the hydrocarbons released, the wind and weather conditions at the time of the incident, and whether the spill event coincides with key breeding / calving periods.

A large accidental release of hydrocarbons, particularly one that extends into sensitive habitats for these marine mammals (i.e. Mayumba National Park and coastal areas) and during a sensitive time of year for these species (i.e. the calving period of the Atlantic humpback dolphin of March / April and the humpback whale of July / August and for several months after while juveniles mature) may potentially have a significant impact on the population viability and longevity of these species at the regional and global scale.

Impact assessment of unplanned accidental events on critical habitat-triggering marine mammal species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Project vessel collision with marine fauna – direct impact, injury / mortality	Low (2) Extent: Local Duration: Short-term Scale: Potential disruption of behaviour or species interactions of nationally/internationally important species of conservation concern but effects confined to minor disturbance of current generation Frequency: Unplanned / accidental event Likelihood: Unlikely	High (4) Critical habitat trigger (humpback whale considered most sensitive)	Moderate (8)
Introduction of AIS – direct impact on prey species, indirect impact on marine mammals	Medium (3) Extent: Potential for regional impacts Duration: Medium to long term Scale: Activity or event disturbing a sufficient portion of a population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population to former levels within	High (4) Critical habitat trigger	Major (12)

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
	several generations. Restoration may require substantial intervention. Frequency: Unplanned / accidental event Likelihood: Unlikely		
Accidental spill, small scale bunkering spill – direct impacts of hydrocarbon contamination	Low (2) Extent: Local - considered that slick would be limited to within 3 km from site Duration: Short-term – impact likely to be mitigated through natural processes (evaporation, dispersion, dissolution) Scale: Spill or accidental event leading to immediate area or localised damage to water resources Frequency: Unplanned / accidental event Likelihood: Possible	High (4) Critical habitat trigger	Moderate (8)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts of hydrocarbon contamination	High (3/4) Extent: International / transboundary Duration: Long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources Frequency: Unplanned / accidental event Likelihood: Very unlikely	High (4) Critical habitat trigger	Major (12/16)

Mitigation Measures

Mitigation measures with respect to collision with marine mammals are as follows:

- Project vessels will follow the BWE Vessel Code of Conduct (see Biodiversity Action and Management Plan (Appendix 11A – Appendix A)). This Code of Conduct also includes provision for MMOs onboard the Project supply vessels during key periods of the year.
- BWE will work with local agencies and environmental groups to improve their understanding of the populations of Atlantic humpback dolphins and humpback whales in the AOI (see Section 4.6.3 of Biodiversity Action and Management Plan (Appendix 11A).
- Any collision with a marine mammal or turtle must be reported to the Agence Nationale des Parcs Nationaux (ANPN) - National Agency of National Parks.

Mitigation measures for reducing the likelihood of the introduction of invasive species are listed in Section 6.4.1.5.

Mitigation measures with respect to accidental releases of hydrocarbons are listed in Section 6.4.1.5.

Residual Impacts

With the implementation of the above mitigation measures, the likelihood of marine mammal collision is reduced from unlikely, to extremely unlikely. This is considered to reduce the residual impact significance to minor (4).

With the implementation of the above mitigation measures, and the development of a Project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of introduction of AIS is substantially reduced from unlikely, to extremely unlikely. This is considered to reduce the residual impact significance to minor (4).

With the implementation of the above mitigation measures the likelihood of a spill event is also reduced from possible to unlikely for small-scale spills, e.g., bunkering, and from very unlikely to extremely unlikely for a major spill event. This is considered to reduce the residual impact significance to minor (4) and moderate (8), respectively.

Residual impact assessment of unplanned accidental events on critical habitat-triggering marine mammal species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Project vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – reduction in prey species	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts of hydrocarbon contamination	Major (12/16)	Moderate (8)

6.4.3 Critical Habitat Qualifying Turtles

6.4.3.1 Sensitivity Summary

Section 6.3.5 identifies one species of marine turtle (leatherback) that triggers critical habitat along with the seascapes in which it is found and the criteria it triggers.

Gabon has been described as having the largest leatherback population in the world (Witt et al. 2009). The Mayumba marine and coastal EBSA is recognised as one of the most important sites globally for leatherback turtle nesting (UNEP-CBD, 2015a), with at least 500 females laying eggs within the National Park each year. Two major nesting beaches have been identified and turtles can be tracked crossing the Atlantic from South America to nest here (Billes et al. 2006; SWOT 2021). The egg-laying season lasts from October through until April with a peak from December to January (see Figure 6.4). Female turtles will come ashore to deposit eggs about 3 or 4 times in a season and will spend the time between beach visits around 20 km out to shore. Monitoring conducted from the drilling rig in the Ruche EEA between 25 November and 4 December recorded one leatherback turtle during this period (Terrocea, 2019).

The sensitivity of this species is considered to be high (4), as it triggers critical habitat as per IFC PS6.

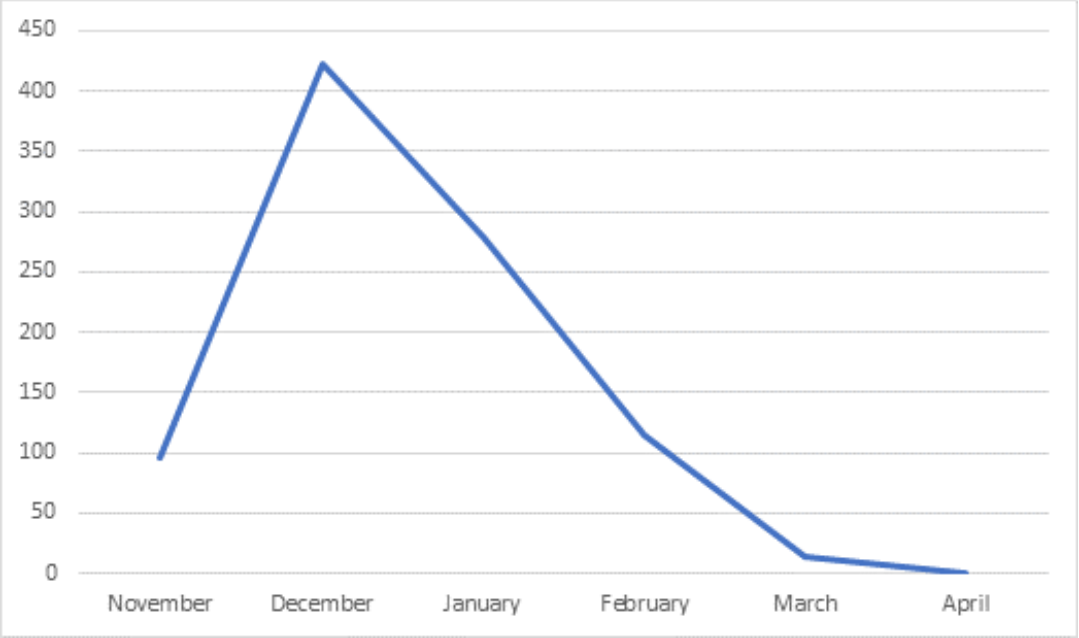

Figure 6.4: Monthly counts of leatherback turtles November 2018 – April 2019 beaches of Mayumba

Source: Terrocea, 2019

6.4.3.2 Impacts from Underwater Noise

Potential Impacts

A description of the underwater noise sources associated with the Ruche EEA field development programme is provided in Section 6.4.1.3.

In order to determine impacts to marine fauna from underwater noise generated by the above sources, acoustic propagation modelling has been carried out in order to determine the potential distances from each noise source at which noise decreases to below thresholds for injury, hearing and behavioural impacts (the full study is provided in Appendix 6A).

Physiological impacts

Sea turtles appear to hear best between 200 and 750 Hz and do not respond well to sounds above 1,000 Hz. As an example, tests to determine the hearing capabilities of adult green turtles concluded that their hearing range was best between 200 - 500 Hz. The opening into a sea turtle's ear is covered by thick skin, known as the cutaneous plate, which is a ring of scales that are similar but smaller than those on the rest of the head. Below this skin is a fatty (subcutaneous) layer. The thick skin and a fatty layer make it difficult for the turtle to hear well in air but provide good tissue conduction for underwater sound to the middle ear and subsequently on to the inner ear.

Due to the general lack of appropriate threshold level data representing physiological damage in sea turtle FHGs, it is not possible to determine suitable distances over which each impact criterion may be met.

Behavioural impacts

With regards to behavioural responses in sea turtles exposed to continuous type noise, an extensive literature search has revealed that no data are available. Finneran and Jenkins (2012) reviewed a number of studies reporting the responses of caged sea turtles when exposed to impulsive-type noises. They report that behavioural responses first become evident at received sound levels of 166 dB re 1 μPa (rms). When sound levels are increased to lie in the range 175-179 dB re 1 μPa (rms), the reactions are more erratic and avoidance behaviour becomes apparent. Given the lack of data on behavioural responses following exposure to continuous-type noise a threshold of 175 dB re 1 μPa (rms) is used to represent the onset of avoidance behaviour in sea turtles for the current study.

Due to the relative audiological insensitivity of sea turtles, behavioural impact criteria are generally met at short distances from each of the noise sources considered, see Table 6.20.

Table 6.20: Distances in metres at which SPL has fallen to recoverable Injury and TTS threshold levels for sea turtles exposed to each noise source

Functional hearing group	Impact	Threshold	Noise source			
			Drilling	FPSO	Vessel Medium	Vessel Large
Sea turtles	Behavioural	175 dB re 1 μPa rms	<1 m	<1 m	<1 m	2 m

Behavioural responses to vessels have been observed but are difficult to attribute exclusively to noise rather than to visual or other cues (Weir, 2007). Loggerhead and Olive Ridley turtles have been shown to avoid areas with sudden noise or high levels of background noise (Peng et al. 2015). Recent studies have shown that marine turtles may wait on the seabed for vessels to pass (Tyson et al. 2017). It is assumed that behavioural changes, if they were to occur, would be limited to evasive manoeuvres such as diving, changes in swimming direction, or changes in swimming speed to distance themselves from vessels.

It should be noted that there is also the potential for nesting turtles to be disturbed by airborne noise from helicopter transfers to the Ruche EEA. However, it is considered highly unlikely that the helicopter route from the facilities in the Ruche EEA to the heliport in Port Gentil will pass over the beaches of Mayumba. This impact is therefore scoped out.

Impact assessment of behavioural effects from underwater noise on critical habitat-triggering turtle species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Drilling activities (rig noise) and facility installation (large construction vessels) – direct impact, behavioural effects from underwater noise	Very low (1) Extent: Immediate, within 2 m of noise source Duration: Temporary – only for period of drilling / installation activities Scale: No discernible effect due to disruption of behaviour Frequency: The frequency of the impact will be continuous but low level for the duration of these activities	High (4) Critical habitat trigger	Minor (4)
Operation of FPSO and support / supply vessels – direct impact, behavioural effects from underwater noise	Very low (1) Extent: Immediate, within 1 m of noise source Duration: Short-term - ongoing operation, mitigated relatively rapidly following cessation of activities Scale: No discernible effect due to disruption of behaviour Frequency: The frequency of the impact will be continuous but low level for the duration of these activities	High (4) Critical habitat trigger	Minor (4)

Mitigation Measures

Mitigation measures listed in Section 6.4.1.3 and 6.4.2.2 (applicable to noise impacts on fish and marine mammals) are also applicable to turtles.

Residual Impacts

The residual impact significance scores provided below are the same as the pre-mitigation impact scores. Although the impact magnitude is anticipated to be very low (particularly taking into consideration the mitigation above) residual impacts are minor due to the high receptor sensitivity.

Residual impact assessment of physical injury from underwater noise on critical habitat-triggering turtle species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling activities (rig noise) and facility installation (large construction vessels) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Minor (4)	Minor (4)

6.4.3.3 Impacts from light spill (from lighting and flaring)

Potential impacts

Light at sea can affect zooplankton, fish, turtles and migrating birds. Of these one of the most important is the effect on turtle hatchlings that have headed to sea away from the coast. It is well-established that artificial lights can interfere with the in-water dispersal of hatchlings (Witherington & Bjorndal, 1991).

The hatchlings of all turtles may respond to light at sea which may impact on their survival. At sea, hatchlings have been reported swimming around lights on boats and in laboratory studies lights have attracted swimming hatchlings (e.g., Salmon & Wyneken, 1990). Passive tracking of hatchlings at sea have also demonstrated that hatchlings are attracted to lights at sea and spend longer in the nearshore environment when lights are present (Thums et al, 2016; Wilson et al., 2018). This attraction can divert hatchlings from their usual dispersal pathway, causing them to linger around a light source, or become trapped in the light spill (Wilson et al, 2018). Hatchlings actively swim against currents to reach light, which is likely to reduce survival either from exhaustion and/or predation. An additional problem is that light sources are associated with structures that also attract fish (such as jetties), as there will be increased predation (Wilson et al, 2019).

Impact assessment of flaring on critical habitat-triggering turtle species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Light spill from facilities (from lighting and flaring) – direct impact, attraction of turtles	Low (2) Extent: Immediate, within project footprint Duration: Ongoing throughout operations Scale: Potential disruption of behaviour or species interactions of nationally/internationally important species of conservation concern but effects confined to minor disturbance of current generation Frequency: The frequency of the impact will be continuous but low level	High (4) Critical habitat trigger	Moderate (8)

Mitigation Measures

Mitigation measures relating to light spill include the following:

- Area and work lighting will be limited to the amount and intensity necessary to maintain worker safety. Directional lighting will be used to minimise light spill onto the sea, and motion-sensitive lighting used where there isn't the requirement for permanent lighting.
- In terms of flaring, gas flow rates will be reduced as far as practicable; any maintenance activities requiring flaring will be scheduled outside of turtle hatchling season; and the flame will be shielded behind a containment structure.
- Seasonal monitoring of potential light attraction effects on turtle hatchlings and other marine life will be conducted and mitigation measures adjusted accordingly.

Residual Impacts

With the implementation of the above mitigation measures the residual impacts are as considered to be as follows:

Residual impact assessment of flaring on critical habitat-triggering turtle species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Light spill from facilities (from lighting and flaring) – attraction of turtles	Moderate (8)	Minor (4)

6.4.3.4 Unplanned / accidental impacts

Potential impacts

Accidental event scenarios that may have the potential for an impact on critical habitat triggering turtle species include:

- Project vessel collision with turtles
- introduction of alien invasive species
- accidental release of hydrocarbons.

Project vessel collision with turtles

All species of sea turtle are vulnerable to vessel strike as they surface to breathe, bask near the surface, or forage in shallow areas or on prey near the sea surface. Adult sea turtles appear to be at increased risk during breeding and nesting season.

Turtles are less mobile than cetaceans and cannot move out of the path of the vessels as easily as cetaceans, however, anecdotal evidence suggests that when ships are travelling at speed, turtles may be carried away from the ship by the bow wave of the vessel, preventing collision.

Hazel et al. (2007) conducted a field experiment to evaluate behavioural responses of green turtles *Chelonia mydas* to a research vessel approaching at slow, moderate or fast speed (4, 11 and 19 km/hour, respectively). Data were recorded for 1,890 encounters

with turtles sighted within 10 m of the research vessel's track. The proportion of turtles that fled to avoid the vessel decreased significantly as vessel speed increased, and turtles that fled from moderate and fast approaches did so at significantly shorter distances from the vessel than turtles that fled from slow approaches. The results implied that vessel operators cannot rely on turtles to actively avoid being struck by the vessel if it exceeds 4 km/hour.

As stated earlier, the coastline in the vicinity of Mayumba has global significance for leatherback turtle nesting. The egg-laying season lasts from October through until April and females come ashore to deposit eggs about 3 or 4 times in a season (approximately 12-14 days apart). They spend the time between beach visits feeding around 20 km out to shore. As the Ruche EEA is located 50 km offshore, interactions between Project vessels and the turtle breeding congregations are anticipated to be limited. The highest number of individuals migrating through the Ruche EEA are anticipated in November and February (at the beginning and end of the peak in egg-laying).

It is expected that an accidental vessel strike would only impact one to a few individuals of turtle and as such would be unlikely to adversely impact the population viability and longevity of these species at the regional and global scales.

Introduction of alien invasive species

As stated earlier, alien species can become invasive in a new environment and out-compete native species (FFI, 2017). This can have a knock-on effect, leading to disturbances in the ecological balance, such as reducing the amount of available prey for predatory species. Whilst AIS are not listed as a specific threat to the critical habitat triggering turtle species identified, the potential impacts of AIS on higher trophic levels of the food chain are well documented.

Accidental release of hydrocarbons

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5.

As with marine mammals, hydrocarbons in the marine environment may affect sea turtles through direct contact, inhalation of volatile components, and ingestion. Several aspects of sea turtle biology and behaviour place them at risk, including lack of avoidance behaviour, indiscriminate feeding in convergence zones and inhalation of large volumes of air before dives (Milton et al., 2003). Studies have shown that direct exposure of sensitive tissues (e.g., eyes, nostrils, other mucous membranes) to diesel fuel or volatile hydrocarbons may produce irritation and inflammation. Hydrocarbons can also adhere to turtle skin or shells. Hatchling and juvenile turtles feed opportunistically at or near the surface in oceanic waters and are especially sensitive to released hydrocarbons.

Turtles are very vulnerable at beach nesting sites during the breeding season. If these sites are oiled it can lead to contamination of adult turtles, eggs and newly hatched juveniles.

Breeding female turtles bury their eggs above the high-water mark. Thus, the nests should be beyond the reach of spilled oil unless a spill coincides with a severe storm. The most critical period in which a spill could occur is when the hatchlings emerge, thereby interfering with their seaward migration. It is probable, although not specifically proven, that the presence of an oil slick will disorientate the hatchlings, which would lengthen their

exposure to predators on the beaches and/or interfere with their swimming abilities. Hatchling survival is not high in any case (Bjorndal, 1982) and increased mortalities, attributable to oil spills, could be reflected in the overall population. Should a spill coincide with the emergence of hatchlings the impact on regional populations could therefore be severe and have a long-term effect.

Large numbers of adult females will be within Gabon's coastal waters between October and April (with peak egg laying in December and January). The eggs incubate for about 60 days therefore hatchlings will be present between December to June, with peak numbers February to May. These are periods of key sensitivity with respect to large-scale hydrocarbon releases.

Impact assessment of accidental events on critical habitat-triggering turtle species

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Project vessel collision with marine fauna – direct impact, injury / mortality impacts	Low (2) Extent: Local Duration: Short-term Scale: Potential disruption of behaviour or species interactions of nationally/internationally important species of conservation concern but effects confined to minor disturbance of current generation Frequency: Unplanned / accidental event Likelihood: Unlikely	High (4) Critical habitat trigger (particularly sensitive during breeding and nesting season)	Moderate (8)
Introduction of AIS – direct impact on prey species, indirect impact on turtles	Low (3) Extent: Potential for regional impacts Duration: Medium to long term Scale: Activity or event disturbing a sufficient portion of a population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population to former levels within several generations. Restoration may require substantial intervention. Frequency: Unplanned / accidental event Likelihood: Unlikely	High (4) Critical habitat trigger	Major (12)
Accidental spill, small scale bunkering spill – direct impacts of hydrocarbon contamination	Medium (2) Extent: Local - considered that slick would be limited to within 3 km from site Duration: Short-term – impact likely to be mitigated through natural processes (evaporation, dispersion, dissolution) Scale: Spill or accidental event leading to immediate area or localised damage to water resources Frequency: Unplanned / accidental event Likelihood: Possible	High (4) Critical habitat trigger	Moderate (8)

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts of hydrocarbon contamination	High (3/4) Extent: International / transboundary Duration: Long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources Frequency: Unplanned / accidental event Likelihood: Very unlikely	High (4) Critical habitat trigger (turtle nesting beaches and hatchlings considered extremely sensitive)	Major (12/16)

Mitigation Measures

Mitigation measures relating to these unplanned / accidental impacts are listed in Section 6.4.2.3.

Residual Impacts

With the implementation of the above mitigation measures, and the development of a Project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of introduction of AIS is substantially reduced from unlikely, to extremely unlikely. This is considered to reduce the residual impact significance to minor (4).

With the implementation of the above mitigation measures the likelihood of a spill event is also reduced from possible to unlikely for small-scale spills, e.g., bunkering, and from very unlikely to extremely unlikely for a major spill event. This is considered to reduce the residual impact significance to minor (4) and moderate (8), respectively.

Residual impact assessment of unplanned accidental events on critical habitat-triggering turtle species

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Project vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – reduction in prey species	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (FPSO collision / well blowout) – impacts of hydrocarbon contamination	Major (12/16)	Moderate (8)

6.4.4 Highly Threatened and/or Unique Ecosystems

6.4.4.1 Sensitivity Summary

The marine biodiversity importance of the waters of southern Gabon is reflected in the designation of three Ecologically or Biologically Significant Marine Areas (EBSAs) which overlap with, or are in close proximity to, the primary AOI and are considered to trigger critical habitat. Their characteristics are summarised as follows (Secretariat of the Convention on Biological Diversity (2020)):

- Mayumba Marine and Coastal EBSA: this site is recognised as one of the most important sites globally for leatherback turtle nesting with nearly 30,000 turtles visiting its beaches each year. Mayumba is also on the migratory pathway for baleen whale species.
- Northwest Continental Shelf EBSA (Republic of Congo): area of high productivity due to the influx of nutrients from the Congo River. Area supports a number of deep-water shrimp - *Parapenaeus longirostris, Aristeus varidens* and *Plessiopenaeus edwardsia* (UNEP-CBD, 2015b).
- Equatorial Tuna Production Area EBSA (spans half the width of the Atlantic Ocean at the equator, largest EBSA on record): supports the partial or complete lifecycle of migratory aquatic species such yellowfin tuna, bigeye tuna, albacore tuna, frigate tuna, sailfish and swordfish, among others (UNEP-CBD, 2015c).

6.4.4.2 Potential Impacts

Impacts on the species that these EBSAs have been designated for could have impacts on the EBSA as a whole.

Mayumba Marine and Coastal EBSA is designated for its nesting leatherback turtles and baleen whales. Impacts of routine / planned activities and unplanned / accidental events on these critical habitat-triggering turtle and cetacean species has already been presented in Sections 6.4.2 – 6.4.3.

Residual impacts from routine / planned activities on these species have been scored as minor, therefore impacts on the EBSA are also anticipated to be minor.

In terms of unplanned / accidental events, the only scenario with moderate residual impacts is a large-scale hydrocarbon spill.

Oil spill modelling of a large-scale release of hydrocarbons indicates that large tracts of the Gabonese coastline could be impacted, including the shoreline within the Mayumba Marine and Coastal EBSA and the coastal and offshore waters. Due to the high sensitivity of the critical habitat triggering species within the Mayumba Marine and Coastal EBSA residual impacts of this kind of accidental event scenario have been scored as moderate, however, it should be noted that the likelihood of such an event is extremely unlikely due to the controls in place. In addition, BWE has an Oil Spill Contingency Plan in place outlining immediate response measures to limit environmental impacts. BWE will work with local agencies and environmental groups to identify marine coastal areas sensitive to spills and develop strategies to protect these areas. In line with this work, more detailed mitigation measures to address impacts of oil on critical habitat triggering species will be

developed (additional information provided in Section 4.5 of the Biodiversity Action and Management Plan (Appendix 11A)).

The Northwest Continental Shelf EBSA is designated for its high productivity and deep-water prawn species. It is in Congolese waters, relatively remote from activities in the Ruche EEA, therefore impacts from routine / planned activities are not anticipated. In addition, the deep-water shrimp species would not be anticipated to be significantly impacted by a surface slick of hydrocarbons resulting from this kind of unplanned / accidental event scenario.

The Equatorial Production Area EBSA is designated for supporting the life cycle of tuna species and other large predatory fish. The impacts of the Ruche EEA field development on critical habitat triggering fish species have been discussed in Section 6.4.1, which can be extrapolated to other species of fish. Residual impacts on fish have been scored as minor (with the exception of produced water discharge which has been scored as moderate), therefore impacts on the EBSA are also anticipated to be largely minor. In terms of unplanned / accidental events two scenarios had moderate residual impacts on fish species, namely introduction of AIS and a large-scale hydrocarbon spill, however as stated earlier, it should be noted that the likelihood of such an event is extremely unlikely. In addition, impacts from the Project are anticipated to be insignificant in comparison to the impacts from the commercial exploitation of tuna and other large predatory species throughout the EBSA.

Scoring of pre and post mitigation impacts has not been undertaken for the ecosystem as impact scoring is covered in detail within the species sections above. The collective impacts described above are not considered to affect the integrity or ecological functioning of the EBSAs and as such only minor residual impacts are likely (with the exception of a large-scale accidental hydrocarbon release the residual impact scoring has been assigned a moderate scoring).

6.4.5 Protected and Designated Areas

6.4.5.1 Sensitivity Summary

The primary AOI is adjacent to one legally protected area that is considered to trigger critical habitat, namely Mayumba National Park (NP). Its marine portions have been designated to protect nesting leatherback turtles and migratory whales.

6.4.5.2 Potential Impacts

Potential impacts on Mayumba National Park from the Ruche EEA field development are anticipated to be similar in extent to those on the Mayumba Marine and Coastal EBSA (see Section 6.4.4).

6.5 Conclusions

Critical habitats are areas of high biodiversity value and are key sensitivities for the Project. This CHA identified 14 critical habitat-qualifying species and three ecosystems, with both seascapes (shallow and deep) qualifying as critical habitat. Several of these features were identified as triggering critical habitat on a precautionary basis due to the paucity of existing data and in alignment with best practice. A summary of these critical habitat-qualifying features is presented in Table 6.7.

The critical habitat impact assessment determined the impacts arising from Project-related activities on these critical habitat-qualifying features. Measures will be implemented by the Project to avoid, minimise or mitigate impacts to the extent practicable. Diligent application of these measures is expected to significantly decrease the potential for residual impacts. The most significant potential Project-related risk to these key sensitivities is a large-scale accidental release of hydrocarbons (e.g., from a well blowout, or collision with the FPSO). However, it is important to acknowledge that the likelihood of this type of accidental event scenario is deemed to be extremely unlikely given the mitigation measures in place.

The assessment also identified that with the diligent application of key avoidance, mitigation measures and spill contingency plans, Project-related direct and indirect impacts will not threaten the longevity and viability of the biodiversity features at the global scale for which the critical habitat was designated. In line with Guidance Note 6 a Biodiversity Action and Management Plan (BAMP) has been developed, due to the Project being located within critical habitat. The BAMP:

- sets out management measures to mitigate adverse impacts during drilling, facility installation and operation
- outline actions required to minimise risks to biodiversity
- describes biodiversity offsets – measures to achieve no net loss or a net gain of biodiversity
- describes the ecological monitoring and reporting commitments
- define roles and responsibilities.

Table 6.21: Summary of impact assessment results

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Impacts on critical habitat triggering fish species		
Installation of facilities and physical presence		
Installation of facilities – disturbance of demersal spawning sites	Minor (4)	Minor (4)
Physical presence of the facilities – reduction in fishing pressure due to safety exclusion zones	Positive (0)	Positive (0)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Light spill from facilities (from lighting and flaring) – attraction of fish / predators	Minor (4)	Minor (4)
Underwater noise		
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – behavioural effects from underwater noise	Minor / Moderate (4 / 8)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Minor / Moderate (4 / 8)	Minor (4)
Discharges to marine environment		
Cuttings and associated fluids discharge – turbidity impacts on adult fish, smothering of benthic eggs	Moderate (8)	Minor (4)
Produced water discharge – impacts from elevated temperature, salinity and chemicals	Moderate (8)	Minor (4)
Hydrotest water discharge – impacts from hydrotest chemicals	Moderate (8)	Minor (4)
Other operational discharges (drilling rig, vessels, Hibiscus Alpha OI and FPSO) – impacts from turbidity, increased BOD and chemicals	Minor (4)	Minor (4)
Accidental event scenarios		
Introduction of AIS – competition, alteration of habitats	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination on adult fish and eggs/larvae	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) - impacts of hydrocarbon contamination on adult fish and eggs/larvae	Major (12 / 16)	Moderate (8)
Impacts on critical habitat triggering marine mammal species		
Underwater noise		
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Facility installation (large construction vessels) – physiological effects and behavioural effects from underwater noise	Moderate (8)	Minor (4)
Operation of FPSO and support / supply vessels - physiological effects and behavioural effects from underwater noise	Moderate (8)	Minor (4)
Accidental event scenarios		
Project vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – reduction in prey species	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts of hydrocarbon contamination	Major (12 / 16)	Moderate (8)
Impacts on critical habitat triggering turtle species		
Underwater noise		
Drilling activities (rig noise) and facility installation (large construction vessels) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Minor (4)	Minor (4)
Light spill from facilities (from lighting and flaring) – attraction of turtles	Moderate (8)	Minor (4)
Accidental event scenarios		
Project vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – reduction in prey species	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental spill, large scale release of hydrocarbons (FPSO collision / well blowout) – impacts of hydrocarbon contamination	Major (12 / 16)	Moderate (8)
Impacts on highly threatened and / or unique ecosystems and protected areas		
Collective impacts from routine / planned activities	Minor	
Accidental spill – large scale release of hydrocarbons	Moderate	

REFERENCES

Angehr, G., Schmidt, B., Njie, F. and Gebhard, C. (2005) Significant records and annotated site lists from bird surveys in the Gamba Complex, Gabon. Malimbus, 27, pp.53-76.

ANPN (2015) Guidelines for minimising the risk of disturbance and injury to marine mammals and sea turtles during offshore seismic exploration within and in proximity to Gabon's National Parks, 2015 – Edition 1 -En.

Bakke, T., Klungsøyr, J. and Sanni, S. (2013) Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry. Marine environmental research, 92, pp.154-169.

Baldé, B.S., Döring, J., Ekau, W., Diouf, M. and Brehmer, P. (2019) Bonga shad (Ethmalosa fimbriata) spawning tactics in an upwelling environment. Fisheries Oceanography, 28(6), pp.686-697.

Balk, L., Hylland, K., Hansson, T., Berntssen, M.H., Beyer, J., Jonsson, G., Melbye, A., Grung, M., Torstensen, B.E., Børseth, J.F. and Skarphedinsdottir, H. (2011) Biomarkers in natural fish populations indicate adverse biological effects of offshore oil production. PLoS One, 6(5), p.e19735.

Barker, V.A., Cowan, J.H. (2018) The effect of artificial light on the community structure of reef-associated fishes at oil and gas platforms in the northern Gulf of Mexico. Environ Biol Fish 101, 153–166 (2018). https://doi.org/10.1007/s10641-017-0688-9

Bejder, L., Videsen, S., Hermannsen, L., Simon, M., Hanf, D. and Madsen, P.T. (2019) Low energy expenditure and resting behaviour of humpback whale mother-calf pairs highlights conservation importance of sheltered breeding areas. Scientific Reports, 9(1), pp.1-11.

Bianchi, G., (1992) Study of the demersal assemblages of the continental shelf and upper slope off Congo and Gabon, based on the trawl surveys of the RV'Dr Fridtjof Nansen'.

Billes, A., Fretey, J., Verhage, B., Huijbregts, B., Giffoni, B., Prosdocimi, L., Albareda, D.A., Georges, J.Y. and Tiwari, M. (2006) First evidence of leatherback movement from Africa to South America. Marine Turtle Newsletter, 111, pp.13-14.

Bjorndal, K.A. (1982), 'Biology and Conservation of Sea Turtles'. Smithsonian Institution Press, Washington.

Blanchard, A., Hauge, K.H., Andersen, G., Fosså, J.H., Grøsvik, B.E., Handegard, N.O., Kaiser, M., Meier, S., Olsen, E. and Vikebø, F. (2013) Harmful routines? Uncertainty in science and conflicting views on routine petroleum operations in Norway. Marine Policy, 43, pp. 313-320.

Blom, E.L., Kvarnemo, C., Dekhla, I., Schöld, S., Andersson, M.H., Svensson, O. and Amorim, M.C.P. (2019) Continuous but not intermittent noise has a negative impact on mating success in a marine fish with paternal care. Scientific reports, 9(1), pp.1-9.

Brei, M., Pérez-Barahona, A., and Strobl, E. (2016) Environmental pollution and biodiversity: Light pollution and sea turtles in the Caribbean. Journal of Environmental Economics and Management, 77, pp.95-116.

Bruintjes, R., Purser, J., Everley, K.A., Mangan, S., Simpson, S.D. and Radford, A.N. (2016) Rapid recovery following short-term acoustic disturbance in two fish species. Royal Society Open Science, 3(1), p.150686.

Byrnes, T.A., and Dunn, R.J. (2020) Boating-and Shipping-Related Environmental Impacts and Example Management Measures: A Review. Journal of Marine Science and Engineering, 8(11), p.908.

Chapuis, L., Collin, S.P., Yopak, K.E., McCauley, R.D., Kempster, R.M., Ryan, L.A., Schmidt, C., Kerr, C.C., Gennari, E., Egeberg, C.A. and Hart, N.S. (2019) The effect of underwater sounds on shark behaviour. Scientific reports, 9(1), pp.1-11.

Charles-Dominique, E. and Albaret, J.J. (2003) African shads, with emphasis on the West African shad Ethmalosa fimbriata. In American Fisheries Society Symposium (pp. 27-48). American Fisheries Society.

Clark, R.B., Frid, C. and Attrill, M. (2001) Marine pollution (Vol. 5). Oxford: Oxford university press.

Codarin, A., Wysocki, L.E., Ladich, F., and Picciulin, M. (2009) Effects of ambient and boat noise on hearing and communication in three fish species living in a marine protected area (Miramare, Italy). Marine pollution bulletin, 58(12), pp.1880-1887.

Cofrepeche (2010) Gabon: Revue socio-economique et environnementale du secteur de la peche industriel au Gabon. Rapport provisoire. COFREPECHE, Paris. 159 p

Collins, T., (2015) Re-assessment of the Conservation Status of the Atlantic Humpback Dolphin, Sousa teuszii (), Using the IUCN Red List Criteria. Advances in marine biology, 72, pp.47-77.Commonwealth of Australia (2020). National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds. Department of the Environment and Energy, Commonwealth of Australia. 107 pp.

Corbett, P.A., King, C.K., Stark, J.S. and Mondon, J.A. (2014) Direct evidence of histopathological impacts of wastewater discharge on resident Antarctic fish (Trematomus bernacchii) at Davis Station, East Antarctica. Marine pollution bulletin, 87(1-2), pp.48-56.

Cordes, E.E., Jones, D.O., Schlacher, T.A., Amon, D.J., Bernardino, A.F., Brooke, S., Carney, R., DeLeo, D.M., Dunlop, K.M., Escobar-Briones, E.G., and Gates, A.R. (2016) Environmental impacts of the deep-water oil and gas industry: a review to guide management strategies. Frontiers in Environmental Science, 4, p.58.

Crawford, R.J.M., Shelton, P.A., Cooper, J. and Brooke, R.K. (1983) Distribution, population size and conservation of the Cape gannet Morus capensis. South African Journal of Marine Science, 1(1), pp.153-174.

Davis, R.A., Richardson, W.J., Theile, L., Dietz, R. and Johansen, P. (1990) State of the Arctic Environment Report on Underwater Noise. Finnish initiative on protection of the Arctic environment.

Defra (2010) Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones) - MB5301. London: Defra.

Di Franco, E., Pierson, P., Di Iorio, L., Calò, A., Cottalorda, J.M., Derijard, B., Di Franco, A., Galvé, A., Guibbolini, M., Lebrun, J. and Micheli, F. (2020) Effects of marine noise pollution on Mediterranean fishes and invertebrates: A review. Marine Pollution Bulletin, 159, p.111450.

Dow Piniak W. E., Eckert, S. A., Harms, C. A., and Stringer, E. M. (2012) Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of

anthropogenic noise. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35pp.

Dudley, N. (2008) Guidelines for Applying Protected Area Management Categories. Gland, Switzerland.

Durand, J.D., Guinand, B., Dodson, J.J. and Lecomte, F. (2013) Pelagic life and depth: coastal physical features in West Africa shape the genetic structure of the Bonga Shad, Ethmalosa fimbriata. PloS one, 8(10), p.e77483.

ECOFAC (2021) ECOFAC6 - Preserving Biodiversity and Fragile Ecosystems in Central Africa. [Online]. Available from: https://ec.europa.eu/international-partnerships/programmes/ecofac6_en [Accessed 15 April 2021].

EDGE of Existence programme (2021) Evolutionarily Distinct and Globally Endangered Database [Online]. Available from: https://www.edgeofexistence.org/search/ [Accessed 22 April 2021].

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N., and Brown, M.J. (2012) Spawning and nursery grounds of selected fish species in UK waters. Science Series Technical Report, No 147. Cefas, Lowestoft.

ELMO (South African Elasmobranch Monitoring) (2016) Guitarfishes, Wedgefishes & Sharkrays (Rhinobatiformes) [Online]. Available from: https://www.elmoafrica.org/post/2016-1-22-guitarfishes-wedgefishes-sharkrays-rhinobatiformes [Accessed 7 July 2021].

Entsua-Mensah, M., Laleye, P. & Moelants, T. (2010) Ethmalosa fimbriata. The IUCN Red List of Threatened Species 2010: e.T182611A7926310. Available at: https://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T182611A7926310.en

Erbe, C., Marley, S.A., Schoeman, R.P., Smith, J.N., Trigg, L.E., and Embling, C.B. (2019) The effects of ship noise on marine mammals—a review. Frontiers in Marine Science, 6, p.606.

Erbe, C. McCauley, R. McPherson, C.Gavrilov, A. (2013) Underwater Noise from Offshore Oil Production Vessels. Acoustic Society of America. Available at: https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/erbe_2013_underwater_noise_from_offshore.pdf

Erbe, C., Peel, D., Redfern, J., and Smith, J.N. eds. (2020) Impacts of shipping on marine fauna. Frontiers Media SA.

Falk-Petersen, I.B. and Kjørsvik, E. (1987) Acute toxicity tests of the effects of oils and dispersants on marine fish embryos and larvae-a review. Sarsia, 72(3-4), pp.411-413.

FAO (Food and Agriculture Organization) (2021) Species Fact Sheet – Ethmalosa fimbriata. Available at: http://www.fao.org/fishery/species/2095/en

Fauna & Flora International (FFI) (2017) Biodiversity and Ecosystem Services: Good Practice Guidance for Oil and Gas Operations in Marine Environments. FFI: Cambridge, U.K.

Fay, R.R. and Popper, A.N., (2000) Evolution of hearing in vertebrates: the inner ears and processing. Hearing research, 149(1-2), pp.1-10.

FIRMS (Fisheries and Resource Monitoring System) (2021) Marine Resource Fact Sheet – Bonga Shad, Southern Area of Eastern Central Atlantic. Available at: http://firms.fao.org/firms/resource/13422/en

Francis, M. and Lyon, W.S. (2013) Review of anthropogenic impacts other than fishing on cartilaginous fishes. Ministry for Primary Industries.

Friedlander, A. M., Ballesteros, E., Fay, M., and Sala, E. (2014) Marine communities on oil platforms in Gabon, West Africa: high biodiversity oases in a low biodiversity environment. PLoS One, 9(8), p.e103709.

Gagnon, M.M. (2011) Evidence of exposure of fish to produced water at three offshore facilities, north west shelf, Australia. In Produced Water (pp. 295-309). Springer, New York, NY.

Geraci, J.R., and St. Aubin, D.J. (1987) 'Effects of offshore oil and gas development on marine mammals and turtles, in Long-Term Environmental Effects of Offshore Oil and Gas Development'. Elsevier Applied Science.

Global Biodiversity Information Facility (GBIF) (2021) Global Biodiversity Information Facility: Free and open access to biodiversity data [Online]. Available from: https://www.gbif.org/ [Accessed 20 April 2021].

Hawkins, A.D., and Popper, A.N. (2017) A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. ICES Journal of Marine Science, 74(3), pp.635-651.

Grøsvik, B.E., Meier, S., Liewenborg, B., Nesje, G., Westrheim, K., Fonn, M., Kjesbu, O.S., Skarphéðinsdóttir, H. and Klungsøyr, J. (2010) PAH and biomarker measurements in fish from condition monitoring in Norwegian waters in 2005 and 2008. ICES.

Hamoutene, D., Volkoff, H., Parrish, C., Samuelson, S., Mabrouk, G., Mansour, A., Mathieu, A., King, T. and Lee, K., (2011) Effect of produced water on innate immunity, feeding and antioxidant metabolism in Atlantic cod (*Gadus morhua*). In Produced Water (pp. 311-328). Springer, New York, NY.

Hastings, M.C. (2008) Coming to terms with the effects of ocean noise on marine animals. Acoustics today, 4(2), pp.22-34.

Hazel, J., Lawler, I.R., Marsh, H. and Robson, S. (2007) Vessel speed increases collision risk for the green turtle Chelonia mydas. Endangered Species Research, 3(2), pp.105-113.

Hjermann, D.Ø., Melsom, A., Dingsør, G.E., Durant, J.M., Eikeset, A.M., Røed, L.P., Ottersen, G., Storvik, G. and Stenseth, N.C. (2007) Fish and oil in the Lofoten–Barents Sea system: synoptic review of the effect of oil spills on fish populations. Marine Ecology Progress Series, 339, pp.283-299.

International Union for the Conservation of Nature (IUCN) (2021) The IUCN Red List of Threatened Species [online]. Available from: https://www.iucnredlist.org/ [Accessed 22 April 2021].

IPIECA (International Petroleum Industry Environmental Conservation Association) (2010) Alien Invasive Species and the Oil and Gas Industry – Guidance for Prevention and Management. OGP Report Number 436.

IPIECA (International Petroleum Industry Environmental Conservation Association) (1997) 'Biological impacts of oil pollution: Fisheries'. IPIECA Report Series, London, 8.

Ismen, A., Yıgın, C. and Ismen, P. (2007) Age, growth, reproductive biology and feed of the common guitarfish (Rhinobatos rhinobatos Linnaeus, 1758) in Iskenderun Bay, the eastern Mediterranean Sea. Fisheries research, 84(2), pp.263-269.

Jefferson, T.A., and Curry, B.E. (2015) Humpback dolphins: a brief introduction to the genus Sousa. Advances in marine biology, 72, pp.1-16.

Ketten, D.R. (2008) Underwater ears and the physiology of impacts: Comparative liability for hearing loss in sea turtles, birds, and mammals. Bioacoustics, 17(1-3), pp.312-315.

Klages, N.T.W. (1994) Dispersal and site fidelity of Cape gannets Morus capensis. Ostrich 65: 218–224.

Kouerey Oliwina C.K., Honarvar S., Girard A., Casale P. (Eds.) (2020) Sea Turtles in the West Africa/East Atlantic Region. MTSG Annual Regional Report 2020. Report of the IUCN-SSC Marine Turtle Specialist Group, 2020.

Kuhnhold, W.W. (1977) The effect of mineral oils on the development of eggs and larvae of marine species. A review and comparison of experimental data in regard to possible damage at sea. Rapports et Proces-Verbaux des Reunions, Conseil Internation pour L'Exploration de la Mer, 171.

Kyne, P.M., Jabado, R.W., Rigby, C.L., Gore, M.A., Pollock, C.M., Herman, K.B., Cheok, J., Ebert, D.A., Simpfendorfer, C.A. and Dulvy, N.K. (2020) The thin edge of the wedge: extremely high extinction risk in wedgefishes and giant guitarfishes. Aquatic Conservation: marine and freshwater ecosystems, 30(7), pp.1337-1361.

Laist, D. W, Knowlton, A.R, Mead, J.G, Collet, A.S and Podesta, M (2001) Collisions between ships and whales .Marine Mammal Science 17:35–75.

Longwell, A.C. (1977), Genetic effects. In: The Argo Merchant oil spill and the fishery resources of Nantucket Shoals and Georges Bank: A summary of assessment activities and preliminary results. National Marine Fisheries Service, Northeast Fisheries Centre, 77-10, pp.43-47.

Loughlin, T.R., Ballachey, B.E. and Wright, B.A. (1996) Overview of studies to determine injury caused by the Exxon Valdez oil spill to marine mammals. In Exxon Valdez oil spill symposium, American Fisheries Society Symposium 18 (pp. 798-808).

Lu, Z. and Xu, Z., (2002). Effects of saccular otolith removal on hearing sensitivity of the sleeper goby (Dormitator latifrons). Journal of Comparative Physiology A, 188(8), pp.595-602.

Mann, D.A., Higgs, D.M., Tavolga, W.N., Souza, M.J. and Popper, A.N., (2001) Ultrasound detection by clupeiform fishes. The Journal of the Acoustical Society of America, 109(6), pp.3048-3054.

Marchesana, M., Spotob, M., Verginellab, L., and Ferrero, E. A. (2005) Behavioural effects of artificial light on fish species of commercial interest. Fisheries Research, 73: 171–185.

Maxwell, S.M., Broderick, A.C., Dutton, P.H., Fossette-Halot, S., Fuentes, M.M., and Reina, R.D. (2019) Advances in the biology and conservation of marine turtles. Frontiers in Marine Science, 6, p.9.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. and McCabe, K. (2000) Marine seismic surveys—a study of environmental implications. The APPEA Journal, 40(1), pp.692-708.

Miller, P.J. (1990) Gobiidae. In: J.C. Quero, J.C. Hureau, C. Karrer, A. Post and L. Saldanha (eds), Checklist of the fishes of the eastern tropical Atlantic (CLOFETA), pp. 925-951. JNICT, Lisbon, SEI, Paris; and UNESCO, Paris, Paris.

Miller, M.J., Robinet, T. (2018) Life history and morphology of Eel Larvae in the Gulf of Guinea of western Africa: revisiting Jacques Blache's research (1960–1977) 40 years later. Rev Fish Biol Fisheries 28, 355–379 (2018). https://doi.org/10.1007/s11160-017-9512-z

Milton, S., Lutz, P. and Shigenaka, G., (2003) Oil toxicity and impacts on sea turtles. Oil and Sea Turtles: Biology, Planning, and Response. NOAA National Ocean Service, pp.35-47.

Moore, A.B., (2017) Are guitarfishes the next sawfishes? Extinction risk and an urgent call for conservation action. Endangered Species Research, 34, pp.75-88.

Neff, J.M. (2005) January. Composition, environmental fates, and biological effect of water-based drilling muds and cuttings discharged to the marine environment: A synthesis and annotated bibliography. In Report prepared for the Petroleum Environmental Research Forum (PERF). Washington DC: American Petroleum Institute.

Neo, Y.Y., Seitz, J., Kastelein, R.A., Winter, H.V., Ten Cate, C. and Slabbekoorn, H. (2014) Temporal structure of sound affects behavioural recovery from noise impact in European seabass. Biological Conservation, 178, pp.65-73.

Newell, B., (2017) Status Review Report of Two Species of Guitarfish: Rhinobatos rhinobatos and Rhinobatos cemiculus.

NOAA (2021) Blackchin Guitarfish [Online]. Available from: https://www.fisheries.noaa.gov/species/blackchin-guitarfish [Accessed 22 June 2021].

NOAA (2018) Revisions to: Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing (Version 2.0): underwater thresholds for onset of permanent and temporary threshold shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, pp. 167.

NOAA (2016) Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing, underwater acoustic thresholds for onset of permanent and temporary threshold shifts. A report prepared by the National Oceanic and Atmospheric Administration and National Marine Fisheries Service. NOAA Technical Memorandum NMFS-OPR-55.

Oatley, T.B., Underhill, L.G. and Ross, G.J.B. (1992) Recovery rate of juvenile Cape gannets: a potential indicator of marine conditions. Colonial Waterbirds 15: 140–143.

O'Connor, J.J., Fobert, E.K., Besson, M., Jacob, H. and Lecchini, D., (2019) Live fast, die young: Behavioural and physiological impacts of light pollution on a marine fish during larval recruitment. Marine pollution bulletin, 146, pp.908-914.

O'Keeffe, N., Clough, S. and Lepper, P. (2009) Preliminary investigations into the response of O+ twaite shad (alosa fallax) to ultrasound and its potential as an entrainment deterrent.

Olivar, M.P., (1989) Spawning and development of Lesueurigobius sanzoi off northern Namibia. African Zoology, 24(2), pp.132-138.

OSPAR commission (2009) Assessment of the environmental impact of underwater noise. OSPAR Secretariat: London.

Pelster, B. (2014) Swimbladder function and the spawning migration of the European eel Anguilla anguilla. Frontiers in Physiology, 5, p.486.

Peng, C., Zhao, X., and Liu, G. (2015) Noise in the sea and its impacts on marine organisms. International journal of environmental research and public health, 12(10), pp.12304-12323.

Pine, M.K., Jeffs, A.G., Wang, D. and Radford, C.A. (2016) The potential for vessel noise to mask biologically important sounds within ecologically significant embayments. Ocean & Coastal Management, 127, pp.63-73.

Plachta, D.T. and Popper, A.N. (2003) Evasive responses of American shad (Alosa sapidissima) to ultrasonic stimuli. Acoustics Research Letters Online, 4(2), pp.25-30.

Polidoro, B., Ralph, G.M., Strongin, K., Harvey, M., Carpenter, K.E., Ayo, T.A., Arnold, R., Bannerman, P., Nguema, B.B., Buchanan, J.R. and Mohamed, K., (2016) Red List of marine bony fishes of the Eastern Central Atlantic.

Popper, A.N., and Fay, R.R. (1999) The auditory periphery in fishes. In Comparative hearing: fish and amphibians (pp. 43-100). Springer, New York, NY.

Popper, A.N., Fewtrell, J., Smith, M.E. and McCauley, R.D., (2003) Anthropogenic sound: effects on the behavior and physiology of fishes. Marine Technology Society Journal, 37(4), pp.35-40.

Popper, A.N. and Hastings, M.C., (2009) The effects of anthropogenic sources of sound on fishes. Journal of fish biology, 75(3), pp.455-489.

Popper, A.N. and Hawkins, A.D. (2019) An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes. Journal of fish biology, 94(5), pp.692-713.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B., and Løkkeborg, S. (2014) Sound exposure guidelines. In ASA S3/SC1. 4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI (pp. 33-51). Springer, Cham.

Pulgar, J., Zeballos, D., Vargas, J., Aldana, M., Manriquez, P.H., Manriquez, K., Quijón, P.A., Widdicombe, S., Anguita, C., Quintanilla, D. and Duarte, C., (2019) Endogenous cycles, activity patterns and energy expenditure of an intertidal fish is modified by artificial light pollution at night (ALAN). Environmental Pollution, 244, pp.361-366.

Purser, J., Bruintjes, R., Simpson, S.D. and Radford, A.N., (2016) Condition-dependent physiological and behavioural responses to anthropogenic noise. Physiology & behavior, 155, pp.157-161.

Razafindrakoto, Y., Cerchio, S., Collins, T., Rosenbaum, H. And Ngouessono, S., (Year unspecified) Similarity of song patterns among humpback whales from Madagascar and Gabon indicates significant contact between South Atlantic and Southwest Indian Ocean populations.

Research Council of Norway (2012) Long-term effects of discharges to sea from petroleum-related activities. The results of ten year's research. Oceans and coastal areas (Havkyst) programme. Oslo, 2012.

Richardson, J, Greene, C. R., Malme, C. I. and Thomson, D.H. (1995) Marine Mammals and Noise. San Diego California: Academic Press, 1995.

Rosenbaum, H. C., and T. Collins. (2006) The ecology, population characteristics and conservation efforts for humpback whales (Megaptera novaeangliae) on their wintering grounds in the coastal waters of Gabon. Pages 425-433 in A. Alonso and P. Campbell, editors. Natural History of the Gamba Complex. Smithsonian Press, Washington,D.C.

Rosenbaum, H.C., Maxwell, S.M., Kershaw, F. and Mate, B. (2014) Long-range movement of humpback whales and their overlap with anthropogenic activity in the South Atlantic Ocean. Conservation Biology, 28(2), pp.604-615.

Rossi-Santos, M.R. (2015). Oil industry and noise pollution in the humpback whale (Megaptera novaeangliae) soundscape ecology of the southwestern Atlantic breeding ground. Journal of Coastal Research, 31(1), pp.184-195.Salmon M & Wyneken J (1990) Do swimming loggerhead turtles (Caretta caretta L.) use light cues for offshore orientation? Marine Behavioural Physiology 17:233-246.

Samuel, Y., Morreale, S.J., Clark, C.W., Greene, C.H., and Richmond, M.E. (2005) Underwater, low-frequency noise in a coastal sea turtle habitat. The Journal of the Acoustical Society of America, 117(3), pp.1465-1472.

Sanzone, D.M., Vinhaeiro, N. and Neff, J., (2016) Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations. IOGP report, 543.

Schlacher, T.A., Mondon, J.A. and Connolly, R.M., (2007) Estuarine fish health assessment: evidence of wastewater impacts based on nitrogen isotopes and histopathology. Marine Pollution Bulletin, 54(11), pp.1762-1776.

Schoeman, R.P., Patterson-Abrolat, C., and Plön, S. (2020) A global review of vessel collisions with marine animals. Frontiers in Marine Science, 7, p.292.

Scholik, A.R. and Yan, H.Y., (2001) Effects of underwater noise on auditory sensitivity of a cyprinid fish. Hearing research, 152(1-2), pp.17-24.

Schwing, P.T., Montagna, P.A., Joye, S.B., Paris, C.B., Cordes, E.E., McClain, C.R., Kilborn, J.P., and Murawski, S.A. (2020) A synthesis of deep benthic faunal impacts and resilience following the Deepwater Horizon oil spill. Frontiers in Marine Science, 7, p.911.

Sea Watch Foundation (2009) Cetacean Ship Strikes [Online]. Available from: https://www.seawatchfoundation.org.uk/cetacean-ship-strikes/ [Accessed 8 July 2021].

Secretariat of the Convention on Biological Diversity (2020) Ecologically or Biologically Significant Marine Areas (EBSAs). Special places in the world's oceans. Volume 6: South-Eastern Atlantic Ocean. Montreal: 108 pages.

Serigstad, B. and Adoff, G.R. (1985) Effects of oil exposure on oxygen consumption of cod eggs and larvae. Marine Environmental Research, 17(2-4), pp.266-268.

Smith, M.E., Coffin, A.B., Miller, D.L. and Popper, A.N. (2006) Anatomical and functional recovery of the goldfish (Carassius auratus) ear following noise exposure. Journal of Experimental Biology, 209(21), pp.4193-4202.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack (2007) Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33:411-521.

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019) Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2).

State of The World's Sea Turtles (SWOT) (2021) Ocean Biogeographical Information System - Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) [Online]. Available from: https://seamap.env.duke.edu/swot [Accessed 23 April 2021].

Stehmann, M. and Séret, B. (1983) A new species of deep-water skate, Breviraja africana sp. (Pisces, Batoidea, Rajidae), from the Eastern Central Atlantic slope, and remarks on the taxonomic status of Breviraja Bigelow & Schroeder, 1948. Bulletin du Muséum national d'histoire naturelle. Section A, Zoologie, biologie et écologie animales, 5(3), pp.903-925.

Strindberg, S., Ersts, P.J., Collins, T., Sounguet, G.P. and Rosenbaum, H.C. (2020) Line transect estimates of humpback whale abundance and distribution on their wintering grounds in the coastal waters of Gabon. J. Cetacean Res. Manage., pp.153-160.

Terrocea (2019). ENVIRONMENTAL OBSERVATION AND INVENTORY OF MARINE SPECIES ON THE TURTLE FIELD IN THE AEE RUCHE PRELIMINARY REPORT 2 Mission on the RIG-Norve_Borr Drilling /BW Energy Gabon SA (From November 25 to December 04, 2019)

Thandar, A. and Mjobo, S. (2014) On some sea cucumbers from Ghana (Echinodermata: Holothuroidea) with descriptions of a new genus and one new species. Zootaxa, 3900(2), pp.243-254.Thums M, Whiting SD, Reisser JW, Pendoley KL, Pattiaratchi CB, Proietti M, Hetzel Y, Fisher R & Meekan M (2016) Artificial light on water attracts turtle hatchlings during their near shore transit. Royal Society Open Science 3:e160142.

Tilseth, S., Solberg, T.S. and Westrheim, K. (1984) Sublethal effects of the water-soluble fraction of Ekofisk crude oil on the early larval stages of cod (Gadus morhua L.). Marine Environmental Research, 11(1), pp.1-16.

Todd, V.L., Williamson, L.D., Jiang, J., Cox, S.E., Todd, I.B. and Ruffert, M. (2020) Proximate underwater soundscape of a North Sea offshore petroleum exploration jack-up drilling rig in the Dogger Bank. The Journal of the Acoustical Society of America, 148(6), pp.3971-3979.

Turnpenny, A.W. and Nedwell, J.R. (1994) Consultancy report. The effects on marine fish, diving mammals and birds of underwater sound generated by seismic surveys. Fawley Aquatic Research Laboratories Ltd.

Turschwell, M.P., Brown, C.J., Pearson, R.M. and Connolly, R.M. (2020) China's Belt and Road Initiative: Conservation opportunities for threatened marine species and habitats. Marine Policy, 112, p.103791.

Tyson, R.B., Piniak, W.E., Domit, C., Mann, D., Hall, M., Nowacek, D.P., and Fuentes, M.M. (2017) Novel bio-logging tool for studying fine-scale behaviors of marine turtles in response to sound. Frontiers in Marine Science, 4, p.219.

UNEP-CBD (2015a) EBSA Zone marine et côtière de Mayumba. Available at: https://chm.cbd.int/database/record?documentID=204064

UNEP-CBD (2015b) EBSA Plateau continental nord-ouest. Available at: https://chm.cbd.int/database/record?documentID=204065

UNEP-CBD (2015c) Zone de production équatoriale de thons. Available at: https://chm.cbd.int/database/record?documentID=204067

Vasconcelos, T., Sarmento, B., and Costa, P. (2007) Solid dispersions as strategy to improve oral bioavailability of poor water-soluble drugs. Drug discovery today, 12(23-24), pp.1068-1075.

Waereebeek, K.V., Baker, A., Félix, F., Gedamke, J., Iñiguez, M., Sanino, G.P., Secchi, E.R., Sutaria, D., Helden, A.V., and Wang, Y. (2007) Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere, an initial assessment.

WCS (Wildlife Conservation Society) (2020a) Initiatives: Fisheries Reform. (online) available at: https://gabon.wcs.org/en-us/Initiatives/Natural-Resource-Use/Fisheries-Reform.aspx. Accessed 13 March 2020.

WCS (Wildlife Conservation Society) (2020b) Wild Places: Gabon's Coast and Ocean. (online) available at: https://gabon.wcs.org/en-us/Wild-Places/Gabons-Coast-Ocean.aspx. Accessed 13 March 2020.

WCS (Wildlife Conservation Society) Gabon (2021) Marine Mammals. [Online] available from: https://gabon.wcs.org/en-us/Wildlife/Marine-Mammals.aspx [Accessed 21 April 2021].

Weilgart, L. S. (2018) The impact of ocean noise pollution on fish and invertebrates. Report for OceanCare, Switzerland.

Weilgart, L.S. (2008) The impact of ocean noise pollution on marine biodiversity. International Ocean Noise Coalition.

Weir, C.R. and Collins, T., (2015) A review of the geographical distribution and habitat of the Atlantic humpback dolphin (Sousa teuszii). Advances in marine biology, 72, pp.79-117.

Wilber, D.H. and Clarke, D.G. (2001) Biological effects of suspended sediments: a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American journal of fisheries management, 21(4), pp.855-875.

Williams, R., Wright, A.J., Ashe, E., Blight, L.K., Bruintjes, R., Canessa, R., Clark, C.W., Cullis-Suzuki, S., Dakin, D.T., Erbe, C., and Hammond, P.S. (2015) Impacts of anthropogenic noise on marine life: Publication patterns, new discoveries, and future directions in research and management. Ocean & Coastal Management, 115, pp.17-24.

Wilson, M., Acolas, M.L., Bégout, M.L., Madsen, P.T. and Wahlberg, M. (2008) Allis shad (Alosa alosa) exhibit an intensity-graded behavioral response when exposed to ultrasound. The Journal of the Acoustical Society of America, 124(4), pp. EL243-EL247.

Wilson P, Thums M, Pattiaratchi CB, Meekan M, Pendoley K, Fisher R & Whiting S (2018) Artificial light disrupts the nearshore dispersal of neonate flatback turtles Natator depressus. Marine Ecology Progress Series 600:179-192.

Wilson P, Thums M, Pattiaratchi CB, Whiting S, Pendoley K, Ferreira L & Meekan M (2019) High predation of marine turtle hatchlings near a coastal jetty. Biological Conservation 236(2019):571-579.

Witherington BE & Bjorndal KA (1991) Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles Caretta caretta. Biological Conservation 55(2):139-149.

Witt, M.J., Baert, B., Broderick, A.C., Formia, A., Fretey, J., Gibudi, A., Mounguengui, G.A.M., Moussounda, C., Ngouessono, S., Parnell, R.J. and Roumet, D. (2009) Aerial surveying of the world's largest leatherback turtle rookery: a more effective methodology for large-scale monitoring. Biological Conservation, 142(8), pp.1719-1727.

World Bank Group (2015) EHS Guidelines for Offshore Oil and Gas Development

Xodus (2015) Brims Underwater Noise Assessment. Assignment No: L100183-S00. Available at: http://marine.gov.scot/datafiles/lot/Brims_Tidal/Supporting_Documents/Brims%20Underwater%20Noise%20Assessment%20Report.%20Xodus%20(2015).pdf

APPENDIX 6A - UNDERWATER NOISE IMPACT STUDY

Refer to standalone Appendix 6A.

APPENDIX 6B - THERMAL EFFLUENT DISPERSION STUDY

Refer to standalone Appendix 6B.

APPENDIX 6C - EXTRACTED FIGURES FROM BWE OIL SPILL CONTINGENCY PLAN

The following figures are for a theoretical well blowout situation and are extracted from BWE's Oil Spill Contingency Plan. For full details please refer to BWE's OSCP (Document 4417-BWE-D-TA-00007).

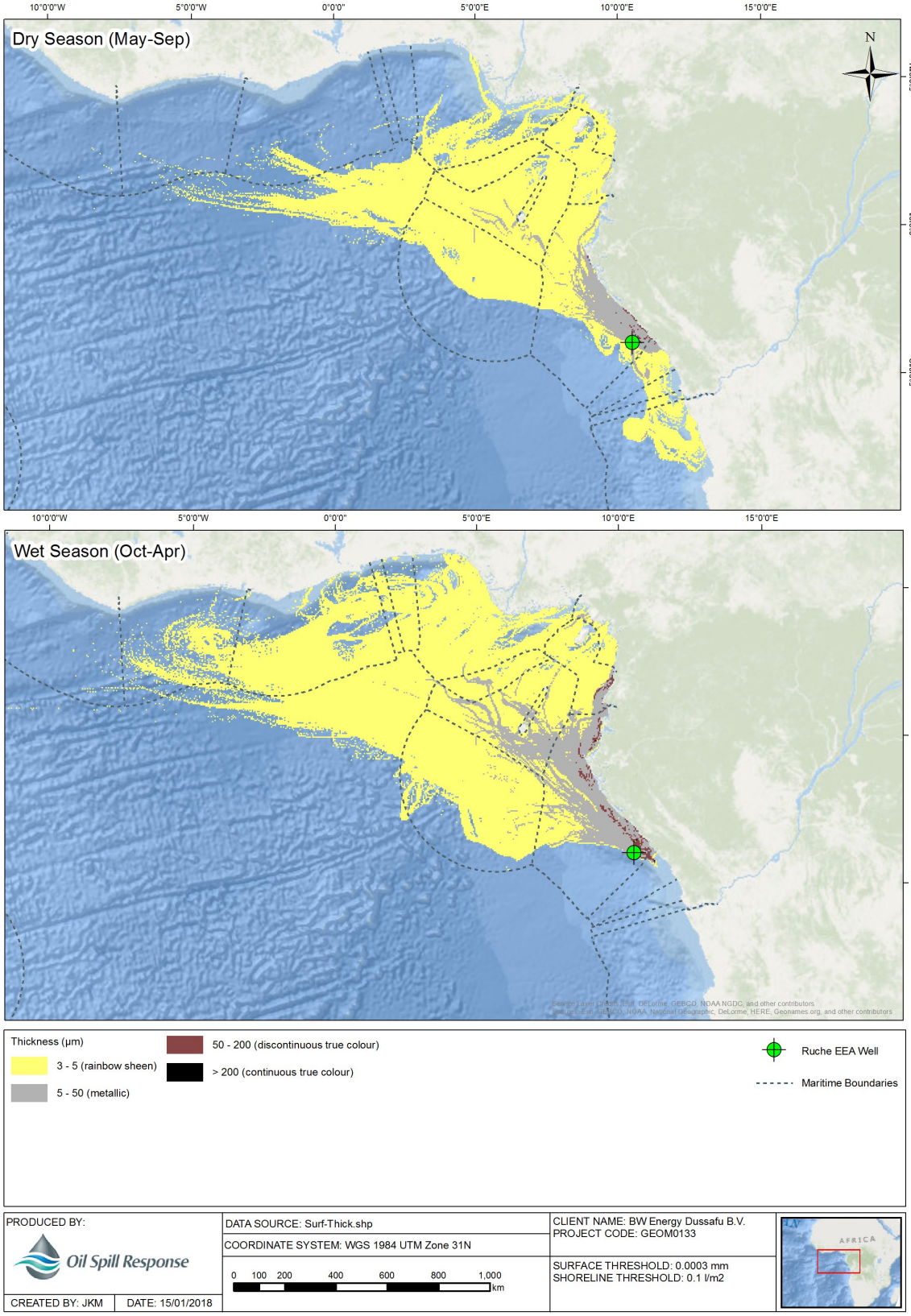

Figure 1: Maximum emulsion thickness of oil from a spill at Ruche EEA Well

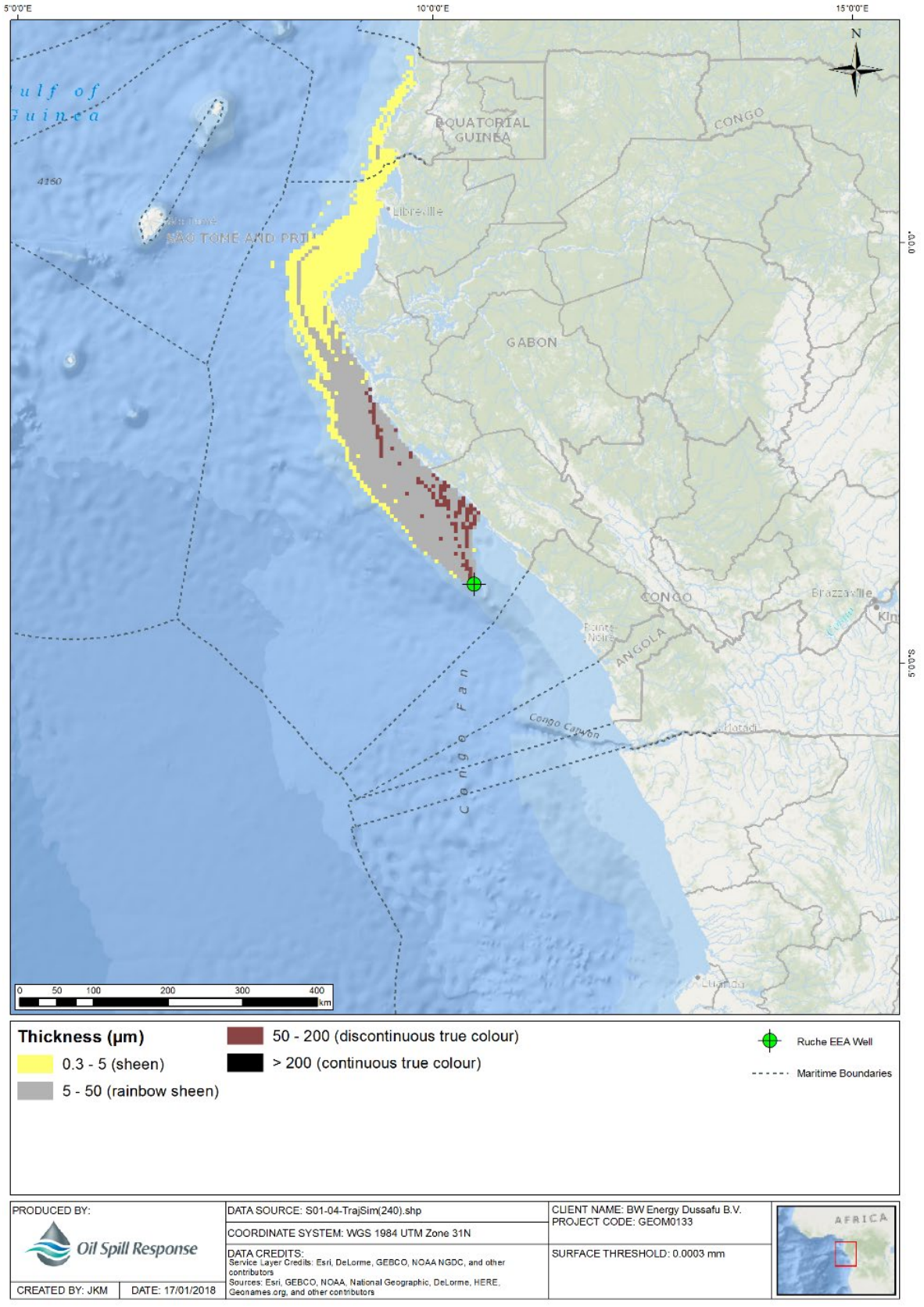

Figure 2: Overall area impacted following a blowout during the dry season – most oil ashore

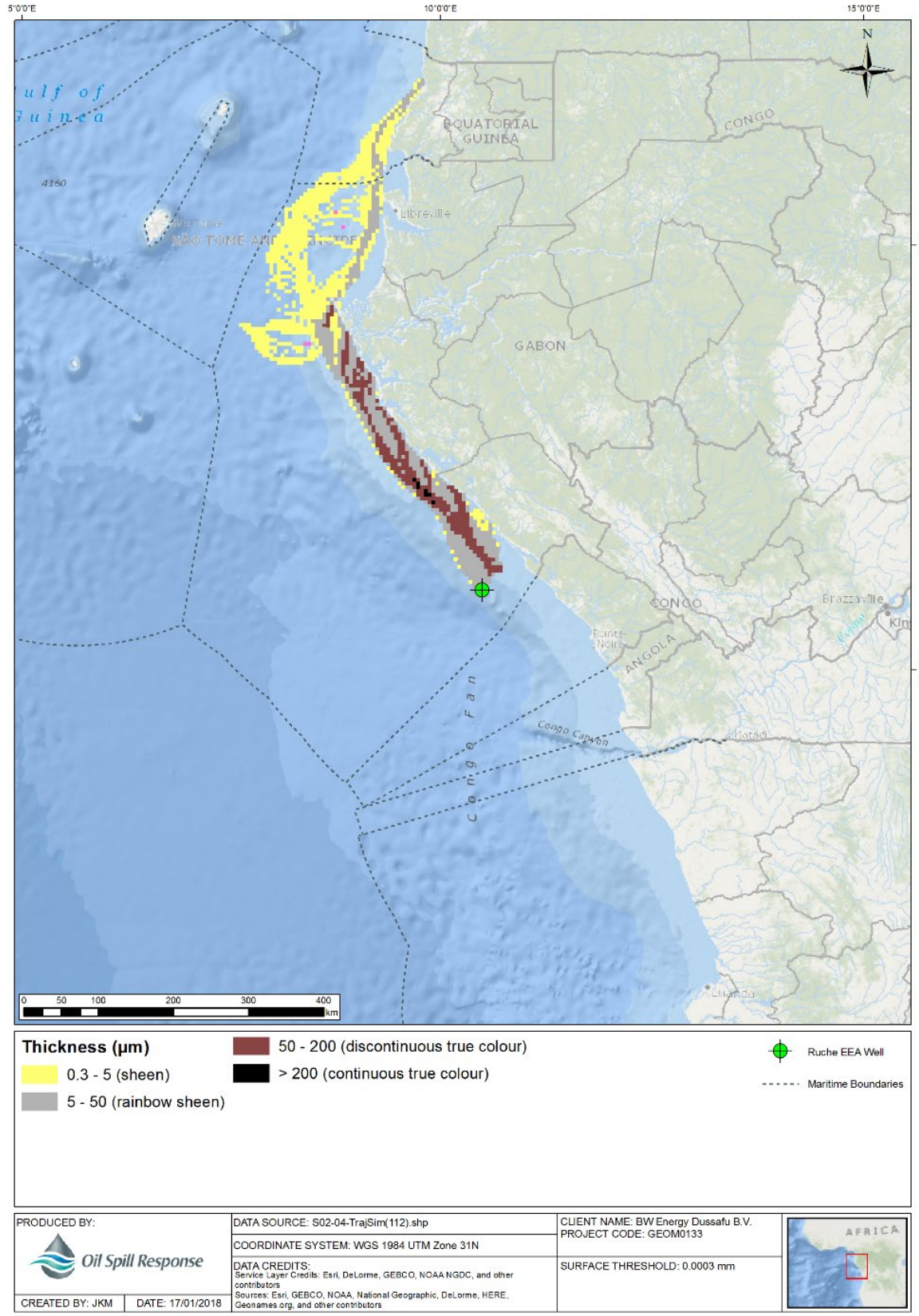

Figure 3: Overall area impacted following a blowout during the wet season – most oil ashore

Underwater Noise Impact Study for Ruche EEA Field Development, Offshore Gabon

P D Ward
Award Environmental Consultants Ltd

Rep: 202115-001-V1

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ADMINISTRATION PAGE

Customer Information	
Customer reference number	
Project title	Underwater Noise Impact Study for Ruche EEA Field Development, Offshore Gabon
Customer Organisation	RSK Environment Ltd Spring Lodge, 172 Chester Road, Helsby, Cheshire, WA6 0AR, United Kingdom
Customer contact	Rebecca Heath, Associate Director
Contract number	AECL/202115
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Principal authors	
P D Ward	Award Environmental Consultants Ltd Southampton SO16 6AA
	Tel: 023 8077 7021
	Email: pdward46@hotmail.com

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Contents

Figures

Tables

ACRONYMS

ADD	Acoustic Deterrent Device
ANSI	American National Standards Institute
BRSS	Behavioural Response Severity Scale
dB	Decibel
DP	Dynamic Positioning
EIS	Environmental Impact Statement
FHG	Functional Hearing Group
FPSO	Floating Production Storage and Offloading
HF	High-frequency (cetacean)
Hz	Hertz
kHz	Kilo-Hertz
LF	Low-frequency (cetacean)
M	Metre
M	M-weighting
μPa	Micro-Pascal
N	Newton
NMFS	National Marine Fisheries Service
Pa	Pascal
PL	Propagation Loss
PTS	Permanent Threshold Shift
RL	Received Level
RMS	root-mean-square
S	South
SE	Sound Exposure
SEL	Sound Exposure Level
SL	Source Level
SPL	Sound Pressure Level
SSP	Sound Speed Profile
T	time
t	time
TL	Transmission Loss
TTS	Temporary Threshold Shift
US	United States
USFWS	US Fish and Wildlife Service
VHF	Very high-frequency (cetacean)
W	West
WOA	World Ocean Atlas

EXECUTIVE SUMMARY

This document has been prepared by Peter Ward of Award Environmental Consultants Ltd for RSK Environment Ltd in connection with the Ruche Exclusive Exploitation Area (EEA) Field Development Project. The project involves drilling activities, facility installation activities (large construction vessel activities), operation of a Floating Production Storage and Offloading (FPSO) vessel, and support / supply vessel movements (medium sized vessel activities).

Underwater noise generated by these activities has the potential to impact ecological receptors in the marine environment. A study has therefore been conducted in order to determine the potential distances from each noise source at which its noise decreases to below thresholds for potential injury, hearing and behavioural impacts.

The published literature was reviewed in order to obtain representative acoustic source levels and frequency spectra representing the noise generated by each activity. These are summarised in Table E.1.

Noise activity	Acoustic Source level dB re 1 μPa at 1 m	Representative frequency range Hz
Drilling	143	2500-8000
FPSO	181	20-2500
Vessel (Medium sized)	180	60-200
Vessel (Large sized)	191	60-200

Table E.1: Acoustic source levels for key activities

The Project Area contains diverse species of marine fauna. Of the cetaceans, humpback whales; members of the sperm whale family; various species of beaked whale; and dolphin are found. Of the fish, members of the shark, skate and ray families are present. Several species of sea turtle are known to inhabit the region.

The international published literature was reviewed in order to access relevant guidance on acoustic impact criteria relating to marine fauna when exposed to continuous-type noise such as that generated by the activities identified above.

Southall *et al*.[1] assigned marine mammals to specific functional hearing groups (FHG) based on differences and similarities in the animal's audiological physiology and behavioural psychophysics. For each FHG, M-weighting functions relating to the auditory sensitivity of marine mammals were derived where these have the effect of emphasising noise frequencies to which each species are more sensitive and de-emphasising those frequencies to which they are less sensitive. Subsequently, threshold levels of sound representing physiological damage, namely Permanent Threshold Shift (PTS); Temporary Threshold Shift (TTS), were given in terms of sound exposure (energy) level (SEL) metrics[2]. Behavioural impacts were defined using the Level B Harassment criterion as given by the National Marine Fisheries Service (NMFS)[3]

[1] Southall, B.L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, P. L. Tyack, "Marine mammal noise exposure criteria: initial scientific recommendations". Aquatic Mammals 2007, 33, 411–521.
[2] Southall B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek and P. L. Tyack, "Marine Mammal Noise Exposure Criteria:Updated Scientific Recommendations for Residual Hearing Effects", Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125
[3] Scoping Report for NMFS EIS for the National Acoustic Guidelines on Marine Mammals. National Marine Fisheries Service. 2005.

and these are assessed in sound pressure level (SPL) units using root-mean-square (RMS) metrics.

For fish, criteria representing Mortality and Potential Mortal Injury; Recoverable Injury; and TTS were based on thresholds developed by Popper *et al*.[4]. The audiological sensitivities for different species of fish were accounted for by having a range of sound level thresholds at which potential impact may occur. However, due to a lack of rigorous data, most of these were expressed qualitatively instead of quantitatively. Behavioural impacts, given using SPL RMS metrics were based on work reviewed by United States Fish and Wildlife Service (USFWS)[5] while those for sea turtles were based on data derived from a review conducted by Finneran and Jenkins[6]. A summary of thresholds for each FHG are given in Tables E.1 and E.2.

Functional hearing group	Physiological damage		Behavioural response		
	M-weighted SEL dB re 1 µPa²s		Unweighted SPL dB re 1 µPa RMS		
	PTS	TTS	Level B	Level B+20	Level B+40
Low-frequency cetaceans	199	179	120	140	160
High-frequency cetaceans	198	178			
Very high-frequency cetaceans	173	153			

Table E.1: Summary of acoustic impact thresholds for PTS, TTS and behavioural responses for marine mammals

Functional hearing group	Behavioural response
	Unweighted SPL dB re 1 µPa RMS
Sea turtles	175
All fish hearing groups	150

Table E.2: Summary of acoustic impact thresholds for behavioural responses for fish and sea turtles

Underwater acoustic propagation modelling was undertaken using the Rogers propagation model[7]. This is a semi-empirical model that provides a high-level view of the propagation of underwater noise in shallow water channels but avoids drawing on the significantly more complex propagation models that might otherwise be used[8]. The subsequent propagation modelling results were applied to the acoustic source data for each noise source in order to yield propagated sound pressure levels at depth and range.

Acoustic impact modelling was carried out by comparing the results of the acoustic propagation modelling with the threshold levels for each impact. The key conclusions are given below.

[4] Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W. T., Gentry, R., Halvorsen, M. B., Løkkeborg, S., Rogers, P., Southall, B. L., Zeddies, D., and Tavolga, W. N. (2014). "Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report," ASA S3/SC1.4 TR-2014 prepared by ANSI Accredited Standards Committee S3/SC1 and registered with ANSI. Springer and ASA Press, Cham, Switzerland.

[5] The 150 dB_{rms} threshold is given for Low Level Behavioral Disturbance. It is widely credited to USFWS but no original reference for this may be found and must therefore be considered non-rigorous.

[6] Finneran J. J., Jenkins A. K., "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis", SSC Pacific Technical Report, April 2012.

[7] Rogers, P. H., "Onboard Prediction of Propagation Loss in Shallow Water." NRL Report 8500, 1981.

[8] Etter Paul C., *Underwater Acoustic Modeling and Simulation*, 4th Edition, CRC Press, 2013, ISBN -10: 9781466564930

Marine mammals

Drilling noise – The PTS impact criterion is not met for any FHG even for continual exposures up to 24 hours. The TTS impact criterion is met for VHF cetaceans at a maximum distance of 13 m - this being the most sensitive of all FHGs considered. The Level B Harassment criterion (which is independent of exposure duration) is met at a maximum distance of 7 m for all FHG.

FPSO noise – The impact modelling indicates that LF cetaceans are the most sensitive FHG to FPSO noise. For an exposure period of 24 hours, the PTS and TTS impact criteria extend to maximum distances of 100 m and 1840 m respectively. By contrast, all other FHG appear much less sensitive to FPSO noise. Over the same exposure duration, for VHF cetaceans, the PTS impact criterion extends to no more than 3 m while the TTS impact criterion reaches a maximum distance of 80 m. The Level B Harassment criterion covers a maximum distance of 2200 m from the noise source.

Vessel noise – When exposed to medium-sized vessels for a period of 24 hours, the PTS and TTS impact criteria for LF cetaceans are met at maximum distances of 40 m and 480 m respectively. When exposed to large-sized vessels, the PTS impact criterion covers a maximum distance of 140 m while the TTS impact criterion extends to 2760 m. For HF and VHF cetaceans, the PTS impact criterion is not met at all, while the TTS impact criterion is met at a maximum distance of 5 m. The Level B Harassment criterion varies between 1500 m and 8740 m according to vessel size.

Fish and Sea turtles

Quantitative threshold level data representing physiological damage in most of the fish and sea turtle FHGs is not currently available hence it is not possible to determine distances over which the impact criteria extend. The exceptions to the above are for fish in Groups 3 and 4 which are those where the swimbladder is either close to or connected to the inner ear. For these groups, the Recoverable Injury criterion is applicable over a maximum distance of no more than 4 m from the noise source while the TTS impact criterion extends to a maximum distance of 40 m.

For sea turtles, the Behavioural Impact criterion reaches a maximum distance of 2 m while for the fish groupings, the criterion extends to a maximum distance of 100 m.

1 INTRODUCTION

The Ruche EEA off the south-west coast of Gabon is in the process of undergoing development. The project involves the installation of infrastructure (Hibiscus Alpha Offshore Installation (OI), 20 km subsea flowline) using large construction vessels. Offshore drilling will take place from a jack-up rig nested within the Hibiscus Alpha OI while the Floating Production Storage and Offloading (FPSO) *BW Adolo*[1] will be moored on-site for the purpose of crude oil processing and subsequent transfer. The project site is located on the continental shelf and in water depths around 125 m. The location of the project site is indicated in Figure 1.1.

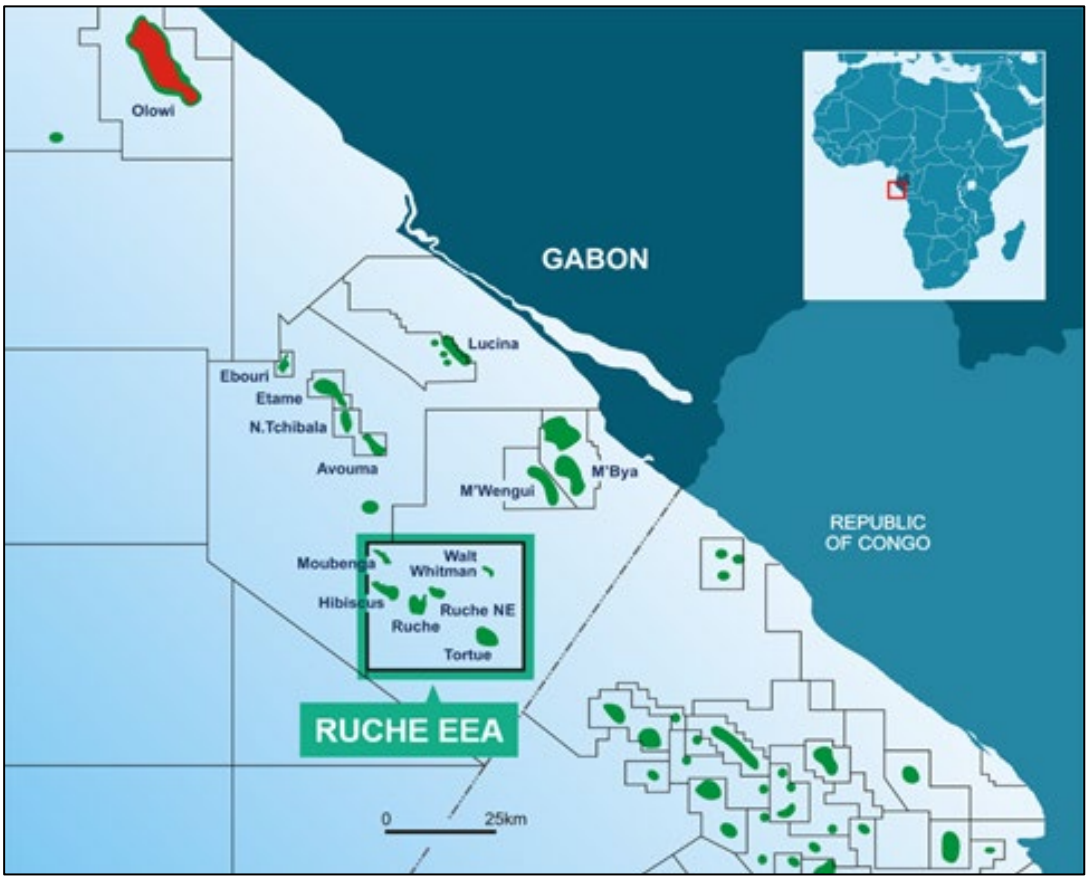

Figure 1.1: Dussafu Block, Ruche EEA and fields[2]

The underwater noise thus generated has the potential to impact on species of marine fauna found in and around the project area.

This report has been prepared by Peter Ward of Award Environmental Consultants Ltd on behalf of RSK Environment Ltd in order to establish distances at which underwater sound levels associated with the project activities meet relevant underwater sound thresholds developed for the protection of marine fauna.

[1] Owned by BW Offshore Ltd, (https://www.bwoffshore.com/)
[2] Dussafu Marin License Offshore Gabon. CEPP Nº G4-209. Ruche EEA Ruche Platform Field Development Plan, December 2019.

This study comprises the following:

- An introduction to terms and units relevant to this work;
- A discussion on the acoustic parameters relating to the noise sources involved in the project activity;
- A summary of relevant acoustic impact thresholds derived from the international published literature on studies of animal audiology, injury and behaviour, taking into account known marine fauna within the offshore Gabon sea area;
- A description of the noise propagation modelling undertaken;
- Application of the acoustic impact models to determine the maximum distances over which each threshold is met; and
- A discussion of the results obtained.

2 DESCRIPTION OF UNDERWATER NOISE AND ASSESSMENT UNITS

2.1 Introduction

Studies by Thomsen *et al*.[3] and Southall *et al*.[4], amongst others, provide detailed reviews of the metrics used to measure and assess the impact of underwater noise in the marine environment. A detailed discussion has not therefore been provided here, although a brief overview is provided to assist the reader. It is noted that a number of these definitions and parameters draw on the advice given in American National Standards Institute (ANSI) S12.7-1986[5].

Sound may be defined as the periodic disturbance in pressure from some equilibrium value. The unit of pressure is given in Pascals (Pa) or Newton per square metre (N/m^2). The measurements however cover a very wide range of pressure values, typically from 1×10^{-3} Pa for the hearing threshold value of a human diver at 1 kHz to 1×10^{7} Pa for the sound of a lightning strike on the sea surface. For convenience therefore, sound levels are expressed in decibels (dB) relative to a fixed reference pressure commonly 1 μPa for measurements made underwater.

2.2 Peak Sound Level

For transient pressure pulses such as an explosion or a single discharge from a seismic source array, the peak sound level is the maximum absolute value of the instantaneous sound pressure recorded over a given time interval. Hence:

$$\text{Peak Level (zero-to-peak)} = 20 \times \log_{10} (|P_{peak}| / P_{ref}) \qquad \text{eqn. 2.1}$$

When the pulse has approximately equal positive and negative parts to the waveform (see for instance Figure 2.1), the peak-to-peak level is often quoted and this is equal to twice the peak level or 6 dB higher.

2.3 RMS Sound Pressure Level

The Root-Mean-Square (RMS or rms) Sound Pressure Level (SPL) is used to quantify noise of a continuous nature. Underwater sound sources of this type include shipping, sonar transmissions, drilling or cutting operations, or background sea noise. The RMS SPL is the mean square pressure level measured over a given time interval (t) (illustrated in Figure 2.1), and hence represents a measure of the average sound pressure level over that time. It is expressed as:

$$\text{RMS Sound Pressure Level} = 20 \times \log_{10} (P_{RMS}/P_{ref}) \qquad \text{eqn. 2.2}$$

When RMS SPLs are used to quantify the transient noise arising from a seismic airgun array discharge, the time period over which the measurements are averaged must be

[3] Thomsen F., Luedemann K., Kafemann R. and Piper W., (2006). "Effects of wind farm noise on marine mammals and fish". Biola, Hamburg, Germany on behalf of COWRIE Ltd. (Coll. Offshore Wind Res. Environ.) Ltd.
[4] Southall, B.L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, P. L. Tyack, "Marine mammal noise exposure criteria: initial scientific recommendations". Aquatic Mammals 2007, 33, 411–521.
[5] ANSI S12.7-1986, "Methods for measurement of impulse noise", Issued by the American National Standards Institute, 20 February 1986.

quoted as the RMS value will vary with the averaging time period: generally, the longer the averaging period, the greater the RMS SPL. When the noise is continuous, as in the examples given above, the time period over which measurements are taken is not relevant as the measurement will give the same result regardless of the period over which the measurements are averaged.

Peak SPLs may be converted to equivalent RMS SPL following consideration of the nature of the signal. For a sinusoidal signal, the relationship between peak level signal and the RMS equivalent is given by peak level – 3dB. For signals having non-equal positive and negative parts of the waveform such as those from impact piledriving or from seismic airguns, this conversion is not valid. Furthermore, during propagation the outgoing source signal stretches out in time (see *e.g.*, Urick[6]) and this is attributed to the sound propagating along multiple paths where each path arrives at a given location at a slightly different time. As a result, the difference between peak level and RMS varies with distance. Various studies[7,8,9] suggest a range of values between 2 dB and 20 dB. The lower the conversion factor, the greater the overestimation of RMS SPL for any given non-sinusoidal signal. For the purpose of the subsequent analysis discussed herein and based on the review of vessel noise and drilling noise undertaken by Jiménez-Arranz *et al.*[10], it is recommended that a value of 9 dB be used to convert all peak level metrics to RMS metrics.

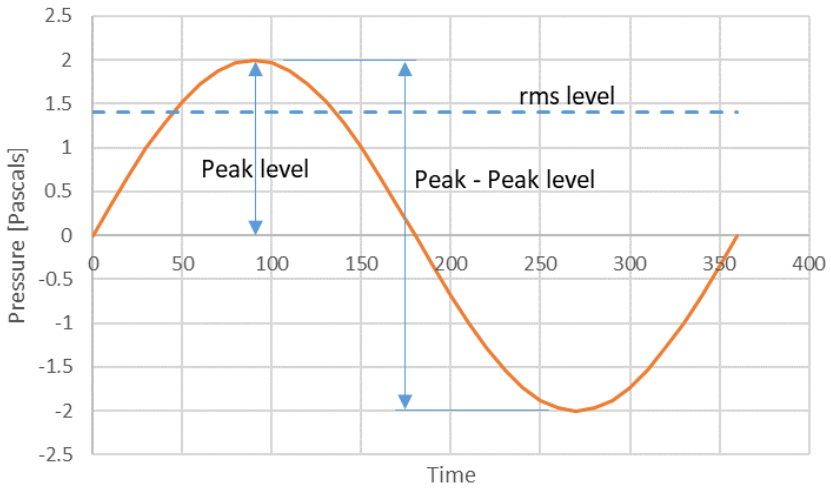

Figure 2.1: Comparison of three metrics used to characterise the loudness of a sinusoidal sound wave

2.4 Sound Exposure Level

The problems associated with the time period over which the Sound Pressure Levels are averaged, as highlighted above, can be overcome by describing a transient pressure

[6] Urick, Robert J. (1983), Principles of Underwater Sound, 3rd Edition. New York. McGraw-Hill.
[7] Madsen P.T., (2005), "Marine mammals and noise: Problems with root mean square sound pressure levels for transients", J. Acoust. Soc. Am. 117(6), 3952.
[8] Greene Jnr C.R.,"Physical acoustics measurements". In: W.J. Richardson (ed.) Northstar Marine Mammal Monitoring Program 1996: Marine Mammal and Acoustical Monitoring of a Seismic Program in the Alaskan Beaufort Sea. LGL Rep 2121-2, LGL Ltd, Canada and Greeneridge Sciences Inc. USA for BP (Alaska) Inc. and Nat. Mar. Fish Serv. Alaska. 245 pp.
[9] McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. and McCabe, K. (2000). Marine seismic surveys – a study of environmental implications. APPEA Journal 2000:692-708.
[10] Jiménez-Arranz G., N. Banda, S. Cook, R. Wyatt, Review on Existing Data on Underwater Sounds Produced by the Oil and Gas Industry: A report prepared by Seiche Ltd for the Joint Industry Programme (JIP) on E&P Sound and Marine Life, June 2020.

wave in terms of its Sound Exposure Level (SEL). The SEL is the time integral of the square pressure over a time window long enough to include the entire pressure-time history. (Note however that Greene[11] described a practical definition of pulse duration based on the interval between the 5% and 95% bounds of the sound exposure as defined below.) The SEL is therefore the sum of the acoustic energy over a defined measurement period, and effectively takes account of both the level of the sound, and the duration over which the sound is present in the acoustic environment. Sound Exposure (SE) is defined by the equation:

$$SE = \int_0^T p^2(t)dt \qquad \text{eqn. 2.3}$$

where p is the acoustic pressure in Pascals, T is the overall duration of the sound in seconds and t is time. The SE is a measure of the acoustic energy and therefore has units of Pascal squared seconds (Pa^2.s).

To express the Sound Exposure as a logarithmic decibel, it is compared with a reference acoustic energy level of 1 μPa^2.s. The SEL is then defined by:

$$SEL = 10 \log_{10} \int_0^T \frac{p^2(t)dt}{p_{ref}^2} \qquad \text{eqn. 2.4}$$

When the time period is less than 1 second, the SPL is greater than the SEL. For signals of more than 1 second duration, the SEL will be greater than the SPL where:

$$SEL = SPL + 10 \times \log_{10}(T) \qquad \text{eqn. 2.5}$$

2.5 Cumulative Sound Exposure Level

Where multiple noise events occur, the total or cumulative SEL can be calculated by summing the SEL from the individual events. The events themselves may be separated in time or space or both. For instance, the events could be either consecutive in time from seismic airgun array emissions at a given location or else concurrent from two seismic source vessels taking place in close physical proximity at the same time.

For multiple events, the cumulative SEL is computed by summing the SEL (in linear units) of N individual events thus:

$$SEL_{cum} = 10 \log_{10} \sum_{i=1}^{N} 10^{\frac{SEL}{10}} \qquad \text{eqn. 2.6}$$

2.6 Source Level

The source level (SL) is the apparent strength of a noise source at a reference distance, usually 1 m, from the source. For example, a source may be quoted as having a source SPL of 180 dB re 1µPa at 1 m. In practice, the parameters of the source are rarely measured at such a close range and the source level is inferred by back-propagating the noise from a number of far-field measurements. Back-propagation in this way is most effective when the noise source is compact i.e., where the dimensions of the noise

[11] Greene, C. R., Jr. (1997). Physical acoustics measurements. In W. J. Richardson (Ed.), Northstar marine mammal monitoring program, 1996 (LGL Report 2121-2, Section 3). LGL Ltd. report for BP Exploration (Alaska) Inc., Anchorage, AK, and National Marine Fisheries Service, Silver Spring, MD. 245 pp.

source are small compared with the wavelength of the emitted noise. For this scenario, the noise source is described as a point-source. The process falls down for the opposite case where the sound source is dimensionally large compared with the wavelength (such as a vessel). Under these circumstances, back-propagation can lead to an over-estimate of source levels.

2.7 Transmission Loss

The transmission loss (TL) represents the loss in intensity or pressure of the acoustic field strength as the noise propagates from source to a receptor. In general terms, the transmission loss is given by:

$$TL = N \log(r) + \alpha r \qquad \text{eqn. 2.7}$$

where r is the distance in metres from the source to the receptor, N is a factor representing attenuation due to geometric spreading, and α (in $dB.km^{-1}$) is a factor for the absorption of sound in water. Rarely is transmission loss as simply described as this: the subject is discussed further in Section 5.

It is noted that the terms transmission loss and propagation loss (PL) are synonymous[12].

2.8 Received Level

The Received level (RL) is the strength of the acoustic field at a given depth and range relative to the source. At a range r from a source, this is given by:

$$RL = SL - TL \qquad \text{eqn. 2.8}$$

From eqn 2.7, this can be written in the form:

$$RL = SL - N \log(r) - \alpha r \qquad \text{eqn. 2.9}$$

As the sound level varies with range, it is important to state the range at which the measurement has been taken or the estimate has been made.

[12] Ainslie M. A., ""Transmission loss" and "propagation loss" in undersea acoustics", Journal of the Acoustical Society of America 118, 603 (2005).

3 SOUND SOURCE CHARACTERISATION

3.1 Introduction

Client-supplied information indicates that there will be a number of activities undertaken in the Project Area which involve the generation of underwater man-made noise. These are:

- drilling;
- facilities installation;
- operation of the *BW Adolo* FPSO; and
- assorted vessel movements associated with logistical support.

Estimates of acoustic source level are provided below.

3.2 Drilling noise

Noise is generated during drilling principally through the action of the drill bit on the surrounding rocks. The level of noise created is dependent therefore not only on the size of the drill bit but also on the degree to which the seabed rock is consolidated; a soft clay will produce lower levels of sound compared to that generated by a granite layer.

Noise generated at the drill head is likely to be transmitted into the water through two mechanisms. The first is where the noise is transmitted from the drill bit-sediment interface and into the surrounding seabed layers before becoming refracted back into the water column while the second is where vibrations travel up the drill shaft and then become transmitted into the water.

Drilling operations tend to last for hours hence qualitatively, drilling noise may be described as being continuous over time. Using the guidance expounded by Southall *et al*.[4], drilling noise is therefore classified as a non-impulsive type sound.

A review of the literature on underwater drill noise revealed that there is little useful data that has been released into the public domain: invariably the noise measurement units are ambiguous; the drill diameter is not quoted; or there is no information on sediment or seabed rock type. Todd *et al*.[13] reviews a number of studies where received levels of drilling noise vary in the range 120 to 145 dB re 1 μPa (rms) measured over distances from 10 m to 1000 m from the source, at frequencies of 1.4 Hz to 4 kHz. From measurements of drilling noise made close to a jack-up platform sited in the central North Sea, Todd *et al*.[13] report spectral source levels around 120 dB re 1 μPa/Hz. Resulting 1/3rd octave band levels are shown in Figure 3.1 across the frequency range 10 Hz to 20 kHz[14]. From this, a broadband source level of 146 dB_{peak} re 1 μPa at 1 m is derived. Figure 3.1 also shows a high band level contained within the frequency bin centred at 16 Hz – this may be attributed to relatively high levels of acoustic energy at

[13] Todd V. L. G, L. D. Williamson, J. Jiang, S. E. Cox, I. B. Todd, and M. Ruffert, "Proximate underwater soundscape of a North Sea offshore petroleum exploration jack-up drilling rig in the Dogger Bank", J. Acoust. Soc. Am. 148 (6), December 2020.
[14] Ibid. Supplementary material at https://www.scitation.org/doi/suppl/10.1121/10.0002958

one or more tonals across the relevant frequency range. Further high band levels are seen over the frequency range 2500-8000 Hz.

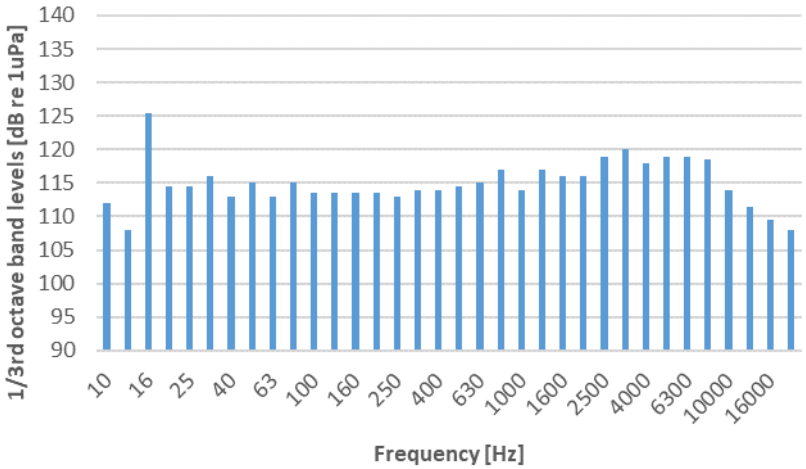

Figure 3.1: Band level spectra for drilling noise

3.3 FPSO noise

An FPSO is a specialised vessel containing production systems that receive mainly crude oil and water from a subsea reservoir through risers, and which then separate the fluids into oil, natural gas, water and impurities within the topsides production facilities onboard. The oil is stored until such time as it can be offloaded onto a tanker for subsequent export. The onboard machinery and the power units that drive them generate noise and vibration which is transmitted through the hull and into the ocean. As the processes are likely to run for extended periods of time, FPSO noise should be classified as being continuous or non-impulsive in nature.

Erbe *et al*.[15] reviewed a number of studies where acoustic source levels for FPSOs had been determined. Mean levels recorded over the frequency range 20-2500 Hz, varied from 174 dB to 183 dB re 1 μPa at 1 m. It is understood that some, if not all of the FPSOs were operating dynamic positioning (DP) thrusters at the time of the recordings. By contrast, it is understood that the *BW Adolo* is moored through a seabed-mounted system and hence will not require use of the DP thrusters to hold it on site. FPSO noise levels are therefore likely to be somewhat lower that those recorded by Erbe *et al*.[15]. However, no data on FPSO noise excluding the use of DP thrusters are currently available.

3.4 Vessel noise

Noise from vessels is a major contributor to the overall noise in a given sea area due principally to the large numbers of ships present, their wide distribution and their mobility. Vessel noise is a combination of broadband sound superimposed with tonals at specific frequencies corresponding to propeller blade rate, engine cylinder firing and

[15] Erbe C., R. McCauley, C. McPherson, A. Gavrilov, "Underwater noise from offshore oil production vessels", J. Acoust. Soc. Am. 133 (6), June 2013

crankshaft rotation. Southall *et al*.[4] classifies vessel noise as being non-impulsive in nature.

A limited set of acoustic data for noise-ranged vessels[16,17,18,19] are available, none of which are likely to include the vessels planned for deployment on the project. It is assumed that vessel noise is proportional to vessel power and overall vessel size[20]. It is necessary therefore to use noise data from other similarly sized (where possible) vessels as proxy data.

A high-level review of the available literature indicates that for medium-sized support vessels such as tugboats, crew boats, supply ships, and research vessels, of length in the range 50–100 m, have broadband source levels around 165–180 dB re 1µPa at 1 m[16, 21]. Large construction vessels may have higher peak source levels around 191 dB re 1 µPa @ 1 m[22]. For each class of vessel, highest band levels are in the frequency range 60-200 Hz.

3.5 Summary source noise levels

In order to provide a precautionary assessment of the impact of each noise activity, the key acoustic characteristics summarised in Table 3.1 below, will be taken forward for use in the acoustic propagation modelling discussed in Section 5.

Noise activity	Acoustic Source level dB re 1 µPa at 1 m	Representative frequency range Hz
Drilling	146	2500-8000
FPSO	183	20-2500
Vessel (Medium sized)	180	60-200
Vessel (Large sized)	191	60-200

Table 3.1: Acoustic source levels for key activities

[16] Richardson, W. J., Green Jr, C. R., Malme, C. I., Thomson, D. H., (1995), Marine Mammals and Noise. Academic Press, New York.
[17] Hannay, D.E. 2004. Noise. In Comparative Environmental Analysis (CEA), Chapter 4. Sakhalin Energy Investment Corporation. Available at: http://www.sakhalinenergy.com/documents/doc_33_cea_chp4.pdf
[18] Kiggavik Tug and Barge Noise Modelling, JASCO Applied Sciences, June 2011.
[19] A. Torbjörn Johansson and Mathias H. Andersson, "Ambient Underwater Noise Levels at Norra Midsjöbanken during Construction of the Nord Stream Pipeline", Report for Nord Stream AG and Naturvårdsverket, 2012.
[20] Li, Z., MacGillivray, A., and Wladichuk, J. (2011). Underwater Acoustic Modelling of Tug and Barge Noise for Estimating Effects on Marine Animals. Version 1.0. Technical report prepared for AREVA Resources Canada by JASCO Applied Sciences.
[21] Götz T., G. Hastie, L. T. Hatch, O. Raustein, B. L. Southall, M. Tasker, F. Thomsen, "Overview of the impacts of anthropogenic underwater sound in the marine environment", OSPAR Commission, 2009.
Accessed from: https://qsr2010.ospar.org/media/assessments/p00441_Noise_background_document.pdf
[22] Brims Underwater Noise Assessment, Xodus Group Technical Report Document Number: L-100183-S00-REPT-001, 2015.
Accessed from: http://marine.gov.scot

4 MARINE FAUNA AND ACOUSTIC IMPACT CRITERIA

4.1 Introduction

This section provides an overview of the assessment criteria against which the impact of continuous-type noise is quantified on species of marine mammal, fish and sea turtle extant to the Project Area. These criteria are used to estimate the extent of impact zones using the results from underwater sound propagation modelling discussed in the next section.

4.2 Acoustic impact thresholds

4.2.1 Introduction

The derivation of appropriate threshold levels of noise on marine life exposed to continuous-type noise draws on the methodologies developed by Southall *et al*.[23] for cetaceans; and Popper *et al*.[24] for fish and sea turtles. An overview of the salient points is given below.

4.2.2 Marine mammals

Physiological impacts

Southall *et al*.[4] commenced by reviewing earlier work on animal audiology and noted that marine mammals could be assigned to one of a number of functional hearing groups (FHG) where each group depended on differences and similarities in the animal's audiological physiology and behavioural psychophysics. To illustrate this, it was noted that although marine mammals possess the typical mammalian 3-stage ear, there are subtle differences that indicate specific adaptations to pressure, hydrodynamics and sound reception in water. For instance, the outer ear, denoted by the pinna, has been eliminated in all cetacean species while gas spaces in the middle ear of some marine mammals have been reduced substantially thus indicating that bone conduction may be an important means by which sound is transferred to the inner ear. In addition, cetaceans were further subdivided on the basis of their hearing sensitivity. The latest hearing group classification[23] for cetacean species is given in Table 4.1.

Functional hearing group	Animals
Low-frequency cetaceans	Mysticetes including humpback whale
High-frequency cetaceans	Odontocetes including sperm whale; beaked whale species; dolphin species.
Very high-frequency cetaceans	Odontocetes including pygmy sperm whale; dwarf sperm whale

Table 4.1: Functional hearing groups for marine mammal species known or likely to be present in the Project Area

[23] Southall B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek and P. L. Tyack, "Marine Mammal Noise Exposure Criteria:Updated Scientific Recommendations for Residual Hearing Effects", Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125

[24] Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W. T., Gentry, R., Halvorsen, M. B., Løkkeborg, S., Rogers, P., Southall, B. L., Zeddies, D., and Tavolga, W. N. (2014). "Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report," ASA S3/SC1.4 TR-2014 prepared by ANSI Accredited Standards Committee S3/SC1 and registered with ANSI. Springer and ASA Press, Cham, Switzerland.

It is acknowledged that, like humans, marine mammals do not hear equally well across all frequencies. In order to account for this, Southall *et al*.[23] proposed a series of frequency-dependent weightings that were derived from the hearing sensitivity curves for animals in each FHG. These have the effect of emphasising the frequencies over which the animals are most sensitive and de-emphasising the remaining frequencies. For each FHG (species of which are listed in Table 4.1), passband functions with specified roll-offs were originally developed by Southall *et al*.[4] and subsequently refined with the latest iteration being given by Southall *et al*.[23]. The frequency-weighting curves (collectively known as M-weightings), for each FHG representing marine mammals found in and around the Project Area, are shown in Figure 4.1. The M-weighting curves are used to modify the frequency spectrum of the impacting noise so that it more closely represents the noise as perceived by the target species. From these data, weighting values are extracted for each FHG and applied to the frequency band levels for each of the noise sources discussed in Section 3.

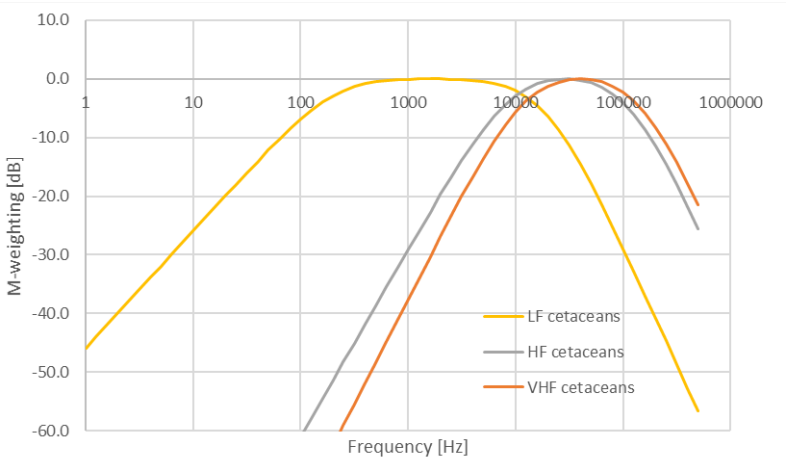

Figure 4.1: M-weighting curves for low-, high- and very high-frequency cetaceans

From reviewing available data derived from extensive tests involving marine mammals, Southall *et al*.[23] proposed thresholds representing the onset of permanent threshold shift (PTS) for marine mammals (based on measurements relating to the onset of temporary threshold shift (TTS)) which were expressed in terms of SPL and SEL, where the latter metric (expressed as dB re 1 $\mu Pa^2.s$) takes note not only of the period of time over which the receptor is exposed but also the sensitivity of the animal to the impacting sound. For continuous-type noise, the thresholds are given using SEL metrics where the appropriate M-weightings have been applied across the noise source spectrum (see Section 3). The resulting impact thresholds for both PTS and TTS are given in Table 4.4.

Functional hearing group	M-weighted SEL thresholds dB re 1 μPa^2 s	
	PTS	TTS
Low-frequency cetaceans	199	179
High-frequency cetaceans	198	178
Very high-frequency cetaceans	173	153

Table 4.2: Summary of acoustic impact threshold criteria for PTS and TTS for each functional hearing group when exposed to continuous-type noise, using the Southall *et al*.[23] thresholds

Given the nature of the M-weighting curves above, and the fact that the noise sources discussed in Section 3 are all predominantly low-frequency in content, it may be ascertained that LF-cetaceans are likely to be most sensitive to the underwater noise generated by each activity. By contrast, the least sensitive FHG are the VHF-cetaceans.

Behavioural impacts

To arrive at threshold levels of noise giving rise to behavioural effects in animals when exposed to man-made underwater sound, Southall *et al*.[4] reviewed a considerable body of data and noted that the responses varied according to the sound level on the animal as well as the frequency and duration of the perturbing noise.

Behavioural impacts were defined by a range of acoustic thresholds which were set following observations of animals in each FHG when exposed to continuous-type noise - predominantly vessel noise but also including drilling noise, acoustic deterrent devices (ADD) and oceanographic research sonar.

- For LF cetaceans, Southall *et al*.[4] noted that there was no (or very limited) response at received levels of 90-120 dB re 1 μPa rms and clearly defined avoidance behaviour at 120-160 dB re 1 μPa rms. However, it was seen that there was considerable variability in received levels for any given response type and this was attributed to contextual variables such as source proximity; the presence of vessels and/or humans close to subjects either for observation or during deployment of sound sources; animal activity at the time of exposure; and habituation or sensitisation to the sound.
- For HF cetaceans, it was noted that high sensitivity to the noise was seen at received levels across the range 90-120 dB re 1 μPa rms while, often, no responses were seen at received levels of 120-150 dB re 1 μPa rms.
- For VHF cetaceans, only one species has been studied extensively thus far: namely harbour porpoise. These were seen to be relatively sensitive to sound levels across the range 90-120 dB re 1 μPa rms but when exposed to sounds above 140 dB rms they exhibited profound behavioural responses. It is noted however that harbour porpoise is not a species extant to the Project Area and it is therefore not clear whether these results are relevant to other VHF cetaceans such as dwarf and pygmy sperm whale.

Hence it is seen that there is a lack of unambiguous data on behavioural responses that may be applied to the animals seen in and around the Project Area. To address this apparent impasse, it is proposed to draw instead on guidance given by the US National Marine Fisheries Service (NMFS)[25] which sets a Level B Harassment threshold for exposure to continuous-type noise of 120 dB re 1 μPa (rms)"[26]. NMFS regards a Level B Harassment as a response that occurs "*to a point where such behavioral patterns are abandoned or significantly altered*."

[25] Scoping Report for NMFS EIS for the National Acoustic Guidelines on Marine Mammals. National Marine Fisheries Service. 2005.
[26] Level B Harassment is defined as having the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioural patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

It is subject to interpretation as to how long a given behaviour (e.g. foraging) should to be interrupted before meeting the definition of being "*abandoned*". Similarly, the term "*significantly altered*" could be interpreted in a statistically-significant sense or in a biologically-significant sense. Despite this, and for the purpose of the current study, a threshold level of 120 dB re 1 μPa (rms)[27] is proposed as representing a noise which results in the onset of a strong behavioural reaction in marine mammals when exposed to continuous-type noise. Additional thresholds at 140 dB re 1 μPa (rms) and 160 dB re 1 μPa (rms) are included for comparison.

4.2.3 Fish and sea turtles

Physiological impacts

Popper *et al*.[24] conducted a similar process for fish as Southall *et al*.[23] had completed for marine mammals where they reviewed a number of studies and subsequently suggested various noise thresholds related to potential acoustic impacts that were a function of the hearing sensitivity of fish species and of the noise type. The functional hearing groups refer back to studies of either the internal physiology of the fish or else to their auditory sensitivity. The latest categories, along with key characteristics of each group, are defined in Table 4.3[28].

Subsequently, Popper *et al*.[24] provides threshold levels of continuous-type noise for fish of all functional hearing groups and these are given in Table 4.4 using, where appropriate, SPL rms metrics.

It is noted that threshold levels representing the onset of Mortality and Potential Mortal Injury; Recoverable Injury; and TTS for most of the fish and sea turtles subgroups do not currently exist due to insufficient data. Popper *et al*.[24] acknowledges the difficulty in ascribing specific distances or a range of distances to the risk of an impact given the number of variables that underpin such a decision. They suggest that "… "near" might be considered to be in the tens of metres from the source, "intermediate" in the hundreds of metres, and "far" in the thousands of metres".

[27] https://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html
[28] Popper A. N., A. D. Hawkins, "An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes", J. Fish Biol. 2019;94:692–713.

Functional hearing group	Description	Characteristics
Group 1	Fish with no swim bladder	Generally, these fish have no swim bladder or other gas chamber. They are relatively unsusceptible to barotrauma[29] and are sensitive only to particle motion rather than sound pressure[30] . This class includes flatfish, sharks and rays.
Group 2	Fish with swim bladders in which hearing does not involve the swim bladder	Although fish in this class have a swim bladder and thus the organ is able to respond to sound pressure, the swim bladder is not connected to the inner ear hence the hearing ability of fish depends only on particle motion. Fish in this class are relatively sensitive to only a narrow range of frequencies.
Group 3	Fishes with swim bladders that are close, but not intimately connected, to the ear	Fish in this class are sensitive to both particle motion and sound pressure. They are sensitive to a wider range of frequencies compared with Groups 1 and 2. This group includes members of the Gadidae, Anguillidae and Sciaenidae families.
Group 4	Fish where hearing involves a swim bladder	Fish in this class have a connection between the swim bladder and the inner ear and are sensitive to both particle velocity and sound pressure. Species in this class are sensitive to sounds over a wide frequency range (~several kHz) and have a higher sensitivity than fish in the preceding groups. The group includes members of the Holocentridae, Sciaenidae, Clupeidae families and the large group of otophysan fishes.
Group 5	Fish eggs and larvae	Studies show that the hearing abilities are similar to those of the adult of the species. Swim bladders may develop during the larval stage hence those species are particularly sensitive to barotrauma. Popper *et al*.[24] shows that there is very little data on the effects of sound or vibration on fish eggs.
Group 6	Sea turtles	There is relatively limited data on sea turtle hearing therefore the area is poorly understood. Studies of the auditory physiology of sea turtles indicate that the ear structure is closer to that found in reptiles than sea mammals but that they are adapted to detect sound pressure changes underwater. Popper *et al*.[24] maintains that until more data become available, fish hearing, rather than mammalian hearing, is the better model to use for sea turtles.

Table 4.3: Fish and sea turtle hearing groups[3]

Behavioural impacts

Threshold levels may be assigned to the onset of behavioural response in fish species but current guidance appears somewhat ambiguous. The US Fish and Wildlife Service (USFWS) works with a level of 150 dB re 1 μPa as a threshold for behavioural responses in fish[31]. Popper *et al*.[24] state that it is not clear whether this is a peak or rms metric. They also affirm that the corresponding criterion does not specify a particular behavioural response or whether it merely assumes that at that sound level, there is the potential to experience a behavioural reaction. Further, Hastings[32] declares that the scientific origin of this threshold is unknown and thus the validity of the criterion is uncertain. However, in the absence of any data in addition to the guidelines provided by USFWS and for the purpose of continuing the analysis contained in the current study, it is decided that a 150 dB re 1 μPa (rms) threshold be used to represent the onset of Low Level Behavioural Responses in fish.

[29] Barotrauma is tissue injury caused by a difference in pressure between a gas-filled space inside an organ and the surrounding tissues. Low levels of damage involve stretching of the tissue in tension or shear. Higher levels involve rupture of the tissues which can lead to fatalities.
[30] Hitherto, nearly all audiological investigations on fish have focussed on sound pressure as a metric. Very little data have been acquired on the responses of fish to particle motion. Attempts are being made by the international research community to address this major knowledge shortfall.
[31] Stadler, J.H. and D.P. Woodbury. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. In: Inter-Noise 2009 Innovations in Practical Noise Control.
[32] Hastings M. C., (2008) "Coming to terms with the effects of ocean noise on marine animals". Acoustics Today 4(2):22–34.

Functional hearing group	Mortality and Potential Mortal Injury	Recoverable Injury	TTS	Masking	Behavioural
Group 1	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Group 2	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Group 3	(N) Low (I) Low (F) Low	170 dB re 1 µPa rms for 48 hr exposure	158 dB re 1 µPa rms for 12 hr exposure	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Group 4	(N) Low (I) Low (F) Low	170 dB re 1 µPa rms for 48 hr exposure	158 dB re 1 µPa rms for 12 hr exposure	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Group 5	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low
Group 6	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Table 4.4: Summary of acoustic impact threshold criteria for fish and sea turtle functional hearing groups[4] exposed to continuous-type noise

With regards to behavioural responses in sea turtles exposed to continuous type noise, an extensive literature search has revealed that no data are available. Finneran and Jenkins[33] reviewed a number of studies reporting the responses of caged sea turtles when exposed to impulsive-type noises. They report that behavioural responses first become evident at received sound levels of 166 dB re 1 µPa (rms). When sound levels are increased to lie in the range 175-179 dB re 1 µPa (rms), the reactions are more erratic and avoidance behaviour becomes apparent. Given the lack of data on behavioural responses following exposure to continuous-type noise and following the approach adopted for the South Fork Wind Farm project[34], a threshold of 175 dB re 1 µPa (rms) is used to represent the onset of avoidance behaviour in sea turtles for the current study.

4.3 Summary

This section has provided an overview of the marine species found in and around the Project Area noting their susceptibility to noise. The international published literature has been accessed in order to determine levels of noise that have the potential to give rise to acoustic impacts on each species. Threshold levels are given in units of SPL using peak level and RMS metrics; while SEL thresholds are M-weighted which takes into account the relative audiological sensitivity of each generic species grouping. These data are subsequently taken forward for use in the acoustic impact modelling discussed in detail further on in this report.

[33] Finneran J. J., Jenkins A. K., "Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis", SSC Pacific Technical Report, April 2012.
[34] CSA Ocean Sciences Inc. 2021. Marine Mammal, Sea Turtle, and Sturgeon Impacts and Underwater Acoustic Assessment. Technical Appendix for South Fork Wind 112 pp.

5 UNDERWATER ACOUSTIC PROPAGATION MODELLING

5.1 Introduction

The following sections describe the propagation modelling undertaken in order to estimate sound level variation with distance from the source, specifically the acoustic models used and the oceanographic and geo-acoustic[35] data required as input parameters for the models.

5.2 Model description

Numerous computer models are available to predict acoustic propagation in the marine environment. Each model has its own strengths and weaknesses in terms of input requirements and calculation methods, but all include some form of description of various environmental parameters, such as the water column sound speed profile[36] (SSP) and sediment acoustic properties.

Reviews of a number of acoustic propagation computer programs are given by Buckingham[37], Jensen *et al.*[38] and Etter[39]. A number of these have been coded up and are included in the Acoustics Toolbox[40]. The computer programs are based on ray-trace, normal mode, parabolic equation and fast field techniques. Not all programs are equally suitable for use: due consideration must be made to the nature of the problem to be addressed and this will guide the user to the most appropriate model[41].

In the current study, there is a lack of project-specific data on acoustic source levels and frequency spectra (noting the estimated data discussed in Section 3). In addition, the requirement for undertaking the current study is to obtain estimates of acoustic impact distances from high-level modelling while working within the data limitations. Hence it is deemed entirely appropriate to draw on a less rigorous modelling procedure.

Expressions based on simple geometrical spreading are quick to implement. These assume that the sound waves travel either spherically ($20 \log_{10} R$ where R is the distance in metres between source and receptor) or else cylindrically ($10 \log_{10} R$). The depth of the water is not a parameter in such expressions and it is always a point for discussion as to when one geometrical expression is deemed more appropriate for use than the other. This dichotomy may be addressed by understanding that in a shallow water channel, sound wave fronts will expand uniformly (given by spherical spreading) in all directions until a boundary impedes their further progress. Beyond some distant point, the wave fronts will expand cylindrically. Over distances between the two, the sound waves propagate according to some intermediate spreading law. It is entirely possible

[35] The term "geo-acoustic" alludes to the type and structure of the sediments that comprise the seabed but instead, described in acoustic terms. These include, amongst others, the speed of sound in the sediment layer, the density of the rock and its layer thickness.
[36] Defined from measurements of sound speed made in the water from the sea surface to the seabed.
[37] Buckingham M.J., "Ocean-acoustic propagation models". Journal d'Acoustique: 223-287 June 1992.
[38] Finn Jensen, William Kuperman, Michael Porter, and Henrik Schmidt, Computational Ocean Acoustics, Springer-Verlag (2000).
[39] Etter Paul C., Underwater Acoustic Modeling and Simulation , 4th Edition, CRC Press, 2013, ISBN -10: 9781466564930
[40] An online repository funded by the US Office of Naval Research and containing a number of underwater acoustic propagation loss computer programmes. Found at http://oalib.hlsresearch.com/Modes/AcousticsToolbox/
[41] Farcas, Adrian, Paul M. Thompson, and Nathan D. Merchant. 2016. "Underwater Noise Modelling for Environmental Impact Assessment." Environmental Impact Assessment Review 57: 114–22.

to generate a propagation model that takes into account the different spreading regimes and a number of these are available e.g., Marsh-Schulkin shallow water model[42]; Weston's energy-flux method[43]. However, the main disadvantage of either of these is that the model assumes the sound speed profile is isospeed i.e., there is no variation in sound speed with increasing depth. It will be seen below that with regards to the oceanography in the Project Area, this requirement is not met.

Rogers[44] followed a semi-empirical approach where the regimes of sound propagation in a shallow water channel are defined in terms of the water depth. At distances far from the source, the wavefronts are cylindrical and the spreading losses are given by a 10*log R relationship. At closer distances, this relationship does not hold. This is the so-called "mode-stripping" range[45] where a 15*log R relationship is assumed. The distances from the source at which spreading changes from one mode to the next are a function of the frequency and the water depth. The resulting expressions were supplemented by semi-empirical terms which themselves were based on observations of a large number of measurements of acoustic propagation in shallow water locations. The equations are thus capable of modelling acoustic propagation in shallow water channels over long distances, while also taking into account a sound speed profile having a negative gradient and if required, a frequency-dependent absorption of sound in both the water and sediment.

The following inputs are required for the model:

- One third-octave band source sound level data;
- Range (distance from source to receiver);
- Water column depth (input as bathymetry data grid);
- Sediment type;
- Sediment and water sound speed profiles and densities; and
- Sediment attenuation coefficient.

A brief discussion of the sources of data used as inputs to the acoustic propagation model are discussed below.

5.3 Model input data

5.3.1 Bathymetry

Client-supplied data indicates that the nominal water depth in the immediate vicinity of the Project Area is approximately 125 m. Accordingly, a range-invariant water depth is assumed.

[42] Marsh H. W. and Schulkin M., "Shallow-water transmission", Journal of the Acoustical Society of America, **34**, 863, 1962.
[43] Weston D. E., "Intensity-range relations in oceanographic acoustics", Journal of Sound and Vibration 18, 271-287, 1971.
[44] Rogers P. H., "Onboard Prediction of Propagation Loss in Shallow Water", NRL Report 8500, 1981.
[45] Weston D. E., "Intensity-range relations in oceanographic acoustics", Journal of Sound and Vibration 18, 271-287, 1971.

5.3.2 Oceanography

Oceanographic data was obtained through the World Ocean Atlas (WOA 2009[46]). This consists of gridded monthly samples of temperature, salinity and depth and from which, sound speed profiles in the vicinity of the project area may be reconstructed with the aid of the Chen-Millero[47] relationship.

A nominal modelling location at 3.5°S 010.0°W off the south-west coast of Gabon was chosen. For this location, oceanographic profiles for four months of the year were extracted from the WOA and these are shown in Figure 5.2. It will be seen that, during the months of November and February, there is a small increase in sound speed over the top 10 m of each profile giving a positive sound speed gradient while below this, there is a decrease in sound speed with depth all the way to the seabed. The positive sound speed gradient indicates that a surface duct forms in the water column and that sound may propagate preferentially in it. For the remaining months, the duct has disappeared and the negative sound speed causes the sound to become directed towards the seabed where it undergoes rapid absorption.

The Rogers acoustic propagation model discussed above, permits the inclusion of a sound speed profile having a negative gradient. In order to represent the oceanographic conditions the year-round, all four profiles were combined in order to generate a composite profile seen in Figure 5.2, having a mean gradient of -0.18 s^{-1}.

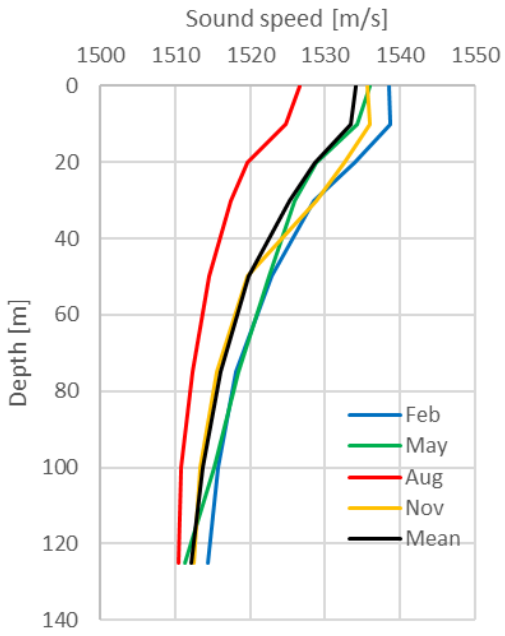

Figure 5.1: Sound speed profiles for the Project Area
for the months of February, May, August and November

[46] WOA (2009), World Ocean Atlas dataset available for download at www.nodc.noaa.gov/OC5/WOA09/pr_woa09.html
[47] C-T. Chen and F. J. Millero, (1977), "Speed of Sound in Seawater at High Pressures". J. Acoust. Soc Am, 32(10), p 1357

5.3.3 Seabed geoacoustics

No data on seabed type in the Project Area are currently available so alternative sources were sought.

A review of the published literature indicates that the Project Area occupies a geographical region between the Ogooué River delta to the north and the Congo River delta to the south. The Ogooué River drains the interior of Gabon where it carries a load of muddy sand for deposition into the Ogooué Fan[48]. This has created various stratigraphic traps which are currently being exploited in the Gabon North offshore oilfields. The Congo River carries a similar sediment load. When this river reaches the open ocean, strong turbidity currents tend to push the load northwards where it adds to the deposits from the other river systems[49]. Drawing on the modified form of the Folk sediment classification[50,51], it is assumed therefore that the seabed around the Project Area consists of thick layers of sandy-mud. Hamilton[52,53,54,55] provides advice on geoacoustic parameters and from this, corresponding sound speed, density and attenuation data were obtained and these are summarised in Table 5.1 below. The thickness is represented by a half-space of semi-infinite thickness.

Layer	Compressional wave velocity Vp m/s	Density kg/m^3	Attenuation dB/m/kHz	Thickness m
Muddy sand	1451	1652	0.08	-∞

Table 5.1: Seabed sediment properties over the Project Area

5.4 Background Noise

Background noise or oceanic ambient noise is considered to be a composite of a number of overlapping components[56]:

- at very low frequencies (1 Hz to 100 Hz) the dominant source is due to earthquake noise from distant activity and from turbulent pressure fluctuations caused by large-scale movements of bodies of water;
- at low frequencies (10 Hz to 1 kHz) vessel noise is dominant;
- at mid-range frequencies (50 Hz to 20 kHz) weather-related noise as prevails while biological activity such as animal vocalisations are also present;
- at high frequencies (>20 kHz), thermal noise becomes apparent.

In deep water regions which are generally remote from centres of population, the

[48] Mignard S., T. Mulder, P. Martinez and T. Garlan, "The Ogooue Fan (offshore Gabon): a modern example of deep-sea fan on a complex slope profile", Solid Earth, 10, 851–869, 2019. Accessed from https://se.copernicus.org/articles/10/851/2019/
[49] Berryman J. and G, Duval, "Hydrocarbon Potential in Ultra-deep Offshore South Gabon", GeoExPro Vol. 16, No. 5, 2019. Accessed from https://www.geoexpro.com/articles/2019/10/hydrocarbon-potential-in-ultra-deep-offshore-south-gabon
[50] Folk, R.L., 1954. The distinction between grain size and mineral composition in sedimentaryrock nomenclature. The Journal of Geology, 62, 344-359.
[51] Long, D., 2006. BGS detailed explanation of seabed sediment modified Folk classification. Available from: http://www.emodnet-seabedhabitats.eu/PDF/GMHM3_Detailed_explanation_of_seabed_sediment_classification.pdf
[52] E.L. Hamilton: Sediment Sound Velocity Measurements made In Situ from Bathyscaph TRIESTE, Journal of Geophysical Research 68 (1963) pp. 5991-5998.
[53] E.L. Hamilton: Sound velocity and related properties of marine sediments, North Pacific, Journal of Geophysical Research 75 (1970) pp. 4423-4446.
[54] E.L. Hamilton: Compressional-wave attenuation in marine sediments, Geophysics 37 (1972) pp. 620-646.
[55] E.L. Hamilton, “Sound Attenuation as a Function of Depth in the Sea Floor”, Journal of the Acoustical Society of America, 59(3), pp 528-535, 1976.
[56] Wenz G. M., (1962), “Acoustic Ambient Noise in the Ocean: Spectra and sources”, Journal of the Acoustical Society of America, 34 (12), pp 1936-1956.

overarching characteristic of the noise field is that it is isotropic and homogenous, that is, it has more or less the same noise level and frequency content regardless of the direction in which the observer is listening. To clarify, vessel noise, for instance, may be heard but it is not significantly louder in one direction than another. In shallow water coastal regions by contrast, background noise levels are very variable being dependent on shipping activity and marine industrial activity as well as wind speed and rainfall (see e.g., Urick[6]). Shipping activity in particular is denoted by clearly marked shipping lanes inside which noise levels are significantly louder than at locations outside[57,58].

By virtue of their relative accessibility, noise levels are more likely to have been recorded in coastal regions[57]. However, no data on underwater background sound levels have been found specifically for the Project Area. In order to address this shortfall, comparisons may be made with other shallow water sites in which similar levels of shipping- and hydrocarbon-related activity takes place.

The North Sea contains numerous oil fields that are in full operation. In addition, a number of ports and harbours are serviced by vessels transiting the region. Measurements of background sound in the coastal fringe of the North Sea by Nedwell *et al.*[59], indicate a background sound level range of 100-135 dB re 1 μPa with a modal value of 120 dB re 1 μPa. The report however fails to explain whether the SPL data are given using RMS or peak values. As it is common practice to present background sound levels in RMS units, it is assumed that the data provided in the report follow this convention.

It is proposed that background sound levels in the vicinity of the Project Area are considered to be in the range of 100-120 dB re 1 μPa (RMS). It must be emphasised that the coastal North Sea data is the best estimate available but nevertheless may not be wholly representative of sound levels in the survey area itself.

5.5 Source Modelling Parameters

Sound emitted by the noise sources discussed in Section 3 can be characterised by a continuous noise covering a wide range of frequencies. For the purposes of modelling the propagation of sound using the simplified approach discussed above, it is assumed that for each noise source, the acoustic energy is carried over a single 1/3rd octave band[60] and these are given in Table 5.2 below.

Noise activity	Modelling frequency [Hz]
Drilling	3150
FPSO	500
Vessel Medium sized)	100
Vessel Large sized)	100

Table 5.2: Acoustic modelling frequencies

[57] Neenan S. T. V., White P. R., Leighton T. G., Shaw P. J., (2016), "Modeling vessel noise emissions through the accumulation and propagation of Automatic Identification System data", Proceedings of the Fourth International Conference on the Effects of Noise on Aquatic Life Dublin, Ireland, 10-16 July 2016
[58] Jalkanan J-P, Johansson L., Liefvendahl M., Bensow R., Sigray P., Östberg M, Karasalo I., Andersson M., Peltonen H., Pajala J., (2018), "Modelling of ships as a source of underwater noise", Ocean Science 14, 1373–1383, 2018.
[59] Nedwell J R, Parvin S J, Edwards B, Workman R, Brooker A G, Kynoch J E, (2008), "Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters", COWRIE NOISE-03-2003.
[60] Kinsler, L.E., Frey, A.R., Coppens, A.B. & Sanders, J.V. (1999), Fundamentals of Acoustics, 4th edn. Wiley, NJ.

Using the bathymetric and geo-acoustic data given in the preceding sections, propagation loss data was generated along a single transect using the composite sound speed profile represented by a negative gradient of 0.18 s^{-1}.

For each noise source, the propagation loss data is generated at each of the 1/3rd octave band frequencies as given in Table 5.2. The propagation loss (indicated by TL in equation 2-7) is subtracted from the acoustic source levels provided in Section 3 in order to derive propagated SPL data as a function of distance. A discussion of the results generated by this stage is given in the following section.

6 UNDERWATER ACOUSTIC PROPAGATION MODELLING RESULTS

6.1 Discussion

This section of the report describes the results of the acoustic propagation modelling undertaken in Section 5.

The previous section indicated that in a shallow water channel, the acoustic propagation characteristic changes as the outgoing sound wavefront transits downstream. Using the aforementioned Rogers acoustic propagation model[44] it will be seen that the sound level at any given distance downstream is a function therefore of the sound source level and the propagation regime. Given the combination of water depth and frequency (strictly speaking, the wavelength is the key parameter), it will be seen that acoustic propagation is characterised approximately by a 15*log R relationship and this is illustrated in Figure 6.1 below for the four noise sources namely drilling; the FPSO; and medium- and large-sized vessels.

The figure includes the threshold level representing background noise (see Section 5.4). It will be seen that drilling noise (having the lowest source level), falls into the mean background noise level at a distance of approximately 8 m from the source. Medium-sized vessel and the FPSO have similar source levels and it is expected that the noise generated by either becomes indistinguishable from the background at a distance of 1.5-2 km. The noise from large-sized vessels could remain audible out to a distance of approximately 9 km.

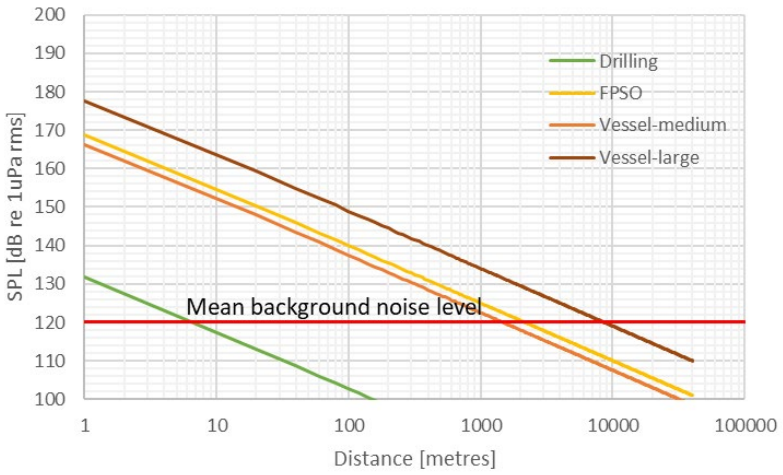

Figure 6.1: SPL as a function of distance from the sound sources

6.2 Concluding remarks

The figure discussed above show the variation of unweighted SPLs with respect to distance. Given the relative audiological sensitivity of each FHG, it is to be expected that overall SPLs as perceived by the marine fauna will be slightly lower in the case of LF cetaceans and significantly lower in the case of VHF cetaceans.

The next section discusses the impact of each noise type on the various groups of marine fauna when exposed to the noise over extended periods of time.

7 ACOUSTIC IMPACT MODELLING RESULTS

7.1 Introduction

This section compares the SPLs and SELs with threshold levels that are associated with various acoustic impacts. Section 4 shows that physiological impacts namely PTS and TTS, are quantified in terms of SEL, while behavioural impacts are given in SPL terms.

7.2 Marine mammals

7.2.1 Physiological impacts

Both PTS and TTS can build up on a receptor following a period of continual exposure to each noise type. NMFS guidance[61] recommends a baseline accumulation period of 24 hours for comparative purposes. However, the guidance also acknowledges that there may be exposure situations where this accumulation period requires adjustment hence shorter or longer exposure durations may also be specified. Accordingly, a range of exposure durations are considered varying from a 30-minute exposure duration up to a 24-hour exposure duration. The range of time exposures considered take into account the various periods over which an animal may be exposed to each noise. The shorter exposure durations are appropriate for animals transiting rapidly through the Project Area while the longer periods are deemed more appropriate for slower moving animals and for those species which are habitat-constrained.

As exposure duration increases, the acoustic impact of the sound, the modelling results show that the receptor must remain further from the construction site as exposure duration increases in order for the acoustic impact criteria not to be met.

The acoustic impact modelling indicates that drilling noise is likely to be the most benign of all activities considered. The results show that the PTS impact criterion is not met even for continual exposures of 24 hours. The TTS impact criterion is met at a maximum distance of 13 m for VHF cetaceans - being the most sensitive FHG to drilling noise.

By contrast, FPSO and vessel noise contain relatively high acoustic energy levels at lower frequencies hence LF cetaceans are likely to be the most sensitive FHG to these noise sources.

When LF cetaceans are exposed to FPSO noise, the PTS impact criterion extends from 6 m to 100 m for exposure durations ranging from 30 minutes to 24 hours. The TTS impact criterion is met at a maximum distance of 1840 m for the longest exposure duration considered. For all other FHG, the maximum distance over which the TTS criterion extends is less than 100 m.

When exposed to noise from medium-sized vessels, neither the PTS nor TTS impact criteria are met for the HF and VHF cetacean groupings. The PTS impact criterion reaches a maximum distance of 40 m when LF cetaceans receive a 24-hour exposure

[61] National Marine Fisheries Service. 2018. 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 p.

duration while the TTS impact criterion is met at a maximum distance of 480 m.

Large sized vessels are likely to generate higher noise levels but, given the generally low frequency content of the noise, these are not likely to impact HF cetaceans. Any impact arising on VHF cetaceans is expected to be minimal as the TTS impact criterion is met at a distance of no more than 5 m for a 24-hour exposure. By contrast, for a 24-hour exposure duration, the PTS impact criterion on an LF cetacean is met at a distance of 140 m while the TTS impact criterion extends over a distance of 2760 m.

A summary of the distances over which the PTS and TTS threshold conditions are met for each noise generating activity is given in Table 7.1 through to Table 7.4.

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	<1 m	<1 m
	TTS	179 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	3 m	6 m
HF cetaceans	PTS	198 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	<1 m	<1 m
VHF cetaceans	PTS	173 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	<1 m	<1 m
	TTS	153 dB re 1 $\mu Pa^2.s$	<1 m	3 m	7 m	13 m
All groups	Behavioural	160 dB re 1 µPa rms	<1 m			
		140 dB re 1 µPa rms	<1 m			
		120 dB re 1 µPa rms	7 m			

Table 7.1: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to drilling noise

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 $\mu Pa^2.s$	6 m	14 m	60 m	100 m
	TTS	179 dB re 1 $\mu Pa^2.s$	140 m	360 m	880 m	1840 m
HF cetaceans	PTS	198 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	3 m	6 m
VHF cetaceans	PTS	173 dB re 1 $\mu Pa^2.s$	<1 m	<1 m	2 m	3 m
	TTS	153 dB re 1 $\mu Pa^2.s$	5 m	11 m	40 m	80 m
All groups	Behavioural	160 dB re 1 µPa rms	4 m			
		140 dB re 1 µPa rms	120 m			
		120 dB re 1 µPa rms	2200 m			

Table 7.2: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to FPSO noise

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 μPa^2.s	2 m	4 m	10 m	40 m
	TTS	179 dB re 1 μPa^2.s	40 m	100 m	240 m	480 m
HF cetaceans	PTS	198 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
VHF cetaceans	PTS	173 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	153 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
All groups	Behavioural	160 dB re 1 μPa rms	3 m			
		140 dB re 1 μPa rms	80 m			
		120 dB re 1 μPa rms	1500 m			

Table 7.3: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to noise from medium-sized vessels

FHG	Impact	Threshold	Exposure duration			
			0.5 hour	2 hour	8 hour	24 hour
LF cetaceans	PTS	199 dB re 1 μPa^2.s	8 m	40 m	80 m	140 m
	TTS	179 dB re 1 μPa^2.s	220 m	540 m	1340 m	2760 m
HF cetaceans	PTS	198 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	178 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
VHF cetaceans	PTS	173 dB re 1 μPa^2.s	<1 m	<1 m	<1 m	<1 m
	TTS	153 dB re 1 μPa^2.s	<1 m	<1 m	3 m	5 m
All groups	Behavioural	160 dB re 1 μPa rms	15 m			
		140 dB re 1 μPa rms	420 m			
		120 dB re 1 μPa rms	8740 m			

Table 7.4: Distances in metres at which SEL has fallen to PTS and TTS and behavioural threshold levels for marine mammals exposed to noise from large-sized vessels

7.2.2 Behavioural impacts

Behavioural impacts are quantified in terms of SPL rms metrics and are independent of exposure-duration. For continuous noise, the NMFS Level B Harassment is set at a threshold value of 120 dB re 1 μPa rms and this is applied to all FHG regardless of audiological sensitivity.

When exposed to drilling noise, the Level B Harassment threshold extends to a maximum distance of 7 m. The distance increases to 2200 m when exposed to FPSO noise. The noise from medium-sized and large-sized vessels results in the threshold extending to distances of 1500 m and 8740 m respectively.

A summary of the distances over which the Level B Harassment threshold and the 140 dB rms and 160 dB rms thresholds are met for each noise generating activity is given in Table 7.1 through to Table 7.4.

7.3 Fish and sea turtles

7.3.1 Physiological impacts

Due to the general lack of appropriate threshold level data representing physiological damage in most of the fish and sea turtle FHGs, it is not possible to determine suitable distances over which each impact criterion may be met.

Some limited data are available for Group 3 and Group 4 fish (i.e., fish with swim bladders close to or connected to the ear) where impact distances for Recoverable Injury and TTS assessed using SPL rms metrics are summarised in Table 7.5. It will be seen that for all noise types, the impact criteria are met at distances extending no further than 40 m from the source.

Functional hearing group	Impact	Threshold	Noise source			
			Drilling	FPSO	Vessel Medium	Vessel Large
Group 3 Group 4	Recoverable Injury	170 dB re 1 µPa rms for 48 hr exposure	<1 m	<1 m	<1 m	4 m
	TTS	158 dB re 1 µPa rms for 12 hr exposure	<1 m	6 m	4 m	40 m

Table 7.5: Distances in metres at which SPL has fallen to Recoverable Injury and TTS threshold levels for fish exposed to all noise sources

7.3.2 Behavioural impacts

Due to the relative audiological insensitivity of fish and sea turtles, behavioural impact criteria are generally met at short distances from each of the noise sources considered.

Of all noise sources, large-sized vessels are potentially the most impactful. The Behavioural impact criterion is met at distances of 2 m and 100 m for sea turtles and fish respectively.

A summary breakdown of impact distances for each noise source is given in Table 7.6.

Functional hearing group	Impact	Threshold	Noise source			
			Drilling	FPSO	Vessel Medium	Vessel Large
Sea turtles	Behavioural	175 dB re 1 µPa rms	<1 m	<1 m	<1 m	2 m
All fish groups	Behavioural	150 dB re 1 µPa rms	<1 m	40 m	20 m	100 m

Table 7.6: Distances in metres at which SPL has fallen to Behavioural threshold levels for fish and sea turtles exposed to all noise sources

8 SUMMARY AND CONCLUSIONS

Man-made underwater sound will be generated during the proposed development of the Ruche EEA off the south-west coast of Gabon. The sound thus produced has the potential to impact on marine fauna found in and around the Project Area.

A number of marine species are known to frequent the region. These include various cetacean species such as baleen whales, dolphins and beaked whales as well as various fish and sea turtle species. The cetaceans are classified in terms of their hearing sensitivity and physiology and these are termed LF-cetaceans; HF-cetaceans and VHF-cetaceans while the fish are classified in terms of their sensitivity to noise. The published literature was accessed in order to determine threshold values of sound relating to potential acoustic impacts on marine life. Potential impacts subsequently considered were auditory impairment (Permanent and Temporary Threshold Shift) and behavioural reactions, which were assessed based on SPL peak; SPL rms and SEL metrics derived from studies by Southall *et al*.[23] and Popper *et al*.[24].

High level underwater acoustic propagation modelling was undertaken using environmental data relating to the Project Area. The ensuing propagation data was applied to acoustic source level data representing noise generated by drilling activity, the FPSO and medium- and large-sized vessels.

The scale of any acoustic impacts arising was determined by comparing the propagated noise levels with threshold values representing each acoustic impact. The results are summarised as follows.

Marine mammals

Drilling noise – The PTS impact criterion is not met for any FHG even for continual exposures up to 24 hours. The TTS impact criterion is met for VHF cetaceans at a maximum distance of 13 m - this being the most sensitive of all FHGs considered. The Level B Harassment criterion (which is independent of exposure duration) is met at a maximum distance of 7 m for all FHG.

FPSO noise – The impact modelling indicates that LF cetaceans are the most sensitive FHG to FPSO noise. For an exposure period of 24 hours, the PTS and TTS impact criteria extend to maximum distances of 100 m and 1840 m respectively. By contrast, all other FHG appear much less sensitive to FPSO noise. Over the same exposure duration, for VHF cetaceans, the PTS impact criterion extends to no more than 3 m while the TTS impact criterion reaches a maximum distance of 80 m. The Level B Harassment criterion covers a maximum distance of 2200 m from the noise source.

Vessel noise – When exposed to medium-sized vessels for a period of 24 hours, the PTS and TTS impact criteria for LF cetaceans are met at maximum distances of 40 m and 480 m respectively. When exposed to large-sized vessels, the PTS impact criterion covers a maximum distance of 140 m while the TTS impact criterion extends to 2760 m. For HF and VHF cetaceans, the PTS impact criterion is not met at all, while the TTS impact criterion is met at a maximum distance of 5 m. The Level B Harassment criterion varies between 1500 m and 8740 m according to vessel size.

Fish and Sea turtles

Quantitative threshold level data representing physiological damage in most of the fish and sea turtle FHGs is not currently available hence it is not possible to determine distances over which the impact criteria extend. The exceptions to the above are for fish in Groups 3 and 4 which are those where the swimbladder is either close to or connected to the inner ear. For these groups, the Recoverable Injury criterion is applicable over a maximum distance of no more than 4 m from the noise source while the TTS impact criterion extends to a maximum distance of 40 m.

For sea turtles, the Behavioural Impact criterion reaches a maximum distance of 2 m while for the fish groupings, the criterion extends to a maximum distance of 100 m.

FINAL

DUSSAFU BLOCK: THERMAL EFFLUENT DISPERSION MODELLING

Project no. 123605

Prepared for:

BW Energy Gabon SA

January 2022

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1. Introduction

1.1 Background

BW Energy Gabon SA (BWE) is proposing to develop oil resources in the Ruche Exclusive Exploitation Area in Dussafu Block, into high quality products in an environmentally responsible manner. The Dussafu Block is located offshore, in the southern Gabon basin approximately 290km north-west of the mouth of the Congo River into the Atlantic Ocean.

The development concept includes a floating production storage and offloading (FPSO) facility- FPSO Adolo that will accommodate central processes. The FPSO facility includes produced water discharges and cooling water flows that are used to regulate the temperature in the cooling water system and the generators. These processes involve the production of thermal waste streams to be discharged into the ambient seawater. An indicative location of FPSO Adolo is shown in Figure 1. The water depth at this location is approximately 115m to 120m.

Figure 1 Indicative location of the FPSO. Co-ordinates taken from the Metocean Data report (4417-BWE-G-RA-00001).

Binnies UK Ltd (BUK) was commissioned to undertake a dispersion modelling study in order to assess the change in ambient temperature and salinity, initially due to the presence of the produced water stream alone. The purpose of the study is to assist in understanding the extent of the area that could potentially be influenced by the routine discharge of the produced water effluent and assess the compliance with thresholds specified by international standards. This initial stage of the study is hereafter referred to as the 'baseline'.

After the submission and review of the findings of the baseline case, BWE requested that two additional discharge scenarios/ events would be incorporated in the study and assessed against the above international standards.

The first scenario relates to discharges from FPSO Adolo and involves the concurrent discharge of all thermal flows; namely the cooling water streams together with the produced water

effluents. The second scenario relates to the concurrent discharge of thermal flows (cooling water and produced water discharges) from Hibiscus Alpha, an Offshore Installation (OI) located approximately 20km away from the FPSO Adolo. Due to the proximity of the two facilities, BWE advised that the ambient and metocean conditions at both locations are similar and therefore the model developed for the 'baseline' could be used to evaluate both scenarios.

The assessment is based on the engineering information supplied by BWE.

1.2 Original scope

BUK's scope under this commission involves the following:

- Prepare a hydrodynamic model using DHI's MIKE 3 software platform to analyse the effluent dilution into the ambient seawater. A simple cuboid shape geometry of a uniform depth is to be assumed to represent the location of discharge (deep waters) with the effluent being discharged at the centre of the domain.
- Initially analyse one model scenario – the 'baseline', whereby:
  - Model boundary conditions are to be selected from the metocean data (water levels, velocities, waves, winds, currents) provided by BWE and will be agreed upon prior to commencement of the analysis.
  - Effluent characteristics are to be supplied by BWE.
- Prepare a short technical report outlining the methodology and results of the modelling exercise. Results are to be presented in plan as contours showing how dilution increases moving away from the discharge. The report needs to address whether a potential temperature difference associated with the discharge of effluent is within the 3°C threshold limit measured at a 100m radius from the release location, as advised by international guidelines.
- If results for the above model scenario indicate non-compliance or likely non-compliance with the 3°C differential temperature threshold, then upon instruction by BWE, BUK will undertake additional simulations until compliance is achieved. The inputs for any additional scenarios are to be agreed upon with BWE.

1.3 Additional scope

After the submission and review of the baseline case findings, BWE requested the following additions to the original scope:

- Two additional simulations are to be incorporated in the thermal dispersion study, namely:
  - At FPSO Adolo, involving the concurrent discharge of three thermal effluents; one from the produced water (PW) stream and two cooling water (CW) flows, originating from the process stream and the steam turbine generators (STGs).
  - At Hibiscus Alpha OI, involving the concurrent discharge of two thermal effluents; the PW discharge and the CW effluent discharged via the secondary outlet. Based on the outcome of this simulation BWE will decide whether it is required to undertake further simulations considering the combined simulations from PW and CW discharge via the primary outlet.
- No changes will be made to the baseline model as part of the two additional simulations, including domain shape and boundaries as well as the ambient conditions considered, except for the model mesh that will be used to model combined flows at

the FPSO Adolo. This is considered necessary in order to achieve a similar level of confidence to the 'baseline' case.

— The findings from these additional modelling scenarios will be incorporated in the report developed for the baseline case.

1.4 Information supplied

As part of the study, BWE supplied the following documents:

— Report number 4417-BWE-G-RA-00001, Rev 00, titled Metocean Data, dated 05/09/2017;

— Report number 4454-BWE-Z-FD-00001, Rev B, titled Basis of Design – Ruche Phase-1 Development, dated 15/10/2020;

— Report number 4417-BWE-Z-FD-00003, Rev 0, titled Basis of design for the Ruche EEA development – Phase 2, dated 8/2/2019;

— Drawing number 0379-BWO-C-XD-00002.001, Rev B, titled FPSO General Arrangement, dated 7/3/2019.

— Drawing number HA-OI-GA-1004, Rev C, titled General Arrangement Machinery Deck, dated 31/07/21.

Further to the documents listed above, information has been exchanged via email correspondence.

1.5 Limitations

BUK undertook this modelling study based on supplied information. No additional investigations and/or surveys have been undertaken to validate the accuracy of the information provided.

Model calibration and validation activities are outside the scope of the current appointment.

2. Model inputs - Scenario 1, Baseline

2.1 Water depth at discharge

The water depth at the FPSO location is taken as 115m. This value is assumed to be uniform across the whole geometry (a flat seabed). No site-specific bathymetry information has been supplied. The FPSO is located at substantially deep waters, therefore seabed topography is not anticipated to have a measurable effect on the results from this modelling task.

2.2 Discharge type

According to information shown on the FPSO's GA drawing supplied, the produced water system discharges at a distance above and/ or on the sea surface, therefore the discharge type resembles that of a 'free outlet' that is not submerged. The outlet location is taken at the sea surface and it is assumed that discharge is undertaken at Mean Sea Level (MSL).

It should be noted that the choice of a conventional three-dimensional hydrodynamic modelling platform, such as MIKE 3 is not able to represent the characteristics of the mixing processes that take place while the plunging effluent comes in contact with the sea (see further discussion in 5.1 below). The presence of the FPSO and any associated interactions between the vessel's hull and the effluent flow is also outside the modelling capabilities of the MIKE 3 suite, which does not accommodate floating structures. The effluent is considered free to propagate unobstructed in the domain both horizontally and in depth (vertically). These assumptions are applicable to all modelling scenarios.

If a more detailed representation of these initial mixing and dilution processes and/or of any flow- structure interactions is necessary, this analysis should make use of Computational Fluid Dynamics (CFD). This is outside the scope of the current commission.

2.3 Ambient and metocean conditions

(a) Sea levels

A uniform water level of 0m has been adopted along all four model boundaries to represent MSL.

Tidal variations have not been considered. It is anticipated that the presence of any tidal currents would assist the mixing process. On the same basis, wave actions have not been considered in the model.

(b) Seawater temperature

The seawater temperature adopted in the model is 24.5°C. This value corresponds to the average temperature of the coldest month in the year with a 1 in 1 year return probability. Since the effluent associated with the cooling water stream is a heated-type waste, it is anticipated that the maximum possible effect in the ambient temperature would be observed when the seawater temperature is lowest. According to Table 2-42 of the Metocean Data report, the lowest seawater temperature is observed in July, with an average value in the order of 21.7°C measured at 90m above seabed. This value has been extrapolated to sea surface level by assuming an increase in temperature equal to 1.4°C, equivalent to the temperature differential trend observed for water depths between 60m and 90m.

(c) Seawater salinity

According to the information supplied, the seawater salinity at the location of the discharge is equal to 20 PSU (Practical Salinity Units). It was assumed that this value is constant across the whole model footprint.

It is noted that this salinity value appears to be relatively low for an offshore location. A possible explanation could be down to freshwater contributions from the Congo River to the south-east and the presence of the Benguela current flowing north along the coast.

(d) Currents

Information on the ocean currents at the FPSO location have been derived from the Metocean Data report. It is anticipated that the most conservative conditions in terms of effluent dilution would be observed when the minimum current velocities. According to data presented in Table 2-26 of the above, the lowest surface current with a 1 in 1 year return probability is observed propagating towards the south-west (SW), with an average speed equal to 0.3 m/s uniform for about 30m below the sea surface, reducing gradually with increasing depths to about 0.1 m/s at 1m above seabed.

A constant current velocity equal to 0.3 m/s has been adopted for the whole depth.

(e) Winds

Information on the average wind speeds at the FPSO location have been derived from the Metocean Data report. As noted above for currents, it is anticipated that the most conservative conditions in terms of effluent dilution would be associated with a 'calm' sea state, i.e., when wind speeds are minimum. According to data presented in Table 2-10 of the above, the lowest wind speed with a 1 in 1 year return probability is observed from a north (N) and north-east (NE) direction, with an average speed equal to 2 m/s.

A constant wind speed equal to 2 m/s has been adopted, blowing from the north.

(f) Summary ambient characteristics

The ambient characteristics and metocean conditions used in the model are summarised in Table 1 below.

Table 1 Ambient characteristics and metocean conditions

Input variable	Value	Unit	Comments
Water level	0	m	Taken as MSL
Temperature at surface	24.5	°C	Uniform and constant
Salinity	20	PSU	Uniform and constant
Current velocity	0.3	m/s	Constant propagating SW
Wind speed	2	m/s	Constant blowing from N

2.4 Effluent characteristics

According to information supplied by BWE, the produced water stream effluent has the characteristics tabulated below (Table 2).

Table 2 Scenario 1 - Effluent characteristics

Input variable	Value	Unit
Flow rate	60,000	BWPD
	0.11	m^3/s
Temperature	115	F
	46.11	°C
Salinity	279	PSU

3. Model inputs - Scenario 2, FPSO Adolo combined flows

This modelling scenario evaluates the concurrent discharge of the following three effluents:

— The produced water (PW) effluent, as considered in the 'baseline' model case;

— The cooling water (CW) flows from the process stream; and

— The cooling water (CW) flows from the steam turbine generators (STG).

Inputs to this modelling scenario are similar to those considered for the baseline case; with the addition of the two cooling water effluents. Details are outlined in the following sections.

3.1 Model ambient and metocean conditions

The model inputs representing the ambient and metocean conditions are as described in sections 2.1 and 2.3 above.

3.2 Discharge locations

According to the FPSO GA drawing supplied, the outlets from the PW and CW from the process stream are located on the port side of the FPSO and are approximately 1m apart. The outlet of the second CW stream, the one originating from the STGs is located on the starboard side of the FPSO, at a horizontal distance approximately 150m from the PW outlet. The above dimensions are scaled from the GA drawing, excerpts of which are reproduced in Figure 2, below. All three outlets discharge above the sea surface and effluents are therefore considered of 'free-discharge' type. The new CW outlets are also taken at the sea surface and it is assumed that discharge is undertaken at Mean Sea Level (MSL).

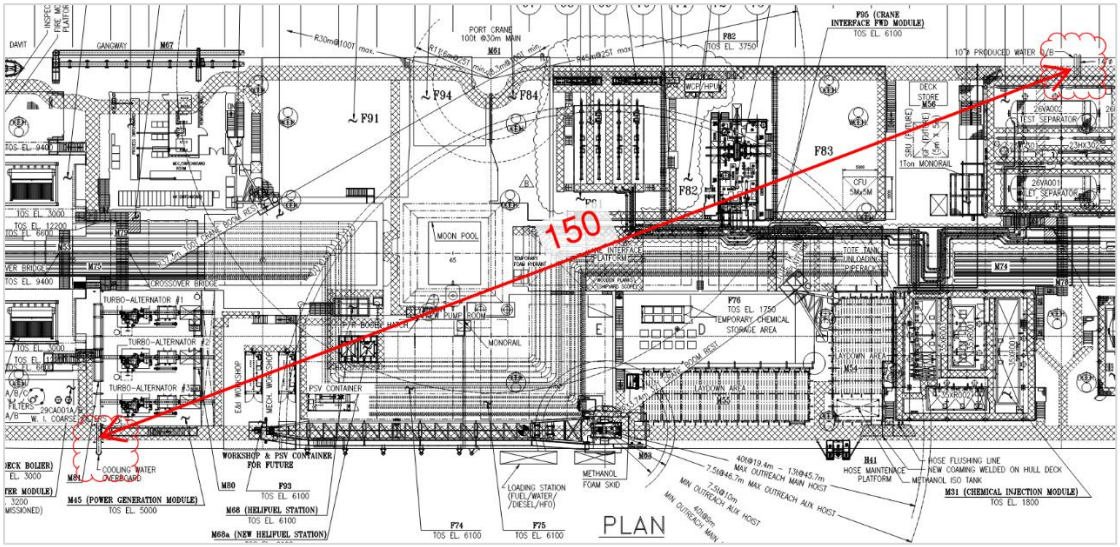

Figure 2 Excerpt from FPSO Adolo GA drawing showing the location of the three outlets.

The model adopts a NE orientation for the FPSO, such that all three outlets discharge in the direction of the applied current. The MIKE 3 modelling platform does not currently accommodate floating structures, hence the presence of the FPSO cannot be taken into consideration in the model. This limitation, however, is considered acceptable in the orientation considered here.

3.3 Effluent characteristics

According to information supplied by BWE, the three effluents have the characteristics tabulated below (Table 3).

Table 3 Scenario 2 – Effluent characteristics

Input variable	Source 1 Produced water	Source 2 Cooling water from STGs	Source 3 Cooling water from process
Flow rate	60,000 BWPD	2,875 m^3/h	1,089 m^3/h
	0.1104 m^3/s	0.7986 m^3/s	0.3026 m^3/s
Temperature	115 F		
	46.11°C	33°C	30°C
Salinity	279 PSU	20 PSU	20 PSU

4. Model inputs - Scenario 3, Hibiscus Alpha OI combined flows

This modelling scenario evaluates the concurrent discharge of the following two types of effluents, being discharged from the Hibiscus Alpha OI:

— The produced water (PW) effluent; and

— The cooling water (CW) flows from the process streams.

4.1 Model ambient and metocean conditions

Hibiscus Alpha OI is located approximately 20 km away from FPSO Adolo and it is therefore advised that the ambient and metocean conditions at this location are similar to those adopted in the baseline model. The model inputs representing the ambient and metocean conditions are as described in sections 2.1 and 2.3 above.

4.2 Discharge locations

According to information supplied by BWE, the produced water is discharged 2m below the sea surface, via a 'submerged' outlet. The cooling water effluent is discharged above the sea surface, via a secondary outlet approximately 10m away from the produced water outlet. The locations of the two outlets are shown in Figure 3, below. For the purposes of the model, the discharge of the CW is assumed to be on MSL.

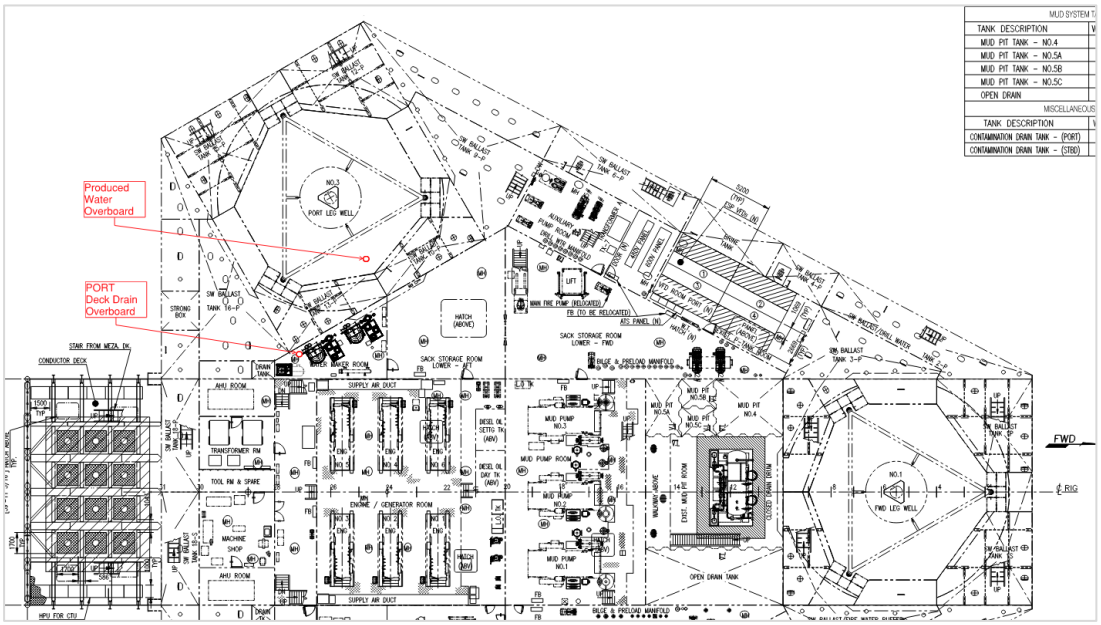

Figure 3 Excerpt from the Hibiscus Alpha OI GA drawing showing the location of the two outlets.

4.3 Effluent characteristics

According to information supplied by BWE, the two effluents have the characteristics tabulated below (Table 4).

Table 4 Scenario 3 – Effluent characteristics

Input variable	Source 1 Produced water	Source 2 Cooling water from STGs
Flow rate	54,000 bbl/d	458 m^3/s
	0.0994 m^3/s	0.1272 m^3/s
Temperature	92.22°C	34.5°C
Salinity	279 PSU	20 PSU

5. MIKE 3 model

5.1 General

Dispersion from each discharge point has been assessed using the MIKE 3 software (developed by DHI). MIKE 3 provides the simulation tools to model 3D (three-dimensional) free surface flows and associated sediment or water quality processes. MIKE 3 is widely used around the world for environmental and ecological studies.

As noted in section 2.2 above, results from the MIKE 3 model will not take into consideration the initial mixing, dilution and momentum of the flow when the effluent hits the surface of the sea. The discharge is added to the model as a point source either on the water surface or submerged. It is further noted that since the MIKE 3 modelling suite does not accommodate floating structures, effluents are considered free to propagate unobstructed in the domain both horizontally and in depth (vertically). A CFD analysis should be undertaken, if a more detailed representation of the initial mixing and dilution processes and/or of any flow- structure interactions is necessary. This is outside the scope of the current commission.

A MIKE 3 model has been developed for the baseline case (Scenario 1). Details covering the model geometry, mesh and boundaries are outlined in the following sections. With the exception of necessary re-meshing activities that have been undertaken for Scenario 2 and are detailed below; information presented next, applies to all three scenarios.

5.2 Model geometry

MIKE 3 uses a three-dimensional grid to represent the water depth and bathymetric profiles of the study area. A cuboid-shaped model geometry with a footprint of 1km by 1km has been developed to assess the effluent dilution. A flat bathymetry profile has been adopted with a uniform depth of 115m.

The co-ordinate system used in the model is WGS 84/ Gabon TM 2011 (EPSG:5523). The grid co-ordinates at the four corners of the modelled area are outlined in Table 5 below.

Table 5 Model corners grid co-ordinates

Easting	Northing
1410066.454	5036609.83
1408610.498	5037981.031
1409961.497	5039415.537
1411417.453	5038044.336

5.3 Model mesh

A triangular mesh was developed for the 'baseline' model (Scenario 1) in order to represent the study area. For a better representation of the mixing characteristics a fine mesh was used at a radius of 100m from the produced water system outlet; with mesh sizes gradually becoming coarser away from the discharge point.

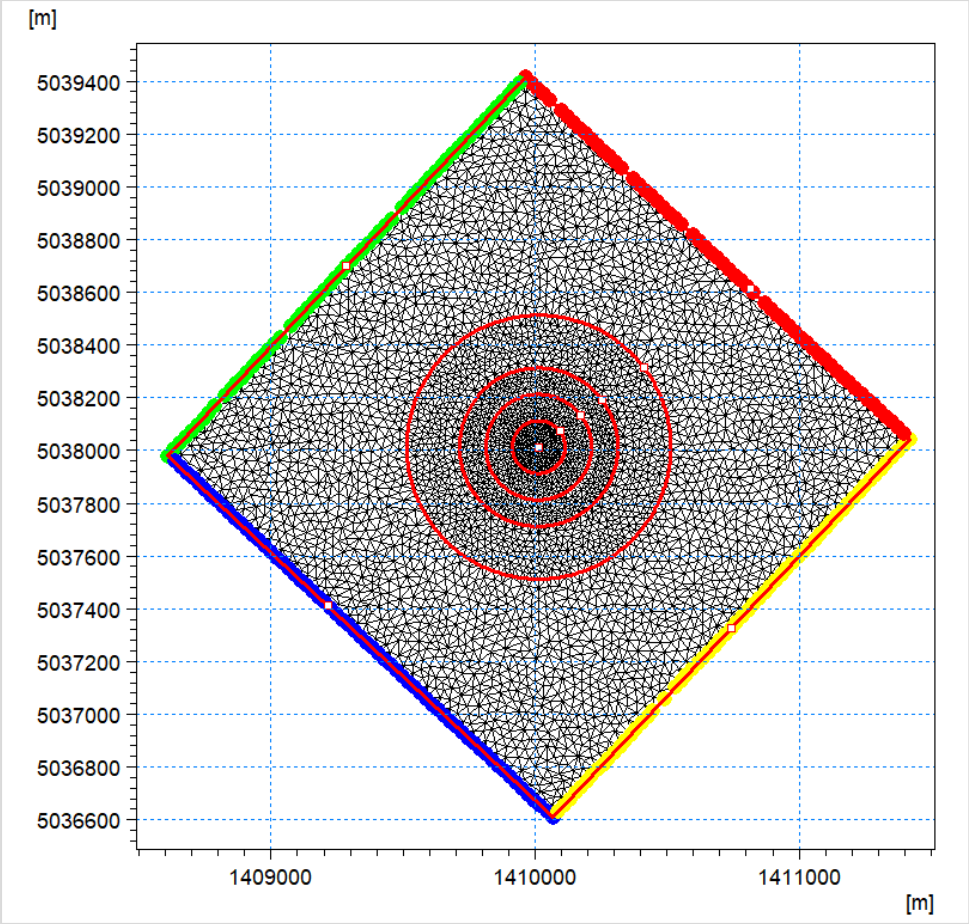

Figure 4 Model mesh used for Scenarios 1 and 3 with the produced water discharge location (source) at the centre. Fine mesh within the first 100m from the source, then gradually coarser at 200m, 300m, 500m and 1000m away from the source. Mesh differentiation areas annotated in continuous red lines.

The same model mesh was adopted for Scenario 3, where the two outlets are spaced close apart (10m). It is not anticipated that a 10m-extension of the fine mesh area from the cooling water outlet at Hibiscus Alpha would provide any significant increase in the accuracy of the results. The mesh profile used for Scenario 1 and Scenario 3 is illustrated in Figure 4 above.

In Scenario 2, however, the distance between the produced water and cooling water outlets on the port side and the cooling water outlet on the starboard side is significant (approximately 150m). It was therefore considered necessary to extend the fine mesh area 100m from each of the outlets. For simplicity, a new fine mesh area was created to incorporate both release locations (port and starboard side). This area extends 250m from the produced water outlet that is located at the centre of the model domain. The mesh profile developed for Scenario 2 is illustrated in Figure 5 below.

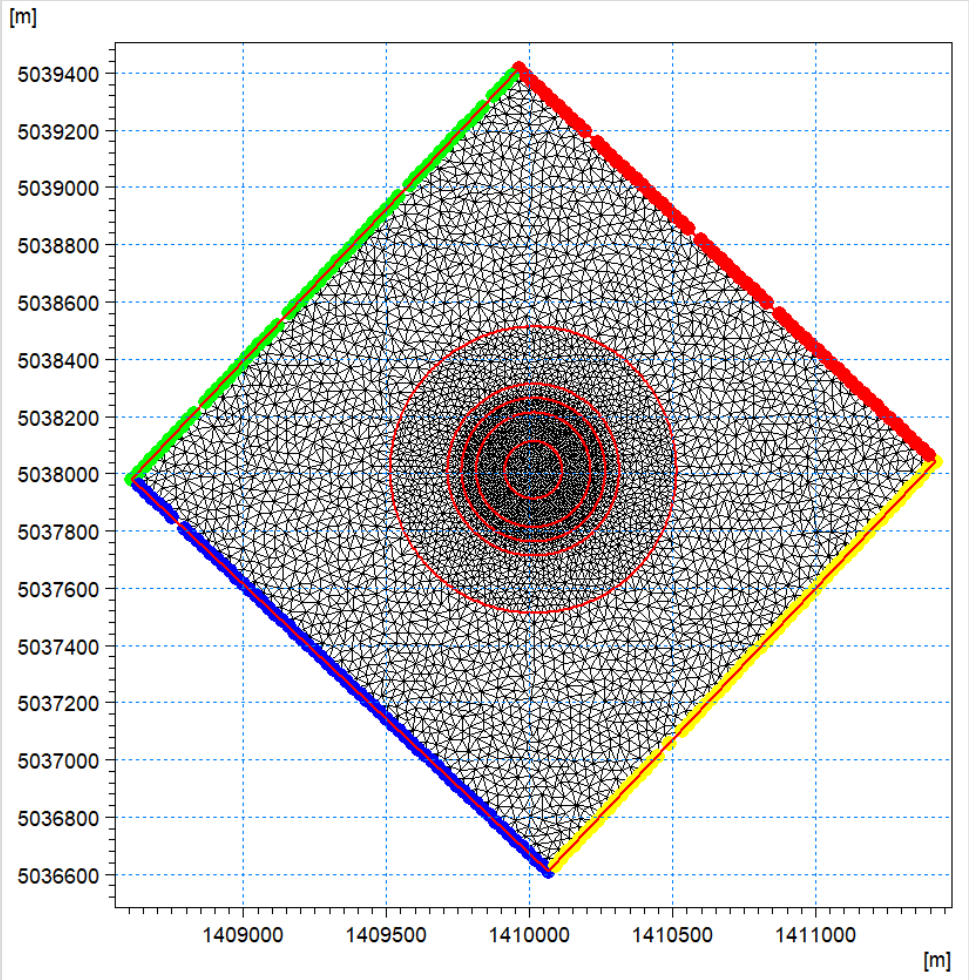

Figure 5 Model mesh used for Scenario 2 with the produced water discharge location (source) at the centre. Fine mesh within the first 250m from the source, then gradually coarser at 300m, 500m and 1000m away from the source. Circles annotated in continuous red lines correspond to areas with radius 100m, 200m, 250m, 300m and 500m.

5.4 Model boundaries

The model boundaries are shown in Figure 4 and Figure 5 and their types are outlined in Table 6 below.

Table 6 Model boundaries

Location	Type	Water level	Velocity	Temperature	Salinity
NE (red)	Current velocity	0m (MSL)	0.3m/s	24.5°C	20PSU
SE (yellow)	Water level	0m (MSL)	-	24.5°C	20PSU
SW (blue)	Water level	0m (MSL)	-	24.5°C	20PSU
NW (green)	Water level	0m (MSL)	-	24.5°C	20PSU

5.5 Model sources

The effluent characteristics adopted for each of the sources are outlined in Table 2, Table 3 and Table 4, above.

The grid co-ordinates for the sources considered in each scenario are shown in Table 7 below. The outlets of the produced water system were taken (arbitrarily) at the centre of the model geometry.

Table 7 Model source, grid co-ordinates

Scenario	Outlet	Easting	Northing
1	Source 1 Produced water	1410013.975	5038012.684
2	Source 1 Produced water	1410013.975	5038012.684
	Source 2 Cooling water - STGs	1409954.578	5037874.091
	Source 3 Cooling water - process	1410014.975	5038012.684
3	Source 1 Produced water	1410013.975	5038012.684
	Source 2 Cooling water	1410023.975	5038012.684

6. Results

6.1 Scenario 1 - Baseline model

(a) Temperature

The maximum predicted temperature values under the specified flow rate of 60,000BWPD (0.1104 m^3/s) measured at distances 10m, 30m, 100m, 200m and 300m away from the produced water outlet are summarised in Table 8.

Table 8 Maximum predicted temperature at various distances away from the outlet. Ambient temperature 24.5 °C.

Distance radius away from PW outlet (m)	Temperature (°C)	Temperature increase, ΔT (°C)	Point co-ordinates where maximum is observed (approximate)	
			Easting	Northing
10	24.52	+0.02	1410024.407	5038012.569
30	24.51	+0.01	1410015.006	5037990.908
100	24.50	-	1410091.738	5037950.298
200	24.50	-	14010172.115	5037892.525
300	24.50	-	1410249.612	5037833.785

The results indicate that the maximum predicted temperature difference (increase) about 10m away from the location of the outlet is approximately +0.02°C and reduces to about +0.01°C at a distance approximately 30m from the discharge location. The predicted temperature difference (increase) at 100m is only noticeable when looking at the results to the order of 3 decimal points; which is not significant.

Figure 6 and Figure 7 (note the differing x- and y-axis aspect ratios and colour scales) show the predicted change in temperature under the specified flow rate of 60,000BWPD (maximum), as a function of horizontal distance away from the source, in plan and in section, respectively. The frames shown correspond to a point almost half-way through the simulation time. Note that a very narrow temperature range was required for the colour shading to show any difference in these plots.

Cross-sections cut at various points during the simulation indicate that the mixing is likely to take place within the first 5m to 20m with insignificant differences in temperature beyond this depth.

Note that these predictions rely on the persistence of winds and currents in constant speed and direction over the whole simulation time and therefore do not account for any build-up of the plume.

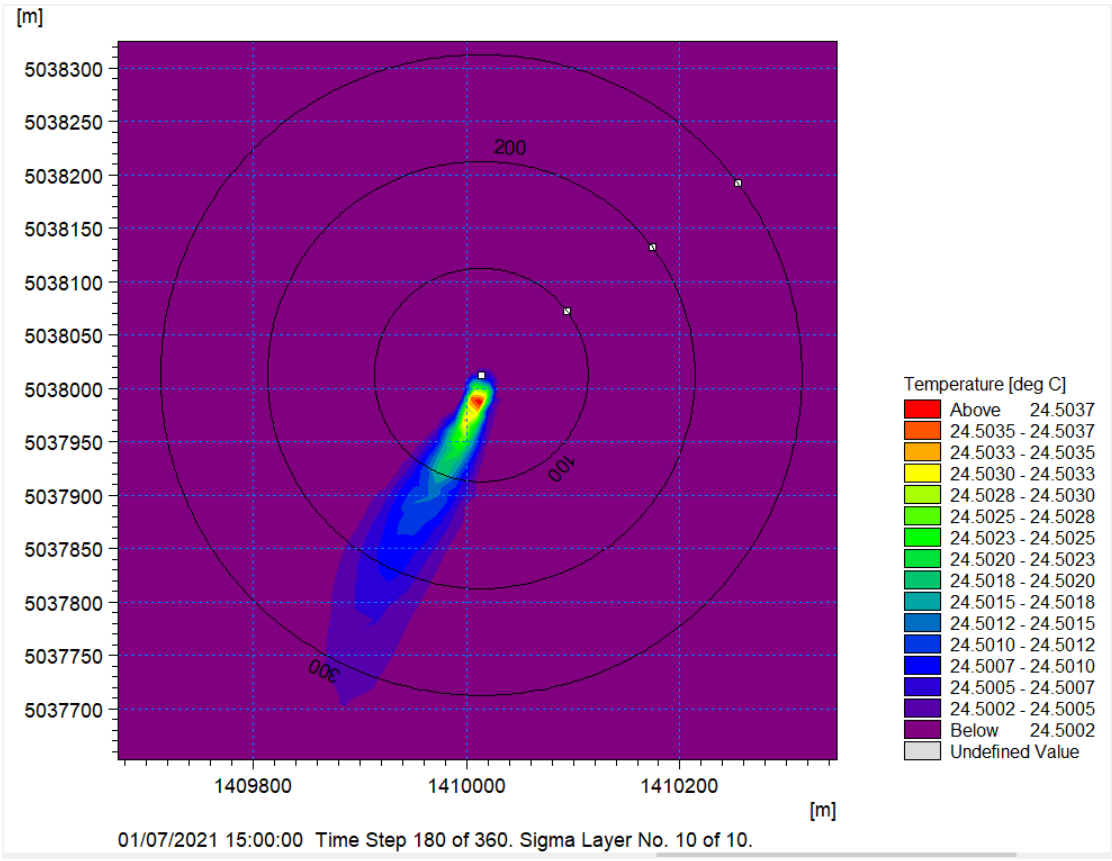

Figure 6 Plan showing temperature of plume at sea surface and areas within 100m, 200m and 300m radius away from the outlet. (Note that the temperature differences are all extremely small.)

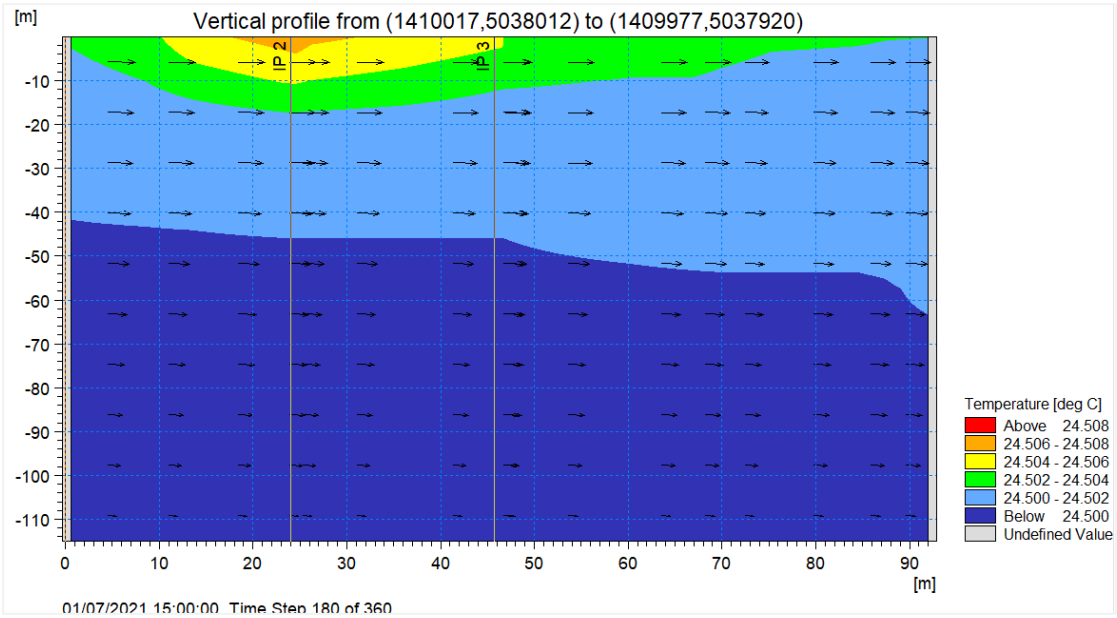

Figure 7 Section profile showing thermal plume and current. (Note that the temperature differences are all extremely small.)

(b) Salinity

The maximum predicted salinity values under the specified flow rate of 60,000BWPD (0.1104 m^3/s) measured at distances 10m, 30m, 100m, 200m and 300m away from the produced water outlet are summarised in Table 9.

The model indicates that for the given flow rate, the produced water plume initially plunges downward creating a mixing zone ranging between approximately 5m to 20m below the sea surface. The model predicts insignificant differences in salinity beyond this depth.

The results indicate that the maximum predicted difference (increase) in salinity at a distance about 10m away from the outlet is about +0.25 PSU and gradually reduces to about +0.15 PSU at a distance approximately 30m from the discharge location. The predicted difference (increase) in salinity at 100m is about +0.06 PSU. The model predicts a decline to ambient salinity within a 300m radius away from the outlet.

Figure 8 and Figure 9 (note the differing x- and y-axis aspect ratios and colour scales) show the predicted change in salinity under the specified flow rate of 60,000BWPD (maximum), as a function of horizontal distance away from the source, in plan and in section, respectively. The frames shown correspond to a point almost half-way through the simulation time. Note that a very narrow salinity range was required for the colour shading to show any difference in these plots.

Table 9 Max predicted salinity at various distances away from the outlet. Ambient salinity 20 PSU.

Distance radius away from PW outlet (m)	Salinity (PSU)	Salinity increase, ΔS (PSU)	Point co-ordinates where max is observed (approximate)	
			Easting	Northing
10	20.25	+0.25	1410024.407	5038012.569
30	20.15	+0.15	1410015.0067	5037990.908
100	20.06	+0.06	1410091.738	5037950.298
200	20.01	+0.01	14010172.115	5037892.525
300	20.00	-	1410249.612	5037833.785

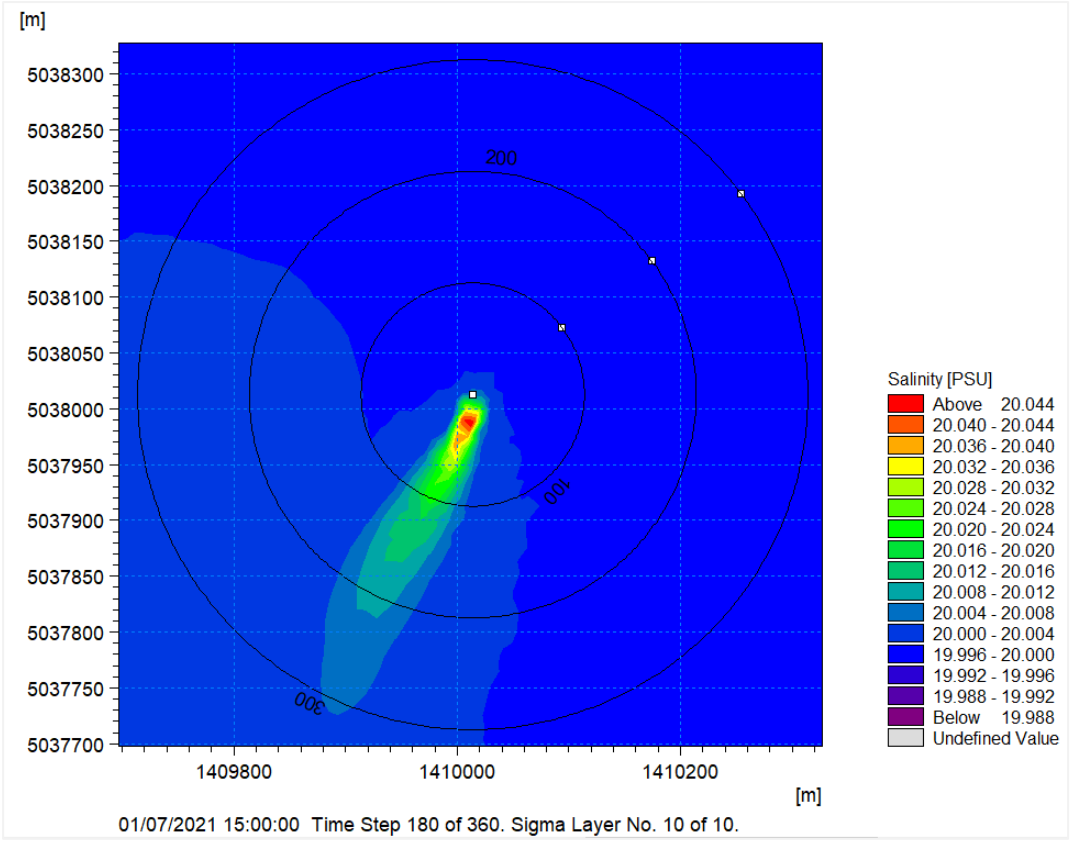

Figure 8 Plan showing salinity of plume at sea surface and areas within 100m, 200m and 300m radius away from the outlet.

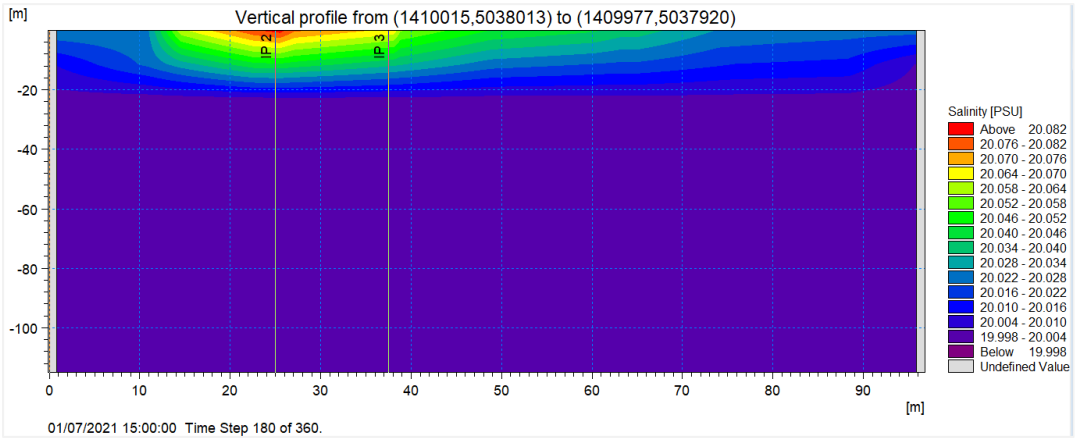

Figure 9 Section profile showing salinity dilution of the thermal plume. Location of outlet at IP2, point at surface where plume changes direction.

6.2 Scenario 2 - FPSO Adolo combined flows

(a) Temperature

Table 10 and Table 11 below, show the maximum predicted temperature values under the combined discharge of the PW effluent with a flow rate equivalent to 60,000bbl/d (0.1104 m^3/s) and the two CW effluents with flow rates of 2,875 m^3/h (0.7986 m^3/s) and 1,089 m^3/h

(0.3026 m^3/s) released from the STGs and process streams, respectively. Due to the two release locations being at a considerable distance apart, values in Table 10 are measured at distances 10m, 30m, 100m, 200m, 300m and 500m away from the PW outlet on the port side, while those outlined in Table 11 are measured at similar intervals away from the CW outlet on the starboard side (effluent from the STGs).

The model indicates that the plume comprising of the two effluents from the port side (PW and CW from process) initially plunges downwards and creates a mixing zone within the first 5m to 20m below the surface, where most dilution takes place. As shown in Table 10 below, the temperature difference (increase) within the first 10m away from the PW release location is in the order of +0.06°C and declines to about +0.01°C within the next 20m, indicating a rapid dilution close to the PW outlet. Beyond this area, the model predicts a further increase in temperature levels as the plume mixes with the CW effluent released from the starboard side. This temperature increase is in the order of +0.49°C measured at 100m away from the PW outlet and goes up to +0.61°C at 200m away, which is within the required standards of +/- 3°C. Note, however, that in reality, effluents from the two release locations might not be able to mix on the surface partly due to the presence of the FPSO and also due to the predicted rapid dilution of the plume originating from the port side, comprising PW and CW from the process stream. A simulation excluding the CW effluent released from the starboard side would be required to confirm the above; this is not within the current scope.

The model indicates that the CW effluent from the STGs, released from the starboard side initially plunges downwards and creates a mixing zone within the first 5m to 25m below the surface. The effluent remains buoyant and continues to dilute as it moves away from the release location with the ocean current. As shown in Table 11 below, the temperature difference (increase) within the first 10m away from the outlet on the starboard side is in the order of +3.32°C and declines to about +1.44°C within the next 20m. The temperature increase is in the order of +0.36°C measured at 100m from the PW outlet, which is within the required standards of +/- 3°C. Note that the maximum temperature value at 100m from the starboard outlet is observed south – southwest of this release location which indicates that it could be mostly due to the CW effluent from the STGs. A simulation excluding the other two effluent released from the port side would be required to confirm the above; this is not within the current scope.

Table 10 Maximum predicted temperature and corresponding ambient temperature increase at various distances away from the produced water outlet. Ambient temperature 24.5 °C.

Distance radius away from PW outlet (m)	Temperature (°C)	Temperature increase, ΔT (°C)	Point co-ordinates where max is observed (approximate)	
			Easting	Northing
10	24.56	+0.06	1410021.046	5038019.755
30	24.51	+0.01	1410003.714	5037984.493
50	24.54	+0.04	1409996.874	5037965.699
100	24.99	+0.49	1409996.610	5037914.203
200	25.11	+0.61	1409945.571	5037824.745
300	24.74	+0.24	1409754.167	5038162.684

The model indicates that the CW effluent from the STGs, released from the starboard side initially plunges downwards and creates a mixing zone within the first 5m to 25m below the surface. The effluent remains buoyant and continues to dilute as it moves away from the release location with the ocean current. As shown in Table 11 below, the temperature difference (increase) within the first 10m away from the outlet on the starboard side is in the order of +3.32°C and declines to about +1.44°C within the next 20m. The temperature increase is in the order of +0.36°C measured at 100m from the PW outlet, which is within the required standards of +/- 3°C. Note that the maximum temperature value at 100m from the starboard outlet is observed south – southwest of this release location which indicates that it could be mostly due to the CW effluent from the STGs. A simulation excluding the other two effluent released from the port side would be required to confirm the above; this is not within the current scope.

Table 11 Maximum predicted temperature and corresponding ambient temperature increase at various distances away from the CW from STGs outlet. Ambient temperature 24.5 °C.

Distance radius away from CW from STGs outlet (m)	Temperature (°C)	Temperature increase, ΔT (°C)	Point co-ordinates where max is observed (approximate)	
			Easting	Northing
10	27.82	+3.32	1409961.649	5037881.162
30	25.94	+1.44	1409964.839	5037845.900
50	25.22	+0.72	1409963.260	5037824.851
100	24.86	+0.36	1409942.391	5037774.836
200	24.70	+0.20	1409839.863	5037710.260
300	24.64	+0.14	1409774.034	5037634.500

The above are further indicated in Figure 10 and Figure 11 (note the differing x- and y-axis aspect ratios and colour scales) which show plans of the predicted change in temperature under the specified combined flow rates, as a function of horizontal distance away from the port and starboard outlets, respectively. Note that due to the very narrow temperature range in the case of the two effluents released from the port side, a plan showing all three effluents would not indicate any noticeable changes near this outlet.

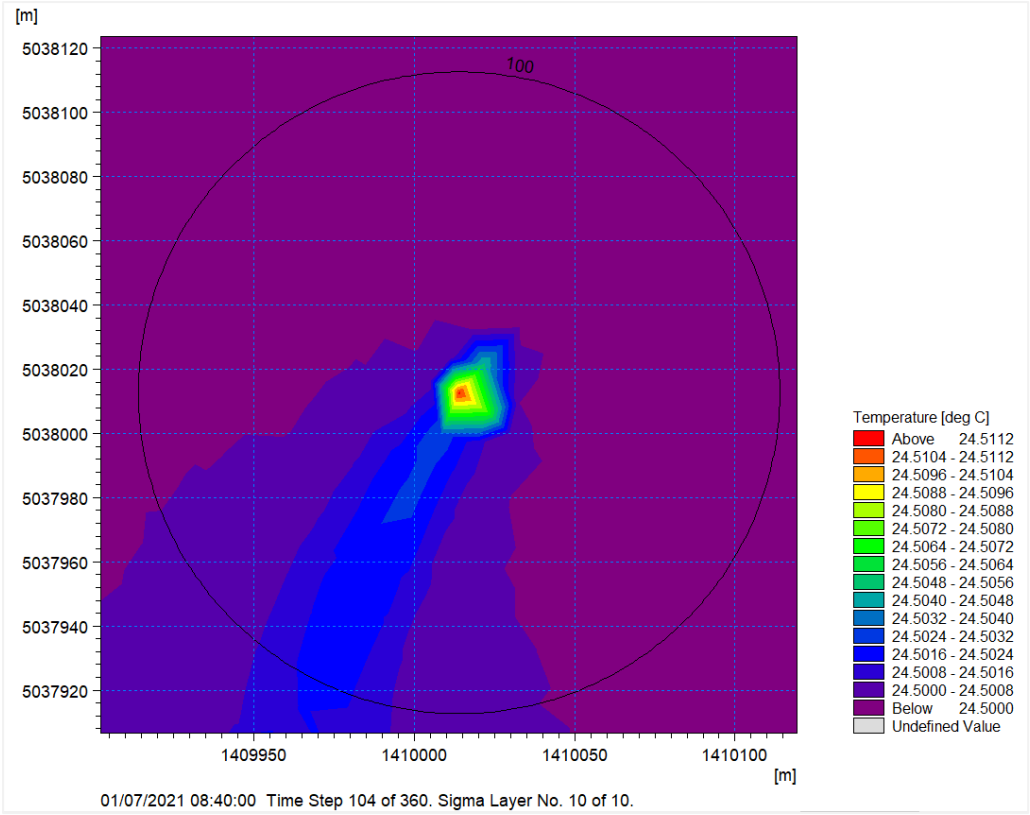

Figure 10 Plan showing temperature of plume at sea surface within 100m away from the PW outlet. (Note that the temperature differences are all extremely small.)

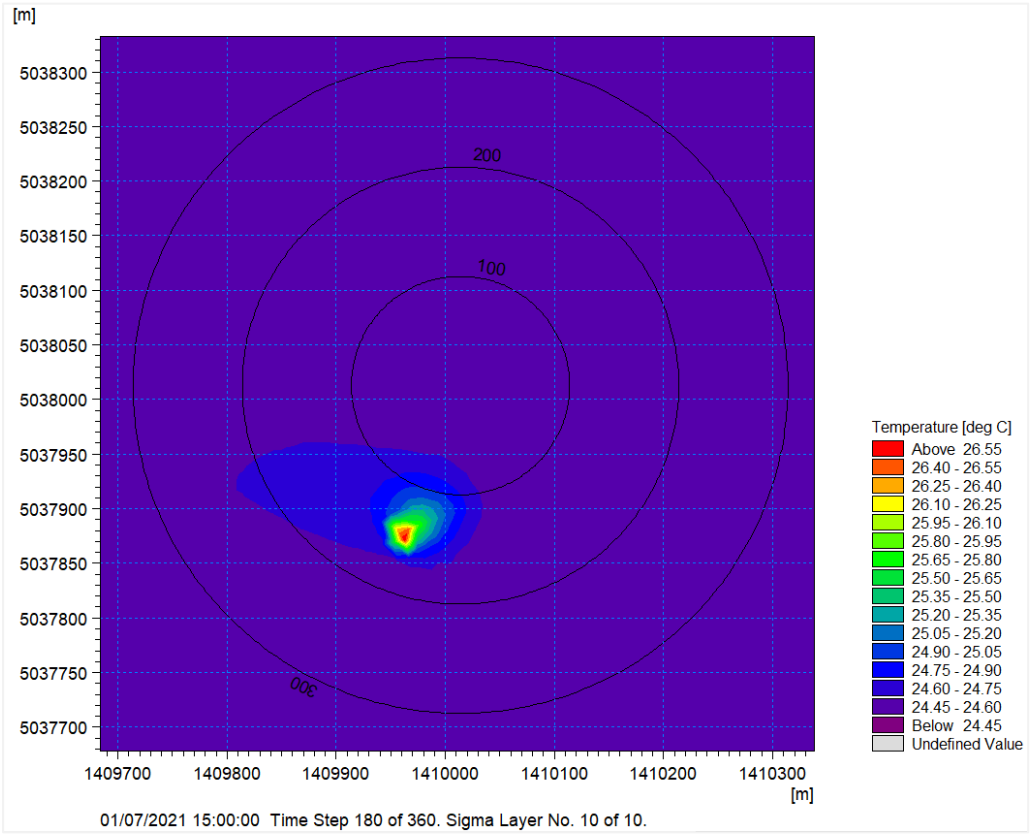

Figure 11 Plan showing temperature of plume at sea surface within 100m, 200m and 300m away from the PW outlet. (Note that the CW from STGs is being discharged at about 150m away from the PW outlet.)

Cross-sections cut at various points during the simulation (Figure 12, Figure 13) indicate that the mixing is likely to take place within the first 5m to 20m in the case of the combined effluents released from the port side and within the first 5m to 25m in the case of the CW effluent released from the starboard side. The model predicts that differences in temperature beyond this depth are insignificant.

Note that these predictions rely on the persistence of winds and currents in constant speed and direction over the whole simulation time and therefore do not account for any build-up of the plume.

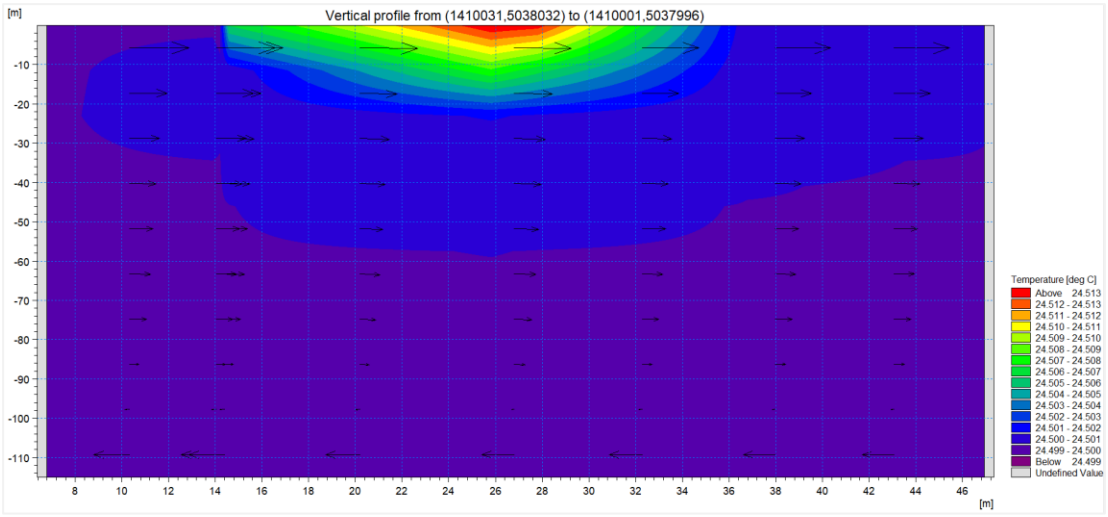

Figure 12 Section profile showing thermal plume at the release location of the PW and CW effluent from process stream and current. (Note that the temperature differences are all extremely small.)

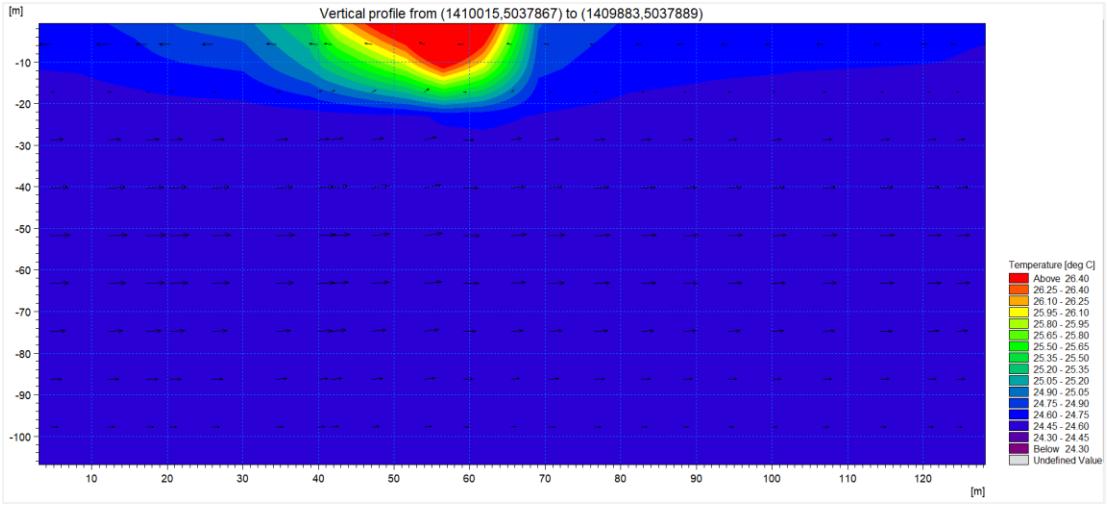

Figure 13 Section profile showing thermal plume at the release location of the CW from the STGs and current.

(b) Salinity

The maximum predicted salinity values under the combined flows of the three effluents measured at distances 10m, 30m, 50m, 100m, 200m and 300m away from the produced water

outlet are summarised in Table 12. Table 13 outlines the maximum predicted salinity values under the combined flows of the three effluents measured at similar intervals away from the CW from STGs outlet on the starboard side.

The model indicates that for the given flow rates and ambient conditions, the maximum predicted difference (increase) in salinity at a distance about 10m away from the PW outlet is about +0.40 PSU and gradually reduces to about +0.06 PSU at a distance approximately 30m from the discharge location. The predicted difference (increase) in salinity at 100m away from the PW outlet is about +0.01 PSU. The increase in salinity measured within the first 50m away from the release location of the CW from the STGs on the starboard side is largely insignificant. The model predicts a salinity increase within 100m from the CW outlet on the starboard side in the order of +0.03 PSU, indicating some mixing of the two plumes. As discussed above, however, this might not be possible due to the presence of the FPSO.

Table 12 Maximum predicted salinity and corresponding ambient salinity increase at various distances away from the produced water outlet. Ambient salinity 20 PSU.

Distance radius away from PW discharge (m)	Salinity (PSU)	Salinity increase, ΔS (PSU)	Point co-ordinates where max is observed (approximate)	
			Easting	Northing
10	20.40	+0.40	1410021.046	5038019.755
30	20.06	+0.06	1410003.714	5037984.493
50	20.03	+0.03	1410005.293	5037963.443
100	20.01	+0.01	1409978.138	5037919.326
200	20.01	+0.01	1409875.043	5037868.816
300	20.00	-	1409768.229	5037840.611

Table 13 Maximum predicted salinity and corresponding ambient salinity increase at various distances away from the cooling water from the STGs outlet. Ambient salinity 20 PSU.

Distance radius away from PW discharge (m)	Salinity (PSU)	Salinity increase, ΔS (PSU)	Point co-ordinates where max is observed (approximate)	
			Easting	Northing
10	20.01	+0.01	1409954.578	5037884.091
30	20.01	+0.01	1409959.788	5037903.635
50	20.01	+0.01	1409967.519	5037922.387
100	20.03	+0.03	1410004.578	5037960.693
200	20.00	-	1409774.819	5037961.765
300	20.00	-	1409659.136	5037821.996

Figure 14 and Figure 15 (note the differing x- and y-axis aspect ratios and colour scales) show the predicted change in salinity under the combined flow rates of the three effluents, as a function of horizontal distance away from the PW outlet, in plan and in section, respectively. Note that a very narrow salinity range was required for the colour shading to show any

difference in these plots. The predicted salinity increase near the release location of the CW effluent is generally insignificant.

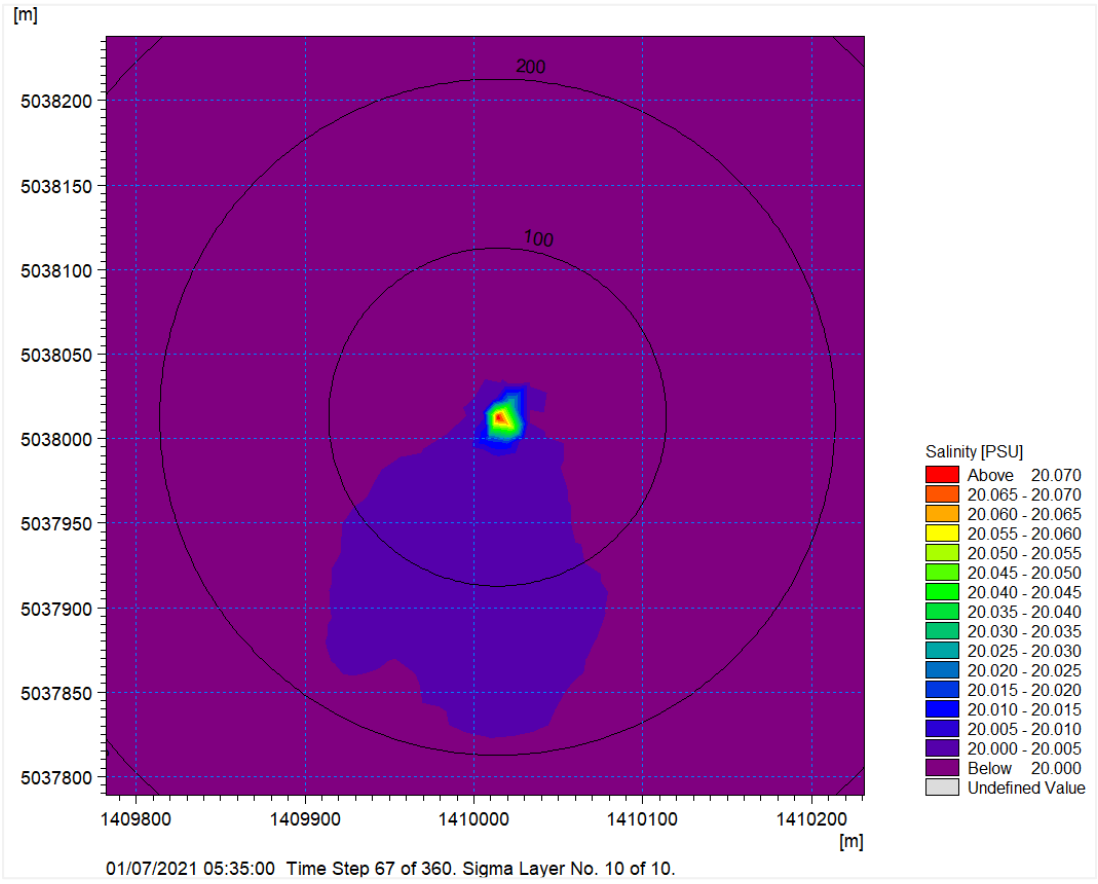

Figure 14 Plan showing salinity of plume at sea surface and areas within 100m and 200m radius away from the PW outlet.

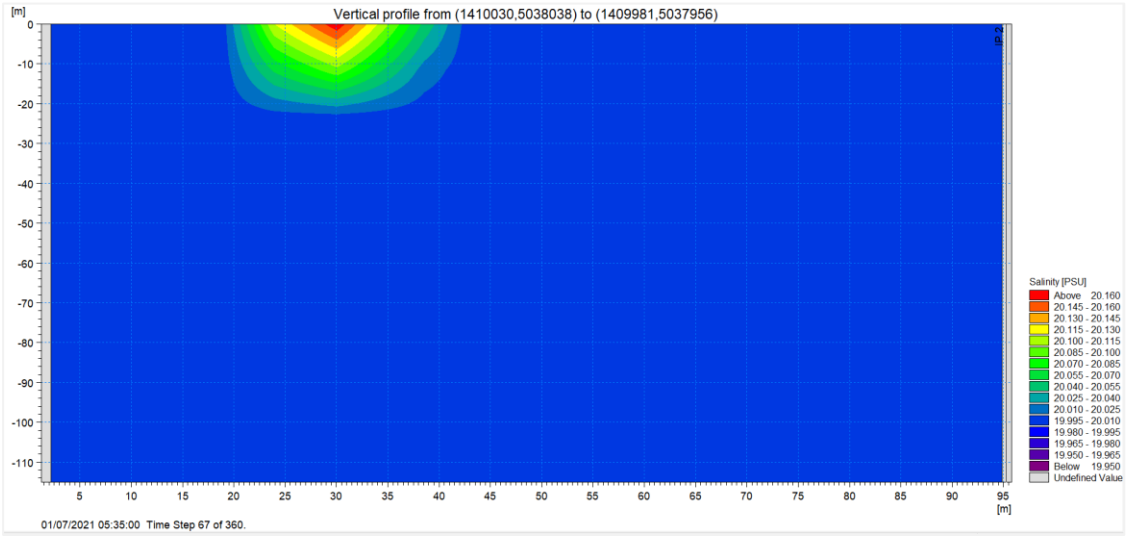

Figure 15 Section profile showing salinity dilution of the thermal plume near the release location of the PW and CW effluent originating from the process stream.

6.3 Scenario 3 – Hibiscus Alpha OI combined flows

(a) Temperature

The maximum predicted temperature values at Hibiscus Alpha OI, under the combined discharge of the PW effluent with a flow rate equivalent to 54,000bbl/d (0.0994 m^3/s) and the CW effluent with a flow rate of 458 m^3/h (0.1272 m^3/s) are summarised in Table 14 below. The values are measured at distances 10m, 30m, 100m, 200m, 300m and 500m away from the submerged PW outlet, on the surface and seabed layers. Measurements taken at similar intervals away from the CW outlet are identical and therefore omitted from the table.

Cross-sections cut at various points during the simulation indicate that the plume made up from the two effluents, initially plunges downwards creating a turbulent mixing zone in the first 10m – 20m, where most part of the dilution takes place. The plume appears to be sufficiently buoyant to rise to the surface, with further dilution taking place as it moves away from the release location. Under the specified current conditions, some part of the plume continues to move downwards affecting the whole of the water column.

The results shown in Table 14 indicate that the maximum predicted temperature difference (increase) on the surface, measured about 10m away from the location of the submerged PW outlet is approximately +1.85°C and reduces to about +0.36°C at a distance approximately 30m away from it. The estimated temperature difference (increase) measured on the seabed, about 10m and 30m away from the PW discharge is +0.34°C and +0.16°C respectively. This indicates that significant mixing of the two effluents takes place within the first few metres from the two outlets and close to the sea surface. The predicted temperature difference measured at 100m away from the submerged outlet is in the order of +0.11°C and +0.07°C on the surface (increase) and seabed respectively. These measurements are well within the required standard of +/- 3°C.

Table 14 Maximum predicted temperature and corresponding ambient temperature increase at various distances away from the produced water outlet. Ambient temperature 24.5 °C.

Distance radius away from PW outlet (m)	Temperature (°C)	Temperature increase, ΔT (°C)	Point co-ordinates where maximum is observed (approximate)	
			Easting	Northing
10 (surface)	26.35	+1.85	1410020.7950	5038019.9974
10 (seabed)	24.84	+0.34	1410021.0461	5038019.7549
30 (surface)	24.86	+0.36	1410011.3604	5037982.7980
30 (seabed)	24.66	+0.16	1410042.953	5038020.448
100 (surface)	24.61	+0.11	1410063.9750	1410063.9750
100 (seabed)	24.57	+0.07	1410049.7875	5037908.6768
200 (surface)	24.55	+0.05	1410167.1839	5037884.1263
200 (seabed)	24.54	+0.04	1409839.0511	5037915.7219
300 (surface)	24.54	+0.04	1410273.7827	5037862.6838
300 (seabed)	24.53	+0.03	1409719.4869	5038069.9265
500 (surface)	24.52	+0.02	1410467.129	5037801.375

500 (seabed)	24.51	+0.01	1409513.975	5038012.684

Figure 16 and Figure 17 (note the differing x- and y-axis aspect ratios and colour scales) show the predicted change in temperature under the specified flow rates, as a function of horizontal distance away from the source, in plan for the surface and seabed layer, respectively. The frames shown correspond to a point almost half-way through the simulation time. Similarly, Figure 18 is a section cut through the plume showing temperature difference within about a 50m radius from the release location. Note that a very narrow temperature range was required for the colour shading to show any difference in the plots shown below.

The predicted plume diameter appears to be similar on the surface and seabed as indicated by the last entries in Table 14 and in Figure 16 and Figure 17. On the surface, the model predicts a decline in plume temperature in the order of two decimal places compared to ambient levels, between the first 100m and 200m away from the PW source. The dilution continues as the plume moves further away from the source, but the temperature does not decline to ambient levels within 500m from the PW release location, with the predicted increase being about +0.02°C. Similarly, on the seabed, the predicted temperature increase is in the order of two decimal places within the first 100m from source, at about 70m. The predicted temperature increase measured at 500m away from the source is about +0.01°C.

Note that these predictions rely on the persistence of winds and currents in constant speed and direction over the whole simulation time and therefore do not account for any build-up of the plume.

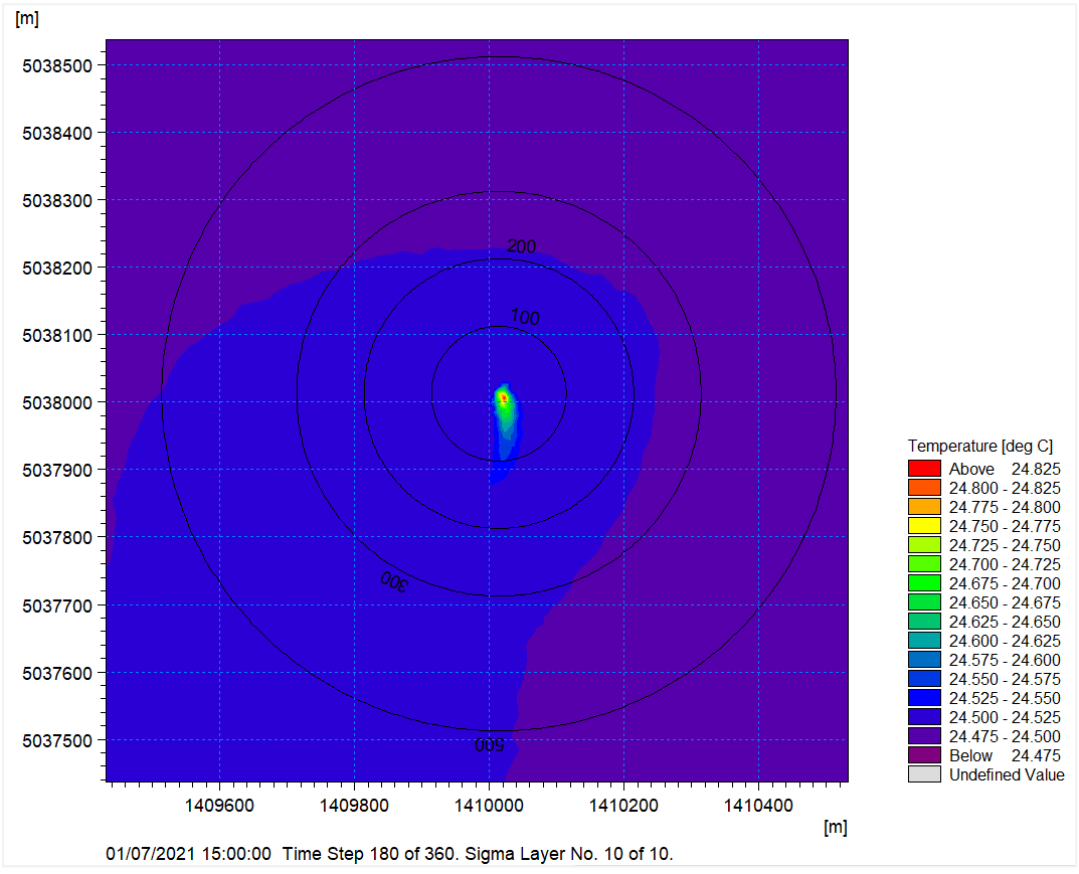

Figure 16 Plan showing temperature of plume at sea surface and areas within 100m, 200m, 300m and 500m radius away from the PW outlet midway through the simulation. (Ambient temperature 24.5°C)

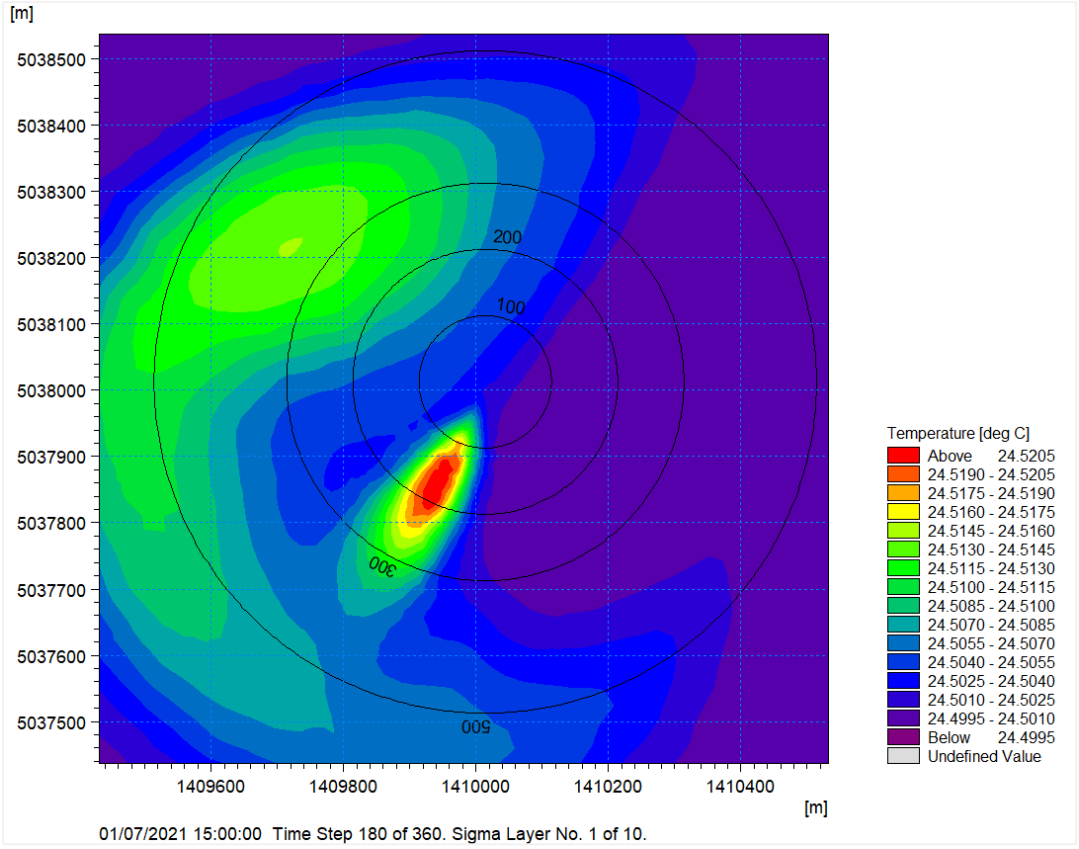

Figure 17 Plan showing temperature of plume at seabed and areas within 100m, 200m, 300m and 500m radius away from the PW outlet midway through the simulation. (Ambient temperature 24.5°C)

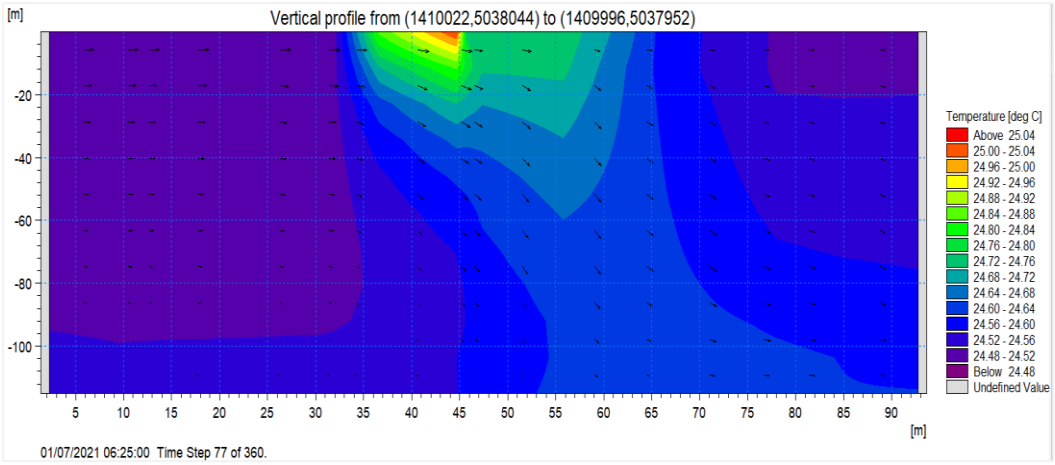

Figure 18 Section profile showing thermal plume and current. (Ambient temperature 24.5°C)

(b) Salinity

The maximum predicted salinity values at Hibiscus Alpha OI, under the combined discharge of the PW effluent with a flow rate equivalent to 54,000bbl/d (0.0994 m^3/s) and the CW effluent with a flow rate of 458 m^3/h (0.1272 m^3/s) are summarised in Table 15 below. The values are measured at distances 10m, 30m, 100m, 200m, 300m and 500m away from the submerged PW outlet, on the surface and seabed layers. Measurements taken at similar intervals away from the CW outlet are identical and therefore omitted from the table.

As discussed in section 6.3 (a) above, the model indicates that for the given flow rates, the plume comprising of the two effluents initially plunges downward creating a turbulent mixing zone in the first 10m – 20m, where most part of the dilution takes place below the sea surface. The plume reaches the surface and moves away with the current diluting further, with some part however, affecting the whole depth of the water column.

On the surface, the model indicates that the maximum predicted difference (increase) in salinity at a distance about 10m away from the PW outlet is about +7.08 PSU and rapidly reduces to about +1.40 PSU at a distance approximately 30m from it. Dilution continues downwards on the water column, with the salinity increase on the seabed layer being +1.31 PSU measured at 10m from the PW outlet, declining to a +0.62 PSU increase at 30m. The plume remains mostly buoyant and dilutes further with the ocean current, however, the model does not predict a decline to ambient levels within the first 500m. On the surface, the predicted difference (increase) in salinity at 100m is about +0.42 PSU and gradually reduces to +0.09 PSU at 500m. Similarly, on the seabed the model indicates an increase compared to ambient levels in the order of +0.26 PSU and +0.05 PSU measured at 100m and 500m radii from the PW outlet, respectively.

Table 15 Maximum predicted salinity and corresponding ambient salinity increase at various distances away from the produced water outlet. Ambient salinity 20 PSU.

Distance radius away from PW outlet (m)	Salinity (PSU)	Salinity increase, ΔS (PSU)	Point co-ordinates where maximum is observed (approximate)	
			Easting	Northing
10 (surface)	27.08	+7.08	1410021.046	5038019.755
10 (seabed)	21.31	+1.31	1410021.046	5038019.755
30 (surface)	21.40	+1.40	1410041.1643	5038000.0053
30 (seabed)	20.62	+0.62	1410042.1658	5038022.9444
100 (surface)	20.42	+0.42	1410063.9750	5037926.0813
100 (seabed)	20.26	+0.26	1410049.7875	5037908.6768
200 (surface)	20.24	+0.24	1410167.1839	5037884.1263
200 (seabed)	20.14	+0.14	1409839.0511	5037915.7219
300 (surface)	20.15	+0.15	1410273.7827	5037862.6838
300 (seabed)	20.10	+0.10	1409719.4869	5038069.9265
500 (surface)	20.09	+0.09	1410467.129	5037801.375
500 (seabed)	20.05	+0.05	1409513.975	5038012.684

7. Conclusions

The model results for all three scenarios analysed, indicate that the predicted difference (increase) in temperature associated with the routine discharge of the cooling water and/or produced water effluents for the combination of ambient and metocean conditions and discharge characteristics adopted is well within the industry defined 3°C threshold.

Further details on predicted temperature and salinity values for each of the three scenarios are outlined below.

7.1 Scenario 1 – Baseline model

The model results indicate that the predicted change (increase) in temperature approximately 10m away from the location of the outlet is about +0.02°C and reduces to about +0.01°C at a distance approximately 30m from the discharge location. The predicted temperature difference (increase) at 100m is in the order of 3 decimal points; which is not significant.

Similarly, the results indicate that the maximum predicted difference (increase) in salinity at a distance about 10m away from the outlet is about +0.25 PSU and gradually reduces to about +0.15 PSU at a distance approximately 30m from the discharge location. The predicted temperature difference (increase) at 100m is about +0.06 PSU.

7.2 Scenario 2 – FPSO Adolo combined flows

The model results indicate that the predicted change (increase) in temperature approximately 10m away from the location of the outlets on the port side (PW and CW effluent from the process stream) is about +0.06°C and reduces to about +0.01°C at a distance approximately 30m from the discharge location. The predicted temperature difference (increase) at 100m increased up to +0.49°C, indicating some degree of mixing with the CW effluent being discharged from the starboard side. It is considered possible that the two effluents will not be able to mix in reality, partly due to the presence of the FPSO's hull and also due to the rapid dilution of the plume originating from the port side. Limitations associated with the fact that the modelling platform does not accommodate floating structures do not allow for this notion to be confirmed with the current model.

The temperature difference (increase) within the first 10m away from the CW outlet on the starboard side is in the order of +3.32°C and declines to about +1.44°C within the next 20m. The temperature increase is in the order of +0.36°C measured at 100m from the PW outlet, which is also within the required standards of +/- 3°C.

The model results indicate that the maximum predicted difference (increase) in salinity at a distance about 10m away from the outlets on the port side is about +0.40 PSU and gradually reduces to about +0.06 PSU at a distance approximately 30m from the discharge location. The predicted temperature difference (increase) at 100m is about +0.01 PSU. The increase in salinity measured within the first 50m away from the release location of the CW from the STGs on the starboard side is largely insignificant. The model predicts a salinity increase within 100m from the CW outlet on the starboard side in the order of +0.03 PSU, indicating some mixing of the two plumes. As discussed above, however, this might not be possible in reality due to the presence of the FPSO.

7.3 Scenario 3 – Hibiscus Alpha OI combined flows

The plume made up from the two effluents appears to be sufficiently buoyant to rise to the surface, with further dilution taking place as it moves away from the release location. Under the specified current conditions, some part of the plume continues to move downwards affecting the whole of the water column.

The model results indicate that the maximum predicted temperature difference (increase) on the surface, measured about 10m away from the location of the submerged PW outlet is approximately +1.85°C and reduces to about +0.36°C at a distance approximately 30m away from it. The estimated temperature difference (increase) measured on the seabed, about 10m and 30m away from the PW discharge is +0.34°C and +0.16°C respectively. This indicates that significant mixing of the two effluents takes place within the first few metres from the two outlets and close to the sea surface. The predicted temperature difference measured at 100m away from the submerged outlet is in the order of +0.11°C and +0.07°C on the surface (increase) and seabed respectively.

The model results indicate that the maximum predicted difference (increase) in salinity on the surface and at a distance about 10m away from the PW outlet is about +7.08 PSU and rapidly reduces to about +1.40 PSU at a distance approximately 30m from it. Dilution continues downwards on the water column, with the salinity increase on the seabed layer being +1.31 PSU measured at 10m from the PW outlet, declining to a +0.62 PSU increase at 30m. The plume remains mostly buoyant and dilutes further with the ocean current, however, the model does not predict a decline to ambient levels within the first 500m. On the surface, the predicted difference (increase) in salinity at 100m is about +0.42 PSU and gradually reduces to +0.09 PSU at 500m. Similarly, on the seabed the model indicates an increase compared to ambient levels in the order of +0.26 PSU and +0.05 PSU measured at 100m and 500m away from the PW outlet, respectively.

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 7: Social Baseline

80834

RSK GENERAL NOTES

Project No.: 80834

Title: ESIA Addendum – Dussafu Block Development, Gabon
Chapter 7

Client: BW Energy Gabon

Date: 26 July 2022

Office: Helsby

Status: Rev_02

CONTENTS

TABLES

FIGURES

7 SOCIAL BASELINE

7.1 Purpose

In order to identify the expected social impacts of a project (Chapter 8) a baseline study is necessary to provide a clear description of the existing socio-economic conditions in the area that could potentially be affected by the project activities.

The objectives of this social baseline are to:

- understand the socio-economic, human rights and cultural heritage context in which the onshore and offshore activities related to the Project will take place
- identify information relevant to past, present and potential human rights issues and exposures
- identify sensitive socio-economic and cultural heritage receptors in terms of the Project's' potential impacts.

This chapter describes the socio-economic and human rights baseline and is structured as follows:

- identification of the study area for the Project
- description of the methods used for the compilation of the socio-economic and human rights baseline
- description of the socio-economic receptors, including trends and vulnerable receptors with regards to human rights
- scoring of receptor sensitivity to identify those receptors taken forward for more detailed assessment in the social impact assessment (SIA).

7.2 Definition of the Study Area

The primary AOI, unplanned / accidental events AOI, and country context AOI are described in Section 1.5.

To provide social context more information is provided below on the onshore components of the primary AOI, namely, the logistics base in the port of Port Gentil; the heliport in Port Gentil; and coastal communities adjacent to the Ruche EEA.

Logistics base

The logistics base is situated in the port of Port Gentil, which is surrounded by industrial units and companies, see Figure 7.1. An oil refinery lies directly north of the port. Hotels and restaurants are scattered along the main road near to the port. Along the coastline to the north lie sandy beaches and club houses. A special economic zone is situated northwest of the port.

Heliport

The airport and heliport are located on the western edge of the city of Port Gentil, see Figure 7.2. The area to the east and south is densely populated with both hotels, businesses and housing, whereas the area to the north-west is more sparsely populated and comprises forest and agricultural land.

Much of the area to the west of both the port and the airport is forested, with a number of rivers running through the area. There are some houses, places of worship, cafes / restaurants and farms located along the coastal road, south of Port Gentil airport, up to Pointe Renard.

Coastal communities

The primary AOI consists of a sparsely inhabited coastline with a small number of towns surrounded by a cluster of villages. The main towns are Omboule, Gamba, Mayumba and Ndindi, see Figure 7.3.

The accidental unplanned events AOI includes Port Gentil, which is the capital of the Province of Ogooué-Maritime and the second largest city in terms of number of inhabitants. The city is the economic capital of Gabon and produces about three-quarters of Gabon's wealth through its oil and timber industry. Gabon's only oil refinery, SOGARA (Société Gabonaise de Raffinage), is located in Port-Gentil. An overview of other settlements within the unplanned / accidental events AOI is provided in Figure 7.4.

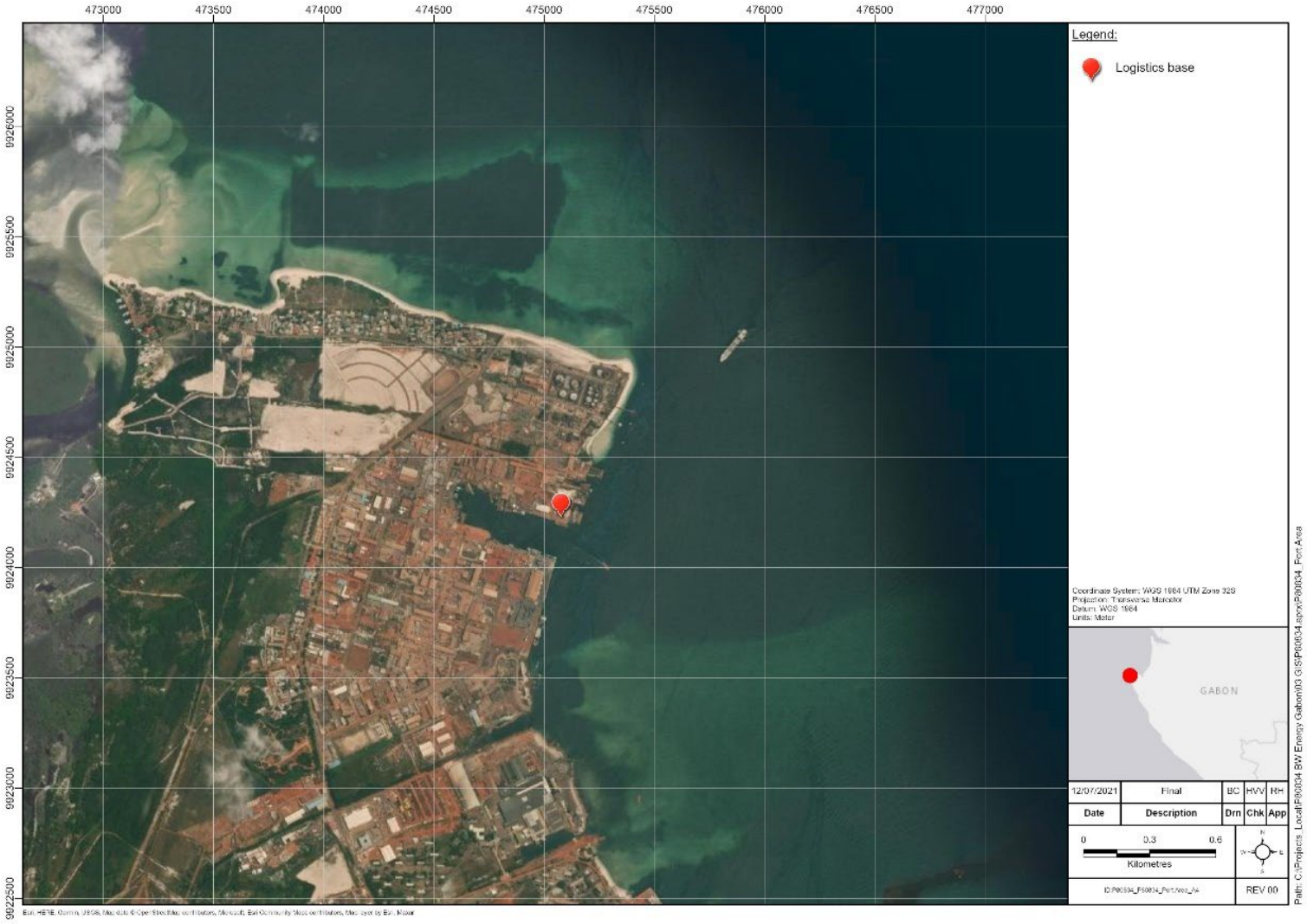

Figure 7.1: Location of logistics base in port of Port Gentil

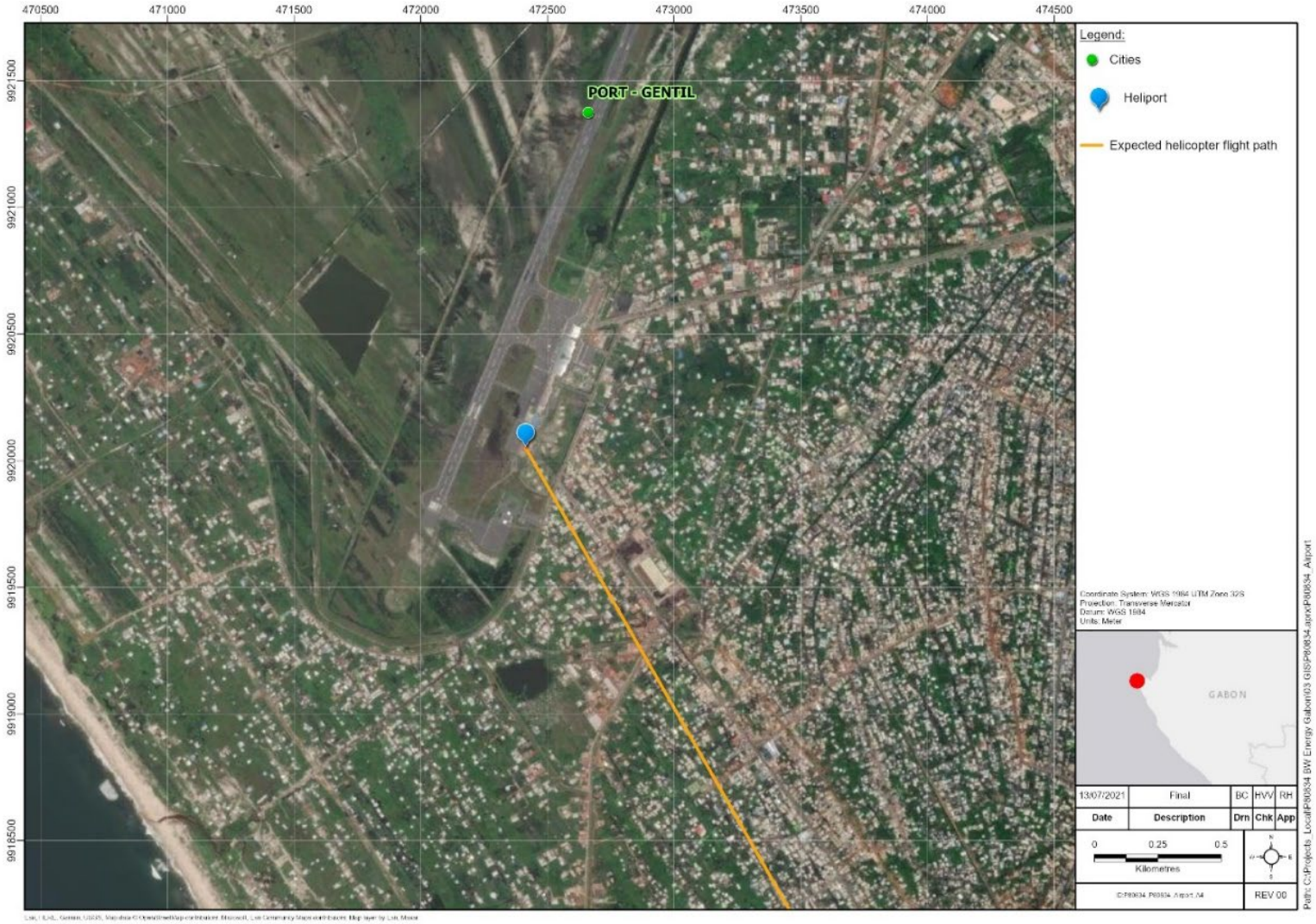

Figure 7.2: Location of heliport

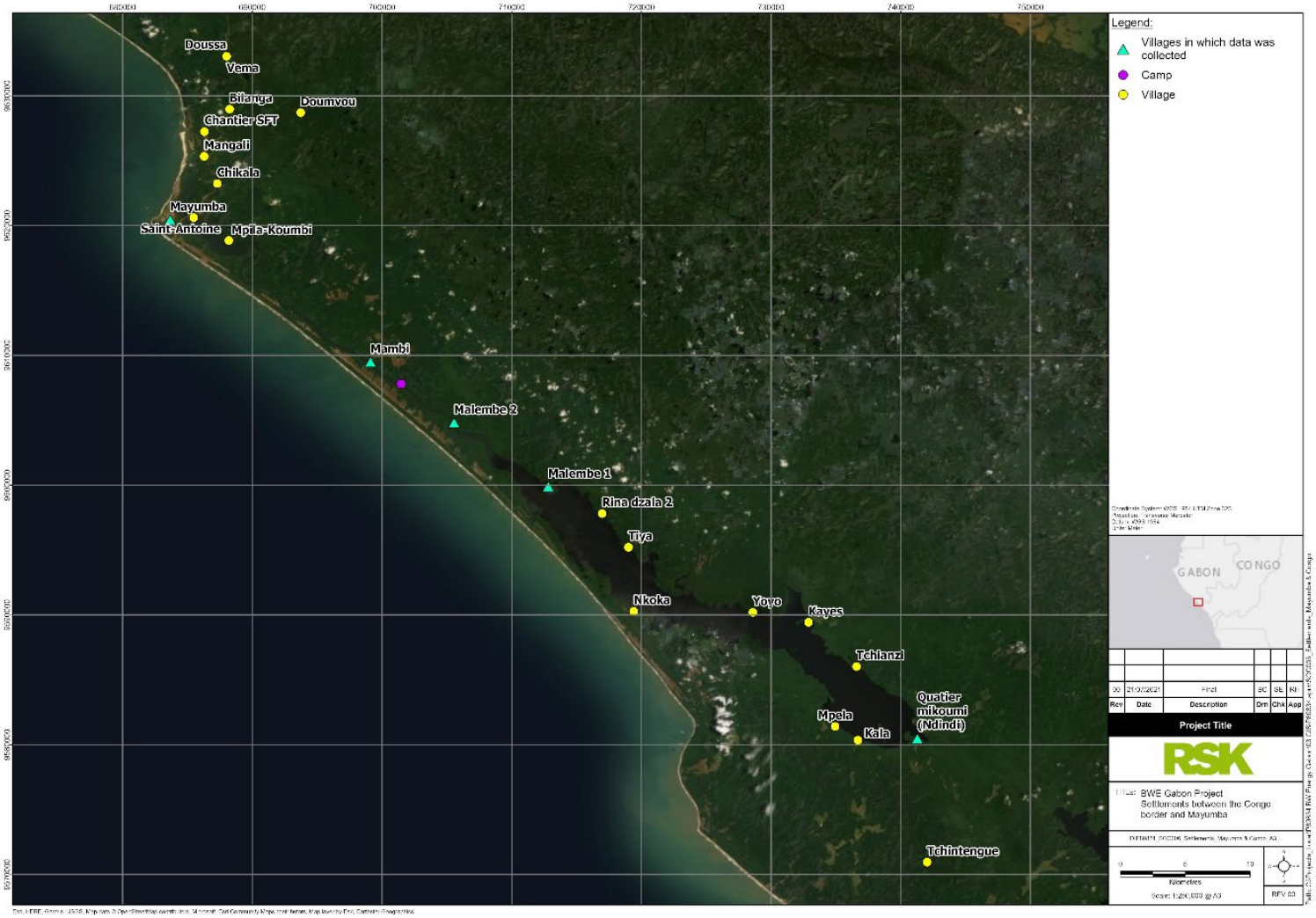

Figure 7.3: Location of villages on coast adjacent to Ruche EEA

Figure 7.4: Overview of socio-economic features in unplanned / accidental events AOI

Source: Adapted from Repsol, 2017

7.3 Methodology

7.3.1 Data collection

Both secondary and primary data were collected to compile the socio-economic baseline.

Secondary data collection

Quantitative and qualitative secondary data were collected from various sources to provide contextual information at national and provincial level and for the accidental events AOI. These included:

- the ESIA / NEIA documents for Tortue Phase 1, Tortue Phase 2 and Ruche Phase 1 and 2 (see Section 1.2)
- reports published by government bodies, research institutes and international organisations
- research papers published in academic journals
- public internet sources.

Primary data collection

Primary socio-economic data were collected for the primary AOI from key informants in Port-Gentil and a number of coastal villages near the Ruche EEA. Focus group discussions (FGD) and key informant interviews (KII) were held in the villages with women, local leaders, fishers and intertidal gleaners, health personnel, people involved in tourism and natural resource users. The villages were sampled based on their geographical position, the level of services provided, their diversity in livelihood strategies and their fishing activities. The sampled villages are presented in Figure 7.3 above. In the remainder of the report these villages will be referred to as the sample villages.

The data collection undertaken is presented below.

Table 7.1: KIIs at village / town level

Villages	Health staff	Fisherfolk	Natural resources	Hotel
Malembe 2	x	x	x	
Mambi		x	x	
Ndindi (Quartier Mikoumi)	x			x
Mayumba	x			x
Mayumba (Quartier Tchiole-Ndembe)		x		

Additional KIIs held in Mayumba, Port Gentil and Libreville include:

Mayumba:

- Coopérative Bana Pêche/Coopérative Ibengounou
- Prefect of Basse Banio department
- Prefect / Mayor of Ndindi

- Prefect / Mayor of Mayumba
- President of the departmental council
- Fisheries brigade, Mayumba.

Port Gentil:

- Office of Ports and Harbours of Gabon (OPRAG)
- Gabon Port Management (GPM)
- Artisanal Fisheries POG (CCPAP)
- Senegalese Fisheries Cooperative
- Gabonese (Itchoni-Nkala) Fishing Cooperative
- Provincial Directorate of the Merchant Marine.

Libreville:

- Gabon Bleu
- General Directorate for the Environment and Nature Protection (DGEPN)
- General Directorate of the Fauna and Protected areas (DGFAP)
- General Directorate of Fisheries and Aquaculture (DGPA)
- General Directorate of Aquatic Ecosystems (DGEA)
- Institute for Agronomic and Forestry Research (IRAF)
- World Wildlife Fund.

Table 7.2: FGDs at village / town level

Villages	Local leaders	Fisherfolk	Women
Malembe 2	x		x
Mambi	x	x	x
Ndindi (Quartier Mikoumi)	x	x	x
Mayumba (Quartier Tchiole- Ndembe)	x	x	x
Mayumba (Quartier Mabounda)	x	x	x

The data were collected by a field team between 31 March 2021 and 1 July 2021.

RSK personnel were unable to take part in the in-country field visit due to travel restrictions associated with the COVID-19 pandemic. Prior to the start of the primary data collection, interview guides were prepared to facilitate consistent data collection. RSK held a one-day workshop with the TEREA field team to familiarise them with the Project and train them in data collection techniques and the field survey approach. The workshop with TEREA was conducted remotely using Microsoft Teams.

Additional measures were taken during the conduct of primary data gathering meetings in Gabon to minimise the risk of COVID-19 transmission and protect the health and safety of all those involved. These measures are described in detail in the SEP (Appendix 11c).

Each FGD and KII started with a word of welcome followed by the distribution of a background information document (BID) (see Chapter 4) amongst participants, which provided an introduction to BWE's activities and explained the purpose of the social data collection. This was followed by the data collection using the various interview guides. Participants were provided with the opportunity to ask questions about the Project and the data collection process at the end of the meetings.

Observations

In addition to KIIs and FGDs, photographs were taken, and geographic coordinates recorded using smartphones equipped with the ArcGIS application Collector. Permission was asked prior to taking any photographs including people.

7.3.2 Data capture, management and analysis

The data collected by the field team during the KIIs and FGDs were entered into electronic templates.

Data were then:

- subjected to a qualitative analysis, interpreted, and triangulated (similar data from different sources were compared to verify reliability and validity)
- presented in figures, tables and maps where possible
- contextualised in a human rights framework
- disaggregated in terms of gender and vulnerable groups, where possible.

Where possible trends and key issues for the impact assessment were identified.

7.3.3 Data assumptions and considerations

For the purpose of the social baseline, it has been assumed that:

- no significant changes will take place in the study area between the time of data collection and the identification and assessment of social impacts
- data provided by the majority of informants are accurate and reliable.

The following data considerations have been encountered:

- recent secondary data, in particular government data, is not readily available
- disaggregated data for departments and towns is not readily available
- the supply chain for the Project may involve transport of goods and materials from other cities in Gabon, however, this has not been considered in this baseline
- the waste disposal site, and road transport between the logistics base and the waste disposal site, was not known at the time of the compilation of the report and is therefore not considered.

7.4 Socio-Economic Context

7.4.1 Political history

Gabon's earliest inhabitants, which were hunter gatherers, date back from 75,000 BC (Rich, 2015). From approximately 500 BC, Bantu-speaking farmers originating in present-day Cameroon migrated south and east across the African continent, leaving evidence of pottery and tools at Njole in central Gabon (Rich, 2015). Later Bantu migrations from the north included the Mpongwe in the 15th century and the Fang in the 18th century (The

Statesman's Yearbook, 2017). Today the Baka people, who inhabit the northern forests, are the only remaining hunter gatherers in Gabon.

Portuguese mariners reached Equatorial Africa in 1472. The next hundred years saw an expansion of Portuguese and Dutch trade, with iron, tools, cloth and tobacco exchanged for ivory, timber, rubber, and increasingly slaves (The Statesman's Yearbook, 2017). During the 17th Century, the region became a hub for Portuguese merchants trading with local chieftains for slaves from the interior who were shipped mainly to Brazil and Cuba (The Statesman's Yearbook, 2017).

French colonial domination in the Gulf of Guinea began in 1839 and lasted for 121 years (Yates, 2018), beginning with merchants along the coast, followed by explorers, missionaries and military conquerors in the interior, and finally administrators and setters. Gabon formally became one of the four territories comprising French Equatorial Africa (AEF) in 1910, alongside Chad, Central African Republic and Republic of Congo (Exotix Capital, 2019) After the second world war, Gabon was incorporated into the French Fourth Republic with its own assembly and representation in Paris. Investment in infrastructure, industry, agriculture, education and healthcare invigorated the economy (The Statesman's Yearbook, 2017). Following the collapse of the Fourth Republic in 1958, Gabon became an autonomous republic within the French Community (The Statesman's Yearbook, 2017). Leon Mba, a prominent member of the Fang ethnic group and former mayor of Libreville was elected as the country's first president in 1961 (Exotix Capital, 2019). His successor, Omar Bongo, one of the world's longest serving heads of state, ruled Gabon from 1967 until his death in 2009. He was succeeded by his son, Ali Ben Bongo Ondimba, who won presidential elections in 2009, 2011 and 2016 (Exotix Capital, 2019). The Gabonese Democratic Party (PDG), which has retained power since it was formed in 1968, holds a dominant position in Gabon's nominally multiparty system. The country's opposition parties are fragmented, and many are spinoffs of the PDG (Freedom House, 2018).

7.4.2 Human rights

The Charter of the United Nations and the Universal Declaration of Human Rights (UDHR), adopted by the General Assembly of the United Nations in respectively 1945 and 1948, lay the foundation for human rights standards. The Declaration sets out the fundamental human rights to be universally protected by all signatory nations.

Gabon is a signatory to the UDHR and a number of related conventions including: the International Covenant on Civil and Political Rights; the International Covenant on Economic, Social and Cultural Rights; the International Convention on the Elimination of All Forms of Racial Discrimination; the Convention on the Elimination of All Forms of Discrimination Against Women; the United Nations Convention against Torture; the Convention on the Rights of the Child; the International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families; and Convention on the Rights of Persons with Disabilities; all of which are binding to them.

The Constitution of the Republic of Gabon (2011) states the following:

'*The Gabonese people, conscious of its responsibility before God and history, animated by the desire to assure its independence and its national unity, to organize a communal life after the principles of national sovereignty, of pluralistic democracy, of social justice and republican legality,*

Affirm solemnly its attachment to human rights and to fundamental liberties that result from the Declaration of the Rights of Man and the Citizen of 1789 and from the Universal Declaration of Human Rights of 1948, consecrated by the African Charter of the Rights of Man and the Rights of Peoples of 1981, and by the National Charter of Liberties of 1990.

Proclaim solemnly its attachment to its profound and traditional social values, to its material and spiritual cultural patrimony, and to its respect of the liberties, rights and duties of the citizen.'

Article 1: "*The Gabonese Republic recognises and guarantees the inalienable and imprescriptible human rights, which are necessarily tied to the public powers […]".*

Article 83: "*The Constitutional Court is the High Authority of the State in constitutional matters. It is the judge of the constitutionality of laws and of the legality of elections. It guarantees the fundamental human rights and public liberties of the country […]".*

Article 95: "[…] The respect and dignity of human rights by the organs of information and communication […]".

The Constitution also confirms the abolishment of the death penalty, the prohibition of slavery, trafficking and forced labour, torture and inhumane treatment, and discrimination. Equality, gender parity, freedom of expression and of the press, right to public information, right to religion, legal rights, data protection, freedom of movement, and the right to protest are also specified.

Gabon is currently a member of the United Nations Human Rights Council (UNHRC), a body that promotes human rights

Human rights relevant for this socio-economic baseline, are outlined in Table 7.3.

Table 7.3: Human rights relevant to the social baseline

Workers' rights
• Non-discrimination (Articles 1, 2 and 23(2) of UDHR) • Freedom from child labour (Articles 25(2) and 26(1) of UDHR) • Freedom from forced labour (Article 4) of the UDHR) • Freedom of association (Articles 20 and 23(4) of the UDHR) • Just and favourable working conditions (Article 7 of the UDHR) • Safe and healthy working conditions (Article 7 of the UDHR) • Contractor and suppliers' workers' rights (All of the above-mentioned rights)
Human rights of community members
• Right to information (Article 19) • Community safety (Article 25(1) of the UDHR) • Community health (Article 25(1) of the UDHR) • Water and environment (Article 25(1) of the UDHR)1 • Cultural rights (Article 27 of the UDHR)

[1] Article 25(1) of the UDHR protects the right to health of community members, which can be affected by the availability and quality of water. However, the human right to water was only recognised by the UN as a stand-alone right in 2010.

- Community investment (Articles 25 and 26 of the UDHR)
- Freedom of movement (Article 13 of the UDHR)
- Adequate standard of living (Article 25 of the UDHR)
- Right to education (Article 26 of the UDHR)
- Security and human rights (Article 3 of the UDHR)
- Women's rights (Articles 1, 2 and 23(2) of UDHR)
- Access to remedies / grievance mechanisms (Articles 6, 7 8 and10 of the UDHR)

Despite its ratification of the UDHR, its commitments to human rights in its Constitution and is membership of the UNHRC, Gabon is still grappling with a number of human rights issues, as outlined below.

7.4.2.1 Integrity of people

The constitution and law prohibit arbitrary arrest and detention without warrants, torture and the use of excessive force. However, Amnesty International has observed some physical abuse of detainees as well as arrests without warrants and detention without charge or trial. Detention conditions are considered to potentially cause health risks to prisoners. Cases of security forces extorting money from noncitizen Africans working legally in the country have also been reported (Amnesty International, 2021).

7.4.2.2 Freedom of speech

In Gabon both the Constitution and the law protect the freedom of speech. Freedom of conscience, thought, opinion, expression, communication and religious freedom, are guaranteed to all, subject to respect for public order. However, authorities have occasionally used libel and slander laws to restrict media criticism of the government. Some news outlets have been practicing self-censorship to avoid legal repercussions for critical reporting (US State Department, 2020a). The 2017 communications code contains provisions that restricted media freedom, including an obligation for media to promote "the country's image and national cohesion (Freedom House, 2021).

7.4.2.3 Freedom of assembly

The freedom of assembly is protected by the Gabonese constitution and law. However, some civil society activists have stated that they chose not to ask permission to hold public meetings because they are concerned that permission would be denied. Cases are known of authorities refusing to approve permits or by blocking access to planned meeting spaces. (US State Department, 2020a).

7.4.2.4 Corruption

According to the Gabonese law corruption by officials is against the law, but according to media and NGOs, officials have on occasion engaged in corrupt practices with impunity (US State Department, 2020a).

7.4.2.5 Indigenous people

Although indigenous ethnic groups (such as the Babongo, Baghama, Baka, Bakoya, and Barimba) are by law entitled to the same civil rights as other citizens, they still suffer from discrimination. They remain largely outside of formal authority, keeping their own traditions,

and local decision-making structures, and do not have ready access to public services. Indigenous people do not benefit from any specific government programmes or policies to assist them (US State Department, 2020a).

7.4.2.6 Gender

Women face several obstacles to gain legal, social, and cultural equality. Married women are hampered in opening a bank account, or own assets without their spouse's permission. This is particularly apparent in rural areas. Furthermore, Gabonese law requires that women receive permission from their spouses to apply for a passport and travel abroad (Verité, 2018). Despite gender-based inequality, women do own property and businesses, and participate in politics, albeit at a lower rate than their male counterparts (Verité, 2018).

Despite full legal rights on paper, many women still suffer discrimination based on customary laws relating to marriage, divorce and inheritance; 22 percent of women ages 18-24 years were child brides, first married before the age of 18 (BTI, 2020).

FGDs in the sample villages showed that in rural areas women's main tasks remain largely reproductive, including care and education of children, collecting water and wood, cleaning and cooking. Women have much less opportunities for employment than men. However, the FGDs also revealed that in most households both men and women take charge of household budgets and decisions and that women are in charge of marketing the household's production. However, community decisions are still generally taken by men.

Gender based violence

Sexual harassment and rape are reportedly widespread problems across Gabon (Verité, 2018).

Female domestic workers, a number of whom are trafficked women and children, have been sexually harassed, with little recourse to legal help or justice (Amnesty International, 2021).

The law criminalises rape and convicted rapists face penalties of ten to 20 years of imprisonment and a fine. However, rape cases are rarely prosecuted, and spousal rape is not covered in the law. This topic has remained taboo, and women generally opt not to report it due to shame or fear of reprisal. The same applies to cases of domestic violence (US State Department, 2020a).

During FGDs verbal violence against women was identified in all sample communities; alcohol abuse and jealousy were provided as the primary reasons for this. In Mayumba's quartier of Tchiole-Ndembe it was reported that women have support from neighbourhood chiefs in terms of gender-based violence, however no support services were mentioned in the other sample communities.

7.4.2.7 Workers' health safety and welfare

The right to work is recognised by both the Constitution and by law No. 3/94 of 21 November 1994 establishing the Labour Code. In particular Article 2 which states that: "*Everyone, including the disabled, has the right to work. Vocational training is an obligation of the State and for employers*". In addition, Gabon has ratified 41 International Labour Organisation (ILO) conventions, which also recognise the universal right to work.

However, in practice workers do not always receive adequate information about their terms of employment and their labour rights. According to the US State Department (2020a) violations of wage payments, overtime and occupational health and safety standards occur, in particularly in the informal sector.

Employment contract

In Gabon, an employment contract can be established in any written or verbal format. Article 19 of the of the law No.3/94 states: "*An employment contract is freely concluded, either verbally or in writing, subject to the compulsory production of a medical certificate attesting that the candidate for the job in question is free from any contagious disease and physically fit to perform the functions for which he is destined*".

The lack of written contracts can cause insecurity and confusion about terms and conditions of employment.

Working hours

The Gabonese Labour Code states that in every private and public establishment, the working week consists of a 40-hour work week with a minimum rest period of 24 consecutive hours. Hours worked beyond the legal working time are considered overtime and give rise to additional payment." (Article 165). Decrees and derogations regulate work in other sectors, in particular that of agricultural enterprises. The law also provides for paid annual holidays. Article 185 states: "Unless there are more favourable contractual provisions, workers acquire the right to paid leave at the rate of two working days per month of actual service. Workers under the age of 18 are entitled to two and a half working days". There are also provisions in the law that regulate overtime and night shifts (US State Department, 2020a). These conditions are however not always complied with.

Wages

In Gabon, every worker is entitled to a minimum monthly income (RMM). The RMM is made up of the minimum wage (Salaire Minimum Interprofessionnel Garanti - SMIG) which is 80,000 Central Africa francs (FCFA) and bonuses (in particular accommodation and transport). Every employee must receive at least 150,000 FCFA net monthly, for a 40-hours workweek. A "solidarity premium" the amount of which is equal to the difference between the minimum monthly income and the gross salary of the worker is paid by the employer to the employee if the monthly income does not reach 150,000 FCFA francs (LegiGabon, 2020).

If there is a collective agreement, the employer must pay the agreed minimum if it is greater than the amount of the minimum wage.

Gabon has yet to ratify the Minimum Wage Fixing Convention, 1970 of the ILO which establishes: "*a system of minimum wages which covers all groups of wage earners whose terms of employment are such that coverage would be appropriate*" (ILO, 2021). Authorities have been unable to adequately enforce wage laws and labour inspections are infrequent. Minimum wage laws are generally not enforced in the informal sector, which accounts for the vast majority of workers (US State Department, 2020a).

Equal opportunities

Article 2 of the Constitution states: "*The Gabonese Republic ensures the equality of all citizens before the law, without distinction of origin, race, sex, opinion or religion*". The

government has also ratified the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW).

The Gabonese labour code prohibits discrimination with respect to employment and work conditions based on race, colour, sex, religion, political opinion, disability, national origin or citizenship, or social background. However, it does not address discrimination based on sexual orientation, gender identity, age, or language.

Even though the Gabonese law prohibits discrimination in terms of employment, married women cannot take up employment without their husbands' permission (IMF, 2021). On average, women earn less than men annually; currently, there are no laws present in Gabon that require equal pay for equal work (Verité, 2018).

Gabonese women generally have lower levels of education which is a major obstacle to gaining access to higher paid jobs (World bank, 2021a). The percentage of businesses with majority female ownership or where female employees are in management positions is lower in Gabon than the average in Sub-Saharan Africa (see Figure 7.5).

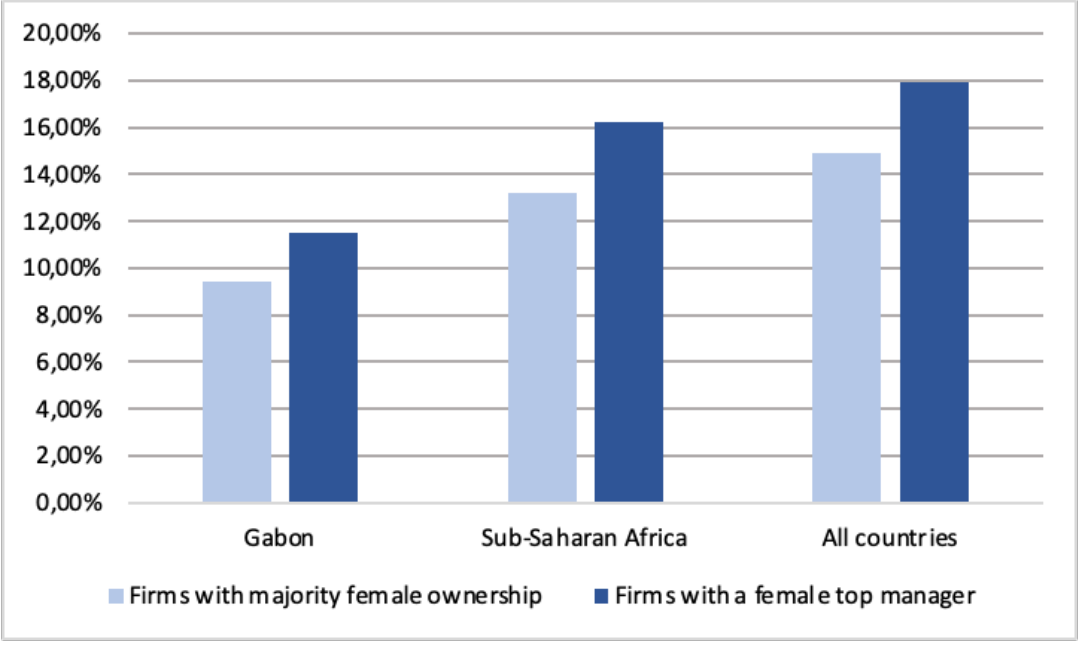

Figure 7.5: Percentage of women in management positions and firms with female ownership

Source: World bank (2021a)

A National Gender Equality and Equity Strategy was adopted in 2010 to promote equality of opportunity and treatment between men and women with respect to education, vocational training, employment, and occupation. However limited budget has prevented the government from achieving the objectives of the strategy (BTI, 2020).

Other vulnerable groups facing discrimination in the workplace include non-citizens, people with disabilities, people with HIV/aids as well as the indigenous ethnic groups (the Babongo, Baghama, Baka, Bakoya, and Barimba).

Non-citizens are often paid less than citizens for the same work and require longer working hours. They are often hired on a short-term, casual basis to avoid paying taxes, social security contributions, and other benefits (US State Department, 2020a).

Social security

The Gabonese social security system is made up of four branches: disease, work accidents and occupational diseases; family benefits (including maternity); old age, invalidity and death; and (survivors) pensions. Under the Labour Code employers are responsible for maintaining wages in the event of illness.

The National Social Security Fund (CNSS) is a private body that manages the social security system, under the joint supervision of the Ministry of Health and the Ministry of Economy, Finance and National Solidarity. It covers work accidents and occupational diseases, pensions, medical evacuation abroad as well as the issuance of family benefits. The CNSS is compulsory for any salaried activity and must be declared within a maximum period of eight days after hiring an employee, regardless of the type of contract (temporary or permanent). However, a number of employees are not covered by the CNSS.

Occupational health and safety

The Ministry of Health establishes occupational safety and health standards whilst the Ministry of Employment, Public Administration, Labour, and Professional Training is responsible for enforcing safety and health standards in the formal sector.

Inspectors have the authority to make unannounced inspections and recommend sanctions, where deemed necessary. However, the number of labour inspectors was considered insufficient to enforce compliance, in particular with regards to the COVID-19 mitigation measures.

In the formal sector, employees are entitled to submit complaints with regards to health and safety standards. Workers are entitled to remove themselves from situations they perceive as a health or safety risk without fear of losing their job. However, these provisions are not enforced in the informal sector or in sectors where the majority of the labour force is foreign, such as in the mining, timber and domestic work sectors. Cases are known of foreign labourers working under substandard conditions and dismissals without notice or recourse (US State Department, 2020a).

Right to assembly

The Constitution recognises the right of workers to form or join a union of their choice (Article 1 of the constitution of 199 amended in 2011): "*The right to form associations, political parties or groups, syndicates, companies, establishments of social interest as well as religious communities is guaranteed to all within the conditions fixed by the law*". Unions in Gabon include amongst others the Gabonese Confederation of Free Trade Unions (CGSL) and the Gabonese Trade Union Confederation (CSG). There are no special laws or exemptions from regular union laws in the country's two export-processing zones (US State Department 2020a).

Anti-union discrimination is illegal, and the law provides for reinstatement of workers dismissed for union activities. Unions must register with the government to obtain official recognition, and the government routinely grants registration. Agreements negotiated by unions also apply to non-union workers. The US State Department, in its 2020 report,

stated that the freedom of association and the right to collective bargaining were not always respected. Some unions were politically active and have been accused of siding with the opposition parties; some employers have created and controlled unions. Some trade unionists in both the public and private sectors have complained of occasional discrimination, including the blacklisting of union members, unfair dismissals, and threats to workers who are unionised (US State Department, 2020a).

Although the law provides workers with the right to strike, it places restriction on the execution of that right. Strikes may be called only after eight days' advance notification and only after mandatory arbitration fails. Public-sector employees' right to strike can be restricted if the government determines that it may pose a threat to public safety.

The law does not define all the essential-services sectors in which strikes are prohibited; however, armed services are prohibited from unionising and striking. The law prohibits government action against strikers who abide by the notification and arbitration provisions and excludes no groups from this protection. However, some labour union leaders reported that the majority of labour violations stemmed from illegal dismissals, including of workers on strike, leaving them without social security and insurance benefits (US State Department, 2020a).

Child labour

Gabonese law prohibits children under the age of 16 to be employed without the expressed consent of the Ministry of Employment, Public Administration, Labor, and Professional Training; the Ministry of Education; and the Ministry of Health (Article 177 of the Labor Code; Article 2 of the Decree on Establishing Individual Exceptions to the Minimum Age for Admission to Employment (22-24)). By law children younger than 16 years of age may perform light work with parental permission, however the Gabonese law does not specify the limit of the number of hours, nor does it define the activities that are considered as light work, nor establish a minimum age for light work. The law provides for penalties commensurate with those for other serious crimes if children are forced to work but does not cover children in informal employment.

In 2012, the estimated percentage of working children in Gabon between the ages of 5 and 14 was 22,3 percent with 23,3 percent of 7 to14 year old's combining work and school (Refworld, 2017). Child labour is generally considered a result of lack of education. Even though the Constitution guarantees free compulsory primary education, in practice students must pay for supplies and school fees, which may be prohibitive. The lack of school infrastructure as well as the shortage of teachers in certain areas plays a part in school dropout. Another cause of lack of schooling is the need to present birth certificates for school enrollment. Indigenous groups and children living in remote areas are most likely to not have birth certificates affecting their access to education (Refworld, 2017).

Human trafficking

Gabon is considered to be a tier two country by the United Nations, meaning that the country's government does not fully meet the minimum standards for the elimination of trafficking.

Gabon is considered to be a destination and a transit country for victims of trafficking from other countries in Central and West Africa. The effect of the March 2020 lock down in order to slow the spread of the COVID-19 pandemic likely increased the vulnerability of Gabonese children, informal sector workers, and immigrants to exploitation. Poverty

continues to represent a key risk factor in forced labour and sex trafficking in the country (US State Department, 2020b).

Reports suggest that trafficked children are forced into the informal sector as street vendors, often selling beauty products and fruits. Girls are forced into domestic service, markets, or roadside restaurants whilst boys are forced to work in sectors such as the fishing, agricultural and mining industry, transportation, wildlife trafficking, car mechanics and cleaning of public spaces.

It has also been reported that smugglers who assist foreign nationals to enter Gabon or traverse the country to Equatorial Guinea, subject those irregular migrants to forced labour or commercial sex after they enter the country (US State Department, 2020b).

However, over recent years Gabon has made efforts to comply with the minimum standards for the elimination of trafficking that were put in place by the United Nations through its 'International Framework for Action to Implement the Trafficking in Persons Protocol' (UNODC, 2009). These efforts include the amendment in 2019 of its penal code, to include the trafficking of persons as an offense, although the law still does not criminalise all forms of trafficking. The penal code limited the definition of trafficking in persons to crimes involving an "*exchange for remuneration or any other advantage or the promise of remuneration or other advantage*," therefore not taking into consideration all forms of trafficking.

The country is also increasingly prosecuting suspected traffickers; is facilitating the training of more officials and civil society members; and finalised and adopted its anti-trafficking national action plan (US State Department, 2020b)

7.4.3 Governance and administrative structure

Gabon is an independent, secular, and sovereign republic, with a presidential government system (Constitute Project, 2011). The country comprises an executive branch, a bicameral legislative branch, and a judicial branch made up of four specialised supreme courts (Verité, 2018).

The executive branch includes the President, the Prime Minister and Council of Ministries. The judicial branch includes the supreme court, the high court of justice, an appellate court and a state security court.

The President of the Republic is head of state, holds executive power, and is the supreme chief of the security and defence forces in Gabon; he presides over the Superior Council of National Defence and Public Security and the committees of defence and security (Constitute Project, 2011). A presidential term typically lasts seven years, and a President is elected by universal and direct vote.

The Vice-President of the Republic is nominated by the President and provides a supporting role. The Vice-President may be chosen from the members of parliament, or from outside of the legislature. The President of the Republic also nominates the Prime Minister, who is head of government. The Prime Minister directs the actions of the government and assures the execution of the laws. The Prime Minister exercises regulatory power and nominates civil and military posts of the State (Constitute Project, 2011). The president, together with the Prime Minister and the Government, determines the policies of the nation.

Legislative power in Gabon is exercised by the parliament, which is composed of two chambers: the national assembly and the senate (Constitute Project, 2011). Members of the Senate, which is presently controlled by the PDG with 98 seats, are indirectly elected by councillors (World Bank, 2021b). In the Assembly, 111 seats are elected by popular vote and nine are reserved for presidential appointments. The Assembly serves for five years, whilst Senate members are appointed for six years (Exotix Capital, 2019).

The administrative structure of Gabon is defined by Law 12/75 of 18 December 1975. Based on the principle of decentralisation, the country is divided into the following administrative entities headed by a representative appointed by the government:

- nine provinces headed by a governor; provinces are divided into:
- 48 departments (*préfectures*) headed by a prefect (departments also have an elected council); departments are divided into:
- 26 districts (*sous préfectures*) headed by a sub-prefect, divided into:
- 164 cantons, each headed by a canton chief, further subdivided into:
- 900 village groupings (*groupement de villages*) headed by a chief, further subdivided into:
- 2743 villages headed by a village chief.

In addition to the above divisions, there are 52 communes (towns) each headed by an elected mayor and a municipal council. Communes can be subdivided into sectors (*quartiers*) and sometimes further subdivided into *blocs*.

The provinces and departments included in the primary and unplanned/accidental events AOIs are presented in Table 7.4.

Table 7.4: Administrative entities relevant to the primary and unplanned/ accidental events AOIs

Province	Department / prefectures
Ogooué- Maritime Principal Town: Port-Gentil	Bendjé Principal town: Port Gentil
	Etimboué Principal town: Omboué
	Ndougou Principal Town: Gamba
Nyanga Principal Town: Tchibanga	Basse Banio Principal town: Mayumba
	Haute Banio Principal village: Ndindi

Administrative organisation in the sample villages

The sample villages are headed by a chief, appointed by the prefect of the department, who represents the state and its branches. He/she has legal authority and is the official representative of the village, in particular the state. He/she handles the majority of disputes and problems at the village level. Disputes which cannot be settled by the village chief are transmitted to the chief of the *groupement de villages*, and when necessary to

the canton chief, to end up in court if solutions are not found at the cantonal level. The basic social unit of the administration is the so-called nuclear family (parents and children).

In the majority of villages, the authority of the village chief is relatively strong because the majority of chiefs are descendants of the founding lineages of the villages. The village chiefs have real power and a legitimacy within the community to settle internal village disputes. However, some chiefs, being relatively old and less educated, may lack the ability to negotiate with outsiders on behalf of the community. They are therefore sometimes replaced by local notables or younger more educated community members in negotiations with outsiders to the village.

7.4.3.1 Traditional governance

Clans

In general, the social organisation of a village is informed by the clan, which consists of a group whose members recognise themselves as descendants of a common mythical ancestor. Membership of a clan is a privilege inherited at birth. An individual always belongs to his/her uncle's clan.

The village land (including forests, lakes or rivers) is considered sacred and provide a mythical link between ancestors and members of the community. In this mythical sense of space, the elders serve as intermediaries between the ancestors and the community, especially in terms of major village events or in decision-making.

Despite the many changes experienced by village communities (abandonment of ancestral lands, introduction of market relations, etc.), traditional power retains its influence in the way the community is organised. For example, the land allocation for particular village sites often obeys rules laid down by the elders.

Lineage

A lineage refers to all the descendants of a common ancestor. In the sample villages the lineage is matrilineal. Despite the presence of the village chief, the lineage governs all the relations of the village population (without ethnic distinction) from the management of disputes to the succession of property. The latter always calls for a committee of elders (representative of each lineage in the village) when dealing with disputes. Village conflicts are therefore more often settled amicably, or through tradition, rather than through rule of law.

The limits of the lineage power and the modern (administrative) power of village chiefs are difficult to define because the majority of chiefs (canton, grouping and village) are descendants of the founding lineages of villages.

Local elites

In addition to the traditional and the state authority structures, there is a third non-negligible component of authority in a village / town, the "local elite", "village elite" or "*cadre*".

These "elites" are generally composed of people from the village who have received an education and have obtained salaried positions in the administration or the private sector outside their village. They are based in the towns such as Port-Gentil or Libreville but keep ties with their village.

These local elites, who benefit from a higher standard of living than the villagers, provide financial assistance when the village is in need. This in turn gives them a degree of power in decision making. For some decisions related to the management of natural resources and land, reference is made to the elites even if they do not reside permanently in the village.

7.4.3.2 Trends

Traditional and modern administrative governance is intertwined at village level.

7.4.3.3 Vulnerability and sensitivity to change

The vulnerabilities in terms of local governance are presented in Table 7.5.

Table 7.5: Governance: vulnerabilities

Vulnerable groups	Rationale
Women	These groups may not be adequately represented in local and national decision-making bodies
Migrants	
Indigenous people	
Children, youth	

7.4.3.4 Key considerations

Key considerations for the impact assessment include:

- Both traditional and government authorities need to be considered
- Local elites may play a role in local (village level) decision making.

7.4.4 Demographics

Gabon has a population of 2.1 million, with a projected increase to 3.8 million by 2050. Between 2011 and 2018, annual population growth averaged 3.3 percent (World Bank, 2021a). The average population growth between 2020 and 2021 is 2.41 percent (CIA, 2021).

Gabon's population is relatively young, with a median age of 21 and an average age of 26 (CIA, 2021; ILO, 2019). Approximately half of the total population is younger than 22 years of age. Figure 7.6 shows the current age structure of the population of Gabon, disaggregated according to gender.

The gender ratio is estimated at 1.08 males per 1 female (CIA, 2021) and the dependency ratio[2] is 68.9.

[2] Dependency ratio is a measure of the number of dependents aged 0 to 14 and over the age of 65, compared with the total population aged 15 to 64. This demographic indicator gives insight into the number of people of non-working age compared with the number of those of working age).

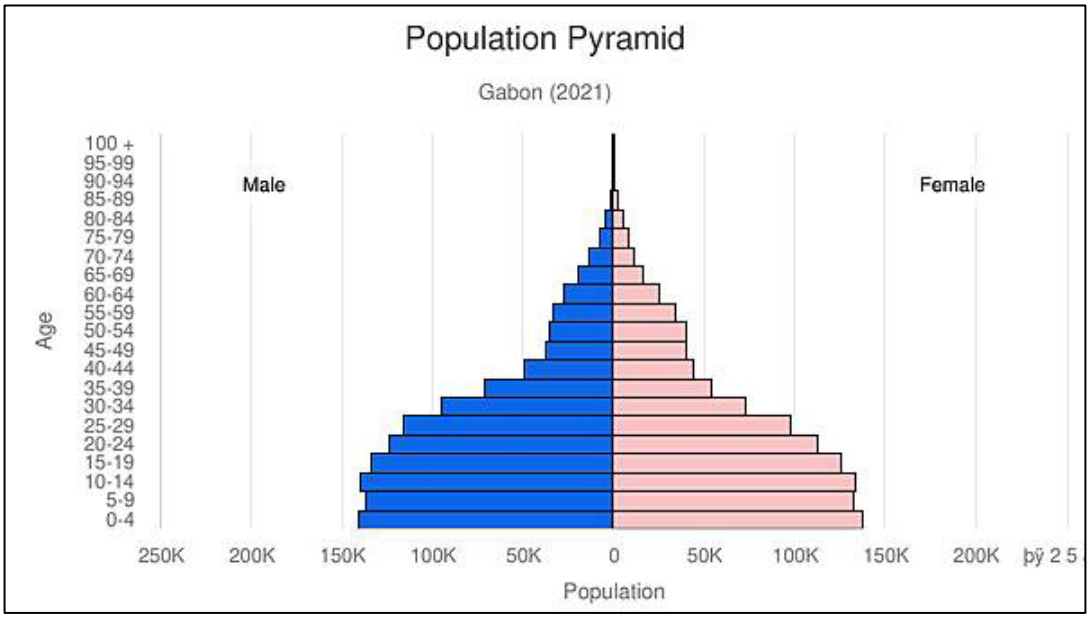

Figure 7.6: Age structure of population in Gabon

Source: CIA (2021)

The demography of the country has changed significantly over the past quarter of a century, with strong growth and intensive urbanisation (Ginestie and Bekale Nze, 2014). Whereas in 1960, only 20 percent of the population lived in urban areas, by 2013, Gabon had the smallest rural population in Africa, with 87 percent of the population residing in urban areas and occupying only 1.1 percent of the national territory (ILO, 2019). The capital Libreville (population 845,000)[3], and Port Gentil (142,280)[4] the economic capital of the country, house approximately 60 percent of the entire population (World Bank, 2020a) and in total, four cities house more than 85 percent of Gabon's population (Lloyds Bank, 2021). In addition to Port Gentil, the main urban areas in the AOI are the coastal towns/villages of Omboue, Gamba, Mayumba and Ndindi and the clustered villages surrounding these. Significant areas along the coast are uninhabited or scarcely inhabited. Gabon's rural population in the hinterland is thinly scattered and access is difficult (World Bank, 2019).

The average population density of Gabon is 4.6 people per km² (IWGIA, 2020), which is significantly lower than the Sub-Saharan Africa (SSA) average of 51 people per km² (World Bank, 2018). However, the population density in the capital Libreville is 1,800 per km².

Nyanga, Province has a population of 52,854 (Imboumy-Limoukou et al. 2020). The provincial capital, Tchibanga, has more than half of the total population of the province. Ogooué-Maritime Province, of which Port Gentil is the capital, has a population of 157,562 (Population census, 2013). Table 7.6 shows population figures for the departments in the AOI.

[3] Libreville, Gabon Population (2021) - Population Stat

[4] Population of Port-Gentil in 2020 2021 – statistics Population of Port-Gentil in 2020 2021 - statistics (all-populations.com)

Table 7.6: Population figures for departments in the AOI

Province	Department	Population in 2013 (latest census)
Nyanga	Basse Banio	7,192 1.9/km²
	Haute Banio	1,413 0.8/km²
Ogooué- Maritime	Ndougou	11,092 (85% urban)
	Etimboué	5,723 (21 % urban)
	Bendjé	140,747 20/km² (94% urban)

Source: EnviroPass (2017, 2019), directinfosgabon.com

There are over 40 ethnic groups[5] in Gabon. The largest ones are the: Fang, Punu, Eshira, Nzebi, Mbede, Kota, Loumbou, Sangu, Teke and Myene (Yates, 2018). The various ethnic groups are spread across the country and there is a relatively high level of integration. Ethnic tensions and conflicts have been rare and intermarriages between different groups are common (Aspenia, 2014).

FGDs in the sample villages indicated the presence of five ethnic groups, including Villi, Loumbou, Punu, Mbamba and Nzebi. Villi, which are also found in the neighbouring Republic of Congo are the dominant ethnic group across all sample communities, followed by Lombou. All ethnic groups are reported to maintain harmonious relationships.

There are a few thousand hunter/gatherer communities in Gabon who are thought to be the descendants of the oldest know inhabitants and are categorised as indigenous peoples. They comprise numerous ethnic groups including the Baka, Babongo, Bavarama. Bakoya, Baghame, Barimba, Akoula and Akowa and live both in the forests and the towns. A small number of Babongo, Bavarama and Barimba live in Nyanga Province and a small number of Akowa reside in Port Gentil, Omboue and Gamba. No indigenous people were identified in the sample villages (IWGIA, 2020).

Non-Gabonese populations include Nigerians, Beninois, Malians, Cameroonians, Senegalese and French nationals. Most foreigners live in or near the two largest cities: Libreville and Port-Gentil (The Statesmans Yearbook, 2017).

French is the official language of Gabon and is spoken by over 80 percent of the population (Exotix Capital, 2019).

Christianity is the most common religion in Gabon and is practiced by over 75 percent of the population. The most common Christian denomination is Catholicism, followed by Protestantism. Other Christian churches include the Christian Alliance Church and the Evangelical Pentecostal Church. Nine percent of the population practice Islam and the rest of the people adhere to traditional beliefs including Bwiti, which is a spiritual discipline mainly present amongst forest dwelling groups and amongst the Fang people (Joshua Project, 2020).

[5] An ethnic group being a group linked by heredity, culture (including language), and historical experience

For decades, Gabon has served as a destination for foreign nationals from other central African states and further afield. Migrants have been attracted by the relatively high economic growth rates. In 2015 foreign nationals accounted for 15.6 percent of the population (Verité, 2018).

According to the UNHCR, there were 913 refugees and 1,986 asylum seekers in the country (Verité, 2018). The current net migration rate in Gabon is 3.76 migrants per 1,000 population (CIA, 2021).

Consistent with the trend at the national level, all sample communities have experienced in-migration of persons from neighbouring and other West African countries (Republic of the Congo, Democratic Republic of the Congo, Togo, Benin, Ghana, Senegal and Mauritania). The proportion of non-Gabonese currently residing in the sample communities is however reportedly relatively low. Mayumba is the most cosmopolitan of the sample villages.

7.4.4.1 Trends

The following trends were identified:

- Gabon is highly urbanised, with a very small rural population. A large percentage of the population is concentrated in Libreville and Port Gentil. Urbanisation is ongoing.
- Whereas Gabon was historically a country of in-migration, this trend is currently in decline (United Nations, 2020).

7.4.4.2 Key considerations

Key considerations for the impact assessment include:

- The population of Gabon, including the coastal areas is highly urbanised, with few rural villages
- The population is young
- There are a number of ethnic groups who are currently coexisting peacefully.

7.4.5 Education

The right to education is a human right included in the UDHR. This section sets out the educational situation and facilities in Gabon and the potential risks and threats to these.

7.4.5.1 The educational system and infrastructure

Education in Gabon is compulsory from the age of 6 to 15 (UIS, 2020). The Gabonese education system is structured according to the French model (Ginestie and Bekale Nze, 2014). It includes five years of primary school, four years of lower secondary and three years of upper secondary schooling (Borgen Project, 2017a).

Primary school pupils achieve two certificates: the Certificat d'Etudes Primaires Elémentaires (CEPE) and the Concours d'Entrée en Sixième. The latter determines whether pupils can enter secondary school.

Upper secondary school culminates in the Baccalauréat, which, when successfully completed, provides access to tertiary education.

The education system is primarily public, secular and free, though there is also a long tradition of private religious education, provided by the Catholic Church and Protestant missions and more recently, by some Muslim institutions (Ginestie and Bekale Nze, 2014).

A system of scholarships and financial aid enables parents to cover tuition fees for children in the public system, but private schools are unaffordable for most, charging disproportionately high rates compared to the scale of local incomes (Ginestie and Bekale Nze, 2014). A private education can cost up to 250 000 FCFA per month (UNESCO, 2018-2019).

There are nine public higher and six private higher education institutions in Gabon (International Association of Universities, 2019), which offer Bachelor, Master and Doctorate degrees. These include training in computer science, forestry and water management, magistracy, computer science, health sciences, natural sciences, medical research and management. The majority of these institutions are located in Libreville, with only one public and one private institution located in Franceville.

Support for schooling of disabled children is almost non-existent. There are only two adapted public schools, both located in Libreville (UNESCO, 2018-2019).

Both Nyanga and Ougooé Maritime have a number of primary, lower and upper secondary schools and few tertiary technical education facilities. The primary and secondary schools in both provinces are presented in the tables below.

Table 7.7: Schools in Ogooué-Maritime

Categories	Ogooué-Maritime
Primary schools	
Classrooms	190
Students	27,956
Teachers	776
Secondary schools	
Public	6
Private	16
Classrooms (public)	127
Classrooms (private)	147
Students	35,527
Teachers	324

Source: Ogooue Maritime (2013)

Table 7.8: Schools in Basse Banio and Haute Banio

Categories	Basse Banio	Haute Banio
Primary schools		
Public schools	10	5
Catholic schools	5	0
Classrooms (public schools)	25	15
Classrooms (catholic schools)	16	0
Students	1,380	212
Teachers	69	15
Teacher shortage	7	4
Secondary schools		
Public schools	1	0
Classrooms (public schools)	11	0
Students	572	0
Teachers	19	0

Source: DGEPF, 2013

All sample communities have a primary school and there is one secondary school in Mayumba. During the FGDs the lack of secondary schools in the AOI was identified as problematic. The main issues identified with the schooling infrastructure in the sample villages included lack of schoolbooks, teachers and equipment.

In 2014 the Oil and Gas Institute was inaugurated in Port Gentil, which provides tertiary technical and professional education linked to the oil and gas industry. The institute is a public-private partnership between the government of Gabon and oil and gas companies.

Figure 7.7: Primary school in the community of Mambi

7.4.5.2 Literacy and educational achievement

Adult literacy refers to the percentage of the population over 15 years that can read and write in a particular language. The adult literacy rate in Gabon is 84.7, which is one of the highest rates in Africa (World Bank, 2020b).

Figure 7.8 shows the gender disaggregated evolution in literacy between 2012 and 2018 in Gabon and Sub-Saharan Africa. This shows that the literacy rates of males and females were considerably higher in Gabon than in Sub Saharan Africa. In 2018, only 58 percent of females in SSA could read and write, compared to 80 percent in Gabon. For males, adult literacy in SSA was estimated at 72.5 percent, compared to 85.9 percent in Gabon.

Between 2012 and 2018, female adult literacy rates improved by 3.5 percent in Gabon. Smaller increases in male literacy rates were observed in SSA and Gabon, at 1.7 percent and 1 percent, respectively.

In the sample villages, the women's FGDs indicated a much lower level of literacy than the national statistic. In only two of the sample villages, it was indicated that more than 50 percent of the women could read and write. The main reasons for illiteracy included early pregnancies as well as the lack of means and support for education for women. These findings may indicate a potential large discrepancy between rural and urban literacy rates.

The net enrolment rate for primary school in Gabon was 88.3 percent in 2013 while at the secondary level, the national enrolment rate was 54.5 percent. This was slightly higher for the urban areas at 58.2 percent. At primary school level, gender parity seems to be achieved, however, in some rural areas, girls' education remains lower than for boys.

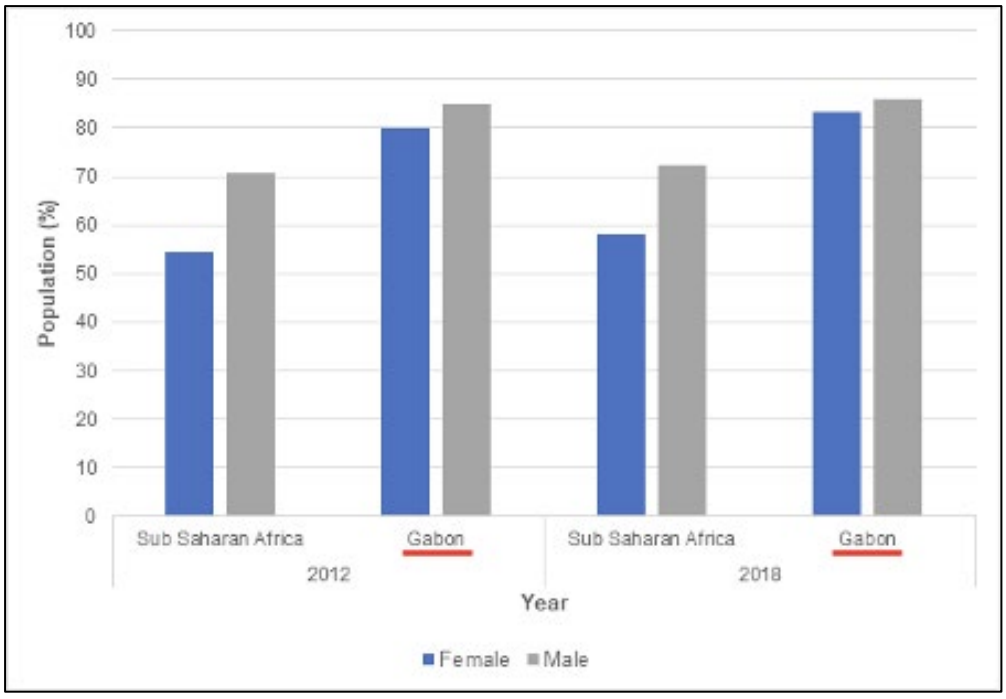

Figure 7.8: Literacy rates for persons aged 15 years and above

Source: World Bank (2020b)

These gender disparities tend to increase across the different stages of schooling; the probability that boys will have access to a higher education is twice as high (17 percent) than for girls (9 percent).

Statistics show that enrolment rates differ between provinces and between rural and urban areas. In 2010 the second highest rate was in Ogooué Maritime with 92.5 percent. (Republic of Gabon, 2010).

FDG with women in the sample villages indicated that children's education is considered of high importance. Schooling is regarded as an insurance policy for the child's future as well as that of his/her family. All sample villages stated a primary school attendance rate of 100 percent except for Mambi which reported an attendance rate of 80 percent.

World Bank (2013) data shows a teacher / pupil ratio in primary school of 45.6, which is twice the average of countries with a similar income.

7.4.5.3 Trends

The following trends were identified:

- There is a dearth of statistical data in the realm of education. Over the past few years, however, the government has been enhancing its capacity to produce statistical educational data through the launch of a project entitled 'Support for the production of basic statistics and the development of the Education Sector Plan' implemented with the support from the World Bank, the French Development Agency, UNICEF and UNFPA. The project aims to assist Gabon to respond more effectively to information needs essential to meet the goals of the Education 2030 Agenda (UNESCO, 2020) one of which is reducing the number of students per teacher to create a better learning environment. However, the statistics are not yet freely available in the public domain.

- The Gabonese schooling system is characterised by a relatively high school dropout rate, particularly at secondary school level.
- The low education levels create a skills shortage and high unemployment. Consequently, the key challenges that Gabon faces consist in adapting its education policy to the real needs of the labour market by promoting technical and vocational training.
- Another challenge faced by the education sector, is the lack of infrastructure, equipment and teachers. There is a significant lack of teachers in secondary school (UNESCO, 2018 - 2019). FGDs in the sample villages confirmed those challenges and indicated that their schools lacked teaching material, especially textbooks, teachers, and school buildings.

7.4.5.4 Vulnerability and sensitivity to change

The vulnerable groups in terms of education are outlined in Table 7.9.

Table 7.9: Education: vulnerabilities

Vulnerable groups	Rationale
Girls	There are still fewer girls than boys pursuing secondary and tertiary education due to a number of barriers for girls. This puts them at a disadvantage to benefit from formal employment opportunities.
Unemployed graduates	Due to a certain mismatch between programmes offered by tertiary education institutions and the skills required by the economy, youth with qualifications may risk not finding suitable employment.
Disabled	Gabon has very few institutions adapted to the disabled
Children from poor households	Children from poor households may not be able to afford education
Rural children and youth	Rural areas are disadvantaged in terms of educational facilities
Illiterate youth	Youth who have not benefitted from a formal education and are therefore unable to read or write are disadvantaged and will not be in a position to access formal employment opportunities.

7.4.5.5 Key considerations

Key considerations for the impact assessment include the following:

- There is a general shortage of people with vocational skills required for the economy of Gabon (including oil and gas)
- Almost all tertiary education institutions are based in Libreville (far from the Project area)
- Women may have less opportunities for employment due to lack of educational qualifications
- There is an Institute for Oil and Gas in Porte Gentil.

7.5 Economy and Livelihoods

An adequate standard of living is a core human right (Article 25 of the UDHR). This section sets out the economic sectors and livelihood opportunities of the people of Gabon and outlines potential risks and challenges faced.

Gabon is one of Africa's wealthiest nations and is one of the few countries on the continent with upper middle-income country status. However, Gabon is also classified amongst the Least Developed Countries (LDC) due to its social indicators, which include a poverty rate of 32.7 percent and an unemployment rate of 35.7 percent for young people between the ages of 15 and 24; and 26 percent for the labour force aged between 25 to 34 (AFDB, 2017).

Gabon's economy is characterised by a strong link with France, its former colonial ruler, a large degree of foreign investment and control, a high dependence on foreign technicians, and a decline in its agricultural production. Gabon's economy has more links with European and American markets than with those in neighbouring states (with the exception of Cameroon) or elsewhere in Africa. The United States, Japan, China, and France are among Gabon's main trading partners.

Gabon is one of the six members of the Central African Economic and Monetary Community (CEMAC). Other members are Cameroon, Central African Republic, Chad, the Republic of Congo and Equatorial Guinea. Gabon is the second biggest member by economy, accounting for 19 percent of its GDP, but the second smallest by population, accounting for 4 percent of the region (Exotix Capital, 2019).

The GDP of Gabon was estimated at $16.88 billion in 2019, and the GDP per capita (based on purchasing power parity) was $17,876. The COVID-19 pandemic, and the associated curbs on economic activities have led to negative growth rates of -1.8 percent (Lloyds Bank, 2021). Real GDP contracted 2.7 percent in 2020, after growing 3.9 percent in 2019, reflecting a 21 percent drop in national oil production, a fall in oil prices and a slowdown in non-oil sector activity that resulted from measures to contain the spread of COVID–19 (World Bank, 2021c).

The Gabonese economy is expected to rebound if the situation caused by the pandemic improves in the second half of 2021 (AFDB, 2021a). Real GDP is projected to increase by 2.1 percent in 2021 and 3.8 percent in 2022, owing to rising oil and agricultural exports, supported by growth in the agriculture, industry and tourism sectors, and improving domestic demand. Growth will stabilise in 2025 as oil prices decline (EIU, 2021).

Overall, the economy remains heavily dependent on oil, and is vulnerable to fluctuations in global oil prices. However, Gabon's economic identity as an oil producer and its attractiveness as an investment destination is increasingly being challenged due to its decreased resource potential and its regulatory framework. Talks of economic diversification have intensified over the past decade and, for the first time, have been communicated in a formal manner through the 'Emerging Gabon Strategic Plan'. Referred to as 'Emerging Gabon' (Plan Stratégique Gabon Emergent - PSGE) the government has announced goals for the economic diversification of the economy by 2025, drawing up strategies for the mining industry, the services sector, agriculture and fisheries (see Section 10.4.5). The National Agency for the Promotion of Investment is assigned with the task of promoting investment in non-oil sectors (Global Business Reports, 2020).

Key economic sectors

Table 7.10 outlines the key economic sectors in Gabon, SSA and the world.

Table 7.10: Key economic sectors in Gabon, SSA and the world

Sector	Percent of GDP (2019)		
	Gabon	SSA	World
Agriculture, forestry and fishing	5.6	14.0	3.3 (2018)
Industry (including construction)	47.2	27.1	25.6 (2018)
Services	41.2	48.8	65.0 (2018)

Source: World Bank (2021c)

As shown in Table 7.10, agriculture, forestry and fishing activities contributed roughly 5.6 percent of GDP in 2019, which is considerably lower than the SSA average of 14.0 percent, but higher than the global average of 3.3 percent (World Bank, 2021c).

Despite the downward trend in the sector's overall importance (due to the dominance of oil in the economy, and rural-urban migration to population centres for petroleum-related activities), agricultural, forestry and fishing activities have strong potential; Gabon has a wealth of natural resources, 22 million hectares of forest, one million hectares of arable agricultural land and over 800 kilometres of coastline (AFDB, 2017; Lloyds Bank, 2021). The agriculture sector includes food crops, rubber (especially in the north), and palm oil (Lloyds Bank, 2021).

Industry contributed 47.2 percent of GDP in 2019, higher than the SSA and global averages of 27.1 percent and 25.6 percent, respectively (World Bank, 2021c). The sector is focused on exports of unprocessed primary commodities, dominated by petroleum, manganese mining, and timber processing. Gabon is Africa's second largest wood producer and after oil, wood is the country's second most important economic resource (Lloyds, 2021).

Gabon is the world's fourth-largest producer of manganese and is thought to have more than 2bn tonnes of iron ore, over 40 tonnes of proven gold reserves, and a range of other base and rare-earth minerals, including lead, zinc, copper, diamonds, niobium, and titanium. The mining sector's contribution to GDP is estimated to have remained flat at 4 percent in 2015. However, the potential of the sector is illustrated by government plans to boost GDP contribution to 25 percent over the next 15 years (Oxford Business Group, 2016a).

Other industrial activities include textile, cement and chemical plants, breweries, shipyards, and cigarette factories. Most industrial establishments are located near Libreville and Port-Gentil.

Services contributed 41.2 percent of GDP in 2019, lower than the SSA and global averages of 48.8 percent and 65 percent respectively. Tourism is still underdeveloped, mostly due to poor infrastructure and the country's landscape, which is mostly covered in forests (Lloyds Bank, 2021).

Employment

Employment per sector is outlined in Table 7.11.

Table 7.11: Employment per sector

Sector	Percent of total employment (2019)		
	Gabon	SSA	World
Agriculture, forestry and fishing	30.0	52.9	26.8
Industry (including construction)	10.7	10.7	22.7
Services	59.3	36.4	50.6

Source: World Bank (2021c)

The table shows that the highest proportion of employment is within the services sector (59.3 percent) which is higher than the percentage for both the SSA and the world. Two-thirds of Gabonese with a higher level of education work in the civil service (ILO, 2019).

The second highest percentage of employment is in the agriculture, forestry and fishing sector (30 percent) which is significantly less than the percentage for SSA. The industrial sector employs approximately 10 percent of the workforce, which is the same as for SSA but only half of the percentage across the world.

Gabon has a high unemployment rate, especially among young people and graduates (ILO, 2019). Unemployment is thought to affect about 20 percent of the working-age population; this is significantly higher than the SSA and global averages of 6.6 percent and 6.5 percent, respectively (World Bank, 2020a). While the rate is fairly even throughout Gabon (21 percent in urban areas and 19 percent in rural areas), the total number of unemployed people is much higher in urban areas (ILO, 2019). Female unemployment is double the rate of male unemployment, estimated at 28 percent for women compared to 14 percent for men (World Bank, 2020a). Both rates have remained broadly unchanged since 2010 (World Bank, 2020a). A strong decade of economic growth in the 2000s did not translate into job creation, particularly in the industry (petroleum) sector (ILO, 2019).

The informal sector continues to play a dominant role. Informal employment is particularly prevalent among the poor, who lack access to productive assets (World Bank, 2020a).

There is a dearth of recent data for anticipating skills and jobs requirements (ILO, 2019). However, anecdotal evidence suggests that Gabon lacks national expertise in many sectors and sub-sectors. Another consequence of the historical reliance on oil extraction is that the school system and the technical and vocational education and training (TVET) system have not evolved to provide the skills required to bring the economy to emergence as intended (ILO, 2019). Employers report recruitment issues and a low skills level in the candidates they end up hiring or taking on a trial basis (ILO, 2019). Data from the National Employment Office indicates a significant mismatch between labour supply and demand at all levels of qualification: the demand for jobs is greater than jobs on offer and more than two-thirds of the jobs offered by businesses are not filled (ILO, 2019).

Geographic disparities in the unemployment rate are more pronounced at the departmental level than at the provincial one (UNECA, 2016).

Formal employment in the sample communities is marginal, with the exception of Ndindi community, where it is reportedly more prevalent. Where formal employment exists, it is provided by the public sector (e.g., government workers, teachers, nurses, village chiefs). The most common types of private sector employment include the hospitality business, small commerce, and artisans. Artisanal fishing remains the key economic sector in the sample communities.

Businesses and enterprises

The Gabonese government maintains that a key driver of economic growth is a vibrant private sector where firms invest to improve productivity and create jobs in the process (IMF, 2013). Small and medium enterprises (SMEs) have been recognised for their potential to boost economic activity at the national level, through employment creation, tax contribution and income-generating activities (IMF, 2013; Moussavou et al., 2016). It is acknowledged that promoting entrepreneurship and SME activities will deliver better prospects for the growing young population.

However, according to the World Bank, Gabon currently ranks 169th out of 190 countries on its 'Ease of Doing Business Index'. Launching a business requires time-intensive and highly bureaucratic procedures (BTI, 2020). As a result, the formal private sector in Gabon remains very small (World Bank, 2020a).

Though precise statistics are not available, it is estimated that there are currently approximately 12,000 SMEs in Gabon, with an average growth rate of 5 percent since 2010 (Diallo, 2015). Small businesses include grocery stores, general food stores, hairdressing salons, drinking establishments, ready-to-wear stores, second-hand clothing sales areas, etc. Small businesses are mainly managed by foreigners, are often neither taxed nor regulated by the state and offer little security to workers. Weak infrastructure, difficulties with obtaining access to credit for SMEs, and the small size of the market in a context of limited regional integration, are all factors that are holding back businesses in the private sector in Gabon (WTO, 2013). Small business. Those who endeavour to develop a regulated business encounter additional challenges which include:

- preferential policies for large foreign investors and inadequate assistance to small enterprises (including limited access to finance) inhibit the emergence of a vibrant private sector (ILO, 2019)
- a minimum capital requirement of more than $2,400 imposed on the start-ups by the government (BTI, 2020)
- bureaucracy and red tape: According to the World Bank, the initial process of registering a new firm takes 50 days on average, well above the SSA average of 26.8 days and the OECD average of 8.3 days
- investors considering constructing their own premises face delays in completing the necessary permits and registering the property, with up to 329 days on average complete the whole process
- the process of winding up business operations through insolvency proceedings is similarly extremely time-consuming and difficult, taking an average of five years to complete (IMF, 2019).

Businesses and artisans in the sample villages are presented below.

Table 7.12: Artisans and businesses in the sample villages

	Mabounda	Tchiole-ndembe	Ndindi	Malembe 2	Mambi
Artisans					
Builder	5	4	6	4	0
Butcher	0	0	10	1	0
Carpenter	5	2	1	1	0
Driver	5	0	3	1	1
Electricians	1	4	3	0	1
Hairdresser	2	2	5	4	0
Mechanic	1	5	1	1	0
Painter	1	0	2	0	0
Plumber	1	1	2	0	0
Seamstress	1	2	3	0	0
Welder	1	5	1	1	0
Business					
Bar	14		10	5	2
Hotel	2		4	0	0
Restaurant	0		3	0	0
Supermarket	2		1	0	0

Note: the list of artisans and enterprises may not be exhaustive

7.5.1 Fisheries

Gabon has one of the most productive marine ecosystems in the world. The coastline extends over 800 km and coastal waters are rich in fish, molluscs and crustaceans.

The fisheries sector plays a significant role in Gabon's economy and fish provides up to 40 percent of animal protein in the Gabonese diet.

The activity of all fishing vessels in the Gabonese fishing zone are subject to Gabonese law. Decree No. 0579/PR/MPE of November 30th, 2015 sets out the terms and conditions for fishing in waters under Gabon's jurisdiction, while delimiting new fishing zones (Juridocs, 2021).

The Ministry of Agriculture, Livestock, Fisheries and Food manages the Exclusive Economic Zone (EEZ) for fisheries. Its tasks include ensuring sustainable development, and participatory management of fisheries and resource protection, the elaboration of management plans for the various fisheries, including their monitoring and evaluation. The role of the Directorate General for Fisheries and Aquaculture is to protect aquatic species and ecosystems, coordinate the legal periods for fishing and the control of fishing in the fishing zones.

The main fish caught in Gabonese waters include the European pilchard, sardinellas, bonga shad, horse mackerel, mackerel, hake, sea breams, shrimps, cephalopods

(octopus, cuttlefish, squids) and tunas (FAO, 2019). Other species include bass, barracuda, snapper, Nile perch, and African sea catfish (Barrett & Houston, 2014).

In 2017, there were an estimated 29,798 fishers and 1,546 boats in Gabon (FAO, 2019). The total fisheries production (from all commercial, industrial, recreational and subsistence purposes) equated to 29,000 metric tonnes in 2018, down from 36,900 metric tonnes in 2014 (World Bank, 2021c). Gabonese exports of fishery products consist of crustaceans, molluscs and fish, shipped frozen. The main markets are China, the European Union and the neighbouring countries of the subregion (WTO, 2007).

Despite being a fish-rich country, Gabon's fisheries production is lower than in neighbouring countries such as Cameroon (281,945 metric tonnes) and the Republic of the Congo (98,650 metric tonnes) (World Bank, 2021c) and Gabon is unable to meet its domestic demand (which is estimated at 37.5 kg, and among the highest in Africa (WTO, 2007). Gabon's fish import cost in 2017 was estimated at USD 49.7 million, while exports were estimated at USD 3.1 million (FAO, 2019).

Fishing zones and types of fisheries

Fishing in Gabon is divided into industrial fishing (comprising approximately 26 percent), traditional sea fishing including artisanal fishing (comprising approximately 51 percent) and inland fishing (comprising 22 percent).

The most recent published statistics from 2014 indicate that while industrial fisheries produced 7,026 t, artisanal fisheries produced 18,076 t (i.e., 72 percent of the national production (Cardiec et al., 2020), underlining the importance of artisanal fisheries. Inland fishing produced approximately 11,000 t in 2017 (FAO, 2019). Aquaculture remains very undeveloped and is restricted to the interior of the country. Aquaculture's annual production in 2017 was estimated at only 45 t (FAO, 2019).

Artisanal, industrial and tuna fishing takes place in demarcated areas. Table 7.13 outlines the fishing areas in Gabon, as set out in Decree No. 0579/PR/MPE. These fishing areas are presented in Figure 7.9.

Although a large proportion of the Ruche EEA is outside the fishing areas presented in Table 7.13, analysis of vessel monitoring system (VMS) data by Terrocea (2019) between October and November 2019 found tuna vessels to the west of the Ruche EEA and trawlers within the Ruche EEA in this period, see Figure 7.10.

Table 7.13: Fishing areas in Gabon

	Distance from the coast	Types of authorised fishing	Permission
1	Continental waters, lagoons and estuaries	Artisanal	Gabonese only
2	< around 3 nautical miles (nm) or 5.5 km	Artisanal Sports fishing	Gabonese only permit required
3	3 to 6 nm, or between approximately 5.5 and 11 km	Industrial and artisanal	All nationalities

	Distance from the coast	Types of authorised fishing	Permission
4	6 to12 nm, or between approximately 11 and 22 km	Industrial	All nationalities
5	12 to 24 nm, or between approximately 22 and 44 km	Tuna fishing	All nationalities

Zones where fishing is prohibited include national parks, marine protected areas and fish breeding grounds, and areas within 500 m of an oil installation (European Commission, 2021).

Gabon's EEZ, in which Gabonese industrial and artisanal fishing takes place covers an area of 213,000 km^2. The EEZ prohibits foreign fishing companies from fishing in this zone without government authorisation (Barrett & Houston, 2014).

Deep-sea fishing, involving the exploitation of tuna resources - is practised in the EEZ under bilateral Fisheries Partnership Agreements with the European Union (EU) and Japan. Such agreements are designed to derive economic benefit from fishing reserves that Gabon has been unable to tap into due to lack of domestic resources (European Commission, 2021; Barrett and Houston, 2014).

The latest agreement with the EU dates from 2013 and aims at sustainable use of fisheries resources on the basis of annual and multi-annual programming, with a community financial contribution of EUR 860,000 per year. This agreement, renewable every 3 years, has not been renewed since 2016. Individual EU countries are currently negotiating commercial fisheries agreements with Gabon.

The fisheries agreement with the EU is part of the network of tuna agreements concluded by the EU in West Africa. It is in line with the continuity of the tuna agreements which allow European vessels to move from one EEZ to another (Côte d'Ivoire, Sao Tome, Cape Verde and Mauritania, for example) and Gabonese waters constitute a privileged zone among these agreements given that between 25 and 30 percent of tuna catches on the African Atlantic coast are made in the Gabonese EEZ.

The Japanese are essentially accompanying the Gabonese authorities in the development of fisheries, aquaculture and agriculture. The agreement with Japan is renewable every 5 years. The last agreement dates from 2010 and has not been renewed to date.

Several fishing associations have been created, bringing together local fishermen, traders, processors and consumers.

There is also an industrial ship-owners union in Gabon, representing all vessels working in the waters under Gabonese jurisdiction. It is the point of contact with the Gabonese government for all negotiations regarding the introduction of new vessels to Gabon and the adjustment of any fisheries regulations.

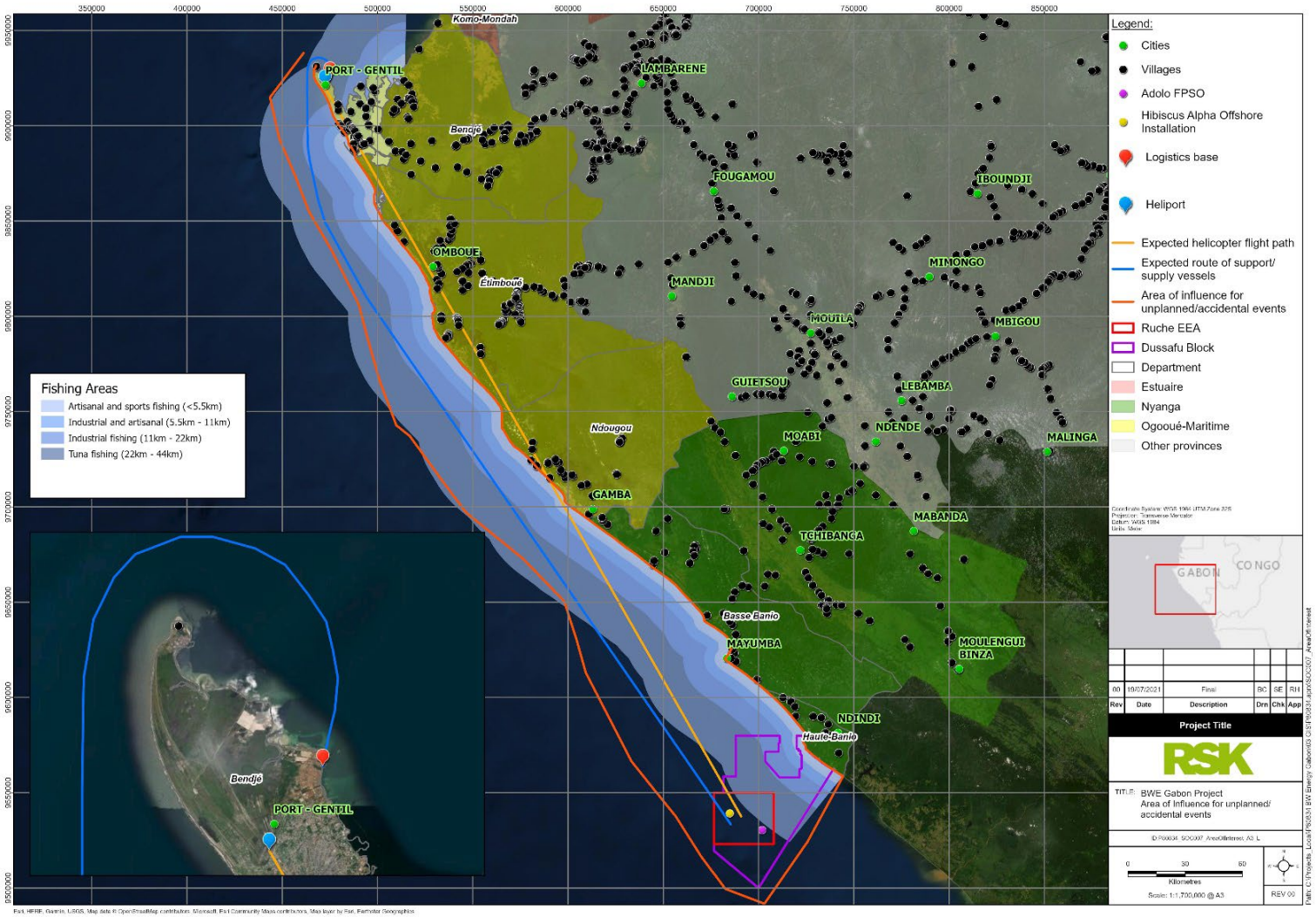

Figure 7.9: Fishing areas in accordance with Decree No. 0579/PR/MPE

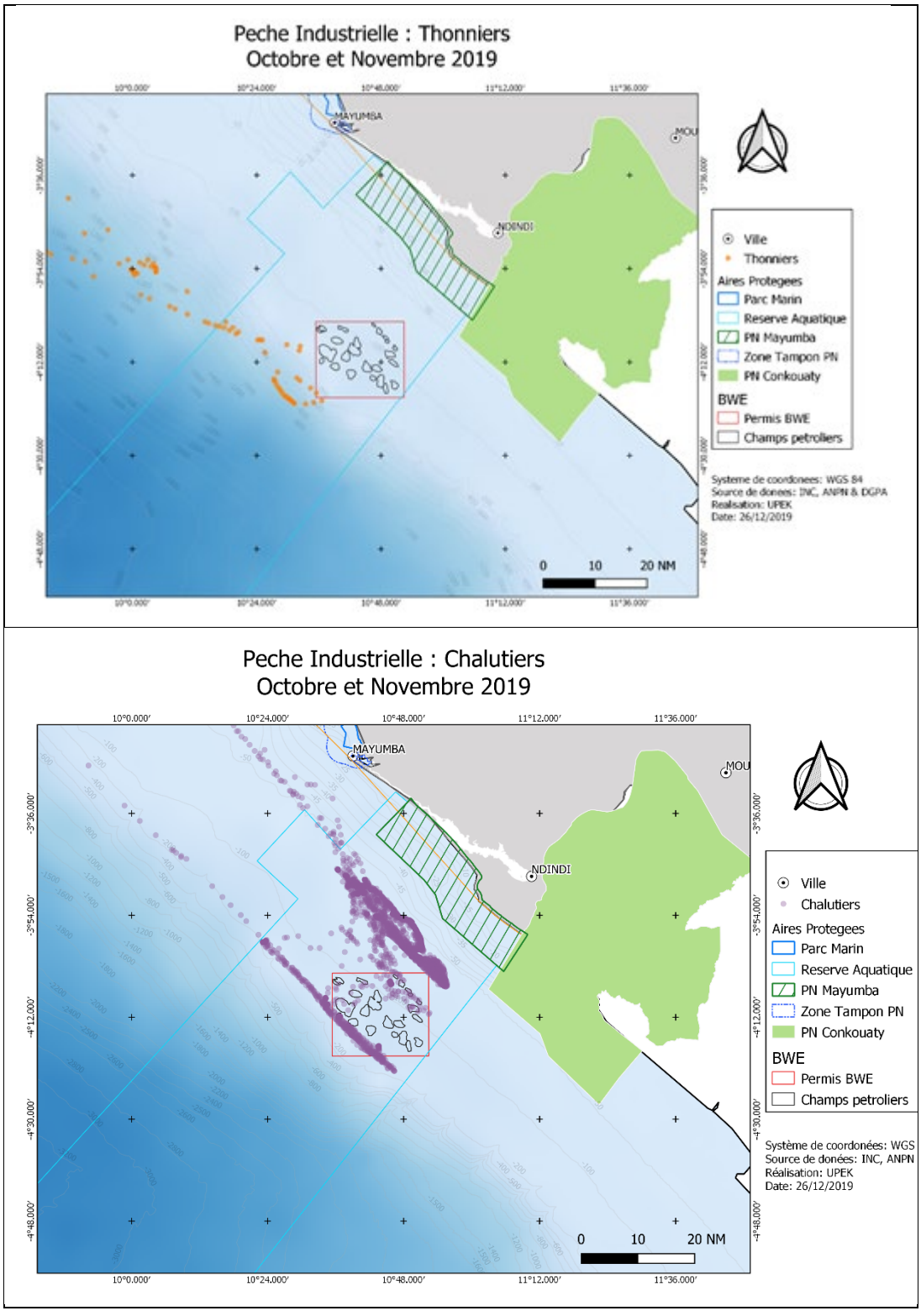

Figure 7.10: VMS data for tuna vessels (top figure) and trawlers (bottom figure) – October to November 2019

Source: Terrocea (2019)

Industrial fishing

The majority of the owners of industrial fishing vessels are of foreign origin. Foreign vessels in the EEZ fly several types of flags including from Madagascar, China, Korea, Japan, Nigeria, Belize, the Netherlands Antilles and Spain.

Local industrial fishing includes four fishing companies (Socipeg, Sigapêche, APG, Amerger) with 24 trawlers, including three shrimp boats; 20 are from Asia, four of which fly the Chinese flag and the others fly the Gabonese flag. These vessels land in Libreville and Port-Gentil and operate all year round in Gabonese territorial marine waters except during four months of biological stoppage[6] which runs from the beginning of January to the end of April.

With a trawler length varying between 20 - 50 m, most of them practice bottom trawling and target mainly shrimp or demersal fish: sea bass, capitaine, sea bream, sole, bluebird, horse mackerel and carangidae (false tuna). All other species caught are thrown back into the sea, mostly dead, which threatens the unsustainability of this type of fishing.

Artisanal fishing

In line with national legislation, artisanal fishing takes place close to the shore (distances < 3 nm). However, artisanal fishers in Mayumba indicated that they may be forced to go beyond the identified fishing demarcation during seasons of severe drought. They may venture as far as 65 km from the coast. Fishing takes place on a daily basis all year round; however, the rainy season is considered to be more productive (Enviropass, 2017, 2019 and 2020).

Maritime artisanal fishing is dominated by migrants from neighbouring West African countries including Nigeria, Ghana, Benin, Togo, Sao Tomé et Principle, Equatorial Guinea and Senegal. Gabonese nationals only account for approximately 20 percent of the traditional fishers.

A large proportion of the traditional fishing activities in Gabonese waters occurs however in the numerous estuaries and lagoons along the coast. A study observed that in Mayumba, 60 percent of the fishers surveyed operated within the lagoon (TEREA, 2010). Inland fishing is only permitted for Gabonese citizens.

The main fish and shellfish species caught by artisanal fishers include sea bass, capitaine, carp, sole, red carp, bass, barracuda, African sea catfish, seabream, tilapia, lobsters and crab. Pilchards are a key species for both artisanal and commercial fisheries and are caught with purse or beach seines and gill nets. They are a staple food source and are marketed fresh, frozen, smoked, canned or dried. They are also often used as bait in fisheries (IUCN, 2016).

The landing sites for the artisanal fishing sector are distributed along the coast. Key landing sites within the unplanned / accidental events AOI are found at Cap Lopez / Port-Gentil, Omboué, Gamba and Mayumba, these and other boat landing sites are included in Figure 7.4. In Nyanga Province, Mayumba is the main base of the artisanal fishery.

In the sample villages artisanal fishing is widely practiced and constitutes a key livelihood activity for almost all households. According to official data from the National Agency for

[6] The Biological Stop is the four-month period during the year that Gabon's Directorate General of Fisheries and Aquaculture (DGPA) requires industrial fishermen to stop fishing to allow resources to regenerate and grow.

Fisheries and Aquaculture, there are currently 39 boats registered with the relevant authorities in Mayumba. The number of persons involved in fishing has reportedly increased across all sample villages, which is reportedly due to a lack of alternative employment opportunities.

Fishing crews consist of a skipper, who is typically the owner of the boat and equipment, and his crew (generally two to three crew but can be up to six). Fishing boats consist of wooden or plastic dugout canoes equipped with a 40-horsepower outboard motor and fishing equipment includes surface drifting gill nets for the capture of small pelagic and bottom gill nets for the capture of demersal fish. An example of an artisanal fishing vessel in Mambi is presented in Figure 7.11.

Figure 7.11: Wooden canoe equipped with nets in the community of Mambi

FGDs with local fishers in the sample villages indicated that the main fish and shellfish species caught are the African sea catfish, bass, great barracuda, sea bream, gilt-head bream, red carp, emperors, snapper, sardines, crabs, prawns and lobsters. Fishers across all sample communities are reportedly experiencing a decrease in fish catch over recent years.

The skipper pays the crew either after each fishing trip, or monthly. Salaries depend on the catch and the particular task of the crew member. Artisanal fishermen of Mayumba often embark on fishing trips which last between three to six days. Successful catches can provide an average of about 250 kg of fish, which can be sold for approximately 300,000 FCFA on the local market. One kg of fish is worth at least 1,500 FCFA. On average, the crew go on three or four fishing trips per month. The minimum monthly income of a crew is 1,200,000 FCFA (Enviropass, 2017, 2019, 2020).

Fish is sold and eaten fresh or processed. Women are responsible for processing (such as salting, smoking, packaging) and assuring transport and sale of fish in urban areas and inland villages. Children are also involved, particularly during school holidays. Most fish caught is however consumed within the household as it provides 70 percent of the animal protein in the local diet.

Artisanal fisheries in the sample villages faces a number of logistical problems that hampers its development. These include:

- lack of a sales and repair facility for fishing and boat equipment
- lack of means to preserve fish locally or during transport to large urban centres, especially Libreville.

In order to encourage sustainable management of artisanal fisheries in Gabon the Minister of Fisheries, Agriculture and Food Security, together with the Ministers of Defence and Environment, have launched in Libreville the national program to equip artisanal maritime fishing vessels with satellite technology. It is hoped that this technology will allow a better control of landings and catch declarations, improve the safety of fishermen and ensure the sustainability of a key resource for a whole part of the Gabonese economy (CLS, 2021).

7.5.2 Natural resource harvesting

Activities such as the collection of wild foods constitute an important part of the subsistence economy and provide a vital source of nutrients for households in rural Gabon, including the sample villages. FGDs indicated that mushrooms, nuts, wild fruits and honey are collected in the sample communities. Wild food plants are primarily collected for subsistence, and honey is used for medicinal purposes. Wild fruits are used both for subsistence and for cash when there is surplus.

Nkumu (*Gnetum africanum*) leaves were reported as an important wild vegetable. They are generally cooked in oil or peanut paste and used as an accompaniment to meat, smoked fish and smoked shrimps. Ngungu (*Megaphrynium macrostachyum*) leaves are used as food wrapping (FAO, 1998).

Women are the main participants in the collection of mushrooms and nuts. Both men and women collect wild fruit and honey. Wild foods are mostly collected during the rainy season, with the exception of honey, which is collected all year round. No permission is required for the collection of wild plants. The key challenge for the harvesting of natural resources is human-animal conflict, as animals, specifically elephants, often compete for the same natural resources as local people.

Intertidal gleaning

Oyster gleaning (carried out on foot or by diving), takes place between August and October is popular in the sample villages and reportedly a good source of income. The main areas for oyster collection are mouth of the Banio Lagoon and Banio bridge. Both men and women collect and process the oysters, which are often cooked before sale. During the school holidays children are also involved in oyster gleaning. In general, approximately 60 percent of the catch is sold and the income from oyster sale is about 200,000 FCFA per month.

Hunting

Although onshore hunting is not classed as a receptor for this offshore Project, information is provided on this activity to ascertain other forms of subsistence for the local communities.

The people of Mayumba, like all Gabonese people, are culturally attached to hunting. However, in the sample villages, hunting is marginal and a highly restricted, due to the regulations that govern this sector, but also due to the existence of the Mayumba National Park and the Marine Park at the mouth of the Banio River. These protected areas lead to the restriction, or prohibition, of hunting. In the authorised zones, hunting (exclusively a male activity) is practised in two forms: trapping and shooting. The sensitive nature of hunting activities makes it difficult to assess its importance for the local population. However, in the current context of under employment, young people turn to hunting to earn an income or to augment the protein source in their diet.

7.5.3 Agriculture

Although onshore agriculture is not classed as a receptor for this offshore Project, information is provided on this activity to provide context and ascertain other sources of income for the local communities.

Only 0.08 percent of Gabon's land is used for agriculture. Great emphasis is placed on food imports to sustain national demands, with food imports totalling over USD 591 million in 2018 (Legault and Cochrane, 2021).

Women are the main actors in food crop cultivation (Yates, 2018; Legault and Cochrane, 2021). Manioc and plantains are the two most important staples, supplemented by yams, sweet potatoes, taro, maize, groundnuts, sugarcane, pineapples and cucumbers (Yates, 2018). Mountain rice is grown in the southwest savannahs around N'Dende and Tchibanga. Fruit trees, such as the mandarin, orange, mango and papaya are the most common in the northern parts of the country (Yates, 2018).

Ogooué Maritime Province imports almost all of its food from other provinces and from Cameroon. Only the plantain consumed is sourced almost entirely from Ndougou. Livestock breeding is not well developed and is geared at subsistence. Market gardening takes place, including cultivation of aubergine, cucumber, passionfruit, okra, melon, onions, chilli, pear, pepper, lettuce and tomato.

Agriculture in Nyanga Province is co-ordinated by the Provincial Directorate of Agriculture whose main mission is to promote income-generating agricultural development by improving crop yields and livestock rearing. Shifting cultivation, which consists of the clearing of land of vegetation, cultivating it for a few years and then abandoning it for a

new area till its fertility has been restored, is mainly practiced. Rudimentary tools (machetes, axes, files) are used for the cultivation of areas of generally less than one hectare. Whereas men are responsible for felling and cleaning the crop plots, women plant and harvest. Market gardening, in small gardens adjacent to household dwellings is also popular. Traditional livestock breeding is practiced in rural villages for self-consumption.

Subsistence crop cultivation is widely practiced in the sample communities, whilst livestock rearing is marginal. Shifting cultivation is conducted in forested areas a few kilometres from the city of Mayumba and on old land parcels for which customary user rights are secured by the Forestry Code. The main crops grown with shifting cultivation include cassava, yam, taro potatoes, bananas. The produce is used for consumption whilst surplus is sold on the local and nearby urban markets. Market gardening, which focusses on vegetables and fruit trees is undertaken by women near the homesteads predominantly for subsistence.

Key challenges for agriculture are as follows:

- a small rural population
- a poorly adapted agricultural training system
- lack of agricultural extension services
- lack of credit facilities
- lack of agricultural development policy.

Key challenges for agriculture in the sample communities include lack of agricultural inputs and damage to crops from wild animals (mainly elephants) (TEREA, 2012).

7.5.4 Forestry

Although onshore forestry is not classed as a receptor for this offshore Project, information is provided on this activity to provide context and ascertain other sources of income for the local communities.

Gabon is Africa's chief exporter of plywood and its fourth most important producer of tropical woods (Yates, 2018). Logging concessions cover approximately 150,883 km² of the country (FCPF, 2018). Dozens of wood varieties are exported, including Keva, Beli, Ebiara, Ovangkol, Dibetou, Padouk, Doussie, Bilinga, Azobe, Acajou, Bosse, Dabema, Iroko, Izombe, Movingui, Niangon, Okoume,Omvong, Ekoune, Okan, Pachyloba, Paorosa, Sapelli, Sipo, Tali, Tiama, Wenge, Gheombi, Andoung.

Timber exploitation has traditionally been carried out by mechanised firms from France and Gabon and by non-mechanised Gabonese family-owned enterprises.

Gabon Wood Industries founded in 2012, owns 400,000 hectares of forest in the Gabon Special Economic Zone (GSEZ) in the south of the country, responsibly for producing around 400,000 square metres of round logs a year. The Company's major markets include South Africa, Europe, the Middle East and China.

Sawmills of the timber industry are located at Port-Gentil, Libreville and Mayumba (Yates, 2018), from where timber is exported (World Bank, 2019).

In September 2018, the Gabonese President announced that all logging concessions must be Forest Stewardship Council (FSC) certified by 2022. Any logging company

operating in Gabon, not involved in this certification process by 2022, will be deprived of its license. In 2019, only three out of 40 major forestry companies were FSC certified: Rougier Gabon, Precious Woods and the Gabon Wood Company (Compagnie des Bois du Gabon) (World Bank, 2019).

Logging and the production of wood products is a core industry in Mayumba. According to the African Conservation Development Group, forestry operations are undertaken at Grande Mayumba and Guiesto by the company African Equatorial Hardwoods (ACDG, 2021). This entails the harvesting of commercial and lesser-known wood species. Logs and wood are sent to the Port Gentil processing facility to produce veneers, plywood and kiln-dried sawn timber. By 2025, the company hopes to expand forestry operations and wood processing capacity at Grande Mayumba, investing in skills training and community support, infrastructure and logistics capacity and market development (ACDG, 2021).

It is anticipated that a new processing mill will be built at Mangali, adjacent to the Mayumba port, in order to process approximately 50,000 m3 of wood annually. The processing of natural hardwoods at Mangali will ultimately be complemented by timber from plantation forests within Grande Mayumba for the regional construction industry (ACDG, 2021).

7.5.5 Shipping and navigation

The General Directorate of the Merchant Navy is responsible for the management of navigation and shipping routes in territorial waters and to ensure maritime security.

Maritime traffic includes international cargo vessels, oil and gas industry support vessels, fishing vessels, national navy vessels and vessels chartered by surveillance agencies (EnviroPass, 2019).

Marine traffic density along the Gabonese coast is presented in Figure 7.12. Shipping densities along the Gabonese coast are highest in the approach to Port Gentil and between Port Gentil and Omboue, due to the prevalence of offshore oil fields in this area. Service vessel routes from Port Gentil to the oil fields in the vicinity of the Dussafu Block can also been seen.

Shipping lanes from Port Gentil north to Libreville and south to Pointe-Noire in RoC follow the coastline. The majority of international cargo vessels generally travel closer to the coast at a distance from the Ruche EEA.

7.5.6 Oil and gas

Gabon has a long history of producing oil, which was first discovered in the vicinity of Libreville in 1931. Following a series of discoveries made in the 1950s, Gabon experienced an oil boom that made it one of the wealthiest countries in the region. Following the US shale revolution, the oil price crisis of 2014 destabilised Gabon's economic foundations based on oil extraction and, in 2015, the country recorded the first fiscal deficit since 1998 as exports declined. Gabon's maturing fields and decreasing production levels, together with the low-price regime over the past five years, have brought the country's oil industry to a turning point.

New market conditions triggered a reshuffle and displacement in the holdings of the main players, some of whom left the country after 50 years of continuous operations.

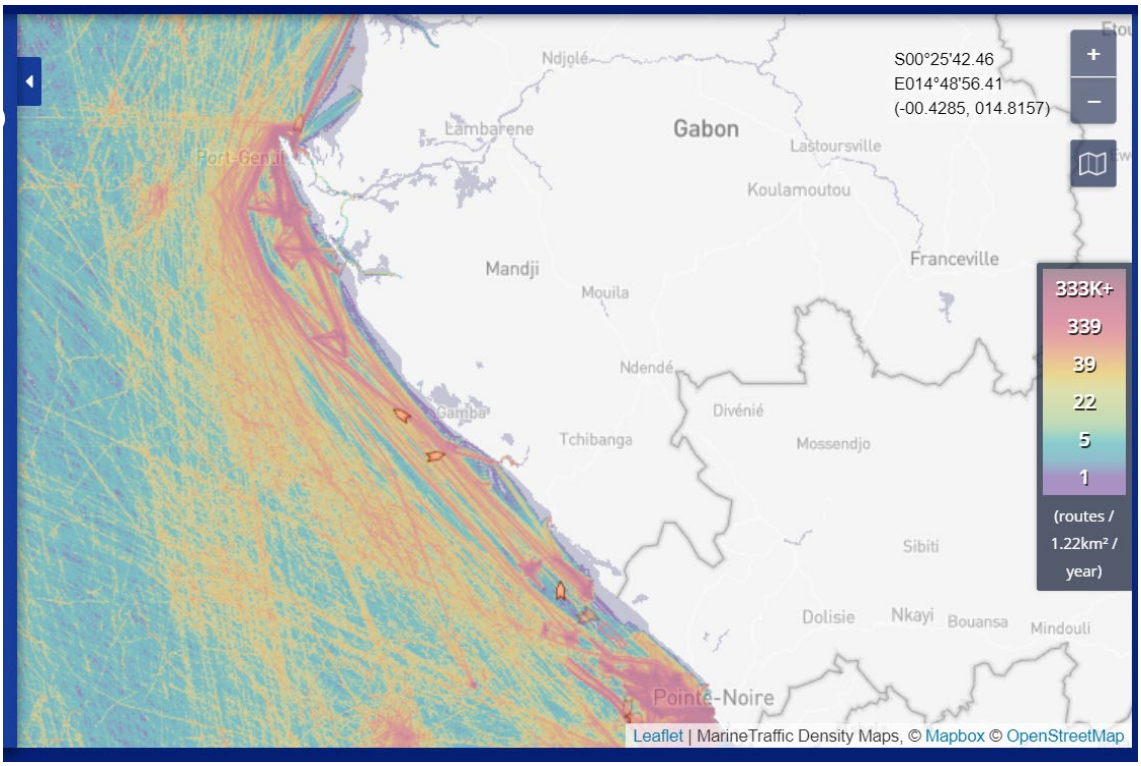

Figure 7.12: Marine traffic density

Source: Marine Traffic (2021)

Gabon is OPEC's smallest member, having re-joined the cartel in 2016 after a breaking away from it in 1994. By re-joining, Gabon sought closer international cooperation and protection in the volatile environment. Although currently contributing less than 1 percent of total global output of oil, Gabon fully bears the consequences of global events. The country's tender for 12 conventional and 23 deep offshore blocks, initially scheduled to close on April 30th, 2020, was postponed until June 2021 in light of the pandemic (http://gabon12through.com/), more information presented in Section 10.4.5.

The oil sector, no longer taken for granted, was revitalised through regulatory changes, including a revamped Oil Code adopted in 2019. This included eradication of double taxation for the upstream sector: the corporate tax of 35 percent has been removed. Royalty rates are also cut from 13 to 7 percent in conventional waters, and from 9 to 5 percent in deep water. The lifespan of Production Sharing Contracts (PSC) has been extended by two years, to allow bidding companies ten years for exploration and 15 years for production under fixed terms for the specified period. The new code introduces special provisions for gas too. The exploitation period granted for gas starts with 15 years in conventional areas and 20 years in deep and ultra-deep offshore areas, both periods are extendable. In shallow water, gas royalties were dropped from 12 to 4 percent while in deep water these came down to 2 from 9 percent. The new legal basis is hoped to galvanise investment (Global Business Reports, 2020).

A new regulation launched by the Central African Economic and Monetary Union (CEMAC) in 2018, with effect on all francophone countries using the CFA Franc, requires any operator registered in Gabon to keep a bank account in the country and pay all suppliers from the resident account, thus setting up oil revenues in the CFA zone. This

measure was taken in an effort to replenish the currency reserves (Global Business Reports, 2020).

Oil and gas activity is intensive in the waters offshore from Gabon, particularly in the area around Port Gentil, see Figure 10.5. Offshore from Mayumba there are the M'Wengui, M'Bya Marin and Malembe Marin fields operated by Vaalco; the Ebouri, Etame, Avouma and North Tchibala fields operated by Perenco; and the Ruche field operated by BWE. Future oil and gas third-party projects in the area are discussed in Section 10.4.5.

Industrial facilities along the coast within the unplanned / accidental events AOI are mostly oil and gas related, see Figure 7.4, and include the petroleum terminal at Cap Lopez, the PG2 natural gas power plant on the coast adjacent to Port Gentil, Perenco's Batanga facility, and the oil terminal at Gamba.

7.5.7 Tourism and recreation

Gabon's primary tourist attraction is nature, including rainforest, wildlife and marine life. Gabon has 13 national parks, representing approximately 11 percent of the territory (Oxford Business Group, 2016c). The country has recently established a network of 20 Marine Protected Areas (MPAs), including 9 marine parks and 11 aquatic reserves, which represent 26 percent of Gabon's aquatic space (Oxford Business Group, 2016c). Commercial fishing has been prohibited within these protected zones in order to safeguard Gabon's coastal ecosystem and species such as whales, sharks and sea turtles. It has also paved the way for the development of high-end tourism based on services with high added value, such as sport fishing, beach tourism and wildlife observation. Although beaches are not particularly promoted in Gabon's international tourism strategy, these constitute a major attraction for domestic tourism (Cloquet, 2020).

There are few reliable data on tourism trends in Gabon, however the number of international tourist arrivals remains low, having never surpassed 270,000 persons, which was the figure for 2005 (Cloquet, 2020). Anecdotal evidence suggests that non-resident visitors are mostly Gabonese from the diaspora, followed by visitors from France, Cameroon, Great Britain and the United States (Cloquet, 2020).

It is estimated that Gabon has in excess of 300 hotels, with a total room capacity of 5,300. Over half of all hotels are located in Libreville (OBG, 2016b).

In recent years, the government of Gabon has made attempts to boost the tourism sector as a means to generate foreign currency, create jobs and promote social and economic development across the country (Cloquet, 2020). The sector is expected to develop in the next few years on the back of expanded hotel capacity, upgraded transport infrastructure and better air links (Oxford Business Group, 2016c).

A 10-year sector development plan is currently being executed called the 'National Tourism Strategy' (Stratégie Nationale du Tourisme 2015-25), which aims at converting Gabon into a major destination for ecotourism, conferences and exhibitions by 2025 (Oxford Business Group, 2016c).

The province of Ogooué Maritime has a number of tourist sites along its coast and lagoons that offer opportunities for sports fishing, observing animals and for walks. The National Park of Loango between Nkomi and Ndogo is recognised by the IUCN and is proposed as a UNESCO world heritage site.

Port Gentil has a number of tourist attractions including churches, markets, botanical and faunal gardens, whale spotting and turtle nesting and it provides a number of excursions to surrounding forest, lagunes, traditional villages and savannas.

Basse Banio and Haute Banio have invaluable tourist potential. Consistent with the trend at the national level, the key attractions in the sample communities are all nature-based and include the beaches and coastline, fishing, and natural beauty sites such as the Kaya falls.

Mayumba is renowned for its fine sandy beaches and ecological diversity. Mayumba boasts a marine park which offers turtle nesting sites (October to April) and sightings for whales and dolphins (July to September) and sharks, rays and manatees.

There are several tourism businesses offering a range of services, including sport fishing, whale and turtle viewing, water sports (surfing, canoeing and sailing) and lagoon hikes.

Hotels in the sample communities include:

- Mbidia Koukou: hotel in Mayumba National Park
- Likwale Lodge: hotel overlooking the Banio Lagoon
- Fabso residence hoteliere
- Sans Enterprise.

Visitors to the tourist sites in the sample communities comprise domestic visitors from Libreville, Port Gentil, Tchibanga and Lambarene, in addition to international tourists from a range of countries, including France and Germany. Visitor statistics are not available; however, numbers are reportedly highest during the dry season and long school holidays (from July to September).

An overview of tourist facilities in the unplanned / accidental events AOI is included in Figure 7.4 and includes sandy beaches and club houses near Port Gentil and tourist facilities for Loango National Park and Mayumba National Park.

The COVID-19 pandemic and the associated curbs on tourist activities have caused a significant slow-down in business, with ramifications for employment - tourist enterprises in Mayumba, including Likwale lodge, have reduced their number of staff.

The tourism sector faces a number of challenges including:

- inaccessibility. One of the main obstacles is the lack of air connectivity between Gabon and the rest of the world and relatively expensive flights (Oxford Business Group, 2016c). Tourist sites are relatively inaccessible. Direct access to most national parks from the main roads remains an obstacle for visitors (Oxford Business Group, 2016c)
- little involvement of local populations.

Figure 7.13: Grounds of hotel in the community of Mayumba

7.5.8 Trends and constraints

The following trends were identified in terms of livelihoods:

Economy

- Gabon faces challenges with regards to the development of its economic sectors, due to lack of policy and financial support (ILO, 2019)
- The economy remains heavily reliant on oil production. The decreasing oil price and the COVID 19 pandemic are negatively impacting the economy. Economic diversification is being sought and a strategy has been outlined in a recent Emerging Gabon document.

Small Business

- Launching a business requires time-intensive and bureaucratic procedures (BTI, 2020). As a result, the formal private sector in Gabon remains small. The private sector is mainly informal and unregulated.

Employment

- Gabon has a high unemployment rate, especially among young people and graduates (ILO, 2019)
- There is a limited coverage of national services - the National Employment Office is the public job service responsible for connecting job seekers with businesses. However, it cannot cover all needs with only five branches throughout the country (ILO, 2019)
- There is a dearth of recent quantitative data for anticipating skills and job requirements (ILO, 2019). However, anecdotal evidence suggests that Gabon

lacks national expertise in many sectors and sub-sectors. Data from the National Employment Office indicates a significant mismatch between labour supply and demand at all levels of qualification: the demand for jobs is greater than jobs on offer and more than two-thirds of the jobs offered by businesses are not filled (ILO, 2019).

Fisheries

- Commercial fishing, has considerable potential, but is little developed.
- Illegal fishing activities include:
  - trawlers in restricted areas near offshore oil installations due to the abundance of fish in these areas
  - Chinese cargo vessels, near or in the Mayumba Marine Park, threatening the traditional artisanal fishing
- Maritime artisanal fishing is mainly in the hands of foreign nationals
- Fish catches are reportedly decreasing in the artisanal fishing zone. This is reportedly due to the creation of marine parks and an increase in fishermen. Fishing is increasingly relied upon in coastal communities near Mayumba due to lack of alternative employment.

Natural resources

- Wild foods, intertidal gleaning, and game continue to play a role in the subsistence of rural communities.

Agriculture

- Although agriculture (mainly subsistence farming) occupies about one-third of the workforce, it plays a small part in the economy of the country as a whole. Moreover, its appeal as a way of life has declined. Better educational and employment opportunities in the towns and cities have emptied the countryside of young people (Britannica, 2021)
- A low population density with wide regional disparities, an ageing, rural labour force and traditional, non-intensive production systems hamper the development of the agricultural sector (AFDB, 2017)
- Gabon continues to rely heavily on food imports (Lloyds Bank, 2021).

Forestry

- Timber is one of the core economic factors of Gabon.

Tourism

- Nature-based tourism has great potential (nature-based) but is not well developed, predominantly due to lack of infrastructure. Efforts are being made to develop the sector.

Oil and Gas

- Gabon's economy is largely oil based
- Gabon's economic identity as an oil producer and its attractiveness as an investment destination is increasingly being challenged due to its decreased resource potential and its regulatory framework, which has recently been adapted.

7.5.9 Vulnerability and sensitivity to change

The vulnerable groups in terms of livelihood activities are outlined in Table 7.14.

Table 7.14: Livelihoods: Vulnerabilities

Vulnerable groups	Rationale
Women and in particular female-headed households	Women have less employment opportunities due to lower educational levels, domestic duties and discriminatory labour laws and practice. Women are more involved in subsistence activities (subsistence agriculture, natural resource collection) than cash earning activities.
Employees in the informal sector	Employees in the informal sector lack legal protection and social security
Business owners and employees in the tourism sector	The tourism sector is currently threatened by the COVID 19 pandemic
Artisanal fishermen solely relying on fishing	Fish catches are reportedly declining and there are few alternative employment opportunities in rural coastal villages
Migrants	Labour practices do not protect migrants
Small business owners	High bureaucracy makes development of small business difficult
Disabled	Lack of employment opportunities
Unskilled youth / low skilled youth	Lack of employment opportunities

7.5.10 Key considerations

Key considerations for the impact assessment include:

- Women have less employment opportunities then men
- Fish catches are reportedly decreasing, an increasing number of local residents turn to fishing due to lack of employment opportunities
- There are illegal fishing trawlers reported in the AOI
- Maritime artisanal fishing is dominated by foreign nationals
- BWE's Tortue, Ruche and Hibiscus fields are outside the areas authorised for artisanal sea fishing. However, according to artisanal sea fishers in Mayumba, during seasons of severe drought, they may be forced to go beyond the usual authorised fishing areas
- Crop farming and fishing are the primary economic activities in the sample villages, livestock rearing, natural resource collection and aquaculture are marginal
- There is a relatively high maritime shipping density along the coast of Gabon, particularly in vicinity of Port Gentil
- Oil and gas are still the mainstay of the Gabonese economy, however due to a decrease in oil prices and resources, economic diversification is increasingly being considered
- The tourism sector, in particular nature-based tourism, is earmarked by the government for development.

7.6 Health

Health is a core human right as stated in the UDHR (Article 25(1)). This section sets out the health indicators and health facilities in Gabon and outlines the potential risks and challenges faced by the population of Gabon in terms of their health.

Gabon's key health indicators are presented in Table 7.15.

Table 7.15: Health indicators for Gabon, Sub Saharan Africa and the World

Indicator	Gabon	SSA	World
Fertility rate, total (births per woman)	3.9	4.6	2.4
Infant mortality rate (IMR) (per 1,000 live births)	31.1	51.7	28.2
Under-five mortality rate	42.5	75.8	37.7
Maternal mortality rate (modelled estimate per 100,000 live births) (2017)	252	534	211
Prevalence of anaemia among children (% of children under 5) (2016)	62.5	60	41.7

Source: World Bank, 2021c

Note: data are from 2019 unless otherwise specified.

Maternal and child health outcomes have improved considerably in recent years and are generally better than the SSA averages. The under-five mortality rate decreased from 89 deaths per 1,000 live births in 2000 to 42.5 in 2019 (UNECA, 2016; World Bank, 2021b). IMR have also decreased year-on-year since 1990. However, the rate of anaemia among children under five remains high, which suggests nutritional deficiency.

Health problems

The main health problems are presented in Table 7.16.

Table 7.16: Main health problems in Gabon

Indicator	Gabon	SSA	World
Disease incidence			
Incidence of HIV, ages 15-49 (per 1,000 people)	1.07	1.62	0.37
Incidence of tuberculosis (per 100,000 people)	521	226	130
Incidence of malaria (per 1,000 people) (2018)	248.2	219.1	57.4
Diabetes prevalence (% of population aged 20 – 79)	6.0	5.4	8.8
Total alcohol consumption per capita (projected estimates, 15+ years of age) (2018)	8.74	5.8	6.2
Cause of death, by non-communicable diseases (% of total)	45.0	36.4	73.6

Source: World Bank, 2021c

Note: data are from 2019 unless otherwise specified

The table shows that the burden of disease in Gabon continues to be dominated by communicable infectious diseases such as HIV and tuberculosis. Malaria is also prevalent. However, there is an increasing prevalence of non-communicable diseases (NCDs) including diabetes, chronic respiratory diseases, cardiovascular diseases, cancers and mental health and substance use disorders. The key health problems are discussed further below:

- **Human Immunodeficiency Virus (HIV):** As outlined in Table 7.16, the incidence of HIV for people aged 15 – 49 years was 1.07 per 1,000 people in 2019. This is a significant decrease from the prevalence rate in 2000 (5.21 per 1,000 people). However, Gabon remains among the Central and West African countries with the highest HIV rate (Hadish et al., 2017). Current estimates suggest that 88 percent of people living with HIV in Gabon know their status. Fifty one percent of those living with HIV are on anti-retroviral therapy (UNAIDS, 2021). Combating HIV/AIDS remains a priority for the Government.
- **Malaria:** Gabon has a high incidence of malaria and other vector-transmitted diseases (see Table 7.16). The incidence of malaria in 2018 was higher than the SSA average and significantly higher than the global average. The risk is especially high during and immediately after the rainy seasons (October to December and February to April). (Borgen Project, 2017b).
- **Tuberculosis (TB**): The incidence of TB in Gabon exceeds the SSA and global averages. Limited access to laboratory diagnosis is one of the main contributing factors to the tuberculosis crisis in Gabon (Borgen Project, 2020a).
- **Zoonotic diseases**: Human incursions into Gabonese forests for exploitation purposes has led to intensified contact between humans and wildlife and generates a risk of emergence of zoonotic disease. At least 51 endemic or potential endemic viral infectious diseases have been reported in Gabon. Among them, 22 are of zoonotic origin and involve 12 families of viruses (Bourgarel et al., 2010).
- **COVID-19:** The global COVID-19 pandemic has also impacted Gabon. Between 3 January 2020 and 14 July 2021, 25,198 confirmed cases of COVID-19 were recorded to the World Health Organisation with 162 deaths. The epicentre of the pandemic is in Libreville with 70 percent of the cases. As of 13 July 2021, a total of 72,351 vaccine doses had been administered (WHO, 2021).

FGDs in the sample villages reported the following main health problems: malaria, flu, diarrhoea and hypertension (amongst adults). Health concerns among women include gynaecological conditions such as vaginal infections and menstrual pains. Sexually transmitted infections (STIs), including HIV, chlamydia, syphilis and gonococcus were also reported as health issues for women. Gender based violence was reported in all of the sample villages.

At the time of primary data collection, ten cases of COVID-19 had been registered in Mayumba. Although no testing facilities are available in Mayumba and Ndindi, samples can be sent to Tchibanga, which is also the nearest treatment facility for COVID-19. Awareness campaigns have been held in terms of COVID health guidelines, including wearing of masks, hand washing and social distancing.

Nutrition and food security

Gabon ranks 68th out of 107 countries in the 2020 Global Hunger Index. Gabon has a hunger score of 18.2, which means that its level of hunger experienced by its population is considered ‘moderate’ (Global Hunger Index, 2021). Food and nutrition insecurity

affects the general population and in particular the vulnerable groups, including children under the age of five, pre-school children, pregnant women, nursing mothers and the elderly. Table 7.17 shows food and nutritional indicators for Gabon.

Table 7.17: Food and nutrition indicators for Gabon

Indicator	Percentage
Children under five	
Under five stunting[7]	17.0
Under five wasting[8]	3.4
Under five overweight	7.7
Adolescents	
Overweight adolescent male	10.6
Overweight adolescent female	18.9
Adults	
Overweight male	25
Overweight female	26.8
Obesity male	10.0
Obesity female	21.2
Diabetes male	10.0
Diabetes female	10.0
Anaemia in women aged 15-49 years	59.1

Source: SUN (2021)

As outlined in Table 7.17 approximately 17 percent of children under five experience stunting. Long term consequences of stunting include compromised growth and development of organs. This causes physical and cognitive challenge and undermines children's health and educational outcomes (Baye et al., 2020).

Approximately 7.7 percent of children under five are considered to be overweight, a higher proportion than the SSA average of 3.9 percent (World Bank, 2021c). This increases the risk of diet-related non-communicable diseases. Gabon's obesity prevalence is also higher than the regional average of 18.4 percent for women and 7.8 percent for men. Diabetes is estimated to affect 10 percent of adults.

Anaemia is prevalent, affecting approximately 59 percent of women aged 15-49 years and 62.5 percent of children under five.

FGDs in the sample villages indicated that households can generally not provide sufficient food for their families year-round. Climate change and destruction of crops by elephants were identified as the main culprits.

[7] Children are defined as stunted if their height-for-age is more than two standard deviations below the WHO Child Growth Standards median

[8] Children are defined as wasting when their weight for height <-2 standard deviations from the median of the WHO

Rice, manioc, banana and taro are the main staple foods. Oysters, fish and poultry are the main sources of protein. Wild foods (nuts, fruits and wild mushrooms, game) supplement the local diet.

7.6.1 Health care

The Ministry of Public Health is responsible for health-related matters and infrastructure in Gabon. The ministry divides the country into ten health regions and 52 departments (Nguema et al., 2018). The main indicators related to health care are presented in Table 7.18.

Table 7.18: Health care indicators for Gabon, Sub Saharan Africa and the World

Indicator	Gabon	SSA	World
Current health expenditure (percent of GDP) (2018)	2.7	5.1	9.8
Total health expenditure per capita (USD) (2018)	218.4	83.2	1,100.8
Physicians (per 1,000 people) (2017)	0.7	0.2	1.6
Nurses and midwives (per 1,000 people) (2017)	2.9	1 (2018)	3.8 (2018)

Source: World Bank, 2021c

Note: data are from 2019 unless otherwise specified

Over the last decade, Gabon has significantly increased its public investment in health. Public funding (or compulsory schemes) as a share of total health expenditure rose from 40 percent in 2001 to 65 percent in 2016 (WHO, 2020). However, the current health expenditure as a share of GDP remains below the regional average and is lower than neighbouring countries (Borgen Project, 2020b).

Following a 2008 health financing reform, Gabon has put in place a system of mandatory health insurance and established a national mandatory health insurance and social security fund. Coverage for the poor is funded through an innovative tax on mobile phones and financial transactions. Today, this fund covers 60 percent of the population, in particular the poor, students and government and private-sector workers (WHO, 2014).

Health facilities

The Ministry of Health and Public Hygiene is responsible for health-related matters and infrastructure in Gabon. Most health care facilities are public; however, the quasi-public and private sectors play a key role in providing services. Libreville is the centre of the public health system with several large hospitals that form the first tier of health care facilities. Outside of Libreville, there are eight regional hospitals based in each of provincial capitals, which form the second tier. The third tier includes an estimated 700 ‘first contact’ sites, including local medical centres, health clinics, infirmaries, dispensaries and rural outposts. However, many of these third-tier sites, particularly in the interior of Gabon, are not operational or are in disrepair (Oxford Business Group 2014). Health facilities in the provinces of Nyanga and Ogooué Maritime are presented in Table 7.19 and Table 7.20 below.

Table 7.19: Health facilities in Ogooué Maritime Province

Ogooué-Maritime Province	
Public health infrastructure	
Hospital	2
Medical centre	2
Ambulatory treatment centre	1
Malaria center	1
Rural outpost	15
Dispensary	51
Maternal and child health	1
Private health infrastructure	
Pharmaceutical depot	4
Health clinic	13
Pharmacy	8
Dental clinic	3

Source: Ogooue Maritime (2013)

Table 7.20: Health facilities in Basse Banio and Haute Banio (Nyanga Province)

Nyanga Province		
	Basse Banio	Haute Banio
Public health infrastructure		
Medical centre	1	1
Rural outpost		
Dispensary	6	3
Infirmary	1	0
Para-public health infrastructure		
Socio-medical centre	1	0
Private health infrastructure		
Pharmaceutical depot	1	0

Source: DGEPF (2013)

Health care personnel is estimated at 12,000 people nationwide, including 9,500 in the public sector. There are approximately four doctors, 50 nurses and four midwives per 10,000 inhabitants in the public sector. The number of beds is estimated at 4,000 for the entire health system, i.e., a ratio of 25 beds per 10,000 inhabitants (ERM, 2012). The health personnel in the provinces of Nyanga and Ogooué Maritime in 2013 is presented in Table 7.21.

Table 7.21: Health staff in the provinces of Nyanga and Ogooué Maritime

Category	Nyanga	Ogooué-Maritime
Dentist	1	
General practitioner	6	22
Gynaecologist	1	
Midwife		14
Nurse		18
Nursing assistant		183
Paediatrician	1	
Pharmacist		1
Senior technician		24
Surgeon	1	1

Source: Ogooue Maritime (2013), DGEPF (2013)

Provision of health care in the sample communities is achieved through primary health care services. Health care facilities at Mayumba and Ndindi offer services including 24-hour emergency care, general consultations, preventative programmes and awareness campaigns, reproductive health programmes, maternity care and family planning services, immunisation services, children's healthcare and medication.

The facility at Mayumba is the largest, with a permanent staff of 25 employees, including two doctors, eight nurses and one midwife. The facility at Ndindi is staffed by one nurse and one midwife. There are dispensaries located at Malembe 2 and Mambi which are staffed by dedicated medical practitioners who provide services to the immediate community.

Consistent with the trend at national level, both healthcare facilities are reportedly ill-equipped and suffer from several deficiencies in terms of infrastructure, medical equipment and supplies, maintenance, staff shortages and medical expertise and lack of ambulances. Running water is provided through a water tank and electricity is provided through generators; however, supply is inconsistent. There is no functioning landline, mobile phone, or radio at either facility. In Malembe 2 there is no sanitation, electricity and refrigeration in the health facility.

Consultation costs range from 500 to 3,000 FCFA. Costs are subsidised for patients who have health insurance. Healthcare is generally considered to be affordable for the majority of the population in Mayumba and Ndindi. However, in Malembe 2 it was reported that health care was unaffordable for some.

The nearest referral hospital is located at Tchibanga. Mayumba facility provides transport to this hospital, which is located approximately 90 minutes away and costs between 14,000 and 30,000 FCFA. Ndindi facility does not provide transport to the hospital and patients must organise their own transport, taking up to 5 hours. Tchibanga hospital provides COVID-19 testing and treatment for COVID affected patients.

Figure 7.14: Health centre in the community of Ndindi

Traditional medicine

In addition to the orthodox health system, traditional healers are an important component of the health system. In KIIs and FGDs in the sample villages it was indicated that traditional medicine is used for a number of ailments, including eczema, stomach aches and haemorrhoids.

7.6.2 Trends

The main trends in health conditions and the health system are as follows:

- Maternal, infant and child mortality remain high, as is the burden of contagious diseases, including and HIV and tuberculosis
- Non-contagious diseases such as diabetes and cardio-vascular diseases are on the increase
- The COVID-19 pandemic has affected Gabon, in particular Libreville
- The health care system faces a number of challenges including disruption of essential drugs, lack of medical diagnostic devices, staff and skill shortages, infrastructure and equipment shortages
- There is an imbalance in resource allocation in favour of the curative aspect to the detriment of the preventive aspect and awareness campaigns. There is inadequate allocation of resources for primary health care.

7.6.3 Vulnerability and sensitivity to change

The vulnerable groups in terms of health are outlined in Table 7.22.

Table 7.22: Vulnerabilities: health

Health - vulnerable groups	Rationale
Women	• Women are generally in charge of the care of family members (children, elderly) and may therefore carry extra burden when a family member is sick. • Women are generally in charge of the nutritional needs of the family to ensure health of babies and children • Women are vulnerable to a number of health problems linked to pregnancy
Rural populations	Rural populations generally have less access to hospitals, and only have access to less-than-optimal health care facilities
Poor households without medical insurance	Poor households may not be able to afford medical care
Children and pregnant women	Children and pregnant women are most vulnerable to nutritional deficiency

7.6.4 Key considerations

Key considerations for the impact assessment include:

- Malaria, HIV, TB and diabetes are prevalent diseases in the AOI. There are risks of zoonotic diseases and the number of people with non-contagious diseases is increasing
- Gabon has been affected by the COVID-19 pandemic
- There are occasional threats to food security in the sample villages
- The health facilities in the sample villages face a number of challenges including disruption of essential drugs, lack of medical diagnostic devices, staff and skill shortages, infrastructure and equipment shortages.

7.7 Infrastructure and Services

Well-functioning and available Infrastructure and services are a requirement for an adequate standard of living, good health and access to information, all of which are stipulated in the UDHR. This section outlines some infrastructure and services and challenges they may face.

7.7.1 Access to water

Gabon has an estimated water resource of 127,825 m^3/capita/year, making it one of the world's richest countries in terms of water (AFDB, 2016). Despite this, the country suffers from a lack of adequate drinking water and well-maintained water storage facilities.

Figure 7.15 shows the percentage of urban and rural households with access to drinking water between 2000 and 2017. The overall rate of access to drinking water is estimated at 72 percent.

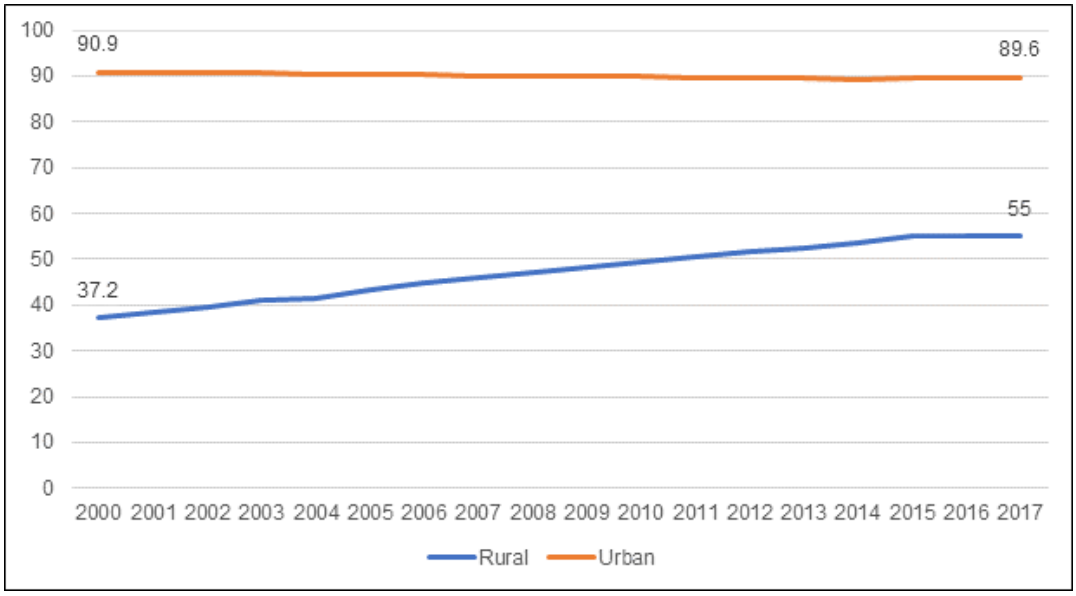

Figure 7.15: Gabon's access to basic drinking water in rural and urban areas

Source: World Bank (2021c)

Figure 7.15 shows that that there is a considerable difference between urban and rural areas and that there has been a slight decrease in the percentage of people with access to drinking water in urban areas, whilst there has been a significant increase in access to drinking water in rural locations.

The COVID-19 pandemic is exacerbating problems related to access to water as an estimated 250,000 people have become unable to pay their water bills due to COVID induced unemployment. A Budget Support Programme has been put in place to assist the population during the pandemic with water and energy bills.

The Gabonese government is currently undertaking an integrated drinking water supply and sanitation programme (AFDB, 2021). The first component of the project aims to guarantee universal access to drinking water and sanitation services in Great Libreville (Libreville, Akanda, Owendo and Ntoum) by building a 280 km extension of the drinking water network by 2025.

It is expected that an additional 31 percent of Libreville's population will have access to drinking water, as a result of the network expansion. The project will also benefit local industries, schools and hospitals (AFDB, 2021b).

The sample villages of Mayumba and Ndindi are connected to the water network (Société d'Energie et d'Eau du Gabon (SEEG). However, the supply is irregular, and it is not uncommon for households or businesses to experience water shortages. To overcome this problem, households collect rainwater or store tap water.

The main source of water for cooking, cleaning and drinking in Mabounda, Tchiole-Ndembe and Ndindi are wells; both pump wells and tap wells were identified. The wells recorded in Tchiole-Ndembe are provided by Société d'Energie et d'Eau du Gabon (SEEG). Water quality from the wells varies from bad to good.

Figure 7.16: Water pump in the community of Mambi

The primary sources of water for all purposes in Malembe 2 and Mambi are lagoons and springs. The quality of water is deemed poor.

Community leaders in the sample communities reported a lack of clean drinking water during the dry season.

7.7.2 Sanitation

Access to liquid sanitation facilities is poor in both urban and rural areas. Gabon is reported to have inadequate sewerage networks for both wastewater and rainwater.

In 2017, it was estimated that only 49 percent of households in urban areas had access to basic sanitation services, whilst the percentage in rural areas was 37 percent (Borgen Project, 2020c).

Open defecation was practiced by approximately 3 percent of the total population in 2017. This is significantly lower than other countries in the region such as Niger (68 percent) and Ghana (18 percent) (Borgen Project, 2020c). In the sample villages the large majority of households had latrines except for in the village of Mabounda where 40 percent of the households had no sanitation facilities.

7.7.3 Waste management

Waste management is a challenge in Gabon. In 2020, the Gabonese government decided to decentralise household waste collection; the management of household waste in Gabon's cities is now the responsibility of local authorities (Magoum, 2020). Poor liquid, combined with poor solid wate management in urban areas, has resulted in serious health (waterborne infectious diseases) and environmental hazards.

In close proximity to the port of Port Gentil, Impact Environnement Gabon (IEG) operates a waste management facility which has been established to support the oil and gas industry. It includes liquid and solid waste storage, incineration / burning of liquids (primarily oils) and some solids (including the burning of paper and cardboard in open burning facilities), drum and intermediate bulk container cleaning and crushing, and the processing of industrial generated recyclables (plastic, aluminium, and other metals) for subsequent off-site transfer for final recycling.

7.7.4 Energy

In 2018, power generation in Gabon was 2.2 billion kilowatt hours (kWh). Generation from fossil fuels accounted for 58 percent (EIA, 2020). Hydropower generation decreased from 920 million kWh in 2017 to 892 million kWh in 2018. Despite this, it is estimated that approximately 49 percent of Gabon's electricity is generated from hydroelectric plants (CIA, 2021).

The World Bank (cited in EIA, 2020) estimated that in 2018, 93 percent of Gabon's population had access to electricity; urban areas consume most of the country's generated power and have an electrification rate of 97 percent, while rural areas have an electrification rate of 63 percent. Despite electrification rates being at 63 percent in rural areas, the World Bank estimated that only 24 percent of rural areas had access to electricity in 2019 (World Bank, 2021d). The government plans to provide electricity for 85 percent of rural regions by 2025.

Gabon's growing and urbanising population, paired with its industrial development, are straining the country's power generation capacity; to meet electricity demand, Gabon continues to invest in new hydroelectric power plants (EIA, 2020).

The main energy source in the sample communities is electricity via SEEG, however hurricane lamps are also used, and solar panels were recorded in Mambi.

FGDs with women identified wood, collected from the surrounding forests, as the main type of energy used for cooking in Mabounda, Tchiole-Ndembe, Ndindi and Mambi, Other energy sources for cooking include gas cylinders and charcoal.

Figure 7.17: Solar panels in the community of Mambi

7.7.5 Transport

Roads

Gabon has one of the lowest road densities in the world, which isolates it from global supply networks. Only 12,000 km of paved road crosses the 260,000 km^2 country. Gabon boasts seven national routes and a number of minor roads and tracks (N1 to N7) (GCR, 2020). Major roads in Libreville and Port-Gentil are paved although in poor condition; minor roads within these cities, and roads outside of large cities are mainly dirt tracks (OSAC, 2020). Despite this, the national road network has been substantially upgraded since 2009, with the paving and improvement of approximately 650 km of roads across the country (Oxford Business Group, 2016b). A mainland road link was constructed between Libreville and Port-Gentil in 2015 improving the road network in the area.

The coastal area is poorly serviced by roads and there is no coastal connection between Port Gentil and Mayumba, which is connected by the N6 to Tchibanga (109 km) and Ndende and then via the N1 to Libreville. There is a coastal track between the Banio lagoon and the seashore.

In 2020, Gabon began work on a 780 km Trans-Gabon highway that will bisect the country from west to southeast and will cross six of the country's nine provinces (GCR, 2020). The $1 billion Trans-Gabon highway will replace some sections of the N1 and N3 roads that have become congested with traffic in recent years. The project was expected to start in July 2020 and end in 2023, however this has been delayed by the recent COVID-19 pandemic (GCR, 2020).

Private cars are the main means of transport on the road. In some towns, such as Tchibanga, transport is organised by small transport agencies which cater for passengers and goods.

Airports

Air travel plays an important role in Gabon's transport. In 2013, there were a total of 44 airports in Gabon (CIA, 2021). Libreville is classed as an air transport hub and has many routes to the interior of Gabon; the airport has seen a steady growth of passenger numbers in recent years (Oxford Business Group, 2015). In Ogooué-Maritime Province there are airstrips in Gamba and Omboué and an international airport in Port Gentil.

The Port Gentil airport is the second largest airport of Gabon, located 3 km northwest of the city of Port Gentil. It handles both domestic and international services from Cameroon and the Republic of Congo. The passenger terminal has a floor area of around 8,000 m^2 and 3,000 m^2 on the mezzanine. One million passengers are expected each year. Thanks to the extension of the airstrip, the airport can now accommodate long-haul aircraft.

In Nyanga Province there are airstrips in Tchibanga, Moabi and in Mayumba.

As the majority of freight in Gabon travels by ship, air freight traffic is limited; the flow has decreased by 2.1 percent between 2009 and 2014 to just 19,458 t.

Rail

The Trans-Gabon Railway covers a single-track, standard gauge line, which crosses the country obliquely from northwest to southeast. The line runs from Franceville in Gabon's eastern mining region, via 23 stations to Libreville (IFC, 2019). Gabon relies heavily on the railway for the transportation of its manganese to the port in Libreville for export. The current railway lacks capacity and a $362 million investment program and recovery plan is currently helping to restore its capacity. The rehabilitated railway aims to provide an efficient, cost-effective transport solution for manganese, wood and agricultural products bound for export. It will also offer cleaner and safer transport to more than 300,000 passengers who travel by train annually (IFC, 2019). There are currently no railway lines along the coast and no lines connecting Mayumba to other locations in Gabon.

In 2015, studies were underway to develop a new railway line connecting agricultural zones in the southwest of Gabon with a future deep-water port in Mayumba (Oxford Business Group, 2015). Both projects present an important opportunity for future growth, but financing has not been obtained. Access to this proposed railway line and port would also see a new 106 km section of road constructed between Tchibanga and Mayumba. There has, however, been little progress reported on the projects and there is not yet a specific timeline for development.

Rivers

Inland waterways are used for the transport of goods and people.

Ports

Gabon has two major ports, the ports of Owendo and Port Gentil, as well as two oil terminals in Gamba and Lucina, which together handle approximately 80 percent of the country's trade. Maritime traffic in Gabon has increased in recent years, with the combined number of ships at quay in Owendo and Port Gentil reaching 610 in 2013 (Oxford Business Group, 2015). The port of Owendo is a key point for most of Gabon's

imports, whilst Port-Gentil plays a greater role in the country's exports (Alpha Ports, 2021).

The port of Port Gentil is a general and bulk cargo port and is considered a medium-sized seaport in terms of land use and volumes of cargo handled per year (World Port Source, 2021). It has 450 m of quay, 280 m of fishing quay, 2 hectares of container and general cargo yards, and 6000 m^2 of warehouses (Portek, 2012). It is the only port on the Gabon coast with a bunkering service. The port is managed by Gabon Port Management (GPM) on behalf of the Office des Ports et Rades du Gabon (OPRAG) (Find a Port, 2021).

Increased cargo volumes have led to insufficient port infrastructure in Gabon, with considerable congestion reported in the port of Owendo (Oxford Business Group, 2015).

The smaller port in Mayumba handles lumber exports from the region's equatorial forest. (EnviroPass, 2017). As stated earlier, since 2015, studies are underway for the construction of a deep-water port in Mayumba. The port would facilitate the export of resources including iron, wood, oil, talc, gold and manganese. However, little progress has been made on the project and there is no specific timeline for the development (Oxford Business Group, 2015). The port is also expected to receive passenger traffic and open the region up to possible tourism development (Oxford Business Group, 2015).

An overview of vessel facilities in the unplanned / accidental events AOI is included in Figure 7.4 and includes boat landing sites at Cap Lopez and Ozouri, and ports / harbours at Omboué, Gamba and Mayumba.

Subsea cables

West Africa has a number of submarine cables that connect the continent to the rest of the world, many of which pass by the Gabon coastline.

A fibre optic submarine telecommunications cable system between Libreville and Port Gentil was developed in 2012. The aim is to extend Gabon's fibre optic cable nationwide to locations including Gamba, Mayumba and Franceville (Oxford Business Group, n.d.).

7.7.6 Media and telecommunication

Gabonese public media are placed under the authority of the Ministry of Communication. Gabon has about thirty written publications, mainly weeklies and two dailies. There are around 40 private or community radio stations and several television channels (Mediasrequest, 2021).

Mobile phone use is prevalent. Whereas in 2019 there were only 22,291 subscriptions on fixed telephone lines, there were 2,992,811 mobile phone subscriptions and 1,313,802 internet users (CIA, 2021).

There are several national mobile networks available in Gabon. These include Airtel, Libertis and Moov. However, internet access via these networks is not always available.

7.7.7 Trends

The following trends were identified:

- The infrastructure and services in Gabon are sub optimal:
    - Some sections of the population lack access to water, electricity and sanitation

- There is a small network of roads, stretches of which are in poor condition
- the rail network is underdeveloped
- ports are congested

- Rural populations are more impacted by lack of infrastructure and services than urban populations
  - Mobile phone and internet use is increasing.

7.7.8 Vulnerability and sensitivity to change

The vulnerable groups in terms of infrastructure and services are outlined in Table 7.23.

Table 7.23: Infrastructure and services: Vulnerabilities

Vulnerable groups	Rationale
Rural populations	Services and infrastructure are less well developed in rural areas

7.7.9 Key considerations

Key considerations for the impact assessment include:

- Services and infrastructure are sub-optimal in most coastal villages
- There are plans to develop a Mayumba deep seaport, rail and road access, the plans have not yet been materialised.

7.8 Community Safety, Security and Welfare

Welfare, safety and security are core components of the UDHR. This section outlines potential safety and security risks.

7.8.1 Safety and security

Crime

Crime is most common in urban areas such as Libreville and Port-Gentil (OSAC, 2020). Crime rates have increased in recent years, with growing rates of theft, drug dealing and vandalism.

The International Maritime Bureau reports that the territorial and offshore waters in the Niger Delta and Gulf of Guinea remain a very high risk for piracy and armed robbery of ships; in 2020 there were 98 reported incidents of piracy and armed robbery at sea in the Gulf of Guinea region (CIA, 2021). In 2020, 130 crew members were kidnapped in 22 separate incidents in the Gulf of Guinea.

Traffic accidents

Traffic accidents are one of the biggest safety threats in Gabon. The death rate from traffic accidents is 23.9 per 100 000 population (GraphtoChart, 2021). Unpaved roads are often treacherous during the rainy season (OSAC, 2020). Other hazards include poor street lighting, erratic driving, failure to adhere to traffic signals, a lack of pedestrian crossings, slow moving vehicles and inebriated drivers (OSAC, 2020).

Civil unrest

Gabon has experienced some civil unrest in recent years. In 2016, following presidential elections, there was widespread looting of stores and businesses and rioting across major cities. Libreville experienced the most unrest. Over 1,000 people were arrested, and three people died during the period of unrest (OSAC, 2020).

Strikes and union action are also common in Gabon. In 2019 Gabon faced student protests over a change in academic regulations and reductions in scholarships and in 2020 the country faced general worker strikes across numerous industries, resulting in shortages of fuel, water and electricity (OSAC, 2020).

Security forces

The Gabonese defence forces comprise approximately 6,500 active-duty troops, which comprise 3,000 land forces (including the Republican Guard), 500 navy, 1,000 air force and 2,000 gendarmerie (CIA, 2021).

The gendarmerie, a branch of the Ministry of Defence, is the main agency in charge of law enforcement in Gabon (OSAC, 2020). The national police are stationed at posts within the departments of the provinces, where they protect persons and property, maintain law and order and direct traffic (Yates, 2018). Police and security forces often lack communications equipment and vehicles, which limit their capability to respond to routine and emergency calls (OSAC, 2020).

7.8.2 Standards of living and welfare

In 2019, approximately 30 percent of the population was considered economically 'vulnerable', with a monthly income below the guaranteed minimum wage of 80,000 FCFA (approximately USD 150) (ILO, 2019). Approximately 20 percent of Gabonese households reported to be unable to feed themselves properly, to own sufficient material goods, to shape their lives, to avoid vulnerability to external shock and to feel included in society (ILO, 2019). Levels of poverty are considerably higher in rural areas (at an estimated 75 percent), compared to urban areas (at an estimated 25 percent).

According to the UNDP (2021), Gabon's Human Development Index (HDI) score dropped from 0.703 to 0.544 when adjusted for inequality in 2019. At the time of writing, the multidimensional poverty index is calculated to be 0.066 percent, and it is estimated that 14.8 percent of the population live in multidimensional poverty (UNDP, 2021).

Based on KIIs with the local authorities in Ndindi the average income per household in the area is 15,000 FCFA per month and 1,800,000 FCFA a year. During FGDs with the fishers, it was mentioned that the average monthly income in Mayumba has been decreasing over the past years.

Social support in Gabon focuses primarily on employees in the formal sector (public service, and medium to large scale companies). The level of social coverage still remains insufficient, despite efforts made by the State to ensure better social support for vulnerable groups (the unemployed, the elderly and widows), or those with small or micro-enterprises (Republique Gabonaise, 2012).

In the sample communities, the elderly, those living with physical and/or mental impairments, and widows were identified as vulnerable. A food, health and sanitation support service was reported in Mayumba. No other support services for vulnerable groups were reported in the sample communities.

7.8.3 Civil society

The country's civil society, in an attempt to augment the welfare and wellbeing of its citizens, is active in a number of structures, such as cooperatives, non-governmental organisations (NGOs) and community groups. These focus either on advocacy and human rights, or on income generating activities such as small trade, agriculture etc.

During FGDs in the sample communities several income generating NGOs were identified. These include:

- MOUTCH: Agriculture and fishing
- ETHRO: Fishing
- Tu nsim'sananga: Agriculture
- DIBURE-NGUDJI: Agriculture and fishing
- Diboure Konngi: Commerce
- Mayumba has 16 fishing associations & cooperatives.
- Women's organisation
- Femme battante: trade.

Membership of these community groups does sometimes require a membership fee.

7.8.4 Trends

The following trends were identified:

- A relatively large section of the population is considered to be economically 'vulnerable'
- Crime rates are on the increase
- Traffic accidents are on the increase and are an important safety risk
- Piracy is a security risk.

7.8.5 Vulnerability and sensitivity to change

The vulnerable groups in terms of safety and security are outlined in Table 7.24.

Table 7.24: Safety and security: Vulnerabilities

Vulnerable groups	Rationale
Seafarers	These may be subject to piracy and robbery
The unemployed, female headed households, handicapped	These may be more at risk of being economically vulnerable
Road users	Traffic accidents are prevalent

7.8.6 Key considerations

Key considerations for the impact assessment include:

- There are high poverty rates in particular in rural areas, and a lack of social protection services
- There are security risks at sea

- There are significant road safety risks.

7.9 Cultural Heritage

The right to tangible and intangible cultural heritage is a right enshrined in the UDHR.

7.9.1.1 Tangible cultural heritage

Gabon has one UNESCO World Heritage Site, Lopé-Okanda, designated in 2007. Covering an area of 4910 km^2, the terrain is mostly rainforest. In the north of the park are the last remnants of the savannahs created during the last ice age. The Ogooué River runs through the north of Lopé-Okanda.

Lopé-Okanda National Park provides evidence of settlements stretching over 400,000 years, dating from the Palaeolithic, Neolithic and Iron Ages to present day Bantu and Pygmy peoples. Iron Age sites and caves, with rock art, provide evidence that Lopé-Okanda was a major migration route of Bantu and other groups from West Africa along the River Ogooué valley to central, east and southern Africa (UNESCO, 2021). Recently archaeologists have dated stone tools found in Lopé-Okanda National Park to between 620,000 and 850,000 years ago, making them the earliest known evidence of human presence in the Congo Basin (Cascone, 2020).

Figure 7.18: Cemetery in Mayumba

In the sample communities several sites of cultural significance were identified. These include:

- Tchibilu located along the Banio Lagoon - this was identified during meetings with community leaders in Malembe and Mambi
- a cemetery along the coast was identified as an archaeological site of high importance to the community of Tchiole-Ndembe
- a baobab tree was identified to be of high cultural significance to community members in Mabounda.

No offshore cultural heritage sites were identified.

7.9.1.2 Intangible cultural heritage

As a predominantly Christian nation, religious celebrations are widely observed throughout Gabon, along with other traditions involving faith like Ramadan. Christmas and New Year are two of the most widely anticipated events in the country, marked by great festivities, colourful traditions, musical programs, festive buffets and street markets.

The Gabonese hold their lifestyle in high regard, evident in festivals that are based on music and the arts.

Although the level of acculturation to western values is significant in Gabon, certain traditional values, ceremonies and practices remain. These include the following:

- Bwiti is an important cultural practise which centres around animism and ancestor worship, and often includes aspects of Christianity. It is based on the trance-inducing ingestion of the root bark of the Ibonga tree, which is used in initiation rights and other ceremonies (Lonely Planet, 2021). Ceremonies are led by the N'ganga, a spiritual leader, and are accompanied by dancing and music. Bwiti and Mboumba/Tchiango were rituals identified in Ndidi.
- Ndjembe-Mabassa and Mboyo in which traditional dances and songs are enjoyed were rituals identified by the community leader of Mabounda. The rituals typically last three days.
- Kpodji, a three-to-four-day Beninese ritual which is attended only by men and initiated children, was identified by the community leader in Tchiole-Ndembe.
- As well as being identified as a spiritual site, Tchibilu was also identified as a ritual by the community leader in Mambi. Specifically held at the Banio Lagoon, the ritual typically lasts between one to two days.

7.9.1.3 Trends

The following trends were identified:

- Some traditional rituals are still being maintained in Gabon, including in the sample villages.

7.9.1.4 Vulnerability and sensitivity to change

The vulnerabilities in terms of cultural heritage are outlined in Table 7.25.

Table 7.25: Cultural heritage: Vulnerabilities

Vulnerable Groups	Rationale
People engaged in traditional rituals	Demographic and socio-cultural changes may threaten traditional practice

7.9.1.5 Key considerations

Key considerations for the impact assessment include:

- Traditional practices and sacred sites exist and need.

7.10 Summary of Receptor Sensitivity

Based on the discussion in this chapter, and the nature of the Ruche EEA field development Project, the receptors in Table 7.26 are taken forward to the social impact assessment and their sensitivity has been scored in accordance with the definitions in Table 5.2 and information in this baseline.

Table 7.26: Summary of identified receptors and sensitivities

Topics	Receptor	Sensitivity	Basis for sensitivity rating
Demographics, human rights, governance, education	Not classed as a receptor, information provides socio-economic context	-	
Economy and livelihoods*	Fisheries		
	Small scale / artisanal fisheries	Medium (3)	Resource of regional importance. Fishing vessels generally small and limited in the distance they can travel. Individuals / households depend on the affected resource with no nearby alternatives. Fish catches are reportedly declining and there are few alternative employment opportunities in rural coastal villages.
	Deep sea / industrial fisheries	Low (2)	Industrial fisheries not as productive as artisanal fisheries. Vessels capable of covering large areas, individuals / companies have access to alternative resources.
	Natural resource harvesting – intertidal gleaners	Medium (3)	Individuals / households depend on the affected resource with no nearby alternatives. Constitutes a key source of income for vulnerable people (women) who have few or no other alternatives for work.
	Shipping and navigation	Low (2)	Shipping lanes from Port Gentil south to Pointe-Noire in RoC follow the coastline. Majority of international cargo vessels generally travel closer to coast at a distance from the Ruche EEA. Shipping densities highest in approach to Port Gentil and in Omboue area.
	Tourism and recreation		
	Recreational fishing vessels (sports fishing)	Low (2)	Nature based tourism is not well developed, predominantly due to lack of infrastructure. Efforts being made to develop sector hampered by Covid-19 pandemic.
	Tourism operators	Low (2)	

Topics	Receptor	Sensitivity	Basis for sensitivity rating
	Economy, employment and skills development	Medium (3)	Limited skills and experience in labour pool. Low education levels create a skills shortage and high unemployment. There is a general shortage of people with vocational skills required for the economy of Gabon (including oil and gas). Mismatch between programmes offered by tertiary education institutions and the skills required by the economy.
Health	Public health	Medium (3)	Study area and potential zone impacted includes low number of inhabitants (in vicinity of logistics base and in coastal communities adjacent to Ruche EEA) and moderate number of inhabitants (in vicinity of heliport and Port Gentil in general). Health facilities in villages face a number of challenges due to lack of medication, equipment and staff. Gabon affected by Covid-19 pandemic.
Infrastructure and services	Infrastructure and services		
	Port facilities, heliport, road network	Low (2)	Major roads in Port Gentil paved, although in poor condition. Majority of bulk materials transported by vessel to logistics base. Port of Port Gentil medium sized seaport with adequate capacity for Project vessel transfers. Heliport adequate capacity for Project helicopter transfers.
	Waste management facilities	Medium (3)	Waste management is a challenge in Gabon and poor solid and liquid wate management in urban areas has resulted in serious health (waterborne infectious diseases) and environmental hazards. Waste management was raised as a concern by stakeholders.
Community safety, security and welfare	Community safety, security and welfare	Medium (3)	There are high poverty rates in particular in rural areas, and a lack of social protection services There are security risks at sea (piracy) There are significant road safety risks.

Topics	Receptor	Sensitivity	Basis for sensitivity rating
Cultural heritage	No significant receptors identified – scoped out**	-	

* ‘Agriculture’ and ‘forestry’ not classed as receptors for this offshore Project. Information provided on these onshore activities to provide context and ascertain other sources of income for the local communities. ‘Oil and gas’ not classed as a receptor in this SIA as not considered sensitive to this offshore field development Project. Cumulative impacts from the Ruche EEA field development and other oil and gas activities in the Gabonese EEZ are discussed in Chapter 10.

** No known offshore cultural heritage sites. There is a ceremony (Tchibilu) that takes place on the lagoon, which cannot be moved, however the lagoon is not affected by routine / planned activities and it is unlikely that unplanned / accidental events will impact it to the extent that the ceremony is disturbed.

REFERENCES

ACDG (2021), 'African Equatorial Hardwoods'. Available at: https://africanconservationdevelopmentgroup.com/sustainable-forestry/

AFDB (African Development Bank) (2016), 'Gabon – Joint 2016-2020 Country Strategy Paper (CSP) and Country Portfolio Performance Review (CPPR) Report'. Available at: https://www.afdb.org/en/documents/document/gabon-joint-2016-2020-country-strategy-paper-csp-and-country-portfolio-performance-review-cppr-report-87884

AFDB (African Development Bank) (2017), 'Gabon: Technical Support for the Agricultural Transformation Strategy and Promotion of Youth Entrepreneurship in the Agricultural Sector and Agribusiness'. Available online: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Gabon_-_Technical_Support_for_the_Agricultural_Transformation.pdf

AFDB (African Development Bank) (2021a), 'African Economic Outlook 2021'. Available at: https://www.afdb.org/en/documents/african-economic-outlook-2021.

AFDB (African Development Bank) (2021b), 'Gabon – Integrated drinking water supply and sanitation programme – First Libreville Integrated Drinking Water Supply and Sanitation Sub-Programme (PIAEPAL) – Drinking Water Component – Project Appraisal Report'. Available at: https://www.afdb.org

Alpha Ports (2021), 'Gabon'. Available at: https://www.alphaports.com/ports/gabon/

Amnesty International (2021), Gabon Human Rights. Available at: Gabon (amnestyusa.org)

Aspenia online (2014), Ethnic integration and economic growth: Cameroon, Gabon and Kenya. Available at: https://aspeniaonline.it/articolo_aspenia/ethnic-integration-and-economic-growth-cameroon-gabon-and-kenya/

Barrett, K and Houston, J. (2014), 'Gabon: A Guide to Improving the Coastal and Inland Fishery Industries'. *Journal of Food Distribution Research* 45(1).

Baye, K., Laillou, A and Chitweke, S. (2020), 'Socio-Economic Inequalities in Child Stunting Reduction in Sub-Saharan Africa'. *Nutrients* (12) 253.

Borgen Project (2017a), Education in Gabon. Available at: https://borgenproject.org/education-in-gabon/?nowprocket=1

Borgen Project (2017b), Common Diseases in Gabon. Available at: https://borgenproject.org/common-diseases-in-gabon/?nowprocket=1

Borgen Project. (2020a), 'The Tuberculosis Crisis in Gabon'. Available at: https://borgenproject.org/the-tuberculosis-crisis-in-gabon/

Borgen Project (2020b) 'What to Know About Healthcare in Gabon'. Available at: https://borgenproject.org/healthcare-in-gabon/?nowprocket=1

Borgen Project. (2020c), '10 Facts About Sanitation in Gabon'. Available at: https://borgenproject.org/sanitation-in-gabon/

Bourgarel, M., Wauquier, N and Gonzalez, J-P. (2010), 'Emerging viral threats in Gabon: health capacities and response to the risk of emerging zoonotic diseases in Central Africa'. Available at: https://pubmed.ncbi.nlm.nih.gov/22460397/

Britannica. (2021), Economy of Gabon. Available at: Gabon - Economy | Britannica

BTI (Bertelsmann Transformation Index) (2020), 'Gabon Country Report 2020'. Available at: https://www.bti-project.org/en/reports/country-report-GAB-2020.html#pos9

Cardiec, F., Bertrand, S., Witt, M., Metcalfe, K., Godley, B., Mclellan, C., Viela, R., Parnell, R and le Loc'h, F. (2020), 'Too Big to Ignore: A Feasibility analysis of detecting fishing events in Gabonese small-scale fisheries'. Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0234091#pone.0234091.ref052

Cascone, S. (2020), 'Archaeologists Have Uncovered Ancient Tools in Gabon That May Rewrite Our Understanding of Humankind's History in Central Africa'. Available at: https://news.artnet.com/art-world/archaeologists-discovered-manmade-tools-congo-basin-1891190

CIA (Central Intelligence Agency) (2021), 'The World Factbook – Gabon'. Available at: https://www.cia.gov/the-world-factbook/countries/gabon/

Cloquet, I. (2020), 'Tourism Development in Gabon: Pioneers operating under adverse conditions' *in* Novelli, M. Adu-Ampong., and Ribero, M, 'Routledge Handbook of Tourism in Africa'. Available at: https://books.google.co.uk/books?id=YVYFEAAAQBAJ&dq=Tourism+development+in+Gabon+Pioneers+operating+under+adverse+conditions&source=gbs_navlinks_s

CLS (2021). Gabon, World Leader in the Management of its Artisanal Fisheries, Relies on CLS. 6 July 2021. Available at: Gabon relies on CLS for the management of its artisanal fisheries (groupcls.com)

Conservation Development Group. (2021), 'Integrated sustainable land-use planning'. Available at: https://africanconservationdevelopmentgroup.com/project/

Constitute Project. (2011), 'Gabon's Constitution of 1991 with Amendments through 2011'. Available at: https://www.constituteproject.org/constitution/Gabon_2011.pdf?lang=en

DGPEF (2013). Situation Socio-Economique 2013 – Nyanga. Available at: https://directinfosgabon.com/wp-content/uploads/2018/10/Nyanga-2013.pdf

Diallo, B. (2015), '12,000 SMEs listed in Gabon'. Available at: https://www.afrikatech.com/start-business/12000-smes-listed-in-gabon/

Economist Intelligence Unit. (2020), 'Political Structure'. Available at: http://country.eiu.com/article.aspx?articleid=508919434&Country=Gabon&topic=Summary&subtopic=Political+structure

EIA (U.S Energy Information Administration) (2020), 'Gabon Overview'. Available at: https://www.eia.gov/international/analysis/country/GAB

EIU (Economist Intelligence Unit) (2021), 'Gabon'. Available at : https://country.eiu.com/gabon

Enviropass. (2017), Etude d'Impact Environmentale et Social en rapport avec le projet de développement Phase I du champ Tortue dans l'AEE Ruche du CEPP Dussafu Marin no. G4-209. Enviropass: Libreville, Gabon.

Enviropass. (2019), Projet de développement du champ Tortue Phase II – Notice d'Impact Environnemental. Enviropass: Libreville, Gabon.

Enviropass. (2020), Projet de développement du champ Ruche Phases I et II dans l'AEE Ruche du Permis Dussafu Marin G4-209 – Etude d'Impact Environnemental et Social. Enviropass: Libreville, Gabon.

European Commission. (2021), 'Council Decision on the conclusion of the Implementing Protocol (2021 – 2026) to the Fisheries Partnership Agreement between the Gabonese Republic and the European Community'. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0247&from=EN

Exotix Capital. (2019), 'Gabon' in 'Exotix Developing Markets Guide: Debt and Risk across the Frontier'. Springer Nature, Switzerland.

FAO (Food and Agricultural Organization) (1998), Enquête Préliminaire Sur Les Produits Forestiers Non Ligneux Présents Sur Les Marchés De Libreville (Gabon). Available at: http://www.fao.org/3/X2161F/x2161f26.htm

FAO (Food and Agricultural Organization) (2019), 'Fisheries and Aquaculture Country Profiles: Gabonese Republic. Available at: http://www.fao.org/fishery/facp/GAB/fr

FCPF (Forest Carbon Partnership Facility) (2018), 'Revised Readiness Preparation Proposal (Revised R-PP) - Gabon'. Available at: https://forestcarbonpartnership.org/system/files/documents/RPP_Gabon_Revised_v23072018_clean_0.pdf

Find a Port (2021), Port Gentil. Available at: Port of Port Gentil, Gabon (findaport.com)

Freedom House (2018), Freedom in the World 2018. Available at: https://www.refworld.org/docid/5b8d24c3a.html

Freedom House (2021), Gabon. Available at: Gabon: Freedom in the World 2021 Country Report | Freedom House

Gabonese Republic. (2020), Steering Committee of the Monitoring Response Plan Against the Coronavirus Epidemic. Available at: https://infocovid.ga/

GCR (Global Construction Review) (2020), 'Gabon begins works on $1bn "Transgabonaise" motorway'. Available at: https://www.globalconstructionreview.com/news/gabon-begins-work-1bn-transgabonaise-motorway/

Ginestie and Bekale Nze (2014). The Republic of Gabon: An overview. In C. Wolhunter (ed.) Education in east and central Africa. London: Bloomsbury. Available at: https://books.google.co.uk/books?hl=en&lr=&id=3_60AwAAQBAJ&oi=fnd&pg=PA245&dq=gabon+government+system&ots=184RLGsjrl&sig=LoyQeFeEc_v5r-cnyauRxt40Exk&redir_esc=y#v=onepage&q=gabon%20government%20system&f=false

Global Business Reports (2020), Africa oil and Gas 2020. Available at: https://www.gbreports.com/publication/africa-oil-gas-2020

Global Hunger Index (2021), Available at: https://www.globalhungerindex.org/

GraphtoChart (2021), Gabon death rate from traffic accidents. Available at: https://en.graphtochart.com/health/gabon-mortality-caused-by-road-traffic-injury-per-100-000-people.php

Hadish, M.T; Mao, J; Gong, G; Hadish, B.T; & Tesfamariam (2017), Predictors of High HIV / AIDS Risk Sexual Behaviours: Comparison Study among Cameroonian and Gabonese Youth Aged 15-24 Years. Journal of HIV & Retro Virus ISSN 2471-9676. Vol. 3 No: 1-3. Available at: https://www.researchgate.net/profile/Minet-Hadish/publication/319023579_Predictors_of_High_HIVAIDS_Risk_Sexual_Behaviors_Comparison_Study_among_Cameroonian_and_Gabonese_Youth_Aged_15-24_years/links/59a1a20a458515fd1fe3bb62/Predictors-of-High-HIV-AIDS-Risk-Sexual-Behaviors-Comparison-Study-among-Cameroonian-and-Gabonese-Youth-Aged-15-24-years.pdf

IFC (International Finance Corporation) (2012), International Finance Corporation's Guidance Notes: Performance Standards on Environmental and Social Sustainability. World Bank: Washington DC.

IFC (International Finance Corporation) (2019), 'An Improved Railway Puts Gabon on the Right Track'. Available at: https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/impact-stories/gabon-improved-railway

ILO (International Labour Organisation) (2019), 'State of Skills: Gabon'. Available at: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/genericdocument/wcms_742205.pdf

ILO (International Labour Organisation) (2021), Information System on International Labour Standards. Available at: (https://www.ilo.org/dyn/normlex/en/f?p=1000:11210:0::NO:11210:P11210_COUNTRY_ID:103391)

Imboumy-Limoukou, R.K., Maghendji-Nzondo, S., Sir-Ondo-Enguier, P.N. et al. (2020), Malaria in children and women of childbearing age: infection prevalence, knowledge and use of malaria prevention tools in the province of Nyanga, Gabon. Malar J 19, 387 (2020). https://doi.org/10.1186/s12936-020-03411-5

IMF (International Monetary Fund), (2013). 'Statement by Mr. Assimaidou on Gabon' (2013) https://www.elibrary.imf.org/view/journals/002/2013/322/article-A004-en.xml

IMF (International Monetary Fund), (2019), 'Improving governance for higher and more inclusive growth in Gabon'. Available at: https://www.elibrary.imf.org/view/journals/002/2019/390/article-A001-en.xml

IMF (International Monetary Fund), (2021) IMF Working Papers – Informality and Gender Gaps Going Hand in Hand. Available at: https://www.imf.org/en/Publications/WP/Issues/2019/05/23/Informality-and-Gender-Gaps-Going-Hand-in-Hand-46888

International Association of Universities (2019), International Handbook of Universities. Available online ps://www.whed.net/Headline1.html#:~:text=International%20Handbook%20of%20Universities%20%28IHU%29%2011%2F12%2F2019%20The%20International,in%20e-format%20and%20in%20print-on-demand%20in%20December%202019

IUCN (2016), 'Red List of Marine Bony Fishes of the Eastern Central Atlantic'. Available online: https://portals.iucn.org/library/sites/library/files/documents/RL-2016-002.pdf

IWGIA (International Work Group for Indigenous Affairs) (2020), Indigenous World: Gabon available online https://www.iwgia.org/en/gabon.html

Joshua Project (2020), 'Gabon'. Available at: https://joshuaproject.net/countries/GB

Juridocs (2021), Décret fixant les modalités et conditions d'exercice de la pêche. Available at: https://juridocs.org/publications/lire/gabon-decret-n0579prmpe-du-30112015-fixant-les-modalites-et-conditions-dexercice-de-la-peche/

Legault, D.D., and Cochrane, L. (2021), 'Forests to the Foreigners: Large-Scale Land Acquisitions in Gabon', *Journal of Land,* 10, 420, 2-22.

Legigabon (2020), L'essentiel; du droit gabonais à la portée de tous. Available at : https://www.legigabon.com/

Lloyds Bank (2021), 'Gabon: Economic and Political Overview'. Available at: https://www.lloydsbanktrade.com/en/market-potential/gabon/economical-context?vider_sticky=oui

Lonely Planet. (2021), 'Gabon in Detail – Culture'. Available at: https://www.lonelyplanet.com/gabon/background/other-features/230b89af-9fc4-42f4-80a7-79b2f2788dfb/a/nar/230b89af-9fc4-42f4-80a7-79b2f2788dfb/355302

Magoum, I. (2020), 'Gabon: Municipalities to handle their household waste, henceforth'. Available at: https://www.afrik21.africa/en/gabon-municipalities-to-handle-their-household-waste-henceforth/

Marine Traffic (2021) Global Ship Tracking Intelligence. Available at: https: //www.marine traffic.com

Mediasrequest (2021), Guide des médias du Gabon. Available at: http://www.mediasrequest.com/fr/afrique/gabon.html

Moussavou, E., Tengeh, R and Cupido, C. (2016), 'Major challenges to sustainable enterprise development within the tourism industry in Gabon'. *Problems and Perspectives in Management* 14(4).

Nguema, R., Mavoungou, J., Ngou-Milama, K., Mamfoumbi., M., Koumba, A., Lamine, M., Diarra, A., Asseko, G., Mourou, J., Akotet., M., Mone, H., Mouahid, G and Atsame, J. (2018), 'Baseline Mapping of Schistosomiasis and Soil Transmitted Helminthiasis in the Northern and Eastern Health Regions of Gabon, Central Africa: Recommendations for Preventative Chemotherapy'. *Tropical Medicine and Infectious Disease* (3) 119.

Ogooue Maritime (2013), Situation Socio-Économique - Ogooué - Maritime 2012. Available at: https://www.bing.com/search?q=Ogooue-Maritime-2012.pdf+(directinfosgabon.com)&src=IE-SearchBox&FORM=IESR4A

Oil Spill Response Ltd (2019), BW Energy Dussafu B.V. Oil Spill Contingency Plan – Ruche Field Development. Oil Spill Response Ltd: Southampton, United Kingdom.

OSAC (Overseas Security Advisory Council) (2020), 'Gabon 2020 Crime and Safety Report'. Available at: https://www.osac.gov/Country/Gabon/Content/Detail/Report/3ae5be4e-e231-413f-a429-18a8deec0b03

Oxford Business Group (2014), 'Universal health insurance is being rolled out'. Available at: https://oxfordbusinessgroup.com/overview/universal-health-insurance-being-rolled-out

Oxford Business Group (2015), 'Expanding infrastructure helps Gabon's economy grow'. Available at: https://oxfordbusinessgroup.com/overview/time-transformation-expanding-and-improving-infrastructure-facilitate-growth

Oxford Business Group (2016a), Industry & Mining – Gabon. Available at: https://oxfordbusinessgroup.com/gabon-2016/industry-mining

Oxford Business Group. (2016b), 'Gabon rolls out new integrated road and highway improvement programme'. Available at: https://oxfordbusinessgroup.com/analysis/growth-network-integrated-road-improvement-programme-rolling-out

Oxford Business Group (2016c), 'Gabon looks to address challenges to development in tourism'. Available at: https://oxfordbusinessgroup.com/overview/time-transformation-expanding-and-improving-infrastructure-facilitate-growth

Oxford Business Group. (n.d.), 'Stronger connections: Greater fibre-optic cable access will foster sector development'. Available at: https://oxfordbusinessgroup.com/overview/stronger-connections-greater-fibre-optic-cable-access-will-foster-sector-development

Refworld (2017), Trafficking in Persons – Gabon. Available at: https://www.refworld.org/docid/5959eccc3.html

Repsol. (2017) Integrated Maps for shoreline type, environmental and socioeconomic features; Coastal Sensitivity Mapping for Oil Spill Response Repsol Gabon Ivela-1.

Republique Gabonaise (2012) Plan Strategique Gabon Emergent - Vision 2025 et orientations stratégiques 2011-2016 (PGSE).

Republic of Gabon, (2010). 'Ogooué-Maritime, Gabon'. Available at: https://knoema.com/atlas/Gabon/Ogoou%c3%a9-Maritime

Rich J. (2015), 'Gabon: Oxford Bibliographies'. Available at: https://www.oxfordbibliographies.com/view/document/obo-9780199846733/obo-9780199846733-0006.xml#obo-9780199846733-0006-bibItem-0001

Savana, A. (2021), 'Gabon – Equatorial Guinea: the dispute over the Mbanié Islands before international justice'. Available at: https://www.kapitalafrik.com/2021/04/14/gabon-equatorial-guinea-the-dispute-over-the-mbanie-islands-before-international-justice/

SUN (Scaling up Nutrition) (2021), Gabon. Available at: https://scalingupnutrition.org/sun-countries/gabon/

TEREA (2010) Initial Socio-Economic Status of the Fisheries Sector – Deepwater seismic campaign in Gabon (Blocks BC9 and BCD10).

TEREA (2012) Etude d'Impact Environnemental et Social Forage d'Exploration sur les Blocs BC9 et BCD10 au large du Gabon; Gamba. Etat initial Aspects socioéconomiques. Juin 2012.

Terrocea (Terrocea Environmental Consulting). (2019). Environmental Observation and Inventory of Marine Species on The Tortue Field in the Ruche EEA. Preliminary Report 2. Mission on the RIG-Norve Borr Drilling / BW ENERGY GABON SA from November 25 to December 04, 2019.

The Stateman's Yearbook (2017), The Politics, Cultures and Economies of the World, 2017. Available at : https://rd.springer.com/book/10.1007/978-1-349-68398-7?page=2#:~:text=THE%20STATESMAN%27S%20YEARBOOK%202017%20This%20classic

UIS (UNESCO Institute for Statistics) (2020), Gabon. Available at: http://uis.unesco.org/en/country/ga

United Nations (2020), Available at: https://www.macrotrends.net/countries/GAB/gabon/population

UNAIDS (2021), 'Country Factsheet: Gabon'. Available at: https://www.unaids.org/en/regionscountries/countries/gabon

UNDP (United National Development Programme). (2021), 'Gabon – Human Development Indicators'. Available at: http://hdr.undp.org/en/countries/profiles/GAB

UNESCO (United Nations Educational, Scientific and Cultural Organisation) (2018-2019) Statistiques basiques et Plan sectoriel de l'éducation du Gabon, 2018-2019.

UNESCO (United Nations Educational, Scientific and Cultural Organisation) (2020), l'Annuaire statistique 2018-2019 du Gabon.

UNESCO (United Nations Educational, Scientific and Cultural Organisation) (2021), 'Ecosystem and Relit Cultural Landscape of Lopé-Okanda'. Available at: https://whc.unesco.org/en/list/1147/

UNECA (United Nations Economic Commission for Africa) (2016), 'Country Profile: Gabon'. Available at: https://archive.uneca.org/sites/default/files/uploaded-documents/CountryProfiles/2017/gabon_cp_eng.pdf

UNODC (United Nations Office on Drugs and Crime) (2009), International framework for Action to implement the trafficking in persons protocol. Available at: https://www.unodc.org/documents/human-trafficking/Framework_for_Action_TIP.pdf

US State Department (2020a), Country Reports on Human Rights Practices: Gabon. Available at: Gabon - United States Department of State

US State Department (2020b), Trafficking in Persons Report: Gabon. Available at: https://www.state.gov/reports/2020-trafficking-in-persons-report/gabon/

Verité (2018), 'Gabon: Country Overview'. Available at: https://www.verite.org/wp-content/uploads/2018/01/SSA-Verite-Country-Report-Gabon.pdf

WHO (World Health Organisation) (2021), Gabon Situation. Available at: https://covid19.who.int/region/afro/country/ga

Wily, L.A. (2012). 'Land Rights in Gabon: Facing up to the Past – And the Present'. Available at: https://www.fern.org/fileadmin/uploads/fern/Documents/Gabon%20summary.pdf

World Bank, (2013), Rapport sur la Croissance et l'Emploi en Republique Gabonaise.

World Bank (2017), 'Program Information Document (PID): Gabon Fiscal Consolidation and Inclusive Growth'. Available at: https://documents1.worldbank.org/curated/en/520481504270198590/pdf/AB7903-PID-Concept-Stage-P159508-Box405298B-PUBLIC.pdf

World Bank (2018), Population density (people per sq.km of land area) – Gabon. Available at: https://data.worldbank.org/indicator/EN.POP.DNST?locations=GA

World Bank (2019), Readiness proposal assessment on a proposed grant in the amount of US$1.95 million to the Republic of Gabon for Gabon-REDD + REDINESS. Available at: https://documents1.worldbank.org/curated/fr/149011569269725956/pdf/Assessment-Note.pdf

World Bank (2020a), 'Gabon: Increasing Economic Diversification & Equalizing Opportunity to Accelerate Poverty Reduction'. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/34108/Gabon-Systematic-Country-Diagnostic.pdf?sequence=4&isAllowed=y

World Bank (2020b), Literacy rate, adult population – Gabon. Available at: https://data.worldbank.org/indicator/SE.ADT.LITR.ZS?locations=GA-ZG

World Bank (2021a), 'Girl's Education'. Available at: Girls' Education Overview (worldbank.org)

World Bank. (2021b), 'The World Bank in Gabon'. Available at: https://www.worldbank.org/en/country/gabon/overview

World Bank (2021c), 'Data for World, Gabon, Sub-Saharan Africa'. Available at: https://data.worldbank.org/?locations=1W-GA-ZG

World Bank. (2021d), 'Data – access to electricity – Gabon'. Available at: https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?end=2019&locations=GA&start=2000&view=chart

WTO (World Trade Organisation) (2007). 'Gabon, Trade Policy Review: Trade Policy and Practice, by Sector'. Available at: https://docsonline.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=Q:/WT/TPR/S188-04.pdf

WTO (World Trade Organisation) (2013), 'Gabon: Economic Environment'. Available online: https://www.wto.org/english/tratop_e/tpr_e/s285-02_e.pdf

WHO (World Health Organisation) (2014), 'Country Cooperation Strategy at a glance: Gabon'. WHO/CCU/14.03/Gabon

WHO (World Health Organisation) (2020), 'Health financing and budgeting reforms in Gabon: Progress and Challenges on the road to universal health coverage'. Available at: https://www.who.int/publications/i/item/WHO-UHC-HGF-HEF-CaseStudy-20.15

Yates, D, (2018), 'Historical Dictionary of Gabon'. Rowman & Littlefield, London.

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 8: Social Impact Assessment

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TABLES

8 SOCIAL IMPACT ASSESSMENT

8.1 Purpose

This chapter evaluates socio-economic impacts that may arise from planned / routine activities as well as unplanned / accidental events related to the Ruche EEA field development programme. The activities outlined in the project description (Chapter 2), social baseline conditions and sensitivities in the AOI (Chapter 7) and input from stakeholder engagement (Chapter 4), have been used to provide input into the analysis.

Given the remote offshore location of the Project, many of the socio-economic impacts typically associated with terrestrial resource projects will not apply to BWE's activities in the Ruche EEA. Furthermore, onshore activities will be confined to the logistics base in the commercial port of Port Gentil, which is not publicly accessible. As such, Project activities will not alter existing land use practices nor displace people from their land.

The assessment of potential socio-economic impacts uses a systematic process that involves:

- identifying Project aspects (activities) or sources of impact (these are listed in Table 2.4)
- identifying related social receptors (for this assessment it is the social features in Table 7.26)
- evaluating Project effects on those receptors (an impact interaction table for the Project is provided below, see Table 8.1).

The impacts interactions identified in Table 8.1 are discussed further in Sections 8.2 to 8.12 and the significance of the impacts are assessed based on the magnitude of the impact and the sensitivity of the receptor, as described in Chapter 5.

Table 8.1: Social impact interaction table

Activities	Shipping and navigation	Fisheries - deep sea / industrial fisheries	Fisheries - small scale / artisanal fisheries	Natural resource harvesting - intertidal gleaners	Tourism and recreation	Infrastructure and services	Community safety, security and well-being	Economy, employment and skills development	Public health
Routine / Planned Activities									
Drilling Programmes									
Installation of the jack-up rig	X	X			X				
Physical presence of rig (500m safety exclusion zone)	X	X			X				
Drilling discharges (cuttings and drilling fluids) and rig operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water		X							
Underwater noise from drilling rig operations		X							
Hibiscus Alpha OI – Installation & Commissioning									
Installation and jack-up of HA OI	X	X			X				
Hibiscus Alpha OI – Operation & Maintenance									
Physical presence (1 km safety exclusion zone around HA OI)	X	X			X				
HA OI operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, produced water		X							
Subsea Flowlines and Umbilicals – Installation & Commissioning									
Installation of pipelines and cables	X	X			X				

Activities	Shipping and navigation	Fisheries - deep sea / industrial fisheries	Fisheries - small scale / artisanal fisheries	Natural resource harvesting - intertidal gleaners	Tourism and recreation	Infrastructure and services	Community safety, security and well-being	Economy, employment and skills development	Public health
Subsea pipeline commissioning discharges – hydrotest discharges		X							
FPSO – Operation & Maintenance									
Physical presence (1 km safety exclusion zone around FPSO)	X	X			X				
FPSO operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water, produced water		X							
Underwater noise from FPSO operations		X							
Support/Supply Vessel and Construction Vessel Operations									
Vessel transfers	X	X	X		X	X			
Vessel operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water		X	X						
Underwater noise from vessel movements		X	X						
Helicopter Support Activities									
Helicopter transfers									X
Logistics Base Operation									
Logistics base operation						X			X
General									
Generation of Project employment opportunities								X	

Activities	Shipping and navigation	Fisheries - deep sea / industrial fisheries	Fisheries - small scale / artisanal fisheries	Natural resource harvesting - intertidal gleaners	Tourism and recreation	Infrastructure and services	Community safety, security and well-being	Economy, employment and skills development	Public health
Local procurement of goods and services								X	
Corporate investment							X		
Transmission of communicable diseases (including COVID-19)							X		X
Potential Unplanned / Accidental Event Scenarios									
Project vessel interaction with fishing vessels / gear		X	X				X		
Road transport associated with logistics base – traffic accidents							X		
Introduction of alien invasive species		X	X						
Bunkering spill - small spill or leak / release during hose disconnection	X	X	X	X	X				
Collision with FPSO resulting in loss of oil	X	X	X	X	X	X			X
Well blowout (expected reservoir crude oil)	X	X	X	X	X	X			X

8.2 Impacts from Installation / Physical Presence of Facilities and Establishment of Safety Exclusion Zones

As indicated in Table 2.4, permanent safety exclusion zones will be in place around infrastructure in the Ruche EEA. In addition, it is anticipated that temporary safety exclusion zones will be in place during drilling and facility installation activities, as follows:

- Drilling rig: 500 m radius safety exclusion zone around the rig during installation and drilling (for the Ruche wells the rig will be nested in the Hibiscus Alpha OI so will be encompassed in OI exclusion zone)
- Hibiscus Alpha OI: 1 km radius safety exclusion zone during installation and throughout lifetime of facility
- BW Adolo FPSO: 1 km radius safety exclusion zone throughout lifetime of facility
- Subsea flowlines and umbilicals: 500 m radius safety exclusion zone around the pipelay barge(s), limited to facility installation activities.

8.2.1 Shipping and navigation

8.2.1.1 Potential impacts

Shipping densities along the Gabonese coast are highest in the approach to Port Gentil and between Port Gentil and Omboue due to the prevalence of offshore oil fields in this area. Service vessel routes from Port Gentil to the oil fields in the vicinity of the Ruche EEA can been seen in Figure 7.12.

Shipping lanes from Port Gentil south to Pointe-Noire in the Republic of Congo (RoC) follow the coastline (inshore from the Ruche EEA). Movements of fishing vessels / trawlers and international cargo vessels were observed during the Terrocea mission to the BW Adolo FPSO between 29 November to 9 December 2019 (Terrocea, 2019). It is understood, however, that the majority of international cargo vessels generally travel closer to the coast at a distance from the Ruche EEA.

Any vessels passing in proximity to the Ruche EEA will be required to adhere to the permanent and temporary safety exclusion zones in place which could lead to them having to divert from their initial route potentially resulting in a decrease in efficiency of commercial shipping operations.

Impacts assessment of installation / physical presence of facilities and establishment of exclusion zones on shipping and navigation

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to shipping and navigation (direct impact)	Very low (1) / Low (2) Extent: Immediate, within Project footprint Duration: Temporary during drilling and facility installation activities; permanent for FPSO and Hibiscus Alpha OI Scale: Very limited / intermittent interference,	Low (2) – Shipping and Navigation	Negligible (2) / Minor (4)

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
	may be noticed by users of resources Frequency: Continuous		

8.2.1.2 *Mitigation measures*

To minimise disruption to commercial shipping operations, the following mitigation measures will be implemented:

- Timely engagement with relevant stakeholders (e.g., maritime authorities, government ministries, shipping companies) regarding the establishment of safety exclusion zones.
- Safety zone authorisation permits will be obtained from the relevant government authorities prior to their establishment. Project infrastructure will be demobilised, and safety exclusion zones will be lifted upon completion of relevant activities.
- A schedule of activities will be communicated to the authorities which issue information and instructions to mariners pertaining to shipping hazards and safety zones (through a notice to mariners).
- The drilling rig will have a support vessel permanently on-site during drilling activities to advise other sea users of the rig's presence and ensure the safety exclusion zone is respected.
- A third-party grievance procedure will be circulated to relevant stakeholders.

8.2.1.3 *Residual impacts*

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of installation / physical presence of facilities and establishment of exclusion zones on shipping and navigation

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to shipping and navigation (direct impact) .	Negligible (2) / Minor (4)	Negligible (2)

8.2.2 Fisheries

8.2.2.1 *Potential impacts*

According to the fishing areas presented in Decree No. 0579/PR/MPE of November 30th 2015, the Ruche EEA is outside the majority of the Gabonese fishing zones, see Figure 7.9. However, deep-sea industrial fishing for large pelagic species such as tuna, typically takes place between 22 km and 44 km offshore and analysis of vessel monitoring system (VMS) data by Terrocea (2019) between October and November 2019 found tuna vessels

to the west of the Ruche EEA and trawlers within the Ruche EEA in this period, see Figure 7.10.

Small-scale/artisanal fishers do not generally venture far enough from the shore to be affected by the safety exclusion zones in the Ruche EEA as their vessels are not capable of navigating deeper offshore waters. Despite artisanal fishers in Mayumba having indicated that they may be forced to go beyond the usual authorised fishing areas during periods of severe drought (see Section 7.5.1) their presence in the Ruche EEA would be considered a rare event. Therefore, the livelihoods of small-scale / artisanal fishers or vulnerable groups such as intertidal gleaners are not anticipated to be affected by the establishment of the safety exclusion zones around infrastructure and activities in the Ruche EEA.

Based on the above, only deep-sea / industrial fisheries have the potential to be affected by the establishment of the safety exclusion zones and a reduction in available fishing area. However, the combined safety exclusion zones (1 km radius around the Hibiscus Alpha OI, 1 km radius around the FPSO and 500 m radius around the drilling rig) will only reduce the fishing grounds available by a small area in comparison to the extent of the fishing zones in Gabonese waters, therefore the magnitude of the impact is anticipated to be low.

Impacts assessment of installation / physical presence of facilities and establishment of exclusion zones on fisheries

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to fisheries (direct impact)	Low (2) Extent: Immediate, within Project footprint Duration: Temporary during drilling and facility installation activities; permanent for FPSO and Hibiscus Alpha OI Scale: Activity that causes minor interference with other users of resources Frequency: Continuous	Low (2) – Fisheries – deep sea / industrial fisheries	Minor (4)

8.2.2.2 Mitigation measures

The mitigation measures listed above for shipping are also relevant to deep sea / industrial fisheries. In order to minimise disruption, timely engagement with fisheries stakeholders regarding the establishment of safety exclusion zones will be carried out.

8.2.2.3 Residual impacts

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of installation / physical presence of facilities and establishment of exclusion zones on fisheries

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to fisheries (direct impact)	Minor (4)	Negligible (2)

8.2.3 Tourism and recreation

8.2.3.1 Potential impacts

Offshore sport fishing for pelagic fish typically takes place between 22 km and 44 km from the shore, although recreational fishing vessels occasionally venture further out provided the size of their vessel allows.

Based on this, recreational fishing has the potential to be affected by the establishment of the safety exclusion zones and a reduction in available fishing area. However, as stated earlier the combined safety zones will only reduce the fishing grounds available by a small area in comparison to the extent of the fishing zones in Gabonese waters therefore the magnitude of the impact is anticipated to be low.

Impact assessment of installation / physical presence of facilities and establishment of exclusion zones on tourism and recreation

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to recreational fisheries (direct impact)	Very low (1) / Low (2) Extent: Immediate, within Project footprint Duration: Temporary during drilling and facility installation activities; permanent for FPSO and Hibiscus Alpha OI Scale: Very limited / intermittent interference, may be noticed by users of resources Frequency: Continuous	Low (2) – Recreational fishing vessels	Negligible (2) / Minor (4)

8.2.3.2 Mitigation measures

The mitigation measures listed above for fisheries are also relevant to recreational fisheries. In order to minimise disruption, timely engagement with tourism and recreational stakeholders regarding the establishment of safety exclusion zones will be carried out.

8.2.3.3 Residual impacts

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of installation / physical presence of facilities and establishment of exclusion zones on tourism and recreation

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to recreational fisheries (direct impact)	Negligible (2) / Minor (4)	Negligible (2)

8.3 Impacts from Facility Operations

8.3.1 Fisheries

8.3.1.1 Potential impacts

Discharges to the environment

Project activities will result in drilling discharges (drill cuttings and fluids), pipeline commissioning discharges (hydrotest water) and facility operational discharges (sanitary wastewater, food waste, drainage water, cooling water, ballast water, produced water) to sea which have the potential to reduce water quality that may then impact fish and therefore fisheries.

Impacts of drilling fluid and cuttings discharge, produced water discharge, hydrotest water, and other operational discharges on fish are discussed in detail in Section 6.4.1.4 and 9.4.3.3. Drill cuttings piles are generally confined to within 200 m of the well site, although biological effects on benthic communities have been recorded out to 2 km. Drill cutting discharge plumes may extend a considerable distance from the well site, however, chemical risk to the water column is generally temporary (number of days) with the main impact being turbidity. Produced water and cooling water discharges rapidly dilute and disperse in the offshore environment - combined modelling of produced water and cooling water from the BW Adolo FPSO and Hibiscus Alpha OI showed ambient temperature and salinity conditions being reached at approx. 300 m from the FPSO, and almost ambient conditions 500 m from the Hibiscus Alpha OI, see Appendix 6B.

Due to the offshore location of the Ruche EEA, the types of fisheries that could be impacted are those targeted by deep sea / industrial fishing vessels (trawlers and tuna fishing vessels). The livelihoods of those engaged in small-scale/artisanal fishing are unlikely to be affected.

Pollution is recognised as one the main threats to the health of marine ecosystems and the species that inhabit them, with discharges from offshore oil and gas infrastructure recognised as a polluter. All of the aforementioned discharges have the potential to be ingested by fish and cause direct negative impacts or disturb the ecological balance. Pollutants into the marine environment can be toxic to marine species and can bioaccumulate up the food chain and result in the ingestion of toxins by other species. Exposure to discharges and bioaccumulation in species such as tuna, which are quite high on the marine food chain, could therefore lead to contaminated and/or toxic fish, unsuitable for human consumption. This in turn could impact on fisheries in that catches could be contaminated rendering them unsuitable for consumption.

It should be noted, however, that discharges to sea from the Ruche field development Project will be treated before release and will be rapidly diluted and dispersed in the offshore environment of the Ruche EEA. As discussed in Section 6.4.1.4, most fish species have a much wider distribution than documented produced water and other effluent impact zones, therefore harmful exposure periods are unlikely to occur. For any species with smaller home ranges, safety exclusion zones will prevent fishing taking place within 1 km of the BWE facilities.

Underwater noise

Underwater noise generated by the drilling activities, construction vessels, and operation of the FPSO and support / supply vessels has the potential for displacement of fish species due to avoidance behaviour, see Section 6.4.1.3. However, behavioural effects are only anticipated out to a maximum of 100 m from the noise sources associated with the Ruche EEA field development (see Table 6.13) and displacement from the area is not anticipated to be significant.

Impact assessment of facility operations on fisheries

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Drilling and operational discharges – direct impacts on water quality, indirect impacts on fish health and fisheries	Low (2) Extent: Local – extent of cuttings plume, produced water plume, etc Duration: Majority of discharges 'temporary' – rapid dilution and dispersion anticipated. For produced water 'short-term' - continuous throughout operations but impact mitigated relatively rapid following cessation of activities Scale: Direct or indirect impacts will be discernible but use and value of resource not impacted. Frequency: Discharges associated drilling and hydrotesting are limited to the duration of these activities; operational discharges throughout the Project lifetime	Low (2) – Deep-sea / industrial fishing vessels	Minor (4)
Underwater noise from drilling, construction and operation – direct impacts on fish from potential displacement and indirect impacts on fisheries	Very low (1) Extent: Local – behavioural effects up to 100 m from large construction vessels (worst case) Duration: Temporary for drilling and construction. Short-term for ongoing operations, mitigated relatively rapidly following cessation of activities	Low (2) – Deep-sea / industrial fishing vessels	Negligible (2)

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
	Scale: Very limited / intermittent interference, may be noticed by users of resources Frequency: Discharges associated drilling and hydrotesting are limited to the duration of these activities; operational discharges throughout the Project lifetime		

8.3.1.2 Mitigation measures

In order to minimise direct impacts on fish health from discharges to the environment, and indirect impacts on fisheries, the mitigation measures outlined in Section 6.4.1.4 will be implemented.

As displacement of fish from underwater noise is anticipated to have a negligible effect on fisheries no mitigation measures are proposed.

8.3.1.3 Residual impacts

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of facility operations on fisheries

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling and operational discharges – direct impacts on water quality, indirect impacts on fish health and fisheries	Minor (4)	Negligible (2)
Underwater noise from drilling, construction and operation – direct impacts on fish from potential displacement and indirect impacts on fisheries	Negligible (2)	

8.4 Impacts from Support Activities (Movement of Supply Vessels and Construction Vessels)

8.4.1 Infrastructure and services

8.4.1.1 Potential impacts

The port of Port Gentil, on the western side of Cape Lopez Bay, is a general and bulk cargo port and is considered a medium-sized seaport in terms of land use and volumes of cargo handled per year (World Port Source, 2021). It has 450 m of quay, 280 m of fishing quay, 2 hectares of container / general cargo yards, and 6000 m^2 of warehouses (Portek, 2012).

The Ruche EEA field development relies on the port for the location of the Project logistics base. This logistics base serves as a transit and storage location for supplies, materials, equipment and waste transfer.

At present, an average of 8 to 9 vessels arrive / depart from the port of Port Gentil per day (Marine Traffic, 2021). For the Ruche EEA field development there are 3 supply vessel transfers per month from the logistics base to Ruche EEA during operations, and 15 transfers per month during drilling periods.

The movement of these vessels in and out of the port of Port Gentil could lead to an increase in congestion, interference with other port users (particularly commercial vessels such as tankers, tugs, pilot boats, and cargo vessels), and increased pressure on port facilities. However, the number of BWE supply vessel transfers through the port are relatively low in comparison to total vessel traffic using the port (only around 6% of all traffic, even during drilling periods).

Impact assessment of support activities (movement of supply and construction vessels) on infrastructure and services

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Supply vessel activities – impacts on infrastructure, port facilities (direct impact)	Low (2) Extent: Local – in the vicinity of the port Duration: Logistics base in place for Project lifetime Scale: Activity that causes minor interference with other users of resources Frequency: Intermittent supply vessel visits	Low (2) Infrastructure – port facilities	Minor (4)

8.4.1.2 Mitigation measures

In order to minimise the increase in congestion, interference with other port users, and increased pressure on port facilities at the port of Port Gentil, the following mitigation measures will be implemented:

- Project supply vessels will operate in accordance with the directions of the Port Authority.
- Project supply vessels will have designated moorings at the onshore logistics base, reducing interference with other port users.

8.4.1.3 Residual impacts

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of support activities (movement of supply and construction vessels) on infrastructure and services

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Supply vessel activities – impacts on infrastructure, port facilities (direct impact)	Minor (4)	Negligible (2)

8.4.2 Shipping and navigation

8.4.2.1 Potential impacts

Shipping densities along the Gabonese coast are highest in the approach to Port Gentil and between Port Gentil and Omboue due to the prevalence of offshore oil fields in the area.

The operation of the Project support/supply and construction vessels will contribute to an increase in the number of vessel movements between Port Gentil, Mayumba, and the offshore Project sites, which may create disruption and inconvenience for commercial shipping vessels in the area. However, the number of support/supply and construction vessels and the frequency of their movements are relatively low.

Impact assessment of support activities (movement of supply and construction vessels) on shipping and navigation

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Support / supply vessel and construction vessel transfers – disruption to shipping and navigation (direct impact)	Low (2) Extent: Local – along the transfer route between Port Gentil & Ruche EEA Duration: Intermittent over Project lifetime Scale: Activity that causes minor interference with other users of resources Frequency: Intermittent supply vessel / construction vessel transfers (more frequent during drilling than ops)	Low (2) – Shipping and navigation	Minor (4)

8.4.2.2 Mitigation measures

In order to minimise disruption and inconvenience for commercial shipping vessels, the following mitigation measures will be implemented:

- Supply vessel movements will be communicated to the port maritime authorities.
- Supply vessels will be operating in accordance with the requirements of the Port Authority, which plans and coordinates vessel traffic movements within its jurisdiction.
- Support / supply and construction vessels will be equipped with navigational aids and communication systems and will observe speed restrictions.

- Third-party grievance procedure will be circulated to relevant stakeholders.

8.4.2.3 *Residual impacts*

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of support activities (movement of supply and construction vessels) on shipping and navigation

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Support / supply vessel and construction vessel transfers – disruption to shipping and navigation (direct impact)	Minor (4)	Negligible (2)

8.4.3 Fisheries

8.4.3.1 *Potential impacts*

Deep-sea / industrial fishing vessels and small-scale / artisanal fishing vessels may be similarly affected by an increase in the number of support / supply and construction vessel movements between Port Gentil, Mayumba and the offshore Project sites. As the number of support / supply and construction vessels and the frequency of their movements is relatively low, impacts are anticipated to be limited. However, it is important to note that the sensitivity of small-scale / artisanal fishing vessels to disruption is greater than that of deep-sea / industrial vessels, as individuals who rely strongly, or solely on fishing as a source of livelihood may be more vulnerable to changes in fish catches.

There is the potential for effects on fisheries from routine Project vessel discharges (sanitary waste, food waste, bilge water, cooling water, ballast water, etc.), however, these will be smaller in scale than those associated with the drilling and facility operational discharges (see Section 8.3.1) and are therefore anticipated to be of negligible significance.

Impact assessment of support activities (movement of supply and construction vessels) on fisheries

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Support / supply vessel and construction vessel transfers – disruption to fisheries (direct impact)	Low (2) Extent: Local – along the transfer route between Port Gentil & Ruche EEA Duration: Intermittent over Project lifetime Scale: Activity that causes minor interference with other users of resources Frequency: Intermittent supply vessel / construction vessel	Low (2) Fisheries - Deep sea / industrial	Minor (4)
		Medium (3) Fisheries small scale / artisanal	Moderate (6)

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
	transfers (more frequent during drilling than ops)		

8.4.3.2 *Mitigation measures*

The mitigation measures listed above for shipping are also relevant to fisheries.

8.4.3.3 *Residual impacts*

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of support activities (movement of supply and construction vessels) on fisheries

Aspect / impact	Significance (pre-mitigation)	Residual impact significance post-mitigation
Support / supply vessel and construction vessel transfers – disruption to fisheries (direct impact)	Minor (4) Fisheries - Deep sea / industrial	Negligible (2)
	Moderate (6) Fisheries small scale / artisanal	Minor (3)

8.4.4 Recreation and tourism

8.4.4.1 *Potential impacts*

Recreational fishing vessels (sports fishing) engaged in the fishing of pelagic species for tourism or leisure purposes may be similarly affected by an increase in the number of support / supply and construction vessel movements between Port Gentil, Mayumba and offshore Project sites. Other tourism activities operating from Port Gentil or Mayumba, such as whale and turtle viewing excursions and sailing, could also be affected. However, tourism activities, whilst noted by the Government of Gabon in terms of their future development and potential, are fairly limited at the time of writing. Since the number of support / supply and construction vessels and the frequency of their movements is relatively low, it will not significantly impact on tourism and recreation activities in the area.

Impact assessment of support activities (movement of supply and construction vessels) on recreation and tourism

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Support / supply vessel and construction vessel transfers – disruption to tourism and recreation (direct impact)	Low (2) Extent: Local – along the transfer route between Port Gentil & Ruche EEA Duration: Intermittent over Project lifetime	Low (2) Recreational fishing vessels	Minor (4)

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
	Scale: Activity that causes minor interference with other users of resources Frequency: Intermittent supply vessel / construction vessel transfers (more frequent during drilling than ops)		

8.4.4.2 Mitigation measures

The mitigation measures listed above for shipping and fisheries are also relevant to tourism and recreation.

8.4.4.3 Residual impacts

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as negligible.

Residual impact assessment of support activities (movement of supply and construction vessels) on recreation and tourism

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Support / supply vessel and construction vessel transfers – disruption to tourism and recreation (direct impact)	Minor (4)	Negligible (2)

8.5 Impacts from Helicopter Support Activities

8.5.1 Public health

8.5.1.1 Potential impacts

Personnel will be transported by helicopter from Port Gentil heliport to the drilling rig, BW Adolo FPSO and Hibiscus Alpha OI. Twenty flights per month are scheduled during operations and forty per month during drilling periods.

Safety will be the main consideration in determining helicopter transit route, alongside the need to optimise travel distances and avoid sensitive receptors as far as possible. It can be assumed that a fairly direct line will be taken by the helicopters between the heliport and Ruche EEA.

Helicopter movements generate airborne noise, which may lead to the disturbance and irritation of communities located on the helicopter flight path between the heliport and the coast. The area between the heliport and the coast is approximately 1.7 km, and not very densely populated (see Figure 7.2). It is not anticipated that an additional 20-40 helicopter flights per month will lead to a noticeable increase in ambient noise levels in the communities located on the flight path.

Impact assessment of helicopter support activities on public health

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Helicopter support activities – disturbance of local communities, potential public health issues (direct impact)	Low (2) Extent: Local - between the heliport and the coast along the routes taken by the helicopters Duration: Helicopter transfers throughout Project lifetime Scale: Reduction of wellbeing stays within normal variation in baseline levels Frequency: Intermittent	Medium (3) – Public health	Moderate (6)

8.5.1.2 Mitigation measures

In order to minimise disturbance to communities located on the helicopter flight path; the following mitigation measures will be implemented:

- A flight plan for each helicopter transfer will be developed and agreed with the relevant government authority.
- Low flights directly over communities will be avoided, where it is safe and practical to do so.
- Helicopter flights will take place during daylight hours, thus helping to minimise noise disturbance to communities on the helicopter flight path at night.
- Helicopter transfers will be optimised as far as possible to reduce the number of flights undertaken.

8.5.1.3 Residual impacts

Assuming implementation of the mitigation measures listed above, the residual impact has been scored as minor.

Residual impact assessment of helicopter support activities on public health

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Helicopter support activities – disturbance of local communities, potential public health issues (direct impact)	Moderate (6)	Minor (3)

8.6 Impacts from Logistics Base Operation

8.6.1 Public health

8.6.1.1 Potential impacts

The logistics base is situated in the commercial port of Port Gentil, which is surrounded by industrial units and companies. The closest residential area are the club houses along

the coastline to the northwest of the port (approximately 0.8 km distant from the logistics base).

Sources of emissions are limited to one back-up generator that will be used if electrical grid power supply is unavailable.

Sources of noise will be limited to those associated with loading and unloading operations. These are not anticipated to be particularly acute noise sources, especially in the context of other activities taking place in the port.

Impact assessment of logistics base operation on public health

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Logistics base operations – impacts on public health from emissions and airborne noise (direct impact)	Very Low (1) Extent: Immediate / local Duration: Activities at logistics base throughout Project lifetime, more intensive during drilling periods Scale: Reduction of wellbeing stays within normal variation in baseline levels Frequency: Intermittent – generator only used if grid supply not available, airborne noise only during loading / unloading	Low (3) Public health	Minor (3)

8.6.1.2 Mitigation measures

In order to minimise the increase in air emissions from the use of the back-up generator, the following mitigation measures will be implemented:

- Use of low-sulphur fuel in generator, where practicable.
- Mandatory, regular maintenance of back-up generator will be ensured, as per manufacturer's guidance and recommendations.
- Third-party grievance procedure will be circulated to relevant stakeholders.

8.6.1.3 Residual impacts

Residual impacts remain minor after mitigation. This is due to the receptor sensitivity having a score of 3 - it is not possible to reduce the impact scoring any further.

Residual impact assessment of logistics base operation on public health

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Logistics base operations – impacts on public health from emissions and airborne noise (direct impact)	Minor (3)	Minor (3)

8.6.2 Infrastructure and services

8.6.2.1 Potential impacts

The operation of the logistics base will require road infrastructure and waste management services.

Although a mainland road link now connects Libreville and Port-Gentil (see Section 7.7.5) it is anticipated that the majority of bulk materials required for the Project will be transported to the logistics base by vessel. Locally sourced goods and services will, however, be transported to the logistics base via the existing road network connected to the port of Port Gentil. The resulting increase in the number of vehicles using the road network, though limited, has the potential to lead to congestion at peak traffic times, resulting in longer journey times and inconvenience for communities in the vicinity of the port of Port Gentil, who may also rely on the roads.

Major roads in Port Gentil are paved, although in poor condition, and minor roads within the city are mainly dirt tracks. Therefore, additional traffic could also increase pressure on the road network and contribute to a deterioration in existing road conditions.

According to Section 7.7.3, waste management is a challenge in Gabon and poor solid and liquid wate management in urban areas has resulted in serious health hazards (waterborne infectious diseases) and environmental hazards.

Project waste management was raised as a concern by OPRAG during Project stakeholder engagement meetings. Waste from offshore activities will be transferred through the logistics base with no on-site waste treatment or storage. Should this waste not be managed responsibly, it could put significant pressure on the current waste management in Port Gentil.

Ruche EEA field development non-hazardous and hazardous waste will be transported onward from the logistics base for disposal by registered waste disposal contractor IEG (see Section 7.7.3). IEG is located west of the logistics base on Cape Lopez and has been established to support the oil and gas industry.

Impact assessment of logistics base operation on infrastructure and services

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Logistics base operations – impact on road network, congestion and deterioration in road conditions (direct impact)	Low (2) Extent: Local Duration: Activities at logistics base throughout Project lifetime, more intensive during drilling periods Scale: Activity that causes minor interference with other users Frequency: Intermittent road transfers (more frequent during drilling than ops)	Low (2) Infrastructure – road network	Minor (4)

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Logistics base operations – impacts from ineffective waste management (direct impact, perceived impact) indirect impacts from increased pressure on Port Gentil waste management	Very low (2) Extent: Local Duration: Activities at logistics base throughout Project lifetime, more intensive during drilling periods Scale: Activity that causes minor interference with other users Frequency: Waste will be generated throughout Project lifetime	Medium (3) – Waste management	Moderate (6)

8.6.2.2 *Mitigation measures*

In order to minimise congestion and inconvenience from road deliveries to the logistics base the following mitigation measures will be implemented:

- Deliveries of locally sourced goods and services will be scheduled outside of peak traffic periods, as far as possible.
- Third-party grievance procedure will be circulated to relevant stakeholders.

In order to minimise increased pressure on and contribution to the deterioration of the existing road network, the following mitigation measures will be implemented:

- A Traffic Management Plan will be developed and implemented which includes topics such as designated vehicle routes and alternatives, driver and vehicle requirements, and speed limit restrictions.
- Condition surveys will be undertaken prior to and during the completion of Project activities to identify any damages that may have occurred to road infrastructure as a result of the Project; repairs will be undertaken as appropriate in a timely manner.

In order to minimise pressure on existing waste management in Port Gentil, the following mitigation measures will be implemented:

- Waste collection and temporary storage will be designed to minimise the risk of escape to the environment.
- Waste transferred through the logistics base will be collected and transported by a registered and appropriately licensed waste management contractor (e.g., IEG).
- Records of waste volumes, waste transfer manifests, safe disposal certificates will be kept in order to effectively track waste generated by the Project.

8.6.2.3 *Residual Impact*

Assuming implementation of the mitigation measures listed above, the residual impacts have been scored as negligible and minor.

Residual impact assessment of logistics base operation on infrastructure and services

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Logistics base operations – impact on road network, congestion and deterioration in road conditions (direct impact)	Minor (4)	Negligible (2)
Logistics base operations – impacts from ineffective waste management (direct impact, perceived impact) indirect impacts from increased pressure on Port Gentil waste management	Moderate (6)	Minor (3)

8.7 General Impacts (Project-wide)

8.7.1 Economy, employment and skills development opportunities

Concerns commonly raised during stakeholder engagement for the ESIA Addendum studies included the provision of employment and business opportunities for local communities and the importance of ensuring that such stakeholders benefit from the Project.

8.7.1.1 Impact analysis

An estimated 23 direct employees and 426 contracted employees will be involved in BWE's activities in Gabon, ranging from skilled, to semi-skilled, to unskilled personnel. Project employees will be stationed in Libreville, Port Gentil and offshore in the Ruche EEA, see Tables 8.2 and 8.3.

Table 8.2: Number of direct employees by work location

Work location	Number of direct employees
Libreville	8
Port Gentil	13
Offshore	2
Total	**23**

Table 8.3: Number of contracted employees by work location

Work location	Number of contracted employees
Libreville	19
Port Gentil	123
Libreville and Port Gentil	16
Offshore	217
Offshore and Port Gentil	51
Total	**426**

As indicated in Section 7.5, the poverty rate in Gabon is 32.7 percent and the unemployment rate is 35.7 percent for young people between the ages of 15 and 24, and 26 percent for the labour force aged between 25 and 34. The generation of Project

employment opportunities could therefore lead to an improvement in living standards and well-being at household level, alongside an improvement in future employment prospects due to the skills and experience gained during Project employment, especially for Gabonese nationals.

In addition, the Project will require a range of goods and services including those related to cleaning, security, and maintenance, which will be sourced (where possible) from local suppliers based in Libreville and Port Gentil. Opportunities for local businesses, can lead to positive multiplier effects across the economy. Many small local businesses are not currently regulated, and their status could be improved through assistance from the Project.

The table below summarises the impact analysis. As the impact is positive potential and residual impacts are not assessed, enhancement measures recommended to maximise positive impacts are provided in Section 8.7.1.2.

Impact assessment (Project-wide) on economy, employment and skills development opportunities

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
General (Project-wide) – employment opportunities (direct impact)	Positive (0) Extent: Gabonese nationals, especially in Libreville and Port Gentil Duration: Temporary during drilling and installation; permanent positions for operations Scale: Beneficial impacts on local communities Frequency: Continuous	Medium (3) Economy, employment and skills development	Positive (0)
General (Project-wide) – provision of goods and services (direct impact)	Positive (0) Extent: Gabonese businesses, especially in Libreville and Port Gentil Duration: Opportunities over Project lifetime Scale: Beneficial impacts on local communities Frequency: Continuous but possibly intermittent	Medium (3) Economy, employment and skills development	Positive (0)

8.7.1.2 Enhancement measures

In order to enhance Project employment opportunities, the following measures will be implemented:

- BWE and its contractors and subcontractors will comply with Act No. 3/94 of 21 November 1994 on the Labour Code of the Gabonese Republic (as amended) and all other applicable national labour legislation.
- The recruitment of Gabonese nationals by the Project will be prioritised provided requisite qualifications, skills, and experience can be met.

- As part of the tendering process, BWE's contractors will be required to demonstrate how they will prioritise the employment of Gabonese nationals (e.g., through the preparation of a Local Employment Plan or equivalent document).
- Information about the Project recruitment process and employment opportunities (including the number and types of positions available, the skills and qualifications required) will be made publicly available and widely distributed through timely engagement with relevant stakeholders (e.g., government authorities, local communities, educational institutions) and advertising; contact details will be provided with which to obtain further information from BWE.
- Where possible, on-the-job training will be provided to enable workers to gain new or improved skills; upon completion of training, formal recognition of training will be provided to workers (e.g., in the form of references or certificates).
- As indicated in Section 7.4.2.6, sexual harassment and gender-based violence is widespread in Gabon; as such, rigorous policies on sexual harassment and gender-based violence in the workplace will be developed and implemented.
- As indicated in Section 7.4.2.7, workers in Gabon do not always receive adequate information about their terms of employment and their labour rights. Moreover, violations of wage payments, overtime, and occupational health and safety standards are known to occur. As such, the treatment of employees will be consistent with the requirements of the Core Labour Conventions of the International Labour Organisation (ILO), including those related to:
    - freedom of association and collective bargaining
    - the recruitment of underage workers, as defined by the ILO
    - the use of forced labour
    - discrimination in hiring practices or pay
    - the provision of just and favourable working conditions.

In order to enhance opportunities for businesses to provide goods and services to the Project, the following measure will be implemented:

- The procurement of local goods and services by the Project will be prioritised, provided requisite standards and delivery timescales can be met.

8.7.2 Community safety, security, and well-being

8.7.2.1 Impact analysis

To date BWE has rolled out a number of Corporate Social Investment (CSI) initiatives in Gabon including the installation of solar powered streetlights and the distribution of backpacks with solar powered power banks to school children in Mayumba (Haute Banio Department). A common theme identified during the stakeholder engagement process for the ESIA Addendum studies was stakeholders' desire for BWE to extend the geographical reach of their CSI initiatives beyond Mayumba to the wider Project area, including communities in Basse Banio Department.

The expansion of BWE's activities in Gabon through the phased development of the Ruche EEA will provide the opportunity for BWE to expand its CSI initiatives, which could

lead to an improvement in living standards, and facilitate development amongst communities within the AOI. As the impact is positive potential and residual impacts are not assessed, enhancement measures recommended to maximise positive impacts are provided in Section 8.7.2.2.

Impact assessment (Project-wide) on community safety, security and well-being

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
General (Project-wide) – impacts on community safety, security and wellbeing (direct impact)	Positive (0) Extent: Gabonese local communities Duration: Opportunities over Project lifetime Scale: Beneficial impacts on local communities Frequency: Continuous	Medium (3) Community safety, security and wellbeing	Positive (0)

8.7.2.2 Enhancement measures

In order to enhance improvements in well-being and facilitate development at community level, through the expansion of BWE's CSI initiatives, the following will be carried out:

- Timely engagement with communities in the Project area and other relevant stakeholders (e.g., local government authorities, service providers) to identify key community challenges, needs and priorities, the outcomes of which will be used to inform the design of BWE's CSI initiatives. In doing so, care should be taken to manage potentially high community expectations.
- CSI initiatives undertaken by BWE will be monitored to evaluate their success and identify the need for corrective actions as appropriate. Where identified, corrective actions will be implemented in a timely manner and lessons learned will be applied to future initiatives.

8.7.3 Public health

8.7.3.1 Potential Impacts

As indicated in Section 7.6, HIV and TB are prevalent diseases in the Project AOI, and Gabon has been adversely affected by the COVID-19 pandemic. The movement of workers to and from their home countries, alongside the interaction of the non-local workforce with local communities in Libreville and Port Gentil, has the potential to lead to an increase in the transmission of these and other communicable diseases, or to introduce new diseases, leading to a reduction in health at community level.

The profile of these diseases will be influenced not only by the existing disease profile in Gabon, but also the disease profile of the countries from which workers are sourced. The risk of disease transmission will be greatest where workers are sourced from countries with a higher prevalence of communicable diseases. Despite this, given the relatively small size of the Project workforce and the fact that the vast majority of workers will be based offshore, opportunities for interactions between the non-local workforce and local

communities (and thus disease transmission) will be relatively limited, with the greatest risk being when workers are transiting to and from the offshore Project sites.

As indicated in Section 7.6.1, health care facilities in the Project area are generally ill-equipped and face several challenges related to their condition and maintenance - the availability of medical equipment and supplies, shortages of staff and medical expertise, and lack of transportation services (i.e., ambulances). An increase in the transmission of an existing communicable disease, or the introduction of a new communicable disease, could also lead to increased pressure on existing health care facilities, and potentially decreased access for local communities.

Impact assessment (Project-wide) on public health

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
General (Project-wide) – increased transmission of communicable disease (direct impact) leading to increased pressure on local health care facilities (indirect impact)	Medium (3) Extent: Gabonese local communities Duration: Could happen at any point over Project lifetime Scale: Activity that causes moderate effects on others Frequency: Intermittent	Medium (3) Public health	Moderate (9)

8.7.3.2 Mitigation Measures

In order to minimise the potential for transmission of communicable diseases (including COVID-19) between the non-local Project workforce and local communities, the following mitigation measures will be implemented:

- All employees (including contractors and subcontractors) will undergo pre-employment medical screenings, which will include testing for TB, COVID-19, and other diseases relevant to the individual's country of origin.
- All employees (including contractors and subcontractors) will undergo regular health screenings (including for COVID-19). Adequate referral and support will be provided for the ongoing treatment of workers identified as having treatable conditions during the health screenings.
- A Worker Code of Conduct will be developed for all employees (including contractors and subcontractors), the scope of which will include rules around interacting with other workers and local communities; training will be provided on the Worker Code of Conduct as part of employee inductions.
- All employees (including contractors and subcontractors) will be educated on potential disease transmission pathways and ways to prevent the spread of communicable diseases as part of their induction.
- The emergence of pandemics will be monitored, and relevant emergency response plans will be updated, as appropriate, to reflect changes in the status of pandemics, in-country health care capacity and so forth.

- Timely engagement with communities and other relevant stakeholders (e.g., public health authorities and health care facilities) will be undertaken to raise awareness about potential Project risks to and impacts on public health and measures to mitigate these; contact details will be provided and BWE's third-party grievance procedure will be implemented, through which questions and concerns about the Project can be raised.

8.7.3.3 Residual Impact

Assuming implementation of the mitigation measures listed above, the residual impacts remain moderate (although the impact score is reduced).

Residual impact assessment (Project-wide) on public health

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
General (Project-wide) – increased transmission of communicable disease (direct impact) leading to increased pressure on local health care facilities (indirect impact)	Moderate (9)	Moderate (6)

8.8 Impacts from Decommissioning

Preliminary information on Ruche EEA field decommissioning is provided in Table 2.4, however at this stage detailed assessment of impact significance cannot be carried out.

Impacts from decommissioning are anticipated to be similar in significance to those from facility installation, with socio-economic impacts on shipping and navigation, fisheries, and tourism / recreation from safety exclusion zones in place during the decommissioning works. Flowlines and wellheads left in place on the seabed may also represent a hazard to fishing activities, in particular trawling. The location of any facilities left on the seabed will need to be mapped and communicated to local authorities. Socio-economic impacts resulting from Project de-manning will also need to be considered.

Closer to the decommissioning period, a Site Abandonment and Rehabilitation Plan will be developed for the Project by BWE (in line with applicable government and international norms / standards). It is recommended that a more detailed assessment of socio-economic impacts from decommissioning is carried out at this stage.

8.9 Impacts from Accidental Release of Hydrocarbons

The degree of damage caused by a hydrocarbon spill event will depend upon the quantity spilled, the type of hydrocarbon, and the sensitivity of the marine and coastal areas impacted as well as wind and weather conditions at the moment of the incident. Social receptors identified in offshore Gabonese waters include deep sea / industrial fisheries and shipping. Social receptors in Gabonese coastal waters and along the shoreline include small scale / artisanal fisheries, intertidal gleaners, coastal communities (public health), tourism and recreation, and shipping and port facilities. These are discussed in turn below.

8.9.1 Fisheries and natural resource harvesting (intertidal gleaning)

8.9.1.1 Potential impacts

Hydrocarbon spills have the potential to affect fisheries as follows:

- Fishing gear may be contaminated by oil. The risk of contamination is greatest for floating gear, such as drift nets and seines and fixed traps extending above the sea surface. Bottom trawls, lines, dredges and gill nets are usually well protected, provided they are not lifted through an oily sea surface or affected by sunken oil.
- The catch may become contaminated which in turn may result in the tainting of fish. In some cases, there may be a loss of sales because clean fish are presumed to be tainted if they come from a spill area and fishing may be banned for a short time in the region of an oil spill in order to maintain market confidence.
- Halting of fishing until the gear is cleaned. Such impacts will be of short duration and in most cases, it will be possible to move to other fishing grounds free of oil slicks.
- Fisheries closures may be imposed by authorities in areas heavily impacted by spills.

In a worst-case oil release scenario (well blowout, or a collision with the FPSO) large areas could be impacted (see Section 6.4.1.5 and oil spill modelling figures in Appendix 6C) with the potential for significant impacts on deep sea / industrial fisheries; small scale / artisanal fisheries and intertidal gleaners.

In the case of small-scale/artisanal fisheries levels of income and food security could be adversely affected at household level with negative repercussions for the income and food security of the local population. Fishing is increasingly relied upon in coastal communities due to lack of alternative employment and individuals who rely strongly, or solely on fishing as a source of livelihood may be more vulnerable to changes in fish catch. Artisanal and industrial fishing takes place all along the Gabonese coastline. Within the accidental / unplanned events AOI, cumulative utilisation (fishing pressure) is thought to be highest around Cap Lopez and Port Gentil, Nyanga (south of Gamba), and Mayumba, based on GPS tracking analysis by Metcalf *et al* (2016).

Should a spill reach the shore, the livelihoods of intertidal gleaners, which often comprise vulnerable groups such as women and children, could also be adversely affected. Although the oil spill modelling does not indicate the potential for oil to enter the lagoon, the risk remains that tidal movements could carry contaminants into this area.

Impact assessment of accidental release of hydrocarbons on fisheries and natural resource harvesting

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts on fish and indirect impacts on deep sea / industrial fisheries, direct impacts on fishing gear, direct impacts from fisheries closures	High (3/4) Extent: > 50 km from site, potential for international / transboundary Duration: Medium to long-term	Low (2) Fisheries - deep-sea / industrial	Moderate (6/8)

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts on fish and indirect impacts on small scale / artisanal fisheries, direct impact on fishing gear, direct impacts from fisheries closures	Scale: Activity or event causing substantial interference to other users of resources Frequency: Unplanned / accidental event Likelihood: Very unlikely	Medium (3) Fisheries - small-scale / artisanal	Moderate / Major (9/12)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts on oysters and any other target species, indirect impacts on intertidal gleaners		Medium (3) Natural resource harvesting - intertidal gleaners	Moderate / Major (9/12)

8.9.1.2 Mitigation measures

Mitigation measures to reduce the likelihood of occurrence of an accidental release of hydrocarbon and measures to reduce the magnitude of spill effects are provided in Section 6.4.1.5.

Local level stakeholder engagement, in the event of a spill, will be carried out in line with BWE Gabon's Oil Spill Contingency Plan / Emergency Response Plan. These documents will be updated as detailed in Appendix 11E.

A third-party grievance procedure is in place that will be circulated to relevant stakeholders, see Appendix 11D.

8.9.1.3 Residual impact

Assuming implementation of the mitigation measures listed above, the likelihood of a large-scale spill event is considered to be reduced from very unlikely to extremely unlikely. This lowers the residual impact significance to moderate.

Residual impact assessment of accidental release of hydrocarbons on fisheries and natural resource harvesting

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts on fish and indirect impacts on deep sea / industrial fisheries, direct impacts on fishing gear, direct impacts from fisheries closures	Moderate (6/8)	Moderate (6)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts on fish and indirect impacts on small scale / artisanal fisheries, direct impact on fishing gear, direct impacts from fisheries closures	Moderate / Major (9/12)	Moderate (9)

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts on oysters and any other target species, indirect impacts on intertidal gleaners	Moderate / Major (9/12)	Moderate (9)

8.9.2 Coastal communities (public health)

8.9.2.1 Potential impacts

A major spill of volatile crude oil can raise health concerns and complaints of breathing difficulties, headache and nausea. In extreme cases, the oil may represent a fire hazard and necessitate the evacuation of communities. In addition, the smell of oil can be very unpleasant and presents a nuisance to people living close to the affected coastline.

A health study carried out after the Braer oil spill off the coast of Scotland in 1993 showed that residents living within 4.5 km of the wreck site experienced a higher incidence of irritated throats and eyes compared to non-exposed residents living farther away. Most symptoms (97 percent) however, resolved within a week. Similarly, a range of acute symptoms was observed after the Sea Empress accident in Wales in 1996. The authors noted a statistically significant increase in the prevalence of headaches, nausea, sore eyes, sore throat, cough, itchy skin, rashes, shortness of breath and general weakness among the exposed (Eykelbosh, 2014).

Such impacts are of short duration and, as the Braer study showed, disappear within a week. This is probably because the volatile components that cause these symptoms usually evaporate in this time.

As the Project facilities with potential for a large-scale release of hydrocarbons (well blowout, collision with FPSO) are located around 50 km from the coastline it is anticipated that most volatile components would have largely evaporated before the slick reaches the shore (worst case trajectory modelling indicates that a spill will take around 4 days to reach the shore) therefore health impacts from this source are anticipated to be limited.

Impacts on public health can also result from consumption of oil contaminated fish. However, fish are not generally affected by oil slicks on the sea surface and have been shown to detect and exhibit avoidance behaviour to hydrocarbon products. In addition, fishermen are not generally permitted to fish in oil-contaminated waters (fisheries closures imposed by the authorities) to restrict oil contaminated seafood reaching the consumer.

Impact assessment of accidental release of hydrocarbons on community health

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts on coastal communities, public health (direct impact)	Low (2) Extent: > 50 km from site, potential for international / transboundary Duration: Short-term (volatiles anticipated to evaporate rapidly, contaminated fishery health impacts anticipated to be limited due to closures) Scale: Incidence of chronic and acute illness and reduction in wellbeing stays within normal variation in baseline levels Frequency: Unplanned / accidental event Likelihood: Very unlikely	Medium (3) Public health	Moderate (6)

8.9.2.2 Mitigation measures

The mitigation measures outlined in Section 8.9.1.2 also apply to impacts on coastal communities.

8.9.2.3 Residual impact

Assuming implementation of the mitigation measures listed above, the likelihood of a large-scale spill event is considered to be reduced from very unlikely to extremely unlikely. This lowers the residual impact significance to minor.

Residual impact assessment of accidental release of hydrocarbons on community health

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts on coastal communities, public health (direct impact)	Moderate (6)	Minor (3)

8.9.3 Tourism and recreation

8.9.3.1 Potential impacts

Gabon's primary tourist attraction is nature, including rainforest, wildlife and marine life. This has paved the way for the development of high-end tourism based on services with high added value, such as wildlife observation and sport fishing. Although beaches are not particularly promoted in Gabon's international tourism strategy, these constitute a major attraction for domestic tourism. The COVID-19 pandemic and the associated curbs

on tourist activities have caused a significant slow-down in business, however, a 10-year 'National Tourism Strategy' is currently being executed.

Although it is currently small-scale, the Gabonese tourism industry could be significantly affected by a hydrocarbon spill with the most serious consequences just before and during the tourist season (peak visitor numbers reportedly highest July to September). Hydrocarbon contamination of the shoreline and coastal waters could deleteriously affect tourist activities such as whale watching, sport fishing, water sports and sunbathing. Affected beaches may have to be closed during clean up.

Hotel, restaurant owners and tour operators who gain their livelihood from the coastal tourist trade can suffer economic losses due to oil spill impacts. Holidaymakers may cancel bookings of accommodation in the affected area and rumours of an oil spill affecting the coast might prevent bookings or entail cancelling of bookings, even in areas along the coast not directly affected by oil.

Impact assessment of accidental release of hydrocarbons on tourism and recreation

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts to shoreline and coastal waters, indirect impacts on tourism and recreation	Medium (3) Extent: > 50 km from site, potential for international / transboundary Duration: Medium-term Scale: Activity or event causing moderate interference to other users of resources Frequency: Unplanned / accidental event Likelihood: Very unlikely	Low (2)	Moderate (6)

8.9.3.2 Mitigation measures

The mitigation measures outlined in Section 8.9.1.2 also apply to impacts on tourism and recreation.

8.9.3.3 Residual impact

Assuming implementation of the mitigation measures listed above, the likelihood of a large-scale spill event is considered to be reduced from very unlikely to extremely unlikely. This lowers the residual impact significance to minor.

Residual impact assessment of accidental release of hydrocarbons on tourism and recreation

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts to shoreline and coastal waters, indirect impacts on tourism and recreation	Moderate (6)	Minor (4)

8.9.4 Shipping and ports

8.9.4.1 Potential impacts

Oil spills in or near ports may hamper normal ship traffic and calls. Vessels can be oiled in the waterline and oil in the water intakes for cooling the engine might create operational problems for the vessels. Mooring lines and berths may also be oiled. In addition, breakwaters that are usually made of rock or concrete may be difficult to clean as the oil may penetrate deep into the structure. This oil may become a secondary source of oil pollution. Furthermore, deployed oil spill combat equipment (e.g., booms) may also hamper usual shipping operations.

The consequences for ports are economic losses and claims from ship owners and firms relying on harbour operations. The impact might also cause temporary unemployment for workers at the port. On the other hand, spilled oil may be easily prevented from entering ports by placing booms across the narrow entrances. The sheltered nature of ports allows for a rapid and effective response, so the length of interruption is generally short.

The main coastal ports in the accidental / unplanned events AOI are Port Gentil and Gamba. The ports of Ombué and Mayumba are not on the coast as they are within the lagoon systems.

Impact assessment of accidental release of hydrocarbons on shipping and ports

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – shipping and navigation (direct impact)	Medium (3) Extent: > 50 km from site, potential for international / transboundary Duration: Short-term to medium-term Scale: Activity or event causing moderate interference to other users of resources Frequency: Unplanned / accidental event Likelihood: Very unlikely	Low (2)	Moderate (6)

8.9.4.2 Mitigation measures

The mitigation measures outlined in Section 8.9.1.2 also apply to impacts on shipping and ports.

8.9.4.3 Residual impact

Assuming implementation of the mitigation measures listed above, the likelihood of a large-scale spill event is considered to be reduced from very unlikely to extremely unlikely. This lowers the residual impact significance to minor.

Impact assessment of accidental release of hydrocarbons on shipping and ports

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – shipping and navigation (direct impact)	Moderate (6)	Minor (4)

8.10 Impacts from Accidental Release of Alien Invasive Species

8.10.1 Fisheries

8.10.1.1 Potential impacts

The impact of alien invasive species (AIS) on fish and marine ecosystems is presented in Section 6.4.1.5. There are numerous cases in literature of the introduction of AIS significantly affecting fisheries. For example, the introduction of *Mnemiopsis* into the Black Sea caused a dramatic decrease in local pelagic fisheries due to predation on eggs and larvae, and reduction in food stocks for adult fish (IPIECA, 2010).

Impact assessment of accidental release of AIS on fisheries

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Accidental introduction of AIS – potential for direct impacts on fish and fish stocks and indirect impacts on fisheries	Medium (3) Extent: Potential for regional impacts Duration: Medium to long term Scale: Activity or event causing substantial interference to other users of resources Frequency: Unplanned / accidental event Likelihood: Unlikely	Low (2) Fisheries Deep sea / industrial	Moderate (6)
		Medium (3) Fisheries Small scale / artisanal	Moderate (9)

8.10.1.2 Mitigation measures

Mitigation measures for reducing the likelihood of the introduction of invasive species are listed in Section 6.4.1.5.

8.10.1.3 Residual impact

Assuming implementation of the above mitigation measures and the requirements in the Project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of introduction of AIS is considered to be reduced from unlikely, to very unlikely. This lowers the residual impact significance to minor / moderate.

Residual impact assessment of accidental release of AIS on fisheries

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental introduction of AIS – potential for direct impacts on fish and fish stocks and indirect impacts on fisheries	Moderate (6) Fisheries Deep sea / industrial	Minor (4)
	Moderate (9) Fisheries Small scale / artisanal	Moderate (6)

8.11 Impacts from Accidental Project Vessel Interaction with Fishing Vessels / Fishing Gear

8.11.1 Fisheries

8.11.1.1 Potential impacts

Accidental interactions between Project vessels and those involved in deep-sea / industrial fishing activities could lead to the disturbance of such activities where fishing gear (e.g., nets, longlines) is damaged or destroyed and cannot be immediately repaired or replaced.

Since vessels involved in small-scale / artisanal fishing activities are significantly smaller than those involved in industrial fishing, accidental interactions (e.g., collisions) between such vessels and Project vessels could lead to damage to fishing gear, vessel and potentially injury to crew members. Damage of fishing gear may lead to the disturbance of fishing activities, resulting in a loss of income for artisanal fishermen and their families. Where fishing gear cannot be quickly repaired or replaced, there may be negative impacts on household food security, health and well-being.

Impact assessment of accidental Project vessel interaction with fishing vessels / gear

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Project vessel accidental interaction with fishing vessel / gear – impacts on fisheries (direct impact)	Medium (3) Extent: Local Duration: One off event Scale: Activity or event that causes moderate interference with other users of resources Frequency: Unplanned/ accidental events Likelihood: Unlikely	Low (2) Fisheries - deep-sea / industrial	Moderate (6)
		Medium (3) Fisheries – small scale / artisanal	Moderate (9)

8.11.1.2 Mitigation measures

In order to minimise the likelihood of accidental interaction with support / supply vessels or construction vessels, the following mitigation measures will be implemented:

- Project vessels will operate in accordance with the requirements of the relevant government (e.g., port and maritime) authorities.
- Project vessels will be equipped with navigational aids and communication systems and will observe speed restrictions.
- Project vessels will spot, monitor and communicate with small vessels / artisanal fishing vessels, as necessary.
- Third-party grievance procedure will be circulated to relevant stakeholders.

8.11.1.3 Residual impacts

Assuming implementation of the above mitigation measures, the likelihood of Project vessel interaction with fishing vessels / gear is considered to be reduced from unlikely to very unlikely. This lowers the residual impact significance to minor / moderate.

Residual impact assessment of accidental Project vessel interaction with fishing vessels / gear

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Project vessel accidental interaction with deep sea / industrial fishing vessel / gear (direct impact)	Moderate (6)	Minor (4)
Project vessel accidental interaction with small scale / artisanal fishing vessel / gear (direct impact)	Moderate (9)	Moderate (6)

8.12 Impacts from Increased Road Use Associated with Logistics Base Operation - Traffic Accidents

8.12.1 Community safety, security, and well-being

8.12.1.1 Potential impacts

As indicated in Section 8.6.2, the transportation of locally sourced goods and services to the logistics base, and the transport of waste from the logistics base to waste treatment / disposal facilities, will make use of existing road infrastructure and the associated increase in the number of vehicles could lead to an increase in the risk of road traffic accidents occurring.

Impact assessment of increased road use associated with logistics base operation, traffic accidents

Aspect / impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Increased road use associated with logistics base operation – potential for traffic accidents (direct impact)	Medium (3) Extent: Local Duration: One off event Scale: Activity or event that causes moderate interference with other users Frequency: Unplanned / accidental event Likelihood: Unlikely	Medium (3) Community safety, security and wellbeing	Moderate (9)

8.12.1.2 Mitigation measures

In order to minimise the risk of traffic accidents and subsequent impacts on community safety, security, and wellbeing, the following mitigation measures will be implemented:

- Development and implementation of a Traffic Management Plan which includes topics such as driver requirements (e.g., training, hours of driving and rest periods, fitness to work), vehicle requirements (e.g., maintenance activities and speed limit restrictions.
- Timely engagement with communities located in the vicinity of the port of Port-Gentil to increase road safety awareness.
- Third-party grievance procedure will be circulated to relevant stakeholders.

8.12.1.3 Residual impacts

Assuming implementation of the above mitigation measures, the likelihood of a traffic accident associated with logistics base road traffic is considered to be reduced from unlikely to very unlikely. Residual impacts remain moderate (although the impact score is reduced).

Residual impact assessment of increased road use associated with logistics base operation, traffic accidents

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Increased road use associated with logistics base operation – potential for traffic accidents (direct impact)	Moderate (9)	Moderate (6)

8.13 Conclusions

Given the remote offshore Project location, many of the socio-economic and cultural heritage issues typically associated with terrestrial resource projects will not apply to the Ruche EEA field development Project. Furthermore, shore-based activities will be confined to a logistics base in the port of Port Gentil that is not publicly accessible. As

such, Project activities will not alter existing land-use practices nor displace people from their land.

The majority of residual negative impacts associated with routine / planned events have been categorised as negligible / minor, see Table 8.4. The exception is the potential for increased transmission of communicable disease, leading to pressure on local health care facilities, from movement of Project workers into Gabon from their home countries and interaction of the non-local workforce with local communities in Libreville and Port Gentil. In addition, positive impacts have been identified associated with Project employment opportunities; provision of goods and services to the Project; and from BWE's Corporate Social Investment projects.

In terms of unplanned / accidental events, moderate residual impacts have been identified for the following scenarios: large scale release of hydrocarbons (e.g., collision with FPSO or well blowout); accidental introduction of AIS; road traffic accidents associated with increased road traffic to the logistics base; and accidental Project vessel interaction with fishing vessels / gear.

A Social Management Plan (SMP) has been developed to ensure that the social impacts associated with planned Project activities and unplanned / accidental events are effectively mitigated, see Section 11.8 and Appendix 11F.

Table 8.4: Summary of impact assessment results

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
PLANNED / ROUTINE ACTIVITIES		
Impacts from installation / physical presence of facilities and establishment of safety exclusion zones		
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to shipping and navigation	Negligible (2) / Minor (4)	Negligible (2)
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to fisheries	Minor (4)	Negligible (2)
Installation / physical presence of infrastructure and establishment of exclusion zones – disruption to recreational fisheries	Negligible (2) / Minor (4)	Negligible (2)
Impacts from facility operations		
Drilling and operational discharges – impacts on fish health and subsequently fisheries	Minor (4)	Negligible (2)
Underwater noise from drilling, construction and operation – potential displacement of fish	Negligible (2)	
Impacts from support activities (movement of supply vessels and construction vessels)		
Supply vessel activities – impacts on infrastructure, port facilities	Minor (4)	Negligible (2)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Support/supply vessel and construction vessel transfers – disruption to shipping and navigation	Minor (4)	Negligible (2)
Support/supply vessel and construction vessel transfers – disruption to fisheries	Minor (4) Fisheries - deep sea / industrial fishing	Negligible (2)
	Moderate (6) Fisheries - small scale / artisanal	Minor (3)
Support/supply vessel and construction vessel transfers – disruption to tourism and recreation.	Minor (4)	Negligible (2)
Impacts from helicopter support activities		
Helicopter support activities – disturbance of local communities (potential public health issues)	Moderate (6)	Minor (3)
Impacts from logistics base operation		
Logistics base operations – impacts on public health from emissions and airborne noise	Minor (3)	Minor (3) Due to receptor sensitivity, it is not possible to reduce impact significance scoring further despite mitigation.
Logistics base operations – impact on road network (congestion and deterioration in road conditions)	Minor (4)	Negligible (2)
Logistics base operations – waste management impacts	Moderate (6)	Minor (3)
General impacts (Project wide)		
General (Project-wide) – employment opportunities	Positive (0)	
General (Project-wide) –provision of goods and services	Positive (0)	
General (Project-wide) – impacts on community safety, security and wellbeing	Positive (0)	
General (Project-wide) – increased transmission of communicable disease leading to increased pressure on local health care facilities	Moderate (9)	Moderate (6)
UNPLANNED / ACCIDENTAL EVENTS		
Impacts from accidental release of hydrocarbons		
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts on fisheries and natural resource harvesting	Moderate (6/8) Fisheries – deep sea / industrial fishing	Moderate (6)
	Moderate / Major (9/12) Fisheries - small scale / artisanal fishing	Moderate (9)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
	Moderate / Major (9/12) Natural resource harvesting - intertidal gleaners	Moderate (9)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts on coastal communities (health)	Moderate (6)	Minor (3)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts on tourism and recreation	Moderate (6)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts on shipping and ports	Moderate (6)	Minor (4)
Impacts from accidental release of alien invasive species		
Accidental introduction of AIS – potential impacts on fish stocks	Moderate (6) Fisheries - deep sea / industrial	Minor (4)
	Moderate (9) Fisheries - small scale / artisanal	Moderate (6)
Impacts from accidental Project vessel interaction with fishing vessels / gear		
Project vessel accidental interaction with fishing vessel / gear – impacts on fisheries	Moderate (6) Fisheries - deep sea / industrial	Minor (4)
	Moderate (9) Fisheries – small scale / artisanal	Moderate (6)
Impacts from increased road use associated with logistics base operation – traffic accidents		
Increased road use associated with logistics base operation – potential for traffic accidents	Moderate (9)	Moderate (6)

REFERENCES

Marine Traffic (2021), Gentil Port. Available at: https://www.marinetraffic.com/en/ais/details/ports/1169/Gabon_port:GENTIL

Portek (2012), Gabon – port of Port Gentil. Available at: https://www.portek.com/port-operations/gabon-port-of-portgentil/

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 9: Ecosystem Services Assessment

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9 ECOSYSTEM SERVICES ASSESSMENT

9.1 Purpose

This chapter provides a technical assessment of the ecosystem services (the benefits that people, including businesses, obtain from ecosystems) of relevance to the Ruche EEA field development programme, assesses project-related impacts to the priority ecosystem services and describes mitigation measures to be applied to avoid or reduce residual impacts.

Applicable standards relevant to this ecosystem services assessment are included in Chapter 3.

9.2 Review of Ecosystem Services Screening

An initial screening exercise was conducted to identify the potential Project impacts and dependencies on ecosystem services, priority and potential priority ecosystem services. Stakeholder engagement and additional data gathering was then carried out to confirm the priority ecosystem services. The screening exercise is described in 'Ecosystem Services Screening Report – Dussafu Development, Gabon' report (RSK, 2021) (P80834/04/02_Rev01) and is summarised below.

9.2.1 Initial Screening

The ecosystem services relevant to the Project were identified through a review of the ecosystems in the Project AOI.

For each of the ecosystem services that were included, the following was considered:

- baseline nature, extent and key trends of the ecosystem service
- whether the ecosystem service was a Type 1 (impacted by the project) or Type 2 (Project dependent on the service) ecosystem service
- for Type 1 ecosystem services:
    - description of key beneficiaries, stakeholders and affected communities
    - importance to beneficiaries
    - potential impact description, including whether it arises from a routine planned activity or accidental event
    - significance of potential impact
    - degree of Project management control/influence
    - potential mitigation options
    - data gaps
- for Type 2 ecosystem services:
    - description of dependency, including whether it arises from a routine planned activity or an accidental event
    - extent of dependency
    - degree of Project management control/influence
    - potential mitigation options
    - data gaps.

A preliminary, high-level assessment of Project impacts on ecosystem services was undertaken, which then allowed the degree to which the Project has management control or influence to be determined. Definitions used in the screening assessment are provided in the Ecosystem Services Screening Report (RSK, 2021) (Table 3-1 importance, Table 3-2 impact significance before mitigation, and Table 3-3 project management control/influence).

A screening template was developed to support the screening assessment and provide a structured approach to the analysis of available data. This screening assessment approach and results are provided in full detail in the Ecosystem Services Screening Report (RSK, 2021).

Following the compilation of a preliminary list of ecosystem services, this list was reviewed against the project description and AOI to identify whether any (and if so, which) ecosystem services were irrelevant to the Project and did not require further consideration.

The ecosystem services relevant to the Project were then assessed to identify priority and potential priority ecosystems. The Ecosystem Services Screening Report (RSK, 2021) identified data gaps, which resulted in some ecosystems services being categorised as potential priority ecosystem services. These data gaps were reduced through the additional data collection and stakeholder engagement described in Section 9.3.1.

All priority and potential priority ecosystem services were identified as Type 1; no Type 2 ecosystem services have been identified and are therefore excluded from further consideration.

According to IFC Performance Standard 6 (Guidance Note 118), Type 1 ecosystem services are to be considered priority ecosystem services under the following circumstances:

- project operations are likely to result in a significant impact on the ecosystem service
- the impact will result in a direct adverse impact on affected communities' "livelihood, health, safety, and/or cultural heritage"
- the project has direct management control or significant influence over the service.

Only ecosystem services where the Project has high or medium level of control/influence can be considered a priority. For those ecosystem services where the Project is identified as having a high or medium level of control/influence, the matrix presented in Figure 9.1 brings together the remaining variables – assessment of importance to beneficiaries and the degree of impact significance – to confirm prioritisation of ecosystem services.

Prioritisation		Importance of ecosystem service to beneficiaries			
		Low	Medium	High	Uncertain
Impact	Minor			P	
	Moderate		P	P	PP
	Major	P	P	P	PP
	Uncertain		PP	PP	PP

Figure 9.1: Matrix for priority and potential priority Type 1 ecosystem services

Note: 'P' refers to priority ecosystem services; 'PP' refers to potential priority ecosystem services.

From the initial screening assessment eleven ecosystem services were eliminated, with a total of eight priority and six potential priority ecosystem services identified (RSK, 2021). These priority and potential priority ecosystem services are presented in Table 9.1 (for routine planned activities), and Table 9.2 (for accidental events).

Table 9.1: Ecosystem services assessment – routine planned activities

Ecosystem service	Importance of ecosystem service to beneficiaries	Significance of potential impact on ecosystem service	Direct Project management control / influence over ecosystem service?	Priority / potential priority ecosystem service?
Supporting services				
Habitat and species support	High	Moderate	Yes – medium	Yes – priority
Primary production	High	Minor	Yes – medium	Yes – priority
Provisioning services				
Capture fisheries	High	Major	Yes – medium	Yes – priority
Regulating services				
Air quality regulation	High	Minor	Yes – high	Yes – priority
Regional/local climate regulation	High	Minor	Yes – high	Yes – priority
Cultural services				
None identified.				

Table 9.2: Ecosystem services assessment – accidental events

Ecosystem service	Importance of ecosystem service to beneficiaries	Significance of potential impact on ecosystem service	Direct Project management control / influence over ecosystem service?	Priority / potential priority ecosystem service?
Supporting services				
Habitat and species support	High	Major	Yes – high	Yes – priority
Primary production	High	Minor	Yes – high	Yes – priority
Provisioning services				
Wild foods	High	Major	Yes – high	Yes – priority
Capture fisheries	High	Major	Yes – high	Yes – priority
Aquaculture	Uncertain	Uncertain	Yes – high	Yes – potential priority
Freshwater	Uncertain (potentially high)	Major	Yes – high	Yes – potential priority
Regulating services				
Air quality regulation	High	Minor	Yes – high	Yes – priority
Regional / local climate regulation	High	Minor	Yes – high	Yes – priority
Water purification and waste treatment	High	Minor	Yes – high	Yes – priority
Natural hazard regulation	High	Moderate	Yes – high	Yes – priority
Cultural services				
Recreation and ecotourism	Uncertain	Uncertain	Yes – high	Yes – potential priority
Spiritual, sacred and religious values	Uncertain	Uncertain	Yes – high	Yes – potential priority
Inspiration for culture, art and design	Uncertain	Uncertain	Yes – high	Yes – potential priority
Visual and aesthetic	Uncertain	Uncertain	Yes – high	Yes – potential priority

9.2.2 Final Screening of Priority Ecosystems Services

The potential and priority ecosystem services identified in the screening were reviewed based on the additional primary data collection and examination of supplementary secondary data (see Section 9.3.1).

This review found that the provisioning services of 'aquaculture' and 'freshwater'; and the cultural services of 'recreation and ecotourism', 'spiritual, sacred and religious values'; 'inspiration for culture, art and design'; and 'visual and aesthetic' were not considered to be priority ecosystem services. This was because stakeholder engagement did not highlight these to be important to beneficiaries in the Project AOI. During stakeholder engagement, the Banio Lagoon was highlighted as a source of freshwater, however, the mouth of the lagoon is a narrow bottleneck from Mayumba Bay and so it is unlikely that the length of lagoon will be affected by Project routine planned activities or unplanned / accidental events, and so freshwater will not be impacted.

Although villagers use beaches for recreation, these are focussed round the lagoon or predominantly around Mayumba, and ecotourism (while a potential ecosystem service) is not currently well developed due to a lack of resources. Impacts on iconic species were discussed during the ecosystem service assessment due to the potential for impact on these species to restrict the development of ecotourism. The visual and aesthetic value of the local environment and coastal scenery was mentioned as key during stakeholder engagement, but this was related predominantly to the Banio Lagoon. There is also a ceremony (Tchibilu) that takes place on the lagoon, which cannot be moved, but the lagoon is not affected by routine / planned activities and it is unlikely that unplanned / accidental events will impact it to the extent that the ceremony is disturbed.

Based on the above, eight priority ecosystem services were confirmed, see Table 9.3. These eight priority ecosystem services are associated with the ecosystems listed in the table and described in Section 9.3.2. These have been carried through into the impact assessment in Section 9.4. Appendix 9A presents more detail on the eight priority ecosystem services identified.

Table 9.3: Final ecosystem services assessment

Ecosystem service	Importance of ecosystem service to beneficiaries	Significance of potential impact on ecosystem service	Direct Project management control / influence over ecosystem service?	Routine planned activities (RPA) / accidental events (AE)?	Ecosystems
Supporting services					
Habitat and species support	High	Major	Yes – high	RPA and AE	Shallow water column; Water Column over the Continental Slope; Seabed; Mangroves; Sandy shores
Primary production	High	Minor	Yes – high	RPA and AE	Shallow water column; Water Column over the Continental Slope; Mangroves
Provisioning services					
Capture fisheries	High	Major	Yes – high	RPA and AE	Shallow water column; Water Column over the Continental Slope; Seabed; Mangroves
Wild foods	High	Major	Yes – high	AE	Shallow water column Seabed; Mangroves
Regulating services					
Air quality regulation	High	Minor	Yes – high	RPA and AE	Shallow water column; Water Column over the Continental Slope; Mangroves
Regional / local climate regulation	High	Minor	Yes – high	RPA and AE	Shallow water column; Water Column over the Continental Slope; Seabed; Mangroves; Sandy shores
Water purification and waste treatment	High	Minor	Yes – high	AE	Seabed; Mangroves
Natural hazard regulation	High	Moderate	Yes – high	AE	Shallow water column; Seabed; Mangroves; Sandy shores

Ecosystem service	Importance of ecosystem service to beneficiaries	Significance of potential impact on ecosystem service	Direct Project management control / influence over ecosystem service?	Routine planned activities (RPA) / accidental events (AE)?	Ecosystems
Cultural services					
Screened-out					

9.3 Ecosystem Services Baseline Data Collection

9.3.1 Methodology

Primary baseline data gathering on ecosystem services was carried out in parallel with primary baseline data collection for the social impact assessment. It was focussed on gaps identified in the Ecosystem Services Screening Report (RSK, 2021), see Section 9.2.

Targeted focus groups discussions (FGDs) and key informant interviews (KIIs), within which data on ecosystem services were collected, included:

- FGDs with:
  - community leaders
  - women
  - fisherfolk
- KIIs with persons engaged in:
  - intertidal gleaning
  - wild foods and/or wild plant collection
  - fish wholesale (plus meetings with fish cooperatives and groups)
  - natural resource use
  - tourism.

In addition, the opportunity to gather additional primary baseline data on ecosystem services was taken during stakeholder engagement meetings with government authorities and NGOs between 26 April and 1 May 2021. Such stakeholders included:

- General Directorate for the Environment and Nature Protection (DGEPN)
- General Directorate for Fisheries and Aquaculture (DGPA)
- National Agency of National Parks (ANPN)
- Gabon Bleu.

More information on stakeholder engagement is provided in Chapter 4.

A number of secondary data sources were utilised in the analysis of ecosystem services, including:

- The ESIA / NEIA documents for Tortue Phase 1, Tortue Phase 2 and Ruche Phase 1 and 2 (see Section 1.2).
- Supplementary data provided by EnviroPass, the in-country consultancy who prepared the ESIA / NEIA documents listed above, in response to targeted questions from RSK. In particular, they provided stakeholder engagement data that was not detailed in the reports above.
- Marine species observation reports provided by Terrocea, the in-country consultancy who conducted the in-field megafauna monitoring.
- Reports and databases compiled and published by various organisations including the World Bank Group (WBG), the World Resource Institute (WRI) and the United Nations (UN).
- Scientific papers written and published by academics and research institutions such as the University of British Columbia (Fisheries Centre).

- Articles written and published by various organisations including the Central Intelligence Agency (CIA), the Oxford Business Group and the Wildlife Conservation Society (WCS) Gabon.

9.3.2 Baseline Conditions

9.3.2.1 Introduction

This section describes the ecosystems present in the Project's AOI. However, in a marine environment these ecosystems are not distinct, contained entities and so the ecosystem services are not provided by a discrete ecosystem, but rather overlap ecosystems.

Off Gabon the continental shelf slopes gently to the 100 m isobath, after which it shelves steeply, forming a naturally distinct barrier between the shallow coastal waters and the deeper open oceanic water. However, mobile species will move between the shallow coastal ecosystems and the open water ecosystem depending on habitat preferences such as depth range, salinity and temperature tolerances, and breeding and/or migratory behaviours.

The Ruche EEA is located within the Aquatic Reserve of the Great South of Gabon, a large (27,518 km^2) Marine Protected Area (MPA) designated to promote biodiversity conservation and the recovery of fish stocks (Protected Planet, 2020). It is also in close proximity to the Mayumba National Park and Ecologically or Biologically Significant Area (EBSA), which recognises the global importance of the area for leatherback turtle nesting (UNEP-CBD, 2015a). Seasonal upwelling drives exceptional primary productivity in offshore Gabonese waters, with contributions from the discharge of nutrients from the Congo River (Cofrepeche, 2010) brought northwards by the Benguela current. This high primary productivity results in high biodiversity in the area.

9.3.2.2 Shallow Water Column

The shallow water column, from the shoreline out over the continental shelf to the 100 m isobath is dominated by phytoplankton, and supports commercially important species including sardinellas, mackerel and shad (small pelagic species). Primary production is highest in this ecosystem, due to seasonal equatorial upwelling and inflow from the Congo River. Female leatherback turtles use this area to feed during nesting events, while humpback whales are known to use the area to breed and calve. Additional background information on critical habitat trigger species such as leatherback turtles and humpback whales is available in Section 6.3.3.

The shallowest waters, adjacent to the shore, can be utilised for swimming, surfing, canoeing and sailing, although in the Nyanga region this is generally confined to a small area around Mayumba. Sport fishing is also conducted within this ecosystem. Where whale-watching is part of ecotourism along the Gabonese coast, for example from Librevillle, Port Gentil, Loango National Park and Mayumba National Park between July and September (IWC, 2021), it will be this shallow water ecosystem offering the service.

Commercial fishing also takes place here, with fishing zones set out in Decree No. 0579/PR/MPE of November 30^{th,} 2015. Gabonese artisanal fishers only are permitted out to 3 nm, and then between 3-6 nm both artisanal and industrial fishing takes place. Intertidal gleaning for oysters takes place in the shallowest reaches of this ecosystem.

Around Mayumba, there are three marine protected areas, which encompass portions of the shallow water ecosystem: the Aquatic Reserve of the Great South of Gabon, the Mayumba National Park and EBSA, and the Banio Mouth Marine Park. Around Port-Gentil, there are five marine protected areas, three are aquatic reserves: Cap Lopez Canyons, Ogooué Delta and Mandji-Etimboue; and two marine parks: Cap Lopez and the mouth of the Ozouri. Fishing is prohibited in these areas, in line with the national legislation in force.

The arbitrary boundary of this shallow water column ecosystem bisects the north-east corner of the Ruche EEA, and while it is most likely to only be affected by accidental events, some routine planned activities have the potential to affect it.

9.3.2.3 Water Column over the Continental Slope

The water column over the continental slope covers various habitats throughout the water column including the top 200 m of open water. It supports commercially important fish species including tuna (large pelagic species: yellowfin, skipjack, big eye) and will be utilised for migration corridors by various other species, such as leatherback turtles and humpback whales. Other commercial species in this ecosystem include deep water shrimp and demersal species such as sea bass, emperors, sea bream, sole, red hake and carangids (false tuna) (Terrocea, 2019). Tuna species also spawn in the equatorial waters of the Gulf of Guinea (ICCAT-SCRS, 2019), and migrate through the area, as do other species such as sardinellas and horse mackerel.

Oceanic cetaceans such as common dolphin are also present in this ecosystem. Primary production is lower in this ecosystem. The Aquatic Reserve of the Great South of Gabon extends into this ecosystem as does the Equatorial Tuna Production Area EBSA.

This deeper, open water ecosystem is important to industrial fishing out to 12 nm, focussing on trawling for demersal and/or pelagic species such as sea bass, emperors, sea bream, sole, red hake, horse mackerel, sardinellas, bonga shad, and carangids (false tuna) (Terrocea, 2019; FGDs/KIIs with fishers). It is also important to tuna fisheries, between 12-24 nm, which fish skipjack, yellowfin and bigeye tuna targeted.

The majority of the Ruche EEA is set within this continental slope water column ecosystem, and routine planned activities and accidental events have the potential to affect it.

9.3.2.4 Seabed

The seabed off Gabon is predominantly soft substrate, creating habitat for a variety of species living both on, in and just above the seabed. This includes commercially important species such as demersal fish (e.g., *Pomadasys* (grunts) and *Cynoglossus* (tonguesole species)) and crustaceans (shrimp/prawns) and squid.

The seabed ecosystem supports the artisanal and industrial fishing that targets demersal or benthic species. In shallower waters it is important for intertidal gleaning for oysters.

Routine planned activities and accidental events have the potential to affect this ecosystem.

9.3.2.5 *Mangroves*

Coastal and estuarine mangrove ecosystems support nursery, breeding and juvenile foraging habitat for species that spend their adult lives offshore. Figure 9.2 shows the land cover along the coast of Gabon, illustrating the mangrove cover at the mouth of main river systems. The Nyanga region supports a small proportion of this ecosystem in Gabon, with mangroves located around the Banio estuary, near Mayumba, and throughout the lagoons along the coast. Mangrove forest are also present around the Ogooué-Maritime region, including Port-Gentil, and the Estuary (Gabon Estuary) region around Libreville. Mangrove ecosystems are also important for artisanal fishers.

The mangrove ecosystems along the Gabonese coast only have the potential to be affected by accidental events.

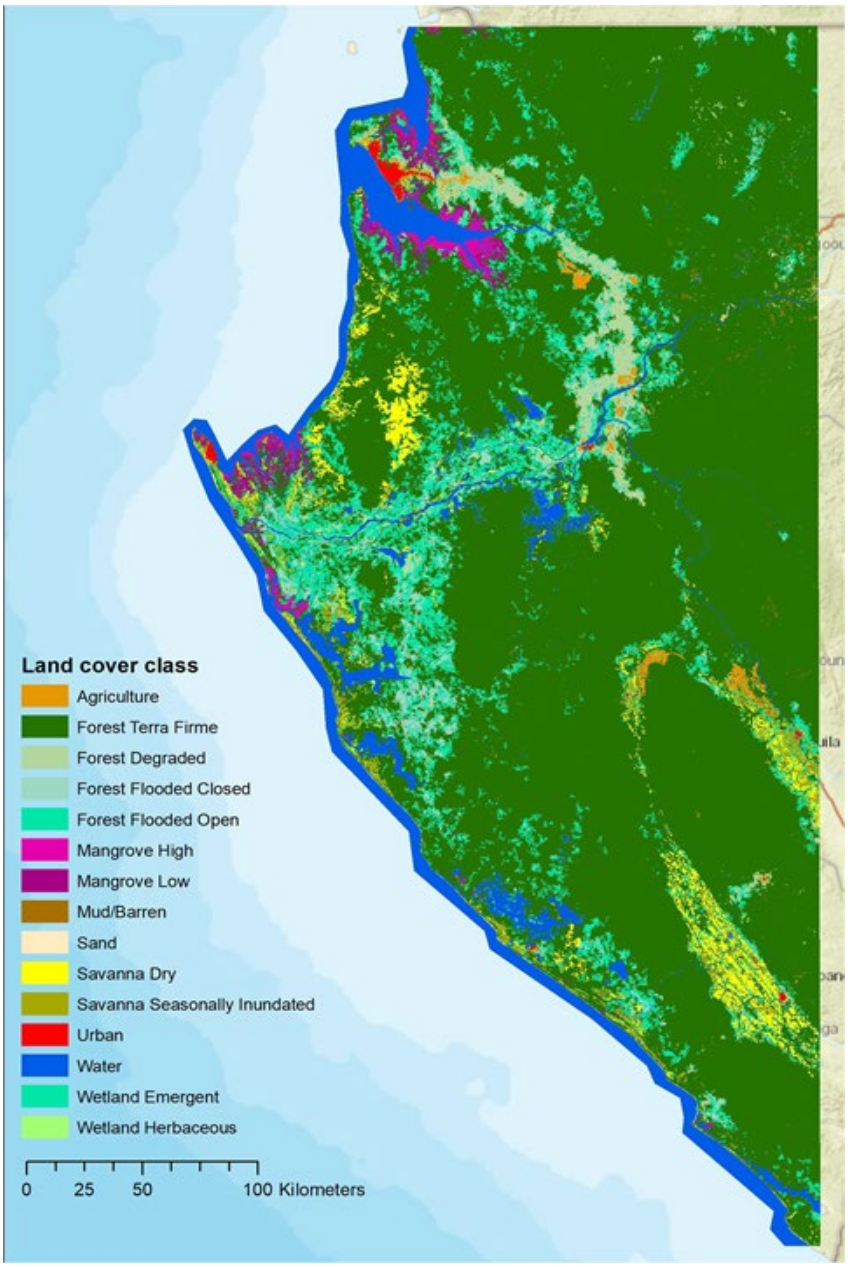

Figure 9.2: Land cover along the Gabonese coast

Source: Adolo et al., 2020

9.3.2.6 Sandy shores

The sandy shores ecosystem covers the majority of the coastline between Mayumba and the border with Congo. Within Gabon this ecosystem provides nesting habitat for sea turtles, including globally important nesting beaches for leatherback turtles. These provide the opportunity for land-based ecotourism, particularly in the Mayumba National Park, where the majority of nests are found.

These sandy shores may be important for beach tourism, as well as recreation (walking, beach football or volleyball) for local communities.

The sandy shore ecosystem only has the potential to be affected by accidental events.

9.4 Ecosystem Services Impact Assessment

The assessment of potential Project impacts on ecosystem services uses a systematic process that involves:

- identifying Project aspects, activities or sources of impact (these are listed in Table 2.4)
- identifying related ecosystem services from Table 9.3
- evaluating Project effects on those ecosystem services where an impact interaction is identified, see Table 9.4.

The impacts interactions identified in Table 9.4 are discussed in Sections 9.4.1 to 9.4.8, and the significance of the impact assessed based on the magnitude of the impact and the sensitivity of the ecosystem service, as described in Chapter 5.

Table 9.4: Priority ecosystem services impact interaction table

Activities/Aspects/Sources of Impact	Supporting Services		Provisioning Services		Regulating Services			
	Habitat and species support	Primary production	Capture fisheries	Wild foods	Air quality regulation	Regional / local climate regulation	Water purification and waste treatment	Natural hazard regulation
Routine / Planned Activities								
Drilling Programmes								
Installation of the jack-up rig			X					
Physical presence of rig (500 m safety exclusion zone)	X		X					
Drilling of top two hole sections with WBDFs – discharge of cuttings and WBDF to sea	X	X	X			X		
Drilling of lower hole sections with NADFs – discharge of cuttings and NADF to sea	X	X	X			X		
Other drilling discharges – cement, pipe dope, BOP testing fluid	X	X	X			X		
Drilling rig operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water	X	X	X			X		
Emissions to air from power generation on rig and from well clean up and testing					X			
Underwater noise from drilling rig operations	X		X					
Lighting of rig – light spill	X		X					
Hibiscus Alpha OI – Installation & Commissioning								
Installation and jack-up of OI	X		X					
Underwater noise from OI installation	X		X					
Hibiscus Alpha OI – Operation & Maintenance								

Activities/Aspects/Sources of Impact	Supporting Services		Provisioning Services		Regulating Services			
	Habitat and species support	Primary production	Capture fisheries	Wild foods	Air quality regulation	Regional / local climate regulation	Water purification and waste treatment	Natural hazard regulation
Physical presence (1 km safety exclusion zone around HA OI)	X		X					
HA OI operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water	X	X	X			X		
Discharge of separated produced water from HA OI	X	X	X			X		
Emissions from power generation and flaring on HA OI					X			
Underwater noise from OI operations	X		X					
Lighting and flaring on HA OI – light spill	X		X					
Subsea Flowlines and Umbilicals – Installation & Commissioning								
Installation of pipelines and cables	X		X					
Subsea pipeline commissioning discharges – hydrotest discharges	X	X	X			X		
FPSO – Operation & Maintenance								
Physical presence (1 km safety exclusion zone around FPSO)	X		X					
FPSO operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water	X	X	X			X		
Discharge of separated produced water	X	X	X			X		
Emissions from power generation and flaring on FPSO, VOCs from offloading operations					X			
Underwater noise from FPSO operations	X		X					
Lighting and flaring on FPSO – light spill	X		X					

Activities/Aspects/Sources of Impact	Supporting Services		Provisioning Services		Regulating Services			
	Habitat and species support	Primary production	Capture fisheries	Wild foods	Air quality regulation	Regional / local climate regulation	Water purification and waste treatment	Natural hazard regulation
Support / Supply Vessel and Construction Vessel Operations								
Vessel operational discharges - sanitary wastewater, food waste, drainage water (bilge, deck drainage, etc), desalination unit discharges, cooling water, ballast water	X	X	X			X		
Emissions to air from vessel engine exhausts					X			
Underwater noise from vessel movements	X		X					
Lights on vessels – light spill	X		X					
Helicopter Support Activities								
Emissions to air from helicopter exhausts					X			
Logistics Base Operation								
On-site power generation emissions					X			
Discharges of rainwater drainage	X	X	X			X		
Potential Unplanned / Accidental Event Scenarios								
Project vessel collision with marine fauna	X							
Project vessel interaction with fishing gear / artisanal vessels			X	X				
Introduction of alien invasive species	X	X	X	X			X	
Bunkering spill - small spill or leak / release during hose disconnection	X		X					
Collision with FPSO resulting in loss of oil	X	X	X	X		X	X	X
Well blowout (expected reservoir crude oil)	X	X	X	X	X	X	X	X

9.4.1 Habitat and Species Support

9.4.1.1 Sensitivity summary

Habitat and species support is an important ecosystem service as it supports many of the provisioning services, particularly capture fisheries and wild foods. Unlike provisioning, regulating and cultural services, this supporting service does not directly impact people but repercussions from impacts to it will occur in other ecosystem services (MA, 2005a). It is the habitats and species themselves that provide the support to the other ecosystem services, for example, if target species of fish are not present in the ecosystem then fish-based capture fisheries are affected. Although the cultural service, ecotourism, is not well developed in the area at present (and has therefore been screened-out as an ecosystem service in its own right) there is potential for the livelihood to expand, and this ecosystem service forms the supporting structure for ecotourism such as whale and dolphin watching.

This ecosystem service occurs across all ecosystems described in this chapter (see Table 9.3), but routine / planned activities will predominantly affect the seabed and water column over the continental slope, and the boundary with the shallow water column. The ecosystems in the Project AOI are considered in good condition; the seabed is generally soft-substrate and the water column supports an abundance of species. Therefore, the sensitivity of the supporting service, habitat and species support, is considered to be high (4), as the area has international ecosystem value with several marine protected areas, species that trigger critical habitat as per IFC PS6 such as humpback whale and leatherback turtle, as well as other iconic marine mammal and turtle species, and commercially important fisheries such as tuna and deep-water shrimp.

9.4.1.2 Impacts from installation of facilities and their physical presence

Impacts comprise:

- installation of the facilities causing disturbance of feeding and spawning grounds and/or to migration, feeding and breeding patterns
- physical presence of the facilities causing
    - disturbance of feeding and spawning grounds and/or to migration, feeding and breeding patterns
    - creation of new artificial habitat and safety exclusion zone increasing in species abundance
- light spill from facilities altering behavioural patterns.

Potential Impacts

Installation of facilities includes the Ruche Phase 1 installation of the Hibiscus Alpha Offshore Installation (HA OI) and drilling jack-up rig, and the associated subsea infrastructure (flowlines and umbilicals). The physical presence of the HA OI, associated subsea infrastructure and BW Adolo FPSO for the duration of the project may prolong impacts associated with installation.

Artificial lighting will be used by the HA OI and drilling rig, BW Adolo FPSO, and support / supply vessels during the hours of darkness for navigation, safety and security. In addition, there will be light from flaring activities on the HA OI and the FPSO.

Direct impacts from the installation and physical presence of facilities on critical habitat trigger species of fish are discussed in Section 6.4.1.2. The impacts on these species of fish can be used in proxy for impacts on other commercially important species. Impacts on the behavioural patterns of iconic species (sharks, large fish, marine mammals and turtles) are discussed further here.

Installation of facilities – disturbance to feeding and spawning grounds and/or behavioural patterns

The installation of the Hibiscus Alpha OI and associated subsea facilities (flowlines / wellheads) will permanently remove some benthic habitat in the immediate area and cause direct physical disturbance of the seabed ecosystem. This may disturb potential demersal feeding and spawning sites of commercially important species, and the mortality of some burrowing infauna, which are less mobile than demersal or pelagic fish species. However, the installation of this infrastructure is a discrete event, while the habitat loss is negligible compared to the extent of the sea floor available (20 km of 12" subsea flowline plus <40 m^2 for the Hibiscus Alpha OI) and temporary as the flowline is likely to self-bury over time in the soft sediment. Therefore, it is unlikely there will be a discernible disturbance effect on benthic communities and demersal feeding and spawning grounds in the Project AOI within a year of installation activities ceasing. As only small disturbance effects to the seabed ecosystem are likely, a reduction in the ability of the seabed ecosystem to support other ecosystem services is unlikely.

The installation of subsea infrastructure associated with Ruche 1 is unlikely to disturb the migration, feeding and breeding patterns of commercially or locally important fishery species or iconic species, as only a small benthic footprint is disturbed by wellheads, flowline and umbilical, even when the presence of the Hibiscus Alpha OI and drilling jack-up rig's feet are considered during installation. The benthic species present in the area upon which the provisioning service (capture fisheries) depend are also mobile - demersal fish and deep-water shrimp - and thus behaviour patterns within the seabed ecosystem are unlikely to be disturbed outside of the random changes in population due to normal environmental variation. Therefore, there is unlikely to be a reduction in the ability of the seabed ecosystem to support other ecosystem services.

Overall, the integrity of the ecosystems is unlikely to be altered outside of natural variation, and so the overall value of the ecosystem service is considered to be minor.

Physical presence of the facilities - disturbance to feeding and spawning grounds and behavioural patterns

The physical footprint of the facilities at the water surface (Hibiscus Alpha OI, FPSO, drilling rig, transient support / supply vessels) is small compared to the area available to commercially important and/or iconic species, so is unlikely to noticeably decrease the area available to these species. There is unlikely to be a discernible effect on commercially important and / or iconic species' populations within the water column over the continental slope and seabed ecosystems because these species are mobile and flexible, adapting to changes in their environment and disturbance related to displacement effects. Fish species such as tunas, jacks and snappers in particular, will

still be able to use the space through and around the Hibiscus Alpha OI when it is in operation, further reducing the disturbance to feeding and spawning grounds. Spawning behaviour of commercially important snappers has been observed around other platforms in the area, as was the courtship behaviour of yellow jacks (Friedlander et al., 2014).

Overall, the integrity of the ecosystems is unchanged as populations of commercially important and/or iconic species will not be altered outside of natural variation through disturbance effects, and so the impact on the overall value of the ecosystem service will be minor.

Physical presence of the facilities – creation of new habitat and safety exclusion zones

The legs of the Hibiscus Alpha OI will provide hard substrate in the open ocean that might otherwise be unavailable to attachment organisms requiring such habitat, with species present varying depending on depth (Friedlander et al., 2014; FFI, 2017). The structures within the pelagic environment may also have a fish aggregation device (FAD) effect. The presence of artificial habitat will modify the existing habitat and alter both the water column over the continental slope ecosystem and the seabed ecosystem and create a novel ecosystem around the platform. It will also link in with the other artificial reefs created in the Gabonese seascape by neighbouring oil and gas platforms, and likely increase ecological connectivity, which could have important biogeographical consequences (van Elden et al., 2019; Friedlander et al., 2014).

This may have a direct positive impact as biodiversity and abundance increases around the Hibiscus Alpha OI and BW Adolo FPSO. Assemblages around other platforms in Gabonese waters are more diverse when the platform area is large, in deep water and far from the shore (Friedlander et al., 2014); as the primary Project AOI is approximately 50 km from shore and the Hibiscus Alpha OI is in 117 m of water and the Adolo FPSO is in 116 m, the assemblages are expected to be relatively diverse. The integrity of the water column over the continental shelf and seabed ecosystems are unlikely to be affected by increased biodiversity and abundance of marine life and may in fact increase the availability of the ecosystem service. This increase of abundance may also attract more whales and dolphins to the Nyanga Province area, increasing the potential for ecotourism.

Due to the safety exclusion zone around the Hibiscus Alpha OI and drilling rig, and BW Adolo FPSO (500 m around drilling rigs; 1 km around the HA OI and FPSO), the area becomes a de facto MPA, and fishing should be reduced. This allows biomass, particularly fish biomass, to increase, and there is a high standing stock of fish biomass seen around other platforms in Gabonese waters. This fish biomass is dominated by pelagic species (barracuda, rainbow runner, jacks) and large snappers in deeper water, with top predators accounting for a large part of it, as on pristine reefs (Friedlander et al., 2014). As mentioned above, spawning behaviour of commercially important snappers was observed around other platforms as was the courtship behaviour of yellow jacks, and they are also likely spawning sites for numerous other species (Friedlander et al., 2014).

Due to the described effects above, the overall impact on the ecosystems' ability to support other ecosystem services is considered to be positive.

Light spill from facilities (lighting and flaring) altering behavioural patterns

Mitigation Measures

Mitigation measures relating to facility installation and physical presence of the facilities are limited as potential impacts are considered to be minor.

Mitigation measures relating to impacts of lighting on turtle hatchlings are discussed in Section 6.4.3.3.

Residual Impacts

The residual impact significance scores are the same as the pre-mitigation impact scores, with the exception of light spill impact (for which mitigation is proposed).

Residual impact assessment of installation of facilities and their physical presence on the supporting service, habitat and species support

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Installation of facilities – disturbance of spawning or feeding grounds and/or behavioural patterns	Minor (4)	Minor (4)
Physical presence of facilities – disturbance of spawning feeding grounds and/or behavioural patterns	Minor (4)	Minor (4)
Physical presence of facilities – creation of new habitat	Positive (0)	Positive (0)
Light spill from facilities (from lighting and flaring)	Moderate (8)	Minor (4)

9.4.1.3 Impacts from discharges to the marine environment

Discharges to marine environment generated from the Project are described in Section 6.4.1.4 and listed in Table 9.4, and include:

- drilling discharges
- hydrotest water from subsea flowline commissioning
- produced water discharges from the Hibiscus Alpha OI and FPSO
- other operational discharges from the drilling rig, HA OI, FPSO and vessel and rainwater drainage discharges from the logistics base.

Potential Impacts

Drilling discharges

Cuttings and drilling fluids have the potential to disrupt the ecosystems in the local area, which may alter their ability to support other ecosystem services. However, as stated in Section 6.4.1.4, it is extremely hard to study the effects of cuttings discharges on populations or communities and the resulting impacts on the structure and function of marine ecosystems, and there is very little published information. Drawing from evidence

collected at a species level, the effects on ecosystems and therefore their ability to provide ecosystem services is therefore inferred.

Impacts resulting from the disposal of drill cuttings and other drilling fluids include:

- Cuttings and drilling fluids disposed of at the seafloor will settle out on the seabed, primarily within a few hundred metres around a well site, with the potential to smother organisms under the pile. Changes to the environmental conditions on the seafloor, as well as elevated suspended particulate matter and turbidity of the water column near the seabed may have ecosystem effects, exacerbated by ill health and fatalities of sessile species with limited mobility, due to a reduced ability to respire. While there are no commercial important sessile species in the Ruche EEA, the species present form part of the seabed ecosystem food web, and a disruption to this can have indirect consequences for other ecosystem services, such as capture fisheries.
- Discharges of drill fluids and cuttings produce a visible plume that moves with the currents as these materials are diluted, dispersed and settle to the seafloor; the associated impacts on fish are described in Section 6.4.1.4, and taken as a proxy for species in the Project AOI. Although impacts from the cuttings and drilling fluids will only be felt in the immediate area of the discharge, some organisms may have to invest a substantial amount of energy in moving away from the plume/pile and this could influence survival and reproductive success. A decrease in survival and reproductive success of marine organisms may disrupt ecosystem food webs and change dominant species, or species abundance.
- The presence of chemical toxins (e.g., hydrocarbons, heavy metals) in cuttings and drilling fluids (WBDFs and NADFs) may also lead to adverse environmental effects (decreased habitat quality) and direct impacts on species' health if ingested. Toxicity impacts occur more in the water column than in the sediment (Lyon et al., 2019), so the immediate water column ecosystem around the discharge site is more likely to be affected. However, contaminated sediment may result in changes in community composition in the seabed ecosystem.
- Drilling discharges such as cement and pipe dope may impact water quality in the local area around the discharge, with loss of habitat causing ecosystem implications. However, only very small volumes of such drilling discharges are likely to be released, and thus the reduction or loss of habitat quality through affected water quality is limited.

Overall, while the disposal of cuttings and drilling fluids, and other drilling discharges, will result in alterations to ecosystems, such as changes to species or community composition, that may temporarily alter their ability to support other ecosystem services, the ecosystems are likely to recover to a similar state within a year of drilling activities. The impact on the overall value of the ecosystem service is considered to be moderate.

Hydrotest water

Hydrotest water is routinely dosed with chemicals such as biocides prior to its discharge to the marine environment. These chemicals have the potential for toxicity effects on marine fauna unless chemicals are selected with low persistence and high biodegradability. More information is provided in Section 6.4.1.4.

Produced water

Section 6.4.1.4 describes the produced water discharges associated with the Project and outlines the results of the produced water hydrodynamic modelling conducted (see

Appendix 6B). As a result of this modelling, the impacts from produced water are likely to be confined to the water column over the continental shelf ecosystem in the Ruche EEA.

The potential impacts to fish, and the difficulties in extrapolating information to population level are also described in Section 6.4.1.4. The impact of produced water on marine organisms is likely to be limited due to rapid effluent dilution and very short exposure time (Bakke et al., 2013). The elevated salinity of the separated produced water could result in marine organisms unable to retain osmotic homeostasis and ionic balance (Farag and Harper, 2013), which can disrupt other functions. However, the rapid dispersion and effluent dilution will reduce this impact and also reduce the effect of increased temperature (see Section 9.4.3.3 for a brief overview on the impact of thermal stress).

Overall, the impacts from the discharge of produced water are likely to be within natural variation in terms of adjustments to species composition and local habitat quality of the water column over the continental shelf ecosystem and so is unlikely to alter the ecosystem's ability to support other ecosystem services. However, as produced water will be discharged throughout the lifetime of the project the impact on the overall value of the ecosystem service could potentially be moderate.

Other operational discharges

Operational discharges from the drilling rig, support / supply vessels, Hibiscus Alpha OI and FPSO have the potential to disrupt the ecosystems in the local area, which may alter their ability to support other ecosystem services. Sanitary wastewater and macerated food waste from the HA OI, Adolo FPSO and support / supply vessels have the potential to affect concentrations of suspended solids, organic material, nutrients and chlorine.

However, operational discharges are unlikely to cause deterioration to local water quality outside the immediate point of discharge, as they will be treated prior to release and will disperse and dilute quickly in the offshore environment of the Ruche EEA. Thus, there are minimal alterations to the water column over the continental shelf or the seabed ecosystem, and so there will be negligible impacts on their ability to support other ecosystem services.

Discharges from the logistics base will be limited to rainwater runoff. This will only be permitted from non-contaminated areas such as the pipe yard, jetty, marshalling areas and the warehouse area. For other areas where there is the potential for spillages, containment will be in place. This discharge is not anticipated to have an impact on habitat and species support and has therefore been scoped out.

Potential impacts from ballast water discharges are discussed in more detail in Section 9.4.1.5.

Overall, operational discharges are unlikely to cause large-scale deterioration of the local water quality and thus habitat quality, which is unlikely to alter the integrity of the ecosystems outside of natural variation, and so the impact on the overall value of the ecosystem service is considered to be minor.

Impact assessment of discharges to the marine environment on the supporting service, habitat and species support

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Drilling discharges – direct impacts on species or community composition from smothering	Low (2) Extent: Local, extent of cuttings plume Duration: Short-term, likely to be mitigated through natural processes within one year of impact occurring Scale: Not anticipated to have a discernible effect outside of natural variation but may have chronic effects on populations or habitat quality that could disrupt ecosystems as a whole Frequency: 6 discrete drilling events during the Project drilling programme	High (4)	Moderate (8)
Hydrotest water discharge – direct impacts on water quality, indirect impacts on species or community composition	Low (2) Extent: Local – extent of hydrotest water plume Duration: Temporary – rapid dilution and dispersion anticipated Scale: Localised impact to individuals of a species Frequency: Once off during hydrotest water discharge	High (4) Critical habitat trigger	Moderate (8)
Produced water discharge – direct impacts on water quality, indirect impacts on species or community composition	Low (2) Extent: Local – extent of produced water plume Duration: Short-term - continuous throughout operations but impact mitigated relatively rapid following cessation of activities Scale: Localised impact to individuals of a species Frequency: Operational discharge throughout the Project lifetime	High (4)	Moderate (8)

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Other operational discharges (drilling rig, vessels, HA OI and Adolo FPSO) – direct impacts on water quality, indirect impacts on species or community composition	Very low (1) Extent: Immediate, extent of discharge plume before dispersion Duration: Temporary, likely to be mitigated through natural processes immediately (within one month of impact occurring) Scale: Not anticipated to have a discernible effect outside of natural variation Frequency: Continuous throughout Project lifetime	High (4)	Minor (4)

Mitigation Measures

Mitigation measures related to discharges to the marine environment are listed in Section 6.4.1.4.

Residual Impacts

With the implementation of the mitigation measures listed in Section 6.4.1.4, the residual impacts are as considered to be as follows:

Residual impact assessment of discharges to the marine environment on the supporting service, habitat and species support

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling discharges - direct impacts on species or community composition from smothering	Moderate (8)	Minor (4)
Hydrotest water discharge - direct impacts on water quality, indirect impacts on species or community composition	Moderate (8)	Minor (4)
Produced water discharge - direct impacts on water quality, indirect impacts on species or community composition	Moderate (8)	Minor (4)
Other operational discharges (drilling rig, vessels, HA OI and FPSO) - direct impacts on water quality, indirect impacts on species or community composition	Minor (4)	Minor (4)

9.4.1.4 *Impacts from underwater noise*

Underwater noise from the Ruche EEA field development programme is generated from several sources, as follows:

- drilling activities
- facility installation activities (operation of large construction vessels, e.g., SBM installer, pipelay barge)
- operation of the BW Adolo FPSO
- support / supply vessel movements (operation of medium sized vessels).

It should be noted that underwater noise from operation of the Hibiscus Alpha OI has been scoped out of the assessment as the hull of the converted jack-up MODU will not be in contact with the water column and noise sources of significance on this facility are anticipated to be minimal.

More information on the noise levels and frequencies of these underwater noise sources is provided in Section 6.4.1.3.

Potential Impacts

Underwater noise from activities may alter the behaviour of commercially important or iconic species, which could disturb migration, feeding and breeding patterns; this may have implications on other ecosystem services (e.g., capture fisheries).

As discussed in Sections 6.3.3 and 9.3.2, the overall area is important for spawning of tuna and jack species amongst others, as well as breeding of humpback whales. Leatherback turtles also migrate through the area to nest on the beaches. Direct impacts, including behavioural effects, to critical habitat triggering fish, marine mammal and turtle species are discussed in Sections 6.4.1.3, 6.4.2.2 and 6.4.3.2 respectively; hearing sensitivity of these fauna are also discussed in these sections. These species are used as proxy species for commercially important and/or iconic species relevant to ecosystem services. It is known, however, that tuna in the area are likely to be in either Group 2 or 3 of hearing sensitivity (Song et al., 2006), as are most other species of economic importance, apart from the bonga shad, which is in Group 4 (as referenced in Section 6.4.1.3).

Drilling and installation of facilities – altered behaviour

Aspects of facility installation and drilling activities may cause disturbance of behaviour (migration, feeding, breeding / spawning patterns) in commercially important and/or iconic species:

- During installation, large construction vessel movements will be the main noise source with disturbance effects up to 100 m for fish species and 9 km for marine mammals. It should be noted that no piling is required for installation of the HA OI.
- During drilling, underwater noise impacts are anticipated to be localised to the well site. This noise is temporary and behavioural disturbance is restricted to the immediate vicinity of the drilling rig (< 1 m for fish species and within 7 m for marine mammals).

Overall, there may be small alterations in the behaviour of commercially important and/or iconic species, but these will not influence the water column ecosystems beyond natural

variation, and so are unlikely to alter their ability to support other ecosystem services. The direct negative impact on the overall value of the ecosystem service is considered to be minor/moderate.

FPSO operation and support / supply vessel movements – altered behaviour

Noise from vessels is likely to be the main constant source of underwater noise throughout the Project lifetime.

- During operation, the BW Adolo FPSO will generate continuous low-level noise, with behavioural effects on fish limited to 40 m and marine mammals limited to 2 km from the FPSO. This noise will be permanent for the duration of the Project but will be at a lower source level than the large construction vessel movements.
- Support / supply vessel movements will be transient as these medium sized vessels undertake transfers between the logistics base and the Ruche EEA. Behavioural effects on fish limited to 20 m from vessels and 1.5 km for marine mammals.

Marine mammals, turtles and fish are expected to move away from noise sources and this avoidance behaviour, and other alterations to behaviour, such as increase in volume of mating calls from fish or mating songs from whales, may result in non-useful expenditures of energy, which in turn may reduce breeding, spawning or feeding success. However, although there may be changes in abundances of commercially important and/or iconic species in the immediate Project AOI as a result of altered behaviour, there is unlikely to be a population level effect within the overall ecosystem.

Overall, there may be an alteration in the behaviour of commercially important and/or iconic species, which may temporarily displace species from the immediate Project AOI, however this is unlikely to influence their ability to support other ecosystem services. The direct negative impact on the overall value of the ecosystem service is considered to be minor / moderate, due to the regional direct impact on iconic (critical habitat triggering) species.

Impact assessment of underwater noise on the supporting service, habitat and species support

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Drilling activities (rig noise) – direct impact, behavioural effects from underwater noise	Very low (1) Extent: Immediate- behavioural effects (< 1 m for fish species and within 7 m for marine mammals) Duration: Temporary – only for period of drilling activities / installation activities Scale: Behavioural effects limited to proximity of noise source and rapid return to normal following cessation of activities Frequency: Continuous but low level for the duration of activities	High (4)	Minor (4)

Aspect / Impact	Potential impact magnitude	Receptor sensitivity	Potential impact significance
Facility installation (large construction vessels) – direct impact, behavioural effects from underwater noise	Very low / Low (1/2) Extent: Local - behavioural effects (up to 100 m for fish species and 9 km for marine mammals) Duration: Temporary – only for period of installation activities Scale: Behavioural effects limited to proximity of noise source and rapid return to normal following cessation of activities Frequency: Continuous but low level for the duration of these activities	High (4)	Minor / Moderate (4/8)
Operation of FPSO and support / supply vessels – direct impact, behavioural effects from underwater noise	Very low / Low (1/2) Extent: Local - behavioural effects (up to 40 m for fish species and 2 km for marine mammals) Duration: Short-term - ongoing operation, mitigated relatively rapidly following cessation of activities Scale: Behavioural effects limited to proximity of noise source and rapid return to normal following cessation of activities Frequency: Continuous but low level for the duration of these activities	High (4)	Minor / Moderate (4/8)

Mitigation Measures

Mitigation measures relating to underwater noise mentioned in Section 6.4.1.3 and Section 6.4.2.2 will be implemented.

Residual Impacts

With the implementation of the above mitigation measures the residual impacts are as considered to be as follows:

Residual impact assessment of underwater noise on the supporting service, habitat and species support

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – behavioural effects from underwater noise	Minor / Moderate (8)	Minor (4)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Moderate (8)	Minor (4)

9.4.1.5 Impacts from accidental events

While routine planned activities are prepared, undertaken and monitored in such a way as to reduce the risk of accidental events, unfortunate events do occur. Accidental events considered here are:

- Project vessel collision with marine fauna
- introduction of AIS
- accidental release of hydrocarbons:
  - bunkering spill – small spill or leak / release during hose disconnection
  - large scale spills such as collision with FPSO resulting in loss of hydrocarbon, or well blowout (expected reservoir crude oil).

Potential Impacts

Vessel collisions with marine fauna

The location of the logistics base at Port-Gentil and the location of the Ruche EEA offshore will increase the vessel traffic traversing the shallow water column and water column over the continental slope ecosystems over the Project lifetime.

Sections 6.4.2.3 and 6.4.3.4 describe the direct impacts on critical habitat triggering marine mammal and turtle species from vessel collisions. These can be used as a proxy for the impacts on other iconic species This section describes how the direct impacts affect the ability of this supporting ecosystem service to support other ecosystem services, primarily the potential for development of ecotourism.

In the shallow water column ecosystem, West African manatees, leatherback turtles and Atlantic humpback dolphins are the iconic species at risk of collision with Project vessels, particularly in estuary mouths in the case of the manatee and the Mayumba National Park for leatherback turtles and Atlantic humpback dolphins.

Humpback whales are the main iconic species at risk of collisions with Project vessels in the water column over the continental slope ecosystem. It should be noted that the area around Port Gentil headland (on the supply vessel transfer route to the logistics base) is particularly important for humpback mothers and calves, with large numbers congregating in the area and using the sand banks in this area to protect young from predation. Peak number of mothers and calves are usually observed in October (*pers. comm* Tim Collins, 2022).

Overall, vessel collisions with marine fauna have the potential to cause a change in abundance over one or more generations of iconic species, due to avoidance behaviour or changes to migration, feeding or breeding success. However, this is unlikely to affect species at a population level, and thus will not alter the integrity of the water column ecosystems. As the ecosystems are not altered, their ability to support other ecosystem services, such as the development of ecotourism is not restricted. Collisions with marine fauna by Project vessels are possible in the transport corridors over the duration of the

Project, therefore impact on the overall value of the ecosystem service is considered to be moderate.

Introduction of Alien Invasive Species (AIS)

The introduction of AIS is considered one of the five major threats to marine ecosystems and to the conservation of biodiversity, as identified in the 1992 Convention on Biological Diversity. The main vectors for accidental introduction of AIS are via ballast water, biofouling and physical introduction. More information is included in Section 6.4.1.5.

The effects of introducing new animal and plants can be almost undetectable or, conversely, can completely dominate and displace native communities. AIS may potentially out-compete or eat native species and/or introduce pathogens into the environment leading to the spread of disease, decline in health, or even extinction of native populations. The water column over the continental shelf and the shallow water column ecosystems could both be impacted, depending on where AIS is released.

As described in Section 9.4.1.2, the installation of the HA OI will create new habitat in the water column over the continental shelf ecosystem. While this can be recognised as a benefit for biodiversity through the creation of islands, there is also the potential that the infrastructure could be a vector for AIS.

Overall, the introduction of AIS could affect the species composition in the Project AOI, altering the food web dynamics through reduction in and removal of key populations affecting the ability of the continental shelf ecosystem to support other ecosystem services. Although the introduction of AIS will alter the ecosystems, there are uncertainties about the impact on the overall value of the ecosystem service, as the altered species composition could also be beneficial to provisioning (capture fisheries) ecosystem services. Impacts on the overall value of the ecosystem service are considered to be moderate to major.

Accidental release of hydrocarbons – small spills during bunkering or transfer operations

A small spill during at sea during bunkering operations is one of the most likely accidental event scenarios, as discussed in Section 6.4.1.5. The direct impacts of hydrocarbon spills on fish, marine mammals and turtles are discussed in Sections 6.4.1.5, 6.4.2.3 and 6.4.3.4 respectively.

Impacts to marine species in the water column over the continental shelf are limited. However, although unlikely, these impacts could potentially have long-term repercussions for populations over generations if large numbers of individuals are affected. Should populations decline and/or the species assemblage of the water column over the continental shelf ecosystem is altered, its ability to support other ecosystem services may be reduced.

It is possible that small bunkering spills could happen over the duration of the Project, while large spills of marine gas oil or crude oil from hose disconnection or rupture are very unlikely. As most bunkering spills are likely to be small, the impact on populations of commercially important and/or iconic species and the ecosystems is likely to be limited. Although the ecosystem service sensitivity is high, the negative impact to the overall value of the ecosystem service is considered to be moderate.

Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout

A collision with the FPSO or a well blowout could result in a large-scale loss of crude oil to sea. Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5. Depending on the volume of oil released and the weather conditions (currents, waves, wind etc.) at the time of release, the water column over the continental shelf, shallow water column, mangroves and sandy shores ecosystems could be impacted.

The health of species comprising the ecosystems may be affected through decreased water quality, or ingestion of hydrocarbons and chemicals. However, as discussed in Sections 6.4.1.5 and 6.4.2.3, adult fish species and marine mammals in the water column over the continental shelf ecosystem have the ability to move away from an area of pollution and are therefore either unaffected by oil, or affected only briefly. This means the water column over the continental shelf ecosystem is unlikely to be impacted at a top predator level, which are generally the species that support the other ecosystem services in the area (e.g., capture fisheries, or the development of ecotourism).

The shallow water column ecosystem will experience similar impacts as the water column over the continental shelf, although should oil slicks remain on the surface, more iconic species may be impacted. Direct impacts on humpback whales and leatherback turtles are discussed in Sections 6.4.2.3 and 6.4.3.4. With large numbers of humpback whales and leatherback turtles present in the shallow water column ecosystem at certain times of the year, numerous individuals could be affected, which could have a population effect if breeding females or calves are impacted in larger numbers than would be affected through natural variation. There may also be long-term secondary health effects that can have repercussions for several population generations. This then could alter the ecosystem's ability to support the development of ecotourism.

Direct impacts on fish larvae are discussed in Section 6.4.1.5. Larvae in both water column ecosystems and the mangrove ecosystem are susceptible to impacts from oil. Lethal effects on the whole population are rare but long-term, sub-lethal effects are possible, particularly if a major spawning area is affected. The death of larvae can impact the ecosystem food web and have recruitment repercussions for some species. Contamination of larvae may also result in bioaccumulation through the food web, which can result in fish unfit for human consumption. These alterations to the ecosystems alter their ability to support other ecosystem services, as contaminated fish reduces the revenue and nutritional value of capture fishery resources.

Should weather conditions be such that oil reaches the shoreline, mangrove and sandy shore ecosystems will be impacted. Here, the habitat will also be altered as mangroves and sandy shores themselves are susceptible to oiling impacts.

Mangroves are present in Mayumba National Park, around the mouth of the Banio Lagoon (see Figure 9.2). Oil slicks may enter the mangroves when the tide is high, and deposit oil on the aerial roots and sediment surface as the tide recedes. Oil clogs the pores in the aerial roots and if many roots are oiled, the respiratory system collapses, and the trees die. The nursery areas in the mangrove and shallow water column ecosystems sustain commercially important fish populations, with many species of fish and shrimp using the mangroves as spawning and nursery areas around Mayumba, as well as shark species. The mangroves also provide valuable habitat for crabs, oysters

and other invertebrates valuable to capture fisheries or intertidal gleaning (wild foods). Should the habitat be destroyed, there would be effects on the recruitment and abundance of commercially important species, with secondary impacts on offshore ecosystem structures. Reductions in recruitment and abundance may alter the mangrove ecosystem's ability to support other ecosystem services and may also impact other ecosystems' ability to do the same.

The sandy beaches of Mayumba National Park hold one of the largest nesting populations of leatherback turtles. The direct impact of a hydrocarbon spill on turtles is discussed in Section 6.4.3.4. While nests should be above the spill strandline, subtle changes in sand temperature/colour can influence turtle behaviour and development, as sex determination in turtles is temperature dependent, so shifts in sand temperature caused by oiling could potentially change hatchlings sex ratios. This could have population effects as there may be an imbalance in the recruitment of the sexes. Also, if the oil spill reaches a sandy beach, toxic concentrations of oil may develop in the shallow water due to the long persistence time of the oil, degrading the water quality, which may have secondary effects on various species' health. Should populations decline and/or the species assemblage of the sandy beach ecosystem is altered, its ability to support the development of ecotourism in Mayumba National Park or in other places along the Gabonese coast may be compromised.

Though unlikely, the seabed ecosystem could also be altered if oil is captured in the sediments. This will affect the benthic communities established in these sediments, as well as demersal fish. Oil degradation can be slow in seabed sediments because the contaminated sediments tend to become anoxic with depth. This means there may be long-term alterations to the structuring of the seabed ecosystem through changes to benthic and demersal assemblages, in species abundance and composition. This may also alter the ecosystem's ability to support other ecosystem services.

Overall, a large-scale hydrocarbon release would result in an environmental incident with the potential for extensive ecological damage. Impacts on marine biodiversity may change biogeographic populations outside of natural variation in recruitment, abundance and breeding success, depending on climatic conditions at the time of spill and size of spill. In turn, this may alter the structure of the ecosystems, and the overall value of the ecosystem service may be compromised. A large-scale spill is very unlikely, and each spill would be a discrete event, however, the direct negative impact on the ecosystems' ability to support other ecosystems is considered to be major.

Impact assessment of accidental events on the supporting service, habitat and species support

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Vessel collision with marine fauna – direct impact, injury / mortality	Low (2) Extent: Local Duration: Temporary Scale: May be changes in abundance over a generation of species, but unlikely to affect the integrity of the ecosystem. Frequency: Accidental event Likelihood: Unlikely	High (4)	Moderate (8)
Introduction of AIS – direct impact on prey species, indirect impact on predators	Low (2) / Medium (3) Extent: Potential for regional impacts Duration: Medium-term Scale: Activity or event disturbing a sufficient portion of a population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population to former levels within several generations. Restoration may require substantial intervention. Frequency: Accidental event Likelihood: Unlikely	High (4)	Moderate (8) / Major (12)
Accidental spill, small scale bunkering spill – direct impacts of hydrocarbon contamination	Low (2) Extent: Local, slick limited to within 3 km from site Duration: Short-term, likely to be mitigated through natural processes (evaporation, dispersion, dissolution) Scale: Limited effect on the integrity of populations and/or ecosystems Frequency: Accidental event Likelihood: Possible	High (4)	Moderate (8)

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – direct impacts of hydrocarbon contamination	High (4) Extent: Regional to International / transboundary Duration: Medium to Long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources, with potential for small-scale pathological damage to iconic species and may affect biogeographic population of a species, altering ecosystem structures Frequency: Accidental event Likelihood: Very unlikely	High (4)	Major (16)

Mitigation Measures

Mitigation measures for reducing the likelihood of collisions with marine fauna are listed in Section 6.4.2.3 and 6.4.3.4.

Mitigation measures for reducing the likelihood of the introduction of invasive species are listed in Section 6.4.1.5.

Mitigation measures with respect to accidental releases of hydrocarbons (bunkering spills, collision with FPSO, well blowout) are listed in Section 6.4.1.5.

Residual Impacts

With the implementation of the above mitigation measures, and the development of a project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of introduction of AIS is substantially reduced from unlikely, to extremely unlikely. This is considered to reduce the residual impact significance to minor (4).

With the implementation of the above mitigation measures the likelihood of a spill event is also reduced from possible to unlikely for small-scale spills, e.g., bunkering, and from very unlikely to extremely unlikely for a major spill event. This is considered to reduce the residual impact significance to minor (4) and moderate (8), respectively.

The residual impacts of large-scale hydrocarbon spills remain moderate due to the high sensitivity of this ecosystem service, but are reduced to ALARP levels, by the implementation of the Project mitigation measures, distance of the Project AOI from shore and the fact that large oil spills are extremely unlikely.

Residual impact assessment of accidental events on the supporting service, habitat and species support

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Vessel collision with marine fauna	Moderate (8)	Minor (4)
Introduction of AIS	Moderate (8) / Major (12)	Minor (4)
Accidental release of hydrocarbons – bunkering spill (small scale)	Moderate (8)	Minor (4)
Accidental release of hydrocarbons –collision with FPSO / well blowout (large scale spill)	Major (16)	Moderate (8)

9.4.2 Primary Production

9.4.2.1 Sensitivity Summary

Primary production is an important ecosystem service as it supports many other ecosystem services, including the provisioning services - capture fisheries and wild food; the regulating services – air quality regulation and regional / local climate regulation; and the supporting service – habitat and species support. Unlike provisioning and regulating services, this supporting service does not directly benefit people but repercussions from impacts to it will occur in other ecosystem services (MA, 2005a).

This ecosystem service occurs across the water column ecosystems described in Table 9.3. However, primary production is likely to be higher in the shallow water column ecosystem than the water over the continental shelf ecosystem.

The Project AOI is in an area of high primary production (abundant phytoplankton) due to seasonal equatorial upwelling and inflow from the Congo River. Primary production is the growth and reproduction of phytoplankton. Phytoplankton are the foundation of the ocean food web and thus the abundant food resources present allows a complex and rich species assemblage to develop. Therefore, the ecosystems in the area are uniquely placed to support species that are important for provisioning and regulating services.

The ecosystems in the Project AOI are considered in good condition; the water column supports an abundance of species due to the high primary productivity. However, as phytoplankton productivity fluctuates by season and distance from coast. The overall sensitivity of the supporting service is considered to be medium (3).

9.4.2.2 Impacts from discharges to the marine environment

Project activities may result in discharges into the marine environment of substances that can have negative impacts on primary production. Discharges likely to occur are listed in Section 6.4.1.4. These discharges may have impacts on the water column over the continental slope ecosystem.

Potential Impact

Drilling and support / supply vessel discharges, construction vessel discharges, and operational discharges from the Hibiscus Alpha OI and BW Adolo FPSO, have the potential to disrupt primary production in the local area, through contamination, increased nutrient levels and suspended matter, release of warm water and increased turbidity, which may alter their ability to support other ecosystem services.

Drilling discharges

Treatment and discharge of cuttings and drilling fluids is described in Section 6.4.1.4. The discharge of cutting and drilling fluids during drilling of the riserless 26" hole sections of the Ruche EEA wells is likely to be restricted to the seabed, with minimal impacts on phytoplankton and thus primary production. Cuttings and associated drilling fluids from the remaining well sections will be discharged (following treatment) from the rig (15 m below sea level). The resulting plume may extend a considerable distance from the rig at surface and mid-water depths, however, chemical risk to the water column is generally temporary (number of days) with the main impact being turbidity effects from the release of insoluble components such as barite and bentonite. These turbidity effects could result in a reduction in primary productivity of the phytoplankton (by reduction in light penetration); however, these are anticipated to be so short term that they will be difficult to distinguish from background.

Overall, the ability of primary production within the water column ecosystems to support other ecosystem services, such as habitat and species support and capture fisheries, will not be affected and so the impact to the overall value and use of the ecosystem service is considered to be minor.

Operational discharges

Sanitary waste and food waste from the HA OI and FPSO, as well as the drilling rig and Project vessels, have the potential to affect concentrations of suspended solids, nutrients and chlorine, as well as changing biological oxygen demand (BOD). Increases in nutrients and BOD can increase primary production, whereas suspended solids and chlorine are anticipated to reduce it. Impacts due to operational discharges from the drilling rig, and construction and support vessels during drilling will also be temporary and more dispersed as they are not in a fixed location. It is anticipated, however, that these alterations in primary production are likely to be within natural variation and will not alter the water column over the continental shelf ecosystem, or its ability to support other ecosystem services, such as habitat and species support and capture fisheries.

Desalination unit discharges, cooling water discharges and produced water discharges can result in thermal and salinity effects on the water column and potential impacts on plankton. If extreme, temperature changes can affect the viability of phytoplankton, if moderate an increase in primary productivity can often be observed. In coastal areas, with more limited circulation, thermal discharges have been observed to affect the phytoplankton communities by altering its species composition within a restricted area close to the discharge point (Lo et al., 2016). Combined hydrodynamic modelling of produced water and cooling water from the BW Adolo FPSO and Hibiscus Alpha OI showed ambient temperature and salinity conditions being reached at approx. 300 m from the FPSO and almost ambient conditions at 500 m from the HA OI. All discharges were in line with the World Bank Group standard for cooling water, i.e., the temperature

of the discharge was within 3°C of ambient seawater temperature within 100 m of the discharge point (see Appendix 6B). These results indicate rapid dilution and dispersion in this offshore location, therefore harmful exposure of phytoplankton to thermal stress is unlikely and changes in primary production are not anticipated. Therefore, primary production's ability to support other ecosystem services will be unaltered.

Overall, operational discharges throughout the Project's lifetime are unlikely to have a discernible effect on primary production within the water column ecosystem, and so the impact on the overall value and use of the ecosystem service is considered to be minor.

Impact assessment of discharges to the marine environment on the supporting service, primary production

Aspect	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Drilling discharges – direct impacts on water quality, indirect impacts on plankton communities	Very low (1) Extent: Local, extent of cuttings plume Duration: Temporary, likely to be mitigated through natural processes immediately (within one month of impact occurring) Scale: Not anticipated to have a discernible effect outside of natural variation but may have chronic effects on populations or habitat quality that could disrupt ecosystems as a whole Frequency: Discrete drilling events during the Project drilling programme	Medium (3)	Minor (3)
Operational discharges (drilling rig, vessels, HA OI and FPSO) - direct impacts on water quality, indirect impacts on plankton communities	Very low (1) Extent: Immediate, extent of discharge plume before dispersion Duration: Temporary, likely to be mitigated through natural processes immediately (within one month of impact occurring) Scale: Not anticipated to have a discernible effect outside of natural variation Frequency: Continuous throughout Project lifetime	Medium (3)	Minor (3)

Mitigation Measures

Mitigation measures relating to discharges to the marine environment mentioned in Section 6.4.1.4 and 9.4.1.3 will be implemented.

Residual Impacts

Although the residual significance of the impact will not change due to the sensitivity of the ecosystem service, the implementation of the mitigation measures will likely further reduce the magnitude of the impacts relating to the drilling and operational discharges to the marine environment, on the supporting service, primary production.

Residual impact assessment of discharges to the marine environment on the supporting service, primary production

Aspect	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Drilling discharges	Minor (3)	Minor (3)
Operational discharges (drilling rig, vessels, HA OI and FPSO)	Minor (3)	Minor (3)

9.4.2.3 Impacts from accidental events

Accidental events considered here are:

- introduction of AIS
- accidental release of hydrocarbons – large scale spills such as collision with FPSO resulting in loss of hydrocarbons, or well blowout

Potential Impact

Introduction of AIS

The introduction of AIS is discussed in detail in Sections 6.4.1.5 and 9.4.1.5. AIS could thrive and out-compete native species of phytoplankton and could also reduce the ability of primary production to support other ecosystem services if the AIS do not follow the same seasonal patterns as native species of phytoplankton.

These impacts are difficult to predict. Overall, the impact on the value and use of the ecosystem service is considered to be moderate.

Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5.

In the water column, over the continental shelf ecosystem, oil will be dispersed relatively quickly due to currents, winds and waves. Therefore, changes to primary production are not expected to be outside natural variation, and so the ability of the ecosystem to support other ecosystem services is unlikely to be compromised.

If conditions are such that the oil slick reaches the shallower water column, impacts on primary production are likely to be more severe as primary production is higher in this ecosystem and the shallow water column may not be as dynamic in terms of currents, winds and waves, so larger amounts of phytoplankton may be affected by the drifting oil

slick. Toxins may also bioaccumulate in the ecosystem's food web if the oil slick persist. This reduces the ability of the ecosystem to support other ecosystem services.

Overall, the impacts on primary production within the water over the continental shelf are likely to be limited if the spill is contained offshore, and so the ability of that ecosystem to support other ecosystem services will not be impacted outside of natural variation. However, if conditions are such that the oil slick reaches the shallower water column, the ability of this ecosystem to support other ecosystem services may be severely reduced. Collisions with the FPSO are very unlikely, as are well blowouts, with each spill a discrete event, and so the impact on overall value and use of the ecosystem service is considered to be moderate.

Impact assessment of accidental events on the supporting service, primary production

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Introduction of AIS – direct impact on plankton communities from competition, etc	Low (2) Extent: Potential for regional impacts Duration: Medium-term, likely to be mitigated through natural processes (or mitigation measures) within a few (up to 5) years of cessation of activities Scale: Limited effect on the integrity of populations and/or ecosystems Frequency: Accidental event Likelihood: Unlikely	Medium (3)	Moderate (6)
Accidental release of hydrocarbons – collision with FPSO / well blowout (large scale spill) - direct impacts on plankton from hydrocarbon contamination	Medium (3) Extent: Regional Duration: Short to Medium-term Scale: Environmental incident typically requiring mobilisation of in-country response resources, but limited effect on the integrity of populations and/or ecosystems Frequency: Accidental event Likelihood: Very unlikely	Medium (3)	Moderate (9)

Mitigation Measures

Mitigation measures for reducing the likelihood of the introduction of AIS are listed in Section 6.4.1.5, and for reducing the likelihood and magnitude of large-scale accidental releases of hydrocarbons are listed in Section 6.4.1.5.

Residual impacts

With the implementation of the Project mitigation measures, and the development of a project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of introduction of AIS is substantially reduced from rom unlikely, to extremely unlikely, while the likelihood of a major spill event (large-scale hydrocarbon spill) is reduced from very unlikely to extremely unlikely, reducing residual impacts to minor.

Residual impact assessment of accidental events on the supporting service, primary production

Aspect	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Introduction of AIS	Moderate (6)	Minor (3)
Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout	Moderate (9)	Minor (3)

9.4.3 Capture fisheries

9.4.3.1 Sensitivity Summary

Only capture fisheries present in the offshore Ruche EEA were considered in the impact assessment of routine planned activities. These are the capture fisheries, where the wild fish or shellfish are provided by the water column over the continental shelf and seabed ecosystems. The key beneficiaries are the international / commercial operators of tuna fishing vessels. The fish / shellfish caught by these operators is unlikely to be landed in Gabon, does not pass-through local supply chains, and is also unlikely to be consumed by persons in the Project AOI. There are industrial fisheries, present slightly further inshore, and these may land catch in Gabon, but catch is unlikely to pass through local supply chains in and is also unlikely to be consumed by persons in the Project AOI. Therefore, the sensitivity of the provisioning service, capture fisheries, when considering offshore tuna fisheries, is considered to be low (2), as the resources impacted are of international importance, but for beneficiaries outside the Project AOI.

The artisanal fishers from the villages around Mayumba are mainly engaged in fishing in Banio Lagoon and the respective fishery supply chains are local to the villages. Most fishing is subsistence, and even those that fish in the sea generally remain coastal. Artisanal sea fishing is also engaged in along other parts of the Gabonese coast. As a result, these beneficiaries are not considered as part of the capture fisheries ecosystem service for activities during routine planned activities.

Artisanal fisheries are, however, considered as part of the impacts from accidental events section, as the assumption is accidental impacts could reach coastal waters, and/or impact the Banio Lagoon. In this case capture fisheries in the shallow water column and mangroves would also be affected. Therefore, the sensitivity of the provisioning service,

capture fisheries, when considering inshore artisanal fisheries, is considered to be medium (3).

9.4.3.2 *Impacts from installation of facilities and their physical presence*

Impacts comprise:

- installation and physical presence of the facilities causing
  - restricted / loss of access to fishing grounds due to safety exclusion zones
  - FAD effect
  - damage or disturbance to spawning, nursery and feeding grounds for commercially important species
- light spill from facilities (lighting and flaring) altering behavioural patterns.

Potential Impacts

As discussed in Section 9.4.1.2, installation of facilities includes the installation of the Hibiscus Alpha OI and jack-up, and the associated subsea infrastructure (flowlines and umbilicals). The physical presence of facilities for the duration of the Project will prolong impacts associated with installation. Artificial lighting is also used during the hours of darkness for navigation, safety and security. In addition, there will be light from flaring activities on the HA OI and the FPSO.

Installation and physical presence of facilities

There should be no impacts on capture fisheries in the Ruche EEA, where the HA OI, drilling rig and associated subsea infrastructure will be installed, as these are 50 km from the coastline whereas industrial fishing is only licensed out to 22 km and tuna fishing to 44 km from the coast.

However, trawlers have been observed around the Ruche EEA, and artisanal sea fishers from around Mayumba indicate that they are occasionally forced to fish beyond the identified fishing demarcation during seasons of severe drought, venturing out to 65 km from shore when resources are scarce. There may therefore be a small reduction to the area available to these fishers from the installation and physical presence of the HA OI, drilling rig and associated subsea infrastructure and associated safety exclusion zones but this is minor compared to the overall fishing space available, so the loss of access caused by the installation works and physical presence will be negligible.

As discussed in Section 9.4.1.2, the addition of the HA OI and the continued presence of the BW Adolo FPSO may have an aggregating effect on species in the Project AOI due to their associated safety exclusion zones. These structures acting as FAD may decrease the amount of fish available to industrial and tuna fishers, even at distances of over 6 km from official fishing grounds. This is because the top predators that are the target species of these fisheries will be attracted to aggregations of prey species around the infrastructure. Demersal species may also aggregate around the new hard subsea infrastructure, decreasing their availability further inshore. However, the small size of the infrastructure may reduce the influence of the FAD.

There could also be a reduced abundance due to increased predation of capture fisheries' targeted species aggregated around Project infrastructure or vessels. The main

target species of the offshore capture fisheries closest to the Project is tuna, and these are unlikely to be affected by predation as they are top predators. However, the reduction in prey species that are the target species of the industrial or artisanal fisheries further inshore may have a ripple effect through the water column ecosystems. There may be a reduction in breeding success if breeding age individuals are eaten and the subsequent alteration to the ecosystems' food web could have an indirect negative impact on industrial and/or artisanal sea fishers. However, changes induced by this increased predation are expected to be within the bounds of natural variation.

Overall, although the HA OI, BW Adolo FPSO, and associated subsea infrastructure may reduce the availability of resources to capture fisheries through a FAD effect and may also have secondary impacts on the availability of fishery resources further inshore, there is assessed to be only a small overall effect on resources available, so the impact on the overall value and use of the ecosystem service is considered to be negligible.

The impact of damage or disturbance to spawning, nursery and feeding grounds for commercially important fish and shellfish are discussed in Section 9.4.1.2. These impacts may have a secondary, indirect negative impact on the availability of resources for commercial and local fishing communities, which may then alter capture fisheries through reduced provision of revenue and nutrition. However as stated in Section 9.4.1.2, the residual impacts to the supporting service of habitat and species support are minor, and so, secondary impacts are considered to be negligible.

Over time there is also the possibility that the exclusion zones will increase the amount of fishery resources available to capture fisheries but is this not easy to forecast or assess.

Light spill

As discussed in Section 9.4.1.2 and above, the structures may have a FAD effect on fish. Artificial light amplifies this effect, and, in terms of capture fisheries, the increased aggregating behaviour of fish around the HA OI and Adolo FPSO, could mean a reduced abundance of fish available in fishing areas outside the Project safety exclusion zones. However, there is a carrying capacity in the space around the Project infrastructure and it is a relatively small area in context of the Gabonese marine environment, so the reduction in abundance of resources available to capture fisheries will be limited.

Overall, light spill related to installation and operation activities may have a direct negative impact on capture fisheries by amplifying aggregating behaviours in commercially important species. This may have a small effect on the overall value and use of the ecosystem service, but the impact is considered to be negligible.

Impact assessment of installation of facilities and their physical presence on the provisioning service, capture fisheries

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Installation and physical presence of facilities – direct impact, restricted / loss of access to	No impact / negligible		

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
fishing grounds due to safety exclusion zones			
Installation and physical presence of facilities – direct impact on fish from FAD effect, indirect impact on fisheries	Very low (1) Extent: Immediate to local Duration: Temporary, likely to be mitigated through natural processes within one month of cessation of activities Scale: Very limited / intermittent interference, may be noticed by fishers Frequency: Permanent for Project lifetime	Low (2)	Negligible (2)
Installation and physical presence of facilities – damage or disturbance to spawning, nursery and feeding grounds for commercially important species, indirect impact on fisheries	Negligible secondary indirect impact See Section 9.4.1.2 for direct impact details		
Light spill from facilities (from lighting and flaring) – direct impact, attraction of fish, indirect impact on fisheries	Very low (1) Extent: Immediate, within project footprint Duration: Temporary, but ongoing throughout operations Scale: Very limited / intermittent interference, may be noticed by fishers Frequency: Continuous but very low level	Low (2)	Negligible (2)

Mitigation Measures

As potential impacts on capture fisheries are considered negligible no additional mitigation measures are proposed, however the mitigation measures relating to navigation mentioned in Section 8.2.1 and 8.2.2 will be implemented.

Mitigation measures relating to light spill outlined in Section 6.4.1.2 will also be implemented.

Residual Impacts

The implementation of the mitigation measures is likely to further reduce the magnitude of the impacts on capture fisheries, but the residual impact remains negligible.

Residual impact assessment of installation of facilities and their physical presence on provisioning service, capture fisheries

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Installation and physical presence of facilities – restricted / loss of access to fishing grounds due to safety exclusion zones	No impact / negligible	
Installation and physical presence of facilities – FAD effect	Negligible (2)	Negligible (2)
Installation and physical presence of facilities – damage or disturbance to spawning, nursery and feeding grounds for commercially important species	Negligible secondary indirect impact See Section 9.4.1.2 for direct impact details	
Light spill from facilities (from lighting and flaring)	Negligible (2)	Negligible (2)

9.4.3.3 *Impacts from discharges to the marine environment*

Planned discharges are listed in Section 9.4.1.3.

Potential Impacts

Impacts from planned discharges on capture fisheries in the water column and seabed ecosystems may include:

- capture fishery resources being contaminated through bioaccumulation of chemicals from discharges, leading to increased human health and nutrition risks from consuming commercially important species
- thermal stress from release of warm water leading to disruption of commercially important species, e.g., fish and shellfish.

Marine discharges

Drilling discharges, produced water, cooling water and hydrotest water discharges may result in chemicals being released into the environment. The impacts relating to the loss of habitat quality as a result of discharges on commercially important species and their ecosystems are discussed in Section 9.4.1.3.

Although most discharges are treated before release to the marine environment (see mitigation measures in Section 6.4.1.4), some of the chemicals may cause sub-lethal effects in the phytoplankton, prey, prey larvae, or larvae of commercially important species. There is then the potential for chronic impacts on fish populations, as larvae develop or affected individuals reproduce. As toxins bio-accumulate in the resources of the capture fisheries, through the ecosystems' food webs, over time this could reduce the availability of the ecosystem service (capture fisheries) in the water column ecosystems (shallow water column and water column over the continental shelf).

There may also be an immediate impact on capture fisheries if resources are suspected of being contaminated. The value of capture fisheries will be reduced if resources are contaminated, as this could lead to human health and nutrition risks, but value of fishery resources will also be reduced if resources are suspected of being contaminated.

Tuna, the main fishery resource close to the immediate discharge site, is particularly vulnerable to bioaccumulation as a top predator. The contamination, or suspected contamination, of fishery resources is a direct negative impact for the provisioning service, capture fisheries, reducing the revenue and nutrition from commercially important species, and so the impact to the overall value and use of the ecosystem service is considered to be moderate.

An increase in temperature can cause impacts on fish species, such as a reduction in the efficiency of enzymes involved in digestion and other functions, which can impair growth and reproduction, or be a stressor through decreased oxygen. Produced water and cooling water will be discharged from the Ruche EEA facilities at elevated temperature and salinity. However, there is rapid dilution and dispersion in this offshore location, so capture fishery resources, such as commercially important fish and shellfish, are unlikely to be exposed to thermal stress.

Impact assessment of discharges to the marine environment on the provisioning service, capture fisheries

Aspect	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Marine discharges (drilling, operational, produced water, hydrotest water discharges) – direct impact on water quality and indirect impacts on fish and fisheries (bioaccumulation of chemicals and contamination of fishery resources)	Medium (3) Extent: Regional, dispersal of fishery resources mean impact experienced up to 50 km from site Duration: Medium-term, impact may not be immediately obvious and potential for chronic impacts on fish populations but likely to be mitigated through natural processes (or mitigation measures) within a few (up to 5) years of cessation of activities Scale: Contamination of fishery resources may cause moderate interference for fishers Frequency: Continuous throughout Project lifetime (drilling discharges temporary)	Low (2)	Moderate (6)

Mitigation Measures

Mitigation measures relating to discharges to the marine environment mentioned in Section 6.4.1.4 will be implemented.

Residual Impacts

The implementation of mitigation measures is likely to further reduce the magnitude of the impacts on the marine environment resulting in all residual impacts being considered minor.

Residual impact assessment of discharges to the marine environment on the provisioning service, capture fisheries

Aspect	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Marine discharges (drilling, operational, produced water, hydrotest water discharges) – bioaccumulation of chemicals and contamination of fishery resources	Moderate (6)	Minor (4)

9.4.3.4 Impacts from underwater noise

As discussed in Sections 6.1.4.3 underwater noise from the Project is generated from several sources.

Potential Impacts

As discussed in Sections 6.4.1.3 and 9.4.1.4 underwater noise may alter the behaviour of commercially important species predominantly through disturbance, which may have implications on capture fisheries. Direct impacts from additional anthropogenic noise in the underwater environment on critical habitat triggering species of fish, including the commercially important bonga shad, are discussed in Section 6.4.1.3, while the hearing sensitivity of tuna and other species of economic importance are stated in Section 9.4.1.4.

Vessel movements – altered behaviour of commercially important species

As discussed in Section 9.4.1.4, vessel noise is likely to be the main source of underwater noise. Section 6.4.1.3 suggests that fish may have behavioural response to all but the smallest of Project vessels, with behavioural responses up to 100 m away from the largest Project vessels.

Behavioural responses that cause a decline in spawning, or a movement out of the area, could reduce the capture fishery resources available. This will not be as relevant in the Ruche EEA itself which is not an official fishing area. However, movement of support / supply vessels and large construction vessels through the shallow water column ecosystem out to the Ruche EEA may cause such behavioural responses. Here, altered behaviour could cause impacts on capture fisheries through temporary avoidance of regular fishing grounds by species, or population level disruption for example if spawning cues are not synchronised, which could then have longer term impacts for capture fisheries.

However, it is thought that the noise from the number of vessels the Project will add to the area over the Project lifetime will be indistinguishable from the background noise (area with existing shipping and fishing traffic). This suggests that alterations to behaviour will not influence the species of economic importance beyond natural variation and so

will have limited impact on capture fisheries. Fishers are also able to follow the fish within a given area.

Overall, underwater noise related to Project vessel activities could cause a direct negative impact on the provisioning service, capture fisheries, through the potential behavioural response of economically important fish species reducing the resource available. However, behavioural responses are often temporary within the ecosystems so the impact on the overall value and use of the ecosystem service is considered to be negligible / minor.

Impact assessment of underwater noise on the provisioning service, capture fisheries

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Vessel movements – direct impact on fish from altered behaviour of commercially important species, indirect effect on fisheries	Very low / low (1 / 2) Extent: Local - behavioural effects up to 100 m from vessels Duration: For large construction vessels temporary – only for period of installation activities; for support / supply vessels short-term - ongoing operation, mitigated relatively rapidly following cessation of activities Scale: Altered resource behaviour may cause minor interference for fishers Frequency: The frequency of the impact will be continuous but low level for the duration of these activities	Low (2)	Negligible / Minor (2 / 4)

Mitigation Measures

Mitigation measures relating to underwater noise outlined in Section 6.4.1.3 will be implemented.

Residual Impacts

The implementation of mitigation measures is likely to further reduce the magnitude of the impacts relating to underwater noise to negligible.

Residual impact assessment of underwater noise on the provisioning service, capture fisheries

Aspect / impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Vessel movements – altered behaviour of commercially important species	Negligible / Minor (2 / 4)	Negligible (2)

9.4.3.5 Impacts from accidental events

Accidental events considered here are:

- Project vessel or subsea infrastructure interaction with fishing gear / artisanal vessels
- introduction of AIS
- accidental release of hydrocarbons:
    - bunkering spill – small spill or leak / release during hose disconnection
    - large scale spills such as collision with FPSO or well blowout

Potential Impacts

Project interaction with fishing gear / artisanal vessels

There will be increased vessel traffic traversing the shallow water column and water column over the continental slope ecosystems between the logistics base at Port-Gentil and the Ruche EEA over the Project lifetime. Therefore, there is the potential for Project vessels to interact with fishing gear and artisanal vessel in these transport pathways. This may be through entanglement of the vessel propellors with nets and lines, or a collision with an artisanal vessel.

Project interactions with artisanal vessels may occur in the shallow water column ecosystem, however navigation corridors are defined around Port-Gentil reducing the risk. The risk is higher away from Port-Gentil where navigation corridors are less defined. The destruction of fishing gear or collision with an artisanal vessel (small motorised wooden or plastic pirogues / canoes; see also Section 8.11) will result in a reduction in the ability of capture fisheries to provide nutrition or revenue, and so reduce the value of the ecosystem service.

Fishing operations will often follow migration routes of their target species and it is likely these will intersect the transport pathways of Project vessels, increasing the risk of interaction, potentially in the shallow water ecosystem but also in the water column over the continental ecosystem around the Project safety exclusion zones. Again, collisions with vessels, or interaction with fishing gear, will reduce the ability of capture fisheries to provide nutrition or revenue, reducing the value of the ecosystem service.

There is also the possibility of industrial trawlers and tuna vessels entering the Ruche EEA, which presents the danger of their fishing gear interacting with the Project's subsea infrastructure: wellheads, flowlines and risers of the Tortue and Hibiscus fields. This fishing gear scrapes the seabed, which could damage the subsea infrastructure, resulting in damage to the fishing gear, but also potentially damage for the Project. The damage to fishing gear results in the reduced ability of capture fisheries to provide nutrition or revenue, reducing the value of the ecosystem service.

Interactions with fishing gear or artisanal vessels are possible and such interactions will cause a direct negative impact for capture fisheries, through a reduction in capture fisheries capacity in terms of revenue and/or nutrition. The impact on the overall value and use of the ecosystem service will be minor / moderate.

Introduction of AIS

As described in Sections 6.4.1.5 and 9.4.1.5, AIS can be introduced through ballast water, biofouling or through creation of new habitats, which can create novel ecosystems within the described ecosystems.

Should the AIS out-compete or eat native target species and/or introduce pathogens into the environment leading to the spread of disease, decline in health, or even extinction of native populations, then the availability of target species will be reduced, resulting in a loss of available resources for capture fisheries, and thus a reduction in value of the ecosystem service.

However, the AIS may be of value to capture fisheries if they can replace target species as a food source.

There are therefore uncertainties about the impact on the overall value and use of the ecosystem service. Overall, the direct impact on capture fisheries, is considered to be minor / moderate.

Accidental release of hydrocarbons – small spills during bunkering or transfer operations

As discussed in Section 6.4.1.5 and 9.4.1.5, a small spill during bunkering is one of the most likely accident scenarios. However, as such spills are unlikely to impact the target species, they are unlikely to compromise the resources available to capture fisheries.

The negative impact to the overall value and use of the ecosystem service is therefore considered to be negligible / minor.

Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5, as are direct impacts on fish.

There may be direct mortality of individuals of target species as a result of a large-scale hydrocarbon spill, but this is likely to be of larvae (discussed in Section 6.4.1.5). The mortality of larvae may have an effect on the recruitment of fish species for that year, potentially altering target species abundance in the short-term, although there is redundancy built into spawning events, so the mortality could be within annual natural variation. However, most adult fish species can avoid oil spills and so population level effects can be short lived due to the death of affected adult or juvenile individuals and the persistence of healthy individuals unaffected by contamination. This means resources available to capture fisheries are unlikely to be compromised more than temporarily. However, perceptions that fish is contaminated may have an immediate impact, reducing the revenue from capture fisheries.

These impacts will be amplified in a well blowout incident. If the oil spill is prolonged the effects to target species and ecosystems described in the well blowout scenario of Section 9.4.1.5 may occur, with lethal and sub-lethal effects in larvae of target species

possible, particularly if a major spawning area is affected. The death of larvae can impact the ecosystem food web and have recruitment impacts for certain target species. Contamination of larvae consumed by target species may also result in bioaccumulation through the food web, which can result in fish unfit for human consumption. This means that there may be more delayed impacts to the availability of resources for capture fisheries. However, there may also be immediate impacts due to contaminated fish reducing revenue and potentially causing human health impacts, reducing the value of the capture fisheries.

Fishing gear may also be oiled, causing a loss of revenue, and so a loss of value to capture fisheries.

Should the oil reach the shoreline and impact mangrove ecosystems, there may be longer term affects. Impacts to the mangroves themselves (discussed in Section 9.4.7.2) will reduce the ecosystem's ability to act as nursery areas for commercially important fish species. If the nursery areas in the mangrove and shallow water column ecosystems are unable the sustain commercially important fish populations through decreased recruitment to the shallow water column and water column over the continental shelf ecosystems the resources available to capture fisheries (mainly industrial and artisanal fisheries) may be reduced, which will compromise the value of the capture fisheries, through loss of revenue and nutrition.

If the oil spill occurs in the dry season (May-September), during the influx of salt water into the Banio Lagoon, then the artisanal capture fisheries in the lagoon could be affected. Only Gabonese nationals are allowed to fish in the lagoon, and for many communities on the lagoon banks fishing is their main source of income. Therefore, impacts to target species could have a significant impact on value of lagoon capture fisheries.

Overall, for capture fisheries offshore the impacts on target species are likely to be less significant, unless the spill occurs during a spawning event, limiting the indirect negative impact on the overall value and use of the ecosystem service. However, for capture fisheries further inshore and potentially in the Banio Lagoon mouth, the impacts on nursery grounds, juvenile fish and adult fish could be more severe, potentially compromising the overall value and use of the ecosystem service; even the threat of hydrocarbon contamination could reduce the value of the ecosystem service. The direct negative impact of a large-scale hydrocarbon spill is considered to be moderate / major for the different beneficiaries of capture fisheries.

Impact assessment of accidental events on the provisioning service, capture fisheries

Aspect / impacts	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Project interaction with fishing gear / artisanal vessels – direct impact on fisheries	Low (2) Extent: Immediate Duration: Short-term Scale: Accident that causes major interference for fishers Frequency: Accidental event Likelihood: Possible	Low (2) for tuna fishers Medium (3) for artisanal fishers	Minor / Moderate (4 / 6)

Aspect / impacts	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Introduction of AIS - potential for direct impacts on fish and fish stocks and indirect impacts on fisheries	Low (2) Extent: Potential for regional impacts Duration: Medium-term Scale: Accident that causes moderate interference for fishers, but may be potential benefits Frequency: Accidental event Likelihood: Unlikely	Low (2) for tuna fishers Medium (3) for artisanal fishers	Minor / Moderate (4 / 6)
Accidental release of hydrocarbons (small spills during bunkering or transfer operation) – direct impact on fish, indirect impacts on fisheries	Very low (1) Extent: Local, slick limited to within 3 km from site Duration: Short-term, likely to be mitigated through natural processes (evaporation, dispersion, dissolution) Scale: Accident that causes minor interference for fishers Frequency: Accidental event Likelihood: Possible	Low (2) for tuna fishers Medium (3) for artisanal fishers	Negligible / Minor (2 / 3)
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – direct impacts on fish, indirect impacts on fisheries	High (4) Extent: Regional to International / transboundary Duration: Medium to Long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources, moderate to major interference with fishers Frequency: Accidental event Likelihood: Very unlikely	Low (2) for tuna fishers Medium (3) for artisanal fishers	Moderate / Major (8 / 12)

Mitigation Measures

Mitigation measures to minimise Project interactions with fishing gear or artisanal vessels in Section 8.11 will be implemented. In order to further reduce the likelihood of collisions, the following mitigation measures should also be adhered to:

- supply vessel transfers from the logistics base at Port Gentil to the Ruche EEA will be optimised (3 transfers per month during operations)
- supply vessel transfers conducted during daylight hours, where feasible
- Project vessels will follow the BWE Vessel Code of Conduct (Appendix 11A – Appendix A).

Mitigation measures for reducing the likelihood of the introduction of invasive species are listed in Section 6.4.1.5.

Mitigation measures with respect to accidental releases of hydrocarbons (bunkering spills, collision with FPSO, well blowout) are listed in Section 6.4.1.5.

Residual Impacts

With the implementation of the Project mitigation measures, and the development of a project-specific Alien Invasive Species Management Plan (Appendix 11B), the likelihood of events and therefore their residual impact is reduced to negligible / minor. However, residual impacts from a large-scale hydrocarbon spill remain moderate due to the high sensitivity of the ecosystem service but are reduced to ALARP levels by implementation of Project mitigation measures, the distance of the Project AOI from shore, and the fact that large oil spills are extremely unlikely.

Residual impact assessment of accidental events on provisioning service, capture fisheries

Aspect	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Project interaction with fishing gear / artisanal vessels	Minor / Moderate (4 / 6)	Negligible / Minor (2 / 3)
Introduction of AIS	Minor / Moderate (4 / 6)	Negligible / Minor (2 / 3)
Accidental release of hydrocarbons – small spills during bunkering or transfer operation	Negligible / Minor (2 / 3)	Negligible / Minor (2 / 3)
Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout	Moderate / Major (8 / 12)	Moderate (6 / 9)

9.4.4 Wild foods

9.4.4.1 Sensitivity Summary

The beneficiaries of wild foods as an ecosystem service includes persons in the Project AOI actively engaged in intertidal gleaning for oysters, and the local supply chains relevant to this. Intertidal gleaning is important to certain communities, such as those around Mayumba, and is often practised by women and children. Intertidal gleaning is limited to the shallowest parts of the shallow water column and seabed ecosystems, and potentially part of the mangrove system around the Banio Lagoon mouth. Therefore, routine planned activities are unlikely to impact this provisioning service. However, accidental events have the potential to impact it.

The sensitivity of the provisioning service, wild foods, is considered to be medium (3), as although few resources are utilised, the beneficiaries may be vulnerable groups.

9.4.4.2 Impacts from accidental events

Accidental events considered here are:

- introduction of AIS
- accidental release of hydrocarbons – large scale spills such as collision with FPSO or well blowout

Potential Impacts

Introduction of AIS

AIS is described in Section 9.4.1.5, the vectors that may affect wild foods, i.e., intertidal oyster gleaning, are mainly ballast water and biofouling. Project vessels are extremely unlikely to be in the vicinity of the mouth of the Banio Lagoon. However, intertidal gleaning around Port-Gentil may be impacted.

Should the introduced AIS out-compete, eat the oysters, and/or introduce pathogens into the environment leading to a decline in health or contamination of oysters, then the availability of oysters will be reduced, causing a reduction in value of the provisioning ecosystem service, through loss of revenue and nutrition.

However, if the AIS fulfils a similar niche to oysters, they may be of value to wild food collection, and may maintain the availability of resources if they have decreased native oysters, or add value if they have no discernible effect on the native target species but settle in the area.

Therefore, although introduction of AIS may alter the ecosystems, there are uncertainties about the impact on the overall value and use of the ecosystem service. Although it is possible that AIS could be introduced over the duration of the Project, it is also possible they will not affect intertidal gleaning and may add economic value to the ecosystem. The direct negative impact on the provisioning service, wild foods, is considered to be moderate.

Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5.

If oil from a spill reaches the shoreline, particularly in combination with natural influx of saltwater to the Banio Lagoon, oysters and associated intertidal gleaning could be affected from Mayumba up to Mayumba Bridge. Oil can influence all stages of the oyster lifecycle and could have sub-lethal effects, which may manifest later through reduced settlement of juveniles. This would then reduce future oyster populations (Garcia et al., 2020).

Adult oysters are less influenced by exposure to oil with limited impact on their immune system, but it does reduce feeding rates, and may cause other sub-lethal effects such as decreased or abnormal growth, increased mucous production, damage to soft tissues, and decreased respiration rates (Morris Animal Foundation, 2018; Garcia et al., 2020). Sub-lethal effects in oysters may not cause a reduction in the availability of oysters for

intertidal gleaning, but perceived contamination may immediately reduce the value of the ecosystem service.

Reduced recruitment may also cause delayed but long-term effects in oyster populations thus reducing the value of the ecosystem service.

The impacts to oysters described above would be amplified in a well blowout incident. If the oil spill is large and prolonged and occurs in the dry season (May-September), during the influx of salt water into the Banio Lagoon, then intertidal gleaning is unlikely to be able to take place, as diving or wading for the oysters will not be possible due to contaminated or oiled water. This will reduce the value of the wild food ecosystem service to zero, as even if intertidal gleaning was possible, the oysters are likely to be contaminated.

As the overall value and use of the ecosystem service may be compromised, while collisions with the FPSO and well blowouts are very unlikely, their direct negative impact on the value and use of ecosystem service is considered to be major.

Impact assessment of accidental events on the provisioning service, wild foods

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Introduction of AIS - potential for direct impacts on oysters and any other target species, indirect impacts on intertidal gleaners	Low (2) Extent: Potential for regional impacts Duration: Medium-term Scale: Accident that causes moderate interference for fishers, but may be potential benefits Frequency: Accidental event Likelihood: Unlikely	Medium (3)	Moderate (6)
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – potential for direct impacts on oysters and any other target species, indirect impacts on intertidal gleaners	High (4) Extent: Regional to International / transboundary Duration: Medium to Long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources, moderate / major interference with users Frequency: Accidental event Likelihood: Very unlikely	Medium (3)	Major (12)

Mitigation Measures

Mitigation measures for reducing the likelihood of the introduction of invasive species and accidental releases of hydrocarbons are listed in Section 6.4.1.5.

An Oil Spill Contingency Plan is in place for Ruche Field Development that is aligned with the National Oil Contingency Plan of Gabon (NOCPG) and details Tier 1, 2 and 3 responses. BWE has agreements in place with Oil Spill Response Limited (OSRL) and the Association of Petroleum Companies (UPEGA) for assistance in the event of a Tier 2/3 spill.

Dispersants, on their own, or in combination with oil can be more toxic to oysters than the oil itself (Morris Animal Foundation, 2018; Garcia et al., 2020); this should be a factor when considering dispersant use, see Section 6.4.1.5.

Residual Impacts

With the implementation of the Project mitigation measures the likelihood of introduction of AIS is substantially reduced from unlikely to very unlikely, while the likelihood of a major spill event from very unlikely to extremely unlikely, reducing residual impacts to minor and moderate, respectively.

Residual impact assessment of accidental events on the provisioning service, wild foods

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Introduction of AIS	Moderate (6)	Minor (3)
Accidental release of hydrocarbons –collision with FPSO / well blowout (large scale spill)	Major (12)	Moderate (8)

9.4.5 Air quality regulation

9.4.5.1 Sensitivity Summary

There are only small villages in the Project AOI, located over 50 km from the Project components.

Air quality in the Project AOI is considered to be good and there is capacity in the offshore atmosphere to absorb Project emissions to air, aided by natural processes in the water column (see Section 9.4.1.3) that reduces the ecosystem service's sensitivity. The sensitivity of this regulating service is considered to be low (2), due to the offshore location of the project.

9.4.5.2 Impacts from emissions to air during routine planned activities

Potential Impacts

The following are the main Project sources of emissions:

- Power generation on the drilling rig, Hibiscus Alpha OI and FPSO
- Flaring on the Hibiscus Alpha OI and FPSO

- Vessel engine exhausts
- Helicopter exhausts
- Power generation at the logistics base (minimal as the base is connected to the electricity grid with a gas oil generator only used as a back-up source).

Emissions to air

Emissions to air from these combustion sources include carbon monoxide, nitrogen oxides, sulphur dioxide, volatile organic compounds (VOCs) and particulate matter. The greenhouse gases (GHGs) carbon dioxide, methane and nitrous oxide will also be emitted (see Section 9.4.6 for a more complete discussion on the impacts of GHGs).

Natural processes will go some way to ameliorating impacts: seawater will solubilise atmospheric gases, particularly CO_2 and phytoplankton will help regulate CO_2 emissions by consuming, through photosynthesis, a large proportion of the CO_2 that could make seawater more acidic. This removal of carbon dioxide from the water column will allow CO_2 to diffuse in from the air, lowering atmospheric levels of the gas (Falkowski, 2012). The atmosphere will also be re-oxygenated through the oxygen released as a by-product of phytoplankton photosynthesis. However, as phytoplankton abundance fluctuates seasonally the ability of the water column over the continental shelf and shallow water ecosystems to aid in air quality regulation will also fluctuate.

Overall, the alterations to ecosystems resulting from emissions to air are likely to be within natural variation, with no discernible effect on air quality regulation, so the impact on the regulating service is considered to be minor.

Impact assessment of emissions to air on the regulating service, air quality regulation

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Emissions to air – direct impacts on air quality	Low (2) Extent: Local Duration: Temporary, likely to be mitigated through natural processes immediately (within one month of impact occurring) Scale: Not anticipated to have a discernible effect outside of natural variation Frequency: Continuous through the Project lifetime	Low (2)	Minor (4)

Mitigation Measures

Although impacts from air emissions on air quality regulation are minor, they can be further reduced by the following mitigation measures:

- All propulsion systems, exhausts systems, engines and other power generation equipment will be well maintained for optimal operational efficiency.
- The HA OI, FPSO and other generators will run at optimal power instead of full power for most of the Project lifetime.

- The requirements of MARPOL 73/78 Annex VI (Air Pollution) will be implemented.
- Fuel consumption of the HA OI, drilling jack-up, FPSO, and support vessels will be regularly monitored as a check to further ensure the combustion efficiency of all systems.
- Support / supply vessel transfers from the logistics base at Port Gentil to the Ruche EEA will be optimised (3 transfers per month during operations).

Residual Impacts

The implementation of the mitigation measures will likely further reduce the magnitude of the residual impacts to emissions to air from minor to negligible.

Residual impact assessment of emissions to air on the regulating service, air quality regulation

Aspect /impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Emissions to air – changes in air quality	Minor (4)	Negligible (2)

9.4.5.3 Impacts from accidental events

The accidental event considered here is a potential fire associated with a well blowout, including the burning of reservoir crude oil (and any associated gas).

Potential Impacts

Fire associated with a well blowout

A fire associated with a well blowout may include the burning of crude oil or associated gas which will release particulate matter, GHGs, volatile organic compounds, and mixtures of various polycyclic aromatic hydrocarbons into the atmosphere. The VOCs will include benzene, while the polycyclic aromatic hydrocarbons will include polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).

These pollutants may dissolve into the seawater or be dispersed into the atmosphere. Should a fire occur, then the volumes released may be large enough to reach the coast at levels which may impact human health at a low level, particularly the elderly and those at risk (Sonibare et al., 2010). However, this will only occur at very high volumes of pollutants under certain climatic conditions, such as strong westerly winds. An impact to air quality regulation in the atmosphere will only occur if volumes are large enough that the ambient air quality cannot buffer it as described in the section above.

These pollutants may also have impacts on water quality once dissolved into seawater, affecting phytoplankton communities and abundance. High concentrations of toxins caused by dissolved hydrocarbons may result in a decrease of CO_2 and nutrient absorption in phytoplankton. This change in the water column ecosystems through reduction of phytoplankton abundance can alter their ability to regulate air quality.

A fire could therefore lead to consequences to air quality regulation that could impact the overall value and use of the ecosystem service. While a well blowout with an associated fire is very unlikely, the direct negative impact on this regulating service is considered to be moderate.

Impact assessment of accidental events on the regulating service, air quality regulation

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Fire associated with well blowout – direct impacts to air quality	Medium (3) Extent: Potential for regional impacts Duration: Short-term Scale: Accident that causes moderate interference for other users and limited effects on the integrity of ecosystems Frequency: Accidental event Likelihood: Very unlikely	Low (2)	Moderate (6)

Mitigation Measures

Mitigation measures with respect to accidental releases of hydrocarbons (well blowout) are listed in Section 6.4.1.5. The emergency relief systems included in the mitigation measures will include firefighting equipment.

Residual Impacts

With the implementation of the Project mitigation measures the likelihood of a fire associated with a well blowout is reduced from very unlikely to extremely unlikely and the residual impact to minor.

Residual impact assessment of accidental events on the regulating service, air quality regulation

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Fire associated with well blowout	Moderate (6)	Minor (4)

9.4.6 Regional / local climate regulation

9.4.6.1 Sensitivity Summary

Regional / local climate regulation takes place in all the ecosystems in the Project AOI, except the sandy shores, in relation to routine planned activities, and in all ecosystems when considering accidental events. Beneficiaries include all persons along the shoreline and in the region, as well as the workers on the Ruche EEA facilities, and workers on the other oil and gas platforms offshore of Gabon. Carbon sequestration services that contribute to climate regulation are likely only to be available at a high level during the upwelling seasons reducing the importance of this ecosystem service through certain parts of the year (winter months). Air quality regulation is also part of regional / local climate regulation. The sensitivity of this regulating service is considered to be medium (3), as although the Nyanga region and shoreline is relatively sparsely populated limiting

the beneficiaries impacted, the Ogooué-Maritime region (Port-Gentil) where the logistics base is located is more densely populated.

9.4.6.2 *Impacts from discharges to the marine environment*

Project activities may result in discharges into the marine environment of substances that can have negative impacts on regional / local climate regulation. Discharges likely to occur are listed in Section 9.4.1.3. These discharges may have impacts on the water column over the continental slope and shallow water column ecosystems (water column ecosystems).

Potential Impacts

Impacts on phytoplankton in the photic zone of the water column may arise due to contamination, increased nutrient levels and suspended matter, release of warm water and increased turbidity, which then has the potential to influence climate regulation.

Discharges to the marine environment

Climate regulation in the Project AOI is influenced by the water column ecosystems' ability to sequester GHGs.

Carbon sequestration is supported by primary production in the water column ecosystems, and so direct negative impacts to phytoplankton from marine discharges as described in Section 9.4.2.2 will have a secondary negative impact on climate regulation, particularly in the local area. Where phytoplankton functionality is reduced, there will be a reduction in the amount of carbon removed from the atmosphere through phytoplankton photosynthesis in the photic zone of the water column. However, as discussed in Section 9.4.2.2, the impacts of drilling and operational discharges on the phytoplankton in the Project AOI are expected to be minor, so phytoplankton functionality is unlikely to be reduced.

Overall, the ability of the water column ecosystems to aid in climate regulation is unlikely to be affected by the impact of marine discharges on phytoplankton. Alterations to ecosystems from emissions are likely to be within natural variation with no discernible effect on climate regulation, and so the impact on the regulating service is considered to be minor.

Impact assessment of discharges to the marine environment on the regulating service, regional / local climate regulation

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Discharges to the marine environment – direct impact water quality, indirect impacts on plankton and regional / local climate regulation	Very low (1) Extent: Local with potential for regional impacts Duration: Temporary, likely to be mitigated through natural processes immediately (within one month of impact occurring) Scale: Not anticipated to have a discernible	Medium (3)	Minor (3)

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
	effect outside of natural variation Frequency: Continuous through the Project lifetime		

Mitigation Measures

Mitigation measures relevant to climate regulation through carbon sequestration in the marine environment are listed in Section 6.4.1.4.

Residual Impacts

The residual impact significance scores are the same as the pre-mitigation impact scores. Although the impact magnitude is anticipated to be very low (particularly taking into consideration the Project mitigation measure) residual impacts remain minor due to the receptor sensitivity.

Residual impact assessment of emissions to air on the regulating service, regional / local climate regulation

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Discharges to the marine environment – changes in water quality	Minor (3)	Minor (3)

9.4.6.3 Impacts from emissions to air during routine planned activities

Project activities may result in emissions to air that can have negative impacts on regional / local climate regulation. Emissions sources during routine planned activities are listed in Section 9.4.5.2. These emissions may have impacts on the water column ecosystems, which have the potential to influence climate regulation.

Potential Impacts

Emissions to air

The water column ecosystems play a major role in climate regulation as the ocean acts as both a physical and biological carbon pump. The biological pump is also a source of oxygen as a by-product of phytoplankton photosynthesis.

As discussed in Section 9.4.5.2, the ocean will help regulate local air quality through the dissolution of the GHGs into the surface seawater and regulating the composition of CO_2 in the atmosphere. However, the solubilisation of GHGs causes ocean acidification through the enrichment of the surface seawater with CO_2, which decreases the pH of the ocean ($7.8 \leq pH \leq 8.2$), making it more acidic. This will have longer term consequences for the ability of seawater to solubilise GHG, but also on the carbon sequestration of phytoplankton as discussed above. This may also impact on the mangrove ecosystem in proximity to the onshore logistics base in Port-Gentil, through alteration of the physical properties surrounding the mangrove roots. Mangroves store more carbon that

continental forests, through storage of organic matter into the sediments, and are therefore vital to climate regulation both for the local area and regionally.

Currently the offshore environment and ecosystems are in good condition and help buffer the coastal areas through climate regulation, but increasing industrialisation, both onshore and offshore, may impinge on the ability of the water column ecosystems in the offshore Project AOI and the mangrove ecosystems near the logistics base to aid climate regulation.

Table 2.5 presents the Project greenhouse gas (GHG) emission estimates. Significant GHG emissions are generated from flare combustion sources, and combustion of diesel and fuel gas on the FPSO and Hibiscus Alpha OI.

The alterations to ecosystems resulting from these emissions may be within natural variation with no discernible effect on climate regulation, but over a longer period of time ocean acidification may affect the overall value and use of the ecosystem service. The impact on the regulating service is therefore considered to be moderate.

A more detailed discussion of intra project GHG cumulative impacts is provided in Section 10.5.6.

Impact assessment of emissions to air on the regulating service, regional / local climate regulation

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Emissions to air – direct impacts on air quality and water quality and its capacity to solubilise GHGs, indirect impacts on regional / local climate regulation	Medium (3) Extent: Regional Duration: Short-term, likely to be mitigated through natural processes within one year of impact occurring Scale: Immediate impacts are not anticipated to have a discernible effect outside of natural variation, but secondary impacts may have a discernible affect Frequency: Continuous through the Project lifetime	Medium (3)	Moderate (9)

Mitigation Measures

Mitigation measures include the following:

- BWE will design and operate its combustion equipment for optimum efficiency and minimise flaring through good oilfield practice
- BWE will support any regional studies on GHG impacts coordinated by the Gabonese authorities.

Residual Impacts

The implementation of the mitigation measures will likely further reduce the magnitude of the impacts to the regulating ecosystem service, but residual impact remains moderate due to the medium sensitivity of the ecosystem service. The residual impact is considered to be ALARP due to the above migration measures and the plasticity and vastness of the offshore environment.

Residual impact assessment of emissions to air on the regulating service, regional / local climate regulation

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Emissions to air	Moderate (9)	Moderate (6)

9.4.6.4 Impacts from accidental events

The accidental event considered here is a potential fire associated with an oil spill as stated in Section 9.4.5.3.

Potential Impact

Fire associated with a well blowout

As described in the air quality regulation section above, a fire may release a large volume of pollutants that can impact air and water quality, which can then limit the ability of the ecosystems to function as regional / local climate regulation.

As described in Section 9.4.5.3 the pollutants are dissolved into seawater and dispersed in the atmosphere, and, depending on climatic conditions, may reach the coast. However, it is very unlikely that a fire would occur in proximity to coastal communities, or that an emission plume would reach these communities. Additionally, the mangrove ecosystems along the coast will also buffer the impacts from air emissions, through the mangroves ability to fix carbon during photosynthesis.

The changes to water quality in the Project AOI, through high concentrations of dissolved hydrocarbons and associated toxins, may also impact the functionality, abundance and composition of the phytoplankton community. The impacts from hydrocarbons on phytoplankton from the spilt oil in described in Section 9.4.2.3 will have a secondary impact on climate regulation, through potentially altering the phytoplankton functionality within the water column ecosystems. These cumulative impacts may alter the water column ecosystems to influence carbon sequestration and therefore, climate regulation.

Burning crude oil may also leave behind a toffee-like residue once the fire has burnt out, which could be transported inshore where it could smother mangrove roots and alter the mangrove ecosystem's ability to aid in climate regulation.

Overall, although impacts to air and water quality may have effects on local climate regulation, there is unlikely to be a long-term impact on regional climate regulation because regional air quality is likely to be good enough to buffer the volumes of emissions released, while phytoplankton reproduction will naturally include a buffer against seasonally fatalities, which means that the impacts from an accidental event should be

within the bounds of natural variation. The direct negative impact on this regulating service is considered to be moderate.

Impact assessment of accidental events on the regulating service, regional / local climate regulation

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Fire associated with an oil spill – direct impacts on air quality, water quality, mangroves, indirect impacts on regional / local climate regulation	Medium (3) Extent: Regional Duration: Short-term Scale: Accident that causes moderate interference for other users and limited effects on the integrity of ecosystems Frequency: Accidental event Likelihood: Very unlikely	Medium (3)	Moderate (9)

Mitigation Measures

Mitigation measures with respect to accidental releases of hydrocarbons (well blowout) are listed in Section 6.4.1.5. The emergency relief systems included in the mitigation measures will include firefighting equipment.

Residual Impacts

With the implementation of the Project mitigation measures the likelihood of a fire associated with a well blowout is reduced from very unlikely to extremely unlikely.

Residual impacts remain moderate due to the medium sensitivity of the ecosystem service but are reduced to ALARP by the distance of the Ruche EEA from shore and the fact that fires are extremely unlikely.

Residual impact assessment of accidental events on the regulating service, regional / local climate regulation

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Fire associated with well blowout	Moderate (9)	Moderate (6)

9.4.7 Water purification and waste treatment

9.4.7.1 Sensitivity Summary

Coastal mangroves function as a regulating service (water purification and waste treatment), as mangroves help filter out and decompose organic wastes and absorb wastewater discharges, as well as act as sink for pollutants, such as heavy metals and chemicals, and sediment (Barbier, 2017). This in turn helps purify and treat the water, which local communities use as drinking water.

Figure 9.2 shows the land use along the coast of Gabon. There is a cluster of mangroves in Nyanga region (7,233 ha in 2016; Keva Initiative); the majority are located around the mouth of the Banio Lagoon, with 6% located in the Mayumba National Park. Larger mangrove forests are present around the Ogooué-Maritime region, including Port-Gentil, and the Gabon Estuary region, including Libreville.

Routine planned activities are unlikely to impact the mangrove ecosystem. However, accidental events have the potential to reach the shoreline and disrupt water purification and waste treatment facilitated by the mangrove ecosystem. The sensitivity of this regulating service is considered to be medium (3), as only a fraction of the shoreline provides the ecosystem service, but there are multiple local beneficiaries.

9.4.7.2 Impacts from accidental events

Accidental events considered here are:

- accidental release of hydrocarbons – large scale spills such as collision with FPSO or well blowout

Potential impacts

Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5.

A well blowout may result in heavy oiling along most of Gabon's coastline, in both the wet and dry seasons. An oil slick may coat leaves and block the oxygen supply to the aerial roots of the mangroves. Hydrocarbon contamination may slightly reduce the mangrove ecosystem's capacity to absorb wastewater discharges or act as a sink for pollutants and organic wastes. There could be a reduction in the mangroves' function around Mayumba, and so the ability of the ecosystem to function as water purification and waste treatment would be compromised.

While lightly oiled trees may recover, a larger oil slick, as may be expected from a well blowout, would likely cause many leaves and roots to be covered, and so the trees may suffer mass defoliation and ultimately die within several months (Connolly et al., 2020), particularly the mangroves located in the Nyanga region. This die back would reduce the mangrove ecosystem's ability to filter organic wastes or absorb pollutants around Mayumba and in the Ogooué-Maritime and the Gabon Estuary regions should the weather conditions push the slick that far. This reduction in the abundance and distribution of mangroves may alter the ability of the ecosystem to function as water purification and waste treatment, as mangrove trees will take a relatively long time to grow back. This loss of function could also have secondary impacts, including salt intrusion into aquifers and a decrease in groundwater quality, as well as a loss of the ecological characteristics of the ecosystem.

While the impact of small spills is likely to limited, there is the potential for a large decrease in mangrove abundance and distribution, from large scale spills. In this instance, the function of the ecosystems will be altered, which will compromise the overall value and use of the ecosystem service. Although collisions with the FPSO are very

unlikely, as are well blowouts, the direct negative impact on the regulating service is considered to be moderate.

Impact assessment of accidental events on the regulating service, water purification and waste treatment

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – direct impact on mangroves, indirect impact on water purification and waste treatment	Medium (3) Extent: Regional Duration: Short-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources, moderate / major interference with other users Frequency: Accidental event Likelihood: Very unlikely	Medium (3)	Moderate (9)

Mitigation Measures

Mitigation measures with respect to accidental releases of hydrocarbons (collision with FPSO, well blowout) are listed in Section 6.4.1.5.

Residual impacts

With the implementation of the Project mitigation measures the likelihood of a major spill event is reduced from very unlikely to extremely unlikely and the residual impact to minor.

Residual impact assessment of accidental events on the regulating service, water purification and waste treatment

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout	Moderate (9)	Minor (3)

9.4.8 Natural hazard regulation

9.4.8.1 Sensitivity Summary

The mangrove and sandy beach ecosystems function as natural hazard regulators. Mangroves can reduce the damage caused by hurricanes or large waves, with mangroves able to buffer winds and attenuate waves (Barbier, 2017). Sandy beaches in the Nyanga Province are constantly being added to through ocean transport of sedimentation, forming parallel strips of sand in front of the Banio Lagoon. Although these

beaches are constantly changing, they function as a buffer against large waves for the area. Beneficiaries of natural hazard regulation are the coastal communities, particularly those around Mayumba.

As mentioned in Section 9.4.7.1, there are clusters of mangroves of varying coverage at the estuaries of the major river systems along the coast of Gabon. These are illustrated in Figure 9.2, which shows land cover along the Gabonese coast, the sand coverage is also shown. There are thin strips of sandy beach present in sections along the whole coastline of Gabon, including from Mayumba down to the border with the Republic of Congo. It is the habitats themselves, the mangroves and the sand, that provide the ecosystem service of natural hazard regulation.

Routine planned activities are unlikely to impact the mangrove and sandy beach ecosystems. Accidental events do have the potential to reach the shoreline and disrupt this regulating service. The sensitivity of the regulating service, natural hazard regulation, is considered to be low (2), as only a fraction of the shoreline provides the ecosystem service, and the southern coastline is sparsely populated.

9.4.8.2 Impacts from accidental events

Accidental events considered here are:

- accidental release of hydrocarbons – large scale spills such as collision with FPSO or well blowout

Potential impacts

Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout

Project-specific hydrocarbon spill / release scenarios and the results of spill dispersion modelling are presented in Section 6.4.1.5.

The geographical consequences of a large-scale accidental release of hydrocarbons (collision with FPSO / well blowout) are discussed in Section 9.4.7.2. A well blowout may result in heavy oiling along most of Gabon's coastline, in both the wet and dry seasons and the shoreline ecosystems (mangroves and sandy beach).

As discussed in Section 9.4.7.2, a small spill may only lead to defoliation of mangroves, without tree mortality or on-going impacts on plant productivity. However, the die back caused by a larger oil spill, would remove the natural flood protection and reduce the mangroves' ability to attenuate waves and buffer winds around Mayumba. Die back would also be expected in the mangroves in the Ogooué-Maritime region and the Estuary region.

Sandy shores are mobile, and because of the scouring effect of wave action, oil deposited on beaches can be buried or washed back into subtidal areas. Scouring may also enable natural and rapid self-cleaning to take place. Although the sand may then be contaminated, the beach remains in place and the deposition of sand will not be affected by the deposition of oil. Therefore, the sandy ecosystem along Gabonese and its neighbouring countries' coastline could continue to function as natural hazard regulators.

There may be a large decrease in mangrove abundance and distribution, due to oiling impacts. Therefore, the function of the ecosystems will be altered, which will compromise

the overall value and use of the ecosystem service. Although large scale spills (collision with FPSO / well blowout) are very unlikely negative impact on the regulating service is considered to be moderate.

Impact assessment of accidental events on the regulating service, natural hazard regulation

Aspect / impact	Potential impact magnitude	Ecosystem service sensitivity	Potential impact significance
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – direct impact on mangroves and sandy shores, indirect impact on natural hazard regulation	Medium (3) Extent: Regional to International / transboundary Duration: Short to Long-term Scale: Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in-country or international response resources, moderate / major interference with other users Frequency: Accidental event Likelihood: Very unlikely	Low (2)	Moderate (6)

Mitigation Measures

Mitigation measures with respect to accidental releases of hydrocarbons (collision with FPSO, well blowout) are listed in Section 6.4.1.5.

Residual impacts

With the implementation of the Project mitigation measures the likelihood of a major spill event is reduced from very unlikely to extremely unlikely and the residual impact to minor.

Residual impact assessment of accidental events on the regulating service, natural hazard regulation

Aspect / impact	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Accidental release of hydrocarbons – large-scale spill caused by collision with FPSO or well blowout	Moderate (6)	Minor (4)

9.5 Conclusion

The ecosystem services described here are valued benefits that beneficiaries derive from ecosystems in the marine environment. This ecosystem service assessment identified

eight priority ecosystem services across five marine ecosystems. A list of these priority ecosystem services, and their associated ecosystems, is presented in Table 9.3.

The ecosystem service impact assessment considered the impacts arising from Project-related activities on these priority ecosystem services. Measures will be implemented by the Project to avoid, reduce or mitigate impacts to the extent practicable. Diligent application of these measures is expected to decrease the magnitude and/or likelihood of residual impacts. The most significant potential Project-related risks to priority ecosystem services is a large-scale accidental release of hydrocarbons (e.g., from a well blowout, or collision with the FPSO). However, it is important to acknowledge that the likelihood of this type of accidental event scenario is extremely unlikely with the mitigation measures in place. The impacts of air emissions and fire associated with oil spill also remain a significant impact, but the plasticity of the offshore environment combined with the mitigation measures in place ensure these impacts are ALARP.

The assessment has also confirmed that, with the diligent application of key avoidance, mitigation measures and spill contingency plans, Project-related direct and indirect impacts will not threaten the value and use of ecosystem services. As discussed in Section 6.5, a Biodiversity Action and Management Plan (BAMP) will be developed in line with IFC Guidance Note 6. The BAMP will include measures that ensure Project-related activities result in no net loss of biodiversity, which will benefit ecosystem services in the Project area.

Table 9.5: Summary of impact assessment results

Aspect / impacts	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Habitat and species support		
Installation of facilities and their physical presence		
Installation of facilities – disturbance of spawning or feeding grounds and/or behavioural patterns	Minor (4)	Minor (4)
Physical presence of facilities – disturbance of spawning feeding grounds and/or behavioural patterns	Minor (4)	Minor (4)
Physical presence of facilities – creation of new habitat	Positive (0)	Positive (0)
Light spill from facilities – attraction of marine fauna	Moderate (8)	Minor (4)
Discharges to the marine environment		
Drilling discharges - impacts on species or community composition from turbidity, smothering	Moderate (8)	Minor (4)
Hydrotest water discharge - impacts on water quality and species / community composition	Moderate (8)	Minor (4)

Aspect / impacts	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Produced water discharge - impacts on water quality and species / community composition	Moderate (8)	Minor (4)
Other operational discharges (drilling rig, vessels, HA OI and FPSO) - impacts on water quality and species / community composition	Minor (4)	Minor (4)
Underwater noise		
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – behavioural effects from underwater noise	Minor / Moderate (8)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Moderate (8)	Minor (4)
Accidental events		
Vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – impacts on prey species and predators	Moderate (8) / Major (12)	Minor (4)
Accidental release of hydrocarbons, small spills during bunkering or transfer operation – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)
Accidental release of hydrocarbons, large-scale spill caused by collision with FPSO or well blowout– impacts of hydrocarbon contamination	Major (16)	Moderate (8)
Primary production		
Discharges to marine environment		
Drilling discharges (cuttings and associated fluids discharge) – turbidity impacts on plankton	Minor (3)	Minor (3)
Operational discharges (drilling rig, vessels, HA OI and Adolo FPSO) – impacts on water quality and plankton	Minor (3)	Minor (3)
Accidental events		
Introduction of AIS – impact on plankton communities from competition, etc	Moderate (6)	Minor (3)
Accidental release of hydrocarbons, collision with	Moderate (9)	Minor (3)

Aspect / impacts	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
FPSO / well blowout (large scale spill) - impacts on plankton from hydrocarbon contamination		
Capture fisheries		
Installation of facilities and their physical presence		
Installation and physical presence of facilities – restricted / loss of access to fishing grounds due to safety exclusion zones	No impact / negligible	
Installation and physical presence of facilities – FAD effect, indirect impact on fisheries	Negligible (2)	Negligible (2)
Installation and physical presence of facilities – damage or disturbance to spawning, nursery and feeding grounds for commercially important species	Negligible secondary indirect impact	
Light spill from facilities – attraction of fish, indirect impact on fisheries	Negligible (2)	Negligible (2)
Discharges to the marine environment		
Marine discharges (drilling, operational, produced water, hydrotest water discharges) – bioaccumulation of chemicals and contamination of fishery resources	Moderate (6)	Minor (4)
Underwater noise		
Vessel movements – altered behaviour of commercially important species	Negligible / Minor (2 / 4)	Negligible (2)
Accidental events		
Project interaction with fishing gear / artisanal vessels – impacts on fisheries	Minor / Moderate (4 / 6)	Negligible / Minor (2 / 3)
Introduction of AIS – potential impacts on fisheries	Minor / Moderate (4 / 6)	Negligible / Minor (2 / 3)
Accidental release of hydrocarbons, small spills during bunkering or transfer operation – impacts of hydrocarbon contamination on fish and fisheries	Negligible / Minor (2 / 3)	Negligible / Minor (2 / 3)
Accidental release of hydrocarbons, large-scale spill caused by collision with FPSO or well blowout – impacts of	Moderate / Major (8 / 12)	Moderate (6 / 9)

Aspect / impacts	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
hydrocarbon contamination on fish and fisheries		
Wild foods		
Accidental events		
Introduction of AIS - impacts on target species and intertidal gleaners	Moderate (6)	Minor (3)
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – hydrocarbon impacts on target species and intertidal gleaners	Major (12)	Moderate (8)
Air quality regulation		
Emissions to air		
Emissions to air – changes in air quality	Minor (4)	Negligible (2)
Accidental events		
Fire associated with well blowout – changes to air quality	Moderate (6)	Minor (4)
Regional / local climate regulation		
Discharges to the marine environment		
Discharges to the marine environment – impacts on plankton and regional / local climate regulation	Minor (3)	Minor (3)
Emissions to air		
Emissions to air –impacts on air quality and water quality and its capacity to solubilise GHGs, impacts on regional / local climate regulation	Moderate (9)	Moderate (6)
Accidental events		
Fire associated with a well blowout - impacts on air quality, water quality, indirect impacts on regional / local climate regulation	Moderate (9)	Moderate (6)
Water purification and waste treatment		
Accidental events		
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – impact on mangroves and water purification and waste treatment	Moderate (9)	Minor (3)

Aspect / impacts	Impact significance (pre-mitigation)	Residual impact significance (post-mitigation)
Natural hazard regulation		
Accidental events		
Accidental release of hydrocarbons (large-scale spill caused by collision with FPSO or well blowout) – impact on mangroves and sandy shores, indirect impact on natural hazard regulation	Moderate (6)	Minor (4)

REFERENCES

Aldous, A., Schill, S., Raber, G., Paiz, M. C., Mambela, E., & Stévart, T. (2021). Mapping complex coastal wetland mosaics in Gabon for informed ecosystem management: use of object-based classification. *Remote Sensing in Ecology and Conservation*, 7(1), 64-79. Available at: https://www.arcgis.com/home/webmap/viewer.html?webmap=d5affe52c8b7450ca9a342739ce225cc&extent=8.1074,-2.137,11.3456,-0.3796. Accessed 07 July 2021.

Barbier, E. B. (2017). Marine ecosystem services. *Current Biology*, 27(11), R507-R510.

BWE (BW Energy Gabon). *Ruche EEA Ruche Platform Field Development Plan*. BWE Gabon : Libreville.

Cofrepeche. (2010). Gabon: Revue socio-économique et environnementale du secteur de la pêche industriel au Gabon. Rapport proviso ire. COFREPECHE: Paris.

Connolly, R. M., Connolly, F. N., & Hayes, M. A. (2020). Oil spill from the Era: Mangroves taking eons to recover. *Marine Pollution Bulletin*, 153, 110965.

Enviropass. (2017). *Etude d'Impact Environmentale et Social en rapport avec le projet de développement Phase I du champ Tortue dans l'AEE Ruche du CEPP Dussafu Marin no. G4-209*. EnviroPass: Libreville.

EnviroPass. (pers. comm.). Supplementary Information Regarding Ruche EEA projects. Email communication: 21 February 2020.

ERM (Environmental Resource Management). (2020). *BW Energy Gabon: Environmental and Social Due Diligence Draft Report*. ERM: London.

Falkowski, P. (2012). Ocean science: the power of plankton. *Nature*, 483(7387), S17-S20.

FFI (Fauna & Flora International) (2017). *Biodiversity and Ecosystem Services: Good Practice Guidance for Oil and Gas Operations in Marine Environments*. FFI: Cambridge U.K. Available at www.fauna-flora.org.

Friedlander, A. M., Ballesteros, E., Fay, M., & Sala, E. (2014). 'Marine communities on oil platforms in Gabon, West Africa: high biodiversity oases in a low biodiversity environment'. *PLoS One*, 9(8), e103709.

Garcia, S. M., Du Clos, K. T., Hawkins, O. H., & Gemmell, B. J. (2020). Sublethal Effects of Crude Oil and Chemical Dispersants on Multiple Life History Stages of the Eastern Oyster, *Crassostrea virginica. Journal of Marine Science and Engineering*, 8(10), 808.

ICCAT-SCRS (ICCAT Standing Committee on Research and Statistics) (2019). Stock status report 2019. Yellowfin tuna - Atlantic. FIRMS Reports. In: Fisheries and Resources Monitoring System (FIRMS) (online). Available at http://firms.fao.org/firms/resource/20/en. Accessed 7 June 2021.

IFC (International Finance Corporation). (2012), *International Finance Corporation's Guidance Notes: Performance Standards on Environmental and Social Sustainability*. World Bank: Washington DC.

IPIECA (International Petroleum Industry Environmental Conservation Association)/IOGP (International Association of Oil and Gas Producers). (2011). *Ecosystem Services Guidance – Biodiversity and Ecosystem Services Guide and Checklists*. IOGP Report 461.

IPIECA (International Petroleum Industry Environmental Conservation Association)/IOGP (International Association of Oil and Gas Producers). (2016). *Biodiversity and Ecosystem Services Fundamentals. Guidance Document for the Oil and Gas Industry*. IOGP Report 554.

IWC (International Whaling Commission). (2021). Gabon: Extent of whale and dolphin watching. (online) Available at: https://wwhandbook.iwc.int/en/country-profiles/gabon. Accessed 08 July 2021.

Lo, W. T., Hsu, P. K., Fang, T. H., Hu, J. H., & Hsieh, H. Y. (2016). Phytoplankton Communities Impacted by Thermal Effluents off Two Coastal Nuclear Power Plants in Subtropical Areas of Northern Taiwan. *Terrestrial, Atmospheric & Oceanic Sciences*, 27(1).

Lyon, D. Y., Smit, M., Lee, B, & Conley, B. (2019). Modeled Environmental Risk of Offshore Drill Cuttings Discharges with Different Drilling Base Fluids. Paper presented at the Offshore Technology Conference Brasil, Rio de Janeiro, Brazil, October 2019. doi: https://doi.org/10.4043/29835-MS

MA (Millennium Ecosystem Assessment). (2005), *Ecosystems and Human Well-being: Biodiversity Synthesis.* (online) Available at: http://www.maweb.org/documents/document.354.aspx.pdf. Accessed 2 March 2020.

MA (Millennium Ecosystem Assessment). (2005a). Ecosystems and Human Well-being: A Framework Approach. *2. Ecosystems and Their Services*. Island Press. (online). Available at: https://www.millenniumassessment.org/documents/document.300.aspx.pdf. Accessed 4 June 2021.

Marchesana, M., Spotob, M., Verginellab, L. & Ferrero, E. A. (2005). Behavioural effects of artificial light on fish species of commercial interest. *Fisheries Research*, 73: 171–185.

Morris Animal Foundation. (2018, September 13). Study shows toxic effects of oil dispersant on oysters following deepwater horizon spill. *ScienceDaily*. Retrieved June 23, 2021 from www.sciencedaily.com/releases/2018/09/180913160039.htm

Protected Planet (2020). Reserve Aquatique du Grand Sud du Gabon. (online). Available at: https://www.protectedplanet.net/reserve-aquatique-du-grand-sud-du-gabon-aquatic-reserve. Accessed 25 February 2020.

RSK (2021). Ecosystem Services Screening Report – Dussafu Development, Gabon. Report prepared for BW Energy Gabon. (P80834/04/02_Rev01)

Sonibare, J. A., Adebiyi, F. M., Obanijesu, E. O., & Okelana, O. A. (2010). Air quality index pattern around petroleum production facilities. *Management of Environmental Quality: An International Journal*.

Terrocea (2019). Environmental Observation and Inventory of Marine Species On The Tortue Field In The Ruche EEA Preliminary Report 2 Mission on the RIG-Norve_Borr Drilling /BW ENERGY GABON SA (From November 25 to December 04, 2019)

UNEP-CBD (United Nations Environmental Program Convention on Biological Diversity. (2015a). EBSA Zone Marine et Côtière de Mayumba (online). Available at : https://chm.cbd.int/database/record?documentID=204064. Accessed 27 February 2020.

Van Elden, S., Meeuwig, J. J., Hobbs, R. J., & Hemmi, J. M. (2019). Offshore oil and gas platforms as novel ecosystems: a global perspective. *Frontiers in Marine Science*, 6, 548.

APPENDIX 9A - PRIORITY ECOSYSTEM SERVICE SUMMARIES

This appendix presents a summary table with details of the Type 1 ecosystem services identified as priority ecosystem services during the reviewed screening assessment. Additional details from the stakeholder engagement have been added where available to the original tables present in Sections 5 and 6 of the Ecosystem Services Screening Report (RSK, 2021).

Whether an ecosystem service is relevant to routine planned activities and/or unplanned / accidental events is highlighted within the tables.

Table 1: Summary table: habitat and species support

Ecosystem service type	Supporting
Relevant to routine planned activities / accidental events?	Routine planned activities and accidental events

Key baseline information	• Nyanga Province has high marine biodiversity; shrimp, squid and crustaceans all contribute to fishery resources, as do small and large pelagics such as horse mackerel, sardinellas, bonga shad, tuna and shark species and demersal species such as threadfins, sole, sea bream and red groupers (EnviroPass, 2017).
	• Tuna, including yellowfin and skipjack, and other pelagics, such as yellow jacks, spawns in the equatorial waters of the Gulf of Guinea or around oil platforms (ICCAT-SCRS, 2019; Friedlander et al., 2014).
	• Panga/Mayumba Bay is an important nursery for sharks and provides conditions that could make it a feeding area for the manta ray (EnviroPass, 2017).
	• Cetaceans are present in the Project AOI:
	  ○ Baleen whales migrate to Gabonese waters during the summer; Gabonese waters are critical breeding and calving habitat for humpback whales, but other large whales relatively common.
	  ○ Atlantic humpback dolphins, a critically endangered species, are regularly seen along the coast.
	  ○ Th West African manatee is present in Banio Lagoon, and potentially in the shallow waters of Panga/Mayumba Bay.
	• Four species of sea turtle are present in the Project AOI: green, olive ridley, hawksbill and leatherback. Species nest along the Mayumba coast and this coastline is one of the most important nesting areas for leatherbacks. The egg-laying area extends from Mayumba to the border with the Congo. The peak nesting period is from October to April.

Key trends (past, present, future)	• Past: throughout Gabon, the biomass estimates between 2005 and 2010 decreased for sardinellas and horse mackerel but stayed relatively constant for other pelagics (carangids, scombrids, barracudas and hairtails) (Mehl et al., 2010). Further historic data on fish stock estimates is unavailable. Leatherback turtle nests at Bame and Nyafessa decreased between the 2006/2007 and 2008/2009 seasons, however, Olive Ridley nests at the same beaches increased between the 2006/2007 and 2012/2013 seasons (WCS & ASF, 2009; Metcalfe et al., 2015). No other trends for turtle species or cetaceans are available. • Present: secondary data on present species population estimates in the Project AOI is limited; given the recent past trends for declines in biomass of important commercial species and anecdotal evidence that fishery

	resources are either fully exploited or over-exploited (EnviroPass, pers. comm.), it could be considered that populations of fish are declining. • Future: limited secondary data on the future of species populations in the Project AOI; given the lack of data (both historic and real time), predicting future trends remains challenging. There is economic potential in the Mayumba area for ecotourism based on the habitats and species present, and changes to habitat and species support will influence future trends in ecotourism.
Description of key beneficiaries / stakeholders / affected communities	• Persons in the Project AOI (i.e., those engaged in fishing activities).

Table 2: Summary table: primary production

Ecosystem service type	Supporting
Relevant to routine planned activities / accidental events?	Routine planned activities and accidental events
Key baseline information	• The area offshore southern Gabon is an upwelling region, with the continent also supplying nutrients through the Congo delta, promoting very high primary production (Cofrepeche, 2010; EnviroPass, 2017). The Benguela current flowing northward also influences this high productivity. • The primary biomass production reaches high levels (about 25mg/m^3 of chlorophyll) from December to February and from June to September (intermittently).
Key trends (past, present, future)	• Past: chlorophyll a is a proxy for primary production and trends may be available from satellite data. Otherwise, secondary data on the historic primary production in the Project AOI is limited. • Present: chlorophyll a is a proxy for primary production and trends may be available from satellite data. Published secondary data on present primary production in the Project AOI is limited. • Future: limited secondary data on the future of primary production in the Project AOI; given the lack of data (both historic and real time), predicting future trends remains challenging.
Description of key beneficiaries / stakeholders / affected communities	Persons in the Project AOI (i.e., those engaged in fishing activities or in ecotourism activities).

Table 3: Summary table: capture fisheries

Ecosystem service type	Provisioning
Relevant to routine planned activities / accidental events?	Routine planned activities and accidental events
Key baseline information	• Fishing is of vital economic and social importance to local livelihoods and food security in the Project AOI. It represents one of the main sources of income and means of subsistence for persons from affected communities, many of whom are artisanal fishers. • An industrial fishing sector, comprising both Gabonese and foreign vessels, conducting shrimp fishing, and trawls targeting demersal species and/or pelagics occurs between 6 and 12 nm offshore.

	• Tuna fishing occurs in the Ruche EEA, closer to the offshore Project AOI (relatively close to the OI/FPSO), between 12 and 24 nm (approximately 22-44 km), conducted by international operators. They catch yellowfin, skipjack and bigeye tuna amongst others. There is evidence of trawlers operating within the Ruche EEA at distances further than 50 km offshore. • Artisanal fishing is undertaken in inshore coastal waters and only Gabonese nationals are allowed to fish within 3 nm of the coast. However, artisanal fishing extends further offshore, with both artisanal and industrial taking place between 3 and 6 nm. This includes fishers from Tchiole Ndembet who fish on average 20 km (approx. 10 nm) from the coast. Fishers from around Ogooué-Maritime Province also fish at sea. • Except during regulatory required periods of no fishing, implemented to enable fish stocks to recover (the "Biological Stop", between January and April), fishing in the Project AOI is a daily activity. There is a fishing ban in the Banio Mouth Marine Park and its buffer zone. • Before the fishing ban in the Banio Mouth MP Gabonese fishers ventured up to 60km offshore. • Target species of artisanal and industrial fishing include bonga shad, sea bass, emperors, sea bream, sole, red hake, pagora, horse mackerel, sardinellas, scomber mackerels, carangids (false tuna), African sea catfish, meagre, barracudas, shrimp, prawns and crabs. • Alternative opportunities for income generation are limited; those involved in fishing predominantly rely on this activity and associated activities for their primary occupation. • Fishing is also undertaken in the coastal lagoons (e.g., the Banio Lagoon); in the latter environment, women from local communities practice mangrove fishing at low tide, using dugout canoes to target crabs, shrimp and other species. • For most of the communities around the Banio Lagoon, fishing in the lagoon is the main source of employment. Only Gabonese nationals are permitted to fish in the lagoon. • Target species in Banio Lagoon are predominantly salt-water species with higher catches when there is an influx of salt water: *Arius* (catfish), sea bream, sole, rouge (possibly red hake), barracuda, *Lethrinus* (emperors), sea bass, carp, sardines, prawns, lobster and crabs. • In addition to fishing, a broader supply chain related to artisanal fishing exists locally and is an important part of the economy. Associated supply chain livelihood activities include fishing boats and equipment, fish processing and the sale and transportation of fish products.
Key trends (past, present, future)	• Past: Gabon's fish stocks have reportedly declined in recent years due to over-fishing and illegal fishing (WCS Gabon, 2020a). • Present: data on the current status of fish stocks in the Project AOI, alongside the number of people engaged in fishing (including those without a licence), is very limited. Fish captures in the Banio Lagoon are thought to be decreasing but this may be because more and more people engaged in fishing due to unemployment. For many fishers it has become difficult to get 1 kg of fish out of the water. • Future: the development of capture fisheries is of great importance to the Government of Gabon (Infosamak, 2019), which indicates that this sector may play an increasingly important role in the sustenance of local livelihoods in the future. However, this will depend largely on the success of conservation measures and sectoral reforms. SFM Africa (date unknown) reports population growth, a projected increase in economic activity, favourable marine conditions and inadequate capacity for cleaning, processing, packaging and storage within Nyanga Province (where the Project is located), which indicates that there may be considerable opportunities for the development of the fisheries sector in the future.

Description of key beneficiaries / stakeholders / affected communities	• The Ministry of Fisheries and the Sea. • Persons in the Project AOI directly and indirectly engaged in fishing through fishing and/or participation in respective fisheries supply chains. • Persons in the Project AOI who consume fish. • NGOs (particularly WCS Gabon). • Representatives of fishing associations (e.g., Association of Artisanal Fishermen of the Sea in Mayumba).

Table 4: Summary table: wild foods

Ecosystem service type	Provisioning
Relevant to routine planned activities / accidental events?	Accidental events
Key baseline information	• Fish from the ocean and coastal lagoons in the Project AOI are an important source of protein for the local population (EnviroPass, 2017); it is consumed year-round in fresh and/or processed forms (e.g., smoked, salted) (EnviroPass, pers. comm.) However, wild fish are included in the capture fisheries. • Local communities also harvest the eggs laid by leatherback turtles on beaches within the Project AOI (EnviroPass, pers. comm.). These beaches are part of Mayumba National Park and thus the harvesting of turtle eggs is technically illegal. • Intertidal gleaning is included here. Oyster fishing is practiced between the mouth of the Banio Lagoon and the Banio bridge. Technically this is in a prohibited zone as activities are not normally allowed in the Banio Mouth Marine Park.
Key trends (past, present, future)	• Past: there is limited information on past trends of wild food or intertidal gleaning for oysters. • Present: data on levels of fish consumption at the local level is unavailable. The harvesting of turtle eggs within the Project AOI is reported to have decreased in recent years in line with increased surveillance activities by guards operating within Mayumba National Park; the practice, though illegal, is reported to remain relevant (EnviroPass, pers. comm.). • Future: data on projected levels of fish and turtle egg consumption at the national and local level is unavailable. However, Gabon's population is forecast to increase from 2.1 million to 3.8 million by 2050 (UN, 2019). Levels of fish and turtle egg consumption are therefore likely to increase in line with this trend (including in the Project AOI), but the number of uncertainties mean that future trends are difficult to predict.
Description of key beneficiaries / stakeholders / affected communities	• Persons in the Project AOI directly and indirectly engaged in wild food harvesting through the legal and illegal harvesting of wild foods and/or participation in respective wild foods supply chains. Note that this includes persons engaged in fishing. • Persons in the Project AOI who consume wild foods (through personal harvesting or by purchasing them from others).

Table 5: Summary table: air quality regulation

Ecosystem service type	Regulating
Relevant to routine planned activities / accidental events?	Routine planned activities and accidental events

Key baseline information	• There is limited industry in Mayumba so air quality in the coastal region and offshore is thought to be good. • There is more industry around Port-Gentil so the air quality may be lower in the Project AOI around the logistics base.
Key trends (past, present, future)	• Past: secondary data on historic air quality in the Project AOI is limited although as there is currently no industry historic air quality is considered good. • Present: secondary date on present air quality in the Project AOI is limited, although with limited industry present air quality is considered to have stayed constantly good. • Future: limited secondary data on air quality predictions in the Project AOI, however as there is no indication of industrial development in the Project AOI, it is expected future air quality will be maintained as good.
Description of key beneficiaries / stakeholders / affected communities	• Persons in the Project AOI (i.e., those engaged in capture fisheries and the associated supply chain or in ecotourism activities). • Persons living in the AOI.

Table 6: Summary table: regional/local climate regulation

Ecosystem service type	Regulation
Relevant to routine planned activities / accidental events?	Routine planned activities and accidental events
Key baseline information	• In an offshore environment such as the Project AOI, carbon dioxide content will be regulated by oceanic processes. The ocean acts as a sink, with seawater solubilising atmospheric gases, particularly carbon dioxide, and thus controls atmospheric greenhouse gas composition. • The general air quality of the offshore Project AOI is considered good, due to the lack of industry in Mayumba. • The Project AOI has high productivity and marine biodiversity, with phytoplankton contributing to climate regulation.
Key trends (past, present, future)	• Past: secondary data on historic climate regulation at a local or regional scale is limited. • Present: secondary data on present climate regulation at a local or regional scale is limited. • Future: limited secondary data on the future of regional/local climate regulation in the Project AOI; given the lack of data (both historic and real time), predicting future trends remains challenging.
Description of key beneficiaries / stakeholders / affected communities	• Persons living along the shoreline (local). • Persons in the region.

Table 7: Summary table: water purification and waste treatment

Ecosystem service type	Regulating
Relevant to routine planned activities / accidental events?	Accidental events
Key baseline information	• There is no information available regarding water purification and waste treatment in the Project AOI.

	• However, mangroves, a habitat which provides water purification and waste treatment services, are an important feature of the Gabonese landscape. Mangroves help to purify the water and provide waste treatment through removal of organic wastes and pollutants. • Gabon is part of the Central African mangrove ecoregion, the largest region of mangrove swamp in Africa. • The outskirts of Libreville contain the largest area of mangrove, although there is a cluster of mangroves in the Nyanga region (7 233.02 ha), with approximately 418 hectares of total mangrove area is located in Mayumba National Park. There is also a larger mangrove forest are present around in the Ogooué-Maritime region (46 900 ha). • There are reports from Mambi that the water is observed to be turning red during the rainy season, which is thought to be brought about by the abundance of rains, and so potentially from increased runoff / sedimentation. Water has been noted as black during the dry season.
Key trends (past, present, future)	• Past: An analysis of changes in mangrove cover in Gabon shows a total loss of 492 hectares of mangrove area against no gain. The losses observed are mainly from mangrove areas in the north of Gabon. • Present: secondary data indicates that mangrove environments in Gabon are being degraded. With reference to those located on the outskirts of Libreville, it is reported that rampant construction (driven by population growth and economic development) and lack of planning is leading to the destruction of mangroves locally. No change reported to the mangroves in the Nyanga region. • Future: Efforts to save mangrove forests from further destruction have been conducted in almost all the coastal nations along the Gulf of Guinea to help communities restore and better manage their mangroves. There is limited secondary data on efforts in Gabon, which makes future trends in the Project AOI difficult to predict.
Description of key beneficiaries / stakeholders / affected communities	• Persons and communities located in proximity to coastal mangroves in the Banio Department, Nyanga Province during routine planned activities, and in the Ogooué-Maritime region around Port-Gentil during routine planned activities at the logistics base and in the case of accidental events.

Table 8: Summary table: natural hazard regulation

Ecosystem service type	Regulating
Relevant to routine planned activities / accidental events?	Accidental events
Key baseline information	See equivalent row in the water purification and waste treatment table above for mangrove baseline, as mangroves provide protection from storm surges, waves and flooding. • The coastline between Mayumba and the border with the Republic of Congo is a narrow sandy strip, which will provide limited protection against flooding and storm surges. However, this stretch of coastline is sparsely populated. There are sandy strips along the whole coastline of Gabon.

Key trends (past, present, future)	• See equivalent row in the water purification and waste treatment table above for mangrove trends. • Past: secondary data on the historic natural hazard regulation, such as changes to the beach along the coast, in the Project AOI is limited. • Present: secondary data on present natural hazard regulation in the Project AOI is limited. Locals have noted water levels rising. • Future: limited secondary data on the future of natural hazard regulation in the Project AOI; given the lack of data (both historic and real time), predicting future trends remains challenging.
Description of key beneficiaries / stakeholders / affected communities	• Persons and communities located along the coastline between Mayumba and the border with the Republic of Congo, adjacent to the Dussafu block.

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 10: Cumulative Impact Assessment

80834

RSK GENERAL NOTES

Project No.: 80834

Title: ESIA Addendum – Dussafu Block Development, Gabon
Chapter 10

Client: BW Energy Gabon

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FIGURES

10 CUMULATIVE IMPACT ASSESSMENT

10.1 Purpose

This chapter assesses cumulative impacts. Cumulative impacts result from the successive, incremental and / or combined effects of a project or activity, when added to other past, existing, planned and/or reasonably anticipated future ones (IFC, 2013).

10.2 Methodology

10.2.1 Introduction

Cumulative impacts have been identified and assessed in accordance with the 'IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets' (2013). The IFC Good Practice Handbook (GPH) uses a six-step approach to cumulative impact assessment (CIA), as presented in Figure 10.1. This approach is described in more detail in the sections below.

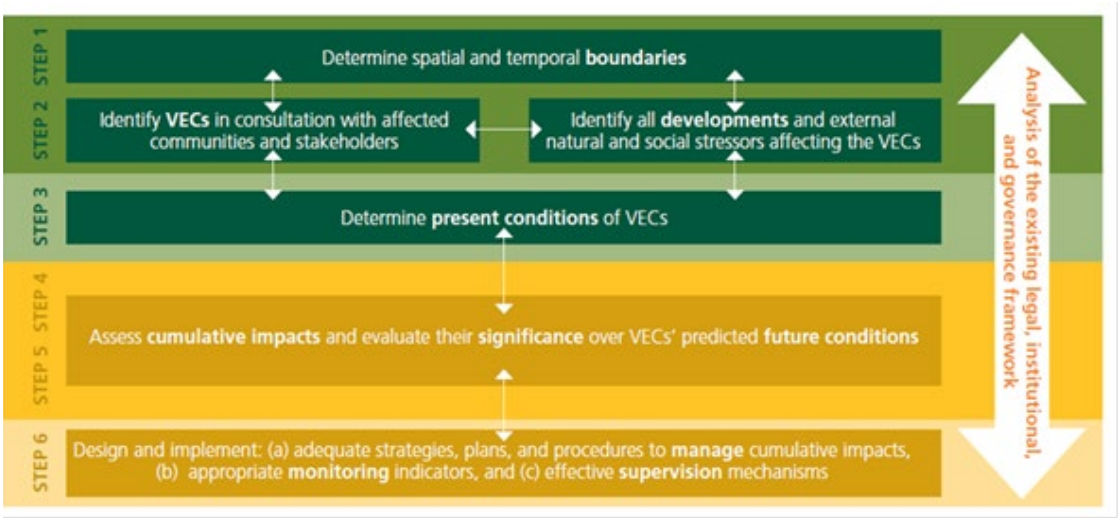

Figure 10.1: IFC cumulative impact assessment process

Source: IFC (2013)

It should be noted that the GPH suggests that government and regional planners have ultimate responsibility for CIA.

10.2.2 Defining the area of influence (Step 1)

For the CIA, the AOI is based on the primary AOI (where the main routine / planned activities of the Project take place) as described in Section 1.5. It should be noted that the unplanned / accidental events AOI is not considered in this impact assessment as the likelihood of simultaneous large-scale hydrocarbon spill events is considered too remote.

The temporal boundary of the CIA AOI is the lifetime of the Project (approximately 20 years), including decommissioning, as this is the duration of potential impacts on receptors.

In addition, a precautionary 50 km radius study area around the Ruche EEA was used to identify third party projects that have the potential to lead to cumulative impacts (Figure 10.2). The study area includes the northern waters of the Republic of Congo (RoC), and a separate area around Port Gentil (location of Project logistics base).

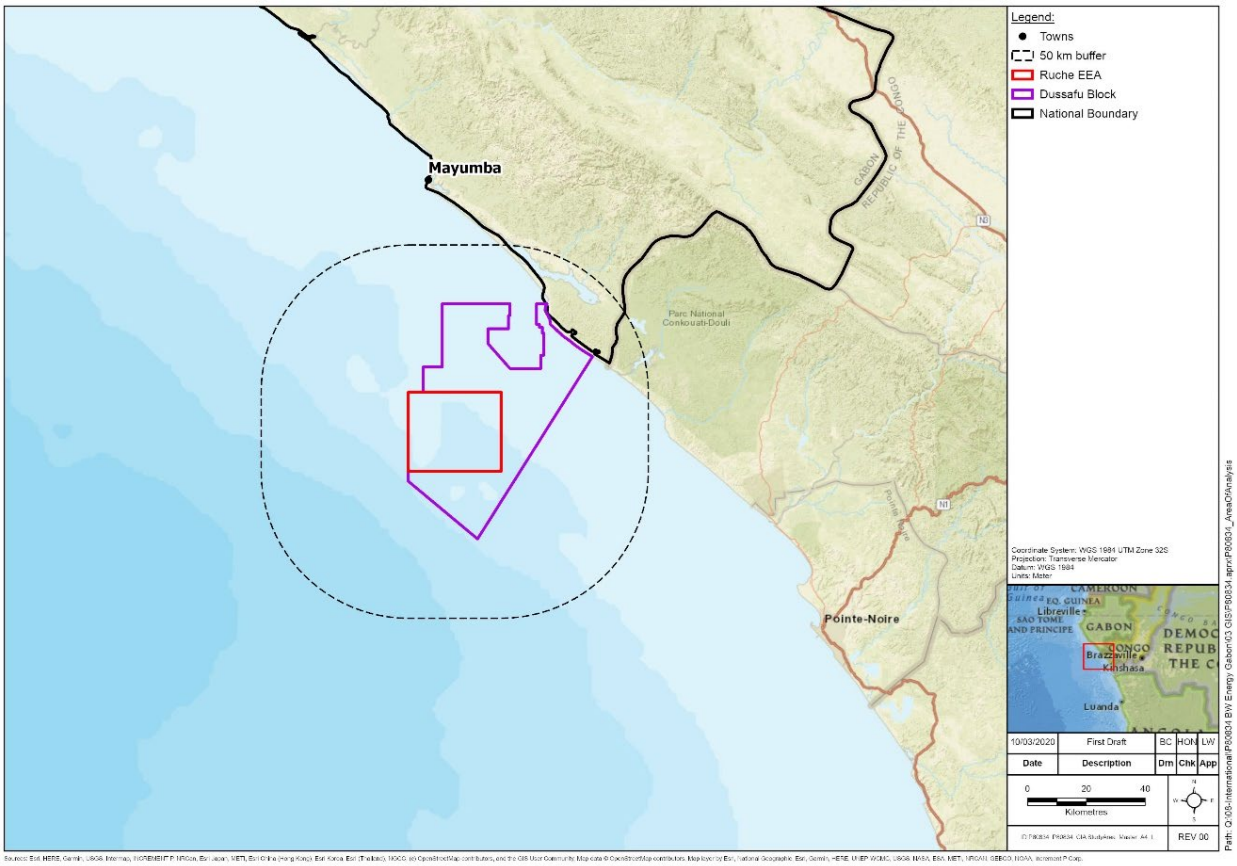

Figure 10.2: CIA study area for identifying third party projects

NB: Separate area around Port Gentil also considered with respect to third party projects

10.2.3 Stakeholder engagement (Step 2)

Stakeholder engagement has been carried out with national, regional and community level stakeholders and the scientific community (see Chapter 4). The output from this engagement has been used to identify environmental and social concerns and potential sources of cumulative impact in the primary AOI and study area.

10.2.4 Valued environmental and social components (Step 3)

The IFC GPH defines valued environmental and social components (VECs) as "environmental and social attributes that are considered important in assessing risks", (IFC, 2013). These attributes may be:

- physical features, habitats, wildlife populations (e.g., biodiversity)
- ecosystem services
- natural processes (e.g., water and nutrient cycles, microclimate)
- social conditions (e.g., health, economics), or
- cultural aspects (e.g., traditional spiritual ceremonies).

In accordance with the IFC GPH, the following criteria for the identification of VECs (or receptors) have been defined:

- identified as important and/or sensitive in the Tortue and Ruche ESIA / NEIA documents (see Section 1.2)
- identified as important by the national / international scientific community, i.e., meeting the GPH criterion that a VEC should be recognised as important on the basis of scientific concern
- identified as important or sensitive by stakeholders.

A list of the identified VECs, a summary of the baseline condition of each VEC, and any trends and stressors affecting it are included in Section 10.3.

Thresholds, limits of acceptable change, or preferred condition have also been defined in Section 10.3 on a case-by-case basis depending on the receptor and the nature of the cumulative impact being assessed. Where objective threshold values are identified by legislation, or by the IFC guidelines, these have been adopted (if relevant to the cumulative impact). For most receptors, however, threshold values are not defined and limits of acceptable change, or preferred condition have been used instead.

10.2.5 Defining the sources of cumulative impacts (Step 4)

Sources of cumulative impact (SCI) include:

- intra Project impacts (including associated facilities)
- oil transhipment operations
- third party planned developments
- induced development.

10.2.5.1 Intra Project impacts

The Tortue Phase 1 and 2 and Ruche Phase 1 and 2 Projects have been assessed individually in independent ESIA / NEIA documents. As part of the cumulative impact assessment, intra Project impacts have been assessed for the Ruche EEA field development as a whole. This involved a review of the three national ESIA / NEIA documents listed in Section 1.2 and the NEIA for the Pre-Installation of Anchors for the Adolo FPSO.

Associated facilities

IFC PS 1 (IFC 2012a) defines associated facilities as:

"facilities that are not funded as part of the project, would not have been constructed or expanded if the project did not exist and without which the project would not be viable".

IFC Guidance Note 1 (IFC 2012b), clause 52 states that:

". . . the client should normally have some commercial leverage on the operators of such [associated] facilities. Where such leverage allows, undertakings can be secured from these operators to operate their facilities consistent with the applicable Performance Standards. In addition, the client should identify its own actions, if any, that could support or supplement the actions of the operators of the associated facilities."

According to this definition, the BW Adolo FPSO is an associated facility as it is owned and operated by BW Offshore and the modifications required for the Ruche EEA field development are not funded by the same loan facility. However, as it is also an integral part of the Project and has been considered in the impact assessments in Chapters 6 to 9 as a Project component, it will be considered under intra Project impacts in this assessment.

10.2.5.2 Oil transhipment operations

Transhipment of oil from the BW Adolo FPSO is outside the scope of the impact assessments in Chapters 6 to 9. Potential cumulative impacts from this activity are included in this assessment.

10.2.5.3 Third party developments

Third-party developments have been identified (within the primary AOI and 50 km radius study area) based on the IFC definitions that projects are reasonably defined, reasonably predictable or foreseeable[1].

Third-party developments were identified by:

- information requests to key ministries responsible for approving environmental impact assessments of third-party projects (see request for information letter in Appendix 10A)
- review of national plans, for example the Plan Strategique Gabon Emergent (Emerging Gabon Strategic Plan) (2013) and Plan Opérationnel Gabon Vert Horizon 2025 (Gabon Green Horizons Operational Plan 2025)
- review of sectoral plans, for example the Code des Hydrocarbures (Hydrocarbons Code) (2019)
- review of international finance institutions' (IFI) websites for projects receiving or applying for funding
- review of other publicly available information on key developments in the region, such as websites of known developers and the press

[1] Definition of projects that are "reasonably defined", taken from IFC Performance Standard 1 (IFC, 2012a). Definition of projects that are "reasonably predictable" or that are "foreseeable future developments", taken from the IFC GPH.

- consultation with stakeholders.

An initial screening process was conducted to identify developments that are reasonably defined, reasonably predictable or foreseeable

It should be noted that existing third-party facilities and activities are assumed to be covered by the existing ESIA / NEIA baselines and are not within the scope of this CIA. However, past and existing third-party projects that continue to affect the current and predicted future of the receptor are discussed in certain cases.

10.2.5.4 Induced development of facilities and services

The CIA considers project-induced development, such as opportunistic businesses not directly supported by the Project, that could appear as a result of the Ruche EEA field development. As an offshore Project, it is unlikely that induced development will occur, but requires consideration. The level of influence that the Project can exert over such developments is likely to be low.

These sources of cumulative impact are discussed in more detail in Section 10.4.

10.2.6 Impact assessment (Step 5)

For an impact to be assessed as cumulative, the Project AOI and the source of cumulative impact AOI must overlap, and the impacts must occur in the same timescale.

The CIA includes:

- identifying potential impacts from the sources of cumulative impact and the Ruche EEA field development Project on VECs
- predicting the contribution of the Ruche EEA field development Project to the cumulative impact
- qualitatively determining the significance of the cumulative impact.

Where available information on SCIs is limited, professional judgement has been used to predict the impacts from these developments.

The significance of cumulative impacts has been determined qualitatively based on a predicted exceedance of VEC thresholds, limit of acceptable change or preferred condition as recommended by the GPH. The cumulative impact assessment is presented in Section 10.5.

10.2.7 Management and monitoring (Step 6)

The final step of the IFC GPH CIA process is concerned with designing and implementing the management and monitoring measures required to prevent significant cumulative impacts (i.e., above the threshold, or outside the limits of acceptable change) from occurring. If they are not avoidable, any adverse impact should be reduced as far as reasonably practicable. A distinction has been drawn, as discussed in the GPH, between management of significant cumulative impacts associated with the Ruche EEA field development Project (where it can be expected that BWE has a high degree of control or influence over mitigation/management) and management of impacts outside of BWE's control (because other third-party projects are the main cause of the cumulative impact). Figure 10.3, taken from the GPH, illustrates this difference and suggests how

management / mitigation should proceed ideally, depending on whether the Project has control or can exercise leverage, to achieve optimal cumulative impact management.

The contribution of the Ruche EEA field to cumulative impacts has considered three scenarios that also have implications for mitigation:

- high risk of potential cumulative impacts and the Ruche EEA field development Project is an important contributor to the cumulative impact. In addition to implementing project mitigation measures, the Project will design and implement monitoring or management strategies to appropriately manage cumulative impacts
- high risk of potential cumulative impacts but the Ruche EEA field development Project is a small contributor to the cumulative impact on a VEC. The Project will design and implement mitigation measures commensurate with the magnitude and significance of its residual contribution to the cumulative impacts
- the Ruche EEA field development Project impacts have a limited / negligible contribution to cumulative impacts. No additional mitigation measures are considered necessary.

Figure 10.3: IFC guidance on responsibility for management and mitigation of cumulative impacts

Source: IFC (2013)

It is acknowledged in the GPH that the total cumulative impacts due to multiple projects typically should be identified in government-sponsored assessments and regional planning efforts. According to IFC PS 1, IFC clients are expected to ensure that their own assessment determines the degree to which each project under review is contributing to the cumulative effects. Figure 10.3 shows the importance of differentiating between those actions over which a private sector sponsor has direct control and those for which it may have leverage to influence others to achieve optimal cumulative impact management as part of a multi-stakeholder effort; an effort that ideally should be led by government agencies, but at a minimum must involve government agencies.

10.2.7.1 Management of impacts where BW Energy has control

BWE has already committed to undertake an extensive range of management and monitoring activities in the existing national ESIA / NEIA documents. A check was first carried out as to whether these will be sufficient to ensure cumulative impacts can be managed. Where this is not the case, additional mitigation measures were explored and defined in accordance with the mitigation hierarchy, having regard to the likely scale of the cumulative impacts:

- avoid at source: remove the source of the impact
- abate at source: reduce the source of the impact
- attenuate: reduce the impact between the source and the receptor
- abate at the receptor: reduce the impact at the receptor
- remedy: repair the damage after it has occurred
- compensate/offset: replace in kind or with a different resource of equal value.

Where existing or additional mitigation measures that are within BWE's control are sufficient to manage the cumulative impact, no further action is recommended.

10.2.7.2 Management of impacts outside of direct BW Energy control

Where significant potential cumulative impacts are identified but action from other parties is required to manage the cumulative impact, BWE will make best endeavours to engage with the appropriate parties and use the leverage it may have to:

- inform others of the potential cumulative impact
- exchange information to assist in the further definition of the cumulative impact as needed
- agree responsibilities for the management of cumulative impacts
- agree monitoring measures as appropriate.

These parties may include the proponents of the associated facilities, other project developers, government agencies and affected communities. The actions taken and the effort expended will be proportionate to the likely scale of the cumulative impacts.

Proposed management and monitoring are presented in Section 10.6.

10.2.8 Limitations

The CIA involved review of available information, including existing national ESIA / NEIA documents, output from stakeholder engagement, and on-line publicly available information. The assessment takes into account the typical limitations that a project developer may face in this type of evaluation, including:

- limited VEC baseline information
- uncertainty regarding the execution of future projects
- incomplete information about other projects and activities (for example, if the information is not available in the public domain)
- availability of local strategic plans.

10.3 Valued Environmental & Social Components (VECs)

10.3.1 Identified VECs

This section summarises the identified VECs and the existing baseline condition of these receptors. The VECs are presented in Table 10.1 with the rationale for their selection.

Table 10.1: Summary of VECs

VEC	Description	Rationale for inclusion
Physical environment		
Water quality	Offshore seawater quality	Potential for intra Project and third-party cumulative impacts from operational discharges Discharges to sea were a concern raised by the General Directorate of Merchant Marine, fishing communities and fisheries stakeholders at Project stakeholder engagement meetings
Sediment quality	Offshore sediment quality	Potential for intra Project and third-party cumulative impacts from discharge of drill cuttings Discharges to sea were a concern raised by the General Directorate of Merchant Marine and fisheries stakeholders at Project stakeholder engagement meetings
Climate	Greenhouse gas (GHG) emissions	Potential for intra Project and third-party cumulative impacts from emissions of GHGs (CO_2, CH_4, N_2O) Climate change effects (sea level rise) were a concern raised by the Mayumba community at Project stakeholder engagement meetings and climate change is a global concern. Gabon has ratified the 2015 Paris Agreement (sets out a global framework to avoid dangerous climate change by limiting global warming to well below 2°C)

VEC	Description	Rationale for inclusion
Marine biodiversity		
Protected and designated areas / threatened or unique ecosystems	Nationally and / or internationally recognised and legally protected areas. Habitats that are a high priority for conservation by regional or national systematic conservation planning - IFC PS 6 Criterion 4.	Potential for intra Project and third-party cumulative impacts on habitats and species of conservation importance for which the protected area is designated Operations close to protected areas was a concern raised by the ANPN - Gabon Bleu during Project stakeholder engagement meetings Importance conferred by national / international scientific community
Species of conservation importance	Flora and fauna species of conservation value, species that meet IFC PS6 critical habitat thresholds	Potential for intra Project and third-party cumulative impacts from underwater noise, discharges to the marine environment, etc Importance conferred by national / international scientific community
Socio-economic		
Fisheries	Deep sea / industrial fisheries	Potential for intra Project and third-party cumulative impacts from physical presence of facilities and safety exclusion zones Restricted zones for fisheries were raised as a concern by Centre Communautaire de Pêche Artisanale de Port-Gentil (CCPAP) and the local fishing communities during the Project stakeholder engagement meetings
Shipping and navigation	Commercial shipping	Potential for intra Project and third-party cumulative impacts from physical presence of facilities, navigational impacts Shipping activity was a concern raised by the General Directorate of Merchant Marine at Project stakeholder engagement meetings
Onshore infrastructure	Port of Port Gentil Waste facilities	Potential for cumulative impacts (pressure on facilities) from use by the Ruche EEA field development Project and other third-party activities and increased risk of vessel collisions in port approaches Waste management was a concern raised by OPRAG at Project stakeholder engagement meetings

10.3.2 Baseline Description of VECs

10.3.2.1 Physical environment

Water quality

Summary of baseline

The Guinea Current Large Marine Ecosystem (GCLME) extends from Guinea Bissau to Angola and covers sixteen countries[2] in West and Central Africa. Deterioration in water quality (chronic and catastrophic) from land and sea-based activities (especially industrial, agricultural, urban and domestic sewage run-off and mining activities including the oil and gas sector) has been identified as a major transboundary environmental problem by the countries as part of the Transboundary Diagnostic Analysis (TDA) project (GCLME Regional Coordinating Unit, 2006).

Substantial quantities of nutrients originating from domestic and agricultural effluents are carried to the sea through river outflows. Excessive nutrient loading causes eutrophication and harmful algal blooms. The Congo River, with the second largest mean annual run-off and catchment area in the world (freshwater run-off and sediment discharge estimated at 30-80 tons/km^2) enters the Gulf of Guinea south of Mayumba (Ukwe & Ibe, 2010).

Offshore in the Ruche EEA, water quality is anticipated to be higher than in the coastal areas of Gabon. Profiles of the water column in the offshore area of southern Gabon indicate that these waters generally have low turbidity and have dissolved oxygen levels ranging from 6.7 mg/l at the surface to 4.4 mg/l at the seabed (Enviropass, 2020).

Trends and thresholds

During the past 50 years, the countries of the GCLME region have registered strong population growth as well as an acceleration of industrialisation and urbanisation without regulation. This has caused major degradation of natural resources and biodiversity in the region and in areas contiguous to the Basin, thus, jeopardising the ecological base for the long-term development of the region. Although most impacts of chronic deterioration in water quality are localised (national issues) and generally more coastal, they are common to all of the countries and require collective action to address them. The Interim Guinea Current Commission (IGCC) created by the countries as a regional consultation and coordination mechanism has greatly facilitated regional dialogue and coordination for the management of the GCLME (Ukwe & Ibe, 2010).

The sensitivity of this VEC is considered to be medium.

The preferred condition is considered to be a return to, or near, the pre-development baseline condition of the VEC and avoid impacts on marine ecosystems.

Sediment quality

Summary of baseline

Information on seabed sediments offshore from Gabon is very limited and no data was provided on this topic in the national ESIA / NEIA documents. In general, the shelf off

[2] Angola, Benin, Cameroon, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Gabon, Ghana, Equatorial Guinea, Guinea, Guinea-Bissau, Liberia, Nigeria, São Tomé and Principe, Sierra Leone, and Togo.

Gabon is dominated by sandy, sand-shell and gravel bottoms, becoming muddy toward the shelf edge and upper slopes. Off Congo, while rocky areas and outcrops are found in the inshore part of the shelf, its intermediate and deeper parts are dominated by muddy, mud-sand bottoms which may be due to transport by currents of sediments from the Congo River Estuary (Bianchi, 1992).

Studies carried out for neighbouring exploration sites indicate that sediments in the Ruche EEA constitute medium to fine sand and non-consolidated silty clays, lying on a cohesive layer of sandy clay (BW Energy Gabon, 2019b).

Trends and thresholds

No information is available on the trends in offshore sediment quality in Gabon. It is anticipated, however, that sediment quality will have decreased in areas of extensive offshore exploration and drilling operations (e.g., off Port Gentil) due to the discharge of cuttings and drilling fluids associated with these activities.

The sensitivity of this VEC is considered to be low.

The preferred condition for sediments is considered to be a return to, or near, the pre-development baseline condition of the VEC and avoid impacts on marine ecosystems.

Climate

Summary of baseline

West Africa's total regional GHG emissions in 2014 were 994.7 million tonnes of carbon dioxide equivalent ($MtCO_2e$), totalling 2% of global GHG emissions. Gabon is a net carbon sink, absorbing 9% of the region's total GHG emissions in 2014 due to the uptake of carbon by its Land Use Change and Forestry (LUCF) sector (Climatelinks, 2019)[3]. According to the UNFCCC, Gabon's GHG emissions without LUCF in 2020 were 6160 $ktCO_2e$; GHG emissions / removals with LUCF in 2020 were -57,996 $ktCO_2e$ (UNFCCC, 2020).

Trends and thresholds

Gabon was the first African country to submit its Intended Nationally Determined Contribution (INDC) (Gabon 2015), which went on to become its Nationally Determined Contribution (NDC) following the ratification of the 2015 Paris Agreement. Through this submission, Gabon has committed to a 50% reduction in the country's GHG emissions in 2025 (excluding carbon stocks in forest biomass) against a baseline scenario of uncontrolled development.

The sensitivity of this VEC is high.

The limit of acceptable change for this VEC is that Gabon's GHG emissions, including those from the Ruche EEA field development Project, must remain in line with the NDCs submitted under the Paris Agreement.

[3] The same report noted that "Direct comparison of GHG emissions across sources can be difficult due to the use of different data and estimation methodologies, and different inventory years. While there is uncertainty associated with GHG estimations from all sectors, uncertainties of LUCF estimates are particularly high".

10.3.2.2 *Marine biodiversity*

Legally protected marine areas

Summary of baseline

The following marine protected areas (MPAs) encompass, or are in close proximity to, the Ruche EEA:

- Aquatic Reserve of the Great South of Gabon – encompasses the Ruche EEA
- Mayumba National Park - located in coastal waters 16.5 km inshore from the Ruche EEA.

More information on these protected areas is provided in Section 6.3.4.2.

Trends and thresholds

The main threats to Mayumba National Park and the Aquatic Reserve of the Great South of Gabon are:

- uncontrolled illegal fishing and fisheries bycatch
- hunting of turtles and egg collection
- infrastructure development
- pollution from offshore oil and gas development (WCS Gabon, 2021).

The presence of ecoguards on the main beaches during turtle nesting season (November to April) and sea patrols (Gabonese authorities and Sea Shepherd) have been introduced to reduce the impact on the MPAs from these anthropogenic activities.

On 5 June 2017, President Ali Bongo Ondimba of Gabon announced the creation of 9 new marine parks (including the Aquatic Reserve of the Great South of Gabon) and 11 aquatic reserves, ensuring that more than 26% of Gabonese waters receive protection. This network of marine protected areas (MPAs) is the largest in Africa. The trend in Gabon appears to be moving towards greater protection for marine areas, however, with new conservation laws and measures comes a need for increased law enforcement (Sea Shepherd, 2021).

The sensitivity of this VEC is considered to be high.

The preferred condition is considered to be no impact on the viability of the species, habitats or intrinsic character for which the marine area is designated.

Threatened or unique ecosystems

Summary of baseline

The water column overlying the West African continental shelf is fed by upwelling of nutrient-rich water, particularly during the rainy seasons as a result of offshore winds. This supports high phytoplankton productivity that in turn underpins a diverse marine ecosystem in Gabonese waters.

Three Ecologically or Biologically Significant Areas (EBSAs) are in close proximity to the primary AOI, namely the:

- Mayumba Marine and Coastal EBSA (in coastal waters immediately inshore from the Ruche EEA)
- Equatorial Tuna Production Area EBSA (encompasses the Ruche EEA)
- Northwest Continental Shelf EBSA (in Congolese waters east of Ruche EEA).

More information on these habitats of conservation importance is provided in Section 6.3.4.1.

Trends and thresholds

According to the Secretariat of the Convention on Biological Diversity (2020), in the Mayumba Marine and Coastal EBSA intrusion or exploitation of natural resources by humans is minimal, as the coastal population of the area is low, therefore the area ranks highly against the "naturalness" EBSA criterion, which is unusual for the inshore waters of any nation.

In the Equatorial Tuna Production Area EBSA several international and industrial fishing operations take place in the area. Closer to shore, numerous land-based human activities also impinge on the natural character of the area.

In the Northwest Continental Shelf EBSA, deep water shrimp species are targeted by international commercial fisheries that often impact the seabed and its integrity.

The sensitivity of this VEC is considered to be high.

The preferred condition is considered to be no impact on the viability of the species that the threatened or unique ecosystems support.

Species of conservation importance

Fish

Summary of baseline

According to the FishBase[4] and the Institute for Research and Development (IRD), the marine fauna of Gabonese waters includes at least 535 species of fish, of which 466 are bony or teleost fish and 69 are cartilaginous.

Oceanic fish generally live beyond the continental shelf, these include sardines from the clupeid family and anchovies from the engraulid family. These fish live in schools and are trailed by their predators, i.e., tuna and mackerel from the scombrid family, or coryphenes of the coryphenid family.

Fish from coastal waters are distributed between the beach and 200 m from the continental shelf. Among the most vulnerable in the Mayumba region are the cartilaginous fish group including chimeras, rays and sharks.

Sharks are very common in the coastal marine and continental waters of the Mayumba region. The most common sharks in Gabon are the bulldog shark *Carcharhinus leucas* and the silky shark *Carcharhinus falciformis acutus*. Panga / Mayumba Bay is an

[4] Fishbase is a global information system providing information about fish species around the world. Fishbase was developed at the WorldFish Centre in collaboration with the Food and Agriculture Organisation of the United Nations (FAO) and other partners, with support from the European Commission. The site is accessible from: http://www.fishbase.org/

important nursery for sharks and provides conditions that could make it a feeding area for the manta ray (EnviroPass, 2017a).

The sawfish currently has four species in the world, three of which are found in Gabon: *Pristis pristis*, *Pristis microdon* and *Pristis pectinata*. They are found in both coastal waters and enter brackish waters of estuaries and lagoons and can be found in fresh waters.

Nyanga Province has high marine biodiversity; shrimp, squid and crustaceans all contribute to fishery resources, as do small and large pelagics such as horse mackerel, sardinellas, shad, tuna and shark species and demersal species such as threadfins, sole, sea bream and red groupers (EnviroPass, 2017a).

Eleven species of fish were found to trigger critical habitat, see Table 6.7.

Trends and thresholds

Throughout Gabon, the biomass estimates for sardinellas and horse mackerel decreased between 2005 and 2010, but stayed relatively constant for other pelagics (carangids, scombrids, barracudas and hairtails) (Mehl et al., 2010). Further historic data on fish stock estimates is unavailable.

Secondary data on present species population estimates in the Project area is limited; given the recent past trends for declines in biomass of important commercial species and anecdotal evidence that fishery resources are either fully exploited or over-exploited (EnviroPass, pers. comm.), it could be considered that fish populations are declining.

Of the eleven fish species triggering critical habitat, five had decreasing populations, and the population status of the remaining six were unknown. The main threat listed for all of the critically endangered or endangered species was fishing (IUCN, 2021).

The sensitivity of this VEC is considered to be high.

The preferred condition is that the population numbers remain stable or increase, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-development numbers.

Marine mammals

Summary of baseline

Twenty-seven species of marine mammal are found in the waters of offshore West Africa, twenty of which have been identified in the waters of offshore Gabon.

An action plan exists to aid conservation of marine mammals in West African waters. The ‘Memorandum of Understanding Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia’ includes two separate Action Plans for small cetaceans and the West African manatee. Gabon is a signatory to this memorandum and as such, demonstrates its understanding of the need for conservation of marine mammals in the offshore environment.

Atlantic humpback dolphin and humpback whale have been identified as critical habitat triggering species (see Table 6.7). More information on these species is presented in Section 6.4.2.

Trends and thresholds

Atlantic humpback dolphins are found near to shore and so are susceptible to human-induced impacts, which is driving their population decline (IUCN, 2021). Fishing is one of the main threats to this species, often as by-catch (idem). Impacts from development, including habitat loss and pollution are also increasingly considered to be threats as development progresses in areas where this species is found (idem).

Humpback whale populations have been steadily recovering since the hunting of this species was banned in 1966, but it still faces threats such as ship strike, habitat loss, loss of prey, and pollution (IUCN, 2021).

The sensitivity of this VEC is considered to be high.

The preferred condition is that the population numbers remain stable or increase, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-development numbers.

Turtles

Summary of baseline

Four species of sea turtle are present in the Project area. These are the green, Olive Ridley, hawksbill and leatherback. Of these, the leatherback turtle has been identified as a critical habitat triggering species. More information on this species is presented in Section 6.4.3.

Trends and thresholds

Globally, leatherback turtle populations are decreasing. Numbers of leatherback turtle nests at Bame and Nyafessa beaches, in Mayumba National Park, decreased between the 2006/2007 and the 2008/2009 seasons (WCS & ASF, 2009; Metcalfe et al., 2015). However, Olive Ridley nests at the same beaches increased between the 2006/2007 and 2012/2013 seasons (WCS & ASF, 2009; Metcalfe et al., 2015).

The leatherback turtle is subject to direct threats and indirect threats in Gabon which include illegal take, accidental catches, degradation of coastal habitat, and threats from industrial offshore activities (WCS Report, 2009-2010). In addition, marine traffic represents a potential source of collisions resulting in the injury or death of species.

The sensitivity of this VEC is considered to be high.

The preferred condition is that the population numbers remain stable or increase, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-development numbers.

Benthic ecology

Summary of baseline

There is little data available regarding the benthic infauna in the Ruche EEA and no data was provided on this topic in the national ESIA / NEIA documents.

The deep-sea biodiversity of the Atlantic continental margin off Angola, Congo and Gabon was mostly unknown before petroleum exploration. The most extended ecosystem in the deep ocean is based on the input of detritus and organic carbon

produced photosynthetically in the euphotic upper layer of the ocean. The majorities of the benthic communities survive with low food resource, low temperature and are characterized by low faunal densities, high species richness and small body size (Sibuet & Vangriesheim, 2009).

A survey conducted by GEMS in 2011 offshore from the Gamba Oil Terminal (north of Mayumba), up to 20 km from the coast, identified 318 taxa from 18 benthic samples. The benthic communities were dominated by annelids (54%) with the remaining community composed of arthropods (28%), molluscs (11%), echinoderms (3%) and other phyla (5%) (GEMS, 2011).

According to the BWE Oil Spill Contingency Plan, a diversified benthic macrofauna exists but is characterised by a relatively low abundance and biomass. However, this is often observed in a deep-water environment. Overall, this environment seems to be dominated by sediment-dwelling polychaetes and tube worms and foraminifera, which is usual in this type of mud/silt sediment at great depths. The other principal phyla, molluscs, gastropods, bivalves, crustaceans and echinoderms were also present. They were mainly of small size (molluscs, bivalves, gastropods, and isopod and amphipod crustaceans) though some were large such as the sipuncula and echinoderms (BW Energy Gabon, 2019b).

Ultimately, no benthic species were found to trigger critical habitat. Two species of sea cucumber, *Holothuria sinefibula* and *Holothuria suspecta*, were identified as potential triggers. However, these were not included due to the lack of evidence and the fact that they may be misidentified juveniles of different species.

It is known that no true reefs exist along the coast of West Africa and Gulf of Guinea. Some sites with rich coral communities can be found in very shallow, protected coves, the number and size of colonies decreasing abruptly outside such areas. In open waters, hermatypic species are limited to depths of less than 20 m.

Trends and thresholds

No information is available on the trends in offshore sediment quality in Gabon. It is anticipated, however, that where sediment quality has decreased in areas of extensive offshore exploration and drilling operations this is likely to have had a knock-on effect to the benthic ecology.

The sensitivity of this VEC is considered to be low.

The preferred condition for the benthic ecology is that the population numbers remain stable or increase, relative to the background changes in population levels. The limit of the acceptable change is a short-term decrease followed by recovery to pre-development numbers.

10.3.2.3 Socio-economic receptors

Fisheries

Section 7.5.1 provides a baseline description of fisheries within the AOI.

Trends and thresholds

Catches by fishing sector in Gabonese waters suggest a recent decline in fish stocks, see Figure 10.4. According to data collated by the Sea Around Us, peak catches were in 2008, with a steady decline since then (with a significant decline in catch between 2012 and 2014).

The reduction in fish catches in the artisanal sector is reportedly due to the creation of marine parks and an increase in fishermen.

The sensitivity of the VEC (deep sea / industrial fisheries) is considered to be low.

The preferred condition is for the standards of living of the impacted fishing communities to be equal to, or better than, pre-development.

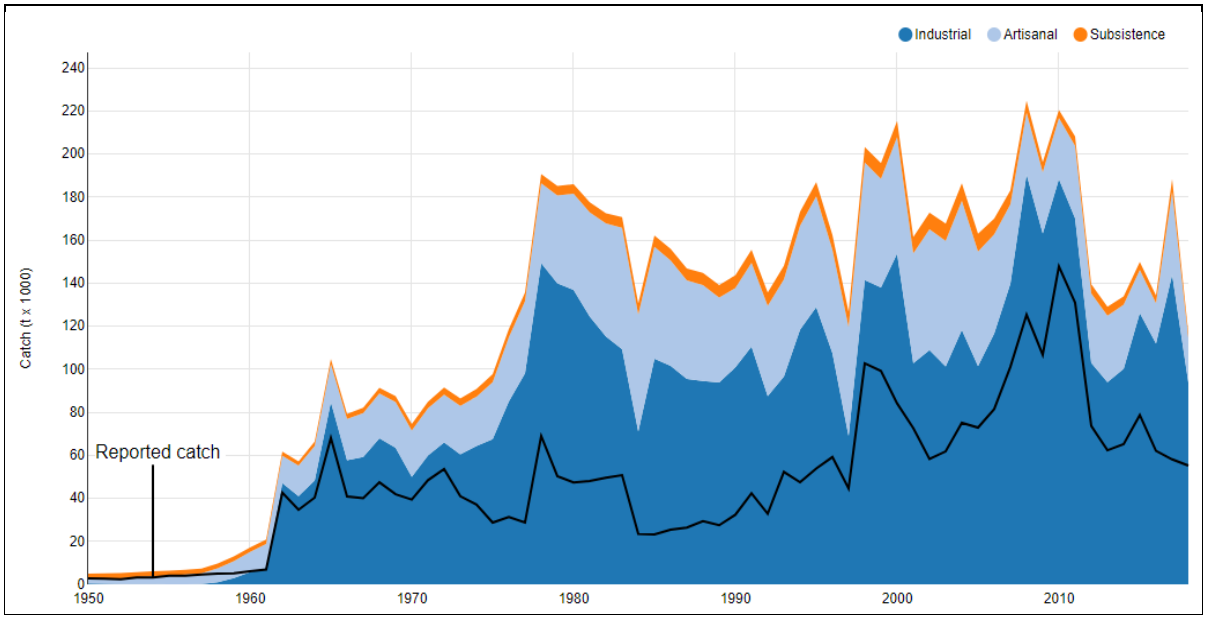

Figure 10.4: Catches by fishing sector in the waters of Gabon

Source: Sea Around Us (2016)

Shipping and navigation

Section 7.5.5 describes the shipping and navigation baseline in the AOI.

The sensitivity of this VEC is considered to be low.

The preferred condition is that there is no negative change to the impacted maritime users compared to pre-development.

Onshore infrastructure

Port-Gentil is Gabon's second-largest city and economic hub. The commercial port at Port-Gentil is managed by the Ports and Harbours Office of Gabon (Office des Ports et Rades du Gabon, OPRAG) and Gabon Port Management (GPM) and is the primary exit point for Gabon's hydrocarbons exports. The port's main quay is 375 m long and has a draught of 11 m. The port also has a fishing quay as well as a 10-hectare container yard.

A mainland road link was constructed between Libreville and Port-Gentil in 2015 improving the road network in the area. A 106 km road between Tchibanga and Mayumba

was completed in 2015. The Tchibanga connection is crucial to the aim of establishing Mayumba as a major mining export port.

Waste management capacity is limited in Gabon (see Section 7.7.3). Waste capability in Port Gentil includes the IEG facility which has been in operation since 2005 and has expanded to support the oil industry since.

The sensitivity of this VEC is considered to be medium for waste management facilities, and low for the port facilities.

The preferred condition is defined as no deterioration in the provision of onshore services compared to pre-development.

10.4 Sources of Cumulative Impact

10.4.1 Introduction

A source of potential cumulative impact is something that affects the condition of the identified VECs.

Cumulative impacts in the primary AOI and 50 km radius study area potentially occur from the combined impacts of BW Energy activities with other activities. These include:

- different stages of BWE's phased development of the Ruche EEA - intra Project impacts (including associated facilities)
- oil transhipment from BW Adolo FPSO
- past and existing third-party projects that continue to affect the current and predicted future of the receptor
- reasonably defined/foreseeable third-party projects
- developments or activities induced by BWE
- other sources of human and natural stressors on the receptors.

These are discussed in more detail below.

10.4.2 Intra Project impacts

Project activities associated with Tortue Phase 1, Tortue Phase 2 and Ruche Phase 1 are described in detail in Chapter 2 and summarised in Table 2.1.

Ruche Phase 2 involves the drilling of an additional six production wells from a rig nested in the Hibiscus Alpha OI.

As stated in Section 10.2.5 although the BW Adolo FPSO is technically an associated facility it in considered under intra Project impacts in this assessment as it is an integral part of the Project.

Adolo Phase 1 included the conversion of the Azurite floating, drilling, production, storage and offloading (FDPSO) unit into the BW Adolo FPSO for redeployment to the Dussafu Block to enable it to process the fluids from Tortue Phase 1.

Adolo Phase 2 included the work scope undertaken to modify the BW Adolo FPSO to enable it to handle the additional fluids arising from Tortue Phase 2.

Adolo Phase 3 includes the work scope to modify the BW Adolo FPSO to enable it to handle the additional fluids from Ruche Phase 1, this will involve revamping the Tortue Phase 1 and 2 cluster using multiphase flow meters and work to reduce pinch points in the oil production systems.

10.4.3 Oil transhipment operations from BW Adolo FPSO

Oil transportation tanker visits to the FPSO over the life of the Project will be considered in the CIA, however, the Project will have limited control over the operations of the buyers of the crude oil.

Transhipment consists of pumping crude oil stored in the FPSO to the cargo vessel via a 16-inch diameter, 200 m long submerged hose. Transhipment is carried out with the assistance of two vessels. Transhipment operations typically last for 36 hours and one transhipment per month is planned.

10.4.4 Past and present activities

Key activities ongoing in the preliminary AOI and 50 km radius study area are:

- other oil and gas exploration and development activities
- fishing activities
- shipping.

10.4.4.1 Oil and gas industry

Gabon

The oil and gas industry has been, and continues to be, prevalent in offshore Gabon, see Figure 10.5 and Section 7.5.6.

A summary of blocks in the 50 km radius study area is included in Table 10.2 and Figure 10.6.

Table 10.2: Oil and gas activities in the study area

Block	Operator	Status
F11	Open	2021 licensing round[5]
F12	Open	2021 licensing round
F13	Open	2021 licensing round
F14 Likuale	Petronas	Exploration
G10-11	Open	2021 licensing round
G13	Open	2021 licensing round
G14	Open	2021 licensing round
Etame Marin	VAALCO	Production
Avouma	VAALCO	Production
Ebouri	VAALCO	Production

[5] Refer to Section 10.4.5 for information on 2021 licensing round.

Block	Operator	Status
Tchibala	VAALCO	Production
Malembe Marin	Perenco	Production
M'Bya Marin	Perenco	Production
M'Wengiu	Perenco	Production
Lucina	Perenco	Production
Nyanga Mayombe/2	Maurel & Prom	Production – onshore
Banio	Maurel & Prom	Production – onshore

Republic of Congo

The northern waters of the Republic of Congo (RoC) are within the 50 km radius study area. Figure 10.7 presents the offshore blocks within this area, namely: Marine XXV where there have been no commercial hydrocarbon discoveries to date; Marine XXIII where five wells have been drilled and one oil discovery; and the Yombo and Masseko fields operated by Perenco (Congo Ministry of Hydrocarbons, 2019).

Online sources were reviewed to identify future third party projects in RoC waters with the potential for cumulative impacts with the Ruche EEA full field development. However, no information was available at the time of writing and therefore no projects in the RoC portion of the study area are discussed in Section 10.5.

10.4.4.2 Fishing and shipping activities

Information on these ongoing activities is included in Section 10.3.

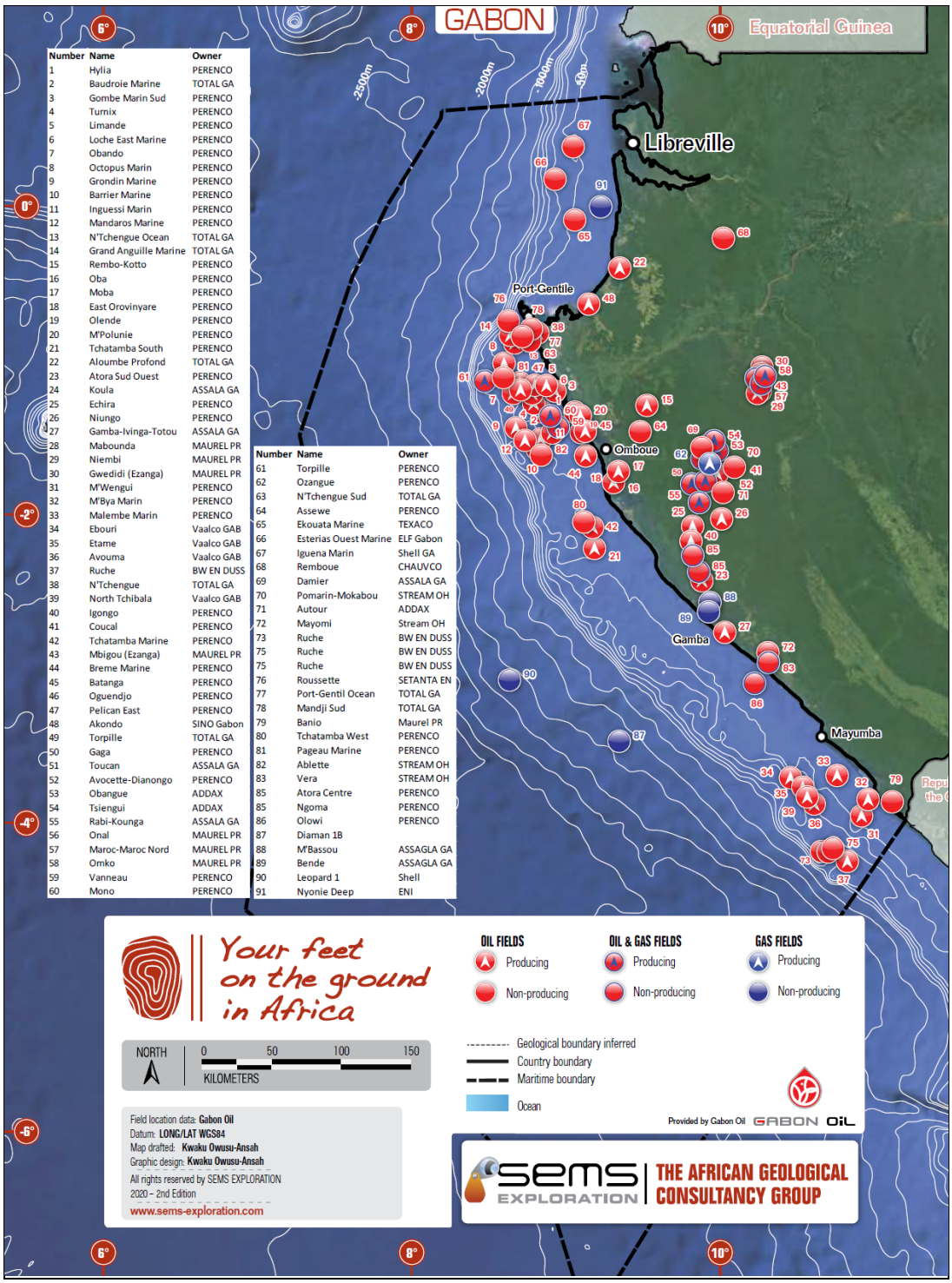

Figure 10.5: Oil and gas fields off Gabon

Source: Green Energy International Ltd (2020)

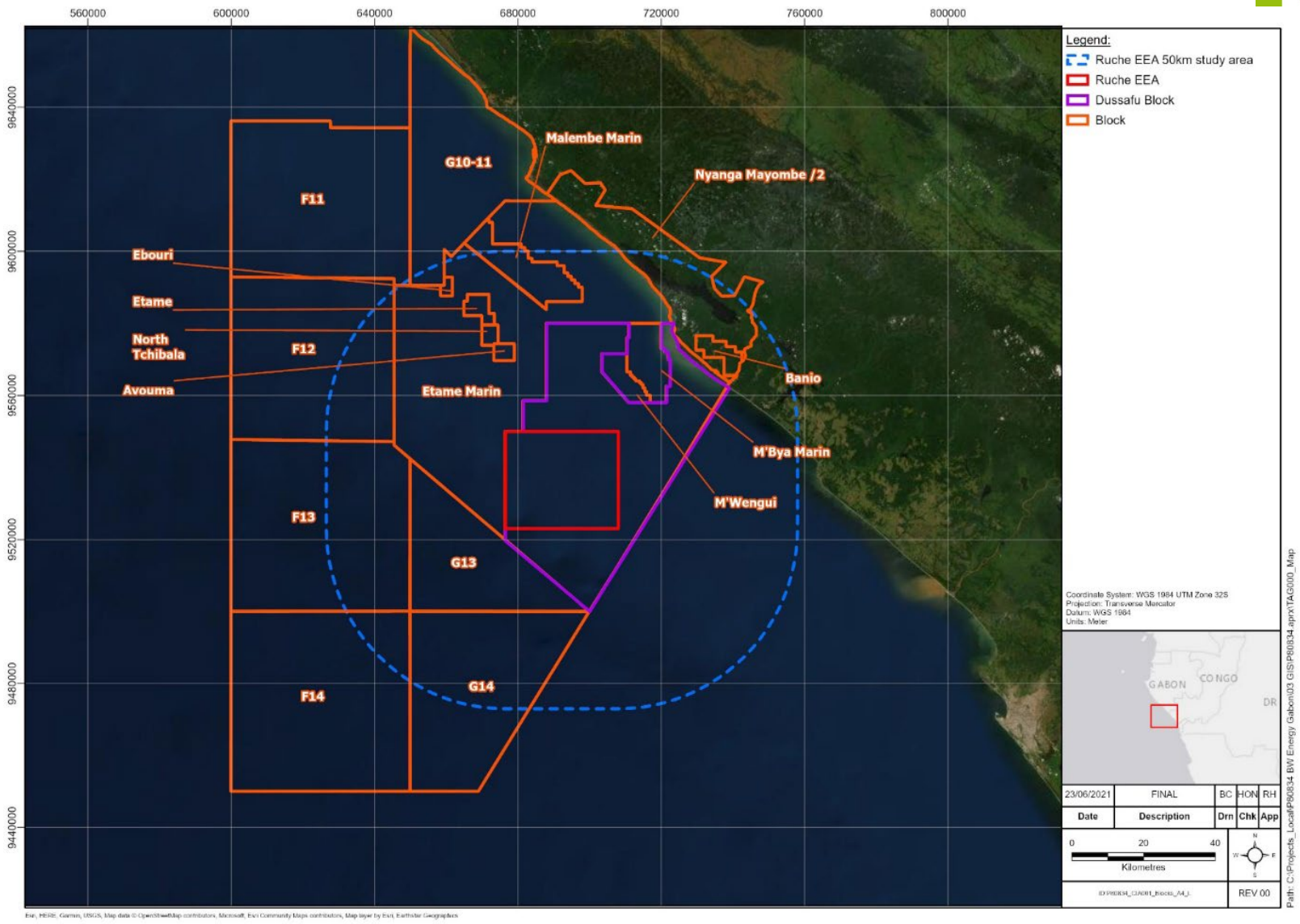

Figure 10.6: Oil and gas activity in the 50 km radius study area, Gabon

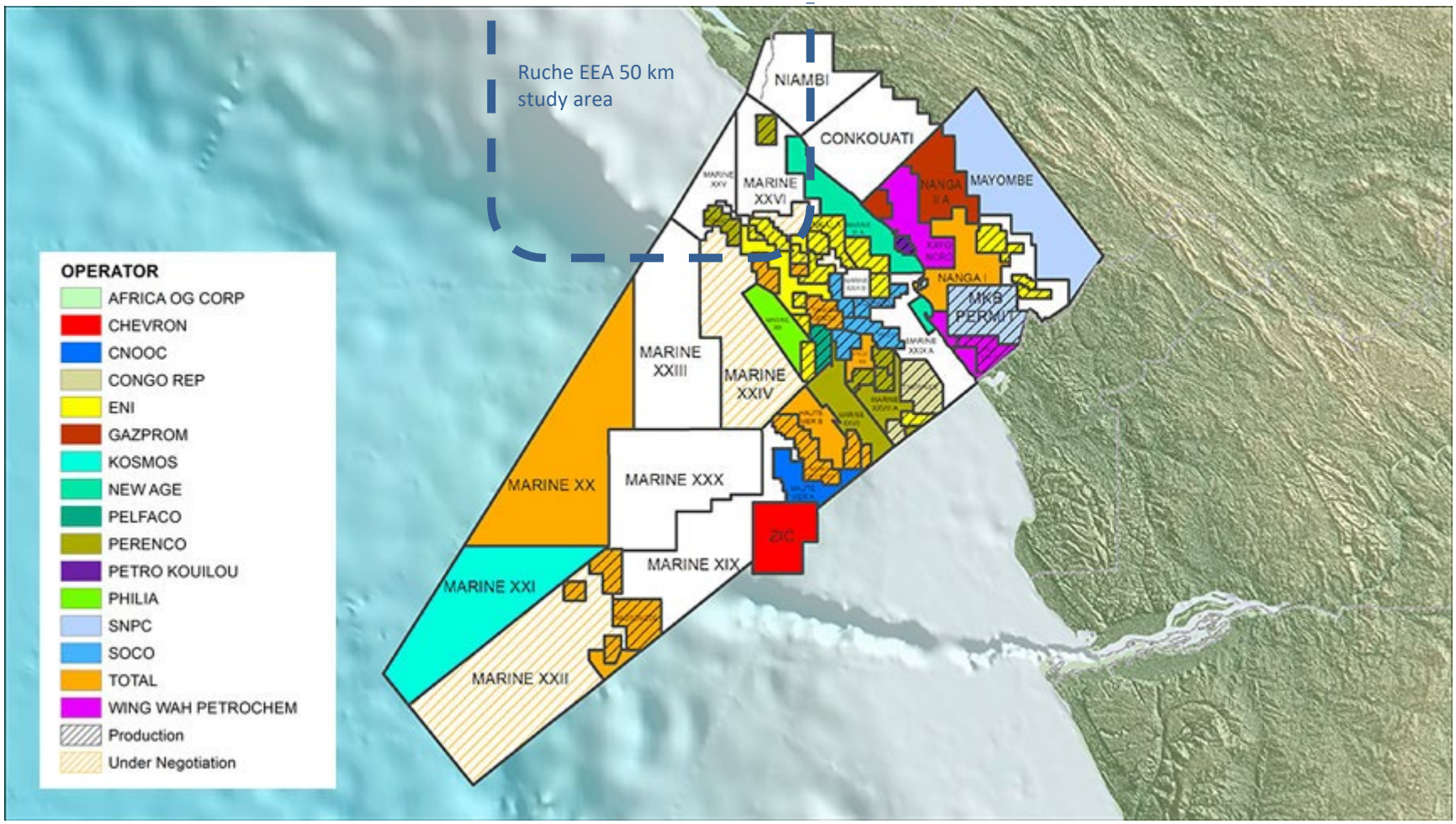

Figure 10.7: Oil and gas activity in the 50 km radius study area, Republic of Congo

Source: PGS, 2020

10.4.5 Reasonably defined or foreseeable third-party projects

Context

To provide some context for the country of Gabon, in 2009, a new economic vision was developed known as Emerging Gabon (Plan Stratégique Gabon Emergent - PSGE) which aims to help Gabon modernise and achieve emerging economy status by 2025. The strategy is built on three pillars (Oxford Business Group, 2021):

- Industrial Gabon (Gabon Industriel) aims to develop the country into an industrial centre of excellence, optimising oil and mining, construction, building materials, and agro-industrial transformation
- Green Gabon (Gabon Vert) has three major goals of sustainable forest management and transforming Gabon into a global leader in certified tropical timber production; developing agriculture and livestock farming sustainability to improve food security; and creating sustainable and responsible fisheries
- Gabon services (Gabon des Services) has the objective of making Gabon a centre of excellence in business, ecotourism and value-added services such as higher education and research, health, media and information technologies.

Spending on infrastructure outlined in the PSGE is largely determined by the country's National Infrastructure Master Plan (Schéma Directeur National d'Infrastructures, SDNI). The plan outlines key projects to be carried out by 2025 in various sectors including energy, telecoms, transport and tourism. In 2017, the Government made a strategic decision to pivot to the so-called 'Presidential Priority Projects' that were small in scale but large in social impact. These projects are not within the study area and not of a large enough scale to undertake a CIA.

Foreseeable third-party projects

Information on reasonably foreseeable third-party projects in the study area was sought from the Gabonese 'Ministry of Water, Forests, Sea and Environment' and the 'Ministry of Petroleum and Hydrocarbons'. At the time of going to print no response has been received from the relevant authorities.

The projects considered are therefore those with publicly available information. Appendix 10B provides a full list of the projects identified and whether the projects have been screened into the CIA. It should be noted that there may be other projects in the planning process, but no information was made available. It should also be noted that actual implementation status of third-party projects in the area is uncertain.

In 2018, the Gabonese State launched the 12th licensing round for the allocation of thirty-five (35) oil blocks from its sedimentary basin. Table 10.2 presents the licensing blocks in the 50 km radius study area. The deadline for submission was delayed due to the COVID-19 pandemic. The new closing date for the submission of tenders was 30th June 2021 (Gabon Offshore 12th Licensing Round, 2021). It has been assumed that following the licensing round, the operators will embark on exploration activities with the first phases involving seismic survey campaigns and exploration drilling.

Foreseeable third-party projects identified in the study area that have the potential for cumulative impacts with the BWE field development project are listed below:

- Exploration drilling in the Etame Marin block (offshore Gabon) scheduled for late 2021 and 2022
- Exploration drilling in Block F13 (offshore Gabon) work under the contract is planned to commence in the third quarter of 2021
- Offshore seismic activities in Blocks F11, F12, F13, G10-11, G13 and G14 (all blocks in 12th licensing round).

10.4.6 Induced development of facilities and services

As an offshore Project, it is unlikely that induced development will occur. This has therefore not been considered as a source of cumulative impact.

10.4.7 Other sources of human and natural stressors

Receptors are exposed to stresses, threats and pressures that are not directly connected with formal development. Consequently, they have not been considered as a source of cumulative impact and are assumed to be part of baseline and covered by the trend sections in Section 10.3.

10.5 Cumulative Impact Assessment

10.5.1 Introduction

Cumulative impacts are those from activities or events which individually may not be significant but may produce significant impacts on the same receptor(s) when combined with impacts arising from different sources that have an overlapping sphere of influence to the activities and events under consideration. Such effects may arise due to their proximity in space or time, or because a certain receptor is particularly sensitive.

To determine the cumulative impacts which could occur as a result of the proposed Project it is necessary to identify interactions between Project aspects and VECs, see Table 10.3. Once interactions have been identified, literature sources and modelling have been used to understand the potential impacts on VECs and how these impacts may change with the inclusion of future projects. The current condition of each VEC is taken into account, as well as any potential natural stresses and events.

Analysis of cumulative impacts on VECs focusses on estimating the future state of the VECs that may result from the impacts they experience from predictable third-party future developments. Past and existing third-party projects that continue to affect the current and predicted future of the receptor are also discussed in certain cases where it is important that trends are considered. The objective is to estimate the state of VECs from the aggregated stresses that affect them.

In CIA, impacts are measured not in terms of the intensity of the stress added by a given development but in terms of the VEC's response and ultimately, any significant changes to its condition.

Table 10.3: Cumulative impacts interactions table – intra Project and predictable third-party future developments

Aspect	VEC	Intra Project		Third party future developments			
		Tortue 1&2 Ruche 1&2	BW Adolo FPSO	Oil trans-shipment operations from BW Adolo FPSO	Exp drilling in Etame Marin Block	Exp drilling in Block F13	Seismic activities in Blocks F11, F12, F13, G10-11, G13, G14
Underwater noise – behavioural disturbance	Fish, marine mammals, turtles *	X	X	X	X	X	X
Discharges to marine environment – drill cuttings and produced water	Water quality and water column communities – fish *	X			X	X	
	Sediment quality and benthic communities	X	X		X	X	
Accidental introduction of alien invasive species	Marine fauna and ecosystems	X	X	X	X	X	X
GHG emissions	Climate	X	X	X **	X	X	X
Physical presence – facility exclusion zones	Fisheries / shipping	X	X		X	X	
Supply of materials / waste management	Onshore infrastructure	X	X	X	X	X	X

Notes:

* Potential for indirect impacts on the VECs of 'protected areas' and 'threatened or unique ecosystems' if a key species for which the site is designated, or which the site supports, is affected by cumulative impacts.

** In terms of GHG emissions, oil trans-shipment operations are classed as intra Project impacts (Scope 3 emissions) in Section 10.5.5.

Past and existing third-party projects that continue to affect the current and predicted future of the receptor are also discussed in certain cases in the following sections where it is important that trends are considered.

10.5.2 Underwater noise

10.5.2.1 Impacts on marine fauna

Noise is transmitted through water very efficiently and may be detectable over many kilometres from its source. This has led to concern that increasing anthropogenic activity in the sea, and consequent increasing noise levels, may have effects on marine fauna through interruption of their communication and hearing mechanisms. The potential outcomes of having multiple noise sources in the sea include more frequent masking, behavioural disruptions and short-term displacement, although this could potentially be mitigated by a certain level of habituation. Prolonged or repeated disturbance is generally considered to be of more concern than isolated short-term disturbance.

Receptors commonly acknowledged to be sensitive to underwater noise, and present within the study area include marine mammals, turtles and fish (of these marine mammals are considered the most sensitive). As presented in the Critical Habitat Assessment (Chapter 6), two species of marine mammal (humpback whale and Atlantic humpback dolphin), one species of turtle (leatherback) and eleven species of fish have been identified as the VEC 'species of conservation importance'. In addition, impacts on 'species of conservation importance' can have an indirect effect on the VEC 'protected areas' as these species are often the reason for the designation of sites (e.g., Mayumba National Park and Mayumba Marine and Coastal EBSA is designated for the protection of leatherback turtle nesting and baleen whale migration routes).

Intra Project impacts

Underwater noise from Tortue Phase 1 and 2 and Ruche Phase 1 and 2 are mainly limited to non-impulsive, low intensity, continuous noise from drilling operations, installation of facilities (e.g., installation of OI and subsea flowlines using large construction vessels), and support / supply vessel operations. Operation of the BW Adolo FPSO associated facility is also included under intra Project impacts as it is considered an integral part of the Project.

Underwater noise from operation of the Hibiscus Alpha OI has been scoped out of the assessment as the hull of the converted jack-up MODU will not be in contact with the water column and noise sources of significance on this facility are anticipated to be minimal.

It should be noted that there is no bioaccumulation of sound in the marine environment, however, there is the potential for an additive effect if sounds from one activity coincide and overlap spatially and temporally with other concurrent activities.

Acoustic propagation modelling has been carried out for the Project (see Appendix 6A) using Rogers acoustic propagation model. The sound level at any given distance is a function of the sound level source and the propagation regime. Given the combination of water depth and frequency (strictly speaking the wavelength is the parameter) acoustic propagation has been characterised by a 15*log R relationship, see Figure 10.8. This figure includes the threshold level representing background noise[6].

[6] Considered to be in the range 100-120 dB re 1 µPa (rms), explained in more detail in Appendix 6A.

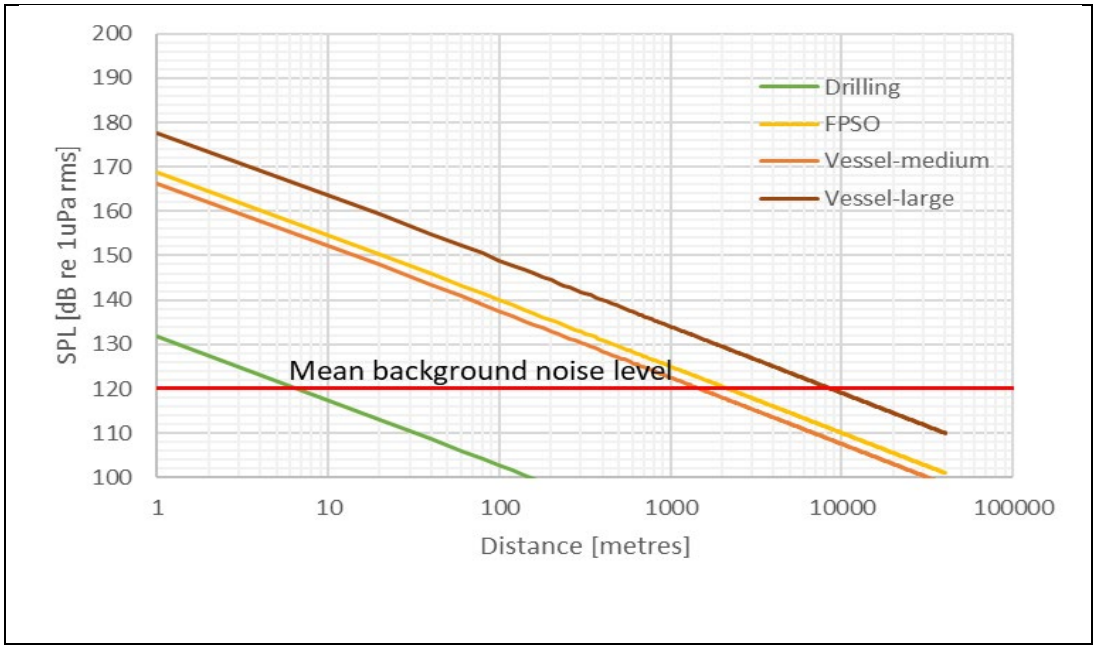

Figure 10.8: Source pressure level as a function of distance from the sound source

Figure 10.8 indicates that:

- Drilling noise (having the lowest source level) falls into the mean background noise level at a distance of approximately 8 m from the source.
- Medium sized vessels and the FPSO have similar source levels and it is expected that the noise generated becomes indistinguishable from the background at a distance of 1.5 – 2 km.
- The noise from large-sized vessels (e.g., vessel for installing Hibiscus Alpha OI, pipelay barge(s)) could remain audible out to a distance of approximately 9 km.

These results correlate with the marine mammal behavioural response distances described in Section 6.4.2.2, as 120 dB re 1 µPa (rms) was also used as the threshold level of noise potentially giving rise to behavioural effects in all cetacean groups.

Based on the above, zones of disturbance to marine mammals[7] are only anticipated to overlap spatially and temporally from installation of the flowline (operation of the pipelay barge(s)) and operation of the FPSO, however, it should be noted that the pipelay barge(s) will only be onsite for a limited period of time (13 days for flowline and umbilical installation) so the duration of additive effects will be very limited. Supply vessels visiting the facilities in the Ruche EEA will also result in overlapping zones of disturbance, but this will be transient and short lived as the vessels transit between the logistics base and the Ruche EEA.

Mitigation measures to address the impacts of underwater noise have been presented in the Critical Habitat Assessment in Chapter 6. Those of particular relevance to the intra Project cumulative impacts described above are as follows:

[7] Discussion focuses on zones of disturbance to marine mammals as zones of disturbance of turtles and fish are significantly smaller. Physical injury zones are considered to be too limited to result in cumulative impacts between the intra project activities / facilities, see Section 6.4.2.2.

- The FPSO is moored so propeller and thruster usage will be minimised
- Large construction vessels will only be used during the facility installation period, medium sized support / supply vessels will be utilised for ongoing operations and maintenance
- Support / supply vessel transfers from the logistics base at Port Gentil to the Ruche EEA will be optimised (3 transfers per month during operations).

Overall, the cumulative impact of underwater noise on marine mammals, turtles and fish from overlapping zones of disturbance from intra Project activities is considered to be minor. Although the sensitivity of the VECs are high, significant changes to their preferred condition are not anticipated (population numbers anticipated to remain stable) from the temporary overlapping disturbance effects. No additional mitigation measures are considered necessary.

Third-party impacts

Within the 50 km radius study area third party activities with the potential for underwater noise cumulative impacts include:

- Oil transhipment operations from the BW Adolo FPSO
- Exploration drilling in Etame Marin Block and Block F13
- Seismic activities in the blocks currently in the 12th Gabon licensing round.

These are discussed in more detail below.

Oil transhipment operations

Transhipment consists of pumping crude oil stored in the BW Adolo FPSO to oil transportation tankers. It is carried out with the assistance of two vessels.

According to McKenna et al (2011), crude oil tankers have source levels of 179 – 182 dB re 1µPa @ 1m (20-1000 Hz). These source levels are similar to those of the FPSO and therefore it is expected that noise generated by the tankers will become indistinguishable from the background at a distance of 1.5 – 2 km, which also correlates to the marine mammal behavioural impact zone.

There will therefore be some spatial overlap of underwater noise (and marine mammal behavioural impact zones) from the BW Adolo FPSO, the visiting tankers and the assistance vessels. It should be noted, however, that only one transhipment per month is currently planned.

Exploration drilling in Etame Marin Block and Block F13

Based on the propagation of drilling noise modelled above, mean background noise levels are predicted at a distance of approximately 8 m from the source, therefore no spatial overlap of drilling noise is anticipated with underwater noise generated from activities in the Ruche EEA.

Seismic activities in the 12th Gabon licensing round blocks

Blocks F11, F12, F13, G10-11, G13 and G14 are currently in the 12th Gabon licensing bid, see Section 10.4.5. It is assumed that these blocks will be subject to seismic survey, and potentially exploration drilling, in the next 2-3 years.

Seismic surveys use airguns - impulsive underwater transducers that produce high energy, low frequency sound waves by the rapid release of compressed air from an underwater piston. According to Evans and Nice (1996), high resolution seismic surveys have an average source level of around 230 dB re 1 µ Pa @ 1m and estimated received levels (based on spherical spreading) can still be above background more than 10 km away from the source.

There is therefore the potential for spatial overlap of underwater noise (and marine mammal behavioural impact zones) from seismic surveys in close proximity to the Ruche EEA (e.g., in Block G-13) with BWE Project activities.

It is assumed that the third-party oil and gas companies conducting seismic surveys in the blocks surrounding the Ruche EEA will carry out their activities in line with international good practice (e.g., soft start of airguns, marine mammal observers, etc), and with the 'Guidelines for minimising the risk of disturbance and injury to marine mammals and sea turtles during offshore seismic exploration within and in proximity to Gabon's National Parks' (ANPN, 2015), however BWE's control and influence over these operators is limited.

Overall, the cumulative impact of underwater noise on marine mammals, turtles and fish from overlapping zones of disturbance from third party activities and Ruche EEA field development activities is considered to be minor. Although the sensitivity of the VECs are high, significant changes to their condition are not anticipated (population numbers anticipated to remain stable) from the temporary overlapping disturbance effects. The Ruche field development Project impacts have a limited / negligible contribution to cumulative impacts in this case. No additional mitigation measures are considered necessary.

Repeated underwater noise impacts

The sections above focus on the spatial and temporal overlap of underwater noise and marine mammal behavioural impact zones. However, a more important consideration is the potential for incremental cumulative underwater noise impacts from present and future activities resulting in repeated injury and disturbance (behavioural response) of marine fauna and the subsequent health of the populations (marine mammals, turtles and fish).

A number of 'species of conservation concern' are particularly sensitive to anthropogenic impacts whilst in Gabonese waters. Humpback whales are sensitive during their time in the Gulf of Guinea owing to the strain put on them from migrating with little food intake, and from breeding (ANPN, 2015). Leatherback turtles are sensitive as they are migrating to Gabonese beaches for nesting.

Figure 10.5 shows the high density of oil and gas operations in Gabonese waters and illustrates the potential for multiple underwater noise impacts as marine mammals and turtles move along the coast. Figure 7.12 shows that third party vessels follow shipping routes following the coastline of Gabon providing another source of underwater noise.

Rosenbaum et al (2014) assessed the potential overlap between humpback whale habitat and anthropogenic activities in the South Atlantic Ocean (using satellite monitored radio tags) and concluded that the highest degree of range overlap with anthropogenic activities (oil platforms, toxicants and shipping) was within the EEZs of Cameroon, Gabon and Nigeria. All whales passed oil platforms that have been or are associated with

exploration (existing oil and gas leases and seismic surveys), development (construction) and production activities indicating that the majority of breeding habitat is likely to fall within areas where hydrocarbon industry is present, see Figure 10.9.

The long term, synergistic and cumulative impact of sound sources is not known, and the introduction of additional low frequency noise into the marine environment from the Ruche EEA field development should be considered to have the potential to contribute to the overall cumulative effect of anthropogenic generated underwater noise.

Mitigation measures to minimise impacts of underwater noise have already been listed earlier in this section. In addition, it should be noted that:

- The Hibiscus Alpha OI design (converted jack-up rig) allows facility installation without the requirement for high noise impulsive piling activity.
- Project vessels will follow the Vessel Code of Conduct, see Biodiversity Action Plan (Appendix 11A – Appendix A).

It should be noted that no good practice guidelines exist for underwater noise associated with drilling or production activities since these are thought to be of low concern in terms of disturbance to marine fauna (JNCC, 2010).

Overall, it is considered that repeated injury / disturbance of marine fauna from existing oil and gas operations in Gabonese waters, third-party shipping activities along the coast, and the Ruche field development has the potential for more significant cumulative impacts due to the sensitivity of certain 'species of conservation concern' whilst in Gabonese waters and possible changes to the preferred condition of these species (which could have an indirect impact on the Mayumba National Park / EBSA as this site is designated for nesting turtles and migratory baleen whales visiting its waters). However, the Ruche field development Project is considered to be a small contributor to the cumulative impact on the VECs; the main source is shipping. Mitigation measures commensurate with the magnitude and significance of Ruche's residual contribution to the cumulative impacts have been presented.

Humpback whale populations in the southern hemisphere are managed by the International Whaling Commission (IWC)[8], an intergovernmental organisation charged with the conservation of whales and the management of whaling (Rosenbaum et al 2014). Regional management measures are required in order to mitigate impacts from multiple anthropogenic sources on this species. BWE's degree of influence is limited but will attempt to promote dialogue between the key parties which include the IWC, the conservator of Mayumba National Park (Wynand Viljoen) and the Wildlife Conservation Society (Tim Collins).

[8] The IWC assesses cetacean status by population rather than by species. This is because the majority of species exist in several different areas and groups. Within a single species there may be one population that is feared to be close to extinction and one that is believed to be thriving.

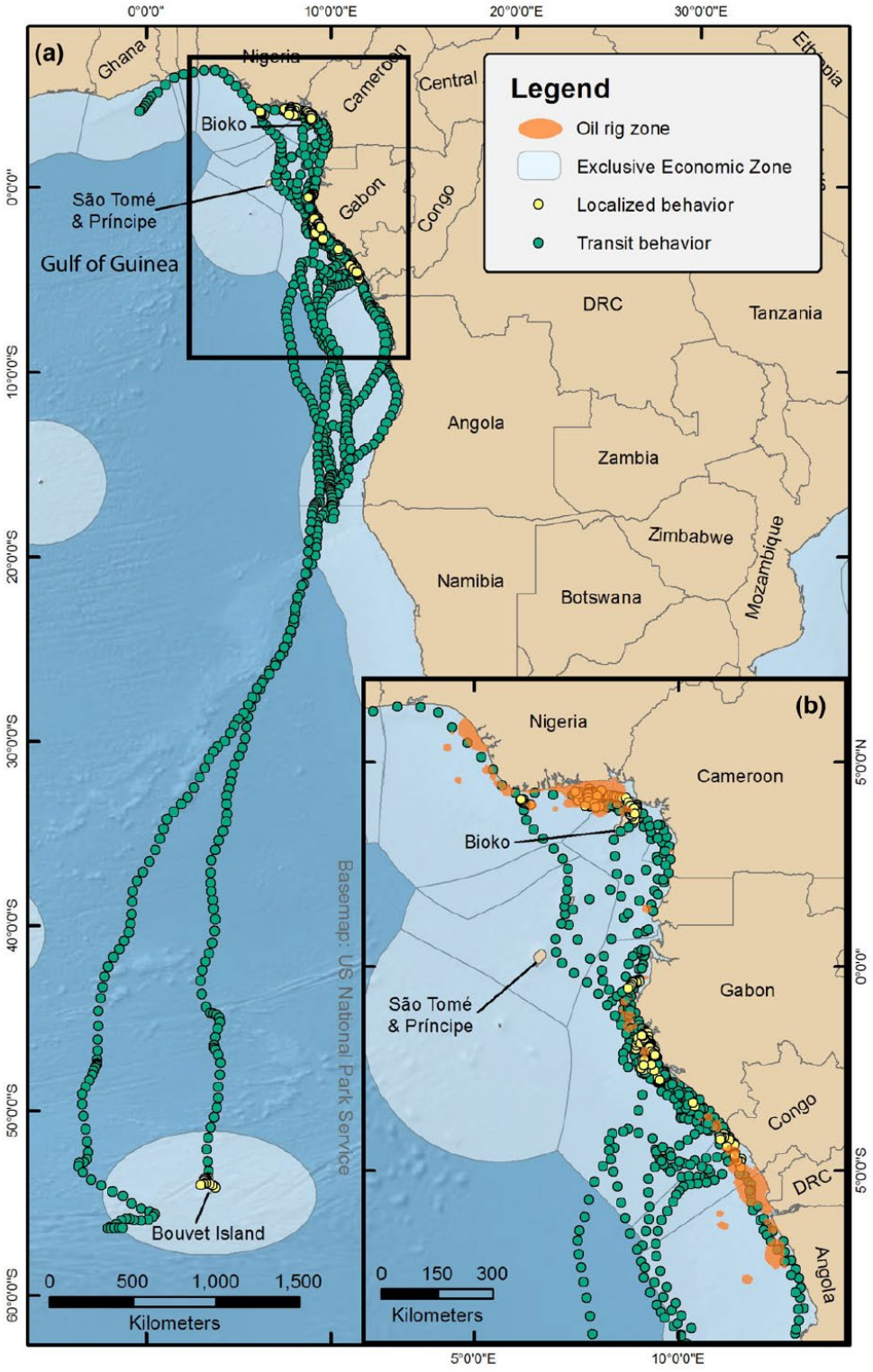

Figure 10.9: a) Results of the state-space model for all whales in relation to EEZs and b) extent of potential overlap of whale locations with oil platform zones

Source: Rosenbaum et al (2014)

10.5.3 Marine discharges

Discharges to sea from the Ruche Field Development Project are generated from several sources, as follows:

- drilling discharges - drill cuttings and associated drilling fluids, cement, and pipe dope
- facility installation and commissioning discharges – hydrotest water
- operational discharges – sanitary wastewater, food waste, drainage water, desalination unit discharges, cooling water, ballast water, produced water.

The majority of the above discharges are relatively small-scale, will be treated before release, and will be rapidly diluted in the offshore environment of the Ruche EEA with minimal impacts so the potential for cumulative impacts is not considered further.

In terms of cumulative impact, two discharges are considered for further discussion, namely: discharge of cuttings and associated fluids; and discharge of produced water.

10.5.3.1 Impacts from discharge of cuttings and associated fluids

Ellis et al. (2012) reviewed 26 papers and technical reports that surveyed sediment samples from 72 production or exploration platform sites to assess the zone of influence of sediment contamination and biological effects on benthic communities.

In terms of water-based fluids, elevated barium concentrations in sediment samples ranged between 1000-3000 m from the drill site before reaching background levels. Biological effects, including changes in community composition (loss of suspension-feeding species and increases in deposit feeders and polychaetes), were documented from 250 m to 2000 m. Increases in trace metals were observed within 250-500 m of the well site.

In terms of non-aqueous drilling fluids, maximum concentrations of synthetic tracers were detected at distances ranging from 100 to 2000 m from the discharge location. Biological effects associated with the release of synthetic base fluid cuttings were generally detected at distances of 50 to 500 m from well sites, although reductions in the abundance of a few taxa (such as bivalves and echinoderms) were detected out to 1000 m.

A regional study was conducted by Hernández Arana et al. (2005) in the Gulf of Mexico to determine the potential for cumulative effects where multiple wells are drilled in the same area. This involved sampling across an 8000 km^2 area that included 200 oil platforms, some of which had been operating since 1974. This study found that stations located in areas of high oil platform densities, or close to oil-related activities, had significantly lower abundance or biomass and different species composition than those stations located in areas of low platform density, or farther away from oil-related activities.

Intra Project impacts

According to the national ESIA / NEIA documents compiled for Tortue Phase 1 and 2 and Ruche Phase 1 and 2, approximately 735 t of water-based cuttings and 248 t of synthetic based cuttings are discharged per well.

The spatial extent of the cuttings pile depends on the volume of cuttings discharged and the tidal current regime in the area: in areas with strong currents, the cuttings piles often have an elliptical footprint with the long axis of the ellipse aligned with the predominant current direction (Breuer et al., 2004). Based on other wells drilled in Gabonese waters, with comparable quantities of cuttings discharged, it is predicted that the cuttings pile may extend up to 200 m from each well site, however, this cannot be confirmed without modelling.

Tortue Phase 1 and 2 involved the drilling of 6 wells in an area west of the Adolo FPSO. Figure 10.10 shows the distance between the Tortue Phase 1 well sites (DTM 2H & 3H) and the Tortue Phase 2 well sites (DTM 4, 5 6 and 7H) as approximately 500 m. Although cross-over of cuttings piles is not anticipated, based on the zones of effect described by Ellis et al (2012) above there is the potential for cumulative impacts on sediment quality and benthic communities from discharge of drill cuttings from these two phases. It should be noted, however, that the Tortue Phase 1 wells were drilled in 2018 therefore natural processes will have resulted in the cuttings piles diminishing over time and physico-chemical and biological recovery is likely to have taken place over this period. Some studies of benthic community change around single wells suggest that communities return to baseline conditions one year after the cessation of drilling (Currie & Isaacs 2005, Manoukian et al. 2010). In some cases, sensitive species remain depressed one year after drilling (Menzie et al. 1980).

The Ruche Phase 1 and 2 wells are ~20 km distant from the Tortue wells therefore cumulative impacts are not anticipated between these two areas with respect to cuttings and drilling fluid discharge. The national ESIA of the Ruche Field Development Project assessed the impacts of Ruche 1 and Ruche 2 production drilling as a whole.

With respect to discharge of cuttings and drilling fluids, intra Project cumulative impacts between the different development stages are limited to those associated with Tortue 1 and Tortue 2. Given the age of the Tortue 1 cuttings piles, and the homogeneity of the benthic environment offshore Gabon (which is considered low sensitivity), it is considered that the seabed and benthic ecology impacts resulting from intra Project cumulative impacts will be minor with no significant changes to the preferred condition of the benthic communities. No additional mitigation measures to those listed in the Critical Habitat Assessment (see Section 6.4.1.4) are proposed.

Third party impacts

In addition to drilling activities in the Ruche EEA, there will be exploration drilling in the neighbouring Etame Marin Block and Block F13 in 2021 / 2022 (see Figure 10.6). Although the location of the well sites within the blocks is not known, given the distances involved and the limited zone of impact around the well sites from drill cuttings discharge, cumulative impacts between the third-party and Ruche drilling activities are predicted to be negligible with no significant changes to the preferred condition of the benthic communities. No additional mitigation measures are considered necessary.

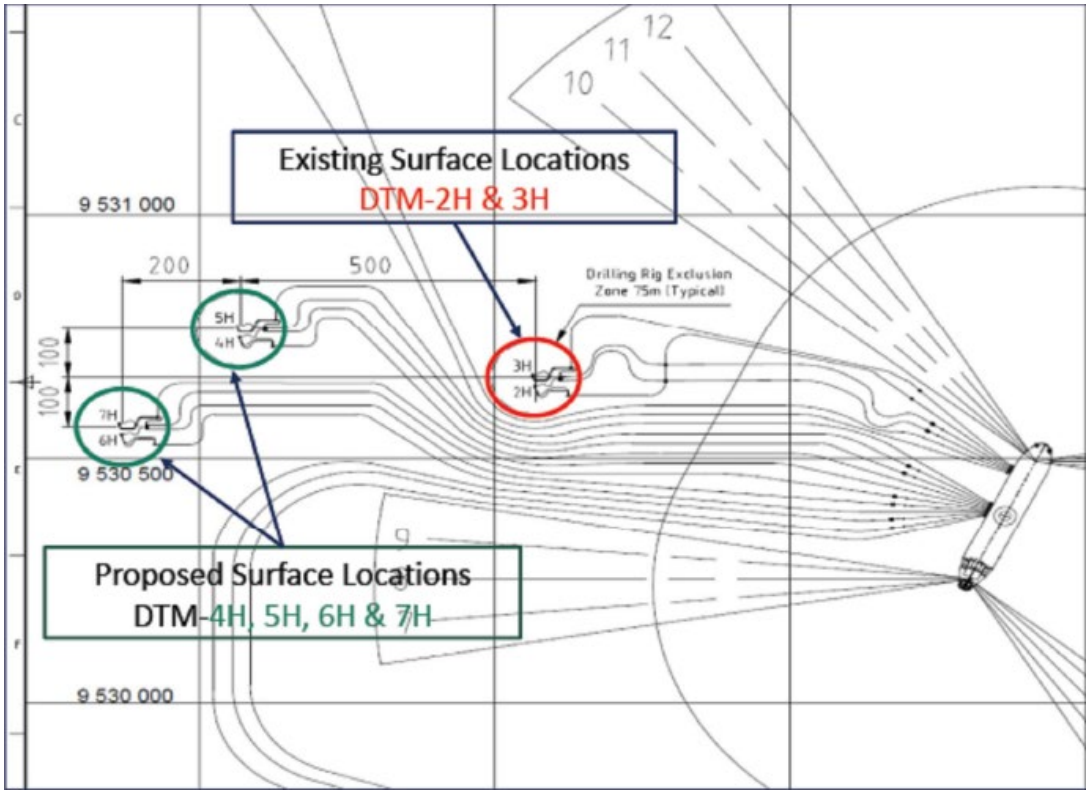

Figure 10.10: Location of Tortue Phase 1 and Tortue Phase 2 wells

10.5.3.2 Impacts from discharge of produced water

Produced water is the largest effluent discharge associated with offshore oil and gas production. The environmental impact potentially caused by produced water is related to the fate and transport of its individual components including organic and inorganic compounds (e.g., petroleum hydrocarbons, heavy metals, nutrients, natural radionuclides) associated with the formation water and production chemicals.

Intra Project impacts

Produced water will be discharged from the Hibiscus Alpha OI and the Adolo FPSO during production. The quantities discharged over the life of the field are presented in Figure 2.5.

Hydrodynamic modelling of the produced water discharge from the Adolo FPSO has been carried out using DHI's Mike 3 software platform to analyse the effluent dilution into ambient seawater (see Appendix 6B). The modelling was based on the design capacity of the BW Adolo FPSO (60,000 bbl/d of produced water) using the parameters of temperature (46.11°C) and salinity (279 PSU). The results show that the plume of produced water released at the sea surface remains in the top 20 m of the water column and dilutes quickly with ambient temperature and salinity conditions being reached approximately 300 m from the FPSO[9]. Considering the distance between the Hibiscus

[9] Combined modelling of produced water and cooling water from the BW Adolo FPSO and Hibiscus Alpha OI showed ambient temperature and salinity conditions being reached at approx. 300 m from the FPSO and almost ambient conditions at 500 m from the HA OI. See Appendix 6B.

Alpha OI and the BW Adolo FPSO (approximately 20 km) there will be no interaction between the produced water discharge plumes.

Water quality in the area will be affected on a local level, however, this will not affect the water quality in the surrounding environment as a whole. Marine fauna (fish species) may be affected by the discharge to a very localised extent however this is likely to be transitory and of low intensity.

Overall, the cumulative impacts of produced water discharge from intra Project activities are considered to be minor with no significant changes to the preferred condition of the water quality or marine fauna (fish species). No additional mitigation measures to those listed in the Critical Habitat Assessment (Section 6.4.1.4) are proposed.

Third party impacts

Future exploration activities in the blocks surrounding the Ruche EEA may lead to full field development which will generate produced water as part of production, however, the uncertainty regarding commercial viability of these blocks is too high to include in the assessment of cumulative impacts.

In terms of existing facilities, there is produced water discharge at the Etame Field where four subsea wells are connected to an FPSO (located approximately 20 km north-northwest of Ruche EEA boundary) and in the M'bya / Mwengui Fields where offshore wells are connected to the Mayumba FPSO (located approximately 10 km north-northeast of the Ruche EEA boundary). Given the distance between these facilities and the Ruche EEA no mixing of produced water plumes is anticipated.

Continuous discharges of produced water from existing oil and gas facilities in the Gabonese EEZ and the Ruche Field Development still represent a concern, however, as they are a large source of crude oil and polyaromatic hydrocarbon (PAH) contamination to sea. Both risk-based modelling and effects-based monitoring in literature indicate only mild acute effects in populations of water-column biota are caused by these produced water discharges. More recently, however, the attention of effects-based offshore studies has shifted towards possible effects that may result from chronic, low-concentration exposures, especially in populations of fish species (Beyer et al. 2020). National or regional management measures would be required if further studies indicate that chronic exposures are having a significant impact on water column biota.

Overall, it is considered that produced water discharge from existing oil and gas operations in Gabonese waters and the Ruche field development has the potential for more significant cumulative impacts on fish species (particularly considering that there are critical habitat triggering fish species within the AOI) and possible changes to the preferred condition of these species (which could have an indirect impact on the Aquatic Reserve of the Great South of Gabon which has been designated to promote biodiversity conservation and the recovery of fish stocks).

In summary, there is a high risk of potential cumulative impacts, but the Ruche field development Project is a small contributor to the cumulative impact on the VECs. Mitigation measures commensurate with the magnitude and significance of its residual contribution to the cumulative impacts have been presented in Section 6.4.1.4. BWE would support any regional studies on produced water impacts coordinated by the Gabonese authorities.

10.5.4 Alien invasive species

10.5.4.1 Impacts on marine fauna and ecosystems

Ecological impacts of alien invasive species (AIS) range from single species interactions and reduction in individual fitness of native species to population declines, local extinctions, changes in community composition, and effects on entire ecosystem processes and wider ecosystem function (Blackburn et al., 2014; Katsanevakis et al., 2014).

Intra Project impacts

The impact of accidental AIS introduction as a result of intra Project activities is discussed in Sections 6.4.1.5 and 9.4.1.5. Residual impacts on marine fauna and ecosystems have been categorised as minor because a Project-specific AIS Management Plan has been developed for the Ruche EEA field development that focuses on the prevention of AIS introduction.

Third-party impacts

Cumulative impacts from the combined activities in the Ruche EEA and those of third parties are difficult to determine with respect to the accidental introduction of AIS. However, it is assumed that the more vessels that are involved in international traffic associated with these projects, the higher the likelihood of the introduction of AIS through ballast water exchange, biofouling and physical introduction.

In particular, ballast water from oil transportation tankers (such as those involved in oil transhipment operations from the BW Adolo FPSO) is a highly significant potential AIS pathway because of the high possible survival rate of biota in ballast tanks, the large volumes of water exchanged and the likelihood that multiple ports will be visited during a trip. Support / supply vessels for the future exploration drilling, and vessels associated with future seismic activities in the blocks surrounding the Ruche EEA are another potential source of AIS introduction as they are likely to be specialised vessels that are involved in international operations and therefore have a higher likelihood of transporting non-native AIS from other parts of the world.

The installation of oil and gas facilities on the continental shelf of Gabon creates new habitat by introducing hard surfaces in an area of predominantly soft substrate. While this can be recognised as a benefit for biodiversity through the creation of islands, there is also the potential that the infrastructure could be a vector for AIS. Friedlander et al (2014) studied the marine communities associated with oil platforms in Gabon and highlighted the unique ecosystems associated with them. At least one potential invasive species *Carijoa riisei* was observed on the platforms and *Tubastracea* species dominated the older platforms in the north. It was concluded that oil platforms may act as stepping-stones, increasing regional biodiversity and production but they may also be vectors for invasive species. The more oil and gas infrastructure that is installed in Gabonese waters the more habitat is created for the potential spread of AIS.

Accidental introduction of AIS has the potential for significant impacts on the whole marine ecosystem and critical habitat triggering species (which could have an indirect impact on the Aquatic Reserve of the Great South of Gabon, and Mayumba National Park / EBSA which have been designated to protect the biodiversity of the area).

In summary, there is a high risk of potential cumulative impacts, but the Ruche field development Project is a small contributor to the cumulative impact on the VECs, particularly as a Project-specific AIS Management Plan has been developed. It is assumed that vessel activities associated with oil transhipment and future projects in the vicinity of Ruche EEA by third parties will be carried out in compliance with the International Convention for the Control and Management of Ship's Ballast Water and Sediments (BWM Convention). BWE would support any regional studies on AIS impacts coordinated by the Gabonese authorities.

10.5.5 Greenhouse gas emissions

10.5.5.1 Impacts on climate change

Key concepts and definitions

GHG emissions are inherently cumulative, as all emissions have the same impact on the same ultimate receptor. The impact is climate change, or global warming, caused by the radiative forcing effects of GHGs in the atmosphere. The affected receptor is the global climate and all the ecosystems and biomes that depend on it.

Climate scientists predict impacts based on global emission scenarios – the balance of GHGs emitted and absorbed (fixed or stored) over a defined period – and the resultant changes in levels of GHG concentrations in the atmosphere. It is impracticable to attribute a particular impact to a particular emission.

Global efforts to mitigate climate change are primarily based on reducing net emissions of GHGs on a burden-sharing basis among nations. For this reason, we have defined the VEC as Gabon's GHG emissions, as Gabon is where the Project's Scope 1 and Scope 2 emissions will occur. The concept of emission 'scopes' is defined by the GHG Protocol (2004). Scope 1 emissions are those that occur directly from sources owned or controlled by a defined entity. Scope 2 emissions are those that occur due to the import of energy (electricity or heat) to that entity. These occur at the place where that energy is generated, e.g., a power station. They are therefore termed indirect emissions.

Scope 3 emissions are all other indirect emissions. These can occur upstream of an activity, e.g., in the production and supply of materials to that activity, or downstream, e.g., in the use of the product of an activity. In today's globalised society, many Scope 3 emissions occur in nations other than where the activity or entity whose emissions are under consideration is located. This is particularly relevant for a Project such as the Ruche EEA development, where the oil will be exported.

GHG emissions are comprised of several individual GHGs. Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are the principal ones to be emitted by the Project. Emissions of other GHGs will be negligible. The individual gases have a radiative forcing effect and their relative power to cause that effect over a defined timescale can be defined. This is carried out by the Intergovernmental Panel on Climate Change (IPCC) in their periodic assessment reports. The result is global warming potentials (GWPs) of gases. GWPs are defined relative to CO_2 which has a GWP of 1. The most common time period over which GWPs are defined is 100 years and that is the period used in this assessment. The GWPs used for CH_4 and N_2O are 28 and 265 respectively. These are from the IPCC's AR5 (Myhre et al., 2013). A unit mass emission of a mixture of gases can then be multiplied by their GWPs and aggregated to create an emission of total

GHGs, which is measured in carbon dioxide equivalent (CO_2e) and this is basis of the reporting of emissions quantities in this assessment.

Intra Project impacts

Table 2.5 in Chapter 2 presents an inventory of the Ruche EEA development GHG emissions from estimates developed by BWE (2022)[10]. Its coverage is limited to the Project's Scope 1 and 2 emissions and three categories of Scope 3 emissions. A summary is presented in Table 10.4.

Table 10.4: Summary of project GHG emissions in Gabon

Category	Comprising sources	Emissions over Project life ($ktCO_2e$)
Scope 1	Fuel gas and liquid fuels consumed on Hibiscus Alpha OI and BW Adolo FPSO for power and heat generation Flaring of gas	2954
Scope 2	Import of electricity to onshore facilities (yards, logistics base, offices)	2
Scope 3	Drilling: consumption of diesel in rig engines for power generation Support vessels: consumption of marine fuel oils in hook-up and installation vessels and production support vessels Helicopters: consumption of aviation kerosene in helicopters supporting drilling and production	386

This inventory quantifies a large proportion of the emissions that will occur in Gabon. The Scope 1 and 2 emissions are considered to be close to fully complete in the scope of their estimation. BWE states within the inventory that "an estimate of emissions from non-combustion sources (fugitive sources, cold venting and fluorinated gases) shall commence starting with the 2022 reporting period". These emissions are not likely to be significant relative to the sources that have been quantified.

Scope 3 emissions is an unbounded dataset – sources of emissions can be many layers of control outside that of the Project and it is impossible to collate all emissions, or even to estimate what proportion is represented. The Project's highest emission sources are Scope 3 emissions in the downstream lifecycle of the oil, and the majority will occur outside Gabon. A selection of some of the most significant of these has been estimated by RSK and the results are presented in Table 10.5. These estimates are subject to a higher degree of uncertainty than those in Table 10.4 as they require assumptions around

[10] A limited-scope assurance and validation of these emissions estimates was undertaken by RSK.

where the oil is shipped to, the products it is used to make, and the GHG emissions associated with the various processes involved to 2038.

Table 10.5: Summary estimate of major downstream Scope 3 GHG emissions

Emission source	Lifetime emission estimate ($ktCO_2e$)	Source
Crude oil transport – emissions from shipping to export markets	1,513	Production rates detailed in Table 2.1 assumed constant between respective Project phase start-ups and end of 2038. Refinery yields based on 2020 data from EIA (2022). Lifecycle emission factors from Cooney et al (2017).
Crude oil refining – emissions from crude oil refining	20,391	
Refined product transport – transport of refined product from refinery to point of sale	2,323	
Refined product combustion – combustion of refined product in stationary and mobile applications	198,898	IPCC (2006) emission factors applied to refinery product yields as generated above. Average of factors for stationary and mobile combustion used.
Total	**223,125**	

As discussed in Section 10.3.2 and above, the VEC related to GHG emissions and climate change is Gabon's total emissions in the context of its commitment under the Paris Agreement.

The breakdown of the national emissions, excluding stored carbon in biomass as per the NDC basis, is as follows:

Table 10.6: Breakdown of Gabon's GHG emissions per NDC

Emission category	GHG emissions ($ktCO_2e$) in year		
	2000	2025 BAU	2025 controlled
Fossil fuel combustion – oil industry	265	163	163
Fossil fuel combustion – electricity	260	2600	1360
Fossil fuel combustion – transport	403	2013	1611
Fossil fuel combustion – other	503	503	413
Flaring	3870	1861	709

Emission category	GHG emissions ($ktCO_2e$) in year		
	2000	2025 BAU	2025 controlled
Land use change and forestry	80,000	165,000	61,000
Industrial processes	90	90	90
Waste	408	743	372
Agriculture	363	363	363
Total	**86,162**	**173,336**	**66,081**
		→ **62% reduction**	

All data are from the NDC (Gabon 2015). Data are mostly read from graphs and sometimes derived from other data within the document and may not, therefore, be 100% accurate. BAU = business as usual scenario, termed the 'trend' scenario in the NDC.

The 62% reduction between the BAU and controlled cases is the headline commitment of the NDC, though in the summary section at the front of the document it has been modified to a reduction of 'at least 50%'.

RSK has carried out analysis on BWE's emission estimates (as summarised in Table 10.4) to convert them into annualised figures for comparison with the NDC data. Calculations have been carried out for both 2025-specific emissions and an annualised average for the forecast period 2022 to 2038. The results are shown in Table 10.7.

Table 10.7: Annualised and 2025-specific Project emissions

Emission category	GHG emissions ($ktCO_2e$)	
	2025	Annual average, 2022 - 2038
Scope 1 only	321	152
- *combustion*	*141*	*96*
- *flaring*	*180*	*55*
Scope 1, 2 and 3*	342	168

* Scope 3 sources included are drilling, support vessels and helicopters

The main reason that 2025's emissions are projected to be significantly higher than the annual average in the field life is high flaring on the BW Adolo FPSO as significant excess gas is produced, whereas in later years as gas production diminishes towards zero, flaring reduces significantly gradually reducing the annual average emissions. 2025 is the second highest year for flaring (2024 is the highest).

A 100-day drilling programme for Ruche phase 2 which was stated to take place in '2024/5' in BWE's inventory was assumed to take place entirely in 2025. This does not have a significant effect on the results, as drilling is a relatively small contributor to the overall emissions.

The data shows that:

- In 2025, the Project's emissions are predicted to comprise 0.5% of the target national emissions to be achieved under the NDC commitment.
- The Project's combustion emissions on the BW Adolo FPSO and the Hibiscus Alpha OI comprise 87% of the planned 2025 emissions from fossil fuel combustion in the oil and gas sector in the NDC controlled scenario, and 25% of the flaring emissions. The targeted reductions in these two sectors would therefore seem to be made impossible and difficult respectively and will have to be compensated for with greater than planned reductions in other sectors to meet the NDC target.

The Project's most significant GHG emissions are, however, outside the VEC that we have defined. They occur when the oil is used, typically as refined fuels. The indirect emissions caused at that point are 67 times greater than the direct emissions in Gabon over the Project lifetime. Adding the emissions caused by transporting the crude, refining it and then transporting the refined products to the end user increases that factor to 76. For the world to move along an emissions pathway that is compatible with the Paris Agreement's aim to limit global warming, each nation in which these emissions occur will need to make commensurate reductions.

Third-party impacts

Future exploration activities in the blocks surrounding the Ruche EEA will have GHG emissions associated with them, which may become significant if commercially viable reserves are discovered and the blocks progress to full field development. In addition, Figure 10.5 shows the high density of oil and gas operations currently in Gabonese waters.

All of these Projects will have a cumulative impact on climate change from the emission of GHGs and could further exacerbate the difficulty in achieving future Gabonese NDC targets.

10.5.6 Physical presence

10.5.6.1 Impacts on other sea users

The presence of the drilling rig, Hibiscus Alpha OI and Adolo FPSO (and their respective safety exclusion zones) and vessel movements associated with facility installation and support / supply activities has the potential to impact other users of the sea in two principal ways:

- Reduction in sea area available for fishing; and
- Shipping navigation hazard.

These are discussed in turn below.

Intra Project impacts

Intra Project impacts are discussed in Section 8.2.

Third-party impacts

In terms of future Projects, exploration drilling in Etame Marin Block and Block F13 will introduce addition 500 m radius safety exclusion zones around the rigs whilst drilling activities are taking place. However, due to the distance from the Ruche EEA and the small extent of the exclusion zones, cumulative impacts on fisheries are anticipated to be minor. Likewise, the presence of the two drilling rigs in Etame Marin Block and Block F13 are unlikely to have a cumulative impact on shipping / navigation.

Cumulative impacts from physical presence of facilities on fisheries need to be considered with existing oil and gas operations along the Gabonese coast. Figure 10.5 shows the density of oil and gas operations in the area. Offshore from Mayumba operational oil fields include the M'Wengui, Malembe Marin and M'Bya Marin fields of Perenco and the Avouma, Ebouri, Etame and North Tchibala fields of Vaalco. Facilities in these fields all have safety exclusion zones associated with them with a more significant cumulative impact on commercial fisheries, especially taking into consideration that commercial fisheries are not permitted within Mayumba Marine Protected Area (Mongabay, 2014).

The presence of facilities in the Ruche EEA will be a minor contributor to overall cumulative impacts due to the small number of permanent facilities and safety exclusion zones. BWE will continue to liaise with the General Directorate of the Merchant Navy to minimise impacts to sea users.

10.5.7 Supply of materials / waste management

10.5.7.1 Impacts on onshore infrastructure

Intra Project impacts are discussed in Section 8.4.1 and 8.6.2.

Third-party impacts

Port of Port Gentil

The use of Port Gentil by existing and future oil and gas projects may result in increased demand on port infrastructure, which may exacerbate congestion levels currently experienced and increase the potential for vessel collision, particularly in the port approaches.

Port Gentil is operated by the Gabon Port Management (GPM) on behalf of OPRAG (Office des Ports et Rades du Gabon) and is considered a medium-sized seaport in terms of land use and volumes of cargo handled per year (World Port Source, 2021).

Given the low frequency of Project vessel visits to the port during drilling (15 support / supply vessel transfers per month) and particularly during operations (3 support / supply

vessel transfers per month) the Project's contribution to cumulative impacts on onshore infrastructure is anticipated to be negligible.

BW Energy will continue to liaise with GPM and OPRAG to ensure compliance with regulations and rules whilst operating in the vicinity of the Port.

Waste management

A Waste Management Plan for the Ruche EEA is in place which is in accordance with MARPOL requirements, relevant Gabonese legislation, and international good practice. Waste requiring disposal onshore is transported to Port Gentil for onward disposal using registered waste disposal contractors (Enviropass, 2017a).

Given the relatively small amount of hazardous and non-hazardous wastes generated, the Project's contribution to onshore infrastructure cumulative impacts is anticipated to be minimal. No additional mitigation measures are proposed.

10.6 Management and Monitoring

10.6.1 Introduction

The effective management of cumulative impacts requires collaboration of all parties that contribute to these cumulative impacts. Ideally, cumulative impact management should be led by government entities that have direct influence on proponents, in order to identify the contributions of each actor and establish the mechanism to handle the cumulative effects. International best practice establishes that individual proponents should mitigate the effects generated by their project and, at a minimum, support and influence cumulative effects management strategies (IFC, 2013).

BWE will comply with IFC Guidance Note 42, which specifies that commercially reasonable attempts should be made to engage relevant stakeholders (e.g., government authorities, affected communities, other developers) in the assessment, design and implementation of coordinated mitigation measures to manage the potential cumulative impacts resulting from multiple developments in the Project's area of influence.

10.6.2 Management of cumulative impacts

The cumulative impacts identified in this assessment are summarised in Table 10.8 which also lists further actions for BWE to mitigate cumulative impacts either by management and/or monitoring, and collaborative mitigations where BWE will engage and liaise with other proponents (or the Gabonese authorities) to further understand, assess or manage potential cumulative impacts or improve overall management of cumulative impacts to the general benefit of both or all parties.

BWE will use commercially practicable efforts to engage relevant government authorities, other developers and other relevant stakeholders, in the implementation of coordinated mitigation measures to manage the potential cumulative impacts. This will be undertaken in accordance with BWE's Stakeholder Engagement Plan.

Table 10.8: Summary of CIA findings and management / mitigation measures

Aspect / Impact	Cumulative impact	Management / mitigation measures
Underwater noise - impacts on fish, marine mammals, turtles*	• Intra Project – risk of CI minor • Third party – risk of CI minor in terms of overlapping zones of disturbance, but higher risk of CI from repeated disturbance from UW noise from Project and third-party projects, and shipping, along marine mammal migration route	Mitigation measures presented in Critical Habitat Assessment and repeated in Section 10.5.2 for ease of reference
		BWE will undertake stakeholder engagement with the International Whaling Commission, the conservator of Mayumba National Park (Wynand Viljoen), and the Wildlife Conservation Society (Tim Collins).
Discharge of cuttings - impacts on water quality and benthic communities*	• Intra Project – risk of CI minor • Third party – risk of CI negligible	Mitigation measures presented in the Critical Habitat Assessment in Chapter 6
Discharge of produced water - impacts on water quality and marine fauna (fish)*	• Intra Project – risk of CI minor • Third party – risk of CI minor in terms of overlapping discharge plumes, but higher risk of CI from chronic exposure to PW discharged from project and third-party projects	Mitigation measures presented in the Critical Habitat Assessment in Chapter 6
		BWE will support any regional studies on produced water impacts coordinated by the Gabonese authorities
Accidental introduction of alien invasive species – biodiversity and ecosystem impacts	• Intra Project – cumulative increased risk of AIS introduction minor • Third party – cumulative increased risk of AIS introduction more significant due to additional vessels and tankers involved in international traffic and more O&G infrastructure creating habitat for AIS spread	Project-specific Alien Invasive Species Management Plan
		BWE will support any regional studies on AIS impacts coordinated by the Gabonese authorities
Emissions of GHGs - impacts on climate change	• Intra Project - projected GHG emissions in Gabon in 2025 represent 0.5% of target national emissions under the NDC. The sectoral contributions to the overall targeted reductions are made difficult, or impossible, by the Project's emissions and therefore greater than planned reductions will be needed elsewhere to compensate. The greater impact occurs indirectly, particularly in end use of the oil	BWE will design and operate its combustion equipment for optimum efficiency and minimise flaring through good oilfield practice BWE has no direct control over the indirect emissions downstream of the Project BWE will support any regional studies on GHG

Aspect / Impact	Cumulative impact	Management / mitigation measures
	• Third party – future exploration activities in surrounding blocks and existing oil and gas operations in Gabonese waters will all contribute to impacts on climate change and exacerbate the difficulty in achieving future Gabonese NDC targets	impacts coordinated by the Gabonese authorities
Physical presence - impacts to other sea users	• Intra Project – risk of CI negligible • Third party – risk of CI minor in terms of extent of safety exclusion zones, but higher risk of CI for fisheries if exclusion zones of all oil and gas facilities along Gabonese coast taken into account as well as MPA commercial fishery exclusions	BWE will carry out timely engagement with relevant stakeholders (e.g., government authorities, shipping companies, industrial fishing associations)
Pressure on onshore infrastructure (port facilities)	• Intra Project and third party – risk of CI negligible	BWE will continue to liaise with GPM and OPRAG to ensure compliance with regulations and rules whilst operating in the vicinity of the port

* Included within species of conservation importance VEC

10.7 Conclusion

This CIA process has been untaken to consider the potential effects of the Ruche EEA field development in-combination with other projects in the region.

The CIA takes into account the sensitivity of the VECs, however, the significance of the cumulative impact is determined qualitatively based on achieving the preferred condition, based on professional judgement. Mitigation measures have been proposed to reduce potentially negative cumulative impacts based on the mitigation hierarchy and the level of influence that BWE has on third-party operators.

The highest risk of potential cumulative impacts is considered to be the following:

- Cumulative effects of GHG emissions on climate change. Intra Project projected GHG emissions in Gabon represent 0.5% of planned 2025 national emissions[11]. The oil and gas sector's forecast contributions to the planned national emissions reductions under the Paris Agreement are rendered difficult, or perhaps impossible, by the Project. End use of the oil is estimated to create GHG emissions of 199 million tCO_2e over the Project lifetime. Third party future exploration activities in surrounding blocks, and existing oil and gas operations in Gabonese waters, will all contribute to impacts on climate change and exacerbate the difficulty in achieving future Gabonese NDC targets.

[11] Boundaries apply to the coverage of this dataset.

- Cumulative effect of repeated disturbance of marine fauna (in particular the critical habitat triggering humpback whale) from underwater noise generated by activities in the Ruche EEA, other oil and gas exploration and production operations in the AOI, and shipping activities along the Gabonese coastline which are all along the humpback whale migration route. Potential for indirect impacts on Mayumba National Park / EBSA designated for the protection of baleen whale migratory pathways.
- Cumulative effects of chronic exposure of marine fauna (particularly fish) to produced water discharged in the Ruche EEA and from other oil and gas operations in the AOI and along the Gabonese coastline. Potential for indirect impacts on the Aquatic Reserve of the Great South of Gabon that is designated for the protection of biodiversity and fish stocks.
- Cumulative increased risk of AIS introduction with the potential for impacts on marine fauna and ecosystems, and possibly indirect impacts on the Aquatic Reserve of the Great South of Gabon and Mayumba National Park that are designated for the protection of biodiversity.
- Cumulative effects on artisanal and commercial fisheries from safety exclusion zones in the Ruche EEA and in other oil and gas fields in the AOI and along the Gabonese coastline and from Marine Protected Area commercial fishery exclusions.

With the exception of GHG emissions, the Ruche EEA field development Project is a small contributor to the potential cumulative impacts listed above. As such mitigation measures commensurate with the magnitude and significance of its residual contribution to the cumulative impacts have been proposed as described in this ESIA Addendum.

To compensate for the predicted greater-than-planned GHG emissions from the oil and gas sector, Gabon will need to make commensurately greater-than-planned reductions in other sectors to fulfil its pledged contribution to global emissions reductions under the Paris Agreement. It is beyond the remit of this assessment to comment on the significance of the indirect emissions created downstream of the Project and outside of its control, most significantly in end use of the oil.

At the time of writing there were no ESIAs or detailed information on potential third party projects in the study area available within the public domain. It is therefore recommended that BWE keeps abreast of the projects being proposed in the Project AOI to best manage potential cumulative impacts.

REFERENCES

African Conservation Development (2019) Grande Mayumba Development Company signs Port Convention Agreement with OPRAG Available at https://africanconservationdevelopmentgroup.com/grande-mayumba-development-company-signs-port-convention-agreement-with-oprag/

ANPN (Agence Nationale des Parcs Nationaux) (2015). Guidelines for minimising the risk of disturbance and injury to marine mammals and sea turtles during offshore seismic exploration within and in proximity to Gabon's National Parks, 2015 – Edition 1 -En.

Beyer, J. Goksøyr, A. Øystein Hjermann, D, Klungsøyr,J. (2029) Environmental effects of offshore produced water discharges: A review focused on the Norwegian continental shelf, Marine Environmental Research, Volume 162, 2020, 105155, ISSN 0141-1136, https://doi.org/10.1016/j.marenvres.2020.105155.

Bianchi G (1992) Study of demersal assemblages of the continental shelf and upper slope of Congo and Gabon, based on the trawl surveys of the RV ''Dr. Fridtjoff Nansen''. Mar Ecol Prog Ser 85: 9–23.

Blackburn, T.M., Essl, F., Evans, T. et al. (2014) A unified classification of alien species based on the magnitude of their environmental impacts. PLoS Biology, 12, e1001850.

Bureau de Coordination du Plan Strategiques Gabon Emergent (2014) Plan Opérationnel Gabon Vert Horizon 2025.

Billes, A., Fretey, J., Verhage, B., Huijbregts, B., Giffoni, B., Prosdocimi, L., Albareda, D.A., Georges, J.Y. and Tiwari, M., (2006) First evidence of leatherback movement from Africa to South America. Marine Turtle Newsletter, 111, pp.13-14.

Breuer, E., Stevenson, A.G., Howe, J.A., Shimmield, G.A., (2004). Drill cutting accumulations in the Northern and Central North Sea: a review of environmental interactions and chemical fate. Mar. Pollut. Bull. 48, 12e25.

BW Energy Gabon. (2019a). Ruche EEA – Ruche Platform: Field Development Plan.

BW Energy Gabon. (2019b). BW Energy Oil Spill Contingency Plan. Document No: 4417-BWE-D-TA-00007.

Conseil National Climat, (2012) Plan National Climat Gabon.

Cooney, Gregory, Matthew Jamieson, Joe Marriott, Joule Bergerson, Adam Brandt, and Timothy J. Skone, 2017. Updating the U.S. Life Cycle GHG Petroleum Baseline to 2014 with Projections to 2040 Using Open-Source Engineering-Based Models. Environmental Science & Technology 2017 51 (2), 977-987. DOI: 10.1021/acs.est.6b028192017. Supporting MS Excel format information available at https://pubs.acs.org/doi/suppl/10.1021/acs.est.6b02819/suppl_file/es6b02819_si_002.xlsx

Climatelinks. (2019). Greenhouse Gas Emissions Factsheet: West Africa Region. Available at: https://www8.climatelinks.byf1.io/resources/greenhouse-gas-emissions-factsheet-west-africa-region

Currie D. R, Isaacs L. R (2005) Impact of exploratory offshore drilling on benthic communities in the Minerva gas field, Port Campbell, Australia. Mar Environ Res 59:217−233.

Droit Afrique (2019) Gabon: Code des hydrocarbures - Loi n°002/2019

EIA (US Energy Information Administration), 2022. Refinery Yield Data. Available at https://www.eia.gov/dnav/pet/pet_pnp_pct_dc_nus_pct_a.htm

Ellis, J.I. Fraser, G. Russell, J. (2012) Discharged drilling waste from oil and gas platforms and its effects on benthic communities. Marine Ecology Progress Series. Volume 456: 285-302, 2012.

Enviropass (2017a) ESIA for Phase I Development of the Tortue Marine Oil Field.

Enviropass (2017b) Environmental and Social Impact Notice in relation to the Pre-installation of anchors for the anchoring of the FPSO.

Enviropass (2020) Environmental and Social Impact Assessment in relation to the Ruche Field Phase I and II Development Project in the Dussafu Marin G4-209 Operating Licence.

Erbe, C. McCauley, R. McPherson, C.Gavrilov, A. 2013. Underwater Noise from Offshore Oil Production Vessels. Acoustic Society of America. Available at: https://cmst.curtin.edu.au/wp-content/uploads/sites/4/2016/05/erbe_2013_underwater_noise_from_offshore.pdf

Fleming and Jackson, 2011, Global review of humpback whales (*Megaptera novaeangliae*).

Gabon, Republic of, 2015. Planned contribution at national level - Conference of the Parties 21, 31 March 2015. Original document in French, unofficially translated English version available at: https://www.climatewatchdata.org/ndcs/country/GAB/full?searchBy=query&query=gabon&idx=0&document=first_ndc-EN

Gabon Offshore 12th Licensing Round, 2021. 12th Offshore License Round Now Open. Available at: Gabon (gabon12thround.com)

GCLME Regional Coordinating Unit. 2006. Transboundary Diagnostics Analysis. A Programme of the Governments of the GCLME Countries with the assistance of GEF, UNIDO, UNDP, UNEP, US-NOAA, NEPAD, FAO and IMO. Available at: https://iwlearn.net/resolveuid/15de2176-7676-4a6c-94da-35d65a68ed97

GEMS, 2011, Metocean and Environmental Data Collection in Gabon. Prepared for Shell Global Solutions International BV.

GHG Protocol. 2004. A Corporate Accounting and Reporting Standard, revised edition. Available at https://ghgprotocol.org/corporate-standard.

Green Energy International Ltd. 2020. Global Business Reports - Africa Oil and Gas 2020.

Hernández Arana HA, Warwick RM, Attrill MJ, Rowden AA, Gold-Bouchot G, 2005, Assessing the impact of oil related activities on benthic macroinfauna assemblages of the Campeche shelf, southern Gulf of Mexico. Mar Ecol Prog Ser 289:89−107.

IAMAT (International Association for Medical Assistance for Travellers). 2020. Gabon General Health Risks – Air Pollution. Available at: https://www.iamat.org/country/gabon/risk/air-pollution

IFC, 2012a, Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts.

IFC, 2012b, Performance Standards Guidance Note 1, Assessment and Management of Environmental and Social Risks and Impacts.

IFC, 2013, Good Practice Handbook. Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.

International Union for the Conservation of Nature (IUCN) (2021) The IUCN Red List of Threatened Species [online]. Available from: https://www.iucnredlist.org/ [Accessed 22 April 2021].

IPCC (Intergovernmental Panel on Climate Change), 2006. IPCC Guidelines for National Greenhouse Gas Inventories Guidelines for Stationary and Mobile Combustion, Volume 2: Energy, Chapters 2 and 3. Available from https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

Joint Nature Conservation Committee (JNCC), 2010. The protection of marine European Protected Species from injury and disturbance (Draft). Guidance for the marine area in England and Wales and the UK offshore marine area. Prepared by Joint Nature Conservation Committee, Natural England and Countryside Council for Wales. June 2010.

Katsanevakis, S., Wallentinus, I., Zenetos, A., Leppakoski, E., Cinar, M.E., Ozturk, B., Grabowski, M., Golani, D. & Cardoso, A.C. (2014) Impacts of marine invasive alien species on ecosystem services and biodiversity: a pan-European review. Aquatic Invasions, 9, 391–423.

Kouerey Oliwina C.K., Honarvar S., Girard A., Casale P. (Eds.) (2020). Sea Turtles in the West Africa/East Atlantic Region. MTSG Annual Regional Report 2020. Report of the IUCN-SSC Marine Turtle Specialist Group, 2020.

Manoukian S, Spagnolo A, Scarvella G, Punzo E, Angelini R, Fabi G (2010) Effects of two offshore gas platforms on soft-bottom benthic communities (north-western Adriatic Sea, Italy). Mar Environ Res 70:402−410.

Marine Traffic (2021) Global Ship Tracking Intelligence. Available at: https: //www.marine traffic.com

Mayumba National Parks, 2021, Mayumba National Park and the Surrounding Marine Reserves. Available at: https://www.mayumbanationalparks.com/home

McKenna, M.F. Ross, D. Wiggins, S.M. & Hildebrand, J.A. (2011) Underwater radiated noise from modern commercial ships. J. Acoust. Soc. Am. 131 (1), January 2012. Pg 92-103.

Mehl, S., Zaera, D. and Dias de Sousa Lopes, J. (2010) Surveys of the pelagic fish resources of Gabon, Congo, DRC, Angola and Namibia. Part I. Gabon and Congo. 18-30 June 2010.

Menzie C, Maurer D, Leathem W (1980) An environmental monitoring study to assess the impact of drilling discharges in the Mid-Atlantic. IV. The effects of drilling discharges on the benthic community. Proc Symp Research on Environmental Fate and Effects of Drilling Fluids and Cuttings, January 21−24, 1980. Lake Buena Vista, FL, Vol 1, API, Washington, DC, p 499–540.

Metcalfe, K., Agamboué, P.D., Augowet, E., Boussamba, F., Cardiec, F., Fay, J.M., Formia, A., Kema, J.R.K., Kouerey, C., Mabert, B.D.K. and Maxwell, S.M. (2015) Going the extra mile: ground-based monitoring of olive ridley turtles reveals Gabon hosts the largest rookery in the Atlantic. Biological Conservation, 190, pp.14-22.

Mongabay (2014). Gabon protects 23% of its coastal waters. Available at: https://news.mongabay.com/2014/11/gabon-protects-23-of-its-coastal-waters/

Myhre, G.; Shindell, D.; Bréon, F.-M.; Collins, W.; et al. (2013). Chapter 8: Anthropogenic and Natural Radiative Forcing. *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. pp. 659–740.

National Agency for Public Works (2012) National Infrastructure Master Plan (Schéma Directeur National d'Infrastructures, SDNI)

OSPAR (2009) Overview of impact of anthropogenic underwater sound in the marine environment, Biodiversity Series, OSPAR Commission.

Oxford Business Group (2021) Gabon aspires to emerging market status. Available at: Gabon aspires to emerging market status | Gabon 2015 | Oxford Business Group

Parnell. R; Weir. C., Witt. M., Merchant. N., Blondel. P., Leeenry. R and Elwen. S., (2010). Cetacean and Turtle observations, Impact evaluation and mitigation during the Vaalco/Harvest Etame-Marin 3D seismic survey off Mayumba National Park, Gabon. Personal Communication. NGOUESSONO Solange - Mayumba National Parc Manager, 2010.

PGS (2020) PGS Data to Support Ongoing Republic of Congo Licensing Round. Available at: https://www.pgs.com/media-and-events/news/pgs-data-to-support-ongoing-republic-of-congo-licensing-round/

Republique Gabonaise (2011) Le Gabon Plan: Plan Opérationnel 2011-2016 - Volume 2: Plan Pêche.

Republique Gabonaise (2012). Plan Strategique Gabon Emergent - Vision 2025 et orientations stratégiques 2011-2016 (PGSE).

Republique Gabonaise (2013). Plan Strategique Gabon Emergent - Stratégie Nationale d'Industrialisation.

Richardson, J, Greene, C. R., Malme, C. I. and Thomson, D.H (1995) Marine Mammals and Noise. San Diego California: Academic Press, 1995.

Rosenbaum, H., & Collins, T. (2006). The ecology, population characteristics and conservation efforts for humpback whales (*Megaptera novaeangliae*) on their wintering grounds in the coastal waters of Gabon. Bulletin of the Biological Society of Washington, 12, 425–436.

Rosenbaum, H.C., Maxwell, S.M., Kershaw, F. and Mate, B. (2014) Long-range movement of humpback whales and their overlap with anthropogenic activity in the South Atlantic Ocean. Conservation Biology, 28(2), pp.604-615.

Sea Around Us (2016) Fisheries, Ecosystems and Biodiversity. Available at: www.searoundus.org

Sea Shepherd (2021). Defending the Largest Marine Protected Area. Available at: https://www.seashepherdglobal.org/latest-news/defending-the-largest-mpa/

Secretariat of the Convention on Biological Diversity (2020). Ecologically or Biologically Significant Marine Areas (EBSAs). Special places in the world's oceans. Volume 6: South-Eastern Atlantic Ocean. Montreal: 108 pages.

Sibueta, M and Vangriesheima, A (2009). Deep-sea environment and biodiversity of the West African Equatorial margin. Deep Sea Research Part II: Tropical Studies in Oceanography. November 2009. Volume 56, Issue 23, Pages 2156-2168.

State of The World's Sea Turtles (SWOT) (2021) Ocean Biogeographical Information System - Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) [Online]. Available from: https://seamap.env.duke.edu/swot [Accessed 23 April 2021].

Terrocea (Terrocea Environmental Consulting). (2019). Environmental Observation and Inventory of Marine Species on The Tortue Field in the Ruche EEA. Preliminary Report 2. Mission on the RIG-Norve Borr Drilling / BW ENERGY GABON SA from November 25 to December 04, 2019.

Todd, V. Williamson, L. Jiang, J. Cox, S. Todd, I. Ruffert, M. (2020) Proximate underwater soundscape of a North Sea offshore petroleum exploration jack-up drilling rig in the Dogger Bank. Journal of the Acoustical Society of America, December 2020.

UNEP-CBD. (2015a). EBSA Zone marine et côtière de Mayumba. [Online]. Available from: https://chm.cbd.int/database/record?documentID=204064 [Accessed 27 February 2020].

UNFCCC (United Nations Framework Convention on Climate Change) (2020) Emissions summary for Gabon. Available at: https://unfccc.int/sites/default/files/gab_ghg_profile.pdf

Ukwe, C.N & Ibe, C.A. (2010). A regional collaborative approach in transboundary pollution management in the guinea current region of western Africa. Ocean and Coastal Management 53 (2010) 493-506.

Walsh, P.D., Fay, J.M., Gulick, S. and Sounguet, G.P., (2000). Humpback whale activity near Cap Lopez, Gabon. Journal of Cetacean Research and Management, 2: 63–67.

WCS & ASF, (2009) *Report to The National Parks and Wildlife Service on Turtle Protection and Related Activities in and around Mayumba National Park, Gabon, 2008 - 09 Nesting Season (Contract Ref D/C/265)* [Online]. Available from: https://www.npws.ie/sites/default/files/publications/pdf/Wildlife_Conservation_Society_2009_Gabon_Turtle_Report.pdf [Accessed 27 July 2021].

WCS (Wildlife Conservation Society). 2021. Gabon's Coast and Ocean. Available at: Gabon's Coast & Ocean (wcs.org)

Weir, C.R., (2010). A Review of Cetacean Occurrence in West African waters from the Gulf of Guinea to Angola. Mammal Review. 40 (1): 2 – 39.

Weir, C.R. and Collins, T., (2015) A review of the geographical distribution and habitat of the Atlantic humpback dolphin (Sousa teuszii). Advances in marine biology, 72, pp.79-117.

Witt, M.J., Baert, B., Broderick, A.C., Formia, A., Fretey, J., Gibudi, A., Mounguengui, G.A.M., Moussounda, C., Ngouessono, S., Parnell, R.J. and Roumet, D., (2009) Aerial

surveying of the world's largest leatherback turtle rookery: a more effective methodology for large-scale monitoring. Biological Conservation, 142(8), pp.1719-1727.

World Port Source (2021). Port of Port Gentil. Available at: WPS - Port of Port Gentil contact information (worldportsource.com)

Xodus. 2015. Brims Underwater Noise Assessment. Assignment No: L100183-S00. Available at: http://marine.gov.scot/datafiles/lot/Brims_Tidal/Supporting_Documents/Brims%20Underwater%20Noise%20Assessment%20Report.%20Xodus%20(2015).pdf

APPENDIX 10A - INFORMATION REQUEST LETTER

BW ENERGY GABON SA
Member of BW Energy Group

Libreville, le 25 Mars 2021

A l'Attention de :
Monsieur Stanislas Stephen MOUBA
Directeur Général de l'Environnement
et de la Protection de la Nature
BP : 3903 Libreville

N° 0862 BWE/25/3/21/GE/UB

Objet : Développement du bloc Dussafu - Demande d'information

Monsieur le Directeur Général,

BW Energy a mandaté Terea Ltd et RSK Environment Ltd pour entreprendre une étude d'impact cumulatif (CIA) pour le projet de développement d'hydrocarbures du bloc Dussafu, au large du Gabon.

Dans le cadre de son rôle, RSK va entreprendre un exercice de collecte de données pour identifier tout projet tiers ou autre développement susceptible d'entraîner des impacts environnementaux et sociaux cumulatifs avec le projet Dussafu. Pour mener à bien la CIA, Terea et RSK doivent collecter et évaluer des données sur d'autres développements et projets tiers qui sont réalisés dans la zone d'étude (rayon de 50 km du bloc Dussafu, voir le document d'information de base).

À cette fin, des informations sont respectueusement demandées à votre Direction Générale sur ses connaissances concernant :

1. Tous les plans de développement stratégique du secteur qui sont accessibles au public
2. Les noms et coordonnées des entités responsables des développements et projets actuels et futurs dans la zone d'étude
3. L'emplacement des développements
4. L'État et délais de construction et d'exploitation
5. Une EIES est-elle accessible au public ?

Nous vous serions reconnaissants de votre réponse dans les meilleurs délais. Si vous avez des questions ou avez besoin de plus d'informations, n'hésitez pas à contacter :

Monsieur Ivan MVE, tel : 07429 93 16 / email : i.mwe@tera.net
Madame Géraldine Ewomba, tel : 077 29 54 03 / email : geraldine.ewomba@bwenergy.no

Veuillez agréer, Monsieur le Directeur Général, l'expression de ma considération distinguée.

DIRECTION GENERALE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE SECRETARIAT

BW Energy GABON SA (BWEGSA) NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

Pièce jointe : Document d'information de base

APPENDIX 10B - SOURCES OF CUMULATIVE IMPACT TABLE

Table 1 presents the associated facilities and third-party projects considered in the CIA.

Table 1: Associated facilities and third-party projects

Project	Proponent	Location	Description	Source	Screening
Associated facility					
FPSO	BW Offshore	Within EEA	The BW Adolo FPSO is owned and operated by BW Offshore and the modifications required for the Dussafu development are not funded by the same loan facility. The FPSO has gone through three phases of modifications to allow it to process the fluids from the Dussafu development.	Enviropass, 2017b	Screened into CIA
Third party projects – Gabon					
Exploration drilling	Vaalco Energy Inc	Etame Marin block	Vaalco Energy Inc. has acquired nearly 1,000 sq km of proprietary 3-D seismic data over the entire Etame Marin block, to support the next drilling campaign of the block scheduled for late 2021 / 2022. Four well campaign. In June 2022 three of the four wells had been drilled.	https://www.ogj.com/exploration-development/area-drilling/article/14188557/vaalco-acquires-seismic-to-support-planned-etame-marin-drilling https://www.offshore-energy.biz/vaalco-finds-more-hydrocarbon-reserves-in-gabon-after-drilling-its-third-well/	Screened into CIA

Project	Proponent	Location	Description	Source	Screening
Exploration drilling	Petronas subsidiary PC Gabon Upstream (PCGUSA)	Block F13	Petronas subsidiary PC Gabon Upstream (PCGUSA) has awarded a contract to Maersk Drilling to provide a deep-water drillship rig to drill one exploration well located at approximately 2,100m water depth in Block F13. Work is planned to commence in the third quarter of 2021. No further detail was publicly available.	https://www.offshore-technology.com/news/petronas-maersk-rig-exploration-gabon/	Screened into CIA
Seismic campaign	Unknown	Blocks F11, F12, F13, G10-11, G13 and G14	Following the licensing round in 2021, it is assumed that seismic activities will take place across the newly acquired blocks. No further detail was publicly available.	http://gabon12thround.com/	Screened into CIA

Project	Proponent	Location	Description	Source	Screening
Grande Mayumba,	African Conservation Development Group (ACDG) Grande Mayumba Development Company (GMDC)	Southern Gabon	Sustainable development of 731,000 hectares for commercial agriculture, forestry and ecotourism, which will be accompanied by the delivery of new transport, power and municipal infrastructure to the region. and a marine area of 260,900 hectares in Nyanga Province in southern Gabon The project forms a key part of the Emerging Gabon Strategic Plan (Plan Stratégique Gabon Émergent, PSGE), which aims to boost activity in the industrial and services sectors. No further detail regarding project definition and timescales was publicly available. The project was not mentioned during stakeholder engagement meetings.	https://africanconservationdevelopmentgroup.com/	Screened out as not reasonably defined as per IFC definition

Project	Proponent	Location	Description	Source	Screening
Port at Port Gentil	Not known at time of writing	Port Gentil	Port-Gentil is planned as a Central African transhipment hub and a specialist fishing port to enable deep-sea fish to be landed prior to export. No further detail regarding project definition and timescales was publicly available. The project was not mentioned during stakeholder engagement meetings.	https://www.wto.org/english/tratop_e/tpr_e/s285-02_e.pdf	Screened out as not reasonably defined as per IFC definition
Deep-water port in Mayumba	Not known at time of writing	Mayumba	Studies are under way for the construction of a deep-water port in Mayumba. The port will facilitate the export of resources such as iron, wood, oil, talc, gold and manganese, among others. However, little progress has been reported on the project and there is not yet any specific timeline for development as implementation awaits the necessary funds and a company prepared to undertake the work. No further detail was publicly available.	https://oxfordbusinessgroup.com/overview/time-transformation-expanding-and-improving-infrastructure-facilitate-growth	Screened out as not reasonably defined as per IFC definition

Project	Proponent	Location	Description	Source	Screening
Mew shallow water port	Not known at time of writing	Mangali	Logistics, shipping and loading facilities will be built at the new shallow-water Mangali port to support the Grande Mayumba businesses and the emerging regional economy. Formal application for a 50-ha zone around the Mangali port to be declared a Special Economic Zone (SEZ) is currently under way. No further detail was publicly available.	https://africanconservationdevelopmentgroup.com/infrastructure/	Screened out as not reasonably defined as per IFC definition
Third party projects – Republic of Congo					
No projects identified					

BW Energy Gabon

ESIA Addendum

Dussafu Block Development, Gabon

Chapter 11: Environmental and Social Management

80834

RSK GENERAL NOTES

Project No.: 80834

Title: ESIA Addendum – Dussafu Block Development, Gabon
Chapter 11

Client: BW Energy Gabon

Date: 26 July 2022

Office: Helsby

Status: Rev_02

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11 ENVIRONMENTAL AND SOCIAL MANAGEMENT

11.1 Introduction

BWE is developing a Project-specific management framework document which integrates all management system policies into an environmental and social management system (ESMS) structure with clear lines of responsibilities between those elements managed by BW Energy, BW Offshore, contractors and subcontractors.

Under this management framework RSK has compiled the following management system deliverables:

- Legal Register and Actionable Items Matrix
- Critical habitat work scope – Biodiversity Action and Management Plan; Alien Invasive Species Management Plan
- Stakeholder engagement work scope – Stakeholder Engagement Plan; Third-party Grievance Management Procedure; document outlining updates to BWE Emergency Response Plans / Oil Spill Contingency Plans based on stakeholder engagement
- Social work scope – Social Management Plan; Social Risk and Impact Management Procedure.

These are discussed below.

11.2 Legal Register

A standalone Legal Register has been developed for the Ruche EEA field development programme that pulls together environmental, health, safety and social (EHSS) requirements from applicable national legislation and conventions / treaties ratified by Gabon (RSK document reference: P80834/04/04_Rev00).

Available national legislation and international conventions have been sourced, translated where necessary, and requirements that BWE must action / implement identified and consolidated into an Actionable Items Matrix for use in compliance assurance activities.

11.3 Biodiversity Action and Management Plan (BAMP)

As the Project is located within critical habitat, a BAMP has been developed for the Project in line with the requirements and criteria of IFC PS 6 and the accompanying Guidance Note 6.

This document:

- Summarises the critical habitat assessment and the species, habitats and protected areas considered to trigger critical habitat

- sets out management measures to mitigate adverse impacts on critical habitat triggering species during facility installation, drilling, and operation and for potential accidental events
- outlines measures for biodiversity offsetting and conservation measures to achieve no net loss
- describes the ecological monitoring and reporting commitments and adaptive management measures
- defines roles and responsibilities
- provides a Vessel Code of Conduct for the Project.

The BAMP is a standalone document and is included in Appendix 11A.

11.4 Alien Invasive Species (AIS) Management Plan

To reduce the likelihood of AIS introduction from Project activities within critical habitat an AIS Management Plan has been developed for the Project.

This document:

- sets out the legislation and guidelines relevant to AIS management
- outlines the Project activities that could introduce AIS
- describes introduced species of concern in Gabonese and Gulf of Guinea waters
- provides mitigation measures for management of ballast water and sediments, biofouling, and other forms of AIS introduction
- provides the monitoring and reporting requirements
- defines roles and responsibilities.

The AIS Management Plan is a standalone document and is included in Appendix 11B.

11.5 Stakeholder Engagement Plan (SEP)

In order to inform stakeholders about the Project, ensure stakeholders understand how they might be affected by the Project, and obtain input from stakeholder regarding their opinions and concerns, an SEP has been developed in line with the requirements and criteria of IFC PS 1 and the accompanying Guidance Note 1.

This document:

- sets out the regulations and applicable standards for stakeholder engagement
- summarises stakeholder engagement conducted to date
- outlines the process for stakeholder identification and analysis
- describes the stakeholder engagement programme (along with specific requirements relevant to conducting stakeholder engagement during a global pandemic)
- describes systems for data management and analysis

- outlines the grievance management procedure (see Section 11.6)
- defines roles and responsibilities
- outlines the next steps in terms of ongoing stakeholder engagement by BWE.

Invitation letters, minutes of meetings, stakeholder analysis, and materials for supporting stakeholder engagement are appended to the management plan.

The SEP is a standalone document and is included in Appendix 11C.

11.6 Third-party Grievance Management Procedure (TGMP)

To address public and community concerns, and complaints and requests related to its operations, a TGMP has been developed for the Project in line with the requirements and criteria of IFC PS 1 and the accompanying Guidance Note 1.

This document:

- provides information on the third-party grievance management process – grievance management steps, grievance workflow, grievance assessment and timeframes for response
- outlines the process for monitoring, reporting and review to prevent the recurrence of grievances
- provides information on confidentiality and conflict of interest
- defines roles and responsibilities.

The TGMP is a standalone document and is included in Appendix 11D.

11.7 Updated Emergency Response Plans

The Lender document 'BWE Gabon Pre-Financial Close Environmental and Social Assessment' (ERM, 2021) includes a requirement that BWE's existing oil spill and emergency preparedness and response procedures / plans need to include community health and safety considerations and mitigations.

In order to address this, a document has been produced entitled 'Local Stakeholder Engagement Input to BWE's Emergency / Oil Spill Response Plans' (see Appendix 11E). This information will be incorporated into BWE's Emergency Response Plan / Oil Spill Contingency Plan as appropriate at their next update.

11.8 Social Management Plan (SMP)

The SMP summarises the social mitigation measures described in the ESIA Addendum, along with responsibilities for action. It also summarises monitoring and reporting requirements.

The SMP is a standalone document and is included in Appendix 11F.

11.9 Social Risk and Impact Management Procedure (SRIMP)

The main aim of the SRIMP is to ensure that formal management of social risks become part of BWE's processes.

For the purposes of the SRIMP, social impacts and social risks are those that stem from BWE's activities and potentially could impact, or pose a risk to, the social environment (not the business itself).

This document:

- describes the process for identifying social risks and impacts and the methodology for assessing the significance of social impacts
- provides a Social Risks and Impacts Register template / worksheet
- outlines roles and responsibilities for SRIMP implementation.

The SRIMP is a standalone document and is included in Appendix 11G.

APPENDIX 11A - BIODIVERSITY ACTION & MANAGENENT PLAN

Refer to standalone Appendix 11A.

APPENDIX 11B - ALIEN INVASIVE SPECIES MANAGEMENT PLAN

Refer to standalone Appendix 11B.

APPENDIX 11C - STAKEHOLDER ENGAGEMENT PLAN

Refer to standalone Appendix 11C.

APPENDIX 11D - THIRD-PARTY GRIEVANCE MANAGEMENT PROCEDURE

Refer to standalone Appendix 11D.

APPENDIX 11E - LOCAL STAKEHOLDER ENGAGEMENT INPUT TO BWE'S RESPONSE PLANS

Refer to standalone Appendix 11E.

APPENDIX 11F - SOCIAL MANAGEMENT PLAN

Refer to standalone Appendix 11F.

APPENDIX 11G - SOCIAL RISK AND IMPACT MANAGEMENT PROCEDURE

Refer to standalone Appendix 11G.

BW Energy Gabon

Biodiversity Action and Management Plan

Dussafu Block Development, Gabon

80834

JULY 2022

RSK GENERAL NOTES

Project No.: 80834

Title: Biodiversity Action and Management Plan - Dussafu Block Development, Gabon

Client: BW Energy Gabon

Date: 28 July 2022

Office: Helsby

Status: Rev02

Author	Fraser Wilkinson and Rahul Srivastava	**Technical reviewer**	Corin Simmonds
Signature		Signature	
Date:	28/07/2022	Date:	28/07/2022

Project manager	Rebecca Heath
Signature	
Date:	28/07/2022

RSK Environment Ltd (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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FIGURES

ABBREVIATIONS

Acronyms	Definition
ANPN	Agence Nationale des Parcs Nationaux (ANPN) - National Agency of National Parks
AOA	Area of Analysis
BAMP	Biodiversity Action and Management Plan
BAP	Biodiversity Action Plan
BAT	Best available techniques
BBOP	Business and Biodiversity Offsets Programme
BMP	Biodiversity Management Plan
BWE	BW Energy Gabon
CHA	Critical habitat assessment
CNAP	Centre National Anti-Pollution
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CSBI	Cross Sector Biodiversity Initiative
DGH	Direction Générale des Hydrocarbures - General Directorate of Hydrocarbons
EEA	Exclusive Exploitation Area
EHS	Environment Health and Safety
ESIA	Environmental and Social Impact Assessment
FPSO	Floating Production Storage and Offloading unit
GN	Guidance Note
HQ	Hazard quotient
IALA	International Association of Lighthouse Authorities
IBA	Important Bird and Biodiversity Area
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission

Acronyms	Definition
KBA	Key Biodiversity Area
KPI	Key Performance Indicator
LC-50	Lethal concentration 50 - concentration of a chemical that will kill 50% of the sample population under scrutiny
LF cetacean	Low frequency cetacean
MARPOL	International Convention for the Prevention of Pollution from Ships
MMO	Marine Mammal Observer
MPA	Marine Protected Area
NADF	Non aqueous drilling fluid
NG	Net Gain
NGO	Non-Governmental Organisation
NNL	No Net Loss
NP	National Park
OCNS	Offshore Chemical Notification Scheme
OI	Offshore installation
OOC	Oil on cuttings
OPRAG	Office des Ports et Rades du Gabon (Office of Ports and Harbours of Gabon)
PAH	Polycyclic Aromatic Hydrocarbons
PAM	Passive acoustic monitoring
PLONOR	Poses little or no risk to the environment
PS	Performance Standard
SOPEP	Shipboard Oil Pollution and Emergency Plans
SPP	Suspended Particulate Phase
SSC	Species Survival Commission
TTS	Temporary threshold shift
WBDF	Water based drilling fluid
WCS	Wildlife Conservation Society

1 INTRODUCTION

1.1 Background

BW Energy Gabon (BWE) is an exploration and production company in the oil and gas sector. It is a subsidiary of BW Offshore and forms part of the BW Group.

BWE has acquired a majority interest in the Dussafu Block located off the east coast of Gabon, adjacent to Basse-Banio Department (Nyanga Province), see Figure 1.1.

The Dussafu Block encompasses the 850 km^2 Ruche Exclusive Exploitation Area (Ruche EEA) that contains six oil discoveries: Tortue, Hibiscus, Ruche, Ruche North East, Moubenga and Walt Whitman fields, together containing a total of 112 million barrels of oil (based on current development plans). BWE is focusing its development efforts on the Tortue, Hibiscus, Ruche and Ruche North East fields.

The Ruche EEA is located approximately 50 km offshore in water depths of 70–650 m.

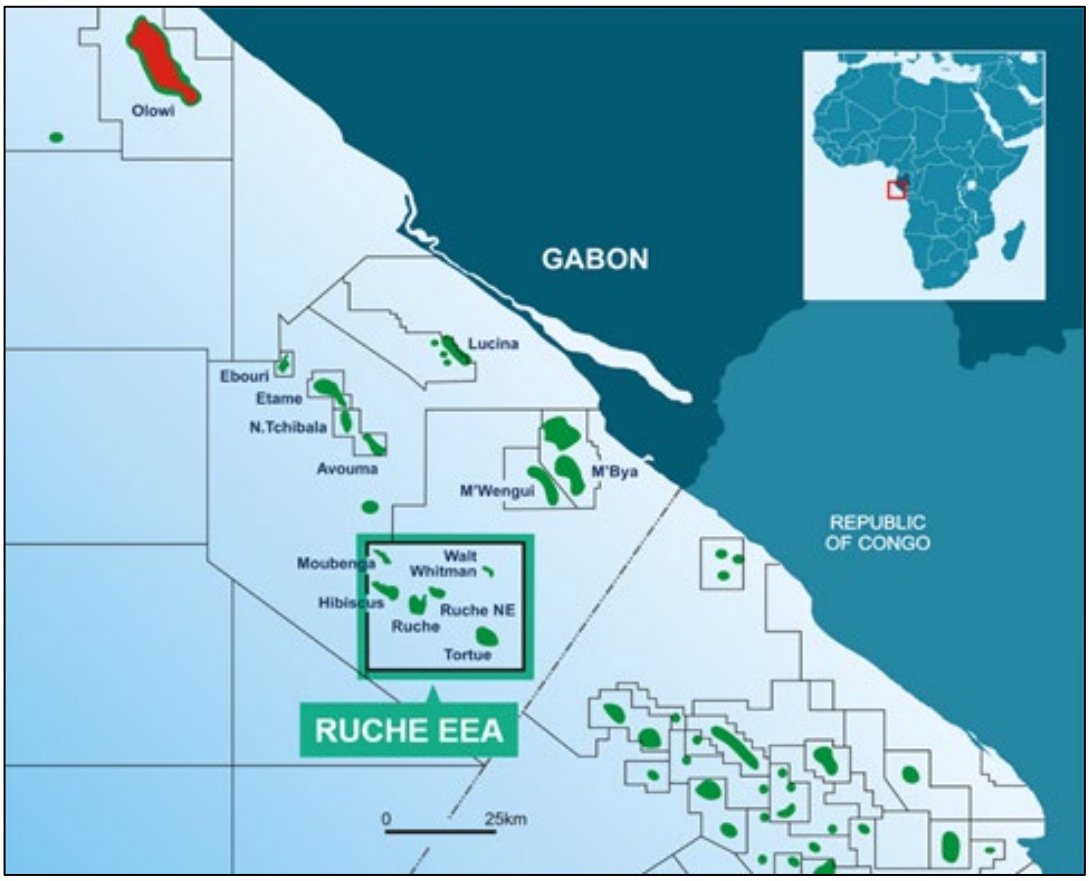

Figure 1.1: Dussafu Block, Ruche EEA and fields

Source: BWE (2019)

BWE has successfully initiated development activities in the Ruche EEA and reached first oil in October 2018 (Tortue Phase 1). Subsequent phases of the development are Tortue Phase 2 and Ruche Phase 1.

The full field development consists of multiple wells, producing from a combination of the Gamba and Dentale formations, tied back through flowlines to a Floating Production Storage and Offloading (FPSO) unit, with a manned Offshore Installation (the Hibiscus Alpha OI) between the Hibiscus and Ruche Fields.

1.2 Aims and objectives

A Biodiversity Action Plan (BAP) is a plan which includes a set of actions that lead to the conservation or enhancement of biodiversity for a specific site or project. The Biodiversity Management Plan (BMP) forms part of the BAP and provides the delivery mechanism for actions given within it. Specifically, the BAP and BMP are needed to ensure that the Project:

- Implements the mitigation, compensation and biodiversity protection measures within the environmental and social impact assessment;
- Complies with national legislation/policy requirements; and
- Complies with international environmental requirements and best practice, including the World Bank Safeguards Policies and the Equator Principles.

The aim of the BAMP is to achieve no net biodiversity loss as a result of the Project by ensuring that the biodiversity is protected and enhanced where possible. This BAMP has been developed in consultation with stakeholders, conservation NGOs and biodiversity experts.

BAPs and BMPs are recommended as global leading practice by bodies such the UN Global Compact and are a requirement for IFC Performance Standard 6 (IFC PS 6)[1]. Specifically, the BAMP:

- collates diverse biodiversity management measures in one place, despite various departmental responsibilities for their implementation
- provides a summary of all biodiversity actions planned by BWE and their subcontractors
- facilitates communication about sound project biodiversity risk management to external audiences such as regulators
- provides reassurance that risks and impacts are being managed, and ensures investment is prioritised towards actions that most cost-effectively tackle highest risks / impacts
- provides a basis for planning and tracking progress.

Paragraph 17 of IFC PS 6 states that the client will not implement any project activities unless all of the following are demonstrated:

[1] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps6

- no other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical
- the project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values
- the project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time
- a robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management programme (please note this level of detail is not provided in this BAMP and will involve subsequent reporting and consultation).

Paragraph 18 suggests that in cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a BAP and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

This BAMP fits within the impact assessment process and is a core component of the Project's environmental and social management system.

This BAMP includes:

- a brief overview of the proposed Project
- management measures to mitigate adverse impacts during facility installation, drilling and operational phases of the Project
- an outline of the ecological monitoring and reporting commitments and processes for adaptive management that will be developed through a detailed monitoring plan
- a definition of roles and responsibilities.

This BAMP should be read in conjunction with the Dussafu Block Development ESIA Addendum (RSK document reference: 80834/04/12).

1.3 Area of Analysis

IFC Guidance Note 6 encourages the determination of critical habitat in the marine environment at a seascape scale (IFC, 2019). The term 'seascape' does not necessarily correspond to any one pre-defined unit of geographical space, rather it is a broadly defined term that might correspond to an ecoregion, a biome, or any other ecologically significant unit of space on a regional level. Seascape analysis is a fundamental step in determining ecologically appropriate mitigation options that align with broader conservation efforts in the region. The external boundaries of marine seascapes are challenging to define due to the wide ranging; highly mobile species present that often have poorly understood population distributions.

For the purposes of the Critical Habitat Assessment (see Chapter 6 of ESIA Addendum), the Area of Analysis (AOA) was defined as the entirety of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park. This area fully encompasses the

Ruche EEA, the administrative area delineated by the Field Development Plan approved by the General Directorate of Hydrocarbons (DGH) within which all of BW Energy's exploration and production activities will take place. The alignment of the AOA with the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park is in line with Paragraph 17 of Guidance Note 6 (IFC, 2019) which states that "*the landscape/seascape unit might be defined in terms of an administrative or territorial boundary or a particular zoned area within international waters. The intention of the requirement is that clients identify project-related impacts, especially those on habitat connectivity and/or on downstream catchment areas, outside the boundaries of the project site*".

The continental slope of Gabon is uniform and gentle up to the 100 m isobath (40-60 km offshore), beyond which depth increases rapidly (Enviropass, 2017). The continental shelf therefore forms a distinct boundary between the shallow in-shore waters to the east and the deep offshore waters to the west.

Given the above, two broad seascapes, including the entire water column and seabed have been defined within the AOA:

- shallow water up to 100 m depth, comprising an area of 3,376 km^2
- deep water > 100 m, comprising an area of 25,105 km^2.

The coverage of these seascapes is presented in Figure 1.2. The majority of the Ruche EEA is within the deepwater seascape. The critical habitat assessment has been undertaken for the full extent of both seascapes. Considering a broader seascape than just the project site demonstrates that the project is taking a precautionary approach to biodiversity so that all project risks are taken into consideration.

Each species in the candidate list for critical habitat screening was considered separately using professional judgement and publicly available scientific information to determine in which seascape(s) it is known or could occur. For example, Atlantic humpback dolphin are confined to the shallow seascape favouring waters less than 30 m in depth close to the shore, whereas leatherback turtles are present in both seascapes using the whole of the AOA (Aquatic Reserve of the Grand South of Gabon) as a migration route to the coastal nesting beaches (*pers. comm.* Tim Collins, 2022). Where little or no information was available on depth distribution, a conservative estimate was made of occurrence in both seascapes.

The AOA discussed above was used to focus the analysis of critical habitat triggering biodiversity and includes a broad suite of habitats from the shore to the abyssal plain and associated species. The results of that analysis are shown in Table 2.2 and includes almost exclusively highly mobile species of fish, marine mammals and turtles. Because of the general uniformity of the coast between the Ruche EEA and Port Gentil with respect to coastline and continent shelf topography the assumption is made that the presence and distributions of critical habitat triggering species are likely to be similar throughout this portion of the EEZ, mindful that there will inevitably be differences over time and space.

The primary AOI and the unplanned / accidental events AOI are the same as that described in Section 1.5 of the ESIA Addendum.

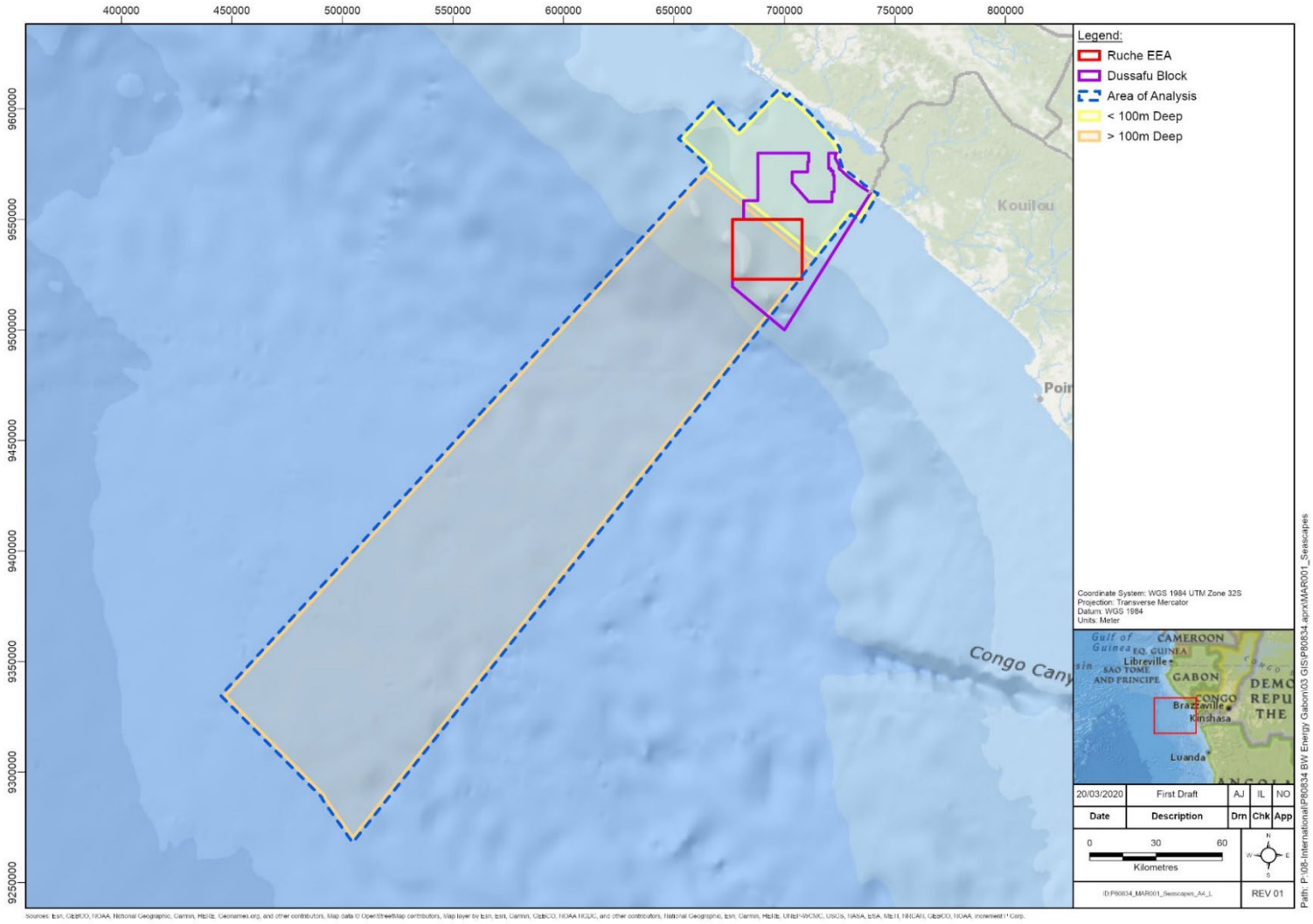

Figure 1.2: Shallow and deepwater seascapes within the AOA

NB: The AoA on this figure reflects the boundaries of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park

1.4 Ecological context of the region

The Ruche EEA is located in southern Gabonese waters, offshore from Basse-Banio Department (Nyanga Province).

The coastline of southern Gabon (south of Port Gentil) is long and relatively straight with four large coastal lagoons (and numerous smaller lagoons) behind a narrow sand strip. These lagoons have only intermittent contact with the ocean (Enviropass, 2020).

The Ruche EEA itself is located within the Aquatic Reserve of the Grand South of Gabon, a Marine Protected Area (MPA) designated to promote biodiversity conservation and the recovery of fish stocks. The Mayumba National Park (NP) is approximately 16.5 km from the Ruche EEA boundary.

Along the stretch of coast from Port Gentil to the Ruche EEA there are seven additional Aquatic Reserves and seven Marine Parks (see Figure 1.3), reflecting the high marine biodiversity importance of this coast. An additional deep-water aquatic reserve is located further offshore (Reserve no. 19 on Figure 1.3).

A seasonal upwelling off the coast of Gabon drives high primary productivity (Enviropass, 2020). The area provides habitat, migration corridors and breeding grounds for sensitive marine migratory species including four species of marine turtle, humpback whales (*Megaptera novaeangliae*), Atlantic humpback dolphin (*Sousa teuszii)* and other cetacean species. There is a high diversity of cartilaginous fish, including hammerhead and silky sharks. There is an important tuna fishery 12 - 24 nautical miles offshore.

1.5 Legal and other requirements

1.5.1 National requirements

The legal hierarchy in Gabon is understood to consist of the following:

- the constitution
- ratified conventions and treaties
- laws
- regulations (including decrees and orders).

A standalone Legal Register has been developed for the Dussafu Project that pulls together environmental, health, safety and social requirements from applicable national legislation and conventions and treaties ratified by Gabon (RSK document reference: 80834/04/04).

The following laws and decrees are of particular relevance to this BAMP:

- Law no° 007/2014, 1 August 2014, on the Protection of the Environment in the Gabonese Republic
- Law n˚002 / 2014, 1 August 2014, Framework Act on Sustainable Development in the Gabonese Republic
- Decree no° 539/PR/MEFEPEPN, 15 July 2005, Regulating Environmental Impact Studies
- Decree n˚00161 / PR of 1 June 2017 establishing 20 marine protected areas in the Gabonese Republic (see Figure 1.3 below).

The following international conventions are of relevance:

- Convention on Biological Diversity (Biodiversity Convention), 1992
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), 1979.

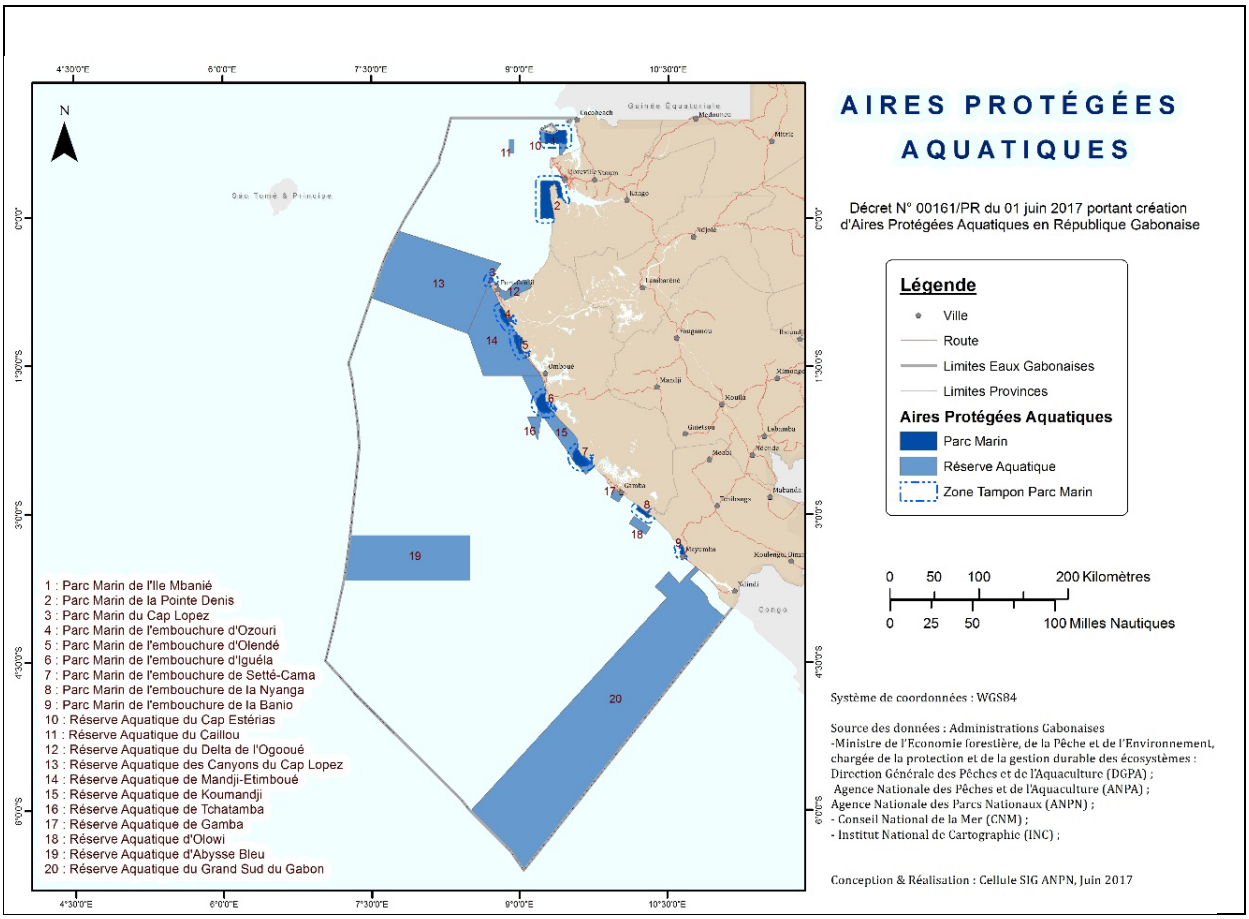

Figure 1.3: Marine protected areas of Gabon (as defined by the Decree n˚00161 / PR of 1 June 2017)

1.5.2 Lender standards and guidelines

1.5.2.1 IFC Performance Standards

The IFC's Performance Standards (PS) offer a comprehensive and practical approach to managing environmental and social risks for private investments in emerging markets and are considered an international benchmark.

In terms of biodiversity 'IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources' (2012) recognises that protecting and conserving biodiversity, maintaining ecosystem services, and managing living natural resources adequately are fundamental to sustainable development. The following provides an overview of the scope of IFC PS 6.

IFC standard requirements summary:

- the company should consider project-related impacts across the potentially affected landscape or seascape

- as a matter of priority, the company should seek to avoid impacts on biodiversity and ecosystem services. When avoidance of impacts is not possible measures to minimise impacts and restore biodiversity and ecosystem services should be implemented.

Protection and conservation of biodiversity:

- the mitigation hierarchy, including biodiversity offsets, may be considered after applying avoidance, minimisation, and restoration measures. A biodiversity offset should be designed and implemented to achieve measurable conservation outcomes that result in no net loss and preferably a net gain of biodiversity; net gain is required in critical habitats.
- habitats are to be divided into modified, natural and critical. Special considerations should be made for natural and critical (high biodiversity value) habitats.
- in addition, if the proposed project is located within a legally protected area or internationally recognised area, the company will demonstrate that the proposed development in such area is legally permitted.
- the company will not intentionally introduce any new alien species.

Management of ecosystem services:

- for projects with adverse impact on ecosystem services, to conduct a systematic review to identify priority ecosystem services
- to avoid, minimise and mitigate impacts on ecosystem services of relevance to affected communities.

Sustainable management of living natural resources

- relating to projects with primary production of living natural resources, including natural and plantation forestry, agriculture, animal husbandry, fisheries.

Supply chain

- a company involved in purchasing primary production (e.g., food, wood, animals, fibre and related commodities) for further processing or trade, known to be produced in the regions where there is a risk of significant conversion of natural and/or critical habitats, should evaluate its primary suppliers and adopt systems and verification practices.

1.5.2.2 Equator Principles

The Equator Principles is a risk management framework, adopted by financial institutions, for determining, assessing, and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making.

In line with the Equator Principles, the Dussafu Project has been classified as Category A – “Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented”.

1.5.2.3 *World Bank Group Guidelines*

The World Bank Group's Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of good international industry practice.

The General EHS Guidelines (2007) and the EHS Guidelines for Offshore Oil and Gas Development (2015) are both applicable to this offshore field development project.

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent.

1.5.2.4 *Other guidelines*

Business and Biodiversity Offsets Programme (BBOP)

The BBOP is a voluntary collaboration of private companies, governments, conservation experts and finance institutions that have developed a set of principles and guidelines for the design and implementation of compensatory measures to achieve measurable conservation gains (no net loss) to offset unavoidable losses to biodiversity.

The mitigation hierarchy is a framework for managing biodiversity and ecosystem services risks as well as direct and indirect project-related impacts to biodiversity receptors and important ecosystem services (CSBI, 2015). The Project's adherence to the steps of the mitigation hierarchy is a requirement of lender finance standards and systems.

The steps of the mitigation hierarchy are presented in Figure 1.4 and are defined by the BBOP (2019) as follows:

- **Avoidance:** this is the first step in the mitigation hierarchy and is defined as measures taken to avoid causing direct and indirect project-related impacts from the outset. Examples of avoidance measures include the spatial or temporal relocation or removal of infrastructure, to completely avoid impacting key components of biodiversity (i.e., particularly priority species, habitats or ecosystem services). Avoidance is often regarded as the most effective way of reducing potential negative impacts to biodiversity and ecosystem services.
- **Minimisation:** this is the second component of the mitigation hierarchy. Minimisation measures (or mitigation measures) are designed to reduce the duration, intensity and / or extent of direct, indirect and cumulative project-related impacts that cannot be completely avoided, as far as is practically feasible. Robust and pragmatic minimisation measures can be effective in reducing biodiversity impacts below significance thresholds.
- **Rehabilitation / Restoration:** this third step in the mitigation hierarchy should be applied to rehabilitate or restore biodiversity and / or ecosystem services that are impacted by project activities that cannot be completely avoided and / or minimised. An example includes rehabilitating degraded habitats or restoring cleared habitats to reduce residual project-related impacts.
- **Offset:** Biodiversity offsets are measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, to achieve no net loss or a net gain of biodiversity. Biodiversity offsets are measurable positive conservation outcomes

on priority biodiversity features that are attributed to project activities, and whose magnitude outweighs that of the residual adverse biodiversity impacts arising from the project development. Offsets require investments in conservation management protection where the results of these investments can be quantified. Offsetting is based on systematic biodiversity accounting based on the explicit calculation of biodiversity losses and gains at matched impact and offset sites.

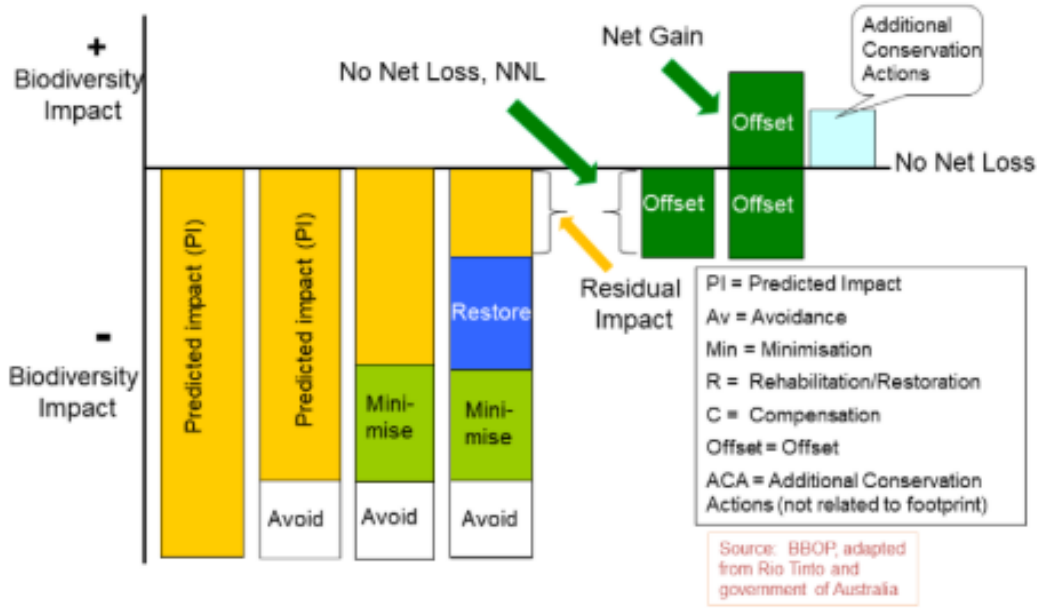

Figure 1.4: Mitigation hierarchy

Source: BBOP, 2019

1.5.3 BWE management systems

BW Energy is committed to contributing to a sustainable environment. The Company recognises that its operations may have wide-ranging impacts on the environment and therefore applies systematic risk management processes to identify, assess and mitigate impacts. Operations are subject to an environmental management system which is third-party certified to ISO14001:2015 environmental management system standard.

According to BW Energy's Annual Report (BWE, 2020), BW Energy contributes to the United Nations Sustainable Development Goals by:

- investing in local communities and people where we operate through safe jobs and by promoting education and innovation
- minimising emissions and waste from offshore assets to align with global efforts to combat climate change and its impacts
- working with local environmental and conservation organisations to monitor the impact of production operations on biodiversity and protected species.

BWE prioritises safety first with 'zero harm' as an overriding objective for people and environment.

The Dussafu BAMP provides a technical framework for BWE's future engagement with the relevant protected area conservation stakeholders. BWE proposes to prepare a strategy for engaging with biodiversity conservation stakeholders in Gabon to operationalize relevant aspects of the BAMP. The date proposed for strategy completion is September 2022. Thereafter, implementation of the strategy would be self-reported by BWE to the International Executive Service Corps (IESC) and lender group via monitoring reports and verified during the monitoring visits.

2 PRIORITY SPECIES AND HABITATS

2.1 Introduction

A core element of IFC PS 6 is to establish whether the Project is located within critical habitat, which is based on the species and habitats within the AOA - their sensitivity to impacts, and their ecological importance. Following Critical Habitat Screening (RSK document reference: 80834/04/01), ecological features, including species and habitats, were identified as having the potential to trigger critical habitat. These features were further analysed and assessed as part of the Critical Habitat Assessment (ESIA Addendum, Chapter 6).

The methodology and findings of these studies are summarised below.

2.2 Critical habitat assessment methodology

A Critical Habitat Assessment (CHA) was conducted by RSK in line with the requirements of IFC PS 6.

Initially, a literature review was conducted to collect secondary data on the species present within the AOA. Analysis was performed on these data to determine which species were above the thresholds for the five criteria established in IFC Guidance Note 6, the accompanying document to IFC PS 6.

The following are the criteria used by IFC for critical habitat triggers:

- Criterion 1: Critically Endangered and Endangered Species
- Criterion 2: Endemic and Restricted-range Species
- Criterion 3: Migratory and Congregatory Species
- Criterion 4: Highly Threatened or Unique Ecosystems
- Criterion 5: Key Evolutionary Processes.

The presence of these species within the AOA was then confirmed or rejected through further literature review and stakeholder engagement. The list of organisations consulted is provided in Table 2.1.

Below is a list of resources used frequently throughout the process:

- IUCN Red List of Threatened Species
- BirdLife International Data Zone
- Global Biodiversity Information Facility
- EDGE of Existence programme: Evolutionarily Distinct and Globally Endangered Database
- Existing national ESIAs for the Project.

Table 2.1: Ex-situ stakeholder engagement

Person / role	Organisation	Subject matter / expertise
Grant Abel Ex-situ Coordinator	IUCN Species Survival Commission (SSC) Cetacean Specialist Group	Cetaceans
Paolo Casale Co-chair	IUCN SSC Marine Turtle Specialist Group	Leatherback turtle
Roderic Mast Co-chair	IUCN SSC Marine Turtle Specialist Group	Leatherback turtle
Brian Hutchinson Programme Officer	IUCN SSC Marine Turtle Specialist Group	Leatherback turtle
Erich Hoyt Co-chair	IUCN SSC Marine Mammal Protected Area Specialist Group	Marine mammals
Giuseppe Notarbartolo Di Sciara Co-chair	IUCN SSC Marine Mammal Protected Area Specialist Group	Marine mammal protected areas
Info email address	IUCN SSC Shark Specialist Group	Rays
BirdLife Africa Regional Office	BirdLife International	Avifauna
Igor Akendengue Aken	Omar Bongo University	Environmental science
Christy Achtone Nkollo Aganga	Omar Bongo University	Fisheries, marine mammals
Jean Bernard Mombo	Omar Bongo University	Environmental science
Peter Wirtz Researcher	n/a	Gabonese marine invertebrates
Rob Crawford Researcher	University of Cape Town	Avifauna
Gavin Naylor Researcher	Florida Museum of Natural History	Rays
Godefroy de Bruyne	Terea	Biodiversity specialist
Matthew Gollock Group Chair / Red List Authority Coordinator	IUCN SSC Anguillid Eel Specialist	Eels
Kent Carpenter Red List Authority Coordinator	IUCN Marine Fishes Red List Authority	Marine fish
Beth Polidoro Red List Authority Coordinator	IUCN Marine Fishes Red List Authority	Marine fish
Ian Burfield IUCN SSC Red List Authority Coordinator	IUCN Bird Specialist Group	Avifauna
Tim Collins	Wildlife Conservation Society (WCS) / National Geographic /	Cetaceans

Person / role	Organisation	Subject matter / expertise
	IUCN SSC Cetacean Specialist Group	
Wynand Viljoen	Mayumba National Park	National Park Management
Angela Formia	WCS	Turtles

The priority list of species was then assessed in terms of impacts relating to Project activities. A literature review was conducted into their sensitivity to these impacts. Following this, a set of targeted mitigation measures were proposed based on academic literature and international best practice guidelines.

Potential impacts were scored pre-mitigation measures and post-mitigation measures from a scale of 0 (positive) to 16 (major). Any residual impacts, generally those with a score of 6 or higher (moderate to major), have been considered for further action in Section 4.5 of this document.

2.3 Critical habitat triggering species

This section summarises the species identified within the AOA as triggering critical habitat. The full assessment process and justification for inclusion of these species is provided in Chapter 6 of the ESIA Addendum.

2.3.1 Fish

African wedgefish

The African wedgefish is a CR[2] species with a decreasing population. The AOA is likely to be a key habitat for this species due to its decline in other areas of its range. The disappearance of this species from parts of its original range drove calls for the IUCN status to be changed from EN to CR (Moore, 2017). This is a neritic species that is mostly found close to shore, up to depths of 35 m (IUCN, 2021).

This species meets the threshold for criterion 1a of critical habitat, and thus is classed as priority species for the Project.

Blackchin guitarfish

The blackchin guitarfish is a CR species with a decreasing population. This species typically occurs on muddy and sandy substrates on the continental shelf, up to a depth of about 80 m (IUCN, 2021). Data are sparse for the majority of the Gabonese coastline, but the species has been confirmed to inhabit the AOA from multiple sources and so the AOA likely represents a key habitat for this species.

This species meets the threshold for criterion 1a of critical habitat, and thus is classed as priority species for the Project.

[2] A taxon is Critically Endangered (CR) when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, as it is therefore considered to be facing an extremely high risk of extinction in wild.

White skate

The white skate is an EN[3] species with a decreasing population. It can be found in a depth range of approximately 40 m to 400 m and is typically found over sandy and detrital bottoms (IUCN, 2021). This species occurs in isolated patches with their presence in the AOA reported by local fishermen and academics.

This species meets the threshold for criterion 1a of critical habitat, and thus is classed as priority species for the project.

Common guitarfish

The common guitarfish is an EN species with a decreasing population. There was a significant level of uncertainty as to whether this species was present within the AOA due to a contradiction between literature and stakeholder reports. This species occupies the demersal zone (i.e., the sea floor) across sandy, muddy, and shelly habitats, up to a depth of 180 m (IUCN, 2021).

Due to the uncertainty, a precautionary approach was used for this species, with the conclusion that this species meets the threshold for criterion 1a of critical habitat, and thus is classed as priority species for the project.

Daisy stingray

The daisy stingray (also known as the daisy whipray) is an EN species with a decreasing population. Information on this species is limited and there is some disagreement in the literature, including disagreement over the species' name, but it has been reported in the AOA. Its biology is unknown other than having an expected maximum size of 1 m (IUCN, 2021).

Due to the uncertainty, a precautionary approach was used for this species, with the conclusion that this species meets the threshold for criterion 1a of critical habitat, and thus is classed as priority species for the project.

West African pygmy skate

The West African pygmy (sometimes dwarf) skate is classed as DD[4] by the IUCN but appears to have a limited range and so was assessed for endemism. This species is benthic and is found at depths of 900 to 1550 m (IUCN, 2021) and so is likely outside of the range of impacts for this project. However, this species was reported as being consumed by local fishermen and so was classed as a critical habitat trigger species following the precautionary principle due to its restricted range.

Due to the uncertainty, a precautionary approach was used for this species, with the conclusion that this species meets the threshold for criterion 2 of critical habitat, and thus is classed as priority species for the project.

[3] A taxon is Endangered (EN) when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.

[4] A taxon is Data Deficient (DD) when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on the abundance and/or distribution are lacking

Bonga shad

The bonga shad is a migratory species listed as LC[5] by IUCN. It can tolerate a wide range of salinities and regularly migrates up rivers to spawn, returning to the open sea between July and December in Gabon. This species' migratory nature means it is likely there will be a high concentration of its population within the AOA from July to December.

This species meets the threshold for criterion 3a of critical habitat, and thus is classed as priority species for the project.

Goby species *Lesueurigobius koumansi*

Lesueurigobius koumansi is listed as LC by IUCN but has a limited range. This species is benthic and occurs over mud and sand bottoms. It occurs from Gabon to Angola, and possibly in Namibia and so was classed as endemic to the AOA.

This species meets the threshold for criterion 2 of critical habitat, and thus is classed as priority species for the project.

Eel species *Hemerorhinus opici*

This species of eel is classed as DD by the IUCN and information on it is limited. However, it has been classed as endemic to the Eastern Central Atlantic (Polidoro et al. 2016). This species is bottom-dwelling and is known from only three specimens (IUCN, 2021).

It is likely that this species is found within the AOA and that the AOA represents an estimated proportion of the species' population greater than the 10% threshold required for criterion 2 to trigger critical habitat and is therefore classed as priority species for the project.

Eel species *Xyrias guineensis*

This species of eel is classed as DD by the IUCN and information on it is limited. However, it has been classed as endemic to the Eastern Central Atlantic (Polidoro et al. 2016). This species is known from only a few specimens (IUCN, 2021). It is typically found in soft substrate that it buries into (idem).

It is likely that this species is found within the AOA and that the AOA represents an estimated proportion of the species' population greater than the 10% threshold required for criterion 2 to trigger critical habitat and is therefore classed as priority species for the project.

Eel species *Uroconger drachi*

This species of eel is classed as DD by the IUCN and information on it is limited. However, it has been classed as endemic to the Eastern Central Atlantic (Polidoro et al. 2016). Little is known about this species as it is known from just one caught specimen (IUCN 2021).

It is likely that this species is found within the AOA and that the AOA represents an estimated proportion of the species' population greater than the 10% threshold required for criterion 2 to trigger critical habitat and is therefore classed as priority species for the project.

[5] A taxon is Least Concern (LC) when it has been evaluated against the Red List criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened.

2.3.2 Cetaceans

Atlantic humpback dolphin

The Atlantic humpback dolphin is a CR species with a decreasing population. It is likely that a high proportion of this species' population lives within the AOA year-round. The calving period for this species is thought to occur in March and April, with calves likely to be present until October (IUCN, 2021).

Their preferred habitat is shallow, warm waters of less than 20 m depth (Weir and Collins, 2015) with the majority of sightings recorded 3 m to 13 km from land.

Areas of localised density in Central Africa are limited to Gabon (Mayumba) and northernmost part of Republic of Congo, but it does range from Dahkla Bay (Rio de Oro) in Western Sahara to Tombua (Namibe Province) in Angola (Collins, 2015).

This species meets the threshold for criteria 1a, 1c and 3a of critical habitat, and thus is classed as priority species for the project.

Humpback whale

The humpback whale is an LC species with an increasing population but is migratory, with as much as 10 percent of the world's humpback whales may be involved in the migration along the western coast of Africa (Parnell, 2010).

Humpback whales migrate to Gabonese waters from colder waters further south, arriving in June with a peak in August, and migrate south again in November (WCS Gabon, 2021). During their residency in Gabonese waters humpback whales mate and produce offspring, with the peak of calving occurring in July and August (IUCN, 2021). This species is considered of heightened sensitivity during its annual period within the AOA.

This species meets the threshold for criterion 3a and 3b of critical habitat, and thus is classed as priority species for the project.

2.3.3 Marine reptiles

Leatherback turtle

The leatherback turtle is VU[6] species with a decreasing population that is also migratory and congregatory. Gabon, in particular two beaches in Mayumba National Park, has beaches that are considered highly important to the success of this species as it uses them for nesting. The egg-laying season lasts from October through until April with a peak from December to January. Female turtles will come ashore to deposit eggs about 3 or 4 times in a season and will spend the time between beach visits around 20 km out to shore.

This species meets the threshold for criteria 1b, 3a and 3b of critical habitat, and thus is classed as priority species for the project.

[6] A taxon is Vulnerable (VU) when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.

2.4 Critical habitat triggering habitats

This section summarises highly threatened and unique ecosystems, and protected areas and internationally recognised areas of high biodiversity value, within the AOA. The full assessment process and justification for inclusion of these habitats is provided in Chapter 6 of the ESIA Addendum.

The following areas were identified as highly threatened and unique ecosystems (criterion 4b) that overlap, or are in close proximity to, the AOA (see Figure 2.1 top):

- Mayumba Marine and Coastal EBSA
- Equatorial Tuna Production EBSA
- Northwestern Continental Shelf EBSA (Congo).

The following protected areas overlap with the AOA (see Figure 2.1 bottom):

- Aquatic Reserve of the Grand South of Gabon
- Mayumba National Park.

Other marine protected areas along the Gabonese coastline (some of which overlap with the project vessel transfer routes to the logistics base) are presented in Figure 1.3.

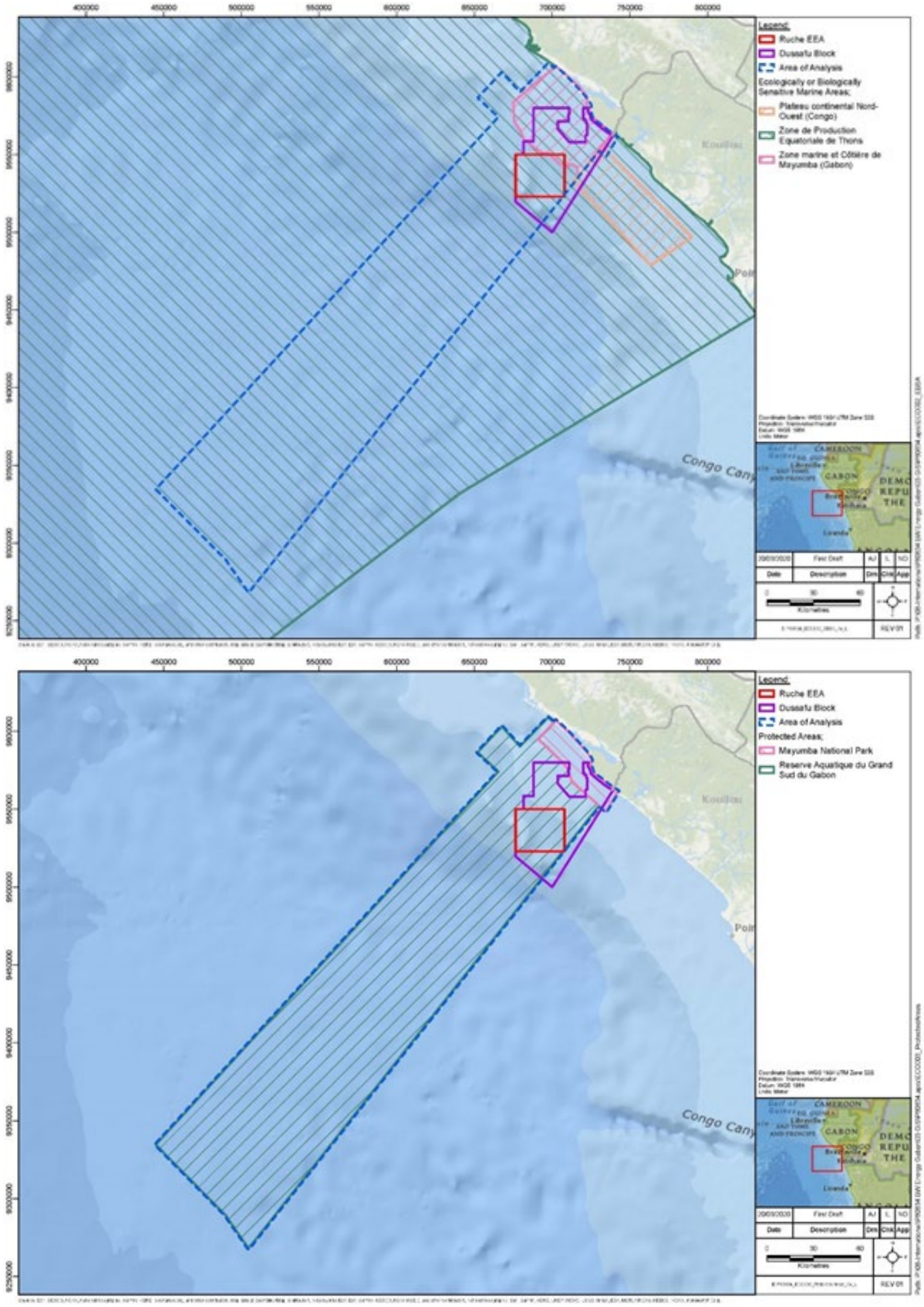

Figure 2.1: EBSAs overlapping AOA (top) and protected areas overlapping AOA (bottom)

2.5 Summary

Ultimately, 14 species and 3 habitats / protected areas were considered to trigger critical habitat for this Project, see Table 2.2. These 17 features were assessed to understand potential impacts from Project activities.

Table 2.2: Critical Habitat-qualifying features

Critical Habitat-qualifying features	IFC PS6 criterion threshold numbers
CH species (shallow seascape)	
African wedgefish	1a
Blackchin guitarfish	1a
Daisy stingray	1a
Atlantic humpback dolphin	1a, 1c, 3a
CH species (deep seascape)	
West African pygmy skate	2
CH species (both seascapes)	
White skate	1a
Common guitarfish	1a
Bonga shad	3a
Goby *Lesueurigobius koumansi*	*2*
Eel *Hemerorhinus opici*	*2*
Eel *Xyrias guineensis*	*2*
Eel *Uroconger drachi*	*2*
Humpback whale	3a, 3b
Leatherback turtle	1b, 3a, 3b
Other CH features	
Mayumba NP and EBSA – shallow seascape	4b and 'other'
Northwestern continental shelf EBSA – deepwater seascape	4b
Equatorial tuna production EBSA – deepwater seascape	4b

3 SUMMARY OF IMPACTS

Potential impacts on priority species and habitats were assessed fully as part of the Critical Habitat Assessment (ESIA Addendum, Chapter 6). A summary of impact significance scoring pre and post mitigation is provided in Table 3.1.

Table 3.1: Summary of critical habitat assessment results

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Impacts on critical habitat triggering fish species		
Installation of facilities and physical presence		
Installation of facilities – disturbance of demersal spawning sites	Minor (4)	Minor (4)
Physical presence of the facilities – reduction in fishing pressure due to safety exclusion zones	Positive (0)	Positive (0)
Light spill from facilities (from lighting and flaring) – attraction of fish / predators	Minor (4)	Minor (4)
Underwater noise		
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – behavioural effects from underwater noise	Minor / Moderate (4 / 8)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Minor / Moderate (4 / 8)	Minor (4)
Discharges to marine environment		
Cuttings and associated fluids discharge – turbidity impacts on adult fish, smothering of benthic eggs	Moderate (8)	Minor (4)
Produced water discharge – impacts from elevated temperature, salinity and chemicals	Moderate (8)	Minor (4)
Hydrotest water discharge – impacts from hydrotest chemicals	Moderate (8)	Minor (4)
Other operational discharges (drilling rig, vessels, Hibiscus Alpha OI and FPSO) – impacts from turbidity, increased BOD and chemicals	Minor (4)	Minor (4)
Accidental event scenarios		

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Introduction of AIS – competition, alteration of habitats	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination on adult fish and eggs/larvae	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) - impacts of hydrocarbon contamination on adult fish and eggs/larvae	Major (12 / 16)	Moderate (8)
Impacts on critical habitat triggering marine mammal species		
Underwater noise		
Drilling activities (rig noise) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Facility installation (large construction vessels) – physiological effects and behavioural effects from underwater noise	Moderate (8)	Minor (4)
Operation of FPSO and support / supply vessels - physiological effects and behavioural effects from underwater noise	Moderate (8)	Minor (4)
Accidental event scenarios		
Project vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – reduction in prey species	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (well blowout / FPSO collision) – impacts of hydrocarbon contamination	Major (12 / 16)	Moderate (8)
Impacts on critical habitat triggering turtle species		
Underwater noise		
Drilling activities (rig noise) and facility installation (large construction vessels) – behavioural effects from underwater noise	Minor (4)	Minor (4)
Operation of FPSO and support / supply vessels - behavioural effects from underwater noise	Minor (4)	Minor (4)

Aspect / Impact	Significance (pre-mitigation)	Residual impact significance (post-mitigation)
Light spill from facilities (from lighting and flaring) – attraction of turtles	Moderate (8)	Minor (4)
Accidental event scenarios		
Project vessel collision with marine fauna – injury / mortality impacts	Moderate (8)	Minor (4)
Introduction of AIS – reduction in prey species	Major (12)	Minor (4)
Accidental spill, small scale bunkering spill – impacts of hydrocarbon contamination	Moderate (8)	Minor (4)
Accidental spill, large scale release of hydrocarbons (FPSO collision / well blowout) – impacts of hydrocarbon contamination	Major (12 / 16)	Moderate (8)
Impacts on highly threatened and / or unique ecosystems and protected areas *		
Collective impacts from routine / planned activities	Minor	
Accidental spill – large scale release of hydrocarbons	Moderate	

4 TARGETS AND ACTIONS FOR BIODIVERSITY MANAGEMENT AND MONITORING

4.1 Introduction

In line with the mitigation hierarchy (Figure 1.4) measures have been developed taking into consideration avoidance and minimisation to reduce the net impact on biodiversity and critical habitats (see Section 4.2).

In addition, rehabilitation / restoration and biodiversity offset measures are considered and proposed where feasible (Section 4.3 and 4.4).

4.2 Avoidance and minimisation

4.2.1 Measures to minimise impacts from installation of facilities and their physical presence on CH species

Mitigation measures proposed in the ESIA Addendum to reduce impacts from Project facility installation and presence are as follows:

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
Area and work lighting will be limited to the amount and intensity necessary to maintain worker safety. Directional lighting will be used to minimise light spill onto the sea.	To minimise disturbance of marine species from light spill	Minimisation	Throughout facility installation, drilling and operation	Vessel contractor, drilling contractor, installation contractor, operator
In terms of flaring, gas flow rates will be reduced as far as practicable; any maintenance activities requiring flaring will be scheduled outside of turtle hatchling season; and the flame will be shielded behind a containment structure. Seasonal monitoring of potential light attraction	To minimise disturbance of marine species from light spill (flaring)	Minimisation	Throughout operations	Operator

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
effects on turtle hatchlings and other marine life will be conducted and mitigation measures adjusted accordingly.				

4.2.2 Measures to minimise impacts from underwater noise on CH species

Mitigation measures proposed in the ESIA Addendum to reduce impacts from Project generated underwater noise on marine species are as follows:

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
Supply vessel transfers from the logistics base at Port Gentil to the Ruche EEA will be optimised	To minimise number of vessel transfers and underwater noise	Minimisation	Throughout facility installation, drilling and operation	Vessel contractor
Drilling rig support vessel will drift around the rig site to minimise engine use	To minimise engine use and underwater noise	Minimisation	During drilling	Drilling / vessel contractor
Vessel speeds will be reduced to minimise underwater noise radiation	To minimise vessel speed and underwater noise	Minimisation	Throughout facility installation, drilling and operation	Vessel contractor
Gradual start-up of vessel engines and thrusters will be implemented where possible	To provide opportunity for species to take evasive action prior to maximum noise source levels	Minimisation	Throughout facility installation, drilling and operation	Vessel contractor
Vessel engines and generators will be operated according to manufacturer's instructions and	To ensure optimum operation of engines and generators and	Minimisation	Throughout facility installation, drilling and operation	Vessel contractor

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
maintenance programmes	minimise noise emissions			
Marine Mammal Observers (MMOs) will be deployed on the construction vessels during facility installation (Hibiscus Alpha OI and flowline to FPSO) in order to record wildlife sightings and any interactions between the installation activities and marine mammals / turtles (more detail provided in the Vessel Code of Conduct, see Appendix A).	To minimise disturbance of marine biota during facility installation activities.	Minimisation	Facility installation	Vessel contractor / installation contractor
Project vessels will follow the Vessel Code of Conduct, see Appendix A	To minimise disturbance of marine biota from all project vessel activity.	Minimisation	Drilling, facility installation and operation	Vessel contractors

4.2.3 Measures to minimise impacts from discharges to the marine environment on CH species

Mitigation measures proposed in the ESIA Addendum to reduce impacts from Project discharges are as follows:

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
Cuttings discharge				
Chemicals used in the WBDF well sections will be PLONOR (poses little or no risk to the environment) or HQ Band Gold, or	To maximise use of chemicals with low toxicity, high biodegradability and low	Minimise	During drilling	Drilling contractor

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
OCNS Group E or D chemicals.	bioaccumulation potential.			
No discharge of whole WBDF to sea except if in compliance with 96 hr. LC-50 of Suspended Particulate Phase (SPP)-3% vol. toxicity test first for drilling fluids or alternatively testing based on standard toxicity assessment species (preferably site-specific species)	To prevent discharge of whole NADF	Avoid	During drilling	Drilling contractor
NADF well sections will utilise the Versaclean system - base fluid Escaid 120 classified as OGP Group III, contains less than 0.001% Polycyclic Aromatic Hydrocarbons (PAHs).	To use NADFs with low PAH content	Minimise	During drilling	Drilling contractor
Maximum allowed oil on cuttings (OOC) for well sections drilled with NADF is 3% (non-compliant cuttings will be returned to Port Gentil). Cuttings are treated using a cuttings dryer that incorporates a high-speed centrifuge. OOC properties will be measured and recorded every 12 hours. Where mud properties become sub optimal then drilling will be stopped and the	To minimise discharge of associated NADF	Minimise	During drilling	Drilling contractor

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
mud system conditioned before drilling goes ahead. In the case of equipment failure if OOC levels cannot be met then drilling will be stopped until the equipment is repaired.				
Barite in drilling fluids will meet World Bank Group heavy metals concentration standards, i.e., mercury <1 mg/kg and cadmium <3 mg/kg dry weight (total). A certificate will be provided for each batch prior to shipment to Gabon.	To minimise heavy metal content of barite	Minimise	During drilling	Drilling contractor
Produced water discharge				
The oil in water content of the produced water discharge will be less than 30 mg/l, in line with OSPAR Recommendation 2001/1 amended by 2006/4 and 2011/8.	To minimise oil content of produced water	Minimise	Operations	Operator
Production chemicals (e.g., demulsifiers and asphaltene inhibitors) will be selected according to the following criteria: lowest toxicity, lowest bioaccumulation potential and highest biodegradation (preference for	To maximise use of chemicals with low toxicity, high biodegradability and low bioaccumulation potential.	Minimise	Operations	Operator

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
PLONOR, HQ Band Gold, OCNS Group E or D).				
BWE will undertake an assessment of best available techniques (BAT) covering produced water. To manage the environmental risk posed by added and naturally occurring chemicals in the produced water discharge, a risk-based approach will be used in line with those described in OSPAR Recommendation 2012/5 and appropriate measures taken to reduce the risk.	To avoid / minimise added and naturally occurring chemicals in produced water.	Avoid Minimise	Operations	Operator
Hydrotest water discharge				
BWE will conduct a risk assessment in respect of the current management and disposal of hydrostatic testing water for the Project and will develop a documented management plan for this waste stream.	To avoid / minimise chemical use in hydrotest water.	Avoid Minimise	Operations	Operator
Other operational discharges				
Sanitary waste, food waste, deck drainage and bilge water will be discharged in line with requirements of the International	To minimise impacts of operational discharges on marine biota.	Minimise	Throughout facility installation, drilling and operation	Vessel contractor, drilling contractor, installation contractor, operator

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
Convention for the Prevention of Pollution from Ships (MARPOL 73/78). Chorine content of sanitary waste will be <1mg/l.				
Low toxicity biodegradable detergents will be used in deck wash.	To maximise use of chemicals with high biodegradability.	Minimise	Drilling and operation	Vessel contractor, drilling contractor, operator
Cooling water discharge will result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution take place in accordance with World Bank Group effluent limits.	To minimise thermal impacts from cooling water discharge.	Minimise	Drilling and operation	Drilling contractor, operator

4.2.4 Measures to minimise impacts of accidental event scenarios on CH species

4.2.4.1 Alien Invasive Species

There are three main pathways for the introduction of AIS associated with the Project vessels, drilling rig, OI and equipment, namely:

- ballast (water and sediment)
- biofouling
- direct physical introduction through other means such as intact plant particles or sediment on anchors.

A Project-specific Alien Invasive Species Management Plan has been developed which details mitigation measures associated with the above.

4.2.4.2 Project vessel collision with marine fauna

Mitigation measures proposed in the ESIA Addendum to reduce the likelihood of a vessel collision with marine fauna are as follows:

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
Project vessels will follow the BWE Vessel Code of Conduct, see Appendix A	To reduce vessel speed to minimise risk of collision with marine fauna.	Avoidance	Throughout facility installation, drilling and operation	Vessel contractor
BWE will work with local agencies and environmental groups to improve their understanding of the populations of Atlantic humpback dolphins and humpback whales in the AOI (see Section 4.6.3)	To gain more understanding of CH triggering species populations	Monitoring	-	Operator
Any collision with a marine mammal or turtle must be reported to the Agence Nationale des Parcs Nationaux (ANPN) - National Agency of National Parks	-	Reporting	Throughout facility installation, drilling and operation	Vessel contractor / operator

4.2.4.3 Accidental release of hydrocarbons

In-built control measures to reduce the likelihood of an accidental hydrocarbon release are listed in Section 6.4.1.5 of the Critical Habitat Assessment. Additional mitigation measures specific to this project are as follows:

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
During the rig special periodic survey in Port Gentil, prior to the Ruche Phase 1 drilling campaign, the current 18 ¾" BOP will be replaced with a new 13 5/8" BOP improving safety, equipment handling and	To reduce the likelihood of a spill event	Avoidance	Drilling	Drilling contractor

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
suitability for the Ruche 1 well design.				
Contingency well control equipment and procedures will be in place at the Hibiscus Alpha OI location that are appropriate to the Ruche Phase 1 surface wellheads (capping stacks more relevant to subsea wellheads).	To reduce the likelihood of a spill event	Avoidance	Drilling	Drilling contractor
In case of a loss of well control scenario, all equipment will be in place (surface wellhead, conductor, casing, drilling fluid, cement) to drill a standalone relief well at an offset location to the platform. A Relief Well Planning document will be developed detailing surface locations and relief well profiles specific to the Ruche Phase 1 drilling campaign.	To minimise the impact of an accidental spill event	Minimisation	Drilling	Drilling contractor
Oil Spill Contingency Plan in place for Ruche Field Development will be maintained and implemented in an accidental event.	To minimise the impact of an accidental spill event	Minimisation	Drilling, facility installation, operation	Operator
Spills will be notified to the Director of the Direction Générale des Hydrocarbures (DGH) and the Technical Director of the Centre	-	Reporting	Throughout facility installation, drilling and operation	Vessel contractor, drilling contractor, operator

Mitigation Measure	Target	Mitigation Hierarchy	Start / end / frequency	Responsible
National Anti-Pollution (CNAP).				
BWE will work with local agencies and environmental groups to identify marine coastal areas sensitive to spills and develop strategies to protect these areas. In line with this work, more detailed mitigation measures to address impacts of oil on critical habitat triggering species will be developed (see Section 4.5.1)	To develop strategies for sensitive areas and CH species	Monitoring	-	Operator

In the event of a spill, response actions will be carried out in line with the following documents:

- Vessel Shipboard Oil Pollution and Emergency Plans (SOPEPs)
- BWE Oil Spill Contingency Plan for Ruche Field Development (4417-BWE-D-TA-00007).

4.3 Restoration and rehabilitation

There is no specific restoration or rehabilitation required for this Project.

4.4 Biodiversity offsetting

In accordance with IFC PS 6, projects are required to consider biodiversity offsets to deliver no net loss (NNL) of natural habitat, and net gain (NG) of critical habitat, if significant residual impacts are anticipated to remain after all feasible preventive and restorative actions have been taken through earlier steps in the mitigation hierarchy (IFC, 2012; IFC, 2019). Biodiversity offsets are measurable positive conservation outcomes on priority biodiversity features that are attributed to Project activities, and whose magnitude outweighs that of the residual adverse biodiversity impacts arising from the Project development (Cross Sector Biodiversity Initiative (CSBI), 2015).

The impact assessment on critical habitat triggers concluded that most impacts could be managed down to an acceptable level through the implementation of applicable mitigation measures. Residual impacts of moderate or above are those related to unplanned / accidental events that are unlikely to occur but have the potential for major impacts. It is not possible to provide an accurate measure of biodiversity impact and subsequently deliver appropriate offsetting for unplanned / accidental events. The

Project's approach will be to develop an effective spill response and work stringently to enforce it, and to work with local communities and conservation groups to deliver positive conservation actions for marine species in the region as described in Section 4.5.

4.5 Additional conservation measures to achieve no net loss

As identified Section 3, moderate residual impacts are limited to an accidental event scenario resulting in the release of large volumes of hydrocarbons. As such this section focuses on conservation measures associated with this source of impact.

4.5.1 Setting up a coordinated response plan for large scale hydrocarbon releases

Unplanned / accidental large-scale release of hydrocarbons poses the most significant threat to marine and coastal habitats and biodiversity. The response to an accidental release of large quantities of hydrocarbons is based on having adequate preparation to mitigate against the impacts of a large spill, followed by a strategy to address the spill. The overall approach is described below, followed by a specific response to mitigate impacts on priority endangered species (Atlantic humpback dolphins and turtles).

Preparation phase

BWE will undertake the following mitigation measures related to oil spill preparedness and impact mitigation:

- Work with the local Agency of National Parks and conservation partners (e.g., WCS, WildAid, WWF, others) to identify the marine coastal areas that are most sensitive to oil spills, building on the spill modelling results.
- With the same partners, catalogue, quantify and rank the sensitive areas and develop oil spill protection strategies to address the most highly sensitive areas. The resulting sensitivity map will identify coastal and marine habitats and associated wildlife and socio-economic resources that could be affected by a BWE accidental spill event and priorities for response.
- Working with the Office des Ports et Rades du Gabon (OPRAG); Marine Marchande; Direction des Hydrocarbures, Marine Nationale and Ministere de l'Enseignement Superieur de la Recherche Scientifique, de l'Environnement et de la Protection de la Nature; undertake an oil spill response capacity assessment and identify needs relevant to a spill scenario associated with the Ruche EEA.
- Contract certified oil spill response expertise to provide (and import) the equipment and training of local teams in the use of spill retention and recovery tools and procedures.
- Conduct in situ training in the use of spill equipment and support creation of an effective spill response to address an accidental spill associated with the Ruche EEA. Note that in the event of a spill, the response actions will be carried out in line with the Vessel Shipboard Oil Pollution and Emergency Plans (SOPEPs) and the BWE Oil Spill Contingency Plan for Ruche Field Development (4417-BWE-D-TA-00007), as described in Section 4.2.4.3. Those plans will include engagement with national and provincial government and with local government and communities in the event of a spill (see Appendix 11E of ESIA Addendum)

and include mobilising local volunteer groups to assist in the preventative, containment, and clean-up measures in the event of a spill reaching the shore and arrangements for rescued wildlife and their rehabilitation.

Mitigation of impacts on mammals and turtles

The following broad measures address potential oil spill impacts on marine turtles and Atlantic humpback dolphins (as well as impacts from vessel collision and flaring):

- Working with the local Agency of National Parks and conservation partners (e.g., WCS, WWF, others), identify the marine coastal areas that host the greatest and/or more resident populations of nesting turtles and Atlantic humpback dolphins.
- With the same partners, develop mitigation procedures to address impacts of oil (and shipping/vessel collision) on these species in the identified high-risk areas. The procedures, the background information obtained from identification of high-risk areas and the participating partners, use and role of MMOs and the response strategy will be combined to form a Marine Mammal Mitigation & Monitoring Plan (MMMMP) which will also cover marine turtles.
- The deployment of a MMO on construction vessels during facility installation (Hibiscus Alpha OI and flowline to FPSO) and seasonally on supply vessels and on the HA OI and FPSO is seen as an integral part of the MMMMP. Observations of marine mammal and turtle species and effectiveness of mitigation measures (including those related to flaring) will be recorded in the MMO Daily Reports and submitted to BWE, and participating partners (e.g., WCS and ANPN to inform their conservation initiatives). Procedures for vessel operators encountering marine mammals or turtles are defined in the Vessel Code of Conduct (Appendix A).

  Of relevance is that 30 local Gabon personnel were trained as MMOs in 2016, from which it will be possible to contract a number to perform the tasks outlined here and in the Vessel Code of Conduct (Appendix A).
- Support the development of training program with field trials involving local and central government personnel and establish a communication and transport systems to facilitate effective implementation mitigation procedures.

4.6 Monitoring to achieve no net loss

Biodiversity monitoring and evaluation will be undertaken to assess the efficacy of the avoidance and mitigation measures and conservation actions and to inform the requirement for adaptive management. This could potentially be a collaborative approach with protected area managers and non-governmental organisations.

A draft set of monitoring actions has been developed to determine the success of the mitigation measures designed for the Project. Where possible, thresholds will be established for each monitoring approach that will alert the Project that mitigation measures need to be adapted and revised biodiversity management measures are required. The following sections describe the main features of the project or biodiversity aspects that have been considered for monitoring, with explanation of whether monitoring will be implemented and if so how.

4.6.1 Project related underwater noise

Monitoring of underwater noise created by project activities is not considered to be justified taking into account the following:

- the lack of impulsive noise sources associated with facility installation, drilling and operational activities (noise source levels are generally low level, continuous and associated with the drilling and vessel movements)
- the fact that the Ruche EEA has been operational since 2018 (therefore not possible to obtain baseline data for comparative purposes)
- that the predicted underwater noise impact distances are relatively short for physiological impact thresholds (maximum of 220 m for temporary threshold shift (TTS) in low frequency (LF) cetaceans for a 30-minute exposure period, see Section 6.4.2.2. of ESIA Addendum for more information).

4.6.2 Discharges

Drilling

Monitoring of discharges during drilling will be reported to BWE by drilling contractor in their End of Well Report.

Following will be monitored:

- Estimated volume of cuttings and drilling fluids (WBDFs and NADFs) discharged – quantities calculated and recorded on a daily basis in the Daily Mud Report and Daily Drilling Report
- Estimated volumes of cuttings and drilling fluids returned to shore (applicable to whole NADFs and out of spec cuttings) - quantities calculated and recorded each time there is a shore transfer in the Daily Mud Report and Daily Drilling Report
- Estimated volume of cement discharged to seabed during cementing of surface hole - recorded in the Daily Mud Report and Daily Drilling Report
- Barite heavy metal concentrations – certificates provided for shipment to Gabon reviewed and mercury and cadmium content recorded in the Daily Mud Report and Daily Drilling Report
- Inventory of drilling fluids / additives and cementing chemicals and their volumes / mass in the drilling system will be maintained.

Produced water

Following will be monitored by BWE:

- Volumes of produced water discharged from BW Adolo FPSO and Hibiscus Alpha OI and oil in water content.
- Inventory of production chemicals and their injection rates into oil stream.

Hydrotest water

Following will be monitored / reported by the flowline installation contractor:

- Volumes of hydrotest water discharged, location and flow rate.

- Inventory of chemicals used in hydrotest water and their volumes / mass in discharged hydrotest water.

Other operational discharges

In addition, following will be monitored / recorded in compliance with MARPOL requirements on rig, vessels and BWE facilities:

- Estimated volumes of sanitary waste discharged and chlorine content. Visible floating solids, discoloration of surrounding water monitored during discharge.
- Volumes of food waste discharged – recorded in Garbage Management Book
- Volumes of bilge water discharged and oil in water content – continuous monitoring of wastewater from bilge and engine rooms, discharges recorded in Oil Record Book
- Volumes and temperature of cooling water discharged.

Accidental spill events

Any accidental spills will be notified to BWE including volume released, type of hydrocarbon / chemical, and measures to contain or minimise impacts of spill.

BWE will inform the Director of the Direction Générale des Hydrocarbures (DGH) and the Technical Director of the Centre National Anti-Pollution (CNAP).

4.6.3 Marine mammal and turtle monitoring

BWE will consider the following dedicated surveys to improve the understanding of the populations of Atlantic humpback dolphins, other marine mammals and turtles:

- Working with local Agency of National Parks and conservation partners (e.g., WCS, WWF, others), identify the marine coastal areas that host the greatest and/or more resident populations of Atlantic humpback dolphins, other cetaceans and turtles. Survey areas need to include the vicinity of Pert Gentil headland (hotspot for humpback whale mothers and calves), parts of the supply vessel navigation route, and around the Ruche EEA.
- Establish a local marine mammal and turtle survey team and conduct targeted surveys, at appropriate times of year, beginning as soon as possible, around the Ruche EEA and between the Ruche EEA and the coast to determine the presence of selected species.
- Establish a beach recorder-based reporting scheme to document dead turtles and marine mammals encountered floating at sea or washed up.
- Working with experts (e.g., within WCS and other specialist organisations), beginning as soon as possible, deploy acoustic recorders at one or two selected sites associated with the Ruche EEA to record marine mammal underwater noise. This method is well-documented and highly efficient at confirming the presence of a wide range of marine mammal species. It will determine different whale and dolphin species passing through the Ruche EEA, and their seasonality. Underwater hydrophones are used to detect and record whale vocalisations or (in the case of humpback whales) song. A number of different technologies are

currently on the market such as wireless PAM buoys that can transmit information to a nearby marine platform.

- Results from the dedicated surveys would inform any future monitoring programme and would be captured in the MMMMP. Longer-term monitoring should be developed in conjunction with WCS and ANPN (engagement with Tim Collins, an expert in cetaceans in Gabon and an associate of WCS, and ANPN has been initiated as part of this BAMP development). Discussions with both organisations showed that effective data collection can provide a good understanding of the status of the critical habitat species and lead to meaningful conservation outcomes for the area.

As stated earlier, any collision with a marine mammal or turtle must be reported to BWE (in order to inform the ANPN) and will be one of the procedures in the MMMMP.

4.6.4 Seabed monitoring

BWE will consider dedicated surveys to improve the understanding of the seabed with the Ruche EEA following the steps outlined here:

- Working with local Agency of National Parks and conservation partners (e.g., WCS, WWF, others) and deep-sea benthos ROV experts (e.g., SERPENT Project, Southampton), define a programme of ROV surveys associated with the drilling and pipe laying programme.
- Engage SERPENT professionals to undertake surveys using the drilling contractor ROV equipment to collect video imagery and samples of seabed fauna around the well locations and pipeline routes.
- Results from the dedicated ROV surveys would inform any future monitoring programme associated with impacts on the seabed from drilling discharges, pipeline laying and other seabed installations.

4.6.5 AIS monitoring

See Alien Invasive Species Management Plan (ESIA Addendum, Appendix 11B).

5 REPORTING, EVALUATION AND ADAPTIVE MANAGMENT

5.1 Introduction

The previous sections describe a number of measures, procedures, plans and actions that are designed to mitigate impacts associated with marine biodiversity within the AOI. Actual implementation of these measures requires the participation of numerous and different stakeholders and contractors, under the leadership of the BWE Operations Manager and the appointed BAMP Manager. Once the project commences, monitoring becomes an ongoing effort which contributes to the success of the project when the data collected is analysed and evaluated, and results and findings are shared with relevant stakeholders so that procedures are adjusted going forward where necessary. Such an approach is often referred to as 'adaptive management' or iterative, which starts with the assessment of the problem, in this case determining the status of the key biodiversity features that informs the design of management measures, during the deliberative phase (see Figure 5.1).

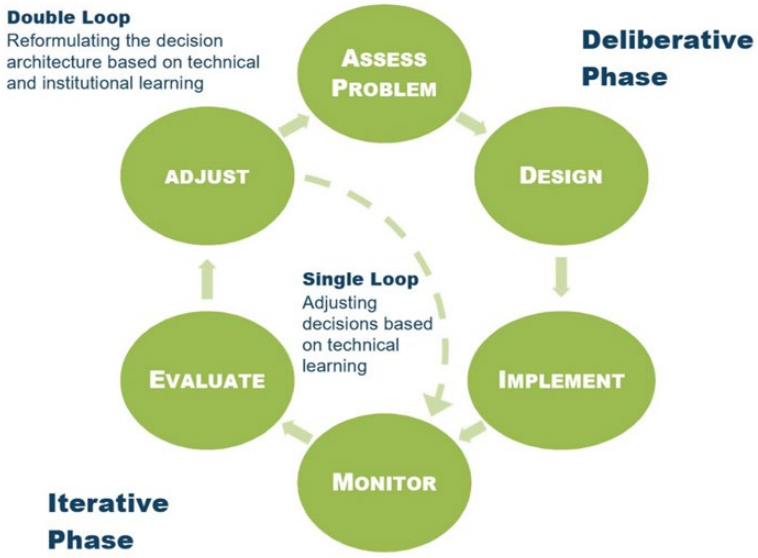

Figure 5.1: Adaptive Management Cycle

Source: MPA Fisheries Management Toolkit, 2020

Adapting marine biodiversity conservation measures based on learning, maximise the opportunity to achieve the BAMP objectives while minimising impacts on the marine environment. This adaptive, approach incorporates feedback loops (Figure 5.1) which can increase the rate at which new information can aid management decisions and creates a shared understanding among project personnel, contractors, local and international stakeholders. As noted in previous baseline sections associated with the ESIA, the marine environment of Gabon, especially the south-eastern portion of the EEZ, is a dynamic, data poor space with substantial uncertainties in the evidence base that

underpins the management of marine biodiversity necessary to achieve the BAMP objectives. For BAPM to be effective, it is important that a process exists to ensure that advice on biodiversity and management continues to evolve as understanding of these factors improves.

5.2 Performance review and auditing

Regular audits of the Project ESMP and associated management systems including the BAMP and ESAP implementation will be undertaken internally by BWE. The audits will assess the following three main features:

1) Adequacy of the plans with respect to the scale and nature of anticipated impacts and current development stage of the Project;
    - workforce awareness, competence and compliance with the ESMP, BAMP and associated plans and procedures
    - performance of managers, operators and contractors in implementing, maintaining and enforcing the ESMP, BAMP and associated plans
    - suitability of allocated resources, equipment and budget for implementation of the ESMP, BAMP and associated plans.
2) Corrective actions will be followed up through the relevant BWE tracking database to ensure the process is documented and items closed. The BAMP will be updated, when necessary, to reflect any significant changes to the Project or if it is determined that the mitigation measures are not effective.
3) During the execution phase of Ruche Phase 1 BWE will submit two monitoring reports per year to the lender group. During operations phase the frequency of monitoring report submission will be annually.

6 IMPLEMENTATION

6.1 Roles and responsibilities

Implementation of this BAMP will require appropriate staff, financial resources and support systems. It is the responsibility of all BWE staff and Project contractors to comply with the requirements set out in this document. The responsibility of Project contractors will be defined through standard terms and conditions of contracts that are consistent with the commitments of the BAMP.

Contractor and BWE responsibilities have been indicated throughout this BAMP. BWE and its contractors will determine more detailed attribution of roles and responsibilities on a case-by-case basis.

The BWE Gabon Country Manager will be accountable for the implementation and maintenance of this management plan and the BWE Operations Manager will be responsible.

BWE's Community Liaison Officer will assist in managing efficient partnerships with local community and conservation groups to deliver positive conservation actions.

7 RELATED DOCUMENTS

7.1 Internal documents

The following internal documents relate to the BAMP:

Reference	Title
80834/04/12	Dussafu Block Development ESIA Addendum
80834/04/06/01 (ESIA Addendum - Appendix 11B)	BWE Alien Invasive Species Management Plan
44417-BWE-D-TA-00007	BWE Oil Spill Contingency Plan
-	Vessel Shipboard Oil Pollution and Emergency Plans (SOPEPs)

8 REFERENCES

Barbier, E. B. (2017). Marine ecosystem services. Current Biology, 27(11), R507-R510.

BBOP (Business and Biodiversity Offsets Programme). Forest Trends, The Mitigation Hierarchy. [Online] available from: https://www.forest-trends.org/bbop/bbop-key-concepts/mitigation-hierarchy/ Accessed 21 April 2021].

BW Energy (BWE) (2020) Annual Report 2020.

Collins, T., (2015) Re-assessment of the Conservation Status of the Atlantic Humpback Dolphin (*Sousa teuszii*), Using the IUCN Red List Criteria. Advances in marine biology, 72, pp.47-77.

Cross Sector Biodiversity Initiative (CSBI), 2015 A cross-sector guide for implementing the Mitigation Hierarchy, The Biodiversity Consultancy http://www.csbi.org.uk/our-work/mitigation-hierarchy-guide/

Enviropass (2020) Etude d'impact Environnemental et Social Projet de Développement du champ Ruche Phases 1 et 2 (ESIA of the Ruche Field Development Project Phases 1 and 2).

FFI (Fauna & Flora International) (2017). Biodiversity and Ecosystem Services: Good Practice Guidance for Oil and Gas Operations in Marine Environments. FFI: Cambridge U.K. Available at www.fauna-flora.org.

IFC (2012) International Finance Corporation's Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

IFC (2019) International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

International Association of Oil and Gas Producers (IOGP). 2005. "Fate and Effects of Naturally Occurring Substances in Produced Waters on the Marine Environment." Report No. 364. London.

International Union for the Conservation of Nature (IUCN) (2021) The IUCN Red List of Threatened Species [online]. Available from: https://www.iucnredlist.org/ [Accessed August 2021].

IPIECA (International Petroleum Industry Environmental Conservation Association)/IOGP (International Association of Oil and Gas Producers). (2016), Biodiversity and Ecosystem Services Fundamentals. Guidance Document for the Oil and Gas Industry. IOGP Report 554.

MA (Millennium Ecosystem Assessment). (2005), Ecosystems and Human Well-being: Biodiversity Synthesis. (online) available at: http://www.maweb.org/documents/document.354.aspx.pdf. Accessed 2 March 2020.

MPA Fisheries Management Toolkit, (2020). Developing a participatory approach to managing fishing activity in UK offshore Marine Protected Areas. JNCC, Natural England, National Federation of Fishermen's Organisation, Marine Management Organisation. Available at: https://jncc.gov.uk/our-work/mpa-fisheries-management-toolkit/

O'Connor, J.J., Fobert, E.K., Besson, M., Jacob, H. and Lecchini, D., (2019) Live fast, die young: Behavioural and physiological impacts of light pollution on a marine fish during larval recruitment. Marine pollution bulletin, 146, pp.908-914.

OSPAR Commission (OSPAR). 2000. "Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings." London.

OSPAR Commission (OSPAR). 2010. "Recommendation 2010/4 on a Harmonised Pre-Screening Scheme for Offshore Chemicals." OSPAR 10/23/1, annex 10. London.

OSPAR Commission (OSPAR). 2011. “Recommendation 2011/8 Amending OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations as Amended.” London.

Polidoro, B., Ralph, G.M., Strongin, K., Harvey, M., Carpenter, K.E., Ayo, T.A., Arnold, R., Bannerman, P., Nguema, B.B., Buchanan, J.R. and Mohamed, K., (2016) Red List of marine bony fishes of the Eastern Central Atlantic.

Pulgar, J., Zeballos, D., Vargas, J., Aldana, M., Manriquez, P.H., Manriquez, K., Quijón, P.A., Widdicombe, S., Anguita, C., Quintanilla, D. and Duarte, C., (2019) Endogenous cycles, activity patterns and energy expenditure of an intertidal fish is modified by artificial light pollution at night (ALAN). Environmental Pollution, 244, pp.361-366.

Schwing, P. T., and Machain-Castillo, M. L. (2020). “Impact and resilience of benthic foraminifera in the aftermath of the Deepwater Horizon and Ixtoc 1 oil spills (Chap. 23),” in Deep Oil Spills: Facts, Fate, Effects, eds S. A. Murawski, C. Ainsworth, S. Gilbert, D. Hollander, C. B. Paris, M. Schlüter, et al. (Cham: Springer).

Sea Watch Foundation (2009) National Whale & Dolphin Watch 18-26th July 2009 https://www.seawatchfoundation.org.uk/wp-content/uploads/2013/06/NWDW-Report_2009_final.pdf

Terrocea (2019a). Environmental Observation and Inventory of Marine Species on the Tortue Field in the Ruche EEA, Preliminary Report. Mission on the BW Adolo FPSO (from August 26 to September 04, 2019).

Terrocea (2019b). Environmental Observation and Inventory of Marine Species on the Tortue Field in the Ruche EEA, Preliminary Report 2. Mission on the Borr Norve Drilling Rig (from November 25 to December 04, 2019).

Terrocea (2020). Environmental Observation and Inventory of Marine Species on the Tortue and Hibiscus Fields in the Ruche EEA, Preliminary Report 3. Mission on the Fugro Scout vessel (from December 09 to January 04, 2020).

U.S. Environmental Protection Agency (US EPA). 2013. “Code of Federal Regulations (CFR). Title 40: Protection of Environment. Part 435. Oil and Gas Extraction Point Source Category; Subpart A—Offshore Subcategory.” Washington, DC.

WCS (Wildlife Conservation Society) Gabon (2021) Marine Mammals. [Online] available from: https://gabon.wcs.org/en-us/Wildlife/Marine-Mammals.aspx [Accessed 21 April 2021].

Weir, C.R. and Collins, T., (2015) A review of the geographical distribution and habitat of the Atlantic humpback dolphin (*Sousa teuszii*). Advances in marine biology, 72, pp.79-117.

APPENDIX A - VESSEL CODE OF CONDUCT

Purpose

The aim of this Vessel Code of Conduct (VCoC) is to facilitate BW Energy's offshore activities while simultaneously minimising potential interaction with marine mammals and turtles – principally from underwater noise effects and potential accidental collision with vessels.

Summary of risks / impacts

Underwater noise:

Underwater noise will be generated during the installation of the Ruche Phase 1 facilities (subsea flowline, umbilicals and Hibiscus Alpha Offshore Installation) due to the large construction vessels involved. This has the potential for physiological and behavioural impacts on marine mammals, and to a lesser extent on turtles.

It is acknowledged, however, that the underwater noise generated will be continuous noise rather than impulsive noise (such as that associated with seismic surveys, etc). As such (based on underwater noise modelling) the zone of physiological impact is predicted to be relatively small, with the behavioural impact zone extending further from the noise source. The mitigation measures outlined in this VCoC take this limited physiological impact zone into consideration.

Accidental collision:

There is the potential for accidental collision with marine fauna during the Ruche Phase 1 activities and during ongoing production operations. The risk of collision is considered to be highest from the faster moving supply vessels, rather than the slower moving large construction vessels.

Importance of Project area and species triggering critical habitat

The Gulf of Guinea has been identified as a marine biodiversity hotspot. Seasonal upwelling drives exceptional primary productivity in offshore Gabonese waters resulting in high biodiversity in the area. The Ruche EEA is located within the Aquatic Reserve of the Great South of Gabon, a large Marine Protected Area (MPA) designated to promote biodiversity conservation. It is also in close proximity to the Mayumba National Park and Ecologically or Biologically Significant Area (EBSA), which recognises the global importance of the area for leatherback turtle nesting.

The following marine mammal and turtle species have been identified as triggering critical habitat in the Project area:

- Atlantic humpback dolphin (*Sousa teuszii*) – coastal species generally found in waters less than 30 m depth, with majority sighted less than 13 km from land. Mayumba National Park is a hotspot for Atlantic humpback dolphins in Gabon.
- Humpback whale (*Megaptera novaeangliae*) – coastal and offshore species, migrates to Gabonese waters to breed between June and November (peak numbers in August). The area around Port Gentil headland (on the supply vessel transfer route to the logistics base) is particularly important for humpback whale mothers and calves, with large numbers congregating in the area and using the sand banks in this area to protect young from predation. Peak number of mothers and calves are usually observed in October.

- Leatherback turtle (*Dermochelys coriacea*) – nests along the Gabonese coastline and particularly in Mayumba National Park, egg-laying from October to April (peak December to January). This species uses the whole of the Aquatic Reserve of the Grand South of Gabon and Mayumba National Park as a migration route to the coastal nesting beaches.

Other marine mammal species commonly found in Gabonese waters include a variety of oceanic dolphins including the common dolphin (*Delphinus capensis*), the Atlantic spotted dolphin (*Stenella frontalis*), the pantropical spotted dolphin (*Stenella attenuata*) and the common bottlenose dolphin (*Tursiops truncatus*). Other larger species include the killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), at least one species of beaked whale (*Ziphius cavirostris*), the sperm whale (*Physeter macrocephalus*) and the Bryde's whale (*Balaenoptera edeni*).

Other turtle species nesting along Gabon's coastline are the hawksbill turtle (*Eretmochelys imbricata*), the green turtle (*Chelonia mydas*), and olive ridley turtle (*Lepidochelys olivacea*).

Restrictions and operational guidelines

General guidelines to be followed to minimise the effects of marine vessels / persons on marine mammals and turtles

General guidelines are provided below, it should be noted that nothing in these guidelines shall operate to prohibit anything done for the preservation of life at sea, or in the interests of public safety. In addition, nothing in these guidelines shall operate to restrict the obligations on persons and vessels to obey rules associated with local, regional and international safety conventions for handling vessels at sea.

1. Project vessels transiting between the logistics base in Port Gentil and the Ruche EEA will not enter the designated waters of Mayumba National Park.

2. Any vessel and/or person(s) shall attempt to maintain a minimum distance of 100 m from any individual marine mammal / turtle or group thereof. Vessels that are themselves approached by marine mammals / turtles may remain but should gear their engines into neutral, providing this does not cause a safety hazard.

3. No vessel shall, when less than 100 m from any marine mammal(s) / turtle(s), exceed a speed of 5 knots, providing this does not cause a safety hazard.

4. No vessel shall alter speed or course suddenly when less than 100 m from any marine mammal(s) / turtle(s).

5. No person or vessel shall deliberately approach to less than 100 m from any turtle(s) situated on land, unless approved to do so by the relevant authority.

6. No vessel shall use underwater acoustic transmitters, except navigational systems, when less than 1000 m from any marine mammal / turtle.

7. No unauthorised divers should be allowed to enter the water within 100 m of any marine mammal / turtle. This will be in the interest of health and safety of the divers as well as any

marine mammal / turtle. Any commercial divers working should be aware that they might be approached by marine mammals / turtles during the course of their work.

8. Any vessel collision with a marine mammal or turtle must be reported to BWE in order to inform the Agence Nationale des Parcs Nationaux (ANPN) - National Agency of National Parks.

Specific guidelines for supply vessels

9. A qualified and experienced Marine Mammal Observer (MMO)[7] will be on board one of the supply vessels transiting between the logistics base in Port Gentil and the Ruche EEA for limited periods (number of days per month, and at specific times of year), but likely to include at least the months of July, August and October during the main humpback whale season. The MMO will record their observations using standardised data forms, such as those adopted by the JNCC in the United Kingdom[8], and the report will be submitted to BWE.

10. Pending the findings from the marine mammal surveys, supply vessels transiting between the logistics base in Port Gentil and the Ruche EEA may need to adhere to restricted vessel speeds (<10 knots) within a specified distance from Port Gentil headland during months of intense humpback whale activity and not navigate through waters shallower than 50 m at Port Gentil headland.

Specific guidelines for vessels engaged in facility installation (construction-related) activities

11. Qualified and experienced MMOs will be on board the facility installation vessels in order to record wildlife sightings and any interactions between the installation activities and marine mammals / turtles (e.g., behavioural effects).

12. The dynamic positioning (DP) systems on the facility installation vessels are considered to be the greatest source of underwater noise from the installation activities. The Vessel Master (VM) will ensure that a mitigation zone of 200 m around the vessel[9] is visually free of marine mammals for 15 minutes before the DP thrusters are activated (MMOs will provide an advisory role). The initial start-up of the DP thrusters on arrival at the installation site will only be carried out during daylight hours to permit effective visual monitoring of marine mammals / turtles within the mitigation zone.

13. If marine mammals are observed within 200 m of the vessel during the 15-minute pre-start-up period, DP thruster activation should be delayed until they move away, and 15 minutes has passed without marine mammal observations within the mitigation zone.

14. Any break in operation of the DP thrusters of greater than 30 minutes will require start-up procedures as outlined in points 12 & 13 above to be implemented.

[7] A qualified and experienced MMO is a person who has undergone marine mammal observation training (JNCC MMO training course or equivalent) and has experience of identification of marine mammals in Gabonese waters or the Gulf of Guinea.

[8] https://hub.jncc.gov.uk/assets/e2a46de5-43d4-43f0-b296-c62134397ce4

[9] Based on under water noise modelling potential physiological injury distances (exposure duration 0.5 hours).

15. There is no requirement for works to cease if a marine mammal / turtle approaches the facility installation area subsequent to the DP start-up detailed in points 12, 13 & 14 above.

16. Should a situation arise where the MMO believes that a marine mammal / turtle may be under threat or in any danger, the VM shall confer with the MMO about the appropriate course of action before the VM decides whether / when works may or may not proceed.

17. The MMOs will record their observations using standardised data forms and the report will be submitted to BWE.

Specific guidelines for vessels engaged in any higher risk activities (i.e., seismic surveys, geophysical surveys)

Geophysical survey of the subsea flowline may be required following installation activities, and seismic surveys may be conducted by BWE as part of future work in the Ruche EEA.

18. Any seismic survey activities or geophysical (sonar) surveys will be carried out in line with the Gabonese 'Guidelines for Minimising the Risk of Disturbance and Injury to Marine Mammals and Sea Turtles during Offshore Seismic Exploration within proximity to Gabon's National Parks' (ANPN, 2015). Key requirements of these guidelines are provided in the boxed text below.

SUMMARY OF REQUIREMENTS IN ANPN GUIDELINES

USE OF AIRGUNS – SEISMIC SURVEYS

The operator should define the lowest practical airgun volume for the survey, and every effort should be made to adhere to this. Airguns should also be configured to minimise horizontal sound propagation, and where possible, to reduce or baffle any unnecessary high frequency noise produced. No firing of airguns is normally permitted outside of the approved prospect area or without adherence to the following standards.

1. **Exclusion Zones**
   An Exclusion Zone (EZ) is recognised representing a radius of set distance around the airguns. Mitigation measures are employed should marine mammals or turtles be observed within the Exclusion Zone. The standard marine mammal and turtle EZ for all seismic surveys in national parks and their buffer zones, is 2000 m for the pre-shoot watch period, and 1000 m for soft starts and airgun shutdowns during line acquisition. These and all other prescribed EZ distances are to be measured as a radius from the centre of the sound source. In order to ensure that received sound levels within national parks and their buffer zones remain at acceptable levels, the ANPN recommends that within a 5 km band surrounding a buffer zone, a pre-shoot watch EZ of 1000 m be observed, with a soft start and shut-down EZ during line acquisition of 500m.

2. **Pre-shoot watch period**

MMOs will conduct a pre-shoot observation period of 30 minutes prior to the commencement of each soft start. Any marine mammal or turtle observed within the 2000 m EZ during the pre-shoot watch period will occasion the delay of the launch of the soft start. The pre-shoot watch period may continue either when the animal is seen to exit the EZ, or should its departure not be witnessed, following a period of 20 minutes (during which no other animals are observed). A period of 30 minutes without any observation of cetaceans or turtles must be achieved prior to the launch of the soft start. If an animal observed during the pre-shoot watch or a soft start shutdown fails to exit the zone, the vessel should alter course and continue its operations at a distance at which the EZ can be maintained.

3. **Exclusion Zones**

An Exclusion Zone (EZ) is recognised representing a radius of set distance around the airguns. Mitigation measures are employed should marine mammals or turtles be observed within the Exclusion Zone. The standard marine mammal and turtle EZ for all seismic surveys in national parks and their buffer zones, is 2000 m for the pre-shoot watch period, and 1000 m for soft starts and airgun shutdowns during line acquisition. These and all other prescribed EZ distances are to be measured as a radius from the centre of the sound source. In order to ensure that received sound levels within national parks and their buffer zones remain at acceptable levels, the ANPN recommends that within a 5 km band surrounding a buffer zone, a pre-shoot watch EZ of 1000 m be observed, with a soft start and shut-down EZ during line acquisition of 500m.

4. **Pre-shoot watch period**

MMOs will conduct a pre-shoot observation period of 30 minutes prior to the commencement of each soft start. Any marine mammal or turtle observed within the 2000 m EZ during the pre-shoot watch period will occasion the delay of the launch of the soft start. The pre-shoot watch period may continue either when the animal is seen to exit the EZ, or should its departure not be witnessed, following a period of 20 minutes (during which no other animals are observed). A period of 30 minutes without any observation of cetaceans or turtles must be achieved prior to the launch of the soft start. If an animal observed during the pre-shoot watch or a soft start shutdown fails to exit the zone, the vessel should alter course and continue its operations at a distance at which the EZ can be maintained.

5. **Soft starts**

Soft starts are required prior to every use of the airguns, including airgun testing (*see 'Line Changes' below for the only exception*). The duration of the soft start should be no less than 25 minutes, and no more than 40 minutes. Shooting should begin with a small individual airgun (i.e., <70 in^3), and should increase in approximately equal increments until the final shooting volume is reached. Soft starts must be conducted as close to the start of each line as possible, and once the final volume is reached, line acquisition should commence as soon as possible.

A soft start shutdown will be requested by the MMO should a marine mammal or turtle be sighted within the 1000 m EZ. In the event of a soft start shutdown, a new soft start may be launched once the animal is observed to exit the EZ, or if not seen, 20 minutes after the last sighting of the animal. No additional pre-shoot watch is required in this instance, as the MMO is required to remain on watch throughout the period.

6. **Shutdown during line acquisition**
   An airgun shutdown during line acquisition will be requested by the MMO any time a marine mammal or turtle is observed within the 1000 m EZ. Should this occur, a new soft start period may commence when the animal is observed leaving the EZ, or 20 minutes after the last observation of the animal. Should the line be shut down for operational reasons not linked to animal presence, any delay in shooting greater than 5 minutes will require a new soft start.

7. **Exclusion Zones**
   An Exclusion Zone (EZ) is recognised representing a radius of set distance around the airguns. Mitigation measures are employed should marine mammals or turtles be observed within the Exclusion Zone. The standard marine mammal and turtle EZ for all seismic surveys in national parks and their buffer zones, is 2000 m for the pre-shoot watch period, and 1000 m for soft starts and airgun shutdowns during line acquisition. These and all other prescribed EZ distances are to be measured as a radius from the centre of the sound source. In order to ensure that received sound levels within national parks and their buffer zones remain at acceptable levels, the ANPN recommends that within a 5 km band surrounding a buffer zone, a pre-shoot watch EZ of 1000 m be observed, with a soft start and shut-down EZ during line acquisition of 500m.

8. **Pre-shoot watch period**
   MMOs will conduct a pre-shoot observation period of 30 minutes prior to the commencement of each soft start. Any marine mammal or turtle observed within the 2000 m EZ during the pre-shoot watch period will occasion the delay of the launch of the soft start. The pre-shoot watch period may continue either when the animal is seen to exit the EZ, or should its departure not be witnessed, following a period of 20 minutes (during which no other animals are observed). A period of 30 minutes without any observation of cetaceans or turtles must be achieved prior to the launch of the soft start. If an animal observed during the pre-shoot watch or a soft start shutdown fails to exit the zone, the vessel should alter course and continue its operations at a distance at which the EZ can be maintained.

9. **Soft starts**
   Soft starts are required prior to every use of the airguns, including airgun testing (*see 'Line Changes' below for the only exception*). The duration of the soft start should be no less than 25 minutes, and no more than 40 minutes. Shooting should begin with a small individual airgun (i.e., <70 in^3), and should increase in approximately equal increments until the final shooting volume is reached. Soft starts must be conducted as close to the start of each line as possible, and once the final volume is reached, line acquisition should commence as soon as possible.

   A soft start shutdown will be requested by the MMO should a marine mammal or turtle be sighted within the 1000 m EZ. In the event of a soft start shutdown, a new soft start may be launched once the animal is observed to exit the EZ, or if not seen, 20 minutes after the last sighting of the animal. No additional pre-shoot watch is required in this instance, as the MMO is required to remain on watch throughout the period.

10. **Shutdown during line acquisition**
    An airgun shutdown during line acquisition will be requested by the MMO any time a marine mammal or turtle is observed within the 1000 m EZ. Should this occur, a new soft start period may commence when the animal is observed leaving the EZ, or 20 minutes after the last observation of the animal. Should the line be shut down for operational reasons not linked to animal presence, any delay in shooting greater than 5 minutes will require a new soft start.

11. **Line changes**
    Line changes of a duration equal to, or longer than, the soft start period will require a full shut-down of the airguns at the end of each completed line, and a full soft start prior to the beginning of the next line. Should time allow between lines (i.e., 30 minutes plus the soft start duration), a pre-shoot watch period will also be respected prior to the soft start. Where line change time is expected to be less than the calculated soft start duration, the operator may employ a 'reduced duration soft start', whereby the airgun volume is reduced to 160 dB rms at the end of the line, and a gradual increase to full power initiated, reaching full volume immediately prior to the start of the new line. During a reduced duration soft start, the MMO is expected to remain on watch and respect the soft start shut-down protocol, but a pre-shoot watch is not required.

12. **Night operations**
    Pre-shoot 'watches', soft starts and EZ controls will continue to be enforced during the hours of darkness, but 'delay' or 'shut-down' requests will be initiated by the PAM operator.

13. **Poor weather/visibility**
    During daylight hours, should the visibility fall below 2000 m during the pre-shoot watch period, or 1000 m during the soft start period and line acquisition, the PAM operator should replace the on-deck MMO team in advising on pre-shoot watch, soft start, and line acquisition mitigation. The same EZ dimensions and delay periods will be respected during low visibility. The on-deck MMO team should replace the PAM system as soon as the visibility improves to the stated levels.

14. **Other vessels**
    Guard vessels and other boats employed during the survey must remain at least 300 m from any marine mammal or sea turtle (unless directed to approach it by the MMO team should injury be suspected, or should the collection of dead specimens be required). It is forbidden for any vessel to shepherd marine mammals, turtles, or any other wildlife away from the sound source or out of the EZ.

SONAR SURVEYS

In cases where no airgun use is anticipated and sonar gear is the only equipment utilised (usually a single towed unit to collect bathymetric and seabed characteristics data) some level of mitigation may still be appropriate, depending on the nature of the sound source. Sonar units operating above 250 kHz are believed to pose little or no direct threat to turtles and cetaceans. Such campaigns are thus exempt from the requirement to observe soft-start, and line shut-down standards. However, a single MMO will be requested or proposed in order to record wildlife sightings, and any interactions involving the survey equipment or the ship (e.g., collisions and any other impacts).

The use of sonar equipment below 250 kHz may be audible to some species and is subject to mitigation guidelines. Due to the narrow beam width of most sonar units, the presence of 1-2 MMO personnel is likely to be adequate in most cases. Within national parks and buffer zones, a 500 m EZ will be observed during a pre-shoot watch period of 30 minutes and a soft start of 25-40 minutes. On some units, a soft start is not possible, and in such cases, it may be possible to activate and deactivate the unit at full power repeatedly over a 25 minute period prior to the start of continuous acquisition. Delay and shut down procedures will follow those for seismic surveys during pre-shoot watch, soft start, and line acquisition, using an EZ of 500 m. After a delay or shut down, activity may continue following the departure of an animal from the EZ or 10 minutes after the last observation of the animal within the EZ.

The use of some sonar systems may, depending on type, be further regulated by the ANPN within parks, if they are deemed to pose a significant threat to wildlife.

Incorporating BWE responses to RSK questions	01				
REASON FOR ISSUE	REVISION	REV. DATE	PREP. BY	CHECKED	APPROVED

BW ENERGY	*Document Class:*	*No. of pages*
Project: RUCHE PHASE 1 *Unit:* Hibiscus Alpha *IMO No:* *Client:* BW Energy	*Doc. type:* XX- *Discipline:* X *System no:* XX	
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Revision History

Revision	Section	Paragraph	Description of changes

TABLE OF CONTENTS

1 Introduction

1.1 Project Background

Dussafu Marin License, offshore southern Gabon, contains four oil discoveries: Ruche (Ruche A), Tortue (Ruche B), Moubenga (Ruche C) and Walt and Whitman (Ruche D) containing a total of 47.5 mmbbl of recoverable oil. The region containing these discoveries is called the Ruche Exclusive Exploitation Area (Ruche EEA) and has an area of 850 km^2, see Figure 1.1.

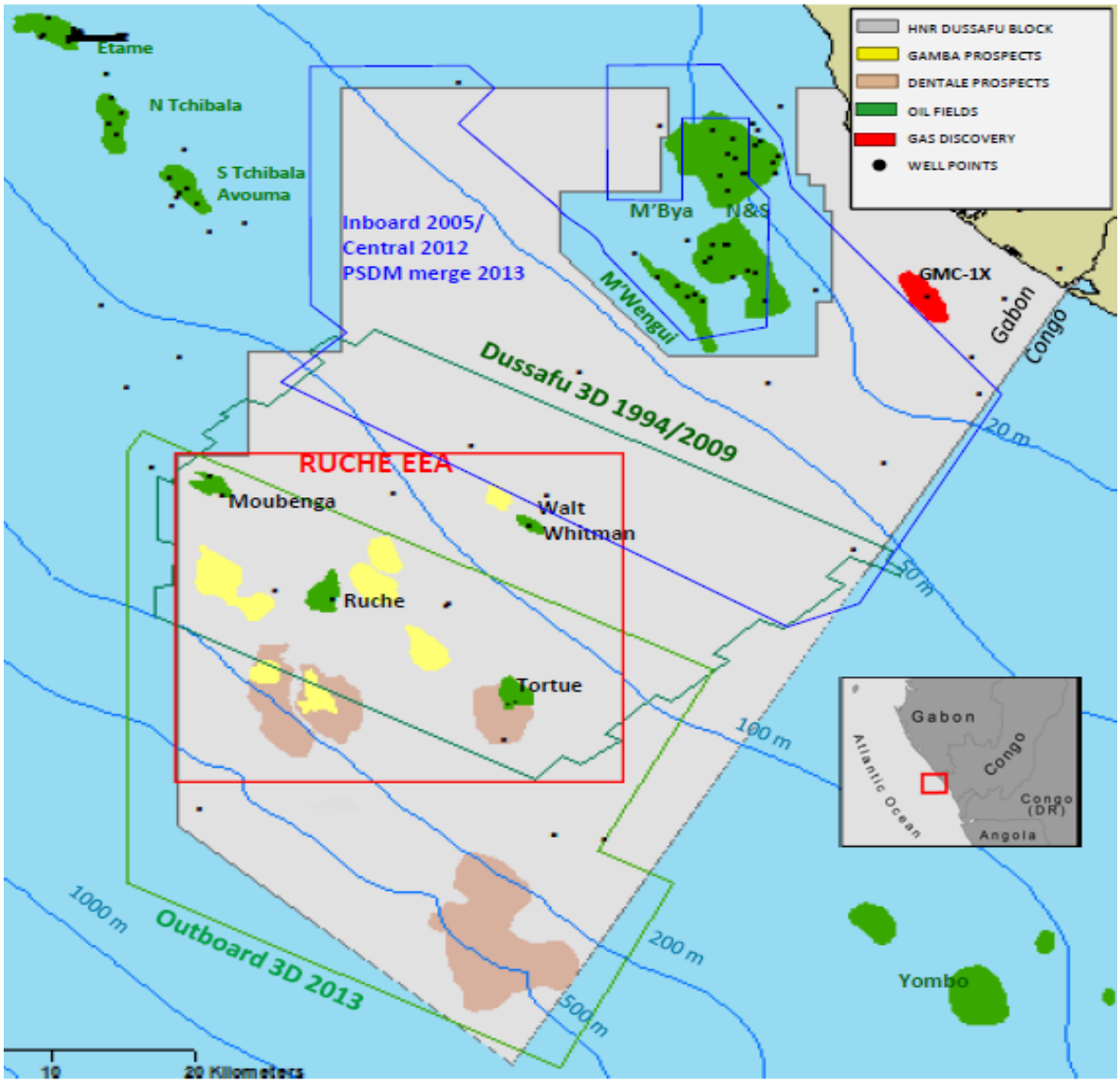

Figure 1.1: Dussafu Block, Ruche EEA and Fields

Source: BW Energy Gabon, 2020

The Ruche EEA was awarded on July 17, 2014. On April 10, 2017, BW Energy Gabon (BWE) acquired Harvest Dussafu BV (66.67% working interest) and was approved by the Ministry of Oil as the operator of the Dussafu Marin Permit. The Field Development Plan was approved by the General Directorate of Hydrocarbons (DGH) in December 2017.

The full field development consists of multiple subsea wells, producing from a combination of the Gamba and Dentale formations, tied back through flowlines to a Floating Production Storage and Offloading (FPSO) unit (located close to the Tortue Field) and an Offshore Installation (OI) (located between Hibiscus and Ruche Fields).

BWE is to develop the discoveries in a phased approach.

- Tortue Phase 1 (currently at operational phase)
- Tortue Phase 2 (currently at operational phase)
- Ruche Phase 1 (currently at execute phase with detailed design, construction / conversion underway).

1.2 Management Plan Scope

This document is an Alien Invasive Species Management Plan (AIS MP) which has been prepared as a result of Critical Habitat Screening conducted for the Project which concluded that there is the potential that Project activities could result in impacts on natural and critical habitat identified in the Ruche EEA through the accidental introduction and/or spread of alien invasive flora and fauna species.

Alien invasive species[1] are non-native species that are deliberately or unintentionally introduced by human action outside their natural habitats where they establish, proliferate and spread in ways that cause damage to biological diversity (e.g., by competing with native organisms for limited resources and altering habitats).

The scope of this AIS MP is as follows:

- Tortue Phase 1 (currently at operational phase)
- Tortue Phase 2 (currently at operational phase)
- Ruche Phase 1 (currently at execute phase with detailed design, construction / conversion underway).

These development phases are all under the ownership of BWE.

It should be noted that the BW Adolo FPSO is not part of the Project, however, it meets the definition of an associated facility and is therefore also included in the scope. Operation of oil transportation tankers serving the FPSO are also considered to be included in scope.

[1] According to the CBD Guiding Principles, an alien species refers to a species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce (some international/ regional/ national instruments use the terms ‘exotic species’, ‘non-indigenous species’ or ‘non-native species’ when referring to ‘alien species’).

2 Legislation and Guidelines

Applicable international, regional and national requirements relevant to the management of AIS, either through general environmental or biodiversity protection requirements, or through more specific management requirements are outlined below.

2.1 International Conventions

2.1.1 International Convention for the Control and Management of Ship's Ballast water and Sediments (BWM Convention)

Adopted in 2004, the BWM Convention is the international convention for the control and management of ship's ballast water and sediments. The aim of the convention is to remove, render harmless or avoid uptake or discharge of harmful aquatic organisms and pathogens within ballast water and sediments by mechanical, physical, chemical and biological processes (either singularly or in combination).

It applies to all vessels operating in the aquatic environment. This includes submersibles, floating crafts, floating platforms, floating storage units (FSU), and floating production storage and offloading units (FPSOs)[2].

Under the Convention, all vessels involved in international traffic, are required to manage their ballast water and sediments to a certain standard, according to a ship-specific Ballast Water Management Plan and record all ballast water operations in the BWM Record Book. Vessels above 400 gross tonnage (GT) are subject to a survey regime and are required to hold an International Ballast Water Management Certificate[3].

The Convention requires that ballast water is managed to meet the standards set and allows for the phased introduction of two standards as detailed under Regulations D-1 and D-2.

- D-1 standard requires vessels to exchange ballast water in open seas, away from coastal areas. Few organisms survive.
- D-2 standard specifies the maximum amount of viable organisms allowed to be discharged, including specified indicator microbes harmful to human health. Usually involves installing a ballast water management system.

All new vessels must comply to the D-2 standard. Until the date they have to meet the D-2 standard, existing vessels should exchange ballast water mid-ocean to meet the D-1 standard. All vessels are required to meet the D-2 standard by 8 September 2024. More information on these standards is provided in Appendix A.

Gabon has been a party to the BWM Convention since 2019.

[2] The BWM Convention does not apply to the following:
- ships not designed or constructed to carry ballast water
- ships trading domestically (unless the coastal state within whose jurisdiction the ship trades requires compliance with the convention)
- any warships, naval auxiliary or other ships owned or operated by a State provided it is used only on government non-commercial service
- ships with permanent ballast water in sealed tanks and therefore not subject to discharge at any time.

[3] Floating platforms, FSUs and FPSOs may not need ongoing certification if they enter a period of exclusive operation within the waters under the jurisdiction of a single Party to the Convention.

2.1.2 Convention on Biological Diversity (CBD)

The CBD calls on its parties to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species (Article 8h).

A set of guidelines entitled 'Guiding principles for the prevention, introduction and mitigation of impacts of alien species that threaten ecosystems, habitats or species' has been developed to assist countries with the implementation of Article 8(h).

Gabon has been a party to the CBD since 1997.

The Aichi Biodiversity Targets of the CBD were developed at the Conference of Parties to the Convention in Nagoya, Japan, in 2010. They are intended to help countries measure their progress in preventing the loss of biodiversity and improving benefits from biodiversity to society. Strategic Goal B – Target 9 requires that: "Invasive species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment".

According to the Republic of Gabon's Sixth National Report on Biodiversity (Ministry of Water, Forests, Sea and the Environment, 2019) the national contribution to achieving this target is through Law n°007/2014 on the Protection of the Environment in the Gabonese Republic that helps regulate, among other things, the introduction of exotic species and monitoring and control measures.

2.1.3 Convention on Conservation of Migratory Species and Wild Animals (Bonn Convention)

The Bonn Convention aims to conserve terrestrial, marine and avian migratory species throughout their ranges. Article III (4)(c) addresses strictly controlling the introduction of, or controlling or eliminating already introduced, exotic species.

Gabon has been a party to the Bonn Convention since 2008.

2.1.4 United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS addresses AIS in Article 196, which requires States to take all measures necessary to prevent, reduce and control the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes to that environment.

Gabon has been a party to UNCLOS since 2009.

2.1.5 International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS Convention)

The AFS Convention prohibits the use of harmful organotins in anti-fouling paints used on vessels and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.

Annex I states that all vessels shall not apply or re-apply organotin compounds which act as biocides in anti-fouling systems. This applies to all ships (including fixed and floating platforms, FSUs, and FPSOs).

Vessels above 400 GT and engaged in international voyages (excluding fixed or floating platforms, FSUs and FPSOs) will be required to undergo an initial survey before the ship is put into service or before the International Anti-fouling System Certificate is issued for the first time; and a survey when the anti-fouling systems are changed or replaced.

Although this Convention addresses anti-fouling systems on vessels, its focus is on the prevention of adverse impacts from the use of anti-fouling systems and the biocides they may contain, rather than the prevention of the transfer of invasive aquatic species through fouling. The issue of transfer of invasive aquatic species through vessels' biofouling is addressed in the 'Biofouling Guidelines' developed by the IMO (see Section 2.4).

Gabon has been a party to the AFS Convention since 2019.

2.2 Regional Agreements

Recognising that addressing AIS requires coordinated responses between nations and especially between nations closely connected geographically and/or through trade and travel, regional AIS strategies and plans have also been developed. Under the GloBallast Partnerships Programme, Regional Strategies and Action Plans for BWM are being developed in all affiliated regions, through the establishment of Regional Task Forces.

The Guinea Current Large Marine Ecosystem region[4], under the coordinating body of the Interim Guinea Current Commission (IGCC), has held two regional conferences to develop and adopt a Regional Strategic Action Plan (finalised in July 2009) and has established a Regional Task Force (Tamelander et al, 2010).

2.3 National Legislation

2.3.1 Law n˚007/2014 on the Protection of the Environment in the Gabonese Republic

Article 76 requires that the introduction of exotic animals or plant species, liable to harm local animals or plant species, is subject to prior authorisation.

Article 86 states that the State is required to set up networks for continuous monitoring of the environment allowing the establishment and updating of quality standards and ensuing control of their application.

The bodies which monitor the presence of exotic species in the Gabonese marine environment are:

- General Directorate for Aquatic Ecosystems (Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan) - responsible for administrative aspects
- National Agency of National Parks (ANPN) including Gabon Bleu programme - responsible for operational monitoring.

2.4 Guidelines

The following guidance documents are considered applicable to this management plan:

- Technical guidelines relating to the uniform implementation of the BWM Convention:
  - Guidelines for sediment reception facilities (G1)
  - Guidelines for ballast water sampling (G2)
  - Guidelines for ballast water management equivalent compliance (G3)
  - Guidelines for ballast water management and development of ballast water management plans (G4)
  - Guidelines for ballast water exchange (G6)
  - Guidelines for risk assessment under regulation A-4 of the BWM Convention (G7)
  - Guidelines for approval of ballast water management systems (G8)
  - Procedure for approval of ballast water management systems that make use of active substances (G9)
  - Guidelines for approval and oversight of prototype ballast water treatment technology programmes (G10)
  - Guidelines for ballast water exchange design and construction standards (G11)
  - 2012 Guidelines on design and construction to facilitate sediment control on ships (G12)

[4] Includes Angola, Benin, Cameroon, Cote d'Ivoire, Congo, Democratic, Republic of Congo, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Sao Tome and Principe, Sierra Leone, and Togo.

- Guidelines for additional measures regarding ballast water management including emergency situations (G13)
- Guidelines on designation of areas for ballast water exchange (G14).

- IMO BWM guidance circulars:
  - BWM.2/Circ.46 - Application of the BWM Convention to Mobile Offshore Units
  - BWM.2/Circ.52/Rev.1 - Guidance on entry or re-entry of ships into exclusive operation within waters under the jurisdiction of a single Party
  - BWM.2/Circ.63 – Application of the Convention to ships operating in sea areas where ballast water exchange in accordance with regulations B-4.1 and D-1 is not possible.

- IMO guidelines relating to biofouling:
  - Guidelines for the control and management of ship's biofouling to minimise the transfer of invasive aquatic species (Biofouling Guidelines) (Resolution MEPC.207(62) 2011).

- General guidelines:
  - Alien Invasive Species and the Oil and Gas Industry – Guidance for Prevention and Management (IPIECA, 2010).

2.5 Lender Requirements

2.5.1 IFC Performance Standard 6 and Guidance Note

According to IFC PS6 and supporting Guidance Note, intentional or accidental introduction of alien, or non-native, species of flora and fauna into areas where they are not normally found can be a significant threat to biodiversity, since some alien species can become invasive, spreading rapidly and out-competing native species.

The client will not intentionally introduce any new alien species (not currently established in the country or region of the project) unless this is carried out in accordance with the existing regulatory framework for such introduction. Notwithstanding the above, the client will not deliberately introduce any alien species with a high risk of invasive behaviour regardless of whether such introductions are permitted under the existing regulatory framework. All introductions of alien species will be subject to a risk assessment (as part of the client's environmental and social risks and impacts identification process) to determine the potential for invasive behaviour. The client will implement measures to avoid the potential for accidental or unintended introductions including the transportation of substrates and vectors (such as ballast, and plant materials) that may harbour alien species.

Where alien species are already established in the country or region of the proposed project, the client will exercise diligence in not spreading them into areas in which they have not already been established. As practicable, the client should take measures to eradicate such species from the natural habitats over which they have management control.

3 Activities That Could Introduce Alien Invasive Species

3.1 AIS Pathways Generated by the Oil and Gas Industry

There are three main pathways for the introduction of AIS into new environments associated with offshore oil and gas projects, namely:

- ballast (water and sediment)
- biofouling
- direct physical introduction through other means such as intact plant particles or sediment on anchors.

There is also the potential for indirect pathways for AIS introduction from oil and gas projects.

These are discussed in more detail below and summarised in Table 3.1.

3.1.1 Ballast

Vessels that are designed to carry a heavy cargo are potentially unstable at sea once they have offloaded the cargo. Therefore, after offloading they take on 'ballast' to weigh down and correctly balance the vessel (see Figure 3.1). Ship's ballast water has been a vector for the spreading of AIS around the globe for more than a century and has had devastating impacts on aquatic ecosystems in many regions.

In particular ballast water from tankers is a significant AIS pathway, with high potential survival rate of biota in ballast tanks, huge volumes of water exchanged, and multiple ports visited during a trip.

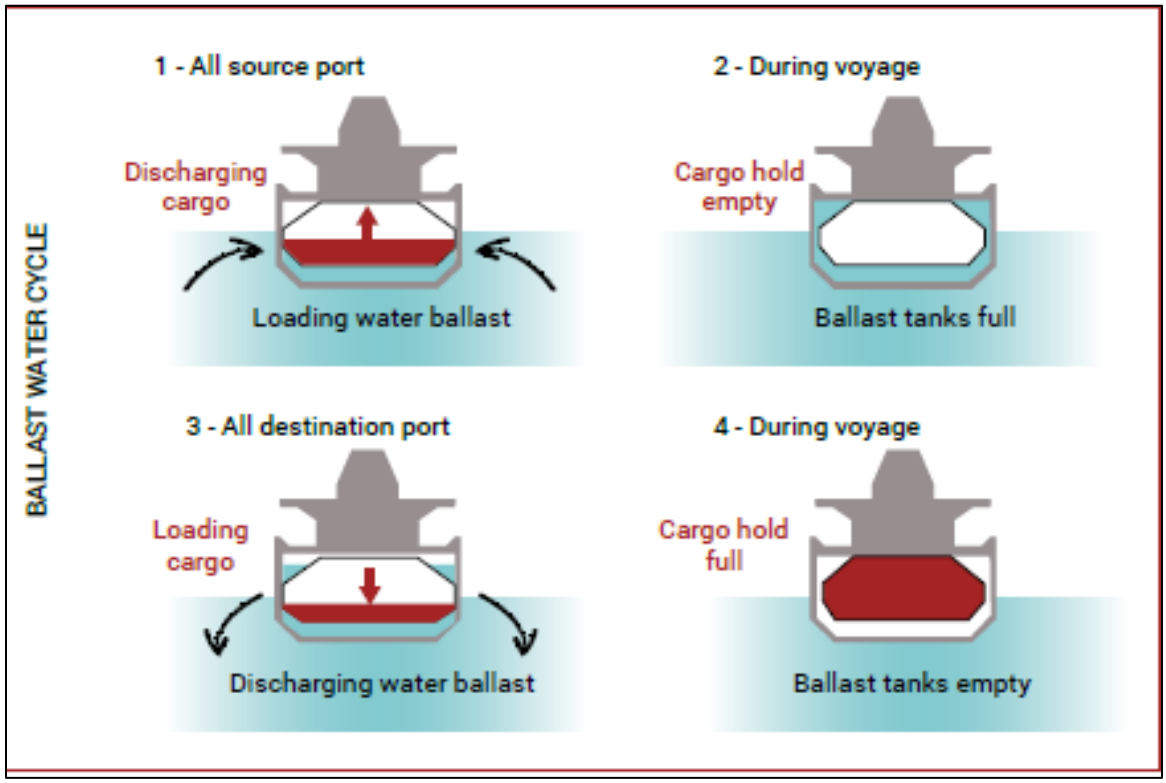

Figure 3.1: Ballast Water Cycle

Source: GEF LME: LEARN, 2017

Many marine species reproduce by dispersing planktonic eggs and/or larvae, and it is inevitable that ballast water will contain large numbers of a wide variety of organisms. Ballast is usually taken on in areas of relatively high shipping traffic, in shallow coastal or port waters that have a high natural abundance of plankton; these are usually the areas in which AIS will be present. While some organisms may not survive in ballast tanks, many do, and upon discharge at the destination port—if conditions are suitable—these organisms can either complete their lifecycle by settling out as biofouling, recruiting to the benthos (e.g., sea-stars) or living in the plankton (e.g., comb jellies).

In addition to ballast water, the intake of turbid water results in the settling out and accumulation of fine sediment in the ballast tanks, which can also be a significant pathway for AIS. For example, dinoflagellate cysts are commonly found in ballast sediments and, when released, can multiply to form harmful algal blooms.

3.1.2 Biofouling

Biofouling can be defined as biological growth on man-made structures in the aquatic environment. While biofouling communities are normal parts of the marine environment in their native range, they present a significant threat when they contain AIS. Recently, there has been a growing recognition that biofouling is a major pathway in the introduction of non-native species, some of which become AIS.

Biofouling can occur in, or on, the following:

- Vessel hulls, including underwater fittings (e.g. propeller, rudder, bow thrusters). Untreated hulls rapidly develop complex communities of immobile species (barnacles, mussels, hydroids, sponges, etc) which mobile species subsequently colonise.
- Exploration, production and accommodation rig / platform legs; subsea pipelines and umbilicals; and subsea wellheads and equipment. These pathways involve the potential introduction of substrata from elsewhere that may already be contaminated by AIS. The introduction of hard structures also results in the creation of hard substratum which is available for colonisation by species that may not otherwise have settled in the local habitat. This process can encourage local development of alien species and also offer a stepping-stone for longer distance relocation of alien species. This may be particularly relevant to offshore rigs, where the support legs can develop fouling communities that could not otherwise survive owing to the depth of water at which the equivalent natural habitat is found.
- Niche areas on vessels (damp or water-filled chain lockers, bilges, sea-chests, internal seawater systems).
- Ancillary equipment that has previously been in seawater, e.g., diving equipment, sampling gear, anchors, ropes, buoys.
- Small amounts of sanitary waste or food waste can be sufficient to instigate local colonisation of alien species where they have survived processes such as digestion and cooking.

3.1.3 Physical Introduction

While biofouling and ballast water are generally considered to be the two main pathways for AIS in the aquatic environment, the following pathways should also be considered as potential risks:

- Direct introduction, for example, of whole plants or plant fragments tangled on anchor chains.
- Sediment, potentially containing AIS eggs, larvae and plant fragments, for example, on anchors and anchor chains and in sea chests where sedimentary communities can become established if sediment is present. These live vectors can then reproduce and transfer AIS to the receiving environment.

3.1.4 Indirect Pathways

Indirect pathways relate principally to habitat alteration and degradation, which allow AIS to gain a foothold and become established.

Examples include:

- Hard substrate anchored in one place in deep water, such as production platforms and FPSOs increase the likelihood of invasion. Linear stepping-stones such as pipelines also represent an offshore AIS risk.
- Waste discharges into the sea that cause localised changes to the environment, e.g. continuous discharges of wastewater that may create higher-temperature water conditions can encourage the growth or reproduction of otherwise dormant species.

3.2 Project Activities in Ruch EEA at Risk of Introducing AIS

The Project activities / aspects with the potential for introducing AIS in the Ruch EEA are listed below. The direct and indirect pathways for AIS introduction associated with these aspects are provided in Table 3.1.

Tortue Phase 1

Tortue Phase 1 is at operational phase. The key vectors for introduction of invasive species are:

- Production: Operation of the FPSO and supply vessels for materials and waste transfer. Operation of oil transportation tankers serving the FPSO. Operation of subsea infrastructure.

Tortue Phase 2

Tortue Phase 2 is at operational phase. The key vectors for introduction of invasive species are:

- Production: Operation of the FPSO and supply vessels for materials and waste transfer. Operation of oil transportation tankers serving the FPSO. Operation of subsea infrastructure.

Ruche Phase 1

Ruche Phase 1 is at execute phase. The key vectors for introduction of invasive species will be:

- Development drilling – jack up platform supported by support / supply vessels operating from the logistics base at Port-Gentil.
- Installation of infrastructure – Hibiscus Alpha offshore installation (OI), subsea flowlines and umbilicals.

When Ruche Phase 1 enters operational phase, the vectors will be same as those for Tortue Phase 1, with the addition of an operational OI.

Table 3.1: Summary of potential pathways for AIS (stages relevant to Ruche EEA field development included)

Phase	Aspect		Direct pathways	Indirect pathways
Field development	Development drilling	Support / supply vessels	Ballast	Ecological disturbance (pelagic and benthic)
		Jack up platform (drilling rig)	Biofouling	Provision of habitat (e.g., hard substrate)
	Installation of infrastructure	Installation of OI	Physical introduction – transfer of live / adult stages	Waste disposal
		Installation of flowlines and umbilicals	Waste disposal	
Production	Operation of infrastructure	Supply vessels	Ballast	Ecological disturbance (pelagic and benthic)
		FPSO	Biofouling	Provision of habitat (e.g. hard substrate)
		Offshore Installation	Physical introduction – transfer of live / adult stages	Waste disposal
		Facilities, flowlines and umbilicals	Waste disposal	
		Shuttle tankers serving FPSO	Biofouling	Waste disposal
			Ballast water	
			Waste disposal	

3.2.1 Introduced Species of Concern

The Global Invasive Species Database (GISD)[5] focuses on invasive alien species that threaten native biodiversity and natural areas. It covers all taxonomic groups from micro-organisms to animals and plants in all ecosystems. According to the GISD the following marine invasive species have been identified in Gabon, or in the Gulf of Guinea:

- *Acanthophora spicifera* - red macroalgae
- *Hypnea musciformis* - red algae
- *Clarias gariepinus* – sharp tooth catfish
- *Caulerpa taxifolia* - green macroalga
- *Tubastraea coccinea* - orange-cup coral.

The Global Register of Introduced and Invasive Species (GRIIS)[6] presents validated and verified national checklists of introduced (alien) and invasive alien species at the country and territory level. The GRIIS for Gabon lists the following as being either introduced or invasive:

[5] www.issg.org/database accessed 17 February 2021

[6] https://www.gbif.org/dataset/search?publishing_org=cdef28b1-db4e-4c58-aa71-3c5238c2d0b5 accessed 17 February 2021

- *Mytilopsis sallei* – Santa Domingo false mussel
- *Carijoa riisei* – branched pipe coral / snowflake coral
- *Clarias gariepinus* – sharp tooth catfish.

Friedlander et al (2014) studied the marine communities associated with oil platforms in Gabon and highlighted the unique ecosystems associated with them. At least one potential invasive species the *Carijoa riisei* was observed on the platforms and *Tubastracea* species dominated the older platforms in the north. It was concluded that oil platforms may act as stepping-stones, increasing regional biodiversity and production but they may also be vectors for invasive species.

Photographs of the species listed above are provided in Appendix B.

4 Mitigation Measures

4.1 Ballast Management

The mitigation measures below are applicable to Project vessels capable of carrying ballast water and mobilised from international waters, namely:

- Support / supply / construction vessels
- Jack up drilling rig
- BW Adolo FPSO
- Hibiscus Alpha Offshore Installation (OI) (conversion of a mobile offshore drilling unit to a manned offshore installation).

4.1.1 General Requirements

Compliance is required with the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) Convention.

Prior to starting work in the field, Project vessels will need to provide a copy of their International Ballast Water Management Certificate (if above 400 GT), and a copy of their Ballast Water Management Plan and Ballast Water Record Book to BWE for review (where applicable).

The Ballast Water Management Plan will detail the procedure for the management of ballast water and the handling of sediment in accordance with Regulation D-1 (ballast water exchange) and / or D-2 (ballast water treatment) and Regulation B-5 (sediment management), see Appendix A for details.

The plan will include procedures for both D-1 and D-2 if the vessel employs both methods, or D-2 only if D-2 is mandatory for the vessel[7].

The Ballast Water Management Plan will include[8]:

- Description of the ballast system (details of ballast tanks and pumps (e.g. number, location, capacity)
- Ballast water management operation (explanation of need for ballast management)
- Ballast water exchange / ballast water treatment
- Precautionary practices
- Sediment management
- Ballast water sampling
- Methods of communication
- Duties of ballast water management officer
- Crew training and familiarisation
- Recording requirements.

The Ballast Water Record Book will be used to record intake and discharge of ballast water, any ballast water discharges to reception facilities, and any accidental or other exceptional discharges of ballast water. The Ballast Water Record book will be retained on board the vessel for at least two years after the last entry has been made and thereafter in the Company's control for a minimum period of at least three years.

Oil transportation tankers visiting the FPSO are also expected to follow the requirements of the BWM Convention.

[7] If vessels were constructed on, or after, 8 September 2017 they will need to prove they have an onboard ballast water treatment system compliant with Regulation D-2.

[8] An example template for a Ballast Water Management Plan is provided by DNV-GL: https://www.dnvgl.com/services/ballast-water-management-bwm-and-biofouling-3416

4.1.2 Specific Requirements for Project Vessels

Support / supply / construction vessels

Project vessels entering Gabon's waters, from other international waters, will first ensure that ballast water exchange is conducted at least 200 nautical miles from the nearest land and in water at least 200 metres deep in accordance with Regulation D-1 (see Appendix A), unless they have a ballast water treatment system in place that meets Regulation D-2 specification (see Appendix A). In the event that ballast water exchange is not possible; or the master reasonably decides that such exchange would threaten the safety of the ship, its crew or its passengers; or equipment failure; or any other extraordinary conditions, the reason(s) is to be entered in the vessel's Ballast Water Record Book (in accordance with BWM.2/Circ.63).

Oil transportation tankers visiting the FPSO are also expected to follow these requirements.

Jack up rig

The BWM Convention stipulates that the requirement to manage ballast water to either the D-1 or D-2 standards (Regulation B-3), will not apply to the discharge of ballast water and sediments when the discharge occurs at the same location from which the whole of the ballast was taken from, provided no mixing of ballast water or sediments from another location takes place (Regulation A-3 Exceptions).

In accordance with 'BWM.2/Circ.46 - Application of the BWM Convention to Mobile Offshore Units', for preloading self-elevating unit leg foundations seawater is taken on board into the preload tanks. This seawater may be discharged, without management, at the same location providing that no mixing with unmanaged seawater and sediments has occurred.

For transit to other areas any transit ballast water and sediments remaining in the preload tanks may be treated by an appropriately approved internal circulation method. Other methods of ballast water management, capable of providing the same level of protection to the environment, human health, property or resources as described in Regulations B-3.1 to B-3.5 of the BWM Convention (see Appendix A), may also be acceptable. The use of exceptions should be recorded in the Ballast Water Record Book, including a reasoning that the exception was justified.

Offshore Installation

On arrival at site, the OI will take on ballast water for preloading the foundation. As above, this seawater may be discharged, without management, at the same location providing that no mixing with unmanaged seawater and sediments has occurred. Once the jack-up becomes a fixed Offshore Installation the requirements of the Ballast Water Convention will no longer be applicable.

FPSO

FPSOs are not normally required by the BWM Convention to undergo surveys or have international convention certification unless they transit or relocate to another location, at which time the requirements of the Convention become applicable.

If the BWM Convention is not applicable as per Article 3, for instance in the case that the vessel is reasonably permanently positioned, then an approved Ballast Water Management Plan for the D-1 standard and a Ballast Water Record Book should be available in the case of single voyages, following the IMO guidance circular BWM.2/Circ.52/Rev.1.

Pursuant to BWM.2/Circ.52/Rev.1, vessels (such as FPSOs and ships that may need to undertake a single international voyage to a dry-dock) that need to enter or re-enter into exclusive operation should also include a procedure in their approved Ballast Water Management Plan for thoroughly cleaning their ballast tanks, piping and equipment to the satisfaction of the Administration and any applicable authorising Party.

4.2 Biofouling

The mitigation measures below are applicable to Project vessels and structures with the potential for biofouling, namely:

- Support / supply / construction vessels
- Jack up drilling rig
- BW Adolo FPSO
- Hibiscus Alpha Offshore Installation (OI).

Biofouling is most likely to affect three main areas:

- Underwater surfaces, e.g., hulls, platform legs
- Internal seawater systems, e.g., cooling, fire fighting
- Ancillary gear, e.g., ropes, buoys.

To minimise the transfer of invasive aquatic species, Project vessels (including fixed and floating platforms and FPSOs) should implement biofouling management practices as outlined in the 'Guidelines for the control and management of ship's biofouling to minimise the transfer of invasive aquatic species - Resolution MEPC.207(62) 2011', including the use of anti-fouling systems and other operational management practices to reduce the development of biofouling. The intent of such practices is to keep the vessel's submerged surfaces, and internal seawater cooling systems, as free of biofouling as practical. A ship following this guidance and minimising macrofouling will have a reduced potential for transferring invasive aquatic species via biofouling.

It is recommended that every ship should have a Biofouling Management Plan which is specific to the ship and included in the ship's operational documentation.

The Biofouling Management Plan includes[9]:

- Introduction
- Ships particulars
- Purpose
- Description of anti-fouling systems (anti-fouling coating systems, internal seawater defouling measures (e.g., marine growth prevention systems, dosing procedures)
- Operating profile
- Description of areas susceptible to biofouling
- Operation and maintenance of anti-fouling system (including inspection details)
- Safety procedures for ship and crew
- Disposal of biological waste
- Crew training and familiarisation
- Recording requirements.

It is recommended that a Biofouling Record Book is maintained for each ship. The book should record details of all inspections and biofouling management measures undertaken on the ship. This is to assist the shipowner and operator to evaluate the efficacy of the specific anti-fouling systems and operational practices on the ship in particular, and of the biofouling management plan in general. It is recommended that the Biofouling Record Book be retained on the ship for the life of the ship.

Anti-fouling system installation and maintenance; and in-water inspection, cleaning and maintenance; should be carried out in line with the Biofouling Guidelines (MEPC.207(62) 2011).

In addition to the above, and in line with the requirements of the AFS Convention, vessels shall not apply or re-apply organotin compounds which act as biocides in anti-fouling systems (this also applies to fixed and floating platforms, FSUs, and FPSOs). Ships above 400 GT and engaged in international voyages (excluding fixed or floating platforms, FSUs and FPSOs) are required to be in

[9] An example template for a Biofouling Management Plan is provided in Appendix 2 of Resolution MEPC.207(62) 2011.

possession of a current International Anti-fouling Certificate. Vessels less than 400 GT, but more than 24 m in length, are required to carry a declaration on AFS signed by the owner or authorised agent accompanied by appropriate documentation.

Oil transportation tankers visiting the FPSO should also follow the requirements of the Biofouling Guidelines.

4.3 Physical Introduction

All submersible equipment (e.g., ROVs, inspection equipment, survey equipment, etc) are required to be subject to pre-use and post-use checks including checks for the presence of marine growth. All equipment is required to be free of marine growth prior to mobilisation. Submersible equipment AIS checks to be recorded.

Routine removal as part of day-to-day activities and maintenance before departing from a site / area is important and the following should be washed with high-pressure water:

- anchor and chain
- ropes, cables, fenders, buoys, etc
- anchor wells and chain lockers (where safe to do so)
- submersible equipment.

4.4 Wastewater Discharges

Wastewater discharge has the potential for direct introduction of invasive species and the creation of indirect pathways (e.g., waste discharges into the sea can cause localised changes to the environment that can encourage the growth or reproduction of otherwise dormant species).

All wastewater discharges from Project vessels will be carried out in line with requirements in the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). In addition, the following measures will be implemented:

- Bilge water will be pumped out at frequent intervals as part of normal watch-keeping to prevent the build-up and subsequent discharge of bilge in areas other than where it originated from.
- Antifoulant chemical dosing to prevent marine fouling of offshore facility cooling water systems will be carefully considered. Available alternatives should be evaluated and, where practical, the seawater intake depth should be optimised to reduce the need for use of chemicals. An assessment of alternatives should be adequately documented. Appropriate screens should be fitted to the seawater intake, if safe and practical, to avoid entrainment and impingement of marine flora and fauna.

4.5 Indirect Pathways

Introducing hard substrate (such as platforms, export flowlines and subsea infrastructure) into an area exclusively composed of soft sediment can provide a habitat that AIS may opportunistically colonise and provide a base for onward invasion.

Mitigation measures include suitable and well-maintained anti-fouling systems on subsea infrastructure and limiting the amount of rock armour, concrete mattresses, etc used in flowline installation.

4.6 Monitoring

BWE will institute checks of Project vessel / rig documentation prior to starting work in the field – ballast water certification, management plans and records books; biofouling management plans and records books; anti-fouling certification; and submersible equipment checklists (if relevant). With respect to the oil transportation tankers, BWE will liaise with the operator and periodic checks of documentation will be carried out if permitted.

BWE will conduct ROV surveys during the course of field development activities (installation of infrastructure, facility hook up and commissioning) and during production activities. This footage, if of sufficient resolution, will be reviewed by a specialist for potential AIS, particularly in respect to the list of AIS listed in Appendix B.

If AIS are identified, they will be reported to:

- General Directorate for Aquatic Ecosystems (Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan)
- National Agency of National Parks (ANPN) including Gabon Bleu programme.

5 Roles and Responsibilities

The following tasks are required in order to effectively implement the various mitigation measures in this AIS MP:

- Ensure BWM Convention requirements are met with respect to ballast water exchange / treatment and that required documentation is in place, implemented and maintained.
- Ensure Biofouling Guidelines are followed with respect to anti-fouling installation and maintenance and that required documentation is in place, implemented and maintained.
- Ensure anti-fouling systems are in compliance with AFS Convention and certification is in place.
- Ensure any submersible equipment is subject to inspection for marine growth before use and that checks are recorded.
- Ensure routine removal of marine growth from anchors, chains, ropes, submersible equipment, etc before departing from site using high pressure water.
- Ensure wastewater discharges are managed as specified in this procedure to minimise AIS introduction.
- Ensure vessel crew are familiar with the requirements of the relevant conventions and guidelines and applicable shipboard systems and procedures.
- Ensure suitable and well-maintained anti-fouling systems are used on subsea infrastructure and that amount of rock armour, concrete mattresses, etc used in flowline installation is minimised.
- Ensure Project vessel / rig documentation is checked prior to starting work in the field (contractor audit) and that liaison is carried out with oil transportation tanker operator and periodic checks of tanker documentation conducted, if permitted.
- Ensure samples of ROV survey footage conducted during Project installation and operation are reviewed by a specialist for potential presence of AIS.
- Ensure any identified AIS reported to the authorities.

BWE and its contractors will determine attribution of roles and responsibilities with respect to the above tasks on a case-by-case basis.

6 References

Friedlander, A.M. Ballesteros, E. Fay, M. Sala, E. 2014. Marine Communities on Oil Platforms in Gabon, West Africa: High Biodiversity Oases in a Low Biodiversity Environment. PLoS ONE 9(8): e103709. doi:10.1371/journal.pone.0103709.

GEF LME: LEARN, 2017. The Large Marine Ecosystem Approach: An Engine for Achieving SDG 14. Paris, France.

Tamelander J., Riddering L., Haag F., Matheickal J., 2010. Guidelines for Development of National Ballast Water Management Strategies. GEF-UNDP-IMO GloBallast, London, UK and IUCN, Gland, Switzerland. GloBallast Monographs No. 18.

Appendix A – Summary of Ballast Water Management Standards (BWM Convention)

The Convention requires that ballast water is managed to meet the standards set and allows for the phased introduction of two standards as detailed under Regulations D-1 and D-2:

- D-1 details requirements relating to ballast water exchange
- D-2 details allowable limits for organisms within the ballast water discharge.

The Convention allows for D-1 to be used until such time as D-2 is required but does not prevent ships operating to the D-2 standard ahead of schedule.

Regulation D-1 Ballast water exchange (BWE)

The standard set by the Convention states that ships undertaking BWE shall do so with an efficiency of at least 95% volumetric exchange of ballast water. For ships exchanging the ballast water by the pumping-through method, pumping through three times the volume of each ballast tank will be considered equivalent to meeting the 95% standard.

Ships undertaking ballast water exchange should conduct the operation at least 200 nautical miles from the nearest land and in water at least 200 metres deep; or in cases where the ship is unable to conduct ballast water exchange in accordance with the above, as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres deep.

In sea areas where the minimum distance and depth criteria cannot be met, the Parties to the Convention have the ability, within their waters, to designate BWE areas.

Regulation D-2 Ballast water performance standard

Stipulates the acceptable level of organisms that may be found within discharged ballast water. The D-2 Standard specifies that treated and discharged ballast water must have:

- fewer than 10 viable organisms greater than or equal to 50 µm in minimum dimension per cubic metre;
- fewer than 10 viable organisms less than 50 µm in minimum dimension and greater than or equal to 10 µm in minimum dimension per millilitre.

In addition, a ballast water discharge of indicator microbes, as a health standard, shall not exceed the following specified concentrations:

- toxicogenic *Vibrio cholerae* (O1 and O139) with less than one colony-forming unit (cfu) per 100 ml or less than 1 cfu per 1 gram (wet weight) zooplankton samples;
- *Escherichia coli* less than 250 cfu per 100 ml;
- Intestinal *Enterococci* less than 100 cfu per 100 ml.

Ballast water treatment equipment is developed, and type approved on the basis of the equipment's ability to treat the ballast water to the required standard. Although not the only way to meet the D-2 standard, the installation of an appropriately type approved ballast water treatment system will be the most common method used. The schedule for implementation means that compliance with the D-2 standard will be phased in over time for individual ships, up to 8 September 2024, as follows (and as summarised in Figure A1):

- All-new ships (ships built on or after 8th September 2017) must comply with D-2 performance standards.
- All existing ships (ships built before 8th September 2017) are required to meet the D-2 standards at the first IOPP renewal survey after 8th September 2019 and
- All vessels must comply with D-2 standards before 8th September 2024.

Regulation B-5 Sediment Management

Requires that ships should, without compromising safety or operational efficiency, be designed and constructed with a view to minimise the uptake and undesirable entrapment of sediments, facilitate removal of sediments and provide safe access to allow for sediment removal and sampling, taking into account guidelines developed by the Organization. Ships constructed before 2009, to the extent practicable, should also comply with this paragraph.

All ships are required to regularly monitor, remove and dispose of sediments from spaces designed to carry ballast water in accordance with the ship's Ballast Water Management Plan. Ballast water tanks and their internal structure should be designed to minimise accumulation of sediments and allow for easy cleaning and maintenance, as required by the BWM Convention.

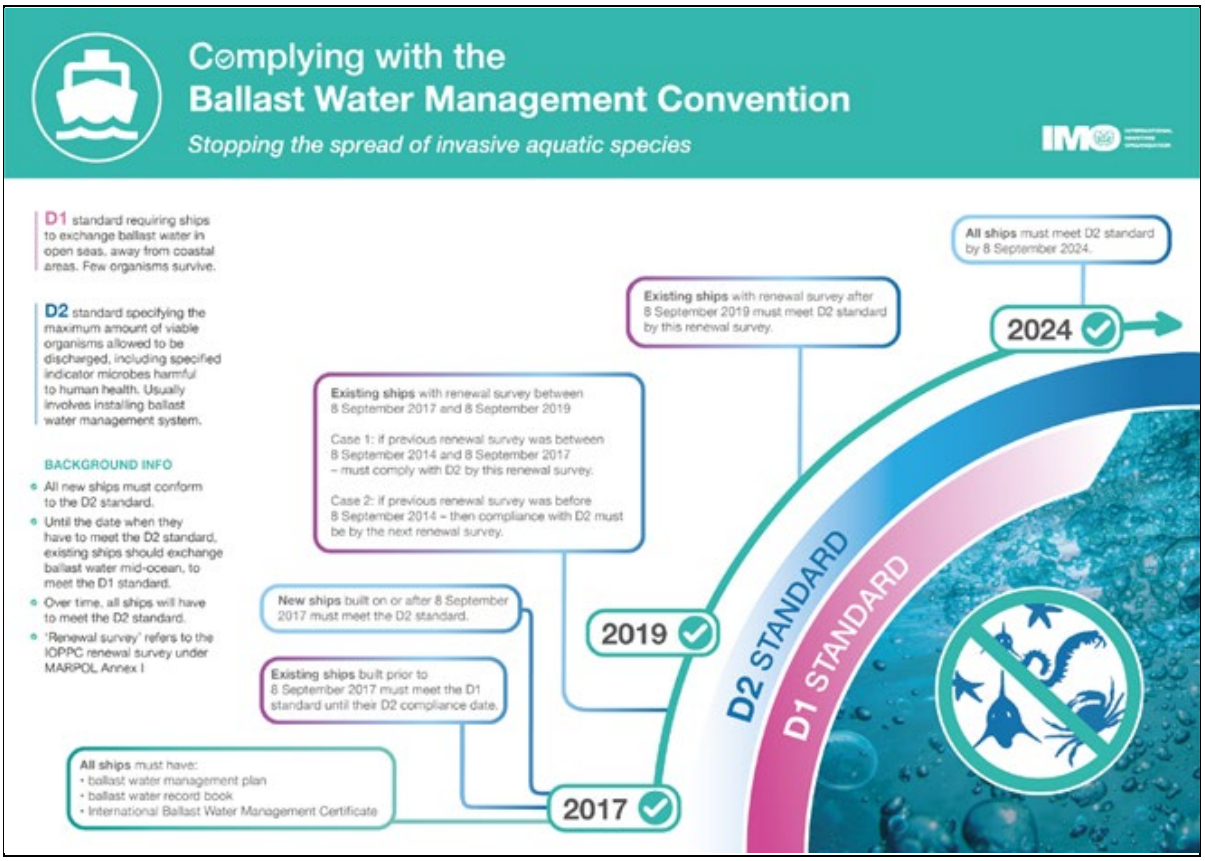

Figure A1: BWM Infographic

Source: IMO https://www.imo.org/en/MediaCentre/HotTopics/Pages/Implementing-the-BWM-Convention.aspx

Appendix B – Photographs of Marine Introduced / Invasive Species Gabon

Acanthophora spicifera - red macroalgae

Source: GRIIS. Creator: kg33. Publisher: iNaturalist. Reference: https://www.inatu...g/photos/98200166

Hypnea musciformis - red algae

Source: GRIIS. Creator: CRRF. Publisher: Smithsonian Institution, NMNH, Botany. Reference: http://n2t.net/ar...b0d9-ae830151a305

Clarias gariepinus – sharp tooth catfish

Source: GRIIS. Creator: cynthiatng. Publisher: iNaturalist. Reference: https://static.in...al.jpg?1607129330

Caulerpa taxifolia - green macroalga

Source: GRIIS. Creator: Abhishek Jamalabad. Publisher: iNaturalist. Reference: https://www.inatu...g/photos/72584968

***Tubastraea coccinea* - orange-cup coral**
Source: GRIIS. Creator: Erika Mitchell. Publisher: iNaturalist. Reference: https://www.inatu...g/photos/65991792

***Mytilopsis sallei* – Santa Domingo false mussel**
Source: GRIIS. Creator: Tan Kok Hui. Publisher: iNaturalist. Reference: https://www.inatu...g/photos/10818784

***Carijoa riisei* – branched pipe coral / snowflake coral**

Source: GRIIS. Creator: Christian M. Galván Villa. Publisher: iNaturalist. Reference: https://www.inatu...g/photos/11421601

BW Energy

Stakeholder Engagement Plan for BWE's Activities in Dussafu Block

Dussafu Block Development, Gabon

80834

JULY 2021

RSK GENERAL NOTES

Project No: 80834

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Authors	Grace Rigby / Johan van der Walt	**Technical reviewers**	Sebastien Essaye / Corinne Kennedy
Signature		Signature	
Date:	22/07/2021	Date:	22/07/2021

Project manager	Rebecca Heath
Signature	
Date:	22/07/2021

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

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ABBREVIATIONS

Abbreviation	Full word/phrase
A	
AJPBB	Association des Jeunes Pêcheurs de la Basse Banio (Association of Young Fishermen of Basse Banio)
ANPA	L'Agence Nationale des Pêches et al L'Aquaculture (National Agency for Fisheries and Aquaculture)
ANPN	L'Agence Nationale des Parcs Nationaux (National Agency of National Parks)
AOI	Area of Influence
APRHM	L'Association des Pêcheurs et Revendeurs d'Huîtres de Mayumba (Association of Fishermen and Resellers of Oysters of Mayumba)
B	
BID	Background Information Document
BWE	BW Energy Gabon
C	
CAPAG	Centre d'Appui à la Pêche Artisanale de Port-Gentil (Port-Gentil Artisanal Fishing Support Center)
CAPAL	Centre d'Appui à la Pêche Artisanale de Libreville (Libreville Artisanal Fishing Support Center)
CECAF	Comité des pêches pour l'Atlantique Centre-Est (Fisheries Committee for the Eastern Central Atlantic)
CENAREST	Centre National de la Recherche Scientifique et Technologique (National Center for Scientific and Technological Research)
CHA	Critical Habitat Assessment
CIA	Cumulative Impact Assessment
CNDIO	Centre National de Données et Informations Océanographiques (National Centre for Oceanographic Data and Information)
CNM	Conseil National de la Mer (National Council of the Sea)
COREP	Commission Régionale Des Pêches Du Golfe De Guinée (Regional Commission of Fisheries of the Gulf of Guinea)
D	
DGFAP	Directrice Générale de la Faune et des Aires Protégées - General Directorate for Fauna and Protected Areas
DGEA	La Direction Générale des Ecosystèmes Aquatiques (General Directorate for Aquatic Ecosystems)
DGEPN	La Direction Générale de l'Environnement et de la Protection de la Nature (General Directorate for the Environment and Nature Protection)
DGH	La Direction Générale des Hydrocarbures (General Directorate of Hydrocarbons)
DGS	La Direction Générale de la Statistique (General Directorate of Statistics)
DGMM	La Direction Générale de la Marine Marchande (General Directorate of the Merchant Marine)
DGDI	La Direction Générale de la Documentation et de l'Immigration (General Directorate of Documentation and Immigration)
DGPA	La Direction Générale des Pêches et de l'Aquaculture (General Directorate for Fisheries and Aquaculture)

E	
ESA	Ecosystem Services Assessment
ESIA	Environmental and Social Impact Assessment
F	
FAO	Food and Agricultural Organisation
FAQs	Frequently Asked Questions
FGDs	focus group discussions
G	
GDPR	General Data Protection Regulation
GIIP	good international industry practice
I	
IFC	International Finance Corporation
IRAF	Institut de Recherches Agronomiques et Forestières (Agricultural and Forestry Research Institute)
IRSH	Institut de Recherche en Sciences Humaines (Institute for Research in Human Sciences)
IUCN	International Union for the Conservation of Nature
K	
KIIs	key informant interviews
N	
NEI	Notice of Environmental Impact
NGOs	non-governmental organisations
O	
OPRAG	Office Des Ports et Rades du Gabon (Office of Ports and Harbours of Gabon)
P	
PACs	Project-affected communities
PCR	polymerase chain reaction
Portek	Portek International
PS	Performance Standard
PTM	Partenariat Tortue Marines (Marine Turtle Partnership Gabon)
R	
ROLBG	Réseau des Organisations Libres de la Société Civile du Gabon (Network of Free Civil Society Organisations for Good Governance in Gabon)
RSKSED	RSK Stakeholder Engagement Database
S	
SEEG	Société d'Energie et d'Eau du Gabon (Gabon Energy and Water Company)
SAPEG	Syndicat des Armateurs et de la Pêche Industrielle au Gabon (Union of Shipowners and Industrial Fishing in Gabon)
SSC	Species Survival Commission
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SNPG	Société Nationale Petrolière Gabonaise (Gabonese National Petroleum Company)
SoW	Scope of Work
SSCS	Sea Shepherd Conservation Society
T	
TEREA	Terre Environnement Aménagement
ToR	Terms of Reference

W	
WCS	Wildlife Conservation Society
WHO	World Health Organisation
WWF	World Wildlife Fund

1 INTRODUCTION

BW Energy Gabon (BWE) is expanding its development and production activities in the Ruche Exclusive Exploitation Area (Ruche EEA) within Dussafu Block, offshore of Gabon, i.e., Tortue Phase 1, Tortue Phase 2, and Ruche Phase 1 (the Project).

RSK has been contracted to provide support to help ensure BWE meets the environmental and social requirements of international financial institutions on the Project, specifically those established by the International Finance Corporation's (IFC's) Performance Standards on Environmental and Social Sustainability (IFC Performance Standards) (2012). Part of this work includes the development of a Stakeholder Engagement Plan (SEP) for the Project.

The SEP is structured as follows:

- Areas of Influence (AOIs) for the studies
- applicable standards and regulations
- stakeholder engagement to date
- stakeholder identification and analysis
- stakeholder engagement programme
- data management and analysis
- grievance management procedure
- resources and responsibilities
- next steps (future engagement activities).

The SEP is a 'living' document which will be reviewed and updated as necessary, at least every two to three years.

1.1 Area of influence

The area covered by the BWE SEP has been determined taking into consideration International Finance Corporation (IFC) definitions of a project's area of influence[1], as follows:

Primary AOI

The primary AOI consists of the area where the main routine / planned activities of the Project take place and comprises an offshore and an onshore component.

The offshore component includes:

- the Ruche EEA, where the field development activities take place
- the expected route of the support /supply vessels between the Ruche EEA and the onshore logistics base in Port Gentil port

[1] Project area of influence defined in IFC Performance Standard 1.

- the helicopter flight path between the Ruche EEA and the onshore heliport in Port Gentil

The onshore component includes:

- the logistics base in the port of Port Gentil and its immediate surroundings
- the heliport in Port Gentil and its immediate environment
- the coastal communities in the vicinity of the Ruche EEA (see Table 1-1).

The various components of the primary AOI are presented in Figure 1-1

It is assumed that no artisanal fishermen from the Republic of Congo (RoC) operate in the primary AOI, based on the following:

- A preliminary analysis of available satellite imagery. This shows that the nearest Congolese coastal/lagoon communities are located approximately 11 km from the border with Gabon.
- RSK's previous work in the Republic of Congo near Pointe-Noire. Congolese fishermen primarily rely on non-motorised canoes for fishing, this means that fishing areas tend to be small which would suggest that a distance of 11 km from the border is too far for the fishermen to travel. The social baseline survey findings confirmed the assumption that no artisanal fishermen from the Republic of Congo are operating within the AOI (and that they are therefore unlikely to be affected by the Project).

Table 1-1 Communities within the AOI

Province	Department	Community
Nyanga	Basse Banio	Mpila – Koumbi
		Saint – Antoine
		Chikala
		Mamgali
		Lunanga
		Mayumba
		Pana
		Mougagara
	Haute Banio	Mambi
		Malembé 1
		Malembé 2
		Tiya
		Kayes
		Kala Boubote
		Ndindi
		Tchianzi
		Yoyo

Province	Department	Community
		Nkoka
		Rina Nzala
		Vavu
		Massanga

Unplanned / accidental events AOI

This AOI takes into account the potential impacts of a large-scale accidental oil spill in the Ruche EEA and is based on the results of project-specific oil spill modelling. It includes the Gabonese coastline and coastal and offshore waters between the Ruche EEA and Port Gentil. The AOI for the accidental events is shown in Figure 1-2.

Figure 1-1 Primary AOI for the Project

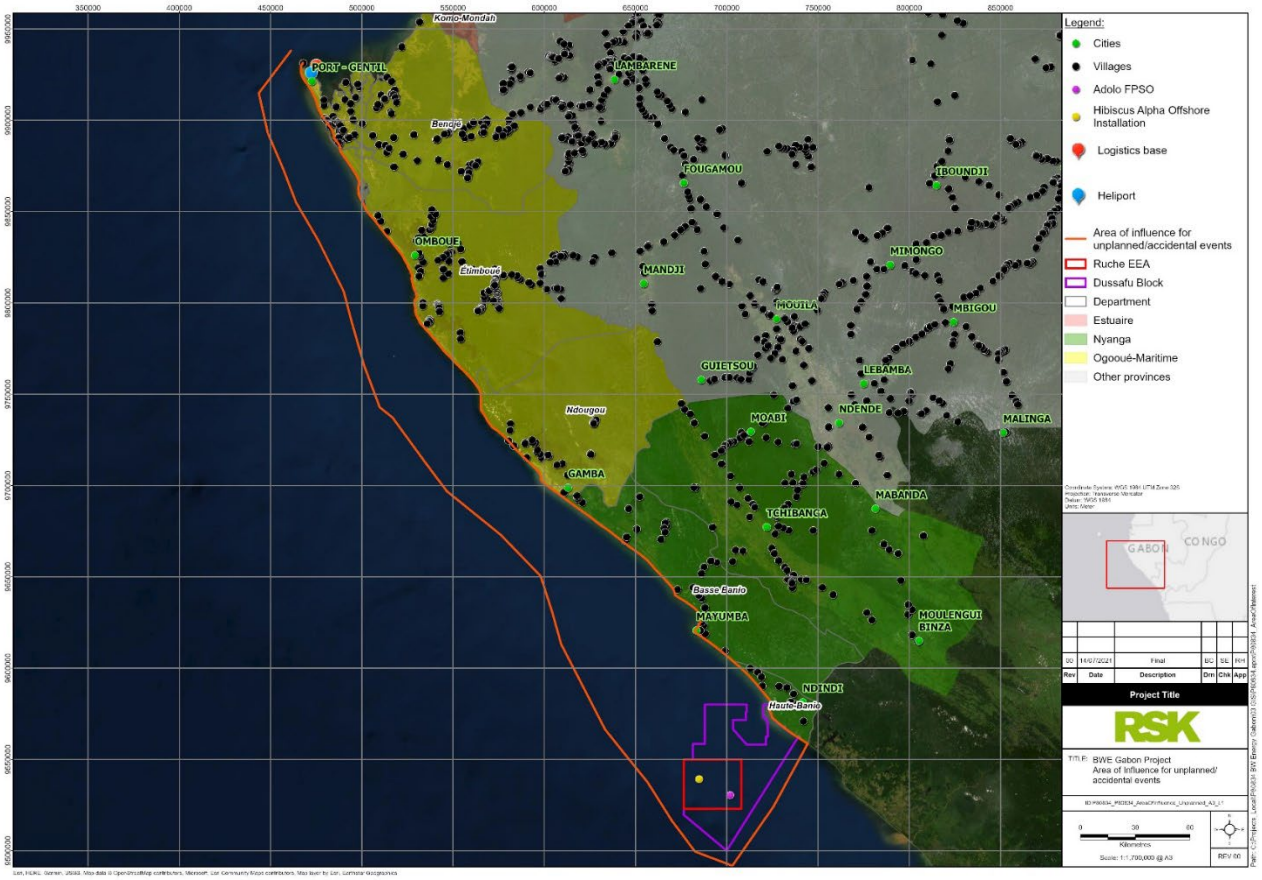

Figure 1-2 Unplanned / accidental events AOI

2 APPLICABLE STANDARDS AND REGULATIONS

Stakeholder engagement is being undertaken in accordance with the applicable legal requirements of the Gabonese Republic and good international industry practice (GIIP), as established by the IFC Performance Standards (2012). This section is structured as follows:

- Section 2.1 outlines the legislative requirements for stakeholder engagement in Gabon
- Section 2.2 outlines the requirements for stakeholder engagement in accordance with the IFC Performance Standards (2012).

The legal requirements of the Gabonese Republic with regards to the coronavirus pandemic (COVID-19) are also outlined (see Section 2.3). Given the proposed timing of the stakeholder engagement activities, compliance with such requirements is, and will continue to be, essential in order to protect the health and safety of all persons involved.

In addition to the above, the SEP is aligned with BWE's internal requirements as detailed in the Social Performance Policy, which includes requirements for stakeholder engagement.

2.1 Legal requirements

Law No. 07 of 2014 on the Protection of the Environment, also known as the Environmental Code, defines public consultation as the procedure for collecting the points of view and opinions of populations, in particular those likely to be affected by a planned project.

Pursuant to the Environmental Code:

- each citizen has the duty to ensure the protection of the environment and to contribute to its improvement, as well as the right to express an opinion on a project likely to have an impact on the environment
- every person's right to (access) information on the environment is recognised
- any operation subject to an impact assessment must be the subject of a public inquiry.

In relation to these provisions, Decree No. 539 of 2005, which regulates the conduct of impact assessments in Gabon, requires proponents (BWE in the case of this Project) to:

- present the project to the population using simple, concrete, and accessible means of communication
- organise public consultations, notification of which must be given by means of posters or any other audio/visual means
- draw up minutes of the consultation sessions and ensure that they are signed by the local authority or by the Minister in charge of the Environment, or their representatives.

2.2 IFC Performance Standards

In addition to national legal requirements, stakeholder engagement conducted during the studies will be aligned with the requirements of the IFC Performance Standards (2012).

IFC Performance Standard (PS) 1 on the Assessment and Management of Environmental and Social Risks and Impacts establishes various requirements for stakeholder engagement, which are as follows:

- Stakeholder engagement must establish and maintain a constructive relationship with a variety of external stakeholders over the project's lifecycle. The engagement process should allow the views, interests, and concerns of different stakeholders, particularly of the local communities directly affected by the project (affected communities) to be heard, understood, and considered in project decisions and the creation of development benefits.
- Affected communities are defined as any people or communities located in the geographical proximity of the project, particularly those contiguous to the existing or proposed project facilities who are subject to actual or potential direct project-related risks and/or adverse impacts on their physical environment, health, or livelihoods.
- Stakeholder engagement may involve the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, a grievance mechanism, and ongoing reporting to affected communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development (e.g., planning, construction, operation, and closure).
- The project sponsor (BWE in the case of this Project) will develop and implement an SEP that is scaled to the project risks and impacts and development stage and be tailored to the characteristics and interests of the affected communities. Where applicable, the SEP will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable.
- Consultation should focus inclusive engagement on those directly affected, as opposed to those not directly affected, including men, women, the elderly, youth, displaced persons, and vulnerable and disadvantaged persons or groups.
- The consultation process should capture all gender views, if necessary, through separate forums or engagements, and reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate.
- If a project is likely to engender risks to, or adverse impacts on, affected communities, a grievance mechanism must be established.

In addition to the requirements of PS 1, specific requirements for grievance mechanisms are outlined in other Performance Standards, including PS 2 (on Labour and Working Conditions) and 4 (on Community Health, Safety and Security).

PS 1 underlines that the disclosure of relevant project information helps affected communities and other stakeholders understand project risks, impacts, and opportunities. The project sponsor must provide stakeholders with access to relevant information on:

- the project's purpose, nature, and scale
- the duration of proposed project activities
- any risks to, and potential impacts on, such communities, and relevant mitigation measures
- the envisaged stakeholder engagement process
- the grievance mechanism.

The timing and method of disclosure is not specified, as PS 1 deems that this may vary according to national legal requirements, the characteristics and needs of the affected communities, the type of assessment involved, and the stage of the project's development or operation. PS 1 does, however, specify that disclosure should be as early as possible.

2.3 Coronavirus pandemic

COVID-19 has resulted in an unprecedented global health and economic crisis. In many countries, mandatory social distancing measures have been introduced by national governments to contain the spread of the disease, focused on limiting physical contact between individuals, households, and communities as far as possible.

In this context, COVID-19 has created new challenges for ESIA practitioners, particularly with regards to stakeholder engagement. The social distancing measures associated with COVID-19 mean that several of the traditional methods of engagement and disclosure (e.g., community meetings, in-person presentations, and workshops) may no longer be safe or legally permissible because, given its highly infectious nature, bringing people together automatically increases the risk of COVID-19 transmission.

At the time of writing, the following measures are in place in Gabon:

- entry and exit requirements:
    - three international flights are permitted per airline, per week to Gabon, but land and sea borders remain closed
    - all passengers travelling to Gabon must present a valid, negative polymerase chain reaction (PCR) test no older than three days prior to entry into Gabon
    - citizens of some countries must receive authorisation from the Gabonese Ministry of Foreign Affairs before travelling to Gabon
    - all passengers must take a compulsory COVID-19 test at Libreville International Airport and self-isolate for 48 hours whilst awaiting results
- movement restrictions:
    - a nationwide curfew is in force between the hours of 2000 and 0500

- travel in and out of the Grand Libreville area[2] is prohibited without a Laissez-Passer (a pass issued to people carrying out essential services)
- a COVID-19 test showing negative results taken within seven calendar days of travel is required for those with a Laissez-Passer who wish to travel between cities and provinces in Gabon.

- public places and services:
  - wearing of masks is mandatory in public from the age of five years old; this includes riding or driving in a vehicle with two or more persons inside
  - gatherings of more than 30 people are banned (except in parliament and educational settings)
  - public transport services (e.g., buses, taxis) are operating at reduced capacity.

All COVID-19 restrictions are subject to change depending on the prevalence of the disease at any given time.

RSK remains committed to supporting BWE with stakeholder engagement during the completion of studies in compliance with international standards and guidelines. At the same time, such activities must be carried out safely and in a way that does not expose Project stakeholders to the risks of COVID-19.

Additional health and safety measures will be taken during the conduct of stakeholder engagement activities in Gabon, in line with government guidelines and restrictions, to minimise the risk of COVID-19 transmission and protect all those involved. These are presented in Section 5.4.1 and will be agreed with BWE based on the advice of the Gabonese Republic and relevant ministries, and the World Health Organisation (WHO).

[2] The Grand Libreville area encompasses three municipalities: Libreville, Owendo, and Akanda.

3 PREVIOUS STAKEHOLDER ENGAGEMENT ACTIVITIES

3.1 Activities undertaken

A number of stakeholder engagement activities were undertaken as part of the preparation of the Environmental and Social Impact Assessments (ESIAs) and Notice of Environmental Impact (NEIA) for the Project by Enviropass (2017; 2019; 2020). A summary of these activities is presented in Table 3-1.

Table 3-1 Summary of ESIA/NEIA stakeholder engagement activities

Activity	Date	Location	Purpose	Number of attendees	Stakeholders present/represented
Tortue Phase 1 (see minutes of meetings in Appendix 2 and 3)					
Stakeholder meeting	13 July 2017	Libreville	To provide information about Tortue Phase 1 and the ESIA	12	General Directorate for the Environment and Nature Protection (DGEPN) National Agency of National Parks (ANPN) General Directorate for Fisheries and Aquaculture (DGPA) General Directorate of the Merchant Marine (DGMM) BWE
	23 October 2017	Mayumba		72	Basse Banio Department Council Mayumba Prefecture Municipality of Mayumba[3] General Directorate of Hydrocarbons (DGH) DGEPN DGPA The National Agency for Fisheries and Aquaculture (ANPA) ANPN Provincial Directorate of Merchant Marine Mayumba Police Company Mayumba Police Brigade

[3] In Gabon, a municipality may also be referred to as a town hall (e.g. Mayumba Town Hall).

Activity	Date	Location	Purpose	Number of attendees	Stakeholders present/represented
					Mayumba Naval Base General Directorate of Documentation and Immigration (DGDI) (departmental branch) Representatives of local fisherfolk Local leaders BWE
Tortue Phase 2 (see minutes of meetings in Appendix 5)					
Stakeholder meeting	01 February 2019	Libreville	To provide information about Tortue Phase 2 and the NEI	18	DGH DGEPN ANPN DGMM DGPA BWE
Ruche Phase 1 (see minutes of meetings in Appendix 7 and 9)					
Stakeholder meeting	26 July 2019	Libreville	To provide information about Ruche Phase 1 and the ESIA	24	DGH DGEPN ANPN Gabon Bleu General Directorate of Customs and Indirect Taxation DGPA Gabonese National Petroleum Company (SNPG) BWE
	12 December 2019	Mayumba		125	Basse Banio Department Council Mayumba Prefecture Municipality of Mayumba Mayumba Police Brigade DGDI (departmental branch) DGEPN DGH DGPA DGMM ANPN BWE

Source: Enviropass (2017; 2019; 2020)

The invitation letters that were issued prior to the meetings on 13 July 2017, 01 February 2019 and 12 December 2019 are presented in Appendix 1, Appendix 4, and Appendix 8 respectively.

3.2 Stakeholder issues and concerns

The stakeholder comments relevant to the Project and studies that were noted during the meetings are summarised in Table 3-2. Full copies of the engagement records (e.g., minutes, attendance lists, photographs) concerning the meetings are presented in Appendix 2, Appendix 3, Appendix 5, Appendix 7, and Appendix 9.

Table 3-2 Summary of minutes of meetings

Meeting	Topic	Details
Tortue Phase 1		
Libreville – 13 July 2017	Project activities	Radar reconnaissance of the seabed to place 12 anchors to fix the floating production, storage and offloading unit. Once placed these anchors will be submitted to testing and will be adjusted accordingly.
	Stakeholder interactions	BWE were recommended to delimit the zone of influence of its installations and activities, as well as provide information on them and updated maps. Enabling access to the FPSO by the stakeholders before entering national waters was also discussed. The addition of l'Agence Nationale des Pêches et de l'Aquaculture and the Conseil National de la Mer as stakeholders to be included was put forward.
	Environmental aspects	It was suggested that BWE write a notice of environmental impact for the anchoring of the FPSO separately from the general EIA. During the anchoring of the FPSO, it was asked that BWE take into consideration the migration periods of the marine turtles during their operations.
Mayumba – 23 October 2017	Accidental oil spills	BWE were recommended to undertake sampling activities to establish the provenance of the oil, and to develop and implement emergency pollution response plans.
	Use of local labour	BWE explained that the jobs available required skilled labour (e.g. qualified engineers and technicians) and that English is the business language used, which may constitute barriers to employment for local people.
	Community development and social investment	Numerous requests for support from BWE on a range of social projects were made, including agricultural projects, working with local youth associations, the rehabilitation of educational premises and the construction of a terminal. BWE, whilst recognising the need for and merits of such initiatives, explained that there would need to be consultation with other operators in the sector before the potential for support could be determined. It was agreed that proposals and applications would be submitted to Mayumba Prefect for sharing with BWE.
Tortue Phase 2		
Libreville – 01 February 2019	Project activities	Carrying out geotechnical and geophysical studies of the seabed as well as the drilling points. The installation of flowlines, manifolds, and umbilical lines, then the connection to the FPSO and the demobilisation of the drilling rig. The start of the production of the four new development wells and temporary abandonment of the initial wells (if successful).

Meeting	Topic	Details
	Stakeholder interactions	Stakeholder recommended the sharing of the geographic coordinates to delimit the operation area in addition to the availability of previous reports done by BWE in terms of the initial drilling points and the preparatory activities linked to Phase II. Technical approval for the drilling campaign was mentioned.
	Environmental aspects	The drawing up of a map establishing environmental sensitivities was discussed. Additionally, the exact type of environmental study was also brought up by the Local Administrations.
Ruche Phase 1		
Libreville – 26 July 2019	Project activities	Presentation and discussions with the government departments relevant to Phase III.
	Stakeholder interactions	It was recommended that BWE ask for formal technical approval of Phase III. The need for information and working partnership with the various administrations present was raised.
	Environmental aspects	The need for an ESIA for Phase III was determined, as well as the importance of taking into consideration the fishing component. The necessity of an onsite visit was discussed.
	Use of local labour	Stakeholders suggested publishing the different calls for tenders in a legal notice to allow the greatest number of local bidders to come forward.
Mayumba – 12 December 2019	Use of local labour	Stakeholders emphasised the importance of recruiting and training young people from Basse Banio Department. The initiative of BWE in 2019, to provide support to students studying for exams, was thus welcomed. Stakeholders requested that such initiatives should go further to facilitate the education of students in the department, without political repercussions of any kind.
	Community development and social investment	Stakeholders regarded the development of Dussafu Block as an opportunity not only for the national economy and for BWE, but also for the development of Basse Banio Department, beginning with its capital, Mayumba. In this context, stakeholders proposed to establish a management and monitoring committee for projects to be submitted to various companies operating within the jurisdiction of the department (on land and at sea). The state, through Basse Banio Department Council, could also help to finance some of the projects selected.

4 STAKEHOLDER IDENTIFICATION AND ANALYSIS

4.1 Stakeholder identification

The first step in the stakeholder engagement process is to identify stakeholders. In the context of this SEP, stakeholders are defined as persons or groups external to the project who may be affected by the project, have an interest in it, or exert influence over it.

4.1.1 Methods of identification

Stakeholders were identified by RSK, Terre Environnement Aménagement (TEREA)[4], and BWE jointly, based on:

- BWE's, RSK's, and TEREA's general knowledge of the area and previous experience conducting ESIAs in Gabon
- field visits conducted by BWE staff and contractors (including TEREA, on behalf of RSK)
- stakeholders identified as part of the preparation of the ESIA / NEIA documents for the Project by Enviropass (2017; 2019; 2020)
- desktop research
- an understanding of the potential impacts of the Project, and the AOIs in which these are expected to occur (see Section 1.1)
- snowballing, whereby encountered stakeholders identify additional stakeholders.

4.1.2 Key stakeholder groups

Several stakeholders have been identified, belonging to a number of groups (see Table 4-1). The engagement approach to each of these stakeholders is further discussed in Appendix 10, and ranges from close engagement to monitoring (no engagement).

[4] RSK's local partner in Gabon.

Table 4-1 Stakeholders by group

Stakeholder group	Stakeholders

Government authorities/agencies – national level	• Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan
	  ○ DGEPN
	  ○ General Directorate for Fauna and Protected Areas (DGFAP)
	  ○ DGEA
	• Ministry of Agriculture Livestock and Fisheries
	  ○ DGPA
	• Ministry of Petroleum, Gas, Hydrocarbons and Mines
	  ○ DGH
	• Ministry of Transport, Equipment, Infrastructures and Housing
	  ○ DGMM
	  ○ Office of Ports and Harbours of Gabon (OPRAG)
	• Ministry of the Interior
	  ○ DGDI
	• Ministry of the National Defence
	  ○ The Marine Navy General Staff
	• Ministry of Employment, Civil Service, Labour and Vocational Training, Government Spokesperson
	  ○ General Directorate of Labour
	• Ministry of Higher Education, Scientific Research, Technology Transfer, National Education, Responsible for Civil Training
	• Ministry of the Economy and Economic Recovery
	  ○ General Directorate of Statistics (DGS)
	• Ministry of Tourism
	  ○ General Directorate of Tourism
	• Ministry of Commerce, Small and Medium Enterprises and Industry
	• Ministry of Culture and the Arts

Stakeholder group	Stakeholders
	• ANPN • CNM

Government authorities/agencies – provincial level	• Estuary Province
	• Ogooué-Maritime Province
	  ○ Provincial Directorate for Fisheries and Aquaculture
	  ○ Provincial Directorate of the Merchant Marine
	  ○ The Marine Navy at provincial level
	• Nyanga Province
	  ○ Provincial Directorate for Fisheries and Aquaculture
	  ○ Provincial Directorate of the Merchant Marine
	  ○ The Marine Navy at provincial level
	  ○ ANPN at provincial level

Government authorities/agencies – departmental/local level (see Figure 4-1)	• Estuary Province
	  ○ Prefect, President of the Departmental Council for:
	  ▪ Noya Department
	  ▪ Komo-Mondah Department
	• Ogooué-Maritime Province
	  ○ Prefect, President of the Departmental Council for:
	  ▪ Bendjé Department
	  ▪ Etimboué Department
	  ▪ Ndougou Department
	  ○ Municipality of Port-Gentil
	  ▪ Education representatives (e.g., teachers)
	  ▪ Health representatives (e.g., health care professionals)
	  ▪ Labour representatives (e.g., unions)
	• Nyanga Province

Stakeholder group	Stakeholders
	○ Prefect, President of the Departmental Council for: ▪ Basse Banio Department ▪ Haute Banio Department ○ Municipality of Mayumba ▪ Mayumba Police Company ▪ Mayumba Police Brigade ▪ Mayumba Naval Base ▪ Mayumba High Port Authority (OPRAG) ▪ Education representatives (e.g., teachers) ▪ Health representatives (e.g., health care professionals) ▪ Labour representatives (e.g., unions)
Project-affected communities (PACs), including groups such as men, women, authority figures (e.g. village chiefs, customary chiefs, religious chiefs, elected leaders), fisherfolk and other natural resource users	• Mayumba including its 6 quartiers: ○ Tchiole-Ndembet (1) ○ Kouango (2) ○ Madounda (3) ○ Bana-aviation (4) ○ Fouika (5) ○ Saint-Antoine (6) • Mambi • Malembé • Tiya • Kaves • Kala Bouboté • Ndindi
Civil society organisations (including	• Union of Shipowners and Industrial Fishing in Gabon (SAPEG) • Libreville Artisanal Fishing Support Center (CAPAL)

Stakeholder group	Stakeholders
non-governmental organisations (NGOs))	• Port-Gentil Artisanal Fishing Support Center (CAPAG) • Association of Young Fishermen of Basse Banio (AJPBB) • Association of Fishermen and Resellers of Oysters of Mayumba (APRHM) • Sea Shepherd Conservation Society (SSCS) • Wildlife Conservation Society (WCS) Gabon • Gabon Bleu • World Wildlife Fund (WWF) Gabon • Ibonga • Brainforest • Adventures Without Borders
Private sector	• Portek International (Portek) – Port of Port-Gentil • SNPG • Assala Gabon • Total Gabon • Perenco Gabon • ENI Gabon • Vaalco Energy • Petronas Gabon • Gabon Energy and Water Company (SEEG) • Local businesses – tourism-related (e.g., hotels such as Likoualé Lodge, restaurants, tour operators) • Local businesses – fisheries-related (e.g., wholesalers, retailers, boat builders) • Local businesses – recreation-related (e.g., equipment hire, sports schools)
Media	• Journal “L’union” • Gabon 24 Television • Radio Gabon

Stakeholder group	Stakeholders
	• Radio Mandji

International organisations	• International Union for the Conservation of Nature (IUCN) Species Survival Commission (SSC)
	  ○ SSC Cetacean Specialist Group
	  ○ SSC Marine Turtle Specialist Group
	  ○ SSC Shark Specialist Group
	  ○ SSC Tuna and Billfish Specialist Group
	• Regional Commission of Fisheries of the Gulf of Guinea (COREP)
	• Fisheries Committee for the Eastern Central Atlantic (CECAF)

Education and research institutions	• Smithsonian Gabon Biodiversity Program • National Centre for Oceanographic Data and Information (CNDIO) • National Centre for Scientific and Technological Research (CENAREST) • Agricultural and Forestry Research Institute (IRAF) • Institute for Research in Human Sciences (IRSH) – Department of Marine Sciences

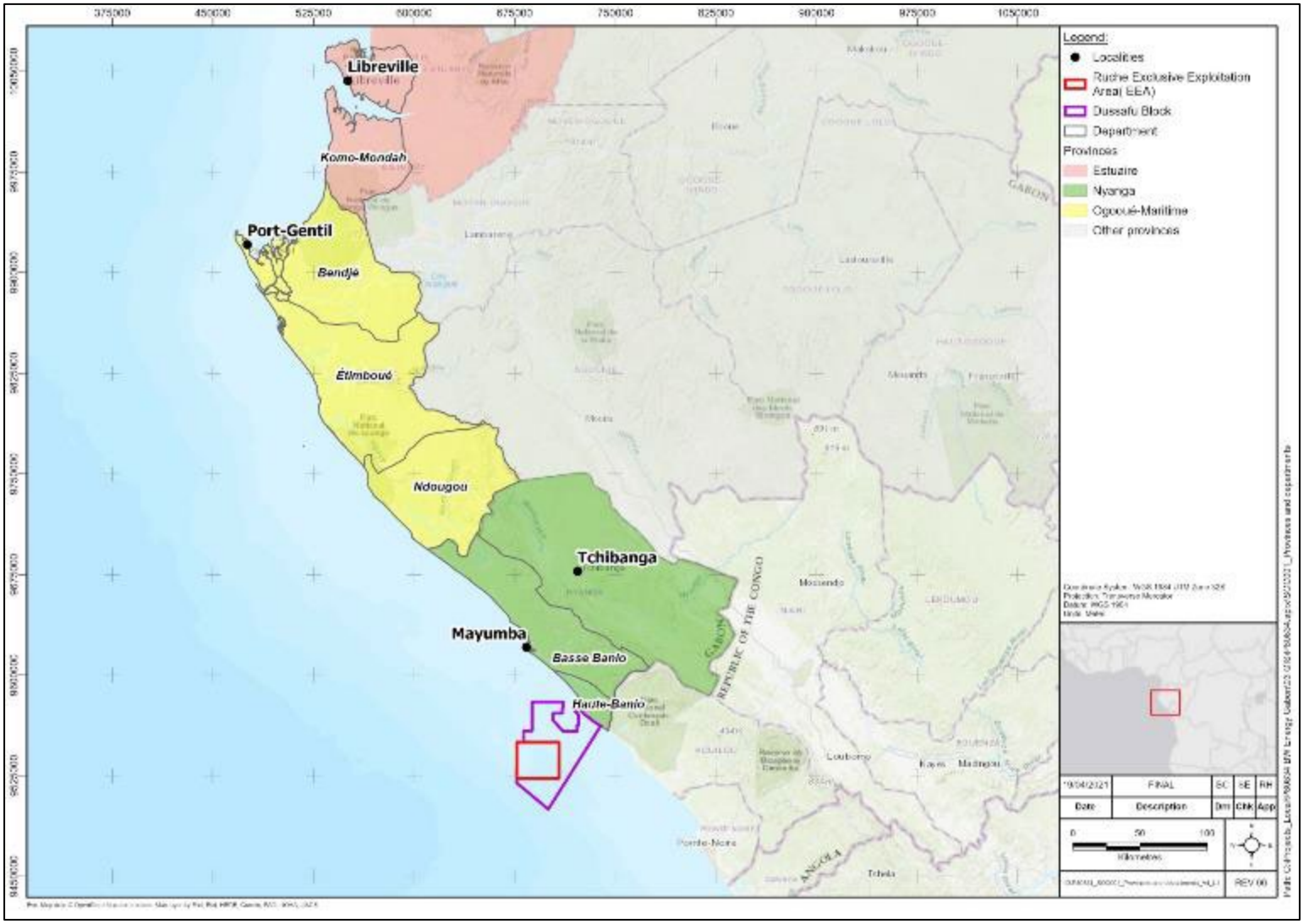

Figure 4-1 Provinces and departments

4.1.2.1 *Potentially vulnerable groups*

Within PACs, there may be people or groups of people who, by virtue of their gender, ethnicity, age, physical or mental disability, economic circumstances, religion, political or other opinion, may be more adversely affected by the Project or disadvantaged in the sharing of Project-related development benefits and opportunities. These may include but not be limited to:

- *Youths*, who may not be able to advocate for their own interests due to age.
- *Women*, who may not be able to advocate for their own interests due to cultural norms and values or may experience difficulties in accessing information due to their educational background, domestic responsibilities, or for other reasons.
- *Elderly*, who may depend on others for care or support and who may not be able to advocate for their own interests due to age, diminished mental capacity, and infirmity.
- *Widows*, who may have multiple responsibilities (e.g., generating income, caregiving, and homemaking) and may have limited family support networks.
- *Persons living with physical and/or mental impairments*, who may depend on others for care or support, experience social marginalisation and obstacles in education and economic participation, alongside reduced opportunities for participation in public engagement, and difficulties in accessing information.
- *Persons experiencing unemployment* due to the increased risk of poverty associated with lack of income.

Consistent with the requirements of IFC PS 1 (see Section 2.2), inclusivity is central to this SEP. Efforts will be made to overcome obstacles to participation such as gender, age, educational background, ethnicity, and language. The following principles will apply during stakeholder engagement:

- Vulnerable people and groups in the PACs will be identified, and additional meetings will be arranged with these stakeholders where necessary. All groups listed above will be engaged through either Focus Group Discussions (FGDs) or Key Informant Interviews (KIIs). They will be met in appropriate locations and at appropriate times, and engagement materials will be modified as needed to facilitate the consultation process.
- Women will be provided with sufficient opportunity to participate in the engagement process and provide their input. They will be engaged separately through FGDs and KIIs to ensure their voices are heard and meetings will be arranged in convenient locations at convenient times, so as to minimise interference with daily routines and schedules.

4.2 Stakeholder analysis

Stakeholder analysis is used to determine the most appropriate strategies and methods of engagement for each stakeholder, including the types of meetings required (e.g., individual, small group, or community meetings). It also helps to identify those stakeholders who can best assist with the studies and Project during operations.

Stakeholder analysis consists of:

- categorising the stakeholders in terms of the type and level of influence they may have over the Project, and the type and level of interest they may have in the Project
- making visual the relationship between stakeholder influence and interest (stakeholder mapping).

4.2.1 Criteria for stakeholder analysis

Stakeholders are first analysed in terms of the following criteria:

- the level of influence they have over the Project:
  - low: the stakeholder cannot influence the execution of the Project
  - medium: the stakeholder has a small influence on the Project and can cause some damage to its reputation
  - high: the stakeholder can damage the reputation of the Project and cause delays or changes to its execution
- the level of stakeholder interest they have in the Project:
  - low: the Project is of little, if any, interest to the stakeholder
  - medium: the Project is of marginal interest to the stakeholder
  - high: the Project is of high interest to the stakeholder.
- the level of impact the Project has on them:
  - low: the Project cannot cause any significant change in the stakeholder's existence, health, wellbeing, and livelihood
  - medium: the Project can cause some damage to the feeling of well-being of the stakeholders (nuisance factor)
  - high: the Project can cause temporary damage to the existence, health, well-being, and livelihood of the stakeholder.

The results of this analysis determine the way stakeholders are engaged going forward. Figure 4-2 shows how the stakeholder analysis is visually presented (mapped) and the implications for the engagement approach adopted.

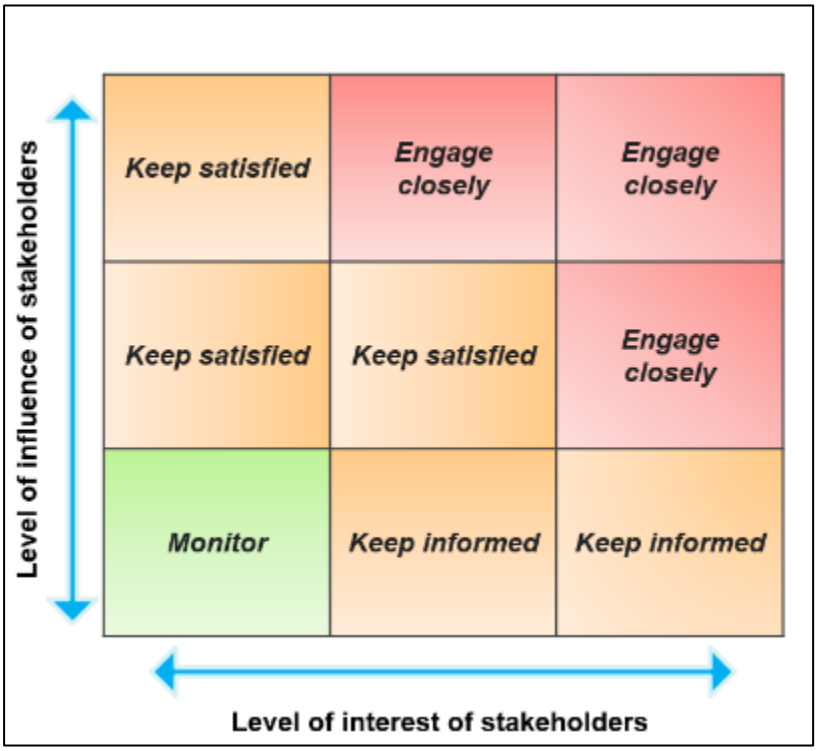

Figure 4-2 Example stakeholder analysis matrix

In the context of this SEP, stakeholders have been further analysed in terms of their ability to provide data that will be relevant to and useful for the studies. All stakeholders who are able to provide data, or with the potential to experience medium or high impacts will be engaged closely, regardless of their level of influence and interest.

The detailed mapping results are an internal document of BWE's and reflects RSK's independent understanding of stakeholders. Mapping will be reviewed and updated on an ongoing basis to reflect relevant insights and additional information gained over the course of the studies.

5 STAKEHOLDER ENGAGEMENT PROGRAMME

5.1 Introduction

Stakeholder engagement will be undertaken concurrently with baseline data collection for the studies and will continue as part of BWE's ongoing operations in-country.

5.2 Objectives of stakeholder engagement

The objectives of stakeholder engagement are to:

- inform stakeholders about the Project and the studies, stakeholder engagement, and the Project grievance management procedure, in an accessible and culturally appropriate manner
- ensure that stakeholders understand how they might be affected by the Project, including potential Project benefits, and understand their potential role in impact identification and management
- obtain the input of stakeholders into the studies with regards to impact identification and to discuss how best to avoid, mitigate, or offset impacts in addition to those previously identified during the preparation of the ESIAs and NEIA for the Project by Enviropass (2017; 2019; 2020)
- provide opportunities for stakeholders to express their opinions, concerns, and recommendations about the Project and the studies, and ensure that these are considered in the studies and related management decisions.

The main objectives for BWE are to:

- ensure that stakeholders understand the Project's aims and requirements, and have confidence in the management of environmental and social risks
- build stakeholders' concerns into Project design and execution, as appropriate
- provide consistency of messaging
- manage stakeholder expectations
- supplement baseline information necessary to meet lender requirements
- meet international standards of environment and social performance to secure international financing.

5.3 Stakeholders to be engaged

Based on the stakeholder analysis outlined in Chapter 4 and detailed in Appendix 10, the stakeholders to be engaged in conjunction with baseline data collection for the studies are listed in Table 5-1. In addition to this, other stakeholders will be sent/handed an information letter and a Background Information Document (BID) for information purposes, and to provide them with the opportunity to comment, if they so wish.

Table 5-1 Stakeholders to be engaged

Stakeholder group	Stakeholders
Government authorities/agencies – national level	• General Directorate for the Environment and Nature Protection (DGEPN) • National Agency of National Parks (ANPN) including Gabon Bleu programme • General Directorate for Fisheries and Aquaculture (DGPA) • General Directorate of Hydrocarbons (DGH) • General Directorate of the Merchant Marine (DGMM) • General Directorate for Fauna and Protected Areas (DGFAP) • General Directorate of Aquatic Ecosystem (DGEA) • National Council of the Sea (CNM)
Government authorities/agencies – provincial level	Ogooué-Maritime province : • Governor (Port-Gentil) • Provincial Directorate of the Merchant Marine (Port--Gentil) • Provincial Directorate for Fisheries and Aquaculture (Port-Gentil) • Office of Ports and Harbours of Gabon or OPRAG (Port-Gentil) Nyanga province : • Governor (Tchibanga) • Provincial Directorate of the Merchant Marine (Mayumba) • Provincial Directorate for Fisheries and Aquaculture (Mayumba)
Government authorities/agencies – departmental/local level	In Port-Gentil: • Bendjé Prefect and departmental board • Mayor In Mayumba: • Basse Banio Prefect and departmental board

Stakeholder group	Stakeholders
	• Mayor, police company, police brigade, and chiefs of quartiers (6) and chiefs of nearby villages In Ndindi: • Haute Banio Prefect, departmental board, and chiefs of nearby villages (Banio Lagoon)
PACs, including groups such as men, women, authority figures (e.g., village chiefs, customary chiefs, religious chiefs, elected leaders), fisherfolk and other natural resource users	In Mayumba: • Local leaders, women and Fisherfolk in 2 quartiers of Mayumba (Madounda and Tchiole-Ndembet) • Local businesses, health staff, fish wholesalers, and sand miners, and other key informants In Malembé and Mambi (Banio Lagoon): • Local leaders, women, and Fisherfolk
Civil society organisations (including NGOs)	In Libreville, • Director of Gabon Bleu In Port-Gentil, representatives of: • the Union of Shipowners and Industrial Fishing in Gabon (SAPEG) • Port-Gentil Artisanal Fishing Support Center (CAPAG) • Wildlife Conservation Society (WCS) Gabon • Fishing national (IRENIKONGO)/foreign (Ghana and Senegal) cooperatives In Mayumba, representatives of: • Bana fishing • Association of Fishermen and Resellers of Oysters of Mayumba (APRHM)
Private sector	In Port-Gentil, representatives of Portek International (“Portek”) (known locally as Gabon Port Management or GPM)
International organisations	In Libreville,

Stakeholder group	Stakeholders
	• World Wildlife Fund (WWF) in Libreville • Wildlife Conservation Society (WCS) in Libreville Remote Engagement: • International Union for Conservation of Nature (IUCN) based in Senegal
Education and research institutions	• National Centre for Scientific and Technological Research (CNDIO) • Agricultural and Forestry Research Institute (IRAF)

5.4 Engagement methods and materials

The main methods for engaging with stakeholders during the studies include:

- correspondence exchange (invitation letters[5], phone calls) to schedule meetings, and information letters accompanied by a BID sent/handed to stakeholders not actively engaged through meetings
- individual, small group, and community meetings to disseminate information about the Project, discuss the process to be followed during the studies and Project-related issues, and to gather data to support impact identification and management; will be held in person.

Table 5-2 presents the stakeholder engagement materials that will be used.

Table 5-2 Stakeholder engagement materials

Information type	Materials
Correspondence exchange	• Letters, phone calls for invitation to meetings.
Project description and process to be followed during the studies, including stakeholder engagement and grievance management procedure	• BID in English and in French (see Appendix 11 for English version). • Posters illustrating the location of the Project (see Appendix 12). • Frequently Asked Questions (FAQs) document in English and in French (see Appendix 13 for English version).

5.4.1 COVID-19

As outlined in Section 2.3, due to COVID-19, additional measures will be taken during the conduct of stakeholder engagement activities in Gabon to minimise the risk of COVID-19 transmission and protect the health and safety of all those involved. These measures will be assessed at the time of implementation to ensure they reflect the latest government guidelines and restrictions, alongside the advice of the WHO.

At the time of writing, the following measures are envisaged:

- when organising the meetings, attendees will be asked to stay at home and self-isolate if they were experiencing symptoms associated with COVID-19 (including mild symptoms such as a cough, headache, or mild fever)
- meetings will be held outdoors as far as possible; where they cannot be held outdoors, meetings will take place in large rooms that meet COVID-19 safety protocols (e.g., WHO advice)

[5] The information and invitation letters will be signed by BWE and will include the contact details of both BWE and TEREA.

- small group and community meetings will be limited to a maximum of 30 participants
- all attendees (facilitators and respondents) will maintain a 2-metre distance from one another whenever possible, or a 1-metre distance with a face covering
- all attendees (facilitators and respondents) will be provided with appropriate PPE (e.g., a face mask to cover the nose and mouth); a face mask will also be worn by facilitators when travelling in vehicles to meetings
- rigorous hand hygiene practices will be encouraged through the establishment of a hand gel station by facilitators, for use during the meetings
- any surfaces used (e.g., tables) during each meeting will be cleaned and disinfected beforehand
- all attendees (facilitators and respondents) will be discouraged from using greetings involving body contact (e.g., shaking hands).

5.5 Arranging and conducting the meetings

For meetings with government authorities/agencies at national, provincial, and departmental/local level:

- RSK and TEREA will arrange individual meetings with the stakeholders on behalf of BWE.
- Letters of invitation will be hand-delivered by TEREA to the head office of the relevant authority/agency to arrange the meetings.
- In case acknowledgment of receipts are not provided at the time letters are hand-delivered, follow-up phone calls will be made by TEREA to confirm receipt of the invitation letter and agree on a date and time for the meeting.
- TEREA will lead and facilitate the meetings.
- A representative from BWE will attend the meetings. His/her role will be to present the Project and to answer any technical questions related to the Project.
- A consultant from TEREA will be present to answer any questions related to the studies, record meeting attendance and meeting minutes, and take photographs (where permission is granted).
- Meetings will be held in French.
- A BID (the French version) will be distributed to all attending stakeholders (300 copies of the BID have been printed).
- Meetings will begin with introductions and opening remarks by the facilitator about the purpose and format of the meeting. The facilitator will highlight that participation is voluntary, and that stakeholders can decline to participate at any point during the meeting. The facilitator will ask whether photographs can be taken of the meeting and explain that no photographs will be taken unless consent is given.
- The Project, the studies, stakeholder engagement, and the Project grievance management procedure will then be presented using the stakeholder

engagement materials (i.e., the BID). BWE will present the Project; a consultant will present the studies, stakeholder engagement, and grievance management procedure. After this, a question-and-answer session will be conducted.

- The Project grievance management procedure will be clearly outlined including contact details, enabling stakeholders to comment on the Project or ask further questions.
- After the meeting, baseline data collection – consisting of the submission of secondary data requests and conduct of key informant interviews (KIIs) – will begin.

For meetings with PACs:

- RSK and TEREA will arrange small group and community meetings with the stakeholders on behalf of BWE.
- Phone calls will be made to the Prefect of Basse Banio Département/Mayor of Mayumba to arrange the meeting in Mayumba and mobilise the chiefs of nearby villages and chiefs of quartiers. For the other community meetings (such as Malembé and Mambi), phone calls will be made to the leaders who will arrange the meetings and mobilise communities and groups and a proposed date, time, and location.
- The proposed date and time of the meetings will be chosen to ensure maximum attendance and minimum interference with stakeholders' daily routines.
- As indicated in Section 5.4.1, the meetings will be held outdoors; they will, however, remain within the PACs to ensure ease of access for stakeholders and eliminate the need to travel.
- Two consultants from TEREA will conduct the meetings. One of the consultants will facilitate the meeting; the other consultant will record meeting attendance and meeting minutes and take photographs (where permission is given).
- A representative from BWE will be present at the meeting to answer any technical questions related to the Project.
- Meetings will be held in French.
- A BID (the French version) will be distributed to all attending stakeholders.
- Meetings will begin with introductions and opening remarks by the facilitator about the purpose and format of the meeting to set the group at ease. The facilitator will highlight that participation is voluntary, and that stakeholders can decline to participate at any point during the meeting. The facilitator will ask participants for permission to take photographs of the meeting and explain that no photographs will be taken unless consent is given.
- The Project, the studies, stakeholder engagement, and the Project grievance management procedure will then be presented by a consultant using the stakeholder engagement materials (i.e., the BID and posters). After this, a question-and-answer session will be conducted.

- The Project grievance management procedure will be clearly outlined including contact details, enabling stakeholders to comment on the Project or ask further questions.
- After the meeting, baseline data collection – consisting of KIIs and focus group discussions (FGDs) – will begin.

Meetings with civil society organisations (including NGOs) will be arranged and conducted in the same fashion as for the meetings with government authorities/agencies.

5.6 Recording meeting outcomes

During the meetings:

- Attendance lists will be completed and signed using an agreed template (see Appendix 14).
- All information from the meeting, including comments, concerns, questions, and responses, will be recorded by hand using an agreed template (see Appendix 14).
- Photographs of meetings will be taken (provided permission is granted by participants).

All data from the meetings, including stakeholder comments, concerns, recommendations, questions, and responses, will be manually entered into the RSK Stakeholder Engagement Database (RSKSED) (see Section 6) by RSK consultants. The comments will be collated and summarised in the stakeholder engagement chapter of the ESIA Addendum report.

Requests, comments, and questions received following the meetings (e.g., through the Project grievance mechanism) will also be entered into the stakeholder engagement database and collated and summarised in the stakeholder engagement chapter of the SIA report.

5.7 Itinerary for engagement

Appendix 15 outlines the itinerary for engaging with stakeholders during the studies. It is important to note that, in light of COVID-19, the dates and timings outlined in Appendix 16 are preliminary and subject to change in the event that new government restrictions are unexpectedly introduced.

6 DATA MANAGEMENT AND ANALYSIS

Documentation of stakeholder engagement is important to ensure that inputs can be fed into the project planning and execution process and to track and address issues raised by stakeholders.

All stakeholder engagement activities (formal and ad-hoc) undertaken during the studies, including telephone communications, will be recorded using agreed templates (see Appendix 14). Permission will always be sought from stakeholders before recording questions / comments. During the stakeholder engagement activities, facilitators will explain that no names will be used when reporting the findings, unless consent is given.

The data will be subsequently entered into the RSKSED, which has been specifically developed for the purpose of managing and analysing stakeholder information during ESIAs (see Figure 6-1).

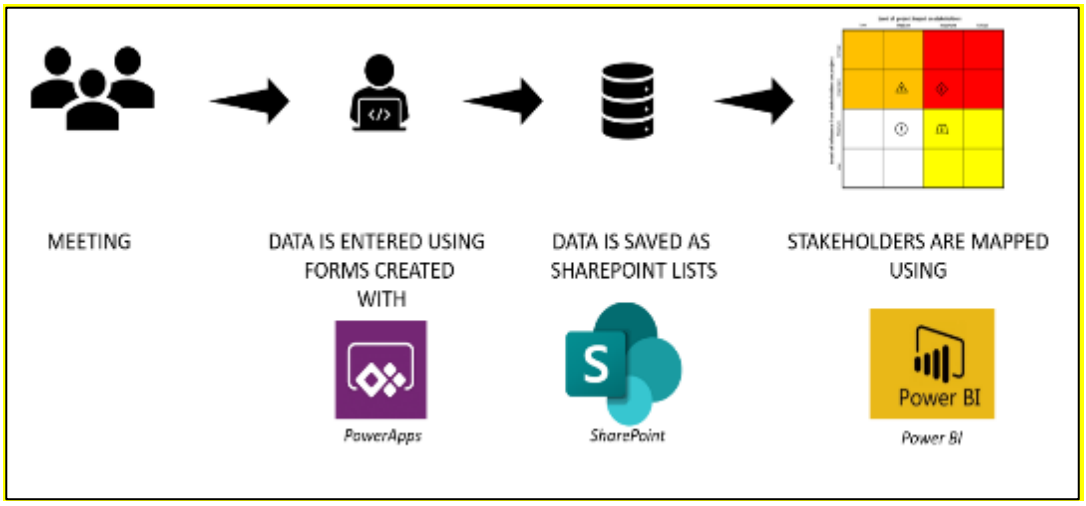

Figure 6-1 Stakeholder engagement data analysis process

RSKSED is designed in Office 365 using applications such as SharePoint lists (which store the data) and PowerApps (which provides a tailored user interface including data entry forms). The application Power BI, which offers great visual reporting tools, is used to provide on-the-fly analyses and to make visual the relationship between stakeholder influence and interest, and project impact (stakeholder mapping).

Storing stakeholder engagement data in Office 365 is advantageous for the following reasons:

- confidentiality
  - data is stored securely in Microsoft's DataCentres, which are ISO27001 certified
  - encryption, multi-factor authentication and classification of documents can be employed
- integrity
  - ability to control who has access to which forms

    - capability to provide auditing for General Data Protection Regulation (GDPR) requirements
- availability
    - enables multiple-user data entry
    - secured versions of the data are recoverable.

Through the use of customised data entry forms, stakeholder-related data gathered over the course of the studies will be managed and analysed according to the following four entities/modules:

- Stakeholders (individuals): This module includes data on individuals such as their names, sex, position within the organisation, and contact details.
- Stakeholders (organisations): An organisation can refer to various stakeholders (e.g., a ministry, community, or business). Data captured as part of this module include stakeholder category (government agencies, communities, and so forth), location, and levels of interest and influence (low, medium, high – see Section 4.2).
- Events: This module includes data about formal and ad-hoc stakeholder engagement activities undertaken over the course of the studies, including telephone communications. Data captured are meeting venues, dates, and number and type (organisations) of attendees.
- Contributions: This module includes questions, suggestions, comments, concerns, and expectations and grievances expressed by stakeholders and responses provided by RSK or BWE. Each contribution is categorised according to specific topics and sub-topics; if follow up actions are required, such contributions can be marked.

7 GRIEVANCE MANAGEMENT PROCEDURE

The process for managing grievances raised by stakeholders in relation to the Project and studies conducted by RSK / TEREA is detailed in BWE's Third-party Grievance Management Procedure.

8 RESOURCES AND RESPONSIBILITIES

RSK in partnership with TEREA will conduct stakeholder engagement for the studies jointly with BWE. The following responsibilities for each party are envisaged:

- RSK is responsible for:
  - the preparation of the SEP and any subsequent updates
  - the preparation, translation, and distribution of stakeholder engagement materials related to the Project and studies (e.g., posters, a BID, and an FAQs document)
  - the coordination and execution of the stakeholder engagement activities for the studies, including regular progress reporting to BWE
  - recording the engagement outcomes (meeting attendance and meeting minutes), using an agreed template format
  - populating the RSKSED and managing the data from the stakeholder engagement process (to be submitted to BWE upon completion of the studies)
  - ensuring that the assessment of impacts and proposed mitigation measures in the studies reflect stakeholder comments, including those obtained during the stakeholder engagement disclosure phase.
- BWE is responsible for:
  - leading the relationship with government stakeholders at national, provincial, and departmental/local level
  - review and approval of the SEP and any subsequent updates
  - review, approval, and printing of the stakeholder engagement materials related to the Project and studies prior to their use (e.g., posters, a BID, and an FAQs document)
  - approving the stakeholder engagement activities prior to their execution
  - attending stakeholder engagement meetings, where appropriate and practicable, to answer technical questions about the Project
  - operating the grievance management procedure; managing grievances as per the procedure and sharing those related to the studies with RSK.

9 NEXT STEPS

Stakeholder engagement will be undertaken by BWE on an ongoing basis to provide stakeholders with updates on the Project and BWE's ongoing operations in-country. BWE's grievance management procedure will remain fully operational, providing stakeholders with an ongoing means through which to lodge grievances and concerns related to BWE's operations.

REFERENCES

Enviropass. (2017), *Etude d'Impact Environmentale et Social en rapport avec le projet de développement Phase I du champ Tortue dans l'AEE Ruche du CEPP Dussafu Marin no. G4-209*. Enviropass: Libreville, Gabon.

Enviropass. (2019), *Projet de développement du champ Tortue Phase II – Notice d'Impact Environnemental*. Enviropass: Libreville, Gabon.

Enviropass. (2020), *Projet de développement du champ Ruche Phases I et II dans l'AEE Ruche du Permis Dussafu Marin G4-209 – Etude d'Impact Environnemental et Social*. Enviropass: Libreville, Gabon.

IFC (International Finance Corporation). (2012), *International Finance Corporation's Guidance Notes: Performance Standards on Environmental and Social Sustainability*. World Bank: Washington DC.

Oil Spill Response Ltd. (2019), *BW Energy Dussafu B.V. Oil Spill Contingency Plan – Ruche Field Development*. Oil Spill Response Ltd: Southampton, United Kingdom.

APPENDIX 1 TORTUE PHASE 1 ESIA – INVITATION LETTERS FOR INFORMATION MEETING IN LIBREVILLE

Information meeting concerning Tortue Phase 1 and the corresponding ESIA, which took place on 13 July 2017 in Libreville.

BW Energy Gabon

Libreville, le 10 Juillet 2017

A
Monsieur le Directeur Général
de l'Environnement et de la Protection
de la Nature
BP 199 Libreville

Objet : Développement du champ Tortue

Monsieur le Directeur Général,

Dans le cadre de ses activités, la société **BW Energy,** nouvel opérateur du permis Dussafu Marin et ses partenaires (l'Etat Gabonais, GOC, Panoro), envisage de procéder au démarrage de la phase 1 du développement du champ Tortue, contenu dans le permis Dussafu (Ruche EEA).

Ce développement initial consiste à :

- Forer deux puits à tête sous-marine dans les réservoirs Gamba et Dentale 6 avec un puits chacun en utilisant les puits de découverte initiale DTM1 et DTM-ST1 comme puits de forage pilotes ;
- Positionner le tanker FPSO à 750 mètres environ des deux futurs puits de développement ;
- Connecter les deux futurs puits de développement avec têtes sous-marines au FPSO par deux flowlines sous-marines et produire le champ Tortue. Le FPSO traitera le brut et l'exportera aux normes de commercialisation ;
- Des phases de développement supplémentaires seront nécessaires pour développer pleinement le champ Tortue.

Le forage des deux puits de développement est prévu débuter en janvier 2018 et prendra environ 4 mois et demi, tandis que la mise en production du champ Tortue (First Oil) est prévue pour juillet 2018.

Le permis Dussafu est situé dans l'offshore sud du Gabon à la limite avec le Congo. Les 2 puits de développement à forer sur le champ Tortue sont à une colonne d'eau d'environ 116 mètres de profondeur et à environ 47 km du trait de côte au large du parc national marin de Mayumba.

Ce projet, comme le stipule la loi n°007/2014 relative à la protection de l'environnement en République Gabonaise, est soumis à l'élaboration d'une étude d'impact environnemental et social.

BW Energy Gabon

Libreville, le 10 Juillet 2017

A

Monsieur le Directeur Général
Des Hydrocarbures
BP 2199 Libreville

Objet : Développement du champ Tortue

Monsieur le Directeur Général,

Dans le cadre de ses activités, la société **BW Energy,** nouvel opérateur du permis Dussafu Marin et ses partenaires (l'Etat Gabonais, GOC, Panoro), envisage de procéder au démarrage de la phase 1 du développement du champ Tortue, contenu dans le permis Dussafu (Ruche EEA).

Ce développement initial consiste à :

- Forer deux puits à tête sous-marine dans les réservoirs Gamba et Dentale 6 avec un puits chacun en utilisant les puits de découverte initiale DTM1 et DTM-ST1 comme puits de forage pilotes ;
- Positionner le tanker FPSO à 750 mètres environ des deux futurs puits de développement ;
- Connecter les deux futurs puits de développement avec têtes sous-marines au FPSO par deux flowlines sous-marines et produire le champ Tortue. Le FPSO traitera le brut et l'exportera aux normes de commercialisation ;
- Des phases de développement supplémentaires seront nécessaires pour développer pleinement le champ Tortue.

Le forage des deux puits de développement est prévu débuter en janvier 2018 et prendra environ 4 mois et demi, tandis que la mise en production du champ Tortue (First Oil) est prévue pour juillet 2018.

Le permis Dussafu est situé dans l'offshore sud du Gabon à la limite avec le Congo. Les 2 puits de développement à forer sur le champ Tortue sont à une colonne d'eau d'environ 116 mètres de profondeur et à environ 47 km du trait de côte au large du parc national marin de Mayumba.

Ce projet, comme le stipule la loi n°007/2014 relative à la protection de l'environnement en République Gabonaise, est soumis à l'élaboration d'une étude d'impact environnemental et social.

DIRECTION GENERALE
DES HYDROCARBURES
2199 LBV 2779106

11/07/17

BW Energy Gabon

AGENCE NATIONALE DES PARCS NATIONAUX
ANPN
LE 11 JUIL. 2017
COURRIER ARRIVE
1527
OK

Libreville, le 10 Juillet 2017

A

Monsieur le Secrétaire Exécutif de
l'Agence des Parcs Nationaux (ANPN)
Libreville, Gabon

Objet : Développement du champ Tortue

Monsieur le Directeur Général,

Dans le cadre de ses activités, la société **BW Energy,** nouvel opérateur du permis Dussafu Marin et ses partenaires (l'Etat Gabonais, GOC, Panoro), envisage de procéder au démarrage de la phase 1 du développement du champ Tortue, contenu dans le permis Dussafu (Ruche EEA).

Ce développement initial consiste à :

- Forer deux puits à tête sous-marine dans les réservoirs Gamba et Dentale 6 avec un puits chacun en utilisant les puits de découverte initiale DTM1 et DTM-ST1 comme puits de forage pilotes ;
- Positionner le tanker FPSO à 750 mètres environ des deux futurs puits de développement ;
- Connecter les deux futurs puits de développement avec têtes sous-marines au FPSO par deux flowlines sous-marines et produire le champ Tortue. Le FPSO traitera le brut et l'exportera aux normes de commercialisation ;
- Des phases de développement supplémentaires seront nécessaires pour développer pleinement le champ Tortue.

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Le permis Dussafu est situé dans l'offshore sud du Gabon à la limite avec le Congo. Les 2 puits de développement à forer sur le champ Tortue sont à une colonne d'eau d'environ 116 mètres de profondeur et à environ 47 km du trait de côte au large du parc national marin de Mayumba.

Ce projet, comme le stipule la loi n°007/2014 relative à la protection de l'environnement en République Gabonaise, est soumis à l'élaboration d'une étude d'impact environnemental et social.

BW Energy Gabon

Libreville, le 10 Juillet 2017

A

Monsieur le Directeur Général
De la Marine Marchande
Libreville, Gabon

Objet : Développement du champ Tortue

Monsieur le Directeur Général,

Dans le cadre de ses activités, la société **BW Energy,** nouvel opérateur du permis Dussafu Marin et ses partenaires (l'Etat Gabonais, GOC, Panoro), envisage de procéder au démarrage de la phase 1 du développement du champ Tortue, contenu dans le permis Dussafu (Ruche EEA).

Ce développement initial consiste à :

- Forer deux puits à tête sous-marine dans les réservoirs Gamba et Dentale 6 avec un puits chacun en utilisant les puits de découverte initiale DTM1 et DTM-ST1 comme puits de forage pilotes ;
- Positionner le tanker FPSO à 750 mètres environ des deux futurs puits de développement ;
- Connecter les deux futurs puits de développement avec têtes sous-marines au FPSO par deux flowlines sous-marines et produire le champ Tortue. Le FPSO traitera le brut et l'exportera aux normes de commercialisation ;
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Le forage des deux puits de développement est prévu débuter en janvier 2018 et prendra environ 4 mois et demi, tandis que la mise en production du champ Tortue (First Oil) est prévue pour juillet 2018.

Le permis Dussafu est situé dans l'offshore sud du Gabon à la limite avec le Congo. Les 2 puits de développement à forer sur le champ Tortue sont à une colonne d'eau d'environ 116 mètres de profondeur et à environ 47 km du trait de côte au large du parc national marin de Mayumba.

Ce projet, comme le stipule la loi n°007/2014 relative à la protection de l'environnement en République Gabonaise, est soumis à l'élaboration d'une étude d'impact environnemental et social.

Reçu le 11/07/2017

BW Energy Gabon

Libreville, le 10 Juillet 2017

A

Monsieur le Directeur Général
Des Pêches et de l'Aquaculture
Libreville, Gabon

Reçu le 11/07/2017
CE-DEN

Objet : Développement du champ Tortue

Monsieur le Directeur Général,

Dans le cadre de ses activités, la société **BW Energy,** nouvel opérateur du permis Dussafu Marin et ses partenaires (l'Etat Gabonais, GOC, Panoro), envisage de procéder au démarrage de la phase 1 du développement du champ Tortue, contenu dans le permis Dussafu (Ruche EEA).

Ce développement initial consiste à :

- Forer deux puits à tête sous-marine dans les réservoirs Gamba et Dentale 6 avec un puits chacun en utilisant les puits de découverte initiale DTM1 et DTM-ST1 comme puits de forage pilotes ;
- Positionner le tanker FPSO à 750 mètres environ des deux futurs puits de développement ;
- Connecter les deux futurs puits de développement avec têtes sous-marines au FPSO par deux flowlines sous-marines et produire le champ Tortue. Le FPSO traitera le brut et l'exportera aux normes de commercialisation ;
- Des phases de développement supplémentaires seront nécessaires pour développer pleinement le champ Tortue.

Le forage des deux puits de développement est prévu débuter en janvier 2018 et prendra environ 4 mois et demi, tandis que la mise en production du champ Tortue (First Oil) est prévue pour juillet 2018.

Le permis Dussafu est situé dans l'offshore sud du Gabon à la limite avec le Congo. Les 2 puits de développement à forer sur le champ Tortue sont à une colonne d'eau d'environ 116 mètres de profondeur et à environ 47 km du trait de côte au large du parc national marin de Mayumba.

Ce projet, comme le stipule la loi n°007/2014 relative à la protection de l'environnement en République Gabonaise, est soumis à l'élaboration d'une étude d'impact environnemental et social.

APPENDIX 2 TORTUE PHASE 1 ESIA – MINUTES AND ATTENDANCE LIST FOR INFORMATION MEETING IN LIBREVILLE

Information meeting concerning Tortue Phase 1 and the corresponding ESIA, which took place on 13 July 2017 in Libreville.

Minute de réunion

L'an 2017, le 13 juillet s'est tenue à l'hôtel Radisson Blu de Libreville, une réunion d'information relative à l'Etude d'Impact Environnemental et Social du projet de développement du champ Tortue dans le permis Dussafu Marin N°G4-209 opéré par la société BW Energy.

Ont pris part à cette réunion les entités suivantes :

- La Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN) ;
- L'Agence Nationale des Parcs Nationaux (ANPN) ;
- La Direction Générale des Pêches et de l'Aquaculture (DGPA) ;
- La Direction Générale de la Marine Marchande (DGMM) ;
- La société BW Energy (BWE).

La liste de présence est annexée à la présente minute.

Les travaux relatifs au développement du champ Tortue consistent dans un premier temps aux activités préparatoires suivantes :

- La reconnaissance radar des fonds marins afin d'y déposer 12 ancres qui serviront de fixation au FPSO ;
- L'ancrage des ancres déposés sur les fonds marins pour l'ajustement des forces de tension des chaines d'ancrage permettant un positionnement équilibré du FPSO ;
- L'abandon des ancres et des chaines d'ancrage en attente sur le fond marin une fois l'ajustement effectué.

Ces opérations seront effectuées par deux bateaux spécialisés à ce type de travaux.

Dans un second temps, les activités suivantes seront mises en œuvre :

- Installation d'un appareil de forage autoélévateur (jack up) à haute spécification proche des deux points de forage ;
- Positionnement des centres des puits sur les fonds marins à 15 mètres de distance pour éviter les attelages entre les puits (centre sous-marin +/- 750 m de FPSO) ;
- Forage de deux puits à têtes sous-marines (tête de puits fabriqué par DrilQuip avec un contrôle hydraulique direct) sur le champ Tortue (puits horizontaux en gas-lift ciblant les réservoirs Gamba et Dentale 6) ;
- Installation et positionnement du FPSO sur 12 chaines reliées chacune à un ancre posé sur le fond marin ;
- Pose de deux flowlines et manifolds et les raccorder au FPSO ;
- Pose des ombilicaux pour le Contrôle et la surveillance des puits depuis le FPSO ;
- Mise en production des deux puits par assistance gas-lift, évacuation des fluides vers le FPSO, traitement et stockage de brut, puis export aux normes de commercialisation ;
- Mise en place du flow assurance pour maintenir la production des puits sans interruption pendant la production normale, les redémarrages après un arrêt inattendu, les effets potentiels de blocages ou restrictions de débits (dépôts de paraffine, d'asphaltène, d'hydrates, d'émulsion, de corrosion ou de précipitation de sel).

Objectif du projet : Mise en production du champ Tortue.

Des phases de développement supplémentaires seront nécessaires pour développer pleinement le champ Tortue.

Historique :

Puits de découverte foré par la société Harvest qui a été rachetée par BW Energie (avril 2017).

Localisation :

Le projet est implanté sur une zone offshore située au sud-ouest du Gabon, à une profondeur d'eau de 116 mètres et à 47 km du littoral de Mayumba.

Planning prévisionnel :

- Les travaux préliminaires de reconnaissance des fonds marins et de pose des ancres de fixation du FPSO sont prévus commencer en décembre 2017 ;
- Le forage des puits est prévu pour janvier 2018 et devrait durer 4 mois et demi ;
- La production du champ Tortue devrait débuter le 15 juillet 2018.

Recommandations :

- Informer la Marine Marchande des spécifications des navires devant réaliser la reconnaissance des fonds marins pour la fixation du FPSO ;
- Faire inspecter le FPSO par la Marine Marchande sur le chantier de modification, au dernier port avant son entrée dans les eaux territoriales et après ancrage ;
- Délimiter la zone d'emprise des installations et des activités pétrolières de BWE et informer la Marine Marchande qui saisira le SHOM pour l'actualisation des données géographiques sur les cartes ;
- Associer l'Agence Nationale des Pêches et de l'Aquaculture ainsi que le Conseil National de la Mer aux parties prenantes ;
- Localiser la zone du projet par rapport au Parc National Marin de Mayumba et réaliser une carte de sensibilités ;
- Tenir compte de la réglementation gabonaise sur la structure et l'ancienneté du FPSO ;
- Prévoir un plan de communication avec les autres acteurs opérant dans les environs ;
- Réaliser une notice d'impact environnemental pour l'ancrage du FPSO, indépendamment de l'Etude d'Impact environnemental et social en rapport avec le forage et la production ;
- Tenir compte des périodes de migration des tortues marines ;
- Prévoir une réunion d'information avec les autorités locales et les parties prenantes du projet dès le 10 août 2017.

2

Direction Générale de l'Environnement

Direction Générale de la Marine Marchande

Agence Nationale des Parcs Nationaux

BW Energy Dussafu B.V. Gabon

BW Energy Dussafu BV GABON
(BWEDBV)
NIF 788501 K

Direction Générale des Pêches et de l'Aquaculture

LISTE DE PRESENCE REUNION 13 JULLIET 2017 AU RADISSON BLEU
DEVELOPPEMENT DUSSAFU

	PRENOM	NOM	FONCTION	SOCIETE/ADMINISTRATION	ADRESSE EMAIL	NUMERO TEL	
✓ 1	Urbain	Beka	Directeur GI	BWE	urbain.beka@bwoffshore.com	06033694	[signature]
✓ 2	Willy	Van de Ven	Fin. Contr	BWE	Wilhelmina.vandeven@bwoffshore.com	07391966	[signature]
✓ 3	Loïs	ALLELA	Consultant	Enviropass	loisallela@hotmail.com	07172909	
✓ 4	ROSTAND	LEPONDO	CE - DEN	D4EPN	rostand... @yahoo.fr	07636203 02636203	[signature]
✓ 5	Roger	AZIZET	Chef de service Zones Périphériques	ANPN	sairamazizet@gmail.com	07089531	
✓ 6	Sonia	EKAGHBA	Assistant EIE SZP	ANPN	msoekaghba@yahoo.fr	04.24.41.78	
✓ 7	Ladislas	TCHIBINDA IPANDY	Conseiller du Directeur General de la Marine March.	DGMM	moutchile@yahoo.fr	07916918	[signature]
✓ 8	Patri VM	SOUNDA	— // —	— // —	lot.sounda@yahoo.fr	08215226	[signature]
9	Georgin	MBENG	consultant	EnviroPass	mdengeo@live.fr	06260834	[signature]
✓ 10	J. Yvon	Elangmane	Directeur	D.G.P.A	elangmanepatrone@yahoo.fr	02928063 05415519	
✓ 11	Pulchérie	MAGANGA	Directeur	DGPA	puledram@yahoo.fr	04411643	[signature]
✓ 12	François	MUEH ALLIANO	Ad. Général	EnviroPass	enviropass@yahoo.fr	07734872	[signature]
13							
14							
15							

... Energy Dussafu BV GABO
(BWEDBV)
NIF 788501 K

APPENDIX 3 TORTUE PHASE 1 ESIA – MINUTES, PHOTOGRAPHS AND ATTENDANCE LISTS FOR PUBLIC CONSULTATION MEETING IN MAYUMBA

Public consultation meeting concerning Tortue Phase 1 and the corresponding ESIA, which took place on 23 October 2017 in Mayumba.

Projet de développement phase 1 du champ Tortue dans l'AEE « Ruche »
CEPP Dussafu marin n°G4-209

Procès-verbal de Consultation Publique

L'an 2017, le 23 octobre s'est tenue à la Préfecture de Mayumba, une Consultation Publique relative à l'étude d'impact environnemental et social du projet de développement phase 1 du champ Tortue dans l'AEE « Ruche » CEPP Dussafu marin n°G4-209.

Ont pris part à cette réunion les entités suivantes :

- La Préfecture de Mayumba
- Le Conseil Départemental
- La Mairie de Mayumba
- La Direction Générale des Hydrocarbures (DGH) ;
- La Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN) ;
- La Direction Générale des Pêches et de l'Aquaculture ;
- L'Agence Nationale des Pêches et de l'Aquaculture ;
- L'Agence Nationale des Parcs Nationaux (ANPN) ;
- La Marine Marchande
- La société BW Energy Dussafu BV ;
- La Compagnie de Gendarmerie de Mayumba ;
- La Brigade de Gendarmerie de Mayumba ;
- La Base Navale de Mayumba ;
- L'Antenne Départementale de la Direction Générale de la Documentation et de l'Immigration
- Les Représentants des pêcheurs de la mer
- La Notabilité Locale ;
- Certains Hauts Fonctionnaires.

La liste de présence est annexée au présent procès-verbal.

Les travaux relatifs au développement phase 1 du champ Tortue consistent dans un premier temps aux activités d'ancrage du FPSO suivantes :

- La reconnaissance radar des fonds marins afin d'y déposer 12 ancres qui serviront de fixation au FPSO ;
- L'ancrage des ancres déposés sur les fonds marins pour l'ajustement des forces de tension des chaines d'ancrage permettant un positionnement équilibré du FPSO ;
- L'abandon des ancres et des chaines d'ancrage en attente sur le fond marin une fois l'ajustement effectué.

Ces opérations seront effectuées par deux bateaux spécialisés à ce type de travaux.

Dans un second temps, les activités suivantes seront mises en œuvre :

- L'Installation d'un appareil de forage autoélévateur (jack up) à haute spécification proche des deux points de forage ;
- Le Positionnement des centres des puits sur les fonds marins à 15 mètres de distance pour éviter les attelages entre les puits (centre sous-marin +/- 750 m de FPSO) ;
- Le Forage de deux puits à têtes sous-marines (tête de puits fabriqué par DrilQuip avec un contrôle hydraulique direct) sur le champ Tortue (puits horizontaux en gas-lift ciblant les réservoirs Gamba et Dentale 6) ;
- L'Installation et positionnement du FPSO sur 12 chaines reliées chacune à un ancre posé sur le fond marin ;
- La Pose de deux flowlines et manifolds et leur raccordement au FPSO ;
- La Pose des ombilicaux pour le Contrôle et la surveillance des puits depuis le FPSO ;

- La Mise en production des deux puits par assistance gas-lift, évacuation des fluides vers le FPSO, traitement et stockage de brut, puis déchargement pour export de brut aux normes de commercialisation ;
- La Mise en place du flow assurance pour maintenir la production des puits sans interruption pendant la production normale, les redémarrages après un arrêt inattendu, les effets potentiels de blocages ou restrictions de débits (dépôts de paraffine, d'asphaltène, d'hydrates, d'émulsion, de corrosion ou de précipitation de sel).
- La zone d'exclusité de l'activité est de 2 km.

Objectif du projet : Mise en production du champ Tortue.

Des phases de développement supplémentaires seront nécessaires pour développer pleinement le champ Tortue.

Historique :

Puits de découverte foré par la société Harvest qui a été rachetée par BW Energie (avril 2017).

Localisation :

Le projet est implanté sur une zone offshore située au sud-ouest du Gabon, à une profondeur d'eau de 116 mètres et à 47 km du littoral de Mayumba.

Planning prévisionnel :

- Les travaux de reconnaissance des fonds marins et de pose des ancres de fixation du FPSO sont prévus commencer en décembre 2017 ;
- Le forage des puits est prévu pour janvier 2018 et devrait durer 4 mois et demi ;
- La production du champ Tortue devrait débuter au plus tard le 15 juillet 2018.

Lors des échanges, les principales inquiétudes et interrogations ont été les suivantes ;

- Les déversements accidentels ou pernicieux de pétrole pouvant constituer un danger pour l'environnement. A ce propos l'opérateur a recommandé le prélèvement d'échantillons dans de tels cas afin d'établir la provenance des déchets incriminés. Par ailleurs, dans le cadre de la surveillance, la Direction Générale des Hydrocarbures a recommandé l'élaboration des plans d'urgence anti-pollution et l'applicabilité de leur mise en œuvre.
- L'emploi de la main d'œuvre locale : au regard des spécificités de l'activité de production, l'opérateur a précisé que les emplois les plus ouverts sont ceux du niveau d'ingénieurs et techniciens et que par ailleurs l'Anglais étant la langue de travail, tous ces facteurs déterminants constituaient des écueils pour l'emploi d'une main d'œuvre de moindre facture ; Toutefois et en compensation, des projets agricoles et autres pourraient être présentés par des jeunes locaux, regroupé en association, projets qui seraient alors financés par l'opérateur via un fonds spécial qui leur sera destiné, en dehors de ceux prévus actuellement par le législateur. Dans ce cadre, il a été signifié que les projets et les dossiers seraient déposer auprès de Monsieur le Préfet pour transmission à l'opérateur.
- In fine, il a été relevé le problème de la piste d'atterrissage de Mayumba, la réhabilitation des locaux à usage d'éducation en vue de la formation ultérieure des jeunes locaux, et la construction d'un terminal. En réponse, l'opérateur a, tout en reconnaissant la nécessité et le bien-fondé de telles initiatives, précise que cela supposait une réflexion profonde en concertation avec les autres opérateurs du secteur et une implication des politiques.

Avant la clôture des échanges par Monsieur le Préfet, l'opérateur a, tout en remerciant les uns et les autres pour leur participation, exhorté les populations et les responsables à soutenir ce projet que tout un chacun souhaite porteur.

Préfecture de Mayumba

Direction Générale des Hydrocarbures

Conseil Départemental

Mairie de Mayumba

Direction Générale de l'Environnement et de la Protection de la Nature

Agence Nationale des Parcs Nationaux

Marine Marchande

Compagnie de Gendarmerie

Base Navale de Mayumba

Brigade de Gendarmerie de Mayumba

L'Antenne départementale de la DGDI

Représentant des Pêcheurs de la mer

Direction Générale des pêches et de l'Aquaculture

Patchanie MAGANGA

BW Energy Dussafu BV

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : Préfecture de Mayumba **LISTE DES PERSONNES PRESENTES** **DATE :** 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
1	PAMBO MABIALA Ambroise	07-51-21-08	60ans	M	2e VP. CDBB	
2	BOUANGA MBOUMBA Germaine	07-39-01-49	46ans	F.	2e Adjoint Mairie de Mayumba	
3	NGOMA-NGOMA Jean-Claude	07.59.48.66	51ans	M	SG. Mairie MYB	
4	MALALOU Madeleine		91ans	F	chef quartier FOUIKA	
5	NDEMBI ALAIN NICAISE	06.88.84.15.	35ans	M	Quartier-Maitre	
6	ADA-EDOU Mijola JOANA	06-64-72-76	34ans	F	Juriste-fiscaliste Environnement	
7	Adjudant LANDI POUNGUI Bertrand	04 32 68 20	35ans	M	Gendarme	
8	NKOUNA PATRICK MIKAËL	04.20.67.66	40ans	M	MARIN D'ETAT	
9	NDOUNA ERIC	07000357	39	M	Ingénieur des Mines Environnement ANPN	
10	OBAME ESSONO Gildas	07 27 68 26	34	M	Expert EIES ANPN	

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : Préfecture de Mayumba **LISTE DES PERSONNES PRESENTES** **DATE :** 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
1	LOEMBE Loick Ralph	02.15.34.46	26 ans	M	Etudiant	
2	PAMZOU TCHIBINDA. M	06 89.36.19	37 ans	M	CHOMEUR	
3	MAMFOUMBI W. HARRIS	04.19.90.29	31 ans	M	— " —	
4	MOUSSOUAMI KOUMBA W.	06-89-41-78	26 ans	M	Commis bureau B. Lèche	
5	MAGANGA LUCIENNE STEVIE	02-73-16-37	37 ans	F	SECRETAIRE	
6	BISSAPHIE Joséphine	07-61-89-09	47	F	Jardinière	
7	BIVIGA Hugues	04-24-92-78	37 ans	M	C.N.	
8	Fouty Alain Brice	02-60-95-81	46 ans	M	Enquêteur	
9	MAROGA stella	06.76.14.80	38 ans	F	contrôleur POSTEBANK	
10	NZALA LEVOUO ANNE	06-69-97-56	39 ans	F	Responsable Halte-Garderie	

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : Préfecture de Mayumba

LISTE DES PERSONNES PRESENTES

DATE : 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
01	NGOMA Victor	04501201 06597790	53 ans	M	Inspecteur Pédagogique	[signature]
02	MAKANGA DIEU DONNE	07 40 74 73	47 ans	M	CHEF	[signature]
03	René LAKISSI MAKOSSO	05 11 59 15	41 ans	M	Enseignant	[signature]
04	Ogouli NGUENDE ONENWE ANGE B.	06.67.25.15	33	M	Marin d'Etat	[signature]
05	KOKOLO MIHINDOU RODRIGUE	06.22.83.44	34	M	MARIN d'ETAT	[signature]
06	DOUKAGA Etienne	07.42-17.17	40 ans	M	chef de Secteur A	[signature]
07	PAMBOU MAKAYA Jean claude	07 67 47 35	1943	M	Chef de quartier	[signature]
08	MAKOSSO Gaétan	07 61 41 55	1931	M	Notable	[signature]
09	NZIENGUI BAKITA	02 17 99 66	54	M	Enqueteur à la Brigade des PECHES	[signature]
10	MBadinga MBoumba Aloïse	07.21.16.66	39	M	Enquêteur Brigade des pêches	[signature]

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : MAYUMBA

LISTE DES PERSONNES PRESENTES

DATE : 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
01	MAGANGA LOUANGA Joseph	07376311	-	-	Prefet	[signature]
02	MAKAYA-CASTANOU Guy	06242556	-	-	Maire	[signature]
03	[illegible]	06.31.[illegible]	—	—	CDBB	[signature]
04	BEKA URBAIN	06033694	-	-	DGBWE	[signature]
05	NGOUEYENO K.P. Gaëlle	07726364	—	—	DGH	[signature]
06	Elangmane Jean Yvon	02928063	-	-	ANPA	[signature]
07	Nontsé Loïs ALLELA	06569206	-	F	Consultant	[signature]
08	DOUBONA Annick	06266360	-	F	DGEPN	[signature]
09	MAKOSSO GUY ALAIN	06-59-64-43	-	M	jeune cadre	[signature]
10	Tchitonji Christia	04909022	-	M	Douanes	[signature]
11	SOUNDA Patrick	06215226		M	Conservateur DGAT	[signature]
12	Angowel Bongunu D. Eric	04679092			Conservateur Mayumba	[signature]

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : Préfecture de Mayumba **LISTE DES PERSONNES PRESENTES** **DATE :** 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
1	Sonami Nzassi	07.52.14.77	54 ans	Masculin	Chef de quartier Konango	
2	IBinda Jean Remy	02669843	48ans	Masculin	Ecogarde	
3	Kassa Nzavi Valentin	07419261	63ans	Masculin	Pêcheur	
04	Kakpo Kanbui frédéric	07548258	53 ans	Masculin	Pêcheur	
05	Cne de Police LETSINA Bienvenu Jean de la croix	05074007/07776408	48 ans	Masculin	C.A.D. DGDI	
06	LT/Gendarmerie PAMBO-Nzienga COGEND Mayumba	05924191 07915777	51 ans	Masculin	COGEND Mayumba	
07	Willy van de Ven	07 39 19 66	40ans	Feminin	Cont. Fin BWE	
08	MAGANGA Pulcherie	04 41 16 43	38 ans	Feminin	DOPA	
09	NTSONO Nicette	07-84-81-18		F	Ingenieur	
10	ANGOUE. Joël. Armand	06 73 33 23	41	M	Administrateur Civil (DGMG)	

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : Préfecture de Mayumba **LISTE DES PERSONNES PRESENTES** **DATE :** 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
01	MBADINGA LAURENT	07101900 06569386	47ans	M.	Infirmier C.M.M.	
2	Priam Miamfoumby	07-50-01-40 06-43-91-45		M.	Etudiant	
3	NGOMA Stéphanie	06 56 91 62 07 54 81 06	66ans	M	Notable	
4	MOUSSAVOU MAPPUNGOU Raymond	06 90 35 68	52ans	M	Notable	
5	MAKOSSO MA NKOUMBA	02 82 05 22	60 ans	M	NOTABLE	
6	NGUEMA SEVERIN	07.30.17.85	37ans	M	Agent Eaux et F.	
7	MAYOUNGOU MBATCHI Justin	07138882	62ans	M	Notable	
8	PAMBO. Joseph Léo	07381241	63ans	M	Retraité	
	MBAKI BIBAYA JEAN BERNARD	07906796	47ans	M	Enquêteur Brigade Feeres MAYUMBA	
	MOIMEDJRÉ ABEL	07 14 MM 02	48ans	M	Gendarme	

PROJET DE DEVELOPPEMENT PHASE I DU CHAMP TORTUE DANS L'AEE « RUCHE »
CEPP DUSSAFU MARIN N°G4-209

CONSULTATION PUBLIQUE

LIEU : MAYUMBA

LISTE DES PERSONNES PRESENTES

DATE : 23/10/2017

Ordre	Nom et Prénom	Contact	Age	Sexe	Profession	Signature
001	Moubamba Alain	06768029		♂	commis Inspect du Trésor	
002	Mbouamba Roger	07756555		♂	Préfecture M/BA	
003	Koukou Olga	07548116		F	Bde des pêches	
004	IBINGAIBINGA	07 75 71 30		♂	Prefecture M/BA	
005	Mekala M. le - MARTIAL	06.51.98.88		♂	TRESOR	
006	MAKANGA DAVI	02.17.77.22		♂	TRESOR	
007	OMANDA Louis François	06 44 9144		♂	GENA	
008	MOUYAMA Félicité	04116709		F	Préfecture	
009	~~MAKOSSO Guy Alain~~	~~07 46 3434~~		♂	~~PERENCO~~	
010	PAMBOU NZIENGUI Nicaise	05 92 41 91		♂	GENA	

APPENDIX 4 TORTUE PHASE 2 NEI – INVITATION LETTERS FOR INFORMATION MEETING IN LIBREVILLE

Information meeting concerning Tortue Phase 2 and the corresponding NEI, which took place on 01 February 2019 in Libreville.

BW Energy Gabon

Libreville, le 28 Janvier 2019

A l'Attention de :

Monsieur le Directeur Général de l'Environnement et de la Protection de la Nature

N0370 BWE/28/01/19/GL/GM

Objet : Invitation à la Réunion d'Information sur le projet de Développement Phase II de Dussafu Marin.

Monsieur le Directeur Général,

BW Energy Gabon SA, opérateur du permis Dussafu Marin a le plaisir de vous convier à la réunion d'information qu'elle organise le **Vendredi 1er Février 2019 au Radisson Blu 09h00** pour vous présenter son projet développement Phase II.

Veuillez agréer Monsieur le Directeur Général l'expression de ma parfaite considération.

BW Energy GABON SA BWEGSA NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon SA, Bureaux Libreville Hôtel Radisson 117/118, 5 Boulevard Nice, BP21773, Libreville, GABON
NIF 745 484 F, Tel: + 241 06 03 36 94

BW Energy Gabon

Libreville, le 28 Janvier 2019

A l'Attention de :

Monsieur Bernardin MVE ASSOUMOU

Directeur Général des Hydrocarbures
BP 2199 Libreville Gabon

N° 0374 BWE/28/01/19/GL/GM

Objet : Invitation à la Réunion d'Information sur le projet de Développement Phase II de Dussafu Marin.

Monsieur le Directeur Général,

BW Energy Gabon SA, opérateur du permis Dussafu Marin a le plaisir de vous convier à la réunion d'information qu'elle organise le **Vendredi 1er Février 2019 au Radisson Blu 09h00** pour vous présenter son projet développement Phase II.

Veuillez agréer Monsieur le Directeur Général l'expression de ma parfaite considération.

BW Energy GABON SA
BWEGSA
NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon

Libreville, le 28 Janvier 2019

A l'Attention de :

Monsieur le Secrétaire Exécutif de l'Agence des Parcs Nationaux (ANPN)

Libreville

N° 0371 BWE/28/01/19/GL/GM

Objet : Invitation à la Réunion d'Information sur le projet de Développement Phase II de Dussafu Marin.

Monsieur le Secrétaire Exécutif,

BW Energy Gabon SA, opérateur du permis Dussafu Marin a le plaisir de vous convier à la réunion d'information qu'elle organise le **Vendredi 1er Février 2019 au Radisson Blu 09h00** pour vous présenter son projet développement Phase II.

Veuillez agréer Monsieur le Secrétaire Exécutif l'expression de ma parfaite considération.

BW Energy GABON SA BWEGSA NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon

Libreville, le 28 Janvier 2019

A l'Attention de :

Monsieur le Directeur Général
de la Marine Marchande

Owendo

N°0372 BWE/28/01/19/GL/GM

Objet : Invitation à la Réunion d'Information sur le projet de Développement Phase II de Dussafu Marin.

Monsieur le Directeur Général,

BW Energy Gabon SA, opérateur du permis Dussafu Marin a le plaisir de vous convier à la réunion d'information qu'elle organise le **Vendredi 1er Février 2019 au Radisson Blu 09h00** pour vous présenter son projet développement Phase II.

Veuillez agréer Monsieur le Directeur Général l'expression de ma parfaite considération.

BW Energy GABON SA
BWEGSA
N° 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon

Libreville, le 28 Janvier 2019

A l'Attention de :

Monsieur le Directeur Général
de la Pêche et de l'Aquaculture

Libreville

N° 0373 BWE/28/01/19/GL/GM

Objet : Invitation à la Réunion d'Information sur le projet de Développement Phase II de Dussafu Marin.

Monsieur le Directeur Général,

BW Energy Gabon SA, opérateur du permis Dussafu Marin a le plaisir de vous convier à la réunion d'information qu'elle organise le **Vendredi 1er Février 2019 au Radisson Blu 09h00** pour vous présenter son projet développement Phase II.

Veuillez agréer Monsieur le Directeur Général l'expression de ma parfaite considération.

BW Energy GABON SA
NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon SA, Bureaux Libreville Hôtel Radisson 117/118, 5 Boulevard Nice, BP21773, Libreville, GABON
NIF 745 484 F, Tel: + 241 06 03 36 94

APPENDIX 5 TORTUE PHASE 2 NEI – MINUTES AND ATTENDANCE LIST FOR INFORMATION MEETING IN LIBREVILLE

Information meeting concerning Tortue Phase 2 and the corresponding NEI, which took place on 01 February 2019 in Libreville.

Réunion d'information sur le projet de Développement Phase II de Dussafu Marin

Minute de Réunion

L'An deux mil dix-neuf, le 1er février dès 9:00 heures, s'est tenue dans la salle Franceville de l'hôtel Radisson Blu à Libreville, une réunion d'information sur invitation de BW Energy Gabon SA operateur du Permis Dussafu Marin relative à l'évaluation environnementale du projet de développement phase II qui consiste en une campagne de forage de 6 puits, dont 4 puits de développement (DTM-4H, DTM-5H, DTM-6H et DTM-7H) dans le périmètre du champ Tortue et 2 puits d'appréciation des prospects de l'AEE « Ruche ».

Ont pris part à cette réunion les Administrations Publiques suivantes :

- Direction Générale des Hydrocarbures (DGH) ;
- Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN) ;
- Agence Nationale des Parcs Nationaux (ANPN) ;
- Direction Générale de la Marine Marchande (DGMM) ;
- Direction Générale des Pêches et de l'Aquaculture (DGPA).

La liste des participants est annexée à la présente minute.

Cette réunion d'information avait pour objectifs de présenter et d'échanger avec toutes les parties prenantes, la Phase II de développement du Permis Dussafu marin n°G4-209, afin de lancer cette étape du projet et de favoriser la décision sur le type d'évaluation environnementale à entreprendre.

En rappel, les actions et résultats du Développement Phase I de Dussafu Marin sont les suivants :

- Installation du FPSO ADOLO ;
- Forage dans le champ Tortue de l'AEE Ruche, de deux (2) puits de développement DTM-3H et DTM-2H, respectivement dans les réservoirs Gamba et Dentale 6 ;
- Forage d'un puits d'appréciation Ruche NE (DRNEM-1) dans le champ Ruche de l'AEE Ruche ;
- Pose sur le fond marin d'un manifold (PLEM), de deux flowlines de 750 mètres linéaires et de 6 pouces connectées au FPSO, de deux lignes ombilicales pour le contrôle et la surveillance des deux puits producteurs depuis le FPSO ;
- Mise en huile des deux puits DTM-3H et DTM-2H, transport des hydrocarbures par flowlines vers le FPSO, traitement de production sur le FPSO et commercialisation du pétrole brut par transbordement vers les navires de transport ;
- Production cumulée 1 618 000 barils ;
- 3 Enlèvements ;

Pour la Phase II du projet de Développement Dussafu Marin, les activités suivantes sont prévues :

- Forage de quatre (4) puits de développement dans le champ Tortue et de deux (2) puits d'appréciation des prospects, notamment Hibiscus Nord ;
- Pose sur le fond marin de deux manifolds (1 pour 2 puits producteurs), de quatre flowlines d'environ 1250-1450 mètres linéaires et de diamètre 6 pouces connectées au FPSO, de quatre lignes ombilicales pour le contrôle et la surveillance des quatre nouveaux puits producteurs depuis le FPSO ;
- Mise en huile des quatre nouveaux puits et augmentation de la production.

Les actions qui seront menées dans le cadre de ces activités sont :

- La mobilisation du soutien logistique ;
- La réalisation des études géotechniques et géophysiques des fonds marins ;
- La réalisation des forages ;
- La pose des flowlines, manifolds et lignes ombilicales, puis raccordement au FPSO ;
- La démobilisation de l'appareil de forage après les travaux ;
- L'abandon temporaire des puits d'appréciation (en cas de succès) ;
- Et la mise en production des quatre nouveaux puits de développement.

Le projet de Développement Phase II de Dussafu Marin est prévu commencer à la fin du mois de juin 2019 avec l'arrivée du Rig Borr Nov, actuellement en opération chez Perenco Gabon. Ce projet durera 10 mois.

En retour, les Administrations présentes ont pris acte des informations communiquées par la société BW Energy et ont formulé les recommandations suivantes :

- La transmission des coordonnées géographiques pour le balisage de la zone des opérations ;
- La mise à disposition des rapports d'études réalisées par BW Energy lors des précédents forages et activités préparatoires à la phase 2 en vue de déterminer le type d'évaluation environnementale à réaliser ;
- L'élaboration de la carte des sensibilités environnementales et sociales ;
- L'approbation technique de la campagne de forage.

L'ordre du jour étant épuisé, la réunion s'est achevée à 13:00 heures.

Direction Générale des Hydrocarbures

Jean-Barthelemy OBAME EMVOGHA

Direction Générale de l'Environnement et de la Protection de la Nature

Bernard Landry PANZOU

Plaxede ANGUE NZE P.O.

Agence Nationale des Parcs Nationaux

Marc MAPANGOU

Direction Générale de la Marine Marchande

Ruben NDZIBE

Ladislas TCHIBINDA IPANDY

Direction Générale des Pêches et de l'Aquaculture

Col. NYAMA MOUKETOU

BW Energy Gabon SA

Urbain BEKA NGUEMA

BW Energy Gabon

Réunion d'information
Développement Permis DUSSAFU
Tortue Phase II

Liste de Présence

1er Février 2019

Ordre	Nom et Prénom	Administration / Societé	Email	Contact	Signature
1	ANGUE NZE Placide	DGEPN	angueplac@yahoo.fr	06.82.11.92	[signature]
2	MAPANGOU MARC	ANPN	marc.map@laposte.net	06.25.31.75	[signature]
3	MALY OSSIE Jovin	DGH	[illegible]	02508002	[signature]
4	KOUBDJE NZE Noel	DGH	~~Koubdje@~~ Koubdje.noel@gmail.com	06088508	[signature]
5	MOUDOUMA GILDAS	DGH / DEXP	moudoumagildas@yahoo.fr	07213815	[signature]
6	OBAME EMVOGHA J. B	DGH/DEXP	jbantobame@yahoo.fr	04-76-16-21	[signature]
7	Jean Urbain ELANGITANE	[illegible]	[illegible]@yahoo.fr	06 00 79 08	[signature]
8	Ladislas TCHIBINDA IPANDY	DGHM	moutchili@yahoo.fr	06218846	[signature]
9	RUBEN NDZIBE	DGHM	rndzibe@yahoo.fr	07344439	[signature]
10	EKAGHBA Sonia	ANPN	msoekaghba@yahoo.fr	04.24.41.78	[signature]

BW Energy Gabon

Réunion d'information
Développement Permis DUSSAFU
Tortue Phase II

Liste de Présence

1er Février 2019

Ordre	Nom et Prénom	Administration / Société	Email	Contact	Signature
1	NBENG Georgin	EnviroPass	ndengel@live.fr	06260834	
2	MVEH ALLOGHO François	EnviroPass	enviropass@yahoo.fr	07.73.45.72	
3	Dr Loïs ALLELA	EnviroPass	loisallela@hotmail.com	07172909	
4	PANZOU Bernard L	DGEPN	panber [illegible] @yahoo.fr	04.13 41 80	
Gl 5.	NYAMA MOUKETOU	DGPA	dielldyelle@gmail.com	07947007	
6	Geraldine Ewomba	BWE	geraldine.ewomba@bwoffshore.com	07 29 54 03	
7	Wilhelmina Van de Ven	BWE	wilhelmina.vandeven@bwoffshore.com	07391966	
8	Urbain BEKA NGUEMA	BWE	urbain.beka@bwoffshore.com	07765120	
9					
10					

APPENDIX 6: RUCHE NE NEI – LETTERS SENT TO AUTHORITIES

BW Energy Gabon

Libreville, le 29 mai 2018

A l'attention de :

Monsieur Bernardin MVE ASSOUMOU
Directeur Général des Hydrocarbures
BP 2199 Libreville Gabon

N° 0120 BWE/29/05/18/FC/GM

Objet : Continuité du Projet de développement dans l'AEE Ruche G5-127
Du Permis Dussafu Marin.

Monsieur le Directeur Général,

Dans le cadre de ses activités l'opérateur BW Energy Dussafu B.V. Gabon envisage de procéder au forage du puits d'appréciation RUCHE NORD EST dans le champs 'Ruche'. Le champ 'Ruche' est situé à environ une quinzaine (15) de kilomètres du champs 'Tortue', actuellement en cours de développement. L'objectif du projet est d'évaluer le potentiel en hydrocarbures et l'étendue des réservoirs 'Gamba' et 'Dentale' dans la perspective d'un développement futur.
Le champ 'Ruche' se trouve à cinquante-sept (57) kilomètres de la côte sur une colonne d'eau de cent-vingt (120) mètres environ. Les travaux devront débuter à la fin du mois juin 2018 et dureront soixante (60) jours.

Ce projet, comme le stipule la loi n°007/2014, a été soumis à une notice d'impact environnemental sur la recommandation de la DGEPN.

En vous remerciant d'avance, je vous prie d'agréer, Monsieur le Directeur Général, l'expression de notre considération distinguée.

DIRECTION GENERALE DES HYDROCARBURES

BW Energy Dussafu BV GABON (BWEDBV) NIF 788501 K

Urbain BEKA NGUEMA
Directeur Général

BW Energy Dussafu B.V, Bureaux Libreville Hotel Radisson 117 & 118, 5 Boulevard Nice, BP 23771, Libreville, GABON
NIF 788 501 K, Tel: +65 6632 7888 / Fax: +65 6323 1263 Tel 00241 07 39 19 66

BW Energy Gabon

Libreville, le 29 mai 2018

A l'attention de :

Monsieur Le Directeur Général
Des Pêches et de l'Aquaculture
Gabon

N° 0121 BWE/29/05/18/FC/GM

Objet : Continuité du Projet de développement dans l'AEE Ruche G5-127
Du Permis Dussafu Marin.

Monsieur le Directeur Général,

Dans le cadre de ses activités l'opérateur BW Energy Dussafu B.V. Gabon envisage de procéder au forage du puits d'appréciation RUCHE NORD EST dans le champs 'Ruche'. Le champ 'Ruche' est situé à environ une quinzaine (15) de kilomètres du champs 'Tortue', actuellement en cours de développement. L'objectif du projet est d'évaluer le potentiel en hydrocarbures et l'étendue des réservoirs 'Gamba' et 'Dentale' dans la perspective d'un développement futur.
Le champ 'Ruche' se trouve à cinquante-sept (57) kilomètres de la côte sur une colonne d'eau de cent-vingt (120) mètres environ. Les travaux devront débuter vers juin 2018 et dureront soixante (60) jours.

Ce projet, comme le stipule la loi n°007/2014, a été soumis à une notice d'impact environnemental sur la recommandation de la DGEPN.

En vous remerciant d'avance, je vous prie d'agréer, Monsieur le Directeur Général, l'expression de notre considération distinguée.

DIRECTION GENERALE DES PÊCHES
ET DE L'AQUA
LE 31 MAI 2018
COURRIER ARRIVEE
Enregistré S/N° 00...19

BW ENERGY GABON BV
NIF 788501 K

Urbain BEKA NGUEMA
Directeur Général

BW Energy Dussafu B.V, Bureaux Libreville Hotel Radisson 117 & 118, 5 Boulevard Nice, BP 23771, Libreville, GABON
NIF 788 501 K, Tel: +65 6632 7888 / Fax: +65 6323 1263 Tel 00241 07 39 19 66

A l'attention de :

Monsieur Le Directeur Général de
La Marine Marchande
Libreville Gabon

N° 0122 BWE/29/05/18/FC/GM

Reçu le 30/05/2018

Objet : Continuité du Projet de développement dans l'AEE Ruche G5-127
Du Permis Dussafu Marin.

Monsieur le Directeur Général,

Dans le cadre de ses activités l'opérateur BW Energy Dussafu B.V. Gabon envisage de procéder au forage du puits d'appréciation RUCHE N²ORD EST dans le champs 'Ruche'. Le champ 'Ruche' est situé à environ une quinzaine (15) de kilomètres du champs 'Tortue', actuellement en cours de développement. L'objectif du projet est d'évaluer le potentiel en hydrocarbures et l'étendue des réservoirs 'Gamba' et 'Dentale' dans la perspective d'un développement futur.
Le champ 'Ruche' se trouve à cinquante-sept (57) kilomètres de la côte sur une colonne d'eau de cent-vingt (120) mètres environ. Les travaux devront débuter vers juin 2018 et dureront soixante (60) jours.

Ce projet, comme le stipule la loi n°007/2014, a été soumis à une notice d'impact environnemental sur la recommandation de la DGEPN.

En vous remerciant d'avance, je vous prie d'agréer, Monsieur le Directeur Général, l'expression de notre considération distinguée.

BW Energy Dussafu BV GABON

Urbain BEKA NGUEMA
Directeur Général

BW Energy Dussafu B.V. Bureaux Libreville Hotel Radisson 117 & 118, 5 Boulevard Nice, BP 23771, Libreville, GABON
NIF 788 501 K, Tel: +65 6632 7888 / Fax: +65 6323 1263 Tel 00241 07 39 19 66

BW Energy Gabon

Libreville, le 29 mai 2018

AGENCE NATIONALE DES PARCS NATIONAUX
ANPN
LE 30 MAI 2018
COURRIER ARRIVE
1149

A l'attention de :

Monsieur Le Secrétaire Exécutif de
l'Agence des Parcs Nationaux (ANPN)
Libreville Gabon

N° 0123 BWE/29/05/18/FC/GM

Objet : Continuité du Projet de développement dans l'AEE Ruche G5-127
Du Permis Dussafu Marin.

Monsieur le Secrétaire Exécutif,

Dans le cadre de ses activités l'opérateur BW Energy Dussafu B.V. Gabon envisage de procéder au forage du puits d'appréciation RUCHE N²ORD EST dans le champs 'Ruche'. Le champ 'Ruche' est situé à environ une quinzaine (15) de kilomètres du champs 'Tortue', actuellement en cours de développement. L'objectif du projet est d'évaluer le potentiel en hydrocarbures et l'étendue des réservoirs 'Gamba' et 'Dentale' dans la perspective d'un développement futur.
Le champ 'Ruche' se trouve à cinquante-sept (57) kilomètres de la côte sur une colonne d'eau de cent-vingt (120) mètres environ. Les travaux devront débuter vers juin 2018 et dureront soixante (60) jours.

Ce projet, comme le stipule la loi n°007/2014, a été soumis à une notice d'impact environnemental sur la recommandation de la DGEPN.

En vous remerciant d'avance, je vous prie d'agréer, Monsieur, l'expression de notre considération distinguée.

BW Energy Dussafu BV GABON
BWEDBV

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon

Libreville, le 29 mai 2018

A l'attention de :

Monsieur Le Directeur Général de
l'Agence des Pêches et de l'Aquaculture
Libreville Gabon

N° 0127 BWE/29/05/18/FC/GM

Objet : Continuité du Projet de développement dans l'AEE Ruche G5-127
Du Permis Dussafu Marin.

Monsieur le Directeur Général,

Dans le cadre de ses activités l'opérateur BW Energy Dussafu B.V. Gabon envisage de procéder au forage du puits d'appréciation RUCHE N²ORD EST dans le champs 'Ruche'. Le champ 'Ruche' est situé à environ une quinzaine (15) de kilomètres du champs 'Tortue', actuellement en cours de développement. L'objectif du projet est d'évaluer le potentiel en hydrocarbures et l'étendue des réservoirs 'Gamba' et 'Dentale' dans la perspective d'un développement futur.
Le champ 'Ruche' se trouve à cinquante-sept (57) kilomètres de la côte sur une colonne d'eau de cent-vingt (120) mètres environ. Les travaux devront débuter vers juin 2018 et dureront soixante (60) jours.

Ce projet, comme le stipule la loi n°007/2014, a été soumis à une notice d'impact environnemental sur la recommandation de la DGEPN.

En vous remerciant d'avance, je vous prie d'agréer, Monsieur le Directeur Général, l'expression de notre considération distinguée.

AGENCE NATIONALE DES PECHES ET DE L'AQUACULTURE
La Direction Générale
COURRIER ARRIVÉE
Le 06 JUIN 2018
S/N°

BW Energy Dussafu BV GABON

Urbain BEKA NGUEMA
Directeur Général

BW Energy Dussafu B.V, Bureaux Libreville Hotel Radisson 117 & 118, 5 Boulevard Nice, BP 23771, Libreville, GABON
NIF 788 501 K, Tel: +65 6632 7888 / Fax: +65 6323 1263 Tel 00241 07 38 19 66

APPENDIX 7 RUCHE PHASE 1 ESIA – MINUTES AND ATTENDANCE LISTS FOR INFORMATION MEETING IN LIBREVILLE

Information meeting concerning Ruche Phase 1 and the corresponding ESIA, which took place on 26 July 2019 in Libreville.

Réunion d'information sur le projet de Développement Phase III Du Permis Dussafu Marin G4-209

L'An deux mil dix-neuf, le 26 Juillet dès 09:50 heures, s'est tenue dans les locaux de BW Energy à Libreville, une réunion d'information du Projet de développement Phase III qui consiste en la construction d'une Plateforme de Production dans le périmètre du champ Ruche dans l'AEE «Ruche».

Ont pris part à cette réunion les Administrations Centrales suivantes :

- Direction Générale des Hydrocarbures (DGH) ;
- Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN) ;
- Agence Nationale des Parcs Nationaux (ANPN) / Gabon Bleu ;
- Direction Générale des Douanes et Droits Indirects ;
- Direction Générale des Pêches et de l'Aquaculture (DGPA) ;
- Gabon Oil Company (GOC), partenaire de BW Energy sur le Permis Dussafu.

La liste des participants est annexée à la présente minute.

Cette réunion d'information avait pour objectif de présenter et d'échanger avec les Administrations sur la Phase III de développement du Permis Dussafu.

A la suite de la présentation les recommandations suivantes ont été formulées à l'endroit de l'opérateur :

Direction Générale des Hydrocarbures (DGH)

- Demander formellement l'approbation technique du Projet Phase III ;
- Planifier une réunion sur l'étude de danger ;
- Publier les différents avis d'appels d'offres dans un journal d'annonces légales pour permettre au plus grand nombre de soumissionnaires locaux de se manifester.

Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN)

- Transmettre l'avis de Projet Phase III avec planification d'une mission préalable de terrain à Mayumba ;
- Réaliser une Etude d'Impact Environnemental et Social pour la Phase III.

Direction Générale des Douanes et Droits Indirects (DGDDI)

- Informer l'Administration des Douanes quinze (15) jours minimum avant l'arrivée du matériel, conformément à la réglementation en vigueur.

Direction Générale des Pêches et de l'Aquaculture (DGPA)

- Prendre en compte le volet Pêche dans l'Etude d'Impact Environnemental et Social ;
- Associer ladite Administration dans la Phase III.

L'ordre du jour étant épuisé, la réunion s'est achevée à 12:30 heures.

Direction Générale des Hydrocarbures

Marie Michèle Olga REONIGNEAUD

Direction Générale de l'Environnement et de la Protection de la Nature

Patrick MABIS MANGOYE

Agence Nationale des Parcs Nationaux / Gabon Bleu

Koumba KOMBILA

Direction Générale des Douanes et Droits Indirects

Dejanire Pauline NZANG

Direction Générale des Pêches et de l'Aquaculture

Donatien LEYOKO

Gabon Oil Company (GOC)

Paul IBOUANGA IBOUANGA

BW Energy Gabon SA

Urbain BEKA NGUEMA

Date : 26 Juillet 2019

Opérateur : BW Energy Gabon S.A. & Administrations Gabonaises

Objet de réunion / mission : Réunion d'Information Développement Phase 3

Liste de présence

Nom(s) et prénom(s)	Sociétés / Administration Positions	Numéros de téléphone	Adresses-mail	Emargements
MOUBECKA [illegible] Grant	Tunis [illegible]	07 91 82 44	grantmoubecka@yahoo.fr	[signature]
MAMS MANGOYE Patricia	DGEPN/C.E	06396814	mabis204@gmail.com	[signature]
[illegible]	ANPN/[illegible]	07432200	KOUMBAKOMBILA@gmail.com	[signature]
TSIEMBE WILBERT jean Thierry C.	C.D.GEPN	07.51.53.16	[illegible]wilbertjeanthierry@yahoo.fr	[signature]
NZANG Dégnière Pauline	Douane	02.03.10.16	nzangdegniere@yahoo.fr	[signature]
MBENG Georges	EnviroPass	06260834		[signature]
NDONG OBIANG Christian	EnviroPass	06872065	christianndong7@yahoo.fr	[signature]
NZENGUET Leslie Sybile	DGEPN	06-85-82-35	lesliebape@gmail.com	[signature]
MINKOUE M OBAME Jealna	DGH / DPC	04-47-54-66	jealnaobame@hotmail.fr	[signature]
REONI BNEAUD	DGH/DPC	06252511	Reommichele@gmail.com	[signature]
Paul IBOUANGA IBOUANGA	GOC	04842306	[illegible]@gmail.com	[signature]
LEYOKO Jonathan	DGPA	07405575	leyokeri@yahoo.fr	[signature]
KOUBDJE NZE NOEL	DGH	06088503	koubdje.noel@gmail.com	[signature]

Date : 26 Juillet 2019

Opérateur : BW Energy Gabon S.A. & Administrations Gabonaises

Objet de réunion / mission : Réunion d'Information Développement Phase 3

Liste de présence

Nom(s) et prénom(s)	Sociétés / Administration Positions	Numéros de téléphone	Adresses-mail	Emargements
MOUDOUMA Gillas NOLA	DGH / Ingenieur	07213815	[illegible]@yahoo.fr	
SAFOU Nelly Stella Mirande	DGH / Ingenieur	04496076	nelly.safou@gmail.com	
NGANA GNAMA Jonas	DGH / DAEJF	06996673	ngandnama@yahoo.fr	
SABINE SENDZOU	DGH / DPC	06172929	[illegible]@yahoo.fr	
BAHONGA IBOUONGA	DGH / Ingenieur	02565622	[illegible]@yahoo.fr	
MVEH ALLOGHO François	EnviroPass	07.73.45.72	enviropass@yahoo.fr	
NENTSE Loïs ALLELA	TERROCEA	07.17.29.09	loisallela@hotmail.com	
MBENG Georgin	EnviroPass	06260834	mdemgeo@live.fr	
NDONG OBIANG Christian	EnviroPass	06.87.20.65	christianndong71@yahoo.fr	
MOUBEKA Borco Grant	TERROCEA	07910244	[illegible]@yahoo.fr	
IBOUANGA IBOUANGA Paul	GOC	04.84.23.06	ibouangaibouanga@gabonmail.com	

APPENDIX 8 RUCHE PHASE 1 ESIA – INVITATION LETTERS FOR PUBLIC CONSULTATION MEETING IN MAYUMBA

Public consultation meeting concerning Ruche Phase 1 and the corresponding ESIA, which took place on 12 December 2019 in Mayumba.

BW ENERGY GABON SA
Member of BW Offshore Group

Libreville, le 05 Décembre 2019

A l'Attention de :

Directeur Général de
l'Environnement et la Protection
de la Nature

Libreville Gabon

N° 0551 BWE/05/12/19/GL/GM

Objet : Réunion de Consultation Publique à Mayumba.

Monsieur le Directeur Général,

Dans le cadre de la réalisation de l'Etude d'Impact Environnemental et Social (EIES), en rapport avec le Projet de Développement Phase III du Permis Dussafu G4-209, BW Energy organise du **Mercredi 11 au Vendredi 13 décembre 2019 à Mayumba**, une Réunion de consultation Publique.

A cet effet, l'opérateur invite **la Direction Générale de l'Environnement et de la Protection de la Nature** à déléguer deux (2) de ses représentants pour cette mission à Mayumba selon le programme ci-après :

- Mercredi 11 décembre 2019 - Départ de Libreville vers Mayumba via Port-Gentil
- Jeudi 12 décembre 2019 - Consultation Publique avec les autorités et la population
- Vendredi 13 décembre 2019 - Retour des délégations sur Libreville

Veuillez agréer Monsieur le Directeur Général, l'expression de ma considération distinguée.

DIRECTION GÉNÉRALE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE SECRÉTARIAT

BW Energy GABON SA (BWEGSA) NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon SA
Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23711 Libreville, Gabon.
Tel : +241 01 76 48 49 www.bwoffshore.com

BW ENERGY GABON SA
Member of BW Offshore Group

REÇU LE
05 DEC. 2019
DIRECTION GENERALE
DES HYDROCARBURES
BP 2199 LBV 77 73 106

Libreville, le 05 Décembre 2019

A l'Attention de :

Monsieur Jean-Félix OBAMBA

Directeur Général des Hydrocarbures
BP 2199 Libreville Gabon

N°0552 BWE/05/12/19/GL/GM

Objet : Réunion de Consultation Publique à Mayumba.

Monsieur le Directeur Général,

Dans le cadre de la réalisation de l'Etude d'Impact Environnemental et Social (EIES), en rapport avec le Projet de Développement Phase III du Permis Dussafu G4-209, BW Energy organise du **Mercredi 11 au Vendredi 13 décembre 2019 à Mayumba**, une Réunion de consultation Publique.

A cet effet, l'opérateur invite **la Direction Générale des Hydrocarbures** à déléguer deux (2) de ses représentants pour cette mission à Mayumba selon le programme ci-après :

- Mercredi 11 décembre 2019 - Départ de Libreville vers Mayumba via Port-Gentil
- Jeudi 12 décembre 2019 - Consultation Publique avec les autorités et la population
- Vendredi 13 décembre 2019 - Retour des délégations sur Libreville

Veuillez agréer Monsieur le Directeur Général, l'expression de ma considération distinguée.

BW Energy GABON SA (BWEGSA) 45484 F

Urbain BEKA NGOMA
Directeur Général

BW Energy Gabon SA
Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23711 Libreville, Gabon.
Tel : +241 01 76 48 49 www.bwoffshore.com

BW ENERGY GABON SA
Member of BW Offshore Group

Libreville, le 05 Décembre 2019

A l'Attention de :

Directeur Général des Pêches et de l'Aquaculture

Libreville Gabon

N° 0550 BWE/05/12/19/GL/GM

Objet : Réunion de Consultation Publique à Mayumba.

Monsieur le Directeur Général,

Dans le cadre de la réalisation de l'Etude d'Impact Environnemental et Social (EIES), en rapport avec le Projet de Développement Phase III du Permis Dussafu G4-209, BW Energy organise du **Mercredi 11 au Vendredi 13 décembre 2019 à Mayumba**, une Réunion de consultation Publique.

A cet effet, l'opérateur invite **la Direction Générale des Pêches et de l'Aquaculture** à déléguer deux (2) de ses représentants pour cette mission à Mayumba selon le programme ci-après :

- Mercredi 11 décembre 2019 - Départ de Libreville vers Mayumba via Port-Gentil
- Jeudi 12 décembre 2019 - Consultation Publique avec les autorités et la population
- Vendredi 13 décembre 2019 - Retour des délégations sur Libreville

Veuillez agréer Monsieur le Directeur Général, l'expression de ma considération distinguée.

DIRECTION GENERALE DES PÊCHES
LE 15 DEC. 2019
COURRIER ARRIVÉE
Enregistré S/N° 0550

BW Energy GABON SA
BWESSA

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon SA
Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23711 Libreville, Gabon.
Tel : +241 01 76 48 49 www.bwoffshore.com

BW ENERGY GABON SA
Member of BW Offshore Group

Libreville, le 05 Décembre 2019

AGENCE NATIONALE DES PARCS NATIONAUX
COURRIER ARRIVE

A l'Attention de :

Agence Nationale des Parcs Nationaux

Libreville Gabon

N° 0553 BWE/05/12/19/GL/GM

Objet : Réunion de Consultation Publique à Mayumba.

Monsieur le Secrétaire Exécutif,

Dans le cadre de la réalisation de l'Etude d'Impact Environnemental et Social (EIES), en rapport avec le Projet de Développement Phase III du Permis Dussafu G4-209, BW Energy organise du **Mercredi 11 au Vendredi 13 décembre 2019 à Mayumba,** une Réunion de consultation Publique.

A cet effet, l'opérateur invite **l'Agence Nationale des Parcs Nationaux** à déléguer deux (2) de ses représentants pour cette mission à Mayumba selon le programme ci-après :

- Mercredi 11 décembre 2019 - Départ de Libreville vers Mayumba via Port-Gentil
- Jeudi 12 décembre 2019 - Consultation Publique avec les autorités et la population
- Vendredi 13 décembre 2019 - Retour des délégations sur Libreville

Veuillez agréer Monsieur le Secrétaire Exécutif, l'expression de ma considération distinguée.

BW Energy GABON SA (BWEGSA) NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon SA
Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23711 Libreville, Gabon.
Tel : +241 01 76 48 49 www.bwoffshore.com

BW ENERGY GABON SA
Member of BW Offshore Group

COURRIER ARRIVÉE
Owendo le
06 DEC. 2019
Edith Epoutar
D.G.M.M

Libreville, le 05 Décembre 2019

A l'Attention de :

Monsieur Martin NDONG NTOUTOUME
Directeur Général de la Marine Marchande
Owendo, Gabon

N° 0554 BWE/05/12/19/GL/GM

Objet : Réunion de Consultation Publique à Mayumba.

Monsieur le Directeur Général,

Dans le cadre de la réalisation de l'Etude d'Impact Environnemental et Social (EIES), en rapport avec le Projet de Développement Phase III du Permis Dussafu G4-209, BW Energy organise du **Mercredi 11 au Vendredi 13 décembre 2019 à Mayumba**, une Réunion de consultation Publique.

A cet effet, l'opérateur invite la **Direction Générale de la Marine Marchande** à déléguer deux (2) de ses représentants pour cette mission à Mayumba selon le programme ci-après :

- Mercredi 11 décembre 2019 - Départ de Libreville vers Mayumba via Port-Gentil
- Jeudi 12 décembre 2019 - Consultation Publique avec les autorités et la population
- Vendredi 13 décembre 2019 - Retour des délégations sur Libreville

Veuillez agréer Monsieur le Directeur Général, l'expression de ma considération distinguée.

BW Energy GABON SA (BWEGSA) NIF 745484 F

Urbain BEKA NGUEMA
Directeur Général

BW Energy Gabon SA
Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23711 Libreville, Gabon.
Tel : +241 01 76 48 49 www.bwoffshore.com

APPENDIX 9 RUCHE PHASE 1 ESIA – MINUTES AND ATTENDANCE LISTS FOR PUBLIC CONSULTATION MEETING IN MAYUMBA

Public consultation meeting concerning Ruche Phase 1 and the corresponding ESIA, which took place on 12 December 2019 in Mayumba.

Procès-verbal de Consultation Publique

Projet Développement Phase III du Permis Dussafu Marin G4-209

L'an deux mille dix-neuf et le douze du mois de décembre, s'est tenue dans la salle polyvalente du Conseil Municipal de Mayumba, à partir de 13h 45, une consultation publique, présidée par Monsieur le Préfet de la Basse-Banio. Cette réunion est relative à l'Etude d'Impact Environnemental et Social du Projet de Développement Phase III du Permis Dussafu Marin G4-209 dont la société BW Energy est opérateur.

Ont pris part à cette séance de travail les entités administratives suivantes :

- La Préfecture de Mayumba ;
- La Brigade de Gendarmerie de Mayumba ;
- L'Antenne Départementale de la Direction Générale de la Documentation et de l'Immigration (DGDI) ;
- La Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN) ;
- La Direction Générale des Hydrocarbures (DGH) ;
- La Direction Générale des Pêches et de l'Aquaculture (DGPA) ;
- La Direction Générale de la Marine Marchande (DGMM) ;
- L'Agence Nationale des Parcs Nationaux (ANPN) ;

Prenaient part également à cette séance, les représentants des populations. La liste de présence est jointe en annexe de la présente.

L'ouverture de la séance a été faite par Monsieur Victor NGOMA, Préfet du Département de la Basse Banio. A la suite, l'opérateur a présenté à l'assistance les Administrations qui l'accompagnent.

A titre de rappel, les Phases I et II concernaient :

1. l'installation du FPSO Adolo ;
2. le forage et la mise en production de deux puits pour 12 000 barils de production / jour ;
3. les forages (en cours) de quatre puits pour une production estimée à 24 000 barils /jour.

A la suite de cela, BW Energy a présenté quelques actions entreprises et en cours de réalisation dans le cadre de la Responsabilité Sociétale de l'entreprise (RSE), notamment :

- Les cours de soutien aux élèves en classe d'examen (2019) ;
- Le projet d'implanter quelques lampadaires à Mayumba.

La Phase III qui fait l'objet de la présente consultation publique, consiste à l'installation d'une plate-forme de production de type Jacket sur la Découverte Hibiscus et dimensionnée pour 12 puits en vue d'atteindre un plateau de production de 40 000 barils / jour. Cette plate-forme sera reliée au FPSO Adolo par deux pipelines.

Sur la question des candidatures déposées en 2017, l'opérateur accuse réception des demandes d'embauches et informe qu'un plan de recrutement est mis en place courant 2020.

Au cours des échanges, les populations ont porté à l'endroit de l'opérateur les attentes suivantes :

- Embauches prioritaires des jeunes du Département de la Basse-Banio ;
- Mise en place d'une représentation locale de BW Energy à Mayumba.

Par ailleurs, pour une meilleure efficacité des actions menées par BW Energy, les populations se sont proposées de mettre en place un comité de gestion et de suivi des projets.

Aux termes des échanges, l'opérateur a, tout en remerciant les uns et les autres pour leur participation, exhorté les populations et les responsables de la localité à soutenir ce projet.

L'ordre du jour étant épuisé, la réunion a pris fin à 19h 02 minutes.

Pour la Préfecture de Mayumba

Pour la Mairie de Mayumba

Georges Pontalier

Pour le Conseil Départemental de la Basse Banio

Jean Joseph NZEBER

Pour la Direction Générale des Hydrocarbures

Laura ESSIMA NGO

Pour la Direction Générale de l'Environnement et de la Protection de la Nature

MARIS DANGOYE Patrick

OPB

ASA

CIE

2

Pour la Direction Générale de la Pêche et de l'Aquaculture

Obi Pascal Blaise

Pour La Direction Générale de la Marine Marchande

Joël Armand. ANGOUÉ

Pour L'Agence Nationale des Parcs Nationaux

Roger AZIZET

Pour la Société BW Energy

Geraldine Owanga

3 LEN

Date : 11 Decembre 2019

Opérateur : BW Energy Gabon S.A. & Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux

Objet de réunion / mission : Consultation Publique Mayumba 12 Decembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
AVOME ANGUE F. de GUEVIT	DGMM	066 07-77-93		
NSA ESSONO PAOLA GINA	DGPA	066 25 36 61		
OBA Pascal Blaise	DGEA	066 27 16 03		
AZIZET ROGER FRANÇOIS	ANPN	077 08 95 31		
SOUNGOU Ghislain	DGEPN	077.36.06.40		
NGUEMA MVE HILAIRE	DGH	066 65 21 20		
MABIS MANGOYE Patrick	DGEPN	06 39 68 14		
IBREMBE WOLBERT Jean Claude	DGEPN	077.57.53.16		
Laura ESSINDONDO	DGH	062 18 31 73		
ANGOUE JOËL ARMAND	DGMM	066 73 33 23		

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
NGOMA NGOMA Jean-Claude	SG MAIRIE	077.59.48.66	ngomangoma.jc@gmail.com	
Charls IWANGOU NITHANDOU	BRIGADE Pêche	074 91 70 15		
Lanchy OBIANG EFFA	CALAB (ANPN)	074.27.36.37	lanchyeffas@yahoo.com	
MAIAMBA Sylviane Flore	AFF. Sociales	07744480		
MBAGOU BOUKOSSO Donald	C.N.A.M.G.S	065.65.66.11		
NGOMA PIRRE NOLASQUE	C.P.A.	07717893		
AEMBE N GOMA	D. Suppl.	074-22-22-06		
BIASSIA NZAMBA ANICET	EAUX ET FORET	077.99.50.16		
BOUSSOUGA Martine	Ste Cible	07738516 4	bouangamartine@yahoo.fr	
BIVIGA Hugues Dany	—	077-56-41-45	—	
MAMBOU Patrick Y.R	EP.CA'	077907787	Fidgemambou87@gmail.com	
NGOMA NGOMA Olivier	Conseiller MBP	077 71 63 14		
MEKINA-MAMADOU-LEONEL	Eaux et Forêts	022-11-37-59	mekinaleonel@gmail.com	
MOUDANGA KODIO Désiré	INSPECTEUR TRAVAIL	077 54 97 23		

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & **Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marcharde, Agence Nationale des Parcs Nationaux**

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
NDOUMBOU HOUSMANOU	Sans	0666087.50	gilg2933@mail.com	[illegible]
MOUCKAGNI Diboubou Lionel	Sans	077 65 05 64	/	[illegible]
MAKAYA FRED HAROLD	— // —	07753.57.30	—	[illegible]
NDOUMBOU Mamadou	— // —	062872237	—	NDOUMBOU
Pambo Martial	Soudeur	066.59.07.62		[illegible]
MAVOUNGOU Rodrigue	HSE	077.430.784	[illegible]	[illegible]
MOUANDAT CHRIST	Sans	066.153.517		[illegible]
MAVOUNGOU TATY J. BAPTISTE	MARINE.M.	066.49.76.23	—	MJBouiaaaq F
PAMBO-NGOMA ANSELME	HSE	066 86 62 18	MAYUMBA	[illegible]
BIWAGOU GUY-NOËL		077.83-48 20	—	[illegible]
MAYOUNGOU MBATCHI JUSTIN	Secrétaire Dep. [illegible]	077-13 88 82		[illegible]
MABIS MANBOYE Patrice	DGEPN	06 39 68 14	mabis204@gmail.com	[illegible]
TSIEMIBE WOLBERT Jean-Rémy	DGEPN	077.51.53.16	[illegible]	[illegible]

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & **Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux**

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
SAFOU-MANVOU, A.	chef de qt	074-828-269		[signature]
SOUAMI NZASSI	Chef de quartier	077.52.14.77	-	[signature]
Pambo MAKAYA Ebone	chef de qt	077.67.47.35		[signature]
N'Gouma Nvamba	NoTable	04-76-67-97		[signature]
EGNAMALobui Jean brice	Police	07778 14 60		[signature]
MAVOUNGOU MBOUADI Edouard	Retraité	07746 58 52		[signature]
MAKAYA VIVAN DMARTELI	[illegible]	077-04-80-20	[illegible]	[signature]
TCHIBINDA MBOULOU D.	chomeur	077270733	mbaloudaly@gmail.c	[signature]
MAKAYA B. Maxe Coplan	CHOMEUR	066300878	Coplin027@yahoo.fr	[signature]
NDELO - Ndelo	CHOMEUR	062-82-03-82	ndelondelo1988@gmail.com	[signature]
ZINGA-MOUENDO. Lully	CHOMEUR.	062.12.04.03.		[signature]
LELO KONGO.	Notable.	-	-	[signature]
MBATCHI Judicaël	Notable	077 14 70 73		[signature]
VOUMBI François	Notable	-	-	[signature]

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & **Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux**

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
Moussou [illegible] Justalie	/	066505730	/	
KOUMBA GUY	/	077835013	/	
MAKOSSO FRANCK	/	062-670415	/	
Sitou Guy Roger	/	074027278	/	
MAVOUNGOU YOUNA [illegible] A	/	07158063 / 066060377	ndembiyouna@gmail.com	
NYAMBY NYAMBY NOÉ	/	06239-25-96		
MBOUBOU Leroux Vianey	/	062 147438	/	
Tavoungou. BRICE	/	77.66.22.02	Brice [illegible]@yahoo.fr	
M'BITSI Chaïté Agena	Eaux et forêt	066-76-78-77	—	
BIVIGA Marie Paule virginie	Douane	077.54.82.90	—	
DAMBOU Sitou	Guy Alain	077662922	/	
Moussolomi NGoma JB		-077 82 24 59	-/-	
Hugues OMBAGHO.	Marine [illegible]	065.4055.44	huguesombagho@gmail.com	
MAKAYA	J.RO	MUALI		

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & **Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux**

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
MOUPELA JOSEPH LANDE	CADASTRE	077 59-16-58	mupel idK@yahoo.Fr	[signature]
PEFOUKA Jean Valéro	SEEG	077 38 60 87	PEFOUKA@gmail.Com	[signature]
NZINGAMAKAYA Judith	SANS	077.50.27.81	—	[signature]
NJAKAYA SERGE [illegible]		066.66.17.81		[signature]
SOUNDAT GAETAN	SANS	07 29 95 59 95	— © —	[signature]
MOUSSAVOU ANGE CHARLY	[illegible]	066 56 90 92	—	[signature]
MOUSSAVOU MICAEL R	Sans	07 79 78 33	— / —	[signature]
TCHIBINDA GREGI - NELSON	Sans	07 47 36 03 2	— / —	[signature]
Nzamba [illegible] Van L.	Sans	066 57 99 56	[illegible]@yahoo.fr	[signature]
Makosso Faty Zabys G	Sans	062 36 67 22 074 75 89 83	— / —	[signature]

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux

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Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
KOUMBA Alban B	—	062 49 25 45	/	
Moundounga Francis	—	06688367	—	
Mavoungou M. AXE	/	062.15.08.41	/	
IGUIBENA MASTAINE	/	066 752 285	Jane@mastaine24@yahoo.fr	
NGOMA AIME HORACE		07 19 22 87		
MAVOUNGOU GUY SILVERE	—	077-81-86-98	mguysilvere@gmail.com	
MBOUMBA Brel Wenes	/	077.05-10-26	Mboumbabrel@gmail.com	
LOEMBET ICHIAMA I-B	—	077.09.92.57	—	
TINDI BOUKA STEVE	-	06654655 8	BKsteeve@gmail.com	
NGOMA MASTAINE Steeve L	—	062/60 80 57	steevelionnel NGOMA MASTAINE@gmail.com	
Priam MAMFOUMBY	/	077.50.07.40/066.43.92.25	regine mast@yahoo.Fr	
MBOUMBA MAKOSSO	/	074 85 97 99	MAKOSSOLarry@gmail.com	

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & **Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux**

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
MIHINDOU MBOUMBA	-	074.19.77-79	-	
MBOUITY.MAKOSSO Bd.	[illegible]	077180158	-	
KOUMBA BINZA.	Notable	07485153C	-	
MABOUMBA J Claude	NOTABLE	074 65-39 54	-	
LOEMBET M. HANS DAVIU	-	077 84-73-95	-	
NGOMA ALAIN		066700896	-	
MOUSSAVOU DAMI Chabcel	-	06223 1110	Moussavoudami82@gmail.com	
MOANDAT GERVAIS	-	077580449	-	
FOUTY Alain Brice	/	066.60.95-81	/	
MAKAYA MAURICE	-Z	066 891420	- -	
BEKALE Constant	Pharmacien	077270505		
MBADINGA ABOUBAKAR	chômeur	077.96.1125	aboubakar.mbadinga@gmail.com	
MAKOSSO JEAN Robert	i.s.P	06502 1513	-	
MAVOUNGOU ROBBY	-	077932409	-	

Date : 12 Décembre 2019

Opérateur : BW Energy Gabon S.A. & **Direction Générale des Hydrocarbures (DGH), Direction de l'Environnement et Protection de la Nature, Direction Générale de la Pêche, Direction de la Marine Marchande, Agence Nationale des Parcs Nationaux**

Objet de réunion / mission : Consultation Publique Mayumba 12 Décembre 2019

Liste de présence

Nom(s) et prénom(s)	Sociétés	Numéros de téléphone	Adresses-mail	Emargements
AZIZET ROGER-F	ANPN	077089531	saiawagizzet@gmail.com	[signature]
ANGOUE Joël Armand	DGMM	077523021	joelarmandeo2@yahoo.fr	[signature]
ESSIMANDO Laura	DGH	062183173	ekhard2@yahoo.com	[signature]
OBi Pascal Blaise	DGPA	066271603	obipascalblaise@gmail.com	Pascal Blaise [illegible]
ANOMEANGUE OLIVEIRA ép GUEVIT	DGMM	066-07-77-93	[illegible]@gmail.com	[signature]
NSA ESSONO PAOLA GINA	DGPA	066-25-36-61	[illegible]@gmail.com	[signature]
Steve Edgar MBA OBAME	ANPN	066.79.78-64	mbaobame28@gmail.com	[signature]
Nontsé Loïs ALLELA	TERRODEA	077172909	loisallela@hotmail.com	[signature]
SOUNGOU Ghislain	DGEPN	077 36 06 40	/	[signature]
MBENG Georges	EnviroPass	066260834	ndemeglo@live.fr	[signature]
NDONG OBIANG Christian	EnviroPass	066872065	christianndong11@yahoo.fr	[signature]
MVEH ALLOGHO F.	EnviroPass	077[illegible]572	enviropass@yahoo.fr	[signature]
NGUEMA MVE HILAIRE	DGH	066642120	[illegible]@gmail.com	[signature]
BOUNDANGA ADOUMI	GESIRANG	066.16.31.50		[signature]

APPENDIX 10 PRELIMINARY STAKEHOLDER ANALYSIS

Table A1: Preliminary stakeholder analysis table

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Government authorities/agencies – national level										
Ministère des Eaux, des Forêts, de la Mer, de l'Environnement, Chargé du Plan Climat et du Plan d'Affectation des Terres La Direction Générale de l'Environnement et de la Protection de la Nature (DGEPN) (Ministère des	Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan General Directorate for the Environment and Nature Protection (Ministry of Water, Forests, Sea, Environment,	Libreville	H	Ministry is responsible for environmental management and the approval of Environmental and Social Impact Assessments (ESIAs) in Gabon. Directorate is responsible for the ESIA process and for ensuring the enforcement of legislation regarding environmental protection and preservation. Stakeholders will thus be able to delay or alter the execution of Tortue Phase 1 and 2 and Ruche Phase 1[9] and enhance or	H	Stakeholders responsible for ESIA approval and the ESIA process in Gabon and will therefore be familiar with the Project impact assessments. Directorate was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the	Yes (DGEPN)	L	*Keep informed* (Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan) *Engage closely* (DGEPN)	Information letter and Background Information Document (BID) (Ministry of Water, Forests, Sea, Environment, Climate Plan and Land Allocation Plan) Invitation letter and individual meeting (DGEPN)

[6] L = low, M = medium and H = high.

[7] Consistent with Section 4.2.1 of the SEP, impact is defined as the degree to which the Project may affect stakeholders' health, well-being and livelihood.

[8] The engagement approach reflects the level of stakeholder influence and interest; the matrix presented in Figure 4.1 (Section 4.2.1) brings together these two variables to determine whether stakeholders are to be monitored, kept satisfied, kept informed or engaged closely. As noted in Section 4.2.1, however, all stakeholders who are able to provide data relevant to the studies or with the potential to experience medium or high impacts will be engaged closely.

[9] Tortue Phase 1, Tortue Phase 2 and Ruche Phase 1 are hereafter referred to as "the Project".

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Eaux, des Forêts, de la Mer, de l'Environnement, Chargé du Plan Climat et du Plan d'Affectation des Terres)	Climate Plan and Land Allocation Plan)			damage its reputation and day-to-day operational efficiency.		purpose(s) of re-engagement.				
Directrice Générale de la Faune et des Aires Protégées (DGFAP) (Ministère des Eaux, des Forêts, de la Mer, de l'Environnement, Chargé du Plan Climat et du Plan d'Affectation des Terres)	General Directorate for Fauna and Protected Areas (Ministry of Water, Forests, Sea, Environment, Climate Plan, and Land Allocation Plan)	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on protected areas and measures to mitigate these.	H	Responsible for the management of protected areas in Gabon. Given the relevance of the Project to three Marine Protected Areas (MPAs)[10], stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting
La Direction Générale des Ecosystèmes Aquatiques (DGEA) (Ministère des	General Directorate for Aquatic Ecosytems (Ministry of Water,	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on the aquatic environment and	H	Responsible for the management and protection of aquatic ecosystems in Gabon. Given the	Yes	L	*Engage closely*	Invitation letter and individual meeting

[10] The Project is located in an MPA, namely the Aquatic Reserve of the Great South of Gabon. Two other MPAs – Mayumba National Park (MNP) and Banio Mouth Marine Park – are in the Area of Influence (AOI).

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Eaux, des Forêts, de la Mer, de l'Environnement, Chargé du Plan Climat et du Plan d'Affectation des Terres)	Forests, Sea, Environment, Climate Plan and Land Allocation Plan)			measures to mitigate these.		location of the Project (i.e. within the aquatic environment), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.				
Ministère de l'Agriculture, de l'Élevage, des Pêches et de l'Alimentation La Direction Générale des Pêches et de l'Aquaculture (DGPA) (Ministère de l'Agriculture, de l'Élevage, des Pêches et de l'Alimentation)	Ministry of Agriculture, Livestock, Fisheries and Food General Directorate for Fisheries and Aquaculture (Ministry of Agriculture, Livestock, Fisheries and Food)	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on fisheries and aquaculture and measures to mitigate these.	H	Directorate responsible for the management and protection of fisheries and aquaculture in Gabon. Given the location of the Project (i.e. offshore and in proximity to fishing grounds and a coastal lagoon), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures. Directorate was engaged during the preparation of the impact	Yes (DGPA)	L	*Keep informed* (Ministry of Agriculture, Livestock, Fisheries and Food) *Engage closely* (DGPA)	Information letter and BID (Ministry of Agriculture, Livestock, Fisheries and Food) Invitation letter and individual meeting (DGPA)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						assessments for the Project and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.				
Ministère du Pétrole, du Gaz, des Hydrocarbures et des Mines La Direction Générale des Hydrocarbures (DGH) (Ministère du Pétrole, du Gaz, des Hydrocarbures et des Mines)	Ministry of Petroleum, Gas, Hydrocarbons and Mines General Directorate of Hydrocarbons (Ministry of Petroleum, Gas, Hydrocarbons and Mines)	Libreville	H	Ministry is responsible for regulating all oil and gas activities in Gabon. Directorate is responsible for authorising and monitoring their execution. Stakeholders will thus be able to delay or modify the execution of the Project and its day-to-day operational efficiency.	H	Stakeholders responsible for regulating, authorising and monitoring oil and gas activities in Gabon and will therefore be aware the Project and the associated impact assessments. Directorate was engaged during the preparation of the impact assessments for the Project and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.	Yes (DGH)	L	*Keep informed* (Ministry of Petroleum, Gas, Hydrocarbons and Mines) *Engage closely* (DGH)	Information letter and BID (Ministry of Petroleum, Gas, Hydrocarbons and Mines) Invitation letter and individual meeting (DGH)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Ministère des Transports, de l'Équipement, des Infrastructures et de l'Habitat La Direction Générale de la Marine Marchande (DGMM) (Ministère des Transports, de l'Équipement, des Infrastructures et de l'Habitat) Office Des Ports et Rades du Gabon (OPRAG) (Ministère des Transports, de l'Équipement, des Infrastructures et de l'Habitat)	Ministry of Transport, Equipment, Infrastructures and Housing General Directorate of the Merchant Marine (Ministry of Transport, Equipment, Infrastructures and Housing) Office of Ports and Harbours of Gabon (Ministry of Transport, Equipment, Infrastructures and Housing)	Libreville (all), Port-Gentil (OPRAG only)	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on maritime traffic, the marine environment, maritime safety and port infrastructure and measures to mitigate these.	H	Directorate responsible for managing navigation issues in territorial waters, protecting the marine environment from pollution (in collaboration with the DGEPN) and ensuring maritime safety. OPRAG responsible for management of Gabon's ports and harbours. Given the location of the Project (i.e. in Gabonese territorial waters) and the use of port infrastructure, stakeholders will likely have a keen interest in the Project, potential impacts and mitigation measures. Directorate was engaged during the preparation of the impact assessments for the Project and	Yes (DGMM, OPRAG)	L	*Keep informed* (Ministry of Transport, Equipment, Infrastructures and Housing) *Engage closely* (DGMM, OPRAG)	Information letter and BID (Ministry of Transport, Equipment, Infrastructures and Housing) Invitation letter and individual meeting (DGMM, OPRAG)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.				
Ministère de l'Intérieur La Direction Générale de la Documentation et de l'Immigration (DGDI) (Ministère de l'Intérieur)	Ministry of the Interior General Directorate of Documentation and Immigration (Ministry of the Interior)	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of the composition of the workforce (i.e. ratio of foreign to national personnel).	M	The prefecture of Basse Banio Department is a decentralised service of the Ministry of Interior. Given that Basse Banio is one of the departments to be affected by the Project, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures. Directorate was engaged during the preparation of the impact assessments for the Project and thus will likely have an interest in why and how they are being updated	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						alongside the purpose(s) of re-engagement.				
Ministère de la Défense Nationale L'Etat Major de la Marine Nationale (Ministère de la Défense Nationale)	Ministry of the National Defence The Marine Navy General Staff (Ministry of the National Defence)	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of security, particularly in Gabon's territorial waters.	M	Gabonese Navy responsible for monitoring and ensuring the security of Gabon's territorial waters. Given the location of the Project (i.e. within Gabon's maritime boundary), stakeholders will likely have an interest in Project details (e.g. vessel movements) and security-related impacts and mitigation measures.	-	L	*Keep satisfied*	Information letter and BID
Ministère de l'Emploi, de la Fonction Publique, du Travail et de la Formation Professionnelle, Porte-Parole du Gouvernement	Ministry of Employment, Civil Service, Labour and Vocational Training, Government Spokesperson General Directorate of	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of labour (e.g. workers' terms of employment and working conditions) and measures to mitigate these.	M	Directorate responsible for issues relating to labour, working conditions and industrial relations alongside the enforcement of labour laws and regulations. Given that the Project	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Direction Général du Travail (Ministère de l'Emploi, de la Fonction Publique, du Travail et de la Formation Professionnelle, Porte-Parole du Gouvernement)	Labour (Ministry of Employment, Civil Service, Labour and Vocational Training, Government Spokesperson)					employs and will employ an offshore workforce, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures, alongside the compliance of BWE and (sub-)contractors with the relevant legal requirements.				
Ministère de l'Enseignement Supérieur, de la Recherche Scientifique, du Transfert de Technologies, de l'Éducation Nationale, Chargé de la Formation Civique	Ministry of Higher Education, Scientific Research, Technology Transfer, National Education, Responsible for Civic Training	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of skills development and capacity building and measures to mitigate these.	M	Ministry responsible for skills development, capacity building and technology transfer in Gabon. Given that the Project is embedded in the oil and gas industry (which can facilitate skills development, capacity building and technology transfer through recruitment of university	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						graduates and other personnel), stakeholder will likely have an interest in the Project, potential opportunities, impacts and mitigation measures.				
Ministère de l'Economie et de la Relance Direction Générale des Statistiques (DGS) (Ministère de l'Economie et de la Relance)	Ministry of the Economy and Economic Recovery General Directorate of Statistics (Ministry of the Economy and Economic Recovery)	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on the economy and livelihoods and measures to mitigate these.	M	Ministry presides over economic development and recovery in Gabon. Given the potential of the Project to influence economic conditions in Gabon (positively and negatively), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures. DGS gathers data on Gabon at various administrative levels; stakeholder may	Yes (DGS)	L	*Keep satisfied* (Ministry of the Economy and Economic Recovery) *Engage closely* (DGS)	Information letter and BID (Ministry of the Economy and Economic Recovery) Invitation letter and individual meeting (DGS)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						therefore have an interest in activities taking place nationally (e.g. oil and gas exploration and development) which will likely affect trends in data over time.				
Ministère du Tourisme Direction Générale du Tourisme (Ministère du Tourisme)	Ministry of Tourism General Directorate of Tourism (Ministry of Tourism)	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on the tourism industry, particularly in the future, and measures to mitigate these.	M	Directorate responsible for the management and development of Gabon's tourism industry. Given the location of the Project (i.e. in a part of the country that is recognised for its touristic value and potential), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures (particularly in relation to an accidental event e.g. oil spill).	Yes (General Directorate of Tourism)	L	*Keep satisfied* (Ministry of Tourism) *Engage closely* (General Directorate of Tourism)	Information letter and BID (Ministry of Tourism) Invitation letter and individual meeting (General Directorate of Tourism)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Ministère du Commerce, des Petites et Moyennes Entreprises et de l'Industrie	Ministry of Commerce, Small and Medium Enterprises and Industry	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on small – medium businesses and measures to mitigate these.	M	Ministry responsible for the management and development of small – medium businesses in Gabon. Given that the Project is embedded in the oil and gas industry (which can create bring opportunities for local businesses), stakeholder will likely have an interest in the Project, potential business opportunities, impacts and mitigation measures.	-	L	*Keep satisfied*	Information letter and BID
Ministère de la Culture et des Arts	Ministry of Culture and the Arts	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on cultural heritage and measures to mitigate these.	M	Ministry responsible for the management and protection of Gabon's cultural heritage. Given the location of the Project (i.e. adjacent to coastal areas which may be endowed with	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						cultural heritage), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures (particularly in relation to an accidental event e.g. oil spill).				
L'Agence Nationale des Parcs Nationaux (ANPN) (Agence National de la Protection de la Nature)	National Agency of National Parks (recently renamed "National Agency for Nature Protection")	Libreville, Tchibanga	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on national parks (e.g. MNP, Banio Mouth Marine Park) and measures to mitigate these.	H	ANPN is responsible for managing Gabon's network of national parks, including those relevant to the Project (e.g. MNP, Banio Mouth Marine Park). Therefore, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures. ANPN was engaged during (the preparation of the impact assessments and	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.				
Conseil National de la Mer (CNM)	National Council of the Sea	Libreville	H	An advisory body which is under the authority of the President of the Gabonese Republic and comprises representatives of several relevant institutions (e.g. the DGEPN, DGMM, Marine Navy and ANPN). Therefore, as a collective body, stakeholder may be able to enhance or damage the reputation of the Project and delay or alter its execution and day-to-day operational efficiency.	H	CNM consists of representatives of stakeholders considered to have a keen interest in the Project due to its location and/or because they have been engaged previously as part of the preparation of the impact assessments.	-	L	*Engage closely*	Invitation letter and individual meeting
Government authorities/agencies – provincial level										
Province de l'Estuaire (Chef-lieu Libreville)	Estuary Province	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the province and measures to mitigate these.	M	Responsible for the governance and administration of Estuary Province. Given the potential for the entirety of the Gabonese coastline to be	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.				
Province de l'Ogooué-Maritime (Chef-lieu Port-Gentil)	Ogooué-Maritime Province	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the province and measures to mitigate these.	H	Responsible for the governance and administration of Ogooué-Maritime Province. Given that Port-Gentil will be the logistical support base for the Project, alongside the potential for Ogooué-Maritime Province to be amongst the most severely affected by an accidental event (e.g. an oil spill), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Direction Provinciale des Pêches et de l'aquaculture de l'Ogooué-Maritime (Chef-lieu Port-Gentil)	Provincial Directorate for Fisheries and Aquaculture of Ogooué-Maritime Province	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on fisheries and aquaculture at provincial level and measures to mitigate these.	H	Responsible for management and protection of fisheries and aquaculture in Ogooué-Maritime Province, given the potential for fisheries and aquaculture in the province to be amongst the most severely affected by an accidental event (e.g. an oil spill), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting
Direction Provinciale de la Marine Marchande de l'Ogooué-Maritime (Chef-lieu Port-Gentil)	Provincial Directorate of the Merchant Marine of Ogooué-Maritime Province	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on maritime traffic, the marine environment and maritime safety at provincial level and measures to mitigate these.	H	Responsible for managing navigation issues in territorial waters, protecting the marine environment and ensuring maritime safety in Ogooué-Maritime Province. Given that Project vessels will pass	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						through provincial waters on route to and from the supply base in Port-Gentil, stakeholders will likely have a keen interest in the Project, potential impacts and mitigation measures.				
La Marine de la Province de l'Ogooué-Maritime (Chef-lieu Port-Gentil)	The Marine Navy at provincial level (Ogooué-Maritime Province)	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of security within the territorial waters of the province.	M	Responsible for monitoring and ensuring the security of Gabon's territorial waters at provincial level. Given that Project vessels will pass through provincial waters on route to and from the supply base in Port-Gentil, stakeholders will likely have an interest in Project details (e.g. vessel movements) and security-related impacts and mitigation measures.	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Province de Nyanga (Chef-lieu Tchibanga)	Nyanga Province	Tchibanga	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the province and measures to mitigate these.	H	Responsible for the governance and administration of Nyanga Province. Given the potential for Nyanga Province to be affected by routine planned and accidental events related to the Project, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting
Direction Provinciale des Pêches et de l'aquaculture de Nyanga (Chef-lieu Tchibanga)	Provincial Directorate for Fisheries and Aquaculture of Nyanga Province	Mayumba	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on fisheries and aquaculture at provincial level and measures to mitigate these.	H	Responsible for management and protection of fisheries and aquaculture in Nyanga Province, given the location of the Project (i.e. offshore and in proximity to provincial fishing grounds and coastal waters), stakeholder will likely have a keen interest in the	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						Project, potential impacts and mitigation measures.				
Direction Provinciale de la Marine Marchande de Nyanga (Chef-lieu Tchibanga)	Provincial Directorate of the Merchant Marine of Nyanga Province	Mayumba	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on maritime traffic, the marine environment and maritime safety at provincial level and measures to mitigate these.	H	Responsible for managing navigation issues in territorial waters, protecting the marine environment and ensuring maritime safety in Nyanga Province. Given the presence of Project vessels and their passage through provincial waters, stakeholders will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting
Province de Nyanga (Chef-lieu Tchibanga)	The Marine Navy at provincial level	Mayumba	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of security within the territorial waters of the province.	M	Responsible for monitoring and ensuring the security of Gabon's territorial waters at provincial level. Given the		L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						presence of Project vessels and their passage through provincial waters, stakeholders will likely have an interest in Project details (e.g. vessel movements) and security-related impacts and mitigation measures.				
L'Agence Nationale des Parcs Nationaux de la Province de Nyanga (Chef-lieu Tchibanga)	National Agency of National Parks at provincial level (Nyanga province)	Tchibanga	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on MPAs within the province (i.e. the Aquatic Reserve of the Great South of Gabon, MNP and Banio Mouth Marine Park) and measures to mitigate these.	H	Responsible for managing national parks within the province, including those relevant to the Project (e.g. MNP, Banio Mouth Marine Park). Therefore, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						update the impact assessments.				
Government authorities/agencies – departmental/local level										
Estuary Province										
Département de Noya (Préfet, Président du Conseil Départemental)	Noya Department (Prefect, President of the Departmental Council)	Cocobeach	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department and measures to mitigate these.	M	Responsible for the governance and administration of Noya Department. Given the potential for the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.	-	L	*Keep satisfied*	Information letter and BID
Département de Komo-Mondah (Préfet, Président du Conseil Départemental)	Komo-Mondah Department (Prefect, President of the Departmental Council)	Ntoum	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department and measures to mitigate these.	M	Responsible for the governance and administration of Komo-Mondah Department. Given the potential for the entirety of the Gabonese	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.				
Ogooué-Maritime Province										
Département de Bendjé (Préfet, Président du Conseil Départemental)	Bendjé Department (Prefect, President of the Departmental Council)	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department and measures to mitigate these.	M	Responsible for the governance and administration of Bendié Department. Given the potential for the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Municipalité de Port-Gentil	Municipality of Port-Gentil[11]	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on the municipality and measures to mitigate these.	H	Responsible for the governance and administration of Port-Gentil. Given that Port-Gentil has been selected as the logistical support base for the Project and will therefore be directly affected by the Project, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting
Représentants de l'éducation (enseignants) de la Municipalité de Port-Gentil	Education representatives (e.g. teachers) of Municipality of Port-Gentil	Port-Gentil	L	Stakeholder may have thoughts or opinions about Project impacts on education within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Responsible for the provision of education to residents of Port-Gentil and surrounding communities. Given that Port-Gentil has been selected as the logistical support base for the Project and will	-	L	*Keep informed*	Information letter and BID

[11] In Gabon, a municipality may also be referred to as a town hall (e.g. Port-Gentil Town Hall, Mayumba Town Hall).

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						therefore be directly affected by the Project, stakeholder will likely have an interest in the Project, potential impacts (particularly with respect to education) and mitigation measures.				
Représentants de la santé (professionnels de la santé) de la Municipalité de Port-Gentil	Health representatives (e.g. health care professionals) of Municipality of Port-Gentil	Port-Gentil	L	Stakeholder may have thoughts or opinions about Project impacts on health within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Responsible for the provision of health care services to residents of Port-Gentil and surrounding communities. Given that Port-Gentil has been selected as the logistical support base for the Project and will therefore be directly affected by the Project, stakeholder will likely have an interest in the Project, potential impacts (particularly with	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						respect to health) and mitigation measures.				
Municipalité de Port-Gentil	Labour representatives (e.g. unions)	Port-Gentil	L	Stakeholder may have thoughts or opinions about Project impacts on labour within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Represents workers in Port-Gentil and surrounding communities. Given that Port-Gentil has been selected as the logistical support base for the Project and will therefore be directly affected by the Project (e.g. through job creation), stakeholder will likely have an interest in the Project, potential impacts (particularly on the workforce) and mitigation measures.	-	L	*Keep informed*	Information letter and BID
Département de Etimboué (Préfet, Président du Conseil Départemental)	Etimboué Department (Prefect, President of the	Omboué	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department	M	Responsible for the governance and administration of Etimboué Department. Given the	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
	Department Council)			and measures to mitigate these.		potential for the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.				
Département de Ndougou (Préfet, Président du Conseil Départemental)	Ndougou Department (Prefect, President of the Department Council)	Gamba	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department and measures to mitigate these.	M	Responsible for the governance and administration of Ndougou Department. Given the potential for the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.	-	L	*Keep satisfied*	Information letter and BID
Nyanga Province										

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Département de Basse Banio (Préfet, Président du Conseil Départemental)	Basse Banio Department (Prefect, President of the Department Council)	Mayumba	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department and measures to mitigate these.	H	Responsible for the governance and administration of Basse Banio Department. Given the proximity of the Project to the department and the potential for the department to be affected by routine planned and accidental events, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures. Moreover, stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						Stakeholder may also be interested in data gathered as part of the studies to update the impact assessments.				
Département de Haute Banio (Préfet, Président du Conseil Départemental)	Haute Banio Department (Prefect, President of the Department Council)	Ndindi	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts within the department and measures to mitigate these.	H	Responsible for the governance and administration of Haute Banio Department. Given the proximity of the Project to the department and the potential for the department to be affected by routine planned and accidental events, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures. Stakeholder may also be interested in data gathered as part of the studies to update	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						the impact assessments.				
Municipalité de Mayumba	Municipality of Mayumba	Mayumba	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on the municipality and measures to mitigate these.	H	Responsible for the governance and administration of Mayumba. Given the proximity of the Project to the municipality and the potential for the municipality to be affected by routine planned and accidental events, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures. Moreover, stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the	Yes	H	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						purpose(s) of re-engagement. Stakeholder may also be interested in data gathered as part of the studies to update the impact assessments.				
Compagnie de Police de la Municipalité de Mayumba	Mayumba Police Company	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on public safety within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Responsible for maintaining public safety within the municipality and surrounding communities. Given the proximity of the Project to the municipality, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures. Moreover, stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						are being updated alongside the purpose(s) of re-engagement.				
Brigade de police de la Municipalité de Mayumba	Mayumba Police Brigade	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on public safety within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Responsible for maintaining public safety within the municipality and surrounding communities. Given the proximity of the Project to the municipality, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures. Moreover, stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Base Navale de la Municipalité de Mayumba	Mayumba Naval Base	Mayumba	L	Stakeholder may have thoughts or opinions about Project-related security issues within the territorial waters of the municipality, but will not be able to alter or delay its execution.	M	Responsible for monitoring and ensuring the security of territorial waters of the municipality. Given the presence of Project vessels and their passage through these waters, stakeholders will likely have an interest in Project details (e.g. vessel movements) and security-related impacts and mitigation measures. Moreover, stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Autorités portuaires de la Municipalité de Mayumba	Mayumba High Port Authority (OPRAG)	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on port infrastructure and measures to mitigate these, but will not be able to alter or delay its execution.	M	Responsible for management of Port of Mayumba. Given the proximity of the Project to the municipality, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.	-	L	*Keep informed*	Information letter and BID
Représentants de l'éducation (enseignants) de la Municipalité de Mayumba	Education representatives (e.g. teachers) of Mayumba Municipality	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on education within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution	M	Responsible for the provision of education to residents of Mayumba and surrounding communities. Given the proximity of the Project to the municipality and the potential for the municipality to be affected by routine planned and accidental events, stakeholder will likely have an interest in the Project, potential	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						impacts (particularly with respect to education) and mitigation measures.				
Représentants de la santé (professionnels de la santé) de la Municipalité de Mayumba	Health representatives (e.g. health care professionals) of Mayumba Municipality	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on health within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Responsible for the provision of health to residents of Mayumba and surrounding communities. Given the proximity of the Project to the municipality and the potential for the municipality to be affected by routine planned and accidental events, stakeholder will likely have an interest in the Project, potential impacts (particularly with respect to health) and mitigation measures.	-	L	*Keep informed*	Information letter and BID
Représentants syndicaux de la	Labour representatives (e.g. unions)	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on	M	Represents workers in Mayumba and	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Municipalité de Mayumba	of Mayumba Municipality			labour within the municipality and surrounding communities and measures to mitigate these, but will not be able to alter or delay its execution.		surrounding communities. Given the proximity of the Project to the municipality and the potential for the municipality to be affected by routine planned and accidental events, stakeholder will likely have an interest in the Project, potential impacts (particularly on the workforce) and mitigation measures.				
Project-affected communities (PACs) (including groups such as men, women, authority figures (e.g. village chiefs, customary chiefs, religious chiefs, elected leaders), fisherfolk and other natural resource users)										
	Mambi	Banio Lagoon	L	Community may have thoughts or opinions about Project impacts at local level and measures to mitigate these (particularly regarding artisanal fishing and other water-based livelihoods), but will not be able to alter or delay its execution.	H	Given the potential for the community to be affected by routine planned and accidental events related to the Project, community members will likely have a keen interest in the	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						Project, potential impacts and mitigation measures, alongside any benefits that they may receive.				
	Malembé	Banio Lagoon	L	Community may have thoughts or opinions about Project impacts at local level and measures to mitigate these (particularly regarding artisanal fishing and other water-based livelihoods), but will not be able to alter or delay its execution.	H	Given the potential for the community to be affected by routine planned and accidental events related to the Project, community members will likely have a keen interest in the Project, potential impacts and mitigation measures, alongside any benefits that they may receive.	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting
	Tiya	Banio Lagoon	L	Community may have thoughts or opinions about Project impacts at local level and measures to mitigate these (particularly regarding artisanal fishing and other water-based livelihoods),	H	Given the potential for the community to be affected by routine planned and accidental events related to the Project,	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
				but will not be able to alter or delay its execution.		community members will likely have a keen interest in the Project, potential impacts and mitigation measures, alongside any benefits that they may receive.				
	Kayes	Banio Lagoon	L	Community may have thoughts or opinions about Project impacts at local level and measures to mitigate these (particularly regarding artisanal fishing and other water-based livelihoods), but will not be able to alter or delay its execution.	H	Given the potential for the community to be affected by routine planned and accidental events related to the Project, community members will likely have a keen interest in the Project, potential impacts and mitigation measures, alongside any benefits that they may receive.	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting
	Kala Bouboté	Banio Lagoon	L	Community may have thoughts or opinions about Project impacts at local level and measures	H	Given the potential for the community to be affected by routine	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
				to mitigate these (particularly regarding artisanal fishing and other water-based livelihoods), but will not be able to alter or delay its execution.		planned and accidental events related to the Project, community members will likely have a keen interest in the Project, potential impacts and mitigation measures, alongside any benefits that they may receive.				
	Ndindi	Banio Lagoon	L	Community may have thoughts or opinions about Project impacts at local level and measures to mitigate these (particularly regarding artisanal fishing and other water-based livelihoods), but will not be able to alter or delay its execution.	H	Given the potential for the community to be affected by routine planned and accidental events related to the Project, community members will likely have a keen interest in the Project, potential impacts and mitigation measures, alongside any benefits that they may receive.	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
	Mayumba (including its six quartiers e.g. Tchiole and Ndembet)	Mayumba Territory	L	Residents of the municipality may have thoughts or opinions about Project impacts at local level and measures to mitigate these, but will not be able to cause changes or delay its execution.	H	Given the potential for the municipality to be affected by routine planned and accidental events related to the Project, community members will likely have a keen interest in the Project, potential impacts and mitigation measures, alongside any benefits that they may receive.	Yes	H	*Engage closely*	Invitation letter/telephone call and meeting
Civil society organisations (including non-governmental organisations (NGOs))										
Syndicat des Armateurs et de la Pêche Industrielle au Gabon (SAPEG)	Union of Shipowners and Industrial Fishing in Gabon	Libreville; Port-Gentil	L	Stakeholder may have thoughts or opinions about Project impacts on industrial fishing and measures to mitigate these, but will not be able to alter or delay its execution.	M	Union responsible for representing persons engaged in industrial fishing in Gabon (e.g. shipowners and crew). Given the location of the Project (i.e. offshore and in proximity to industrial fishing grounds), stakeholder will likely have an	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						interest in the Project, potential impacts and mitigation measures.				
Centre d'Appui à la Pêche Artisanale de Libreville (CAPAL)	Libreville Artisanal Fishing Support Center	Libreville	L	Stakeholder may have thoughts or opinions about Project impacts on artisanal fishing and measures to mitigate these, but will not be able to alter or delay its execution.	M	Center works close with artisanal fisherfolk from Libreville and surrounding communities. Given the potential for artisanal fishing along the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.	-	L	*Engage closely*	Telephone call and individual meeting
Centre d'Appui à la Pêche Artisanale de Port-Gentil (CAPAG)	Port-Gentil Artisanal Fishing Support Center	Port-Gentil	L	Stakeholder may have thoughts or opinions about Project impacts on artisanal fishing and measures to mitigate these, but will not be able	H	Center works closely with artisanal fisherfolk from Port-Gentil and surrounding communities. Given the	Yes	M	*Engage closely*	Telephone call and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
				to alter or delay its execution.		potential passage of Project vessels through artisanal fishing grounds on route to and from the supply base in Port-Gentil, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.				
Association des Jeunes Pêcheurs de la Basse Banio (AJPBB)	Association of Young Fishermen of Basse Banio	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on artisanal fishing and measures to mitigate these, but will not be able to alter or delay its execution.	H	Association responsible for representing the young fishermen of Basse Banio Department. Given the proximity of the Project to artisanal fishing grounds used by fisherfolk from Basse Banio Department, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data	Yes	M	*Engage closely*	Telephone call and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						gathered as part of the studies to update the impact assessments.				
L'Association des Pêcheurs et Revendeurs d'Huîtres de Mayumba (APRHM)	Association of Fishermen and Resellers of Oysters of Mayumba	Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on artisanal fishing and oyster farming and measures to mitigate these, but will not be able to alter or delay its execution.	H	Association responsible for representing fisherfolk and oyster sellers from Mayumba. Given the proximity of the Project to fishing grounds and coastal waters used by artisanal fisherfolk and oyster farmers, stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.	Yes	M	*Engage closely*	Telephone call and individual meeting
	Sea Shepherd Conservation	XXX	M	Able to enhance or cause some damage the reputation of the Project	H	Branch of an international NGO focused on the	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
	Society (SSCS)			depending on their opinion of impacts on marine wildlife and measures to mitigate these.		protection of marine wildlife in Gabon through campaigns against illegal fishing. Given the location of the Project (i.e. offshore, in an MPA and in proximity to fishing grounds and national parks), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.				
	Wildlife Conservation Society (WCS) Gabon	Libreville, Port-Gentil, Mayumba, Lopé	M	Able to enhance or cause some damage the reputation of the Project depending on their opinion of impacts on marine wildlife and measures to mitigate these.	H	Branch of an international NGO focused on the protection of wildlife in Gabon, including marine species such as turtles, sharks and rays. A network of field staff, some of	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						whom are based in Port-Gentil and MNP, work with government authorities and artisanal fishing communities to build capacity and raise awareness. Given the location of the Project (i.e. offshore, in an MPA and in proximity to fishing grounds and national parks), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.				
	Gabon Bleu	Libreville	M	Able to enhance or cause some damage the reputation of the Project depending on their opinion of impacts on marine wildlife and	H	A government marine conservation initiative aimed at the sustainable management of Gabon's coastal	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
				measures to mitigate these.		and oceanic waters and the creation of a comprehensive marine protected area network. Given the location of the Project (i.e. offshore, in an MPA), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments. Stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.				

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
	World Wildlife Fund (WWF) Gabon	Libreville, Gamba, Tridom (northern Gabon)	M	Able to enhance or cause some damage the reputation of the Project depending on their opinion of impacts on marine wildlife and measures to mitigate these.	H	Branch of an international NGO focused on the protection of wildlife in Gabon, including marine species such as turtles. Engaged in collection of baseline data on marine and coastal biodiversity through beach, lagoon and marine surveys. Given the location of the Project (i.e. offshore, in an MPA and in proximity to national parks), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
	Ibonga	Port-Gentil, Gamba	L	Stakeholder may have thoughts or opinions about Project impacts on marine wildlife, particularly leatherback turtles, and measures to mitigate these, but will not be able to alter or delay its execution.	H	Local NGO focused on the conservation of leatherback turtles in Gabon. Given the location of the Project (e.g. in proximity to MNP, a critical nesting site for leatherback turtles), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.	-	L	*Keep informed*	Information letter and BID
	Brainforest	Libreville	L	Stakeholder may have thoughts or opinions about Project impacts on the environment and measures to mitigate these, but will not be able to alter or delay its execution	M	Local NGO focused on environmental protection and facilitating the participation of key stakeholders in the management of natural resources	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						in Gabon. Given the location of the Project (e.g. in an area renowned for its natural environment), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.				
Aventures Sans Frontières	Adventures Without Borders	Libreville (Pongara National Park)	L	Stakeholder may have thoughts or opinions about Project impacts on marine wildlife, particularly leatherback turtles, and measures to mitigate these, but will not be able to alter or delay its execution.	H	Local NGO focused on the conservation of leatherback turtles in Pongara National Park. Given the location of the Project (e.g. in proximity to MNP, a critical nesting site for leatherback turtles), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						of the studies to update the impact assessments.				
Private sector										
	Portek International ("Portek") – Port of Port-Gentil (known locally as Gabon Port Management)	Port-Gentil	L	Stakeholder may have thoughts or opinions about Project impacts on the Port of Port-Gentil and measures to mitigate these, but will not be able to alter or delay its execution.	H	Responsible for the management of the Port of Port-Gentil, including the development of and investment in port infrastructure and provision of port and maritime services. Given that the Port of Port-Gentil will be used as the supply base for the Project, stakeholder will likely have a keen interest in Project details (e.g. vessel movements), potential impacts and mitigation measures.	Yes	L	*Engage closely*	Invitation letter and individual meeting
Société Nationale Petrolière Gabonaise (SNPG)	Gabon Oil Company	Libreville	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how	M	National petroleum company in Gabon and may therefore have an interest in the	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
				to mitigate these, but will not be able to alter or delay its execution.		activities of other oil and gas companies, including BWE, and the potential for these to lead to cumulative impacts. Moreover, stakeholder was engaged during the preparation of the impact assessments and thus will likely have an interest in why and how they are being updated alongside the purpose(s) of re-engagement.				
	Assala Gabon	Port-Gentil	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how to mitigate these, but will not be able to alter or delay its execution.	M	Actively involved in Gabon's exploration and production sector and may therefore have an interest in the activities of other oil and gas operators, including BWE, and the potential for these to lead to cumulative impacts.	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
	Total Gabon	Libreville, Port-Gentil	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how to mitigate these, but will not be able to alter or delay its execution.	M	Actively involved in Gabon's exploration and production sector and may therefore have an interest in the activities of other oil and gas operators, including BWE, and the potential for these to lead to cumulative impacts.	-	L	*Keep informed*	Information letter and BID
	Perenco Gabon	Port-Gentil	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how to mitigate these, but will not be able to alter or delay its execution.	M	Actively involved in Gabon's exploration and production sector and may therefore have an interest in the activities of other oil and gas operators, including BWE, and the potential for these to lead to cumulative impacts.	-	L	*Keep informed*	Information letter and BID
	ENI Gabon	Libreville	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how	M	Actively involved in Gabon's exploration and production sector and may therefore have an interest in	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
				to mitigate these, but will not be able to alter or delay its execution.		the activities of other oil and gas operators, including BWE, and the potential for these to lead to cumulative impacts.				
	Vaalco Energy	Libreville,Port-Gentil	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how to mitigate these, but will not be able to alter or delay its execution.	M	Actively involved in Gabon's exploration and production sector and may therefore have an interest in the activities of other oil and gas operators, including BWE, and the potential for these to lead to cumulative impacts.	-	L	*Keep informed*	Information letter and BID
	Petronas Gabon	Libreville	L	Stakeholder may have thoughts or opinions about cumulative impacts resulting from the interaction of the Project with its projects and how to mitigate these, but will not be able to alter or delay its execution.	M	Actively involved in Gabon's exploration and production sector and may therefore have an interest in the activities of other oil and gas operators, including BWE, and the potential for these to lead to	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						cumulative impacts.				
Société d'Energie et d'Eau du Gabon (SEEG)	Gabon Energy and Water Company	Libreville, Port-Gentil, Mayumba	L	Stakeholder may have thoughts or opinions about Project impacts on energy supply and measures to enhance these, but will not be able to alter or delay its execution.	M	Responsible for maintaining the production and distribution of electricity in Gabon and may therefore have an interest in the Project, potential impacts (particularly in terms of energy supply) and mitigation measures.	-	L	*Keep informed*	Information letter and BID
	Local businesses – tourism-related (e.g. hotels such as Likwalé Lodge, restaurants, tour operators)		L	Stakeholder may have thoughts or opinions about Project impacts on tourism-related businesses and measures to mitigate these, but will not be able to alter or delay its execution.	M	Reliant on tourism industry for income and livelihood. Given the location of the Project (i.e. in a part of the country that is recognised for its touristic value and potential), stakeholder will likely have an interest in the Project, potential impacts and mitigation	Yes	M	Engage closely	Telephone call and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						measures (particularly in relation to an accidental event e.g. oil spill).				
	Local businesses – fisheries-related (e.g. wholesalers, retailers, boat builders)		L	Stakeholder may have thoughts or opinions about Project impacts on fisheries, the fisheries supply chain and measures to mitigate these, but will not be able to alter or delay its execution.	H	Reliant on the fisheries sector for income and livelihood. Given the location of the Project (i.e. offshore, in proximity to fishing grounds), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures.	Yes	M	Engage closely	Telephone call and individual meeting
	Local businesses – recreation-related (e.g. equipment hire, sports schools)		L	Stakeholder may have thoughts or opinions about Project impacts on recreational activities and measures to mitigate these, but will not be able to alter or delay its execution.	M	Reliant on recreational activities for income and livelihood. Given the location of the Project (i.e. in a part of the country that provides opportunities for water sports), stakeholder will likely have an	Yes	M	Engage closely	Telephone call and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						interest in the Project, potential impacts and mitigation measures (particularly in relation to an accidental event e.g. oil spill).				
Media										
Journal “L’union”		Libreville (with regional correspondents)	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts and measures to mitigate these, as conveyed by other stakeholders.	M	Focused on reporting on current affairs and disseminating information of national interest and is the main newspaper involved in publishing information about public consultations for ESIAs in Gabon; stakeholder will therefore have an interest in significant developments taking place in Gabon (e.g. oil and gas exploration and production) and	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						reporting on these to citizens.				
	Gabon 24 Television	Libreville	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts and measures to mitigate these, as conveyed by other stakeholders.	M	National television news network focused on reporting on current affairs and disseminating information of national interest. Stakeholder will therefore have an interest in significant developments taking place in Gabon (e.g. oil and gas exploration and production) and reporting on these to citizens.	-	L	*Keep satisfied*	Information letter and BID
	Radio Gabon	Libreville, Port-Gentil (provincial station)	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts and measures to mitigate these, as conveyed by other stakeholders.	M	Leading radio station in Gabon focused, amongst other things, on reporting on current affairs and disseminating information of national interest. Stakeholder will therefore have an interest in	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						significant developments taking place in Gabon (e.g. oil and gas exploration and production) and reporting on these to citizens. Given the Project's supply base will be in Port-Gentil, the provincial station of Radio Gabon will likely have a particular interest in the Project alongside potential impacts and mitigation measures at provincial level.				
	Radio Mandji	Port-Gentil	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts and measures to mitigate these, as conveyed by other stakeholders.	M	Provincial radio station in Gabon focused, amongst other things, on reporting on current affairs and disseminating information of provincial and national interest. Given the Project's supply	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						base will be in Port-Gentil, where the station is based, stakeholder will likely have an interest in the Project alongside potential impacts and mitigation measures at provincial level.				
International organisations										
	International Union for the Conservation of Nature (IUCN) Species Survival Commission (SSC) Cetacean Specialist Group	Sénégal	L	Stakeholder may have thoughts or opinions about Project impacts on threatened species, particularly cetaceans, and measures to mitigate these, but will not be able to alter or delay its execution.	H	SSC a science-based network of volunteer experts working to address conservation issues associated with particular species. Cetacean specialist focuses on identifying conservation challenges for world's whales, dolphins and porpoises. Given the location the location of the Project (i.e. offshore) and presence of cetaceans in	Yes	L	*Engage closely*	Email and individual meeting (to be conducted remotely)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						Gabon, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.				
	IUCN SSC Marine Turtle Specialist Group	Sénégal	L	Stakeholder may have thoughts or opinions about Project impacts on threatened species, particularly marine turtles, and measures to mitigate these, but will not be able to alter or delay its execution.	H	The Marine Turtle Specialist Group focuses on developing and supporting strategies, setting priorities and providing tools that promote and guide the conservation of marine turtles. Given the location the location of the Project (i.e. offshore) and presence of marine turtles in the AOI and other parts of Gabon, stakeholder will likely have an	Yes	L	*Engage closely*	Email and individual meeting (to be conducted remotely)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.				
	IUCN SSC Shark Specialist Group	Sénégal	L	Stakeholder may have thoughts or opinions about Project impacts on threatened species, particularly sharks, and measures to mitigate these, but will not be able to alter or delay its execution.	H	The Shark Specialist Group focuses on achieving science-based management of sharks, rays and chimaeras. Given the location the location of the Project (i.e. offshore) and presence of shark species in Gabon, stakeholder will likely have an interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to	Yes	L	*Engage closely*	Email and individual meeting (to be conducted remotely)

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						update the impact assessments.				
	IUCN SSC Tuna and Billfish Specialist Group	Sénégal	L	Stakeholder may have thoughts or opinions about Project impacts on threatened species, particularly tuna and billfish, and measures to mitigate these, but will not be able to alter or delay its execution.	H	The Tuna and Billfish Specialist Group focuses on increasing knowledge on the global status and conservation of world's tuna and billflish species. Given the location of the Project (i.e. offshore, in proximity to industrial, including tuna, fishing grounds), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.	Yes	L	*Engage closely*	Email and individual meeting (to be conducted remotely)
Commission Régionale Des Pêches Du	Regional Commission of Fisheries of	Libreville	M	Able to enhance or cause some damage to the reputation of the Project	M	A regional fisheries body consisting of	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
Golfe De Guinée (COREP)	the Gulf of Guinea			depending on their opinion of impacts on fisheries and measures to mitigate these.		numerous member states surrounding the Gulf of Guinea, including Gabon. Given the potential for the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill), stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.				
Comité des pêches pour l'Atlantique Centre-Est (CECAF)	Fisheries Committee for the Eastern Central Atlantic	Ghana	M	Able to enhance or cause some damage to the reputation of the Project depending on their opinion of impacts on fisheries and measures to mitigate these.	M	A regional fisheries body consisting of numerous member states surrounding the Eastern Central Atlantic, including Gabon. Given the potential for the entirety of the Gabonese coastline to be affected by an accidental event (e.g. an oil spill),	-	L	*Keep satisfied*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						stakeholder will likely have an interest in the Project, potential impacts and mitigation measures.				
Educational and research institutions										
	Smithsonian Gabon Biodiversity Program	Gamba	L	Stakeholder may have thoughts or opinions about Project impacts on marine biodiversity and measures to mitigate these, but will not be able to alter or delay its execution.	H	Branch of an international research centre focused on undertaking biodiversity research and conservation initiatives in southwestern Gabon. Given the location of the Project (i.e. in an MPA, in proximity to national parks renowned for their biodiversity value), stakeholder will likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data	-	L	*Keep informed*	Information letter and BID

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						gathered as part of the studies to update the impact assessments.				
Centre National de Données et Informations Océanographiques (CNDIO)	National Centre for Oceanographic Data and Information	Libreville	L	Stakeholder may have thoughts or opinions about Project impacts on the ocean environment and measures to mitigate these, but will not be able to alter or delay its execution.	H	The focus of CNDIO is on the collection, processing, storage and dissemination of oceanographic data; stakeholder may therefore have a keen interest in activities taking place within the ocean environment (e.g. oil and gas exploration and development) which have the potential to alter baseline conditions.	Yes	L	*Engage closely*	Invitation letter and individual meeting
Centre National de la Recherche Scientifique et Technologique (CENAREST)	National Center for Scientific and Technological Research[12]	Libreville	L	Stakeholder may have thoughts or opinions about the Project, but will not be able to alter or delay its execution.	H	Technical body responsible for the coordination and application of national research in Gabon. Key	Yes	L	*Engage closely*	Invitation letter and individual meeting

[12] Exists under the Ministry of Higher Education, Scientific Research, Technology Transfer, National Education, Responsible for Civic Training in Gabon.

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						objectives include to develop scientific research planning projects and carry out research programs; given its focus on research, stakeholder may be interest in data gathered as part of the studies to update the impact assessments.				
Institut de Recherches Agronomiques et Forestières (IRAF), part of CENAREST	Agricultural and Forestry Research Institute	Libreville	L	Stakeholder may have thoughts or opinions about Project impacts on fisheries and artisanal fishing communities, but will not be able to alter or delay its execution.	H	Gabon's principal agricultural research and development agency with a focus on carrying out research in several areas, including socioeconomics and fisheries. Given the location of the Project (i.e. offshore, in proximity to fishing grounds) and the importance of artisanal fishing to local livelihoods and food security, stakeholder will	Yes	L	*Engage closely*	Invitation letter and individual meeting

Stakeholder	Stakeholder (English translation)	Location	Level of influence (L, M, H)[6]	Justification for influence level	Level of interest (L, M, H)	Justification for interest level	Can provide data relevant to the studies?	Level of project impact (L, M, H) [7]	Engagement approach[8]	Engagement methods and materials
						likely have a keen interest in the Project, potential impacts and mitigation measures, and may also be interested in data gathered as part of the studies to update the impact assessments.				
Institut de Recherche en Sciences Humaines (IRSH) – Département des Sciences Marines, part of CENAREST	Institute for Research in Human Sciences – Department of Marine Sciences	Libreville	L	Stakeholder may have thoughts or opinons about Project impacts on the ocean environment and measures to mitigate these, but will not be able to alter or delay its execution.	H	Focused on developing research in the fields of oceanography and the geography of the seas; stakeholder may therefore have a keen interest in activities taking place within the ocean environment (e.g. oil and gas exploration and development) which have the potential to alter baseline conditions.	Yes	L	*Engage closely*	Invitation letter and individual meeting

APPENDIX 11 BACKGROUND INFORMATION DOCUMENT

BACKGROUND INFORMATION DOCUMENT

BW Energy (BWE) is an oil and gas exploration and production company established in 2016. BWE recently acquired a majority interest in the Dussafu Block, which is located off the coast of Gabon adjacent to Basse-Banio Department (Nyanga Province).

Six oil discoveries have been made on the licence to date: Tortue, Hibiscus, Ruche, Ruche North East, Moubenga and Walt Whitman fields.

BWE is focusing its development efforts on the Tortue, Hibiscus, Ruche and Ruche North East fields, which are within the Ruche Exclusive Exploitation Area (EEA). The Ruche EEA is located approximately 50 km offshore in water depths of 70–650 m.

BW ENERGY

PROJECT INFORMATION

BWE has successfully initiated development activities in the Ruche EEA marked by the following achievements:

- In September 2018, oil production began at Tortue Field **(Tortue Phase 1).** Approximately 12,500 barrels of oil per day (bopd) are currently being produced from two subsea wells at first oil. These wells are connected to the BW Adolo floating production, storage and offloading (FPSO) unit (located close to Tortue Field) by subsea pipelines.
- In late 2018, the second phase of development at Tortue Field **(Tortue Phase 2)** was sanctioned. Four additional subsea wells were planned for Tortue Phase 2. Owing to the global pandemic, the drilling campaign was suspended in early 2020. As a result, only three wells were drilled and two were brought on production. The remaining two wells will be brought on production in the second half of 2021.
- In 2019, the first phase of development in the Ruche Field **(Ruche Phase 1)** was sanctioned. Ruche Phase 1 is currently at the design phase but will consist of six production wells (in the Ruche and Hibiscus fields). A manned offshore installation will be established to support the on-deck wellheads and a subsea pipeline will connect this installation to the BW Adolo FPSO unit. This phase of development is anticipated to increase production to up to 40,000 bopd.

IN 2019, THE FIRST PHASE OF DEVELOPMENT IN THE **RUCHE FIELD (RUCHE PHASE 1) WAS SANCTIONED.**

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

In line with the legislative requirements of the Republic of Gabon, impact assessments for Tortue Phase 1, Tortue Phase 2 and Ruche Phase 1 were undertaken in 2017, 2019 and 2020 respectively.

The potential impacts included effects on water quality, marine species and other sea users, e.g., artisanal fishing vessels.

The ESIA/notice of environmental impact (NEI) documents for Tortue phases 1 and 2 respectively have been reviewed and approved by the Gabonese ministry in charge of the environment.

BACKGROUND INFORMATION DOCUMENT

THE ESIA PROCESS

BWE is currently applying for international finance to support its activities in Gabon, including Tortue phases 1 and 2, and Ruche Phase 1. To secure international financing, updates to the impact assessments are required to meet the additional requirements of the international lending institutions (banks).

Some of the additional studies include

- a lender addendum social impact assessment: a study of the communities that may be affected by the activities focusing on topics such as local health, economy and livelihoods, and cultural heritage conducted in a manner that meets lender requirements
- a critical habitats assessment: a study of the critical habitats that may be affected by the activities, i.e., habitats with the highest biodiversity value that support biodiversity features that have the highest degree of irreplaceability and vulnerability
- an ecosystem services assessment: a study of the ecosystem services that may be affected by the activities, i.e., the benefits that people derive from the natural environment
- a cumulative impact assessment: a study of other projects taking place or planned, regionally and nationally, that may interact with the activities in Ruche EEA.

The results of the studies and assessments will be presented in an ESIA addendum covering all three phases of the development and will be made available to the public for review and comment.

HOW WILL YOU BE INVOLVED?

As part of the process of updating the impact assessments, engagement with stakeholders is required. This will include re-engagement with previous stakeholders and engagement with other more recently identified stakeholders. Government authorities, non-governmental organisations, educational institutions and local communities will be engaged through individual, small group and community meetings.

The purpose of these meetings is to provide information on Tortue phases 1 and 2, and Ruche Phase 1, and to obtain information from stakeholders to improve the identification, assessment and ongoing management of social and environmental issues relating to BWE Gabon's activities. We will also seek your opinions and concerns about the Ruche EEA activities and their potential impacts, and to obtain your input to the studies associated with the impact assessment updates.

AS PART OF THE PROCESS OF UPDATING THE IMPACT ASSESSMENTS, **ENGAGEMENT WITH STAKEHOLDERS IS REQUIRED.**

FURTHER COMMUNICATION

BWE Gabon has created a way to enable you to engage to share information on an ongoing basis. There is an easy means of contacting us to request or provide us with further information and to report any grievance related to Tortue phases 1 and 2, Ruche Phase 1 and the impact assessment update studies.

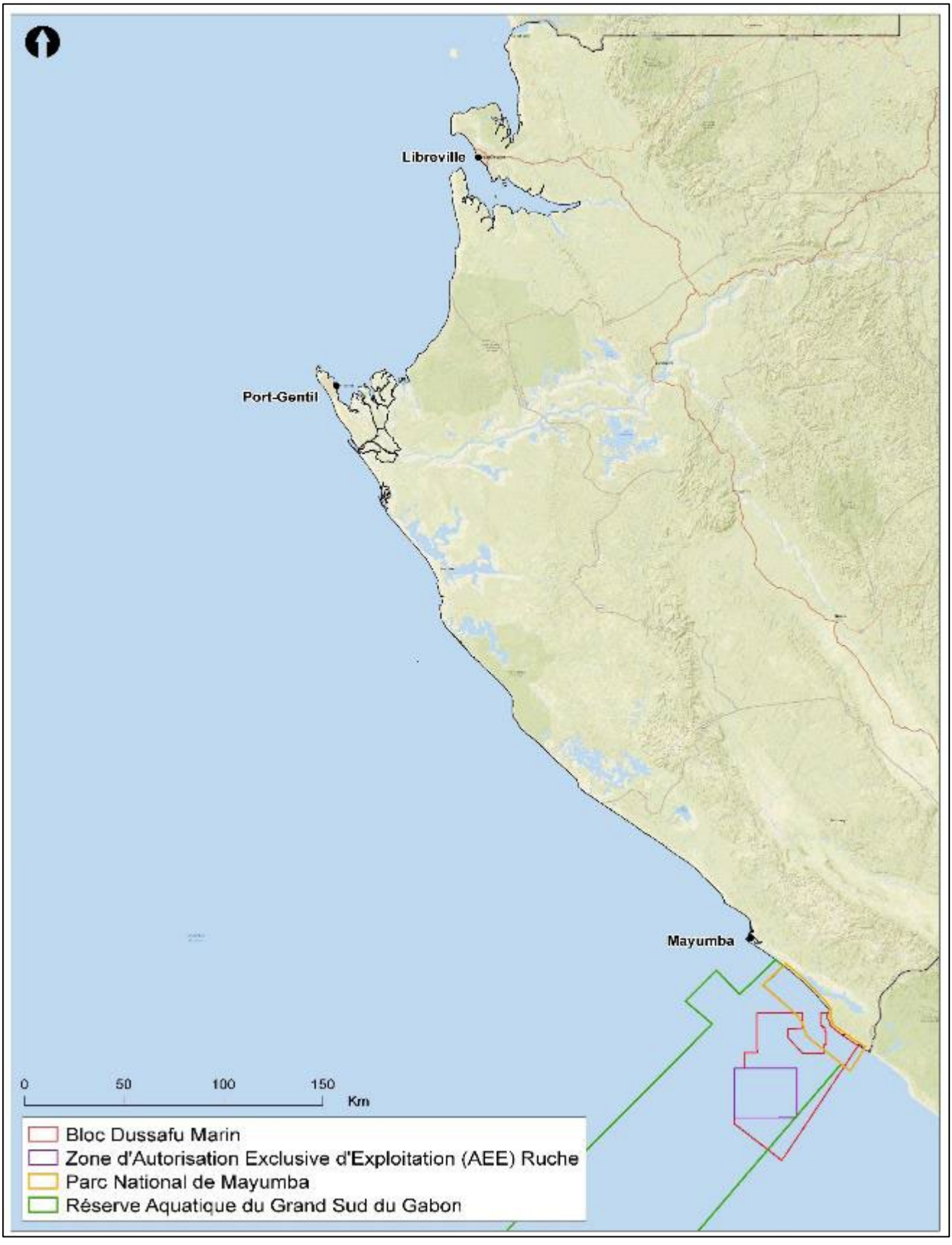
To report a grievance, please contact a member of BWE's community liaison team via the following:

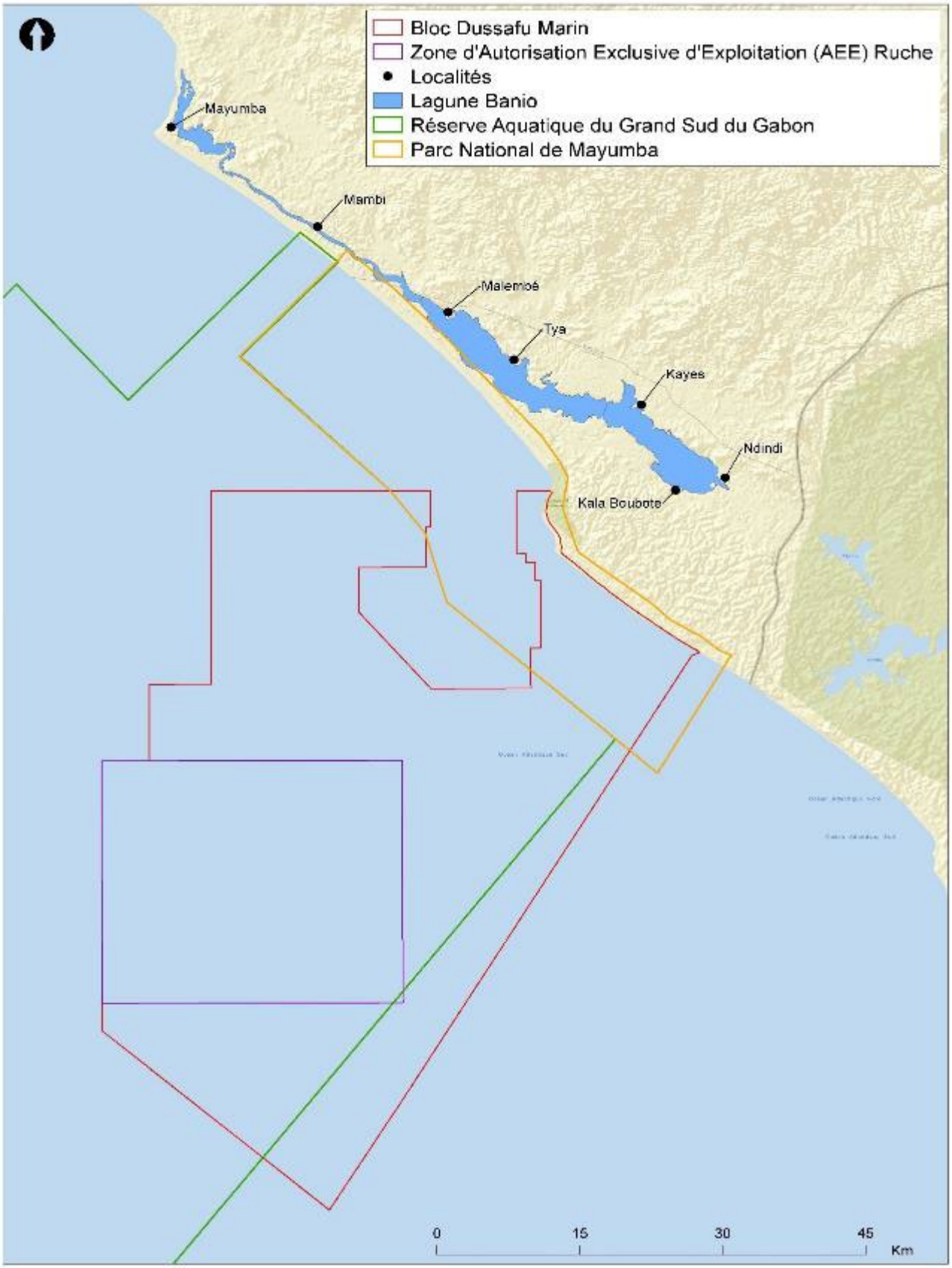
Tel: +241 77 29 54 03 or +241 77 83 82 82

Email : geraldine.ewomba@bwenergy.no or guy-marcel.ndziami@bwenergy.no

Mail: BW Energy Gabon S.A., Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23771 Libreville, Gabon.

APPENDIX 12 POSTERS




Bloc Dussafu Marin
Zone d'Autorisation Exclusive d'Exploitation (AEE) Ruche
Localités
Lagune Banio
Réserve Aquatique du Grand Sud du Gabon
Parc National de Mayumba
Mayumba
Mambi
Malembé
Tya
Kayes
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APPENDIX 13 FREQUENTLY ASKED QUESTIONS DOCUMENT

Question	Answer
Project description	
What is the Project?[13]	The territorial marine waters of the Department of Basse Banio, with Mayumba as capital, represent one of the major centres of oil production in Gabon. BWE recently acquired a 73.5% operational working interest in the Dussafu Block off the coast of Mayumba. The Dussafu Block is a 2,776 km^2 area that encompasses the Ruche Exclusive Exploitation Area (Ruche EEA). The Ruche EEA is 850 km^2 size and contains six oil discoveries: Moubenga, Walt Whitman, Ruche, Tortue, Ruche North East (NE) and Hibiscus. BWE are focusing their development efforts on the Tortue, Hibiscus, Ruche and Ruche NE fields that are within the Ruche EEA. In September 2018 oil production began at Tortue Field (Tortue Phase 1). Approximately 12,500 barrels of oil per day (bopd) are currently being produced from two subsea wells. These wells are connected to the BW Adolo floating production, storage and offloading (FPSO) unit (located close to Tortue Field) by subsea pipelines. In late 2018, the second phase of development at Tortue Field (Tortue Phase 2) was sanctioned. Four additional subsea wells were planned for Tortue Phase 2. Due to the Covid-19 pandemic, the drilling campaign was suspended in early 2020. As a result, only three wells were drilled. The remaining well will be drilled in the first half of 2021. In 2019, the first phase of development in the Ruche Field (Ruche Phase 1) was sanctioned. Ruche Phase 1 is currently in the design phase but will consist of six production wells (in the Ruche and Hibiscus Fields). A manned Offshore Installation (OI) will be established to support the on-deck wellheads and a subsea pipeline will connect this installation to the BW Adolo FPSO. This phase of development is anticipated to increase production to up to 40,000 bopd.

[13] The Project refers to Tortue Phase 1, Tortue Phase 2, and Ruche Phase 1.

When will project activities start and end? How long will they last?	Production commenced from the Tortue Phase 1 development in September 2018; therefore, it is already in the operational phase. Current production is 12,500 bopd. In late 2018, the second phase of development at Tortue Field (Tortue Phase 2) was sanctioned. Three of the four subsea wells have been drilled and two are currently producing. All four wells will be in production phase by the second half of 2021. Ruche Phase 1 is currently in the front-end engineering and design (FEED) phase. Drilling of the first production well is expected to take place in the second half of 2022, with first oil expected at the end of 2022 / beginning of 2023. The expected life of the project is approximately 20 years.
What are the project's key components?	The key components of the project are: • Tortue Phase 1 (currently at operational phase) • Tortue Phase 2 (currently in active development) • Ruche Phase 1 (currently at detailed design/execute stage).
What is the BW Adolo FPSO? What is an FPSO and what does it do/what is its purpose?	The BW Adolo FPSO is a Floating Production Storage and Offloading unit. The FPSO facilitates the storage of oil at sea and the transfer of the oil to tankers for ongoing transport. The host location for the BW Adolo FPSO is close to the Tortue Field. The BW Adolo FPSO is owned and operated by BW Offshore. This is classed as an associated facility.
What is the Offshore Installation and what is its purpose?	The Offshore Installation (OI) will be installed as part of the Ruche Phase 1 development. It will be a platform (converted mobile drilling unit) located between Hibiscus and Ruche Fields. There will be oil / water separation on the OI and then the oil will be transferred by subsea pipeline[14] to the FPSO.
Which administrative divisions (e.g. province, departments, towns/villages) will be affected by the project?	The Dussafu Block is located off the coast of Gabon adjacent to Basse-Banio Department, in the Nyanga Province. Two Areas of Influence (AOIs) have been defined:

[14] Subsea pipeline 20-22 km in length.

	• An operational AOI, which includes all of the marine (coastal and offshore) area within the Dussafu block, as well as the coastal communities between Mayumba and the border with the Republic of Congo adjacent to the block. This also includes:
	  ○ Fishing (e.g. artisanal, sports fishing and industrial, including tuna fishing) which could potentially be affected by the operations of BWE
	  ○ Coastline areas potentially affected by onshore project activities (e.g. logistics base at Port Gentil).
	• An accidental event (or worst-case scenario) AOI, which is based on the results of oil spill modelling conducted by BWE. This encompasses the entirety of the Gabonese coastline.

Will any land onshore be required for the project? If so, where is this land and how much land will be needed?	The Project will only utilise existing facilities, including an existing logistics base, heliport, and waste disposal facilities. It will not require any land clearance onshore, nor the procurement of construction aggregates/materials.
Will any new roads be needed for the project?	No new access roads will be required for the project.
What vessel movements are associated with the project (e.g. number, frequency, type of vessels)?	During drilling activities there will be there will be supply vessels undertaking materials transfers between the drilling platform and the logistics base. Personnel transfers will be by helicopter. During operations there will be one vessel supporting hydrocarbon transfer operations at the FPSO and there will be supply vessel transfers between the logistics base and the FPSO and Ruche Offshore Installation (OI).
What port will be used by project-related vessels?	The existing Project logistics base is located at Port-Gentil.
Will project activities and infrastructure be visible from the shoreline? If so, what should we expect to be able to see?	The Ruche EEA is approximately 50 km offshore and project activities and infrastructure will therefore not be visible from the shoreline.
Project proponent and contractors	
Who is BWE and what is their role?	BW Energy is an exploration and production company in the oil and gas sector operating in Gabon. The Company is a subsidiary of BW Offshore, established in 2016, and forms part of the BW Group. BWE recently acquired a 73.5% operational working interest in the Dussafu Block and is the operator of the Ruche EEA.

	BWE are applying for international finance to support its activities in Gabon, including Tortue Phases 1 and 2, and Ruche Phase 1. To secure international financing, additional environmental and social studies are required to meet the requirements of the international lending institutions (banks).
Who gave BWE permission to progress with the project?	Environmental and Social Impact Assessment (ESIA) / Notice of Environmental Impact (NEI) documents have been prepared for Tortue Phase 1 and 2, and Ruche Phase 1. The first two documents have been reviewed and approved by the Gabonese Ministry for Protection of the Environment, Natural Resources, Forests, and the Sea. The Ruche Phase 1 ESIA has been submitted to the Ministry and is awaiting approval. Overall permission for BWE to progress with the project was, however, given by the General Directorate of Hydrocarbons (belonging to the Ministry of Petroleum, Gas, Hydrocarbons and Mines).
Who is RSK and what is their role?	RSK provides independent consultancy and technical services in the areas of environment, social, health and safety, engineering, and sustainability management to industrial, financial, and public-sector clients worldwide. RSK has been contracted to provide support to BWE in meeting the environmental and social requirements of the international lending institutions (banks). RSK is being supported by the in-country environmental consultancy TEREA.
Environmental and Social Impact Assessment (ESIA)	
What is an ESIA?	An Environmental and Social Impact Assessment (ESIA) is an independent scientific study that reviews environmental and social sensitivities in the baseline environment; identifies project activities (particularly emissions, discharges and wastes); and subsequently determines the potential environmental and social impacts of a project. It aims to predict impacts at an early stage in project planning and find ways to reduce adverse impacts, and enhance positive impacts, through the implementation of mitigation measures. ESIAs have been carried out for Tortue Phase 1 and Ruche Phase 1.
What is a Notice of Environmental Impact (NEI)?	In accordance with the requirements of the 'Law Relating to the Protection of the Environment in Gabon' (Article 30), some projects due to their size and relatively low ecological impact are subject to a smaller environmental impact study or a 'Notice of Environmental Impact'. This was the case for Tortue Phase 2.
Who completed the ESIAs and NEI for the project phases?	The ESIAs and NEI were completed by Enviropass, a chemical, environmental and industrial risk engineering consultancy based in Libreville.
What were the main findings of the ESIAs and NEI?	The purpose of the ESIA baseline review was to identify sensitive receptors that may be affected by project activities. The analysis of the baseline conditions included the following elements: • Biological environment • Physical environment • Socio-economic environment. Key findings included:

	• Biological / ecological context: The Tortue Phase 1 and 2 and Ruche Phase 1 projects are located in the Aquatic Reserve of the Great South of Gabon, a Marine Protected Area (MPA). Mayumba National Park is located in the coastal waters adjacent to the Ruche EEA (7.5 km between Ruche EEA boundary and national park buffer zone). • Economic context: Oil production from the Ruche EEA is a significant contribution to the national economy. The decline in national oil production observed over the past 10 years, combined with the drop in oil prices, has raised concerns about the sustainability of public resources, 53% of which are derived from oil revenues. Gabon has expectations of deep and ultra-deep offshore oil production to counter the current decline. Key potential impacts of the projects include: • Physical presence of the FPSO, Offshore Installation (OI) and subsea pipelines – disruption of other sea users due to facility safety exclusion zones; disorientation of turtles from facility lights • Project vessel movements – disruption of other sea users, risk of vessel collision with turtles / marine mammals; risk of vessel collision with third parties • Subsea pipeline laying and installation of Ruche Offshore Installation (OI) – disturbance of seabed fauna and habitats • Drilling discharges – impacts on seabed fauna and habitats from discharge of cuttings (brought up from the well bore) and drilling fluids (fluids used to cool and lubricate the drill bit) • FPSO/OI discharges – impacts on water column and marine fauna from discharge of produced water (water separated from the oil stream) • Generation of underwater noise from drilling, subsea pipeline and facility installation and vessel movements – disturbance of marine fauna • Generation of air emissions from project vessels, drilling rig power generation and well testing activities, and from power generation on the FPSO and the Offshore Installation (OI) • Accidental events – release of oil into the marine environment, potential for impacts to water column and marine fauna and flora offshore and in coastal waters / along coastline. Key mitigation measures include: • Lighting and signage on facilities, rigs and vessels; security vessel at drilling rig location; other sea users informed of project activities • Facility lighting selected to minimise impacts on turtles (e,g. green lights)

	• Project vessel speed restrictions in place • Underwater images of seabed taken before pipe laying and OI installation to identify any sensitivities • Cuttings and drilling fluids treated on rig before discharge to sea. Oil content of cuttings required to be < 1% for discharge to sea (if standard can't be met cuttings returned to shore for treatment and disposal) • Discharge of produced water only allowed if oil content < 30 mg/l (if standard can't be met cuttings returned to shore for treatment and disposal) • Security vessel at rig site will drift, rather than having engines on constantly, to reduce underwater noise • Discharges and emissions compliant with MARPOL International Convention for the Prevention of Pollution from Ships • Oil spill modelling conducted for the project. Procedures in place to reduce the likelihood of an accidental release of oil. Oil Spill Response Plan in place with measures to reduce the impact in case of an oil release.
If ESIA and NEI documents for the project have already been prepared and approved why are they being updated?	BWE is currently applying for international finance to support its activities in Gabon, including Tortue Phases 1 and 2, and Ruche Phase 1. To secure international financing, updates to the impact assessments are required to meet the additional requirements of the international lending institutions (banks).
What will the updates entail?	Additional studies include: • A Social Impact Assessment - a study of the communities that may be affected by the activities, focusing on topics such as local health, economy and livelihoods, and cultural heritage. • Critical Habitat Assessment - a study of the critical habitats that may be affected by the activities (i.e. habitats with the highest biodiversity value, that support biodiversity features which have the highest degree of irreplaceability and vulnerability). • Ecosystem Services Assessment - a study of the ecosystem services that may be affected by the activities (i.e. the benefits that people derive from the natural environment). • Cumulative Impact Assessment - a study of other projects taking place, or planned, regionally and nationally that may interact with the activities in Ruche EEA. The results of the studies and assessments will be presented in an ESIA Addendum, covering all three phases of the development, and will be publicly disclosed.
How long will it take for them to be updated?	Approximately 4 – 6 months.

Why has an international consultancy been asked to update them?	To secure international financing, updates to the impact assessments are required to meet the additional requirements of the international lending institutions (banks). RSK has extensive experience in helping companies to meet these environmental and social requirements.
Will local specialists be involved in making the updates?	TEREA, a local Gabonese environmental consulting company, will be assisting RSK in the studies. TEREA specialises in environment and sustainable management of natural resources and has considerable experience in engaging with stakeholders and carrying out fieldwork in Gabon.
What new impacts are anticipated?	Further potential impacts on communities, critical habitats, ecosystem services, and cumulative impacts (combined impacts with other projects in the area) may be identified during the additional studies.
Data collection	
What will you do with the additional data you collect? Will we get to see it?	The data we collect will be used to inform the additional studies by increasing our knowledge of the study area (with a particular emphasis on critical habitats, ecosystem services and cumulative impacts) and by understanding stakeholders' opinions and values. The ESIA Addendum report will be disclosed to the public.
Environmental impacts	
Will there be impacts on noise levels (above and below sea surface)? If so, what will they be and how will they be managed?	Underwater noise may be generated from drilling activities, subsea pipeline and facility installation, vessel movements, and operation of the FPSO. All these activities generate low-level continuous noise which may have small-scale behavioural impacts on marine fauna but is unlikely to result in injury. It is generally accepted that impulsive noise (for example that released during a seismic survey) has more impact on marine fauna. Above water noise may also be generated from the sources listed above, however, there are no sensitive receptors this far offshore in the Ruche EEA.
Will there be impacts on air quality/levels of pollution? If so, what will they be and how will they be managed?	The main sources of atmospheric emissions will be from the drilling rig power generation, well test flaring[15], and from power generation and gas flaring on the BW Adolo FPSO. BW Energy will rigorously maintain all equipment to minimise emissions and follow MARPOL Annex VI requirements (regulations to prevent air pollution from ships). Calculations of the project's greenhouse gas emissions have been made. On the Ruche OI gas separated from the oil stream will be used for power generation on the platform rather than being flared.
Will there be impacts on marine and coastal waters? If so, what will they be and how will they be managed?	A risk to marine and coastal waters from the project is an accidental oil spill. BWE has developed specific measures both to minimise the likelihood of oil spills and to ensure that appropriate spill control procedures are in place in the unlikely event that a spill does occur. Oil spill modelling has been conducted for the project and an Oil Spill Contingency Plan developed based on the results of the modelling.

[15] Well test flaring occurs during drilling and testing of oil and gas wells. This is a standard practice used to determine the types of fluids the well can produce, the pressure and flow rates of fluids and other characteristics of the underground reservoir.

How will the waste generated by the project be disposed of?	Waste generated by the project will be collected and disposed of according to BWE's Waste Management Plan. This specifies: • Segregation of wastes into different types (e.g. those for onboard incineration, those that can be discharged to sea following treatment (in accordance with MARPOL requirements), those that can be recycled, those that need to be treated and disposed of on land) • Waste storage requirements • Measures for minimising waste generation • Any hazardous waste streams transported to shore and treated and disposed of by specialised waste subcontractors.
Biodiversity impacts	
Will there be impacts on biodiversity, particularly related to the marine and coastal environment (e.g. beaches, mangroves, lagoons)? If so, how will the project manage these impacts?	Impacts on flora and fauna, particularly for protected or endangered species, have been identified as part of the ESIA process, and any significant impacts identified have had mitigation measures put in place. Mangroves and mudflats along the Mayumba coast are the most vulnerable sites to a major oil spill and will require the mobilization of pollution response equipment as soon as possible in the event of a spill. BWE is very aware of the environmental sensitivity of this area, with its marine protected areas and adjacent coastline, including the late Mayumba sandy beaches, and marine park buffer zones. A Critical Habitat Assessment (CHA) will be undertaken as part of the updated ESIA/NEI, and will further identify potential impacts on critical habitat, and recommend measures to address these, including, if necessary, how the project will achieve no net loss/net gain for biodiversity.
There are lots of important species and habitats related to Gabon's marine and coastal environment. How will these be affected by the project? What measures will be taken to protect them and ensure that no damage is done to such species and habitats?	Impacts on flora and fauna, particularly for protected or endangered species, have been identified as part of the ESIA process and any significant impacts identified have had mitigation measures put in place. In recognition of the ecological importance of Gabon's marine and coastal environment, a CHA is being undertaken to develop a full understanding of how species and habitats of conservation importance (including rare, threatened, endemic or range restricted species, or significant numbers of migratory and congregatory species) may be affected by the project. Based on the impacts identified, the CHA will recommend measures to protect the marine and coastal environment/associated biodiversity, in line with GIIP.
Will Mayumba National Park be affected by the project? If so, in what way and how will potential impacts be managed?	Impacts on Mayumba National Park are not anticipated from normal routine operations in the Ruch EEA. Only in the event of an accidental release of oil are significant impacts predicted. BWE has developed specific measures both to minimise the likelihood of oil spills from project activities, and to ensure that appropriate spill control procedures are in place in the unlikely event that a spill does occur. Spill response will prioritise protection of sensitive coastal areas.

Will there be any impacts on critical habitats? If so, what will they be and how will they be managed?	As part of the ESIA, a Critical Habitat screening process was undertaken to determine which species and habitats are likely to be found in the project area. Further information is now required about those species and habitats identified during the screening and their likely presence within the project area. This information will be used to update the critical habitat screening, inform the critical habitat assessment to understand potential impacts on critical habitat, and devise appropriate and specific mitigation measures to reduce impacts of the project through the management and monitoring plans.
Socio-economic impacts	
Will project activities damage our fishing vessels and equipment? If so, how will people be compensated for any damages?	There will be an increase in vessel traffic during the project due to construction vessels installing the subsea pipelines and project vessels supporting the drilling and operational phases. There will also be mobilisation of the Hibiscus Alpha OI. However, as the Ruche EEA is approximately 50 km offshore, the focus of these activities will be outside the main artisanal and tuna fishing grounds. The project will create safety exclusion zones around key installations in which other vessels will be prohibited from entering without authorisation. The safety exclusion zone around the Ruche Offshore Installation (OI) and the FPSO will be a radius of 1 km. The safety exclusion zone around the mobile drilling rig will be 500 m. However, these safety zones do not represent a significant footprint in relation to the extent of the remaining ocean area. The potential impacts of the project on fishing vessels and equipment will be given full consideration during the SIA and recommended mitigation measures will be considered. These measures will be developed, as appropriate, to ensure that stakeholders are compensated for any damages/losses where they occur.
Will there be any impacts on fishing as a result of the project? If so, what will they be and how will they be managed? How will people be compensated for any loss of income related to fishing?	The site is located approximately 50 km from the south coast of Mayumba and is largely outside the zones authorised for artisanal fisheries and tuna fisheries[16]. As a result, it is understood that there are no interactions between artisanal fisheries and tuna fisheries and the project under normal operating conditions. Industrial fishing boats in Gabon are allowed to fish in the area where the project is located, although there is a prohibition of fishing in the safety exclusion zones around the oil facilities. In the unlikely event of an oil spill, offshore and coastal waters could be impacted along the Gabonese coast and this could have a negative impact on fishing revenue. BWE has developed an Oil Spill Response Plan in the case of accidental oil spill with response measures to minimise impacts on the environment and fisheries. A SIA is being undertaken in order to develop a full understanding of any socio-economic impacts. Based on the impacts identified, the SIA will recommend measures to ensure that stakeholders are compensated for any damage/losses where they occur.
Will there be any impacts on the natural resources that we harvest? If so, what will they be and how will they	Under normal routine operations there should be no impact on resource harvesting. In the unlikely event of an oil spill, it could affect coastal waters and the shoreline with the potential for negative impacts on resource

[16] Tuna fishing zone 22-44 km from coast.

be managed? How will people be compensated for any loss of natural resources?	harvesting. BWE has developed an Oil Spill Response Plan in the case of accidental oil spill with response measures to minimise impacts on the environment and community health. Any potential impacts on natural resource harvesting in the study area will be considered during the SIA, and measures will be recommended to address these to ensure that stakeholders are compensated for any damages/losses where they occur.
Will there be any impacts on tourism and recreation as a result of the project? If so, what will they be and how will they be managed? How will people be compensated for any loss of tourism-related income?	Under normal routine operations there should be no impacts on tourism from the project due to the fact that it is 50 km from the shore. In the unlikely event of an oil spill, this could affect coastal waters and the shoreline and have a negative impact on tourism. BWE has developed an Oil Spill Response Plan in the case of accidental oil spill with response measures to minimise impacts on the environment. Any key tourism areas will be a priority for protection in a spill event.
Will the project lead to impacts on health? If so, how will health be affected and how will health-related impacts be managed?	Under normal routine operations there should be no impact on community health from the project. In the unlikely event of an oil spill, it could affect coastal waters and the shoreline with the potential for negative impacts on the health of people coming in contact with the oil, or ingesting tainted food (e.g. fish). BWE has developed an Oil Spill Response Plan with response measures to minimise impacts on the environment and community health. Any potential impacts on health, including the current COVID-19 pandemic, will be considered during the SIA, and mitigation measures developed.
Cultural heritage impacts	
Will there be impacts on cultural heritage (e.g. sacred, spiritual, religious, archaeological sites)? If so, how will the project manage these impacts?	Any potential impacts on cultural heritage will be considered during the SIA, and measures will be recommended to ensure that these are mitigated.
Project benefits	
What will the project bring us in terms of local development?	BWE will contribute to local development through the generation of employment and procurement opportunities, alongside the implementation of corporate social responsibility programmes (see answers below).
Will there be an opportunity for local people to be employed by the project? If so, how many opportunities will there be and what skills will be required? Will jobs be available for skilled, semi-skilled and unskilled people?	Yes, there will be an opportunity for local people to be employed. Currently, there are estimated 426 employees involved in BWE's activities in Gabon. The upcoming Ruche Phase 1 will bring an additional number of positions (approximately 40), which will require skilled, semi-skilled, and unskilled personnel.

Will any training opportunities be available to make sure that local people will have access to skilled, semi-skilled and skilled positions?	Yes, through the BWE nationalisation programme and apprenticeship programmes.
Will BWE buy any goods/services from local businesses?	Yes; BWE currently procures goods and services from 73 suppliers in Gabon and will continue to work with local businesses, provided requisite standards, delivery quantities and timescales can be met.
What plans are in place for corporate social responsibility programmes?	BWE has undertaken a number of corporate social responsibility programmes in recent years. In 2019/2020, for example, tutoring was provided for high school students to prepare them for their final examinations, over 1,000 solar backpacks were distributed and assistance with the installation of solar streetlighting was provided in Mayumba. The plans in 2021 are to renovate the University of Omar Bongo and Technical Professional School of Omar Bongo and assist with road renovations in the Owendo area. Future projects which are currently being considered, but are yet to be confirmed, include the donation of global positioning system (GPS) equipment to fishermen in Mayumba to help them avoid entering protected fishing areas near the FPSO, alongside further tutoring of high school students to prepare them for their final examinations.
Health and safety	
Are there any safety issues or concerns related to the project that we should know about? How will these issues or concerns be managed?	There are no specific safety concerns onshore. Safety concerns related to the offshore environment will be managed in accordance with an Emergency Response Plan, Waste Management Plan and Oil Spill Contingency Plan. In addition, a grievance management procedure has been established to enable you to report safety-related concerns, using the following contact details: Tel: +241 77 29 54 03 / +241 77 83 82 82 Email : geraldine.ewomba@bwenergy.no / guy-marcel.ndziami@bwenergy.no
How will risks related to an oil spill be managed? What measures will be taken in the event of an oil spill to minimise impacts on the environment, biodiversity, people, and their livelihoods?	Oil spill modelling has been conducted for the project, this information has informed the project Oil Spill Contingency Plan, as described above.
How will risks related to vessel collisions (e.g. involving project vessels and artisanal fishing vessels)	Safety exclusion zones will be in place around the FPSO and Ruche OI (1 km diameter) and drilling rig (500 m diameter) and only authorised vessels will be allowed to enter these zones. These safety zones will be monitored by security vessels. All BWE facilities and vessels will comply with requirements for lighting, signage and

be managed? What measures will be taken in the event of a collision to minimise impacts on people and their livelihoods?	communication equipment. Speed restrictions will be in place for project vessels. This will reduce the risk of vessel collisions.
Consultation and feedback	
How will our views be considered during the update of the ESIAs and NEI?	RSK and TEREA will ensure that any concerns raised during the consultation process are documented and considered during the process of developing the additional studies.
When will we get formal documentation about the results of the updates to the ESIAs and NEI?	The data collected will be used to compile a number of reports, namely a Social Impact Assessment, Critical Habitat Assessment, Ecosystems Services Assessment, and Cumulative Impact Assessment. The findings of these reports will be compiled into an ESIA Addendum that will be publicly disclosed.
How will our questions and concerns be answered?	During the consultation meetings you will have the opportunity to ask questions and express your concerns to the TEREA field team. We will try to answer these questions verbally at the time of the meeting; however, in some cases we may have to clarify and respond at a later date. BWE welcomes feedback at any stage of the project, so please get in touch should you wish to raise any questions, concerns and grievances. You can get in touch with BWE by using any of the following: Tel: +241 77 29 54 03 / +241 77 83 82 82 Email : geraldine.ewomba@bwenergy.no / guy-marcel.ndziami@bwenergy.no
Why are you visiting our community to discuss the project? What about other communities in the area?	Engagement with local communities and other impacted stakeholders has started and will continue throughout the duration of the process of conducting the additional studies.
Who do we contact if we have any grievances? Will you be the team handling grievances, or will there be new people for us to talk to going forwards?	A grievance management procedure has been established to provide you with an easy means of reporting any issues related to Tortue Phases 1 and 2, and Ruche Phase 1, as well as the impact assessment update studies. You can get in touch with BWE by using any of the following: Tel: +241 77 29 54 03 / +241 77 83 82 82 Email : geraldine.ewomba@bwenergy.no / guy-marcel.ndziami@bwenergy.no
Next steps	
What happens next in relation to the project?	The operation of Tortue Phase 1 will continue; Tortue Phase 2 and Ruche Phase 1 will proceed to execution. Meanwhile, BWE will work to identify additional development opportunities in Gabon.
What happens next in relation to the ESIA and NEI updates?	The information collected during stakeholder engagement will inform the additional reports being developed by RSK. The information will be collated into an ESIA Addendum that will be publicly disclosed.

Will you or other people related to the project be visiting us again?	A Stakeholder Engagement Plan is in the process of being developed for BWE's ongoing operations in Gabon; under the Plan, BWE will continue to engage with stakeholders affected by the project.

APPENDIX 14 STAKEHOLDER ENGAGEMENT RECORDING TEMPLATES

BW ENERGY Date : Lieu de la reunion: RSK TEREA

Liste de présence

Nom	Prénoms	Sexe	Structure/village	Fonction/Profession	Téléphone/email	Signature

GENERAL INFORMATION ABOUT THE MEETING	
Meeting ID:	**Date:**
Easting (X):	**Northing (Y):**
City/town/village *where the meeting is taking place*:	
Département *in which the city/town/village is located*:	
Province *in which the Département is located*:	
Number of attendees:	
Notes/reasons for interacting:	

Provide the following information for "key" stakeholders (e.g. village executive officer) and those who have raised an intervention					
First name	**Last name**	**Gender (M/F)**	**Disability (Y/N)**	**Position within organisation**	**Name of organisation**

SUMMARY OF THE DISCUSSION				
Issues/questions	Stakeholder (first and last names)	Responses	Response by	Follow-up (Y/N?)

APPENDIX 15 ITINERARY FOR ENGAGEMENT

Table A2: Stakeholder engagement itinerary

Date	Location	Activity
Libreville		
31/03/2021	Libreville	Individual meeting with ANPN and Gabon Bleu
02/04/2021	Libreville	Individual meeting with DGEPN
29/052021	Libreville	Individual meeting with DGPA
29/06/2021	Libreville	Individual meeting with DGFAP
01/07/2021	Libreville	Individual meeting with WWF
Port-Gentil		
19/05/2021	Port-Gentil	Meeting with the Governor of Ogooué-Maritime province
19/05/2021	Port-Gentil	Provincial Directorate of the Merchant Marine of Ogooué-Maritime Province Office of Ports and Harbours of Gabon (OPRAG) Port-Gentil Artisanal Fishing Support Center (CAPAG
20/05/2021	Port-Gentil	Provincial Directorate for Fisheries and Aquaculture of Ogooué-Maritime Province Fishing sector Cooperatives Provincial Directorate of the Merchant Marine of Ogooué-Maritime Province (2nd meeting)
Tchibanga		
26/04/2021	Tchibanga	Meeting with the Governor of Nyanga province
In and near Mayumba		

Date	Location	Activity
26/04/2021	Mayumba	KII with tourism businesses
27/04/2021	Mayumba	Meeting with the Basse Banio Prefect and departmental board, Mayor, police company, police brigade and chiefs of quartiers and nearby villages Community meeting followed by FGD with Local leaders, women and Fisherfolk in Madounda (Quartier of Mayumba)
28/04/2021	Ndindi/Malembé	Meeting with Haute Banio Prefect, departmental board and chiefs of nearby villages Community meeting followed by FGD with Local leaders, women and Fisherfolk in Malembé
29/04/2021	Mambi/Mayumba	Community meeting followed by FGD with Local leaders, women and Fisherfolk in Mambi KII with Local businesses, health staff, fish wholesalers and sand miners and other key informants
30/04/2021	Mayumba	Provincial Directorate of the Merchant Marine Provincial Directorate for Fisheries and Aquaculture Meeting with Association of Fishermen and Resellers of Oysters of Mayumba (APRHM) Meeting with Bana fishing
01/05/2021	Mayumba	Community meeting followed by FGD with Local leaders, women and Fisherfolk in Tchiole-Ndembet (Quartier of Mayumba) KII with Local businesses, health staff, fish wholesalers and sand miners and other key informants

BW Energy Gabon

Third-party Grievance Management Procedure

Dussafu Block Development, Gabon

80834

JULY 2021

RSK GENERAL NOTES

Project No: 80834

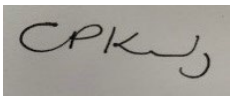
Title: Third-party Grievance Management Procedure – Dussafu Block, Gabon

Client: BW Energy Gabon

Date: 09 July 2021

Office: Helsby

Status: Rev01

Author	Zhanar Zhakeyeva	**Technical reviewer**	Corinne Kennedy
Signature		Signature	
Date:	09/07/2021	Date:	09/07/2021

Project manager	Johan van der Walt
Signature	
Date:	09/07/2021

RSK Environment Ltd (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of RSK and the party for whom it was prepared.

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

CONTENTS

ABBREVIATIONS

Abbreviation	Full description
BWE Gabon	BW Energy Gabon
TGMP	Third-party Grievance Management Procedure
FPSO	Floating production, storage, and offloading unit
MER	Manager External Relations
LLO	Local Liaison Officer
GM	General Manager BWE Gabon

1 INTRODUCTION

1.1 Background and scope

BW Energy Gabon (BWE Gabon) holds the majority interest in the Dussafu Block, located off the coast of Gabon adjacent to Basse-Banio Department (Nyanga Province).

BWE Gabon seeks to build strong relationships with stakeholders and to manage the impacts of its business activities on affected communities via a range of stakeholder engagement, compliance, and impact mitigation processes.

BWE Gabon developed this formal grievance management process to address public and community concerns, complaints, and requests related to its operations. To ensure that stakeholders are provided such an opportunity through a structured process, this Third-party Grievance Management Procedure (TGMP) has been compiled.

The TGMP is applicable to BWE Gabon's current and planned activities related to the Dussafu Block (herein referred to as the "project"). The key project components are:

- The Tortue Field (Tortue Phase 1) which currently produces approximately 12,500 barrels of oil per day (bopd) from two subsea wells. These wells are connected to the BW Adolo floating production, storage, and offloading (FPSO) unit (located close to Tortue Field) by subsea pipelines.
- The second phase of the development at Tortue Field (Tortue Phase 2) is currently under development and includes four additional subsea wells and the installation of subsea pipelines to connect the wells to the BW Adolo FPSO.
- The Ruche Phase 1, which is currently at the design phase, will consist of six production wells (in the Ruche and Hibiscus Fields). A manned Offshore Installation will be established to support the on-deck wellheads, and a subsea pipeline will connect this installation to the BW Adolo FPSO.

The TGMP outlines the processes for managing third-party grievances by BWE Gabon. Worker grievances shall be managed by a separate grievance procedure and are outside the scope of the TGMP.

1.2 Purpose and objectives

The purpose of the TGMP is to describe the steps to address, manage, resolve, and document grievances raised by external stakeholders in relation to BWE Gabon's activities. Grievances raised by external stakeholders need to be managed through a transparent process which is:

- culturally appropriate;
- understandable;
- acceptable;
- at no cost to; and
- without retribution for stakeholders.

The TGMP describes the scope, specifies roles and responsibilities, and details the steps in the grievance management process.

This TGMP has the following objectives:

- establishing a prompt, consistent, and fair mechanism for receiving, investigating, and responding to grievances from stakeholders, community members, and other third parties;
- ensuring the proper documentation of grievances and any corrective actions that are taken; and
- contributing to continuous improvement in social performance through the analysis of trends, and the preparation and dissemination of lessons learned.

This TGMP will not be published, as it's for internal BWE Gabon use. Relevant contact details (see Section Appendix 1) will be published as part of project related information to inform stakeholders of the vehicles through which communication with BWE Gabon can take place.

All received enquiries will be reviewed and addressed, regardless of whether they stem from actual issues or from perceptions, or whether the complainant is named or anonymous. Any stakeholder who considers himself or herself affected by BWE Gabon project activities will have access to the public process set out in the TGMP. The TGMP is a company managed redress mechanism for project stakeholders and communities and shall not be considered as a replacement for other forms of stakeholder engagement or other non-legal and legal redress mechanisms available to external parties at their choice. Confidentiality will be respected at all times.

BWE Gabon will endeavour to resolve any grievances with complainants in good faith, transparently, and in a timely manner. It is understood that complainants may refer the grievance to an alternative third-party body (the national judicial system, an arbitrator, or other available mechanisms of alternative dispute resolution) at any point in the process.

The TGMP is a dynamic document and may be changed and updated based on experience and feedback from stakeholders, audit findings, and lessons learned.

1.3 Definitions

For the purposes of the TGMP, the terms grievance, complaint, issue, and concern are interchangeable and refer to statements of dissatisfaction with any aspect of the project's activities (including both actual issues and perceptions) that have already happened, are happening or may happen in the future.

A request, however, is normally a neutral statement and indicates that the stakeholder is asking for information or assistance but implies nothing about their attitude to the project. Requests for information, assistance, or support which are not expressions of dissatisfaction will be recorded, tracked, and managed by Manager External Relations (MER). They are not considered further in this TGMP.

2 ROLES AND RESPONSIBILITIES

This section outlines key personnel involved in the execution of the TGMP, as detailed in Table 1 below. Please note that at the time of writing, the Local Liaison Officer (LLO) position had been created but the recruitment process was on hold due to COVID-19 related delays. However, the processes in the TGMP are written to include the role of the LLO.

Table 1: Roles and responsibilities

Role	Responsibility
Head of Sustainability BWE	Accountable for ensuring that a grievance management process is in place. Ensuring that the GMP is updated regularly and remains relevant.
General Manager BWE Gabon (GM)	Overall accountability for project implementation, including grievance management. Approving and issuing compensation payments (where applicable).
Manager External Relations (MER)	Facilitating timely resolution of grievances. Providing capacity-building support to Local Liaison Officer. Advising on specialist engagement for environmental and social grievances. Analysing trends and preparing reports on the grievance management progress.
Local Liaison Officer (LLO)	The LLO is the direct interface between BWE Gabon and communities, and will be responsible for the following: • Communicating the TGMP to communities. • Providing feedback to the MER on concerns raised by the community. • Providing feedback to the community on project developments, concerns raised, or important decisions taken. • Identifying potential grievances or project risks / opportunities. • Assisting the MER with the resolution of grievances lodged. • Grievance reporting and resolution monitoring.

3 THIRD-PARTY GRIEVANCE MANAGEMENT PROCESS: OVERVIEW

3.1 Grievance management steps

The TGMP will be published on the BWE Gabon website, through posters and leaflets in local communities, and via the LLO during meetings and presentations with stakeholders.

3.1.1 Lodging a grievance

A formal grievance may be lodged through direct reporting to the LLO, by mail, or by email. All BWE staff are to be informed that they must pass all submissions that could be considered as a grievance to the LLO and/or MER as soon as possible after they are received. Community and traditional leaders and government departments will also be advised to pass any complaints they receive on to the LLO and/or the MER, who will be properly trained to process these further.

The LLO will assist community members in recording grievances on a standard Grievance Form, and will ensure that the name of the complainant, the date recorded, and the name of the person that received the grievance are noted. A template Grievance Form is provided in Appendix 2.

Grievances may be submitted in French.

A complainant submitting a grievance may request that their identity is kept confidential from all outside of the BWE Gabon team, unless they represent an organisation or required by law. The request for confidentiality and the reasons for the request must be submitted with the grievance. BWE Gabon will use reasonable efforts to maintain the requested confidentiality.

3.1.2 Confirmation of receipt

For grievances received in the field, the LLO will verbally acknowledge the receipt of the grievance and provide a copy of the Grievance Form to the complainant. For grievances received through email or post, the MER will work to issue an acknowledgement receipt form within seven (7) working days of receiving the grievance, using reasonable efforts to do so in the same form of communication that the grievance was received. The acknowledgment receipt will explain the appropriate process to be followed to resolve the grievance. If possible, the MER and/or LLO will make follow up calls to ensure the complainants understand the grievance process to be followed.

3.1.3 Verification

The MER and LLO will verify that the grievance is related to the BWE Gabon activities. If the grievance is not related to the BWE Gabon project, the MER will reject the complaint and send a formal letter to the complainant explaining the reasons for the rejection.

3.1.4 Register grievances in grievance register

The LLO will register all grievances. Each case will receive a unique registration number and be included into the grievance register (Grievance Log), as well as the Grievance Database where the status of grievances will be monitored (see Appendix 3).

3.1.5 Categorisation

The MER, with support of LLO, will analyse each grievance according to its severity and category or general subject. Further details are provided in Sections 3.4.1 and 3.4.2.

3.1.6 Investigating grievances

The MER, with support from the LLO, will investigate each grievance, interview witnesses, and meet with relevant project department heads as applicable. Where possible, grievances will be finalised and resolved within 30 days of receipt. If financial compensation is required, the monetary values will be determined. The complainant may be contacted during this time if any clarification of issues is required.

3.1.7 Grievance resolution and sign-off

Once a grievance has been investigated, a letter will be sent to the complainant, explaining the outcome of the investigation and any proposed course of action that may be required to resolve the grievance. The MER or LLO will also contact the complainant in person, if this is required, and explain the results of the investigation and the proposed course of action. If the complainant is satisfied that the complaint has been resolved, he/she will be asked to sign a statement confirming that the complaint has been resolved.

If the complainant is not satisfied, a re-assessment may be undertaken. New information may be sought, and the situation may be escalated to an internal grievance committee. The internal grievance committee will be called on an ad hoc basis to review grievances where the complainant remains dissatisfied. Participation will include the Country Manager, BWE Head of Sustainability and MER. The complainant will be informed of the outcome by letter.

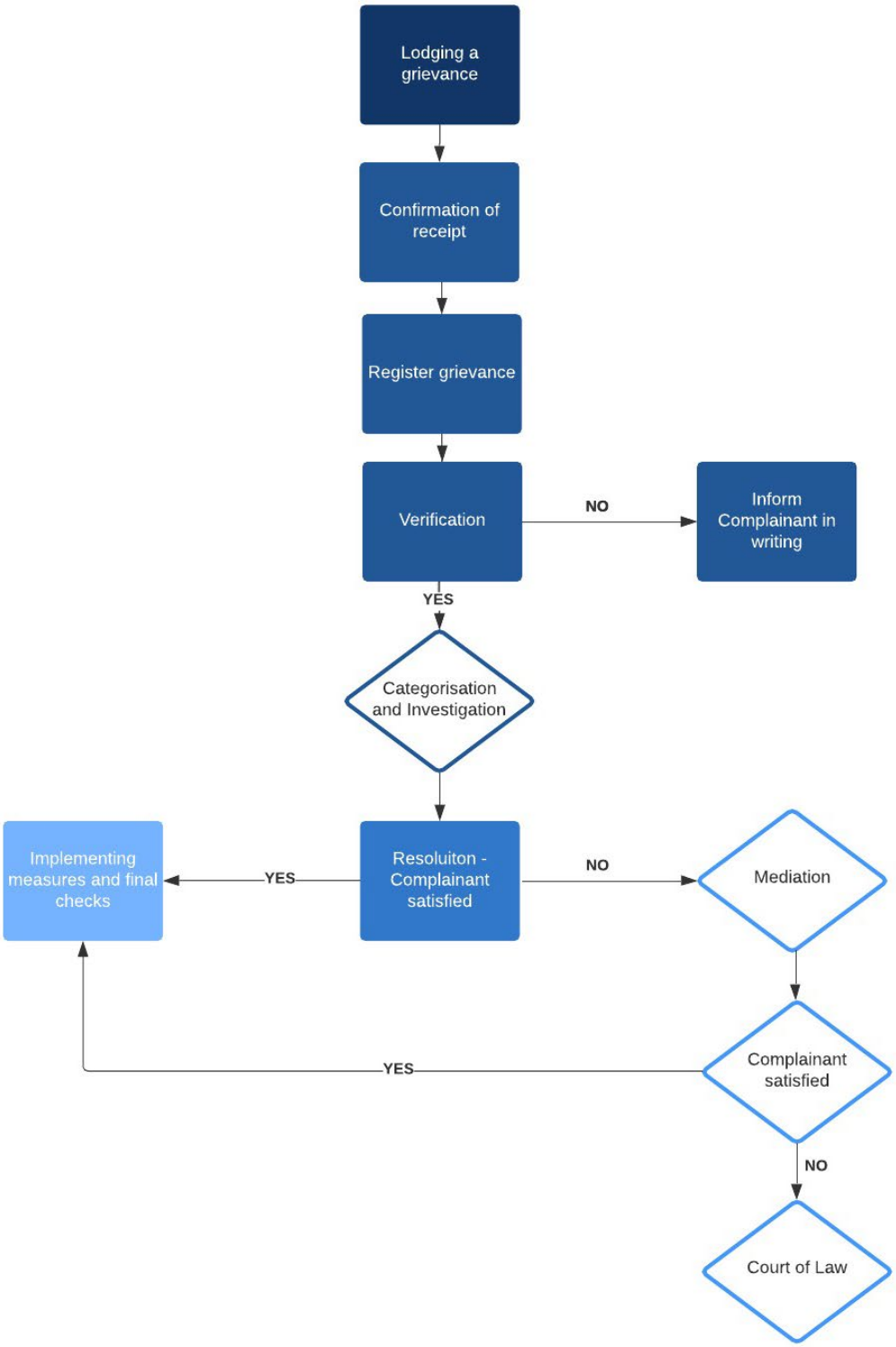
In the event that the complainant remains dissatisfied, they should be advised that the opportunity to seek legal redress remains open to them.

3.1.8 Implementing remediation measures and final checks

As soon as the complainant has been consulted and agreed with the proposed remediation measures, implementation will begin.

If financial compensation is part of remediating the grievance, payments will be made within a maximum 90-day period after the agreement of the actions to resolve the grievance, where practical (for example, the complainant may not have a bank account).

3.2 Grievance workflow



3.3 Grievance assessment

3.3.1 Severity level

In order to prioritise resolution, grievances will be categorised according to three severity levels: low, medium, and high, as outlined in Table 2 below. The overall severity level assigned to the grievance is the highest level when assessed against each of the consequences.

Categorization of severity may partially be determined by complainant vulnerability[1]; similar effects may impact differently on vulnerable and non-vulnerable households.

Table 2: Grievance severity matrix

Consequences	Consequence/ Severity		
	Low	Medium	High
Social and environmental*	Minimal impact, likely to have little real effect. Mitigation is easily achieved; compensation unlikely to be necessary.	Impact is real but not substantial or long-lasting. Mitigation is both feasible and easily achieved; compensation likely to be moderate.	Significant impact and potentially long-lasting. Mitigation is likely to be difficult: expensive, time consuming and requiring difficult negotiation; compensation may be significant.
Corporate reputation	No impact	Local or moderate reputation damage	Significant loss of shareholder/ public trust
Project schedule	No delay	Moderate delays	Significant disruption
Input required for resolution	Local: in-field discussion with complainant	Local/national: may require technical input from relevant work stream and Project Manager decision	Project: may require Corporate level input and decision- making
Effect on construction and operations	No effect	May require some limited or local adjustment in construction planning and operations	May require substantial or widespread change in construction planning and operations
* Health, safety, security, livelihoods, access to services, lifestyle, community cohesion, environmental quality, vulnerable people			

[1] Vulnerable status may stem from an individual's or group's race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status, such as gender, age, ethnicity, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

3.3.2 Grievance categories

The following grievance categories are proposed as a guide and are not definitive. Correct assignment of the grievance category ensures that each grievance is appropriately investigated by the relevant work-stream. The MER shall apply professional judgement in assigning new grievances to an appropriate category.

- **Construction**: grievances resulting from project construction activities.
- **Legal and compliance:** grievances with legal ramifications for BWE Gabon, and those alleging breaches of BWE Gabon's code of conduct, anti-bribery, and ethical behaviour commitments.
- **Social disturbance**: grievances resulting from unfavourable interactions between BWE Gabon or contractor employees and external third parties.
- **Community safety and security:** grievances resulting from transport noise, project traffic, site safety risks for general public, and project security personnel behaviour.
- **Cultural heritage:** grievances on the topic of cultural heritage.
- **HSSE incidents**: any event which leads to or has the potential to lead to injury, loss of life, or damage to assets or to the environment. HSSE matters shall be managed by a separate grievance procedure and are outside the scope of the TGMP.
- **Environment**: grievances resulting from activities deemed detrimental to the local environment, ecosystem services, and biodiversity.
- **Employment**: grievances resulting from the claims of unfair or non-transparent recruitment practices by BWE Gabon or the construction contractors, alleged by the external third party. As indicated in Section 1.1, worker grievances shall be managed by a separate grievance procedure and are outside the scope of the TGMP.
- **Stakeholder Engagement**: grievances resulting from a lack of stakeholder consultation, or a general lack of information for community stakeholders.
- **Community investment**: grievances on the subject of community investment (whether requests for or implementation thereof).

3.4 Timeframes

The following timeframes will be targeted, where feasible, but may not be met in the event of complex grievances or extenuating circumstances.

Table 3: Applicable timeframes

Action	Timeframe	Responsible party
Register grievance in BWE Gabon grievance log	Within 2 working days of receipt	LLO / MER
Acknowledge grievance	Within 7 working days of receipt	LLO / MER
Issue grievance rejection letter (if required)	Within 10 working days of receipt	LLO / MER
Issue grievance feedback explaining time required for	Within 15 working days of receipt	LLO / MER

Action	Timeframe	Responsible party
resolution and on-going progress (if not yet resolved)		
Issue grievance resolution letter	Within 30 working days of receipt and on agreement of grievance remediation action	LLO / MER
Monitor implementation of agreed resolution actions	To be agreed as part of resolution letter (depends on severity level)	LLO / MER
Approve and issue compensation payments	60 days after signing agreement	General Manager, BWE Gabon

4 MONITORING, REPORTING AND REVIEWS

BWE Gabon is committed to preventing the recurrence of grievances derived from its business activities and operations. Therefore, BWE Gabon will periodically review the TGMP and its processes to ensure that the resolution process is working efficiently and produces effective outcomes.

Grievance management will be integrated into the monitoring, reporting and audit systems of the environment and social management system. The key performance indicators outlined in Table 5 will be used in the preparation of periodic internal reports, as appropriate. An annual internal grievance audit will take place. The regular grievance reporting and analysis will inform revisions to the TGMP.

Table 5: Third-party grievance management key performance indicators

Commitment	Indicator (the target is 100%)
Efficiency (Timely resolution)	▪ Total number and percentage of grievances received, logged, acknowledged, processed, resolved, and closed within the set time frame ▪ Number and percentage of grievances closed versus open ▪ Number and percentage of outstanding non-resolved grievances
Trends (Quantitative data)	▪ Number and percentage of grievances received per category ▪ Number and percentage of grievances received per severity level ▪ Number and percentage of grievances resolved versus rejected ▪ Number and percentage of grievances per location
Effectiveness (Awareness, usage, satisfaction of complainants)	▪ Number and percentage of stakeholders satisfied with resolution ▪ Number and percentage of unresolved grievances escalating into legal cases
Continuous improvement (Commitment to integrate procedural lessons learned)	▪ Qualitative indicators shall be reported monthly and include root cause analysis, specific case examples, and lessons learned

5 CONFIDENTIALITY

5.1 Duty of confidentiality

BWE Gabon is committed to protecting the identity of the complainant and to handling personal information in accordance with applicable legal requirements. This duty extends to all employees or representatives of BWE Gabon and its contractors who participate in the grievance management process.

Information about a complainant will be shared within BWE Gabon on a need-to-know basis and only to the extent necessary to complete a step under this TGMP. BWE Gabon will not share personal information with third parties except in accordance with its privacy policy unless required to do so by law or authorised by the complainant.

5.2 Personal data

Personal data will be managed within BWE Gabon's Data Privacy Policy as incorporated in its Code of Ethics and Business Conduct Policy.

5.3 Conflict of interest

A conflict of interests exists where there is a divergence between the interests of a BWE Gabon employee or contractor and his or her responsibilities under the TGMP, such that an independent observer might reasonably question whether the actions of that person are influenced by his or her own interests.

The TGMP seeks to manage potential conflicts of interest by segregating the roles and responsibilities of individuals involved in the grievance management process and avoiding placing individuals in a position where conflicts could be perceived to arise. When a grievance relates to a specific BWE Gabon contractor or employee, that person will not play a role in the grievance management process.

APPENDIX 1: CONTACT DETAILS

To ensure that all external stakeholders are aware of how to access project-related information or know how to submit a grievance, the following grievance submission details will be made available:

Grievance Submission: BWE Gabon

Email: : *An email address such as info@bwenergy.no to be created for this purpose*

Postal address: BW Energy Gabon S.A., Boulevard du Bord de Mer, Immeuble Bord de Mer, 3eme étage, BP23771 Libreville, Gabon.

Phone number: *A phone number to be included for this purpose*

APPENDIX 2: GRIEVANCE FORM

Grievance Submission Form (External/Third party) (To be filled out by complainant and, if necessary, completed with assistance from BWE representative			
Full name of complainant: If the complaint is filed for another person, please provide their names and contact details.	First Name/Last Name Gender: Home address: Telephone number: Email:		
Complainant confidentiality:	I request BWE Gabon not to disclose my identity without my consent: I wish to raise my grievance anonymously:		Yes/No Yes/No
Preferred language:			
Grievance details:	Date of activity/incident		DD/MM/YYYY
Description of incident: What happened? When? How? Why? Who did it happen to? What is the result of the problem? What would you like to see happen next? (Please use additional sheets if necessary)			
Frequency/Status of incident:	▪ One-time incident/grievance ▪ On-going ▪ Recurring: How many times and when and reason?		
Evidence and/or supporting documentation:			
Complainant signature:			
Date of submission (DD/MM/YYYY)			
Consent to personal data processing and sharing	Yes	No	

Formulaire de soumission de grief (externe / tiers) (À remplir par le plaignant et, si nécessaire, complété avec l'aide du représentant de BWE)			
Nom complet du plaignant : Si la plainte est déposée pour une autre personne, veuillez indiquer son nom et ses coordonnées.	Prénom/nom de famille : Genre : Adresse du domicile : Numéro de téléphone : Courriel :		
Confidentialité du plaignant :	Je demande à BWE Gabon de ne pas divulguer mon identité sans mon consentement : Je souhaite soulever mon grief de manière anonyme :		Oui/Non Oui/Non
Langue préférée :			
Détails du grief :	Date de l'activité/de l'incident		JJ/MM/AAAA
Description de l'incident : Que s'est-il passé ? Quand ? Comment ? Pourquoi ? À qui est-ce arrivé ? Quel est le résultat du problème ? Que voudriez-vous qu'il se passe ensuite ? (Veuillez utiliser des feuilles supplémentaires si nécessaire)			
Fréquence/État de l'incident :	▪ Incident/grief ponctuel ▪ En cours ▪ Récurrent : combien de fois et quand et pourquoi ?		
Preuve et/ou pièces justificatives :			
Signature du plaignant :			
Date de soumission (JJ/MM/AAAA)			
Consentement au traitement et au partage des données personnelles	Oui	Non	

APPENDIX 3: GRIEVANCE REGISTER

Example of the third-party grievance register (grievance log)

Grievance ID	Date of lodgement	Method of lodgement	Location	Date of receipt/ acknowledgement sent	Verification	Category	Severity	Investigation steps	Accountability	Closure date	Resolution letter data	Stakeholder satisfied with outcome	Escalation to grievance committee

LOCAL STAKEHOLDER ENGAGEMENT INPUT TO BWE'S EMERGENCY / OIL SPILL RESPONSE PLANS

CONTENTS

1. BACKGROUND AND SCOPE

This appendix outlines local level stakeholder engagement to be carried out in case of an environmental incident associated with BWE Gabon's activities. This information will be incorporated into BWE's Emergency Response Plans (ERP) / Oil Spill Contingency Plan (OSCP) as appropriate at their next update.

1.1 Scope

The following accidental event scenarios are discussed in the ESIA Addendum (Chapter 8 – Social Impact Assessment):

- Accidental release of hydrocarbons
- Accidental introduction of alien invasive species (AIS)
- Project vessel interactions with fishing vessels / gear
- Road traffic accidents arising from increased traffic to logistics base.

This appendix considers only the local level stakeholder engagement required following an accidental release of hydrocarbons and is limited to local government at department level as well as communities. It is understood that BWE Gabon will address engagement at national and provincial government levels required following an accidental release of hydrocarbons in their ERP / OSCP update. This will include, but not be limited to, the statutory notification of Direction Générale des Hydrocarbures (DGH) and the Centre National Anti-Pollution (CNAP). It is also assumed that BWE Gabon will address engagement required with deep sea / industrial fisheries groups, and any engagement required with industrial / oil and gas facilities located along the coast, in their higher-level ERP / OSCP update.

The accidental release of AIS would necessitate only government level engagement and is described in the Project-specific Alien Invasive Species Management Plan, see Appendix 11B of ESIA Addendum.

Management of any Project vessel interactions with fishing vessels / gear would be addressed through BWE's Third-Party Grievance Management Procedure (TPGMP), see Appendix 11D of ESIA Addendum.

A road traffic accident associated with the Project would only necessitate dialogue with the individuals involved, rather than broader stakeholder engagement.

2. ENVIRONMENTAL INCIDENT SCENARIOS AND IMPACTS ON LOCAL LEVEL STAKEHOLDERS

2.1 Incident scenarios

As detailed in the ESIA Addendum, BWE has an Oil Spill Contingency Plan (OSCP) in place for the Ruche Field Development, that is aligned with the National Oil Contingency Plan of Gabon (NOCPG), and details Tier 1, 2, and 3 responses. Definitions of these tiers are provided in Table 1. The tier assessment system for determining the severity of the spill and the tier level is provided in Figure 1.

Table 1: BWE's tiered response classifications

Response	Situation
Tier 1	A situation where the emergency response is within the control and capability of the Emergency Response Team (ERT) with or without the assistance from response agencies and / or authorities.
Tier 2	A situation where the emergency response is not within the control and capability of the ERT, thus requiring Emergency Management Team (EMT) support as well as involvement from external response agencies and / or authorities.
Tier 3	A situation where the emergency response is not within the control and capability of the EMT, thus requiring Crisis Management Team (CMT) support as well as involvement and management from multiple external response agencies and / or authorities.

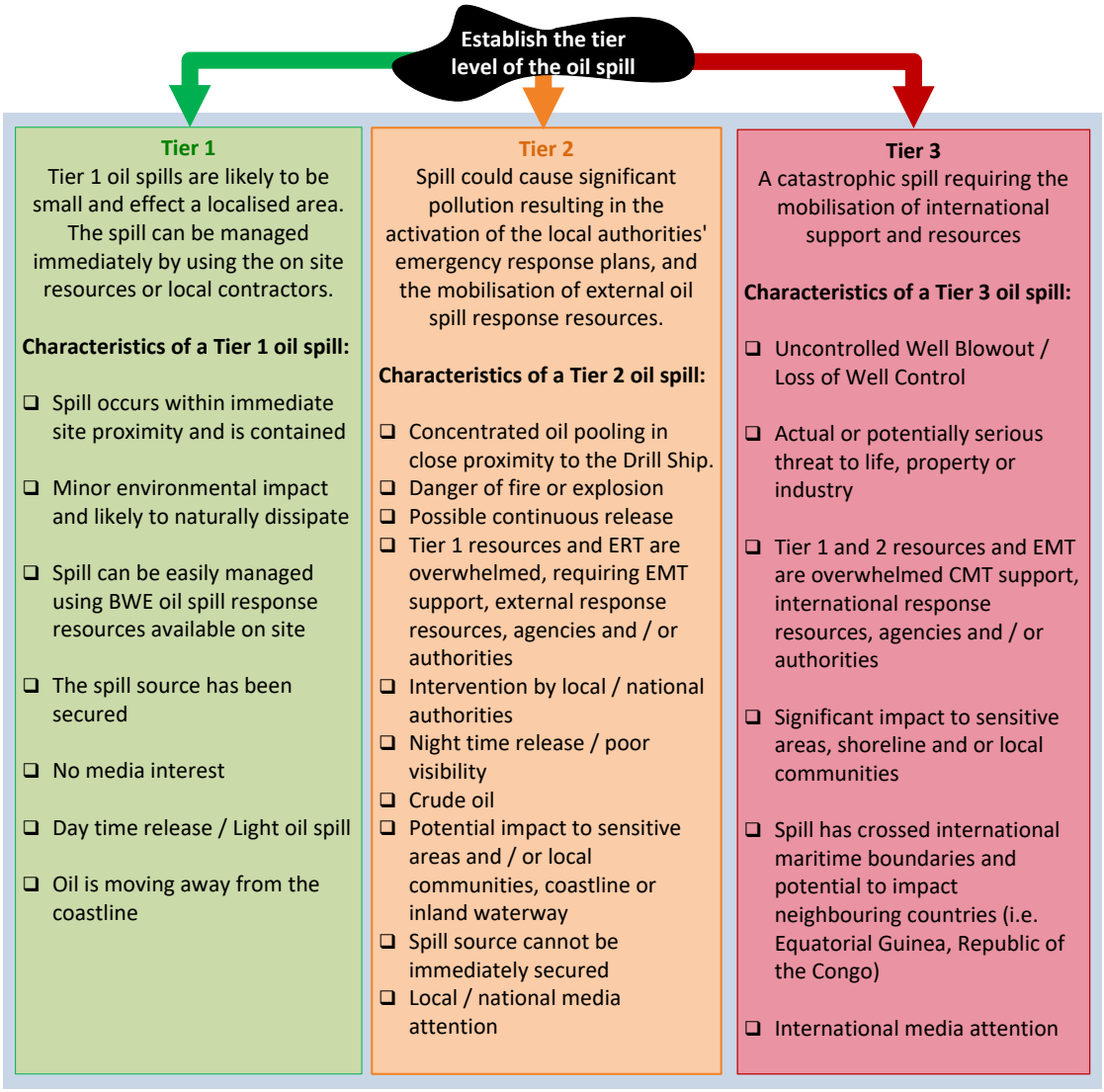


Figure 1: Tiered response assessment system

2.2 Impacts of environmental incident scenarios on local level stakeholders

The Ruche EEA is located approximately 50 km offshore, and it is therefore highly unlikely that Tier 1 or Tier 2 spills would have an impact on local level stakeholders. However, as indicated in Chapter 8 of the ESIA Addendum, a Tier 3 spill could affect small scale artisanal fishermen, and tourism and recreation operations in waters closer to the coast. Should a spill reach the shore, the livelihoods of intertidal gleaners could also be adversely affected. Although the oil spill modelling does not indicate the potential for oil to enter lagoons or estuaries, the risk remains that tidal movements could carry contaminants into these areas.

3. STAKEHOLDER IDENTIFICATION

The Stakeholder Engagement Plan (SEP) prepared as part of the ESIA Addendum (see Appendix 11c) identified the following stakeholder groups:

- Government authorities/agencies – national, provincial, and departmental level (see Table 2 for local level department per province)
- Project-affected communities (PACs)
- Civil society organisations (including non-governmental organisations (NGOs))
- Private sector
- Media
- International organisations
- Education and research institutions.

It is important to note that stakeholder engagement conducted during the ESIA Addendum process focussed on the Project's Primary Area of Influence (AOI) as defined in Section 1.5 of the ESIA Addendum document and only included coastal communities in the vicinity of the Ruche EEA (see Figure 2 below). In the event of large-scale accidental hydrocarbon release, the potential impact on communities could be much wider that these PACs. The extent of the AOI for accidental events is based on the results of Project-specific oil spill modelling included in the BWE OSCP and encompasses the Gabonese coastline and coastal and offshore waters between the Ruche EEA and Port Gentil (see Figure 3).

However, irrespective of the location of the communities, the same type and extent of engagement would be required in the event of a spill. These will include:

- Prefects of departments (see Table 2)
- Departmental councils
- Mayors (where applicable)
- Chiefs of the quartiers
- Local authority figures (e.g., village chiefs, customary chiefs, religious chiefs, and elected leaders)
- Fishing cooperatives
- Tourism operators
- Local groups, e.g., fishers and natural resource users such as gleaners.

Oil spill modelling presented different scenarios for wet and dry seasons, with the potential extent of impacts during the wet season being greater than during the dry season. Weather conditions at the time of the spill and in the days thereafter, will also contribute to the extent of the impacts. This means that the local stakeholders affected could differ depending on the season and weather conditions, and this will be taken into consideration in determining who would need to be informed of a spill, and the timing thereof.

Table 2: Local level coastal departments within the unplanned events/ accidental AOI by province

Province	Department
Nyanga	Basse-Banio
	Haute-Banio
Ogo oué-Maritime	Bendjé
	Etimboué
	Ndougou

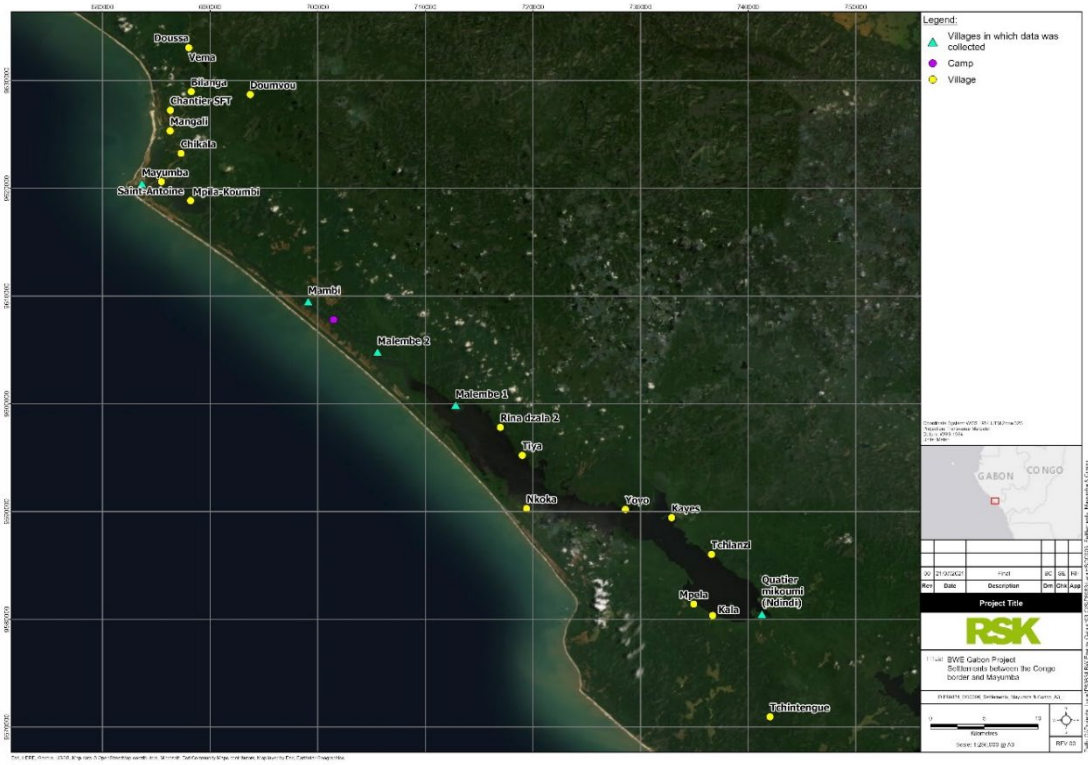


Figure 2: Location of villages on coast adjacent to Ruche EEA

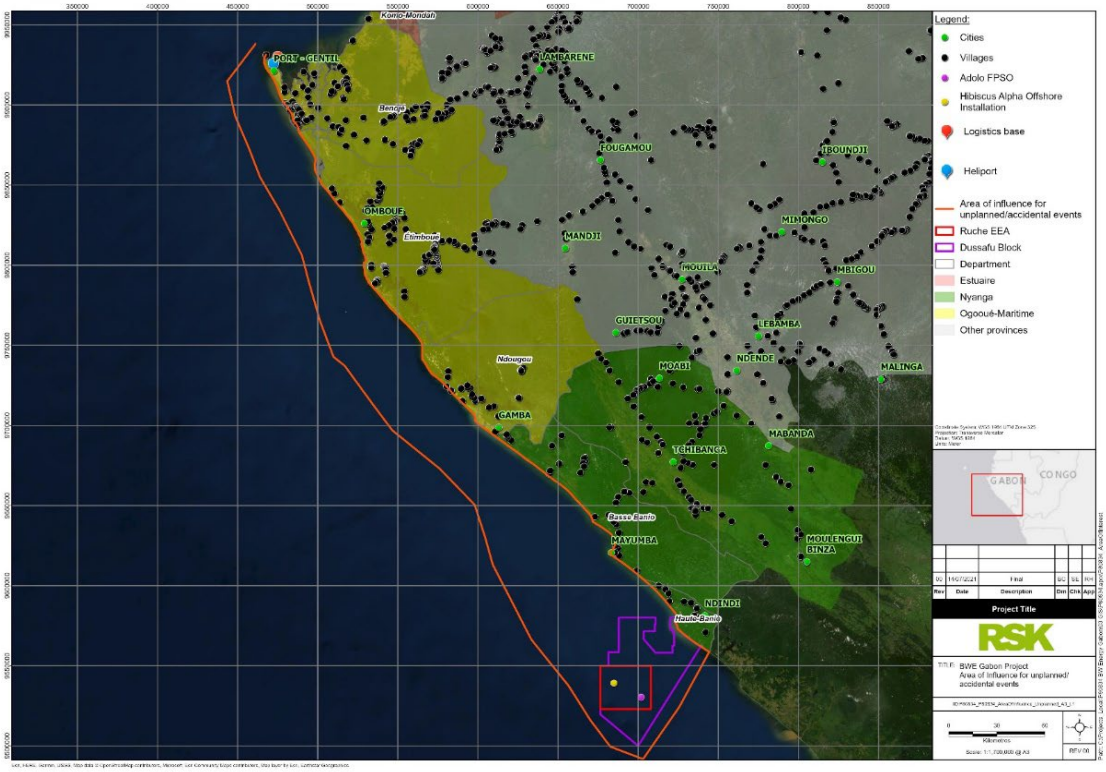


Figure 3: Unplanned / accidental events area of influence

4. LOCAL LEVEL STAKEHOLDER ENGAGEMENT

4.1 Importance of local level stakeholder engagement

During stakeholder engagement undertaken for the ESIA Addendum, approximately 8% of the issues raised by PACs were environment related. Due to the extent of offshore oil and gas operations in Gabon there is an awareness of the potential for hydrocarbon spills and their potential detrimental impact on communities. Concerns raised related to hydrocarbon spills were not directed at BWE's operations per se, but rather offshore oil and gas operators as a whole. Although PACs in the Primary AOI were consulted as part of the process, it stands to reason that there could be a similar level of awareness and concern among communities along the rest of the Gabonese coastline.

In the event of a large-scale spill event there is therefore a need for PACs to understand and have access to incident-specific information, in order to make sense of and explain the situation as it unfolds. In the absence of rapid access to that information from BWE and incident management teams such as the Emergency Management Team (EMT) / Crisis Management Team (CMT), communities and other stakeholders will seek the information from other sources, which will not always be accurate or reliable.

Dialogue through engagement is further necessary to learn about stakeholder and community risk perceptions associated with the incident, to assess the situation in relation to those perceptions, and then develop appropriate responses to their questions and concerns.

4.2 Local level stakeholder engagement process

4.2.1 Pre-spill awareness engagement

As part of BWE's construction and operation SEP, pre-spill awareness engagement will take place at department level with Prefects of the coastal departments (indicated in Table 2), the departmental councils, mayors (where applicable), chiefs of the quartiers, tourism operators, and fishing associations. During these engagements, the aspects of BWE's OSCP of relevance at local level will be communicated and discussed. The purpose is to create awareness of the measures in place to prevent a spill, what to expect in the event of the spill, how stakeholders at local level could be affected, and how they could get involved. In departments where lagoons or estuaries are located, measures to prevent tidal movements carrying contaminants into these areas (such as containment booms) will also be communicated.

Local level stakeholders will be made aware of the BWE TPGMP and the channels available through which grievances can be communicated.

Pre-spill awareness engagement will also serve to establish direct lines of communication between BWE and the relevant coastal department level stakeholders. These lines of communication would be crucial for the expediency of information dissemination in the event of a spill.

4.2.2 Post-spill engagement

In the event of a Tier 3 spill, the EMT will conduct an immediate assessment, considering factors such as the volume released, the season and weather conditions, and the trajectory of the spill. The assessment will be dynamic and will be constantly updated, based on changing conditions and interventions implemented.

The assessment will identify which offshore areas are likely to be affected, as well as the coastal areas in a scenario where the spill reaches the shore. This information will be used by the BWE External Relations Manager to determine which local level coastal departments should be informed of the spill and the extent to which engagements are to take place.

The lines of communication established during pre-spill awareness engagement will be used to inform the relevant Prefects and other local level stakeholders. The following steps will be followed:

- Initial notification of the occurrence of a spill, its anticipated extent, and potential coastal and shoreline areas that might be affected. These will contain warnings to fishermen and tourism operators on offshore areas that are to be avoided. Stakeholders in departments with lagoons and/or estuaries will also be informed of the containment measures that will be deployed to prevent contamination of these areas.
- Regular progress updates on the trajectory of the spill, preventative measures implemented for dispersion / containment, the areas potentially impacted and to be avoided, as well as other actions to be taken by local stakeholders. These updates will continue until such a time that the spill has been contained and/or clean-up measures successfully implemented.
- Mobilisation of local volunteer groups to assist in the preventative, containment, and clean-up measures in the event of the spill reaching the shore.

4.3 Engagement methods and materials

4.3.1 Means of notification

4.3.1.1 Initial and formal notification

According to the findings of the BWE OSCP, worst case trajectory modelling indicates that a spill will take just under 4 days (3 days and 20 hours) to reach the shore during the dry-season, and just over four days (4 days and 8 hours) during the wet season. Normal correspondence such as posted, or hand delivered letters will therefore not be an expedient means of communication for initial notification. Initial notification will therefore take place via email, phone call, sms, or Whatsapp message.

Formal letters will still be sent to Prefects of the coastal departments, the departmental councils, mayors, etc. as formal and official communication, but not as part of initial notification.

4.3.1.2 *Direct engagement*

Based on the EMT's assessment of potentially impacted areas (see Section 4.2.2), Local Liaison Officers (LLOs) will travel to the identified potential impact areas to meet with Prefects, departmental councils, mayors (where applicable), chiefs of the quartiers, tourism operators and fishing associations. LLOs will also conduct emergency community meetings to explain the spill, the preventative measures implemented for containment, the areas that are potentially impacted and which are to be avoided, as well as other actions to be taken by local stakeholders.

Local stakeholders will once again also be made aware of the BWE TPGMP and the channels available through which grievances can be communicated.

4.3.2 Posters

Poster will be prepared to be used during both pre- and post-spill engagement. These will include information on the types of spills, possible trajectories of a spill from the Ruche EEA, information on the fate and behaviour of oil in the marine environment, measures for spill prevention and containment, and stakeholders' role in the event of a spill. All posters will be available in French.

4.3.3 Frequently Asked Questions

The ESIA Addendum SEP includes a list of Project-related Frequently Asked Questions (FAQs). This list includes the following question and answer related to hydrocarbon spills:

- Q: Will there be impacts on marine and coastal waters? If so, what will they be and how will they be managed?
  - A: BWE has developed specific measures both to minimise the likelihood of oil spills and to ensure that appropriate spill control procedures are in place in the unlikely event that a spill does occur. Oil spill modelling has been conducted for the project and an OSCP developed based on the results of the modelling.

BWE will develop a list of hydrocarbon spill specific FAQs, which builds on that included in the SEP. The FAQs will be appended to the updated ERP / OSCP. Examples of topics to be covered in the FAQs are:

- What can cause a spill to occur.
- The possible trajectories of a spill based on oil spill modelling.
- How the season and weather conditions could affect the trajectory and fate of spilled hydrocarbons.
- Response strategies – offshore containment and recovery, dispersant use, etc
- How a spill would be communicated to local government and communities.
- How a spill could potentially impact fish and/or other marine biota.
- How small scale/artisanal fishers and tourism operators could be affected, e.g. fisheries closures, impacts to beaches, etc.
- What the impacts of a spill could be if it reaches the shore.
- What local communities should do in the event of a spill.

- What people should do if they come into contact with oil on skin or clothing.
- Potential health impacts related to a spill and what communities should do if they experience any health impacts related to a spill.
- How a spill will be cleaned-up and who will do the clean-up.
- What communities could to do to assist in the event of a spill.
- Who should be contacted if people want to ask questions, raise issues, claim compensation in the event of a spill.

The FAQs will be used during pre-spill awareness and engagement and, also be of value in other interactions with broader stakeholder groups by BWE. In the event of a spill, the FAQ will serve as a guide to the LLOs when engaging with local level stakeholders.

4.3.4 Spill information template

A spill response information template with fields for all relevant spill-related information will be developed by BWE. In the event of a spill, this template can be easily populated with the information provided by the EMT and used to rapidly disseminate information. The template will continue to be used as part of the regular updates by the EMT on the trajectory of the spill, the response measures, the areas that are potentially impacted and which are to be avoided, other actions to be taken by local stakeholders, and clean-up measures implemented.

4.4 Human resource requirements

At the time of the compilation of the ESIA Addendum, the BWE Gabon External Relations Team consisted of the External Relations Manager and an LLO, supported by the Health, Safety, Environment, and Quality (HSEQ) Coordinator. As indicated in Table 2, there are ten coastal departments, in order to conduct pre-spill awareness engagements in all these departments, additional resources would be required. According to the OSCP, in a worst-case scenario all these departments could be impacted by a spill, and in such an event, significant additional resources will be required for timely and effective local stakeholder engagement.

BW Energy Gabon

Social Management Plan for BWE's Activities in Dussafu Block

Dussafu Block Development, Gabon

80834

DECEMBER 2021

RSK GENERAL NOTES

Project No.: 80834

Title: Social Management Plan – Dussafu Block Development, Gabon

Client: BW Energy Gabon

Date: December 2021

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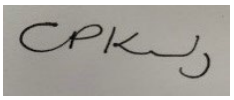
Signature		Signature	
Date:	16/12/2021	Date:	16/12/2021

Project manager	Rebecca Heath
Signature	
Date:	16/12/2021

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Environment Ltd.

CONTENTS

ABBREVIATIONS

Abbreviation	Full description
AIS	Alien invasive species
BAMP	Biodiversity Action and Management Plan
BWE Gabon	BW Energy Gabon
CSI	Corporate Social Investment
ERP	Emergency Response Plan
FPSO	Floating production, storage, and offloading unit
ILO	International Labour Organisation
LLO	Local Liaison Officer
SEP	Stakeholder Engagement Plan
SMP	Social Management Plan
TGMP	Third-party Grievance Management Procedure
TMP	Traffic Management Plan

1 INTRODUCTION

1.1 Background

BW Energy Gabon (BWE) is an exploration and production company in the oil and gas sector and is part of the BW Group of companies.

BWE has acquired a majority interest in the Dussafu Block located off the east coast of Gabon, adjacent to Basse-Banio Department (Nyanga Province). The Dussafu Block encompasses the 850 km^2 Ruche Exclusive Exploitation Area (Ruche EEA) that contains six oil discoveries: Tortue, Hibiscus, Ruche, Ruche North East, Moubenga and Walt Whitman fields. BWE is currently focusing its Dussafu Block development efforts on the Tortue, Hibiscus, Ruche and Ruche North East fields.

BWE has successfully initiated development activities in the Ruche EEA and reached first oil in October 2018 (Tortue Phase 1). Subsequent phases of the development are Tortue Phase 2 and Ruche Phase 1.

The full field development consists of multiple wells, tied back through flowlines to the BWE Adolo Floating Production Storage and Offloading (FPSO) unit, with a manned Offshore Installation (the Hibiscus Alpha OI) between the Hibiscus and Ruche Fields.

BWE's offshore operations are supported via a logistics base located in the port of Port Gentil.

1.2 Scope

This Social Management Plan (SMP) applies to all BWE's activities in Gabon, and is applicable to offshore and onshore activities, including all sites, the logistics base, helicopters, and rigs or vessels operating on behalf of the Project.

The SMP summarises the social mitigations described in the Dussufu Block Development Environmental and Social Impact Assessment (ESIA) Addendum (RSK document reference: 80834/04/12) under the following sections:

- Shipping and navigation
- Fisheries
- Tourism and recreation
- Infrastructure and services
- Public health
- Economy, employment, and skills development
- Community safety, security, and well-being
- Unplanned/accidental events.

A number of related documents, such as the BWE Third-party Grievance Management Procedure, are referenced throughout and are listed in Section 5.

1.3 Purpose

The purpose of the SMP is to:

- Set out actions and plans to check the efficacy of the industry-standard and project-specific social impact mitigations in place
- Describe how the mitigation measures detailed in the ESIA Addendum will be implemented
- Cross-reference to other management plans that have relevance for the mitigation of social impacts
- Describe how the Project's social impacts are measured, monitored and reported.

2 MANAGEMENT OF SOCIAL IMPACTS

Specific measures to manage social impacts were identified in the ESIA Addendum. These measures are detailed in this chapter in terms of the specific roles and responsibilities assigned to BWE and contractors.

2.1 Shipping and navigation

2.1.1 Measures to minimise disruption to commercial shipping and navigation operations

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Timely engagement with relevant stakeholders (e.g., maritime authorities, government ministries, shipping companies) regarding the establishment of safety exclusion zones around offshore facilities as per the Stakeholder Engagement Plan (SEP) (ESIA Addendum, Appendix 11C). • Safety zone authorisation permits will be obtained from the relevant government authorities prior to their establishment. Project infrastructure will be demobilised, and safety exclusion zones will be lifted upon completion of relevant activities. • A schedule of activities will be communicated to the authorities which issue information and instructions to mariners pertaining to shipping hazards and safety zones (through a notice to mariners).	To minimise disruption to commercial shipping and navigation	Minimisation	Throughout construction and operation	BWE, vessel contractor, drilling contractor, installation contractor

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• A TGMP (ESIA Addendum, Appendix 11D) has been established and will be communicated to relevant stakeholders. • All supply vessel movements will be communicated to the port maritime authorities. • Supply vessels will operate in accordance with the requirements of the Port Authority, which plans and coordinates vessel traffic movements within its jurisdiction. • Support/supply and construction vessels will be equipped with navigational aids and communication systems, follow specified routes, and observe speed restrictions. • The drilling rig will have a support vessel permanently on-site during drilling activities, to advise other sea users of the rig's presence, and ensure safety zones are respected.				

2.2 Fisheries

The management measures listed above for shipping in relation to safety exclusion zones and support vessel movements (for both BWE and contractors) are also relevant to deep sea / industrial fisheries.

Additional measures to manage and minimise the impact of discharges and underwater noise on fish, and subsequently fisheries, are outlined in detail in Section 5 of the Biodiversity Action and Management Plan (BAMP) (ESIA Addendum, Appendix 11A).

2.3 Tourism and recreation

The measures listed above for fisheries (for both BWE and contractors) are also relevant to recreational fisheries. In addition, BWE will undertake timely engagement with tourism and recreational stakeholders regarding the establishment of safety exclusion zones and support vessel movements.

2.4 Infrastructure and services

2.4.1 Measures to minimise an increase in congestion, interference with other port users, and increased pressure on port facilities at the port of Port Gentil

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Project supply vessels will have designated moorings at the onshore logistics base, reducing interference with other port users. • Supply vessels will operate in accordance with the directions of the Port Authority.	To minimise an increase in congestion, interference with other port users, and increased pressure on port facilities	Minimisation	Throughout construction and operation	BWE, vessel contractor, drilling contractor, installation contractor

2.4.2 Measures to minimise increased pressure on and contribution to the deterioration of the existing road network, as well as congestion and inconvenience from road deliveries to the logistics base

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• A basic Traffic Management Plan (TMP) will be developed and implemented which includes topics such as designated vehicle routes and alternatives, driver and vehicle requirements, and speed limit restrictions. • Condition surveys will be undertaken prior to and during the completion of Project activities to identify any damages that may have occurred to road infrastructure as a result of the Project; repairs will be undertaken as appropriate in a timely manner. • Adherence to the BWE TMP. • Deliveries of locally sourced goods and services will be scheduled outside of peak traffic periods, as far as possible.	To minimise increased pressure on and contribution to the deterioration of the existing road network, as well as congestion and inconvenience	Minimisation	Throughout construction and operation	BWE, contractors

2.4.3 Measures to minimise pressure on existing waste management in Port Gentil

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Waste collection and temporary storage will be designed to minimise the risk of escape to the environment. • Waste transferred through the logistics base will be collected and transported by a registered and appropriately licensed waste management contractor. • Records of waste volumes, waste transfer manifests, and safe disposal certificates will be kept, in order to effectively track waste generated by the Project. • Ensuring relevant licenses and registrations to transport and process waste are kept up to date.	To minimise pressure on existing waste management in Port Gentil	Minimisation	Throughout construction and operation	BWE, contractors

2.5 Public health

2.5.1 Measures to minimise disturbance to communities located on the helicopter flight path from Port Gentil Airport to offshore infrastructure

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Helicopter flights will take place during daylight hours, thus helping to minimise noise disturbance to communities on the helicopter flight path at night. • Helicopter transfers will be optimised as far as possible, to reduce the number of flights undertaken. • A flight plan for each helicopter transfer will be developed and agreed with the relevant government authority. • Low flights directly over communities will be avoided, where it is safe and practical to do so.	To minimise disturbance to local communities	Minimisation	Throughout construction and operation	BWE, helicopter contractors

2.5.2 Measures to minimise the potential for transmission of communicable diseases (including COVID-19) between the non-local Project workforce and local communities

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• All employees (including contractors and subcontractors) will undergo pre-employment medical screenings, which will include testing for TB, COVID-19, and other diseases relevant to the individual's country of origin. • All employees (including contractors and subcontractors) will undergo regular health screenings (including for COVID-19). Adequate referral and support will be provided for the ongoing treatment of workers identified as having treatable conditions during the health screenings. • A Worker Code of Conduct will be developed for all employees (including contractors and subcontractors), the scope of which will include rules around interacting with other workers and local communities; training will be provided on the Worker Code of Conduct as part of employee inductions. • All employees (including contractors and subcontractors) will be educated on potential disease transmission pathways and ways to prevent the spread of communicable diseases, as part of their induction. • The emergence of pandemics will be monitored, and relevant ERPs will be updated, as appropriate, to reflect changes in the status of pandemics, in-country health care capacity, etc. • Timely engagement with communities and other relevant stakeholders (e.g., public health authorities and health care facilities) will be undertaken to raise awareness about potential	To minimise the transmission of communicable diseases	Minimisation	Throughout construction and operation	BWE, contractors

Project risks to, and impacts on, public health and measures to mitigate these.				

2.6 Economy, employment and skills development opportunities

2.6.1 Measures to enhance Project employment opportunities

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• BWE and its contractors and subcontractors will comply with Act No. 3/94 of 21 November 1994 on the Labour Code of the Gabonese Republic (as amended) and all other applicable national labour legislation. • The recruitment of Gabonese nationals by the Project will be prioritised provided requisite qualifications, skills, and experience can be met. • As part of the tendering process, BWE's contractors will be required to demonstrate how they will prioritise the employment of Gabonese nationals (e.g., through the preparation of a Local Employment Plan or equivalent document). • Information about the Project recruitment process and employment opportunities (including the number and types of positions available, the skills and qualifications required) will be made publicly available and widely distributed through timely engagement with relevant stakeholders (e.g., government authorities, local communities, educational institutions) and advertising; contact details will be provided with which to obtain further information from BWE (see also SEP document, ESIA Addendum - Appendix 11C). • Where possible, on-the-job training will be provided to enable workers to gain new or improved skills; upon completion of training, formal recognition of training will be provided to workers (e.g., in the form of references or certificates).	Enhancing Project employment opportunities	Enhancement	Throughout construction and operation	BWE, contractors

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Rigorous policies on sexual harassment and gender-based violence in the workplace will be developed and implemented. • The treatment of employees will be consistent with the requirements of the Core Labour Conventions of the International Labour Organisation (ILO), including those related to: o freedom of association and collective bargaining o the recruitment of underage workers, as defined by the ILO o the use of forced labour o discrimination in hiring practices or pay o the provision of just and favourable working conditions. • Contractors will have rigorous policies on sexual harassment and gender-based violence in the workplace will be developed and implemented. • The treatment of employees will be consistent with the requirements of the Core Labour Conventions of the International Labour Organisation (ILO), including those related to: o freedom of association and collective bargaining o the recruitment of underage workers, as defined by the ILO o the use of forced labour o discrimination in hiring practices or pay o the provision of just and favourable working conditions.				

2.7 Community safety, security, and well-being

2.7.1 Measures to enhance improvements in well-being and facilitate development at community level through the expansion of BWE's Corporate Social Investment (CSI) initiatives

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Timely engagement with communities in the Project area and other relevant stakeholders (e.g., local government authorities, service providers) (as per the SEP document, ESIA Addendum - Appendix 11C) to identify key community challenges, needs, and priorities, the outcomes of which will be used to inform the design of BWE's CSI initiatives. In doing so, care should be taken to manage potentially high community expectations. • CSI initiatives undertaken by BWE will be monitored to evaluate their success and identify the need for corrective actions as appropriate. Where identified, corrective actions will be implemented in a timely manner, and lessons learned will be applied to future initiatives.	Expansion of BWE's Corporate Social Investment initiatives	Enhancement	Throughout construction and operation	BWE

2.7.2 Measures to minimise the risk of traffic accidents and subsequent impacts on community safety, security, and wellbeing Traffic accidents

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Development and implementation of a TMP which includes topics such as driver requirements (e.g., training, hours of driving and rest periods, fitness to work), and vehicle requirements (e.g., maintenance activities and speed limit restrictions). • Timely engagement with communities located in the vicinity of the port of Port-Gentil (as per the SEP document, ESIA Addendum - Appendix 11C) to increase road safety awareness.	To minimise traffic accidents	Minimisation	Throughout construction and operation	BWE, contractors

2.8 Unplanned/accidental events

2.8.1 Measures to minimise the risk of accidental release of hydrocarbons

In order to minimise the risk of the accidental release of hydrocarbons on fisheries, recreational fishing, and natural resource harvesting (intertidal gleaning), BWE has committed to implement the measures outlined in Section 4.2.4 of the BAMP (ESIA Addendum, Appendix 11A), contractors will also be responsible to implement the same. In addition, a TGMP has been established by BWE and will be communicated to relevant stakeholders.

The requirements for local level stakeholder engagement in the event of an accidental release of hydrocarbons will be included in BWE's update of their Oil Spill Contingency Plan / Emergency Response Plans in line with recommendations in Appendix 11E of the ESIA Addendum.

2.8.2 Measures to minimise the risk of the accidental release of alien invasive species (AIS) on fisheries, recreational fishing, and natural resource harvesting (intertidal gleaning)

In order to minimise the risk of the accidental release of AIS on fisheries, recreational fishing, and natural resource harvesting (intertidal gleaning), BWE has committed to implement the measures outlined in the Alien Invasive Species Management Plan (ESIA Addendum, Appendix 11B). Contractors will also be responsible to implement the same. In addition, a TGMP (ESIA Addendum, Appendix 11D) has been established by BWE and will be communicated to relevant stakeholders.

2.8.3 Measures to minimise the likelihood of accidental interactions between Project vessels and those involved in deep-sea / industrial fishing, and small-scale/artisanal fishing activities

Mitigation Measure	Target	Mitigation Hierarchy	Frequency	Responsible
• Project vessels will operate in accordance with the requirements of the relevant government (e.g., port and maritime) authorities. • Project vessels will be equipped with navigational aids and communication systems, follow specified routes, and observe speed restrictions. • Fisheries Liaison Officers (or equivalent personnel) will be stationed on support/supply and construction vessels to spot, monitor the movements of, and communicate with small-small/artisanal fishing vessels on route to and from the offshore Project sites. • A TGMP (ESIA Addendum, Appendix 11D) is in place that will be circulated to relevant stakeholders. • Vessels will operate in accordance with the requirements of the relevant government (e.g., port and maritime) authorities. • Vessels will be equipped with navigational aids and communication systems, follow specified routes, and observe speed restrictions.	To minimise accidental Project vessel interaction with fishing vessels / fishing gear	Minimisation	Throughout construction and operation	BWE, contractors

3 ROLES AND RESPONSIBILITIES

3.1 BWE's role and responsibilities

The majority of the Project activities are undertaken by contractors and service providers. However, BWE has the ultimate responsibility for management of environmental and social impacts and the development of mechanisms for managing environmental and social aspects of the Project.

In order to give effect to the SMP it is recommended that BWE undertake the following activities:

- Communicating the contents and requirements of the SMP to contractors to assist with the development of their Implementation Plans.
- Review and approval of contractors' Implementation Plans.
- Updating the SMP following disclosure and approval of the ESIA Addendum and communicating any additional commitments to contractors.
- Monitoring that Project personnel engaged on the Project receive appropriate environmental and social awareness training.
- Implementation of a programme of planned and unplanned, documented environmental inspection, monitoring and reporting to verify the implementation of its commitments and auditing contractor performance with respect to the requirements of the SMP and other Management Plans and Implementation Plans.
- Identifying non-conformance with the SMP and other Management and Implementation Plans and determining the appropriate corrective action through its non-conformance procedures.
- Stopping work in the event of non-conformance that presents an immediate threat to people, environment and property.
- Implementation of a programme for follow-up and analysis of all environmental or social incidents or accidents.
- Developing and maintaining a Commitments Register for the Project that lists the commitments generated during the Project's ESIA and ESIA Addendum processes, which will be updated as a live document during the course of the Project. The Commitments Register will also record the SMP and other Management Plans that incorporates each commitment and responsibility for implementation.
- Maintaining a Stakeholder Engagement Plan (SEP) (ESIA Addendum, Appendix 11C) for the Project to ensure effective management of consultations with third parties during the life of the Project.

To carry out the above tasks, BWE shall appoint the following personnel to work in conjunction with contractor's management team to ensure that environmental and social concerns are adequately addressed:

- **Social Performance Manager:** responsible for ensuring social commitments are implemented effectively.
- **Environmental and Social Adviser(s):** responsible for monitoring compliance with and performance against the SMP and other Management Plans; raising and tracking corrective actions as necessary; compiling appropriate documentation as necessary; and providing advice and assistance to personnel on environmental and social issues.
- **Community Liaison Officer(s):** responsible for monitoring and ensuring contractors and subcontractors comply with the SMP and other Management Plans, raising and tracking corrective actions as necessary; compiling appropriate documentation as necessary; and providing advice and assistance to personnel on social issues.

3.2 Contractors' roles and responsibilities

Contractors shall be responsible for:

- Implementation of and adherence to all requirements included in this SMP.
- Implementation of any additional commitments that have been made during public disclosure of the Project ESIA Addendum (document ref. 80834/04/12) or other public commitments as advised by the BWE.
- Monitoring the performance of its activities and those of its subcontractors with regard to implementation of, and adherence to, all relevant mitigation measures outlined in the SMP.
- Proposing a programme of regular self-inspections and audit, and a programme of community liaison and feedback gathering, and implementation of an action tracking system to record the findings and track progress on actions taken to address them.

Major contractors shall develop an equivalent 'Implementation Plan' for the SMP for review by BWE. Contractors Implementation Plans shall:

- Follow the structure and content of the SMP.
- Specify contractor's organisational structure including the lines of responsibility for ensuring the implementation of generic and site-specific mitigation measures.
- Define the roles and responsibilities of contractor's Project social management personnel.
- Specify how the communication of the contents of SMP requirements will be relayed to the workforce.
- Specify the social awareness training that it will provide to its personnel engaged on the Project and to its subcontractors' personnel.
- Define how contractor proposes to inspect and audit its own work to ensure that the commitments made in its Implementation Plans are delivered effectively.
- Meet all relevant policy and legislative requirements.

- Explain the document control procedures that will be implemented for recording environmental and social information and reporting it to BWE.

Contractors shall ensure that appropriately experienced and qualified personnel are employed for the above purposes.

Contractors shall include relevant content from the SMP within the Project Induction for personnel.

4 MONITORING AND REPORTING

4.1 BWE's monitoring and reporting

BWE's monitoring of contractor's social performance will continue throughout facility installation (from mobilisation through demobilisation), drilling, as well as the operations phase. Monitoring activities will include, but are not limited to, site inspections, periodic reviews of the contractor's facilities and documentation, as well as regular BWE-contractor progress meetings where requirements and adherence to the SMP are discussed.

The frequency of contractor reporting during facility installation and drilling will be bi-weekly. Scheduled site inspections will be conducted monthly during these phases. The frequency of contractor reporting during operations will be monthly (where relevant).

BWE will review contractor reports and follow up as needed to ensure timely resolution of issues of non-compliance with SMP requirements. This may include additional visits to the contractor's sites or offices (outside of the scheduled monthly inspections), further communications with contractor, issuance of notices of deficiency or warnings to the contractor, and other actions as needed.

BWE will schedule a programme of verification audits to gather tangible evidence demonstrating whether contractor is complying with the SMP. The formal verification audits will be periodic (e.g., quarterly), and when it is practical to do so, BWE will provide contractor with written notice of planned audits to ensure that all appropriate staff, documentation and monitoring records are available. BWE shall document each audit carried out by compiling a written report that includes all identified non-conformances and recommendations. Where good practices are observed these will also be recorded.

If the contractor has not taken appropriate action to achieve compliance with SMP requirements after repeated notices of violation and warnings of noncompliance, and significant social impacts are occurring or imminent, the BWE will order the contractor to stop work until social performance is brought under control and up to acceptable standards.

4.2 Contractors' monitoring and reporting

Contractors will be responsible to ensure compliance with all the requirements outlined in the SMP.

4.2.1 Inspections

Contractors will develop a formal inspection programme and present this to BWE for approval.

Contractors will develop a proforma to record any observations.

The inspections may also include talking to personnel and community members, to determine whether commitments that cannot be assessed by visual inspection have been implemented.

Contractors will record all non-conformances and propose appropriate corrective actions and agree these with BWE.

The outcome of inspections will be incorporated as part of contractors' reporting.

4.2.2 Reporting

As indicated in Section 4.1, the frequency of contractor reporting during facility installation and drilling will be bi-weekly, decreasing to monthly during operation (where relevant).

These reports shall include elements of the SMP as relevant. They may include, for example, local content and employment information, community safety issues, grievance reports, and other community monitoring data.

Social monitoring data shall be stored within the contractor's document control system, made available at BWE request, and handed over to the BWE on completion.

5 RELATED DOCUMENTS

5.1 Internal documents

The following internal documents relate to the SMP:

Reference	Title
80834/04/12	ESIA Addendum – Dussafu Block Development
80834/04/14/01 (ESIA Addendum – Appendix 11A)	BWE Biodiversity Action and Management Plan (BAMP)
80834/04/06/01 (ESIA Addendum - Appendix 11B)	BWE Alien Invasive Species Management Plan
80834/04/08/03 (ESIA Addendum – Appendix 11C)	BWE Stakeholder Engagement Plan
80834/04/08/04/01 (ESIA Addendum – Appendix 11D)	BWE Third-party Grievance Management Procedure
80834/04/08/04/03 (ESIA Addendum – Appendix 11E)	Local Stakeholder Engagement Input to BWE's Emergency / Oil Spill Response Plans
80834/04/08/04/04 (ESIA Addendum – Appendix 11G)	BWE Social Risk and Impact Management Procedure
4417-BWE-O-TA-00001_02_05	BWE Emergency Response Plan

BW Energy Gabon

Social Risk and Impact Management Procedure

Dussafu Block Development, Gabon

80834

DECEMBER 2021

RSK GENERAL NOTES

Project No.: 80834

Title: Social Risk and Impact Management Procedure – Dussafu Block, Gabon

Client: BW Energy Gabon

Date: December 2021

Office: Helsby

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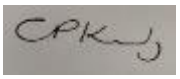
Signature		Signature	
Date:	16/12/2021	Date:	16/12/2021
Project manager	Rebecca Heath		
Signature			
Date:	16/12/2021		

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ABBREVIATIONS

Abbreviation	Full description
ALARP	As low as reasonably practicable
BWE	BW Energy Gabon
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
GIIP	Good international industry practice
IFC	International Finance Corporation
NGO	Non-governmental organisation
NEI	Notice of Environmental Impact
PS 1	Performance Standard 1
Ruche EEA	Ruche Exclusive Exploitation Area
SEP	Stakeholder Engagement Plan
SRIR	Social Risks and Impacts Register
SMP	Social Management Plan
SRIMP	Social Risk and Impact Management Procedure
TGMP	Third-party Grievance Management Procedure

1 INTRODUCTION

1.1 Background

BW Energy Gabon (BWE) is an exploration and production company in the oil and gas sector and is part of the BW Group of companies.

BWE has acquired a majority interest in the Dussafu Block located off the east coast of Gabon, adjacent to Basse-Banio Department (Nyanga Province). The Dussafu Block encompasses the 850 km^2 Ruche Exclusive Exploitation Area (Ruche EEA) that contains six oil discoveries: Tortue, Hibiscus, Ruche, Ruche North East, Moubenga and Walt Whitman fields. BWE is currently focusing its Dussafu Block development efforts on the Tortue, Hibiscus, Ruche and Ruche North East fields.

To manage the potential risks associated with its operations in Dussafu Block BWE is developing a Corporate Risk Management Standard and an associated Corporate Risk Register.

This Social Risk and Impact Management Procedure (SRIMP) has been prepared in response to a recommendation in the lender document 'BWE Gabon Pre-Financial Close Environmental and Social Assessment' (ERM, 2021). This states that the development of a corporate procedure for the identification, assessment and mitigation of social risks and impacts associated with BWE's operations is required.

The SRIMP is informed by, and aligned with, the draft BWE Corporate Risk Management Standard, which applies to all of the company's operations in Gabon (both onshore and offshore). The Corporate Risk Management Standard primarily focuses on business risks, whereas the SRIMP is concerned with social risks and impacts and therefore adds value and complements the corporate standard.

1.2 Scope of application

This procedure is applicable to all of BWE's activities in Gabon.

1.3 Objectives

The objectives of the SRIMP are to:

- define and provide an understanding of social risks and social impacts
- establish a structured approach and methodology for the identification, assessment and management of social risks and impacts in line with the requirements of good international industry practice (GIIP)
- provide a template for a Social Risks and Impacts Register (SRIR)
- ensure that social risks and impacts, where identified, are mitigated as effectively as possible in line with GIIP
- strive for continuous improvement in the management of social risks and impacts associated with BWE's operations

- ensure that formal management of social risks becomes part of BWE's business processes and is embedded in the BWE Gabon management system.

To date, BWE has developed two Environmental and Social Impact Assessments (Enviropass, 2017 and 2020), and two Notices of Environmental Impact (Enviropass, 2019) for its operations in Gabon. This was followed in 2021 by an ESIA Addendum (RSK document reference: 80834/04/12) based on the lender due diligence referred to in Section 1.1.

A Social Management Plan (SMP) (RSK document reference: 80834/04/08/04/02) has been developed as part of the ESIA Addendum with a particular focus on managing and mitigating social impacts identified as part of the impact assessment. However, the social environment does not remain static and BWE's activities also change over time. The SRIMP is based on the findings of the ESIAs conducted to date, but also provides a mechanism by which future risks and impacts may be identified and mitigated.

2 DEFINING SOCIAL RISKS AND IMPACTS

This section provides a definition of social risks and impacts, which are integral to and applied by the SRIMP.

International Finance Corporation (IFC) 'Performance Standard 1 (PS 1): Assessment and Management of Environmental and Social Risks and Impacts' (IFC, 2012) states that environmental and social impacts refer to any change, potential or actual, to (i) the physical, natural, or cultural environment, and (ii) impacts on surrounding community and workers, resulting from the business activity to be supported. Risks are the combination of the probability of a certain hazard occurrence and the severity of impacts resulting from such an occurrence.

It is important to distinguish between social risks as per the IFC definition, and business risks, as there is a tendency for the two terms to become conflated. Business risks are the potential future threats to a company's operations, reputational capital, market share and profitability as a consequence of operational decisions and strategies, and the responses of other actors to these decisions and strategies. Some of these business risks are also social issues, for example risks associated with a non-governmental organisation (NGO) campaign or labour rights, but they are evaluated in terms of the risk to the business, not the risk to the social environment.

For the purposes of the SRIMP, social impacts and social risks are therefore those that stem from BWE's activities and potentially could impact, or pose a risk to, the social environment (not the business itself).

3 METHODOLOGY

3.1 Principles

The SRIMP is underpinned by the following principles:

- **Stakeholder-focused**: The emphasis of the SRIMP is on identifying and managing adverse potential social risks and impacts on external stakeholders.
- **Consultative**: Potentially affected stakeholders should have the opportunity to provide input to the identification and mitigation of social impacts. This could be facilitated via the implementation of BWE's Stakeholder Engagement Plan (SEP) and Third-party Grievance Management Procedure (TGMP) (RSK document reference: 80834/04/08/01).
- **Inclusive**: It is recognised that certain stakeholders may experience impacts differently and more, or less, severely than others. Analyses should consider these factors when determining the consequence level of potential social impacts and risks.
- **Transparent and informative**: As far as possible there should be transparency in relation to information-sharing, stakeholder engagement and potential social and human rights impact analysis. Transparency may be constrained by legal requirements, commercial confidentiality, or by security considerations (for example, if engaging specific stakeholders puts staff or stakeholders at risk). In general, however, a participatory and inclusive approach should be underpinned by openness. The full range of potential and actual impacts cannot be understood without engaging a wide spectrum of stakeholders. Similarly, those stakeholders cannot form a reasoned opinion on potential and actual impacts without an understanding of BWE's activities and future plans.
- **Cross-functional**: While personnel in the HSSE and Sustainability team may facilitate implementation of the SRIMP, successful implementation of the process requires cross-functional involvement particularly by the teams that are responsible for managing the risk mitigation measures.
- **Comprehensive and continuous**: The objective is to identify all adverse potential and actual impacts on external stakeholders within BWE's activities' Area of Influence, including those potential and actual impacts resulting from contractor activities. Impacts and risks may emerge or evolve at any time and the SRIMP is therefore designed to be a process that is part of BWE's management system in Gabon.

3.2 Impact assessment methodology

3.2.1 Overall approach

The assessment of potential social risks and impacts resulting from BWE activities uses a systematic process that involves:

- identifying activities and associated aspects or sources of impact and risk
- identifying related social receptors

- evaluating the effects on those receptors
- assessing the significance of the impacts on receptors based on the **magnitude** of the impact and the **sensitivity** of the receptors.

The significance of the 'residual' impacts (subsequent to application of mitigation measures) is then determined using the same criteria.

This process is outlined in Figure 3.1 and discussed in more detail below.

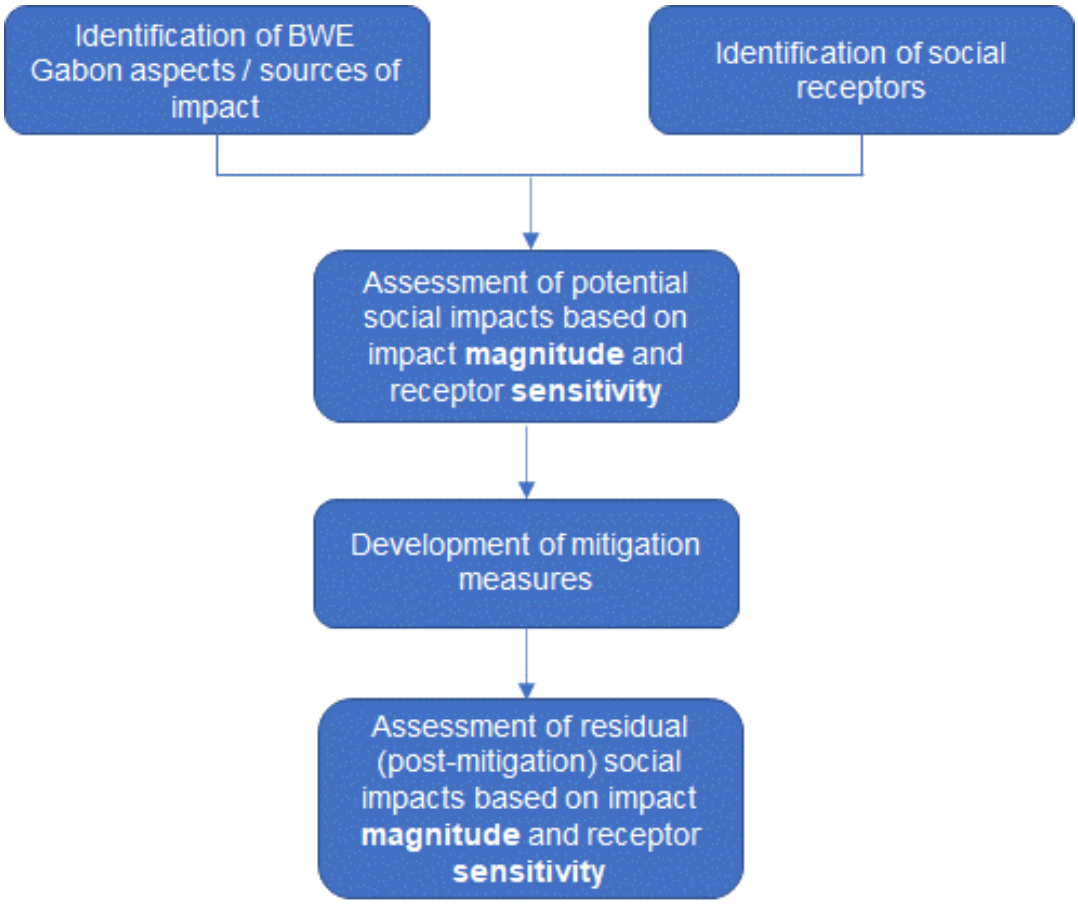

Figure 3.1: Process for assessing significance of social impacts

3.2.2 Types of Impact

Impacts arise when activities and associated aspects interact with social receptors. Impacts may be described in several ways, as follows:

- positive - an impact considered to represent an improvement to the baseline social conditions, or that introduces a new desirable factor
- negative - an impact considered to represent an adverse change from the baseline conditions, or that introduces a new undesirable factor
- direct - an impact that results from a direct interaction between a planned project activity and the receiving social environment
- indirect - an impact between the proposed activity and the environment as a result of subsequent interactions within the social environment

- induced – impact resulting from other non-project activities that happen as a consequence of the project activities
- cumulative - an impact that acts together with other impacts (including from other third-party project or projects) to affect the same receptor(s)
- perceived - issues that stakeholders believe would change baseline conditions even when there is no factual basis for the concern.

3.2.3 Impact Significance

The significance of impacts is determined based on the magnitude of the impact and the receptor sensitivity using the matrix presented in Figure 3.2.

Significance			Sensitivity rating			
			Very low	Low	Medium	High
		0 Positive	1	2	3	4
Magnitude rating	Very low	1	1 Negligible	2 Negligible	3 Minor	4 Minor
	Low	2	2 Negligible	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

Figure 3.2: Impact significance matrix

The criteria for scoring / rating impact magnitude and receptor sensitivity are explained in more detail in Sections 3.2.4 and 3.2.5 respectively.

3.2.4 Impact Magnitude

For each activity/aspect, the magnitude of impact is evaluated according to the following criteria:

- the geographical extent of the impact
- the duration of the impact
- the scale of impact
- the frequency of impact
- the likelihood / probability of the impact.

Definitions / criteria to assist in determining impact magnitude with respect to geographical extent, duration and scale are provided in the SRIR worksheet in Appendix A.

Impact frequency relates to the constancy or periodicity of the impact. Where possible this is expressed quantitatively, where this is not possible terms such as 'once-off', 'temporary' or 'continuous' are used.

The likelihood / probability of an event occurring is designated using a qualitative scale:

- possible - event that occurs during such projects
- unlikely - event that happens occasionally
- very unlikely - event that is very unlikely to occur
- extremely unlikely - event that would occur only in exceptional circumstances.

Scoring is allocated from 1 (very low) to 4 (high). A rating of 0 is provided for beneficial (positive) effects.

3.2.5 Receptor Sensitivity

The evaluation of receptor sensitivity takes into account its local, regional, national and international designations, its importance to the local or wider community and its economic value. The assessment of the sensitivity of human receptors, for example, a household, community or wider social group, takes into account their likely response to change and their ability to adapt to and manage the effects of the impact. Stakeholder concerns associated with the type of receptor and the potential for cumulative and/or transboundary impacts to occur are also taken into consideration.

Definitions / criteria to assist in determining receptor sensitivity are provided in the SRIR worksheet in Appendix A. Scoring is allocated from 1 (very low) to 4 (high).

3.2.6 Mitigation Measures

Mitigation measures are proposed to eliminate or reduce potential negative impacts that are rated as moderate or major, and enhancement measures recommended to maximise potential positive impacts where possible. The following mitigation hierarchy is followed:

- avoid at source/reduce at source
- abate on-site
- abate off-site/at receptor
- repair or remedy
- compensate in kind.

The above hierarchy is aimed at ensuring that, wherever possible, potential negative impacts are reduced at the source rather than mitigated through restoration / compensation after the impact has occurred.

3.2.7 Residual Impacts

Any impacts that remain after mitigation measures have been applied are considered residual impacts. Mitigation recommendations are explored as part of the impact assessment process for 'moderate' or 'major' effects. Impacts are reassessed as described above until either the significance is reduced to acceptable levels ('negligible' or 'minor'), or no more mitigation can be applied, and impacts are 'as low as reasonably practicable' (ALARP).

3.3 Social risk and impact identification

Social risks and impacts are identified based on:

- review of documentation (e.g., impacts identified as part of the ESIA Addendum as a base document)
- internal workshops with key company personnel, representing all relevant departments and divisions
- comments / concerns raised during engagement with stakeholders and through the TGMP
- input / advice from contractors.

As part of the risk and impact identification process, a Social Risks and Impacts Register (SRIR) is compiled. A template for the SRIR is included in the worksheet in Appendix A. The SRIR in Appendix A has been completed based on the outcome of the ESIAs conducted to date and is amended and updated over time as the social environment and BWE activities change.

To aid the review and update of the SRIR, typical social impacts encountered in the oil and gas industry and social risk guidewords are also provided in the SRIR worksheet in Appendix A.

3.4 Social risk and impact management, monitoring and review

The SRIR is owned by the BWE Social Performance Manager. It is regularly reviewed and updated, i.e.:

- not less than every 6 months;
- as part of management of change if Project activities change; or
- if there are changes in the external environment.

Updating the SRIR will involve a workshop of key personnel to run through each line item and agree if the current approach is sufficient, or if more needs to be done / more issues need to be added.

Periodic monitoring and review are necessary in order to:

- reflect latest project activities;
- reflect changes in the external environment;
- reflect the efficacy of the current mitigation measures; and
- continuously improve.

4 ROLES AND RESPONSIBILITIES

This section describes the key roles and responsibilities associated with the SRIMP.

4.1 Ongoing development of SRIMP

The BWE Head of Sustainability and HSSE will champion the ongoing development of the SRIR and SRIMP. The BWE Gabon General Manager is responsible for implementation of the SRIMP in Gabon.

4.2 Communication of social risks and impacts

All managers are responsible for communicating information with respect to social risks and impacts to the relevant personnel internally and ensuring that the mitigation measures outlined in the SRIR are properly implemented.

4.3 Bi-annual review of the SRIR

A review of the relevance of the risks and impacts identified through implementation of the procedure and the effectiveness of the proposed mitigation measures shall be conducted bi-annually. The SRIR will be updated as appropriate to reflect any changes in the relevance of risks and impacts and to include new ones that may be identified alongside any changes in the mitigation measures necessary.

The BWE Social Performance Officer shall coordinate this review process, with participation of relevant BWE personnel both in Gabon and elsewhere (e.g., Houston).

4.4 Monitoring of BWE's management of social risks and impacts and reporting

Monitoring of BWE's management of social risks and impacts is part of its monitoring of contractor and internal social performance. This will take place as part of the SMP monitoring and the monitoring conducted under the Environmental and Social Management System (ESMS). It will continue throughout facilities installation (from mobilisation through demobilisation), drilling, as well as the operations phase of all BWE's activities.

5 RELATED DOCUMENTS

5.1 Internal documents

The following internal documents relate to the SRIMP:

Reference	Title
80834/04/12	ESIA Addendum – Dussafu Block Development
80834/04/08/03 (ESIA Addendum – Appendix 11C)	BWE Stakeholder Engagement Plan
80834/04/08/01 (ESIA Addendum – Appendix 11D)	BWE Third-party Grievance Management Procedure
80834/04/08/04/02 (ESIA Addendum – Appendix 11F)	BWE Social Management Plan
-	BWE Corporate Risk Management Standard
-	BWE Corporate Risk Register

6 REFERENCES

Enviropass 2017. BW Energy: Environmental and Social Impact Assessment of the Phase 1 Development Project of the Tortue Oilfield of the PSC Dussafu Marin.

Enviropass 2019. BW Energy: Notice of Environmental Impact of the Turtue Field Development Project Phase II.

Enviropass, 2020. BW Energy: Environmental and Social Impact Assessment of the Ruche Field Development Project Phases I and II in the Ruche EEA in Dussafu.

ERM. 2021. Pre-Financial Close Environmental and Social Assessment. 12 February 2021.

International Finance Corporation. 2012. Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.

IPIECA. 2004. An IPIECA Guide to Social Impact Assessment in the Oil and Gas Industry.

IPIECA. 2020. Sustainability Reporting Guidance for the Oil and Gas Industry.

RSK, 2021. BW Energy Gabon: ESIA Addendum, Dussafu Block Development, Gabon (RSK document reference: 80834/04/12).

APPENDIX A SOCIAL RISKS AND IMPACTS REGISTER (SRIR) WORKSHEET

SRIR Worksheet_Rev01.xl