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ESHIA for GHANA OCTP BLOCK Phase 2

ABSTRACT

This Chapter includes a non-technical summary about the environmental, social, cultural and health impact assessment undertaken for the Ghana OCTP Block Phase 2 Project.

March 2015	02	Interim Draft Issued for Disclosure	ERM	HSE & CI Manager Juan Deffis HSE Project Manager Giuseppe Nicotra	Development Project Manager Ezio Miguel Lago
Date	Revision	Revision Description	Prepared	Checked	Approved

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<i>Summary of Revisions</i>					
27-02-2015	01	Issued for submission to Authorities	ERM	HSE & CI Manager Juan Deffis HSE Project Manager Giuseppe Nicotra	Development Project Manager Ezio Miguel Lago
27-02-2015	00	-	Cristina O.	Henry C.	Daniele S.
Date	Revision	Revision Description	Prepared	Checked	Approved

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ACRONYMS

Acronym	Definition
ABS	American bureau of shipping
AFDB	African Development Bank
AHTS	Anchor handling tug supply
AHV	Anchor handling vessel
ALARP	As low as reasonably practicable levels
ANC	Antenatal care
AoI	Area of influence
API	API Technical Standard 520 and 521
ART	Antiretroviral therapy
BA	Bachelor of Arts
Bbls/d	Barrels per day
BCG	meningitis and disseminated tuberculosis in children
BDT	Basic Design and Technology
BDVs	Blow down valves
BID	Background information document
BOD	Biological Oxygen Demand
BOP	Blow out preventer
Bsc	Bachelor of Science
BSCF	Billion Standard Cubic Feet
CBD	Convention on Biological Diversity
CBOs	Community based organisation
CBSV	Community-based surveillance volunteers
CCF	Congestive cardiac failure
CHN	Community health nurse
CHO	Community health officers
CHPS	Community-based health planning and services
CLC	Convention on Civil Liability for Oil Pollution Damage
CLO	Community liaison officer
CMC	Carboxyl methyl cellulose
CMU	Concrete Masonry Units
cMYP	Comprehensive multi-year plan
CO	Carbon monoxide
CO₂	Carbon dioxide
COLREG	International Regulations for Preventing Collisions at Sea
CPF	Central processing facility
CPUE	Catch per unit effort
CRC	Coastal Resources Centre
CSR	Corporate social responsibility
CVA	Cerebral vascular accident
DACF	District Assembly Common Fund

Acronym	Definition
DANIDA	Danish International Development Agency
DAoI	Direct Area of Influence
DFI	Developmental Finance Institutions
DFID	UK department for International Development
DHIMS	District health information management system
DIF	Drill-In-Fluid
DNV	Det Norske Veritas
DP	Dynamically positioned vessel
DPT	diphtheria-pertussis-tetanus
EA	Environmental assessment
EAoI	Extended Area of Influence
ECC	Equatorial Counter Current
ECOWAS	Economic Community of West African States
EDA	Ellembelle District Assembly
EDF	Électricité de France
EDP	Ellenbelle Distric Profile
EEZ	Economic Exclusion Zone
EHS	Environmental, health and safety
EIA	Environmental Impact Assessment
EIS	Environmental impact statement
EMP	Environmental Management Plans
EN	Endangered
eni	Ente Nazionale Idrocarburi
EP	Environmental Permit
EPA	Environmental protection agency
EPA	Environmental protection Agency
EPFI	Equator Principle Financial Institutions
EPI	Expanded program on immunisation
EPs	Equator principles
ERM	Environmental Resources Management
ERP	Economic Recovery Programme
ERT	Emergency Response Team
ESD	Emergency Shutdown System
ESH	Environmental, social and health
ESHIA	Environmental and social impact assessment
ESHMP	Environmental, social and health management plan
ESIA	Environmental and social impact assessment
ESL	ESL Consulting
ESL	ESL Consulting
EU	European Union
EZZ	Exclusive economic zone
FADs	Fish Aggregating Devices

Acronym	Definition
FAO	Food and Agriculture Organization
FCM	Flow control module
FGD	Focus Group Discussions
FGDs	Focus group discussions
FIA	Fisheries Impact Assessment
FIR	Flight information region
FLETs	Flowlines end terminations
FMC	Flow Control Module
FoN	Friends of the Nations
FP	Family Planning
FPSO	Floating production storage and offloading vessel
FRHP	Ghana Focus Region Health Project
FUND	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage
GACL	Ghana Airports Company Limited
GCAA	Ghana Civil Aviation Authority
GCLME	Guinea current large marine ecosystem project
GDHS	Ghana Demographic and Health Survey
GDP	Gross Domestic Product
GEF	Global environmental fund
GH	Ghana
GHG	Greenhouse gas
GHS	Ghana health service
GII	Gender Inequality Index
GIIP	Good international industry practice
GIS	Geographical Information System
GMA	Ghana Maritime Authority
GNGC	Ghanaian National Gas Company
GNPC	Ghana National Petroleum Corporation
GoG	Government of Ghana
GPHA	Ghana Ports and Harbours Authority
GPRTU	Ghana Private Transport Union
GSGDA	Ghana shared growth and development agenda
H&S	Health and safety
Ha	hectare
HIRD	High impact rapid delivery
HIV/AIDS	Human immunodeficiency virus / Acquired immune deficiency syndrome
HP	High pressure
HPI	HPI Llc. Company
HRDU	Human resource development unit
HTC	HIV testing and counselling
HVAC	Heating, Ventilating and Air Conditioning

Acronym	Definition
IBA	Important bird area
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICSS	Integrated Controlled Safety System
ID	Inner Diameter
IDSR	Integrated disease surveillance and response
IEZ	Inshore Exclusion Zone
IFC	International Finance Corporation
IFG	Induced Gas Flotation
IGF	Internally generated fund
ILO	International labour organisation
IMF	International Monetary Fund
IMO	International Maritime Organisation
INTERVENTION	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties
IPIECA	International petroleum industry environmental conservation association
IPT	Intermittent preventive treatment
ISPS	International ship and Port Facility Code
ITC	Information Communication Technology
ITCZ	Inter Tropical Convergence Zone
ITDP	Integrated Tourism Development Plan
ITNs	Insecticide Treated Net
IUCN	International Union for the Conservation of Nature
JHS	Junior High School
JV	Joint venture
KII	Key informant interviews
km	Kilometre
KP	Kilometre Point
KVIP	Kumasi Ventilated Improved Pit
LC	Least Concern
LEAP	Livelihood Empowerment against Poverty
LI	Legislative instrument
LN	Legislative Notice
LNG	Liquefied natural gas
LP	Low pressure
LPG	Liquid petroleum gas
m	metre
MARPOL	International Convention for the Prevention of Pollution From Ships
MDAs	Ministries Department and Agencies
MDGs	Millennium Development Goals
MEDEVAC	Medical Evacuation
MEG	Mono ethylene glycol
MMbbls	Million barrels

Acronym	Definition
MMboe	Million barrels of oil equivalent
MMcf/d	Million cubic feet per day
MMSCFD	Million Standard Cubic feet per Day
MODU	Mobil offshore drilling units
MoH	Ministry of Health
MSc	Master degree
MTDP	Medium term development plan
MTN	MTN Group - Mobil telephone operator
MW	Megawatt
NAB	National Accreditation Board
NADF	Non-aqueous drilling fluid
NADMO	National Disaster Management Organization
NAFAG	National Fisheries Association of Ghana
NAG	Non associated gas
NAS	National ambulance service
NBTS	National blood transfusion service
NCA	National Communication Authority
NE	North East
NEAP	National environmental action plan
NECC	North Equatorial Counter Current
NEP	National environmental policy
NGO	Non-governmental organisation
NHIS	National health insurance scheme
nm	Nautical mile
NO₂	Nitrogen dioxide
NORSOK	Norsk Sokkels Konkuranseposisjon
NO_x	Oxides of nitrogen
NPA	National Petroleum Authority
NRCD	National Redemption Council Decree
NT	Near Threat
NTP	National tuberculosis control program
NW	North West
OCNS	Offshore Chemical Notification Scheme
OCTP	Offshore cape three points
OD	Outer diameter
ODP	Outpatient department
OECD	Organisation of Economic Cooperation and Development
OGP	International association of oil & gas producers
OPRC	Oil pollution preparedness, response and co-operation
ORF	Onshore reception facility
OSPAR	Oslo-Paris Convention for the protection of the marine environment of the North-East Atlantic

Acronym	Definition
OVC	orphan or vulnerable child
PAHs	Polycyclic Aromatic Hydrocarbons
PEAs	Preliminary environmental assessments
PLET	Pipeline end termination
PLONOR	Pose Little or No Risk
PLWA	People living with HIV/AIDS
PM₁₀	Particulate matter less than 10 microns diameter
PMTCT	Prevention of mother to child transmission
PNC	Postnatal care
PNDCL	Marine Zones (Delimitation) Law
PoD	Plan of development
PPBME	Policy Planning Budgeting Monitoring and Evaluation
PPE	Personal protective equipment
PPP	Public-private partnership
PS	Performance Standards
PSA	Production Sharing Agreement
PSV	Process safety valves
PTA	Parent Teacher Association
PTR	Pupil per teacher ratio
PTTR	Pupil per trained teacher ration
PWD	Person with extreme disability
QA/QC	Quality Assurance and Quality Control
RCC	Regional Coordinating Council
RCH	Reproductive and child health
RDT	Rapid diagnostic testing
ROV	Remotely operated vehicle
ROW	Right of way
RPF	Resettlement policy framework
RSIM	Research Statistics Information Management
SAIPEM	Società Anonima Italiana Perforazioni E Montaggi
SBM	Synthetic oil based mud
SCADA	Supervisory Control And Data Acquisition
SCM	Subsea control module
SEP	Stakeholder engagement plan
SHS	Senior High School
SO₂	Sulphur dioxide
SOLAS	International convention for the Safety of Life At Sea
SOPEP	Shipboard oil pollution emergency plan
SO_x	Sulphur oxides
SPS	Subsea production system
SRC	SRC consulting
SSIV	Sub-sea isolation valve

Acronym	Definition
STCW	International Convention on Standards of Training, Certification, and Watch keeping for Seafarers
STIs	Sexually transmitted disease
STMA	Sekondi-Takoradi Metropolitan Assembly
SURF	Subsea umbilicals, risers and flowlines
SWOT	Strengths-Weaknesses-Opportunities-Threats
TB	Tuberculosis
TBA	Traditional birth attendant
TBC	To be confirmed
TBD	To be determined
TEN	Tweneboa, Enyenra and Ntomm
TH	Teaching hospital
ToR	Terms of reference
TPH	Total petroleum hydrocarbons
TSP	Total suspended particulate
TT	tetanus toxoid
TTC	Teacher Training Colleges
TWA	Time-Weighted Average
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United nation Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UPS	Uninterruptable power supply system
US	United State
USAID	United States Agency for international development
USD	US dollar
UTM	Universal Transverse Mercator
VIP	Ventilation Improved Pit
VLCC	Very large crude carrier
VOCs	Volatile Organic Compounds
VU	Vulnerable
WACAF	West And Central Africa
WAGP	West African Gas Pipeline Company
WB	World Bank
WC	Water Closet
WD	Water Deep
WHO	World health organization
WHRU	Waste Heat Recovery Unit
WRCC	Western Region coordinating Council
WRSDF	Western region spatial development framework
XTs	Christmas trees

1 NON TECHNICAL EXECUTIVE SUMMARY

1.1 INTRODUCTION AND PURPOSE OF REPORT

1.1.1 Overview

The Offshore Cape Three Points (OCTP) Project involves the development of the Sankofa and Gye Nyame Fields located in the OCTP Block which is located approximately 60 km offshore the Western Region of the Republic of Ghana. The Project has two phases:

- **Phase 1:** Oil development project.
- **Phase 2:** Non Associated Gas (NAG) development project.

The Phase 2 Project components include five subsea gas production wells connected by subsea umbilicals, risers, and flowlines to the Floating Production Storage and Offloading (FPSO) unit installed for the Phase 1 project. During operations, well fluids will be collected at a dedicated production manifold located on the FPSO where the multiphase fluids will be sent to a slug catcher for initial separation. The gas separated from the other fluids (mainly condensates and water) will then be routed to a dew point control system to achieve the required export specification ensuring no flow assurance problems. The treated gas will then be exported to shore via a new subsea pipeline. Onshore, the gas will be received at an Onshore Receiving Facility (ORF) and then sent to the existing GNGC sales pipeline.

1.1.2 Project Justification

The Project represents a foundation for gas production in Ghana bringing new sources to market for the benefit of industries and the people of Ghana. The Project will support the wider Ghana Gas Infrastructure Development Project which is currently under development in the Western Region.

The development of the Project will also provide local employment and other economic benefits to the local communities as well as to the Western Region and Ghana in general.

1.1.3 ESHIA Process

Under the Ghana Environmental Assessment Regulations (1999), the Phase 2 Development Project requires a full ESHIA process and submission of this ESHIA Report to the Ghanaian Environmental Protection Agency (EPA) for their decision on whether to issue an environmental permit for the Project.

The ESHIA for the Project was undertaken in accordance with the Ghana Environmental Assessment Regulations as well as the requirements of international lender environmental and social standards. An overview of the ESHIA process undertaken follows.

Screening and scoping

The Project was registered with the EPA on 12 December 2014. EPA screened the Project and determined that a full ESHIA was necessary.

A scoping process was conducted and a Scoping Report was prepared. The Scoping Report provided a description of the Project, scoping consultation process, baseline information and a proposed Terms of Reference for the ESHIA. The Scoping Report was submitted to the Ghana EPA on 30 December 2014 for review. The Ghana EPA provided comments to the Scoping Report on 24 February 2015 and instructed eni Ghana to proceed with the full ESHIA.

Baseline data collection

Available data on the existing environmental, social and health conditions was gathered as a basis against which the impacts of the project can be assessed. In addition to a desktop review, primary data was collected during field surveys. Surveys included offshore and onshore biophysical surveys undertaken in the wet and dry season and a socio-economic and health field survey undertaken in December 2014.

Stakeholder engagement

The stakeholder engagement process comprised the following activities:

- Identification of a preliminary list of stakeholders;
- Background information document (BID) for communicating with stakeholders;
- Meetings with government departments and stakeholder groups; and
- Meetings with local community members.

During scoping, meetings were held with 30 stakeholder groups. Stakeholders consulted included national, regional and district authorities, traditional leadership, non-governmental organisations (NGOs), international organisations and fisherman groups.

Stakeholder engagement continued through the ESHIA with formal and ad hoc communication with Project stakeholders through email and telephone and meetings between eni Ghana and local community members who engaged with the process.

A summary of the key issues and further details on the stakeholder consultation process are included in Chapter 1 and Stakeholder Engagement Plan (SEP) (Annex A).

Impact assessment

Using the baseline information gathered and a detailed description of the Project and planned activities, the impact assessment process followed four steps:

1. Prediction of what will happen as a consequence of project activities;
2. Evaluation of the importance and significance of the impact;
3. Development of mitigation measures to manage significant impacts where practicable; and
4. Evaluation of the significance of the residual impact.

The impact assessment considered both predictable and unpredictable impacts (such as accidents). Those that were assessed as significant were further rated as being of minor, moderate or major significance. For significant impacts, mitigation measures were developed to reduce the residual impacts to *As Low As Reasonably Practicable* (ALARP) levels. This approach takes into account the technical and financial feasibility of mitigation measures.

Management plans

The ESHIA process identified a range of mitigation measures, management actions and monitoring to be implemented during the project to eliminate or reduce adverse environmental and social impacts and risks and enhance positive impacts. Delivery of these will be through the Project's Environmental, Social and Health Management Plan (ESHMP).

Reporting and disclosure

The results of the ESHIA process are drawn together into an ESHIA report which is submitted to Ghana EPA for review. The EPA will disclose the ESHIA report to the affected communities, interested stakeholder, and to the public and facilitate public review and comment. The ESHIA will also under go technical review by the EPA and appointed experts.

Following review, the EPA will make a decision to grant or deny the Environmental Permit.

1.2 LEGAL AND POLICY FRAMEWORK

1.2.1 Ghanaian Administrative Framework

The EPA, within the Ministry of Environment, Science, Technology and Innovation, is the leading public body responsible for the protection and improvement of the environment in Ghana. The EPA is responsible for issuing environmental permits and pollution abatement notices for controlling waste discharges, emissions, deposits or other source of pollutants and issuing directives, procedures or warnings for the purpose of controlling noise. EPA also directs the National Efforts for Tier 2 spillages and is one of coordination and provision of technical advice, logistic and maintenance support, materials and equipment, and training for Tier 3 spillages. EPA, in accordance with relevant Memoranda of Understanding and relevant International Conventions (such as Abidjan Convention), may also assist or receive assistance from neighbouring countries in relation to oil spill incidents.

Other authorities with responsibilities related to the project are:

- Ministry of Energy and Petroleum – represented through the Ghana Petroleum Commission and the National Petroleum Corporation (GNPC);
- Ministry of Transport – represented through the Ghana Maritime Authority (GMA), the Ghana Ports and Harbours Authority (GPHA) and the Ghana Civil Aviation Authority (GCAA);
- Ministry of Food and Agriculture – represented through the Directorate of Fisheries the Fisheries Commission and the Regional Departments of Fisheries;
- Ministry of Defence - represented through the Ghana Navy and Ghana Air Force;
- Ministry of Finance and Economic Planning;
- Ministry of Roads and Highways;
- Ministry of Water Resources, Works and Housing;
- Ministry of Lands and Natural Resources; and
- Ministry of Local Government and Rural Development – represented through the ten Regional Coordinating Councils.

1.2.2 National Law and Regulations

The Constitution of Ghana within Article 36 of Chapter 6 states that “*The State shall take appropriate measures needed to protect and safeguard the national environment for posterity; and shall seek co-operation with other states and bodies for purposes of protecting the wider international environment for mankind*”. Within the Article 41(k) of the same Chapter 6, it is also requires that “*it shall be the duty of every citizen [...] to protect and safeguard the environment*”.

The Ghana EPA was established under the Environmental Protection Agency Act (Act No. 490 of 1994) as the leading public body responsible for the protection and improvement of the environment in Ghana. The EPA has the authority to require an EIA, is responsible for ensuring compliance with EIA procedures and is the lead EIA decision-maker.

Laws and regulations relevant to the Project are listed in Table 1.1. Further detail is provided in Chapter 3 of this EIS.

Table 1.1 List of Relevant National Environmental, Social, and Health Legislation

Applicable Legislative Instrument	Aspect
Environmental Protection Agency Act, 1994 (Act 490)	Environmental Protection
Environmental Assessment in Ghana, a Guide to Environmental Impact Assessment Procedures (EPA, 1996).	Environmental Protection
EPA Environmental Quality Guidelines for Ambient Air	Environmental Protection
EPA Guidelines for Environmental Assessment and Management in the Offshore Oil and Gas Development (EPA, 2010)	Environmental Protection
EPA Sector Specific Effluent Quality Guidelines for Discharges into Natural Water Bodies	Environmental Protection
EPA General Environmental Quality Standards for Industrial or Facility Effluents, Air Quality and Noise Levels	Environmental Protection
Ghana Oil & Gas Operational Guidelines	Environmental Protection
Environmental Assessment Regulations, 1999 (LI 1652) Environmental Assessment (2002 Amendment) Regulations	EIA requirements and process
Wild Animals Preservation Act, Act 235 1964	Biodiversity
Wildlife Conservation Regulations 1971 (LI 685),	Biodiversity
Wild Reserves Regulations 1971 (LI 740)	Biodiversity
Wetland Management (RAMSAR sites) Regulation, 1999	Protected Areas
Water Resources Commission Act (Act 522 of 1996)	Water Resources
Water and Sewerage Corporation Act (Act 310 of 1965).	Water Resources
Beaches Obstructions Act, 1987 (CAP. 240)	Coastal and maritime legislation
Ghana Maritime Authority (Amendment) Act 2011 (Act 825)	Coastal and maritime legislation
Ghana Shipping Act	Coastal and maritime legislation
Ghana Maritime Security Act	Coastal and maritime legislation
The Maritime Zones (Delimitation) Law	Coastal and maritime legislation
Ghana Shipping (Protection of Offshore Operations and Assets) Regulations	Coastal and maritime legislation
Fisheries Act 2002, Act 625	Fisheries and Access to Fishing
Fisheries Regulation, LI 1968	Fisheries and Access to Fishing
Oil in Navigable Waters Act (Act 235 of 1964)	Pollution Control
Marine Pollution Bill (pending approval)	Pollution Control
Marine Pollution Prevention and Control Regulations (pending approval)	Pollution Control
Ghana National Petroleum Corporation Act (Act 64 of 1983)	Petroleum activities
Petroleum (Exploration and Production) Law (Act 84 of 1984)	Petroleum activities
National Petroleum Authority Act (Act 691 of 2005)	Petroleum activities
Petroleum Commission Act	Petroleum activities
Ghana Highways Authority (Act 540 of 1997)	Transport activities
Labor Act, 2003, Act 651	Labour and Social responsibilities
The Children's Act (Act 560) of 1998	Labour and Social responsibilities

Applicable Legislative Instrument	Aspect
Commission on Human Rights and Administrative Justice Act (Act No. 456 of 1993)	Labour and Social responsibilities
National Vocational Training Act (Act 351) of 1970	Labour and Social responsibilities
Local Government Act 462	Land management
National Development Planning Commission Act, 1994	Land management
National Development Planning (Systems) Act, 1994	Land management
National Building Regulation, 1996 (LI 1630)	Land management
Town and Country Planning Ordinance, 1945	Land management
Lands Commission Act, 1994 (Act 483)	Land management
Land Planning and Soil Conservation Act 1953 (Act 32)	Land management
Stool Lands Act, 1994 (Act 481)	Land management
State Lands Act. 1962 (Act 125)	Land management
Hospital Fees act, 1971 (Act 387)	Health
Mental Health Decree, 1972 (NRCD 30)	Health
Nurses and Midwives Decree 1972 (NRCD 117)	Health
Medical and Dental Decree 1972 (NRCD 91)	Health
Medical Profession (Professional Conduct and Ethics). Regulations, 1975 (LI 1023)	Health
The Ghana College of Physicians and Surgeons Act (635)	Health
Ghana Health Service and Teaching Hospital Act, 1996	Health
Traditional Medicine Practice Act (Act 575)	Health
Private Hospitals and Maternity Homes (No. 9) Act, 1958 (LN. 295)	Health
Pharmacy Act 1994 (Act 489)	Health
Environmental Protection Agency Act (Act 490);	Health
Infectious Diseases, (Cap 78)	Health
National Health Insurance Act 2003 (Act 650)	Health
National Health Insurance Regulation 2004 (L.I 1809)	Health

1.2.3 International Conventions

The Republic of Ghana is signatory to a number of international conventions and agreements relating to industry, development and environmental management. In certain cases, conventions and agreements have influenced policy, guidelines and regulations and therefore are relevant to planning, construction and operation of the Project.

1.2.4 Industry Best Practice

There are a number of industry good practice standards and guidelines for offshore oil and gas developments. Considering the oil and gas industry, one's of the most commonly used best practices references are the guidelines and best practices standards provided by the International Association of Oil and Gas Producers (OGP) and of the International petroleum Industry

Environmental Conservation Association (IPIECA) of which eni is member. A detailed list of guidelines is provided in Chapter 3 of the ESHIA.

1.2.5 Financial institution Environmental and social performance standards

The ESHIA is aligned to comply with the relevant standards and guidelines for environmental and social performance set out and adopted by World Bank (WB) and International Finance Corporation (IFC).

In particular the Project takes into account the International Finance Corporation Performance Standards for Environmental and Social Sustainability (2012) (the 'Performance Standards') and the World Bank Group Environmental, Health and Safety (EHS) Guidelines. These are summarized in Table 1.3.

Table 1.2 WB/IFC Guidelines

PS 1: Assessment and Management of Environmental and Social Risks and Impacts	Performance Standard
PS 2: Labour and Working Conditions	Performance Standard
PS 3: Resource Efficiency and Pollution Prevention	Performance Standard
PS 4: Community Health, Safety, and Security	Performance Standard
PS 5: Land Acquisition and Involuntary Resettlement	Performance Standard
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Performance Standard
PS 7: Indigenous Peoples	Performance Standard
PS 8: Cultural Heritage	Performance Standard
EHS General Guidelines	EHS Guideline
EHS Guidelines for Shipping	EHS Guideline
EHS Guidelines for Offshore Oil and Gas Development	EHS Guideline
EHS Guidelines for Thermal Power Plants	EHS Guideline
World Bank Policy on Access to Information	Access to Information

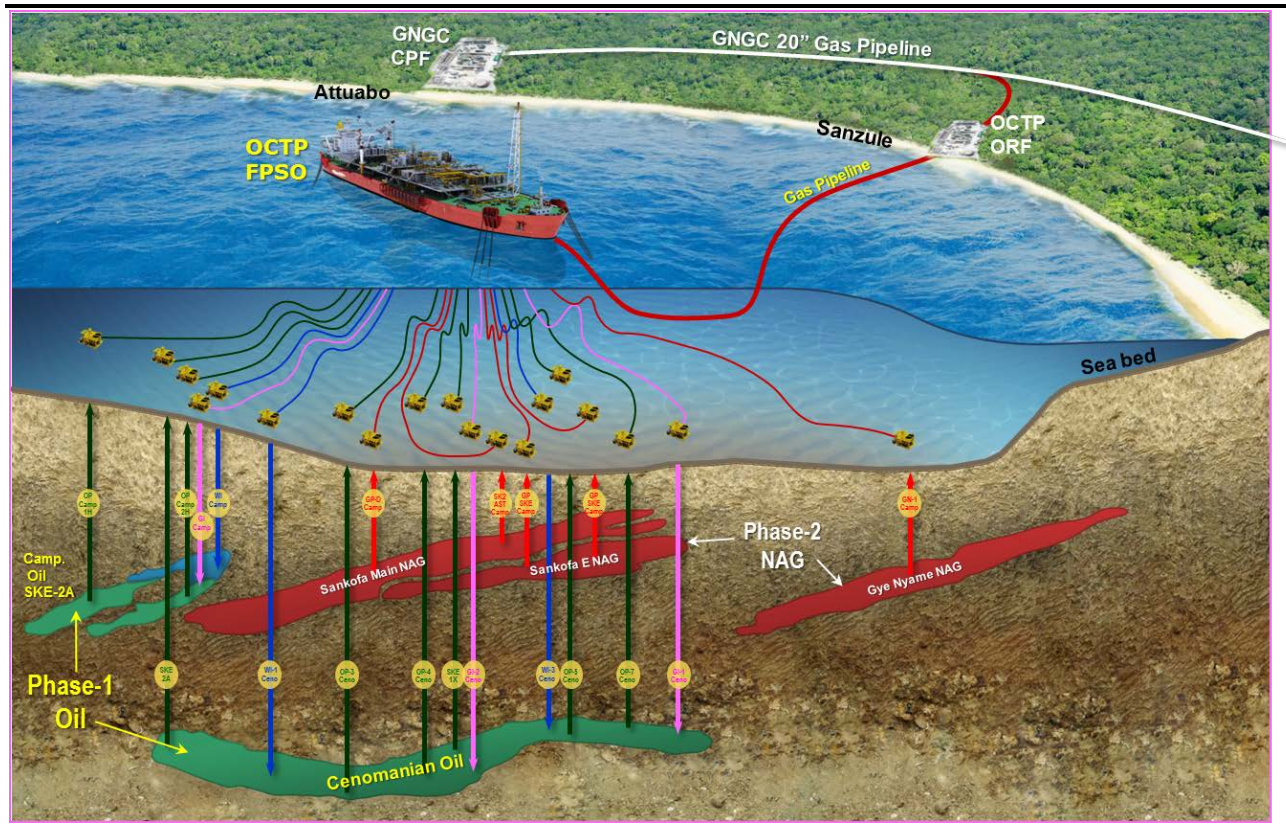
1.2.6 Project Environmental Standards

The standards applied by the Project for environmental and social components are based on MARPOL, good industry practice and IFC EHS Guidelines. Many of these standards have now been adopted in the EPA's Guidelines for Environmental Assessment and Management in the Offshore Oil and Gas Development (2010). Details of the standards applied by the Project are reported in Chapter 3 of the EIS.

1.3 PROJECT DESCRIPTION

The Project involves production of gas from subsea production wells located approximately 60 km offshore of Ghana. The Phase 2 Project is designed to be integrated with the Phase 1 Development. The Phase 1 development includes eight oil production wells, three water injection wells, three associated gas injection wells, related subsea facilities and a Floating Production Storage and Offloading (FPSO) unit. Figure 1.1 presents a schematic of the integrated development scheme. Phase 2 components shown in red.

Figure 1.1 Schematic of the OCTP project



Source: eni, 2015

1.3.1 Project Location

The OCTP field is located at about 60km south of the village of Sanzule on the Western Ghanaian coast. The fields are located in water depth of approximately 500m to 1000m.

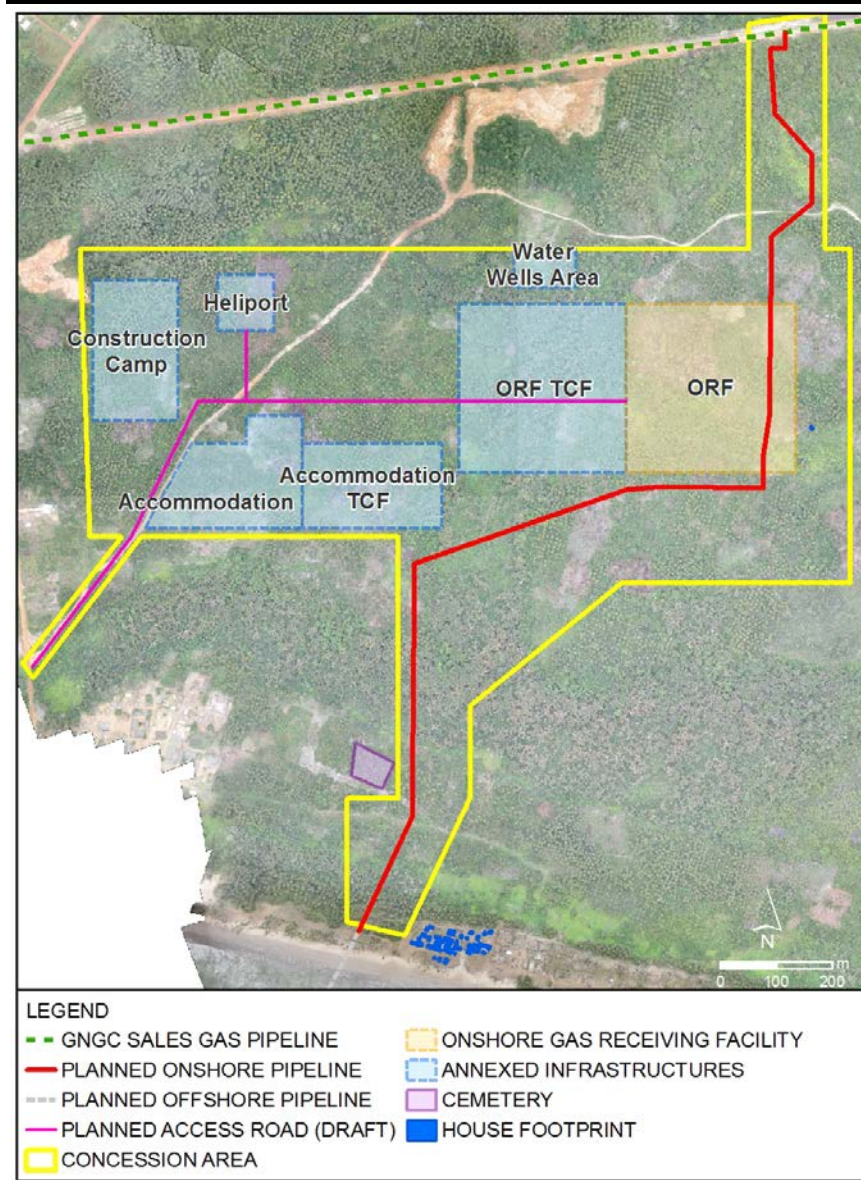
The gas wells, subsea infrastructure, and FPSO will be located in the OCTP Block. The gas pipeline will run from the FPSO to a shore landing near Sanzule. The onshore components will be located near Sanzule, approximately 900 m northeast of the village (Figure 1.1).

The gas reservoirs are named Sankofa Main, Sankofa East and Gye Nyame. Four wells will be drilled in the Sankofa reservoirs, while the fifth will be drilled in Gye Nyame.

The FPSO will be located near the Sankofa reservoirs (Figure 1.3). The onshore concession area is shown in Figure 1.2. Rights to use the concession area will be acquired by eni.

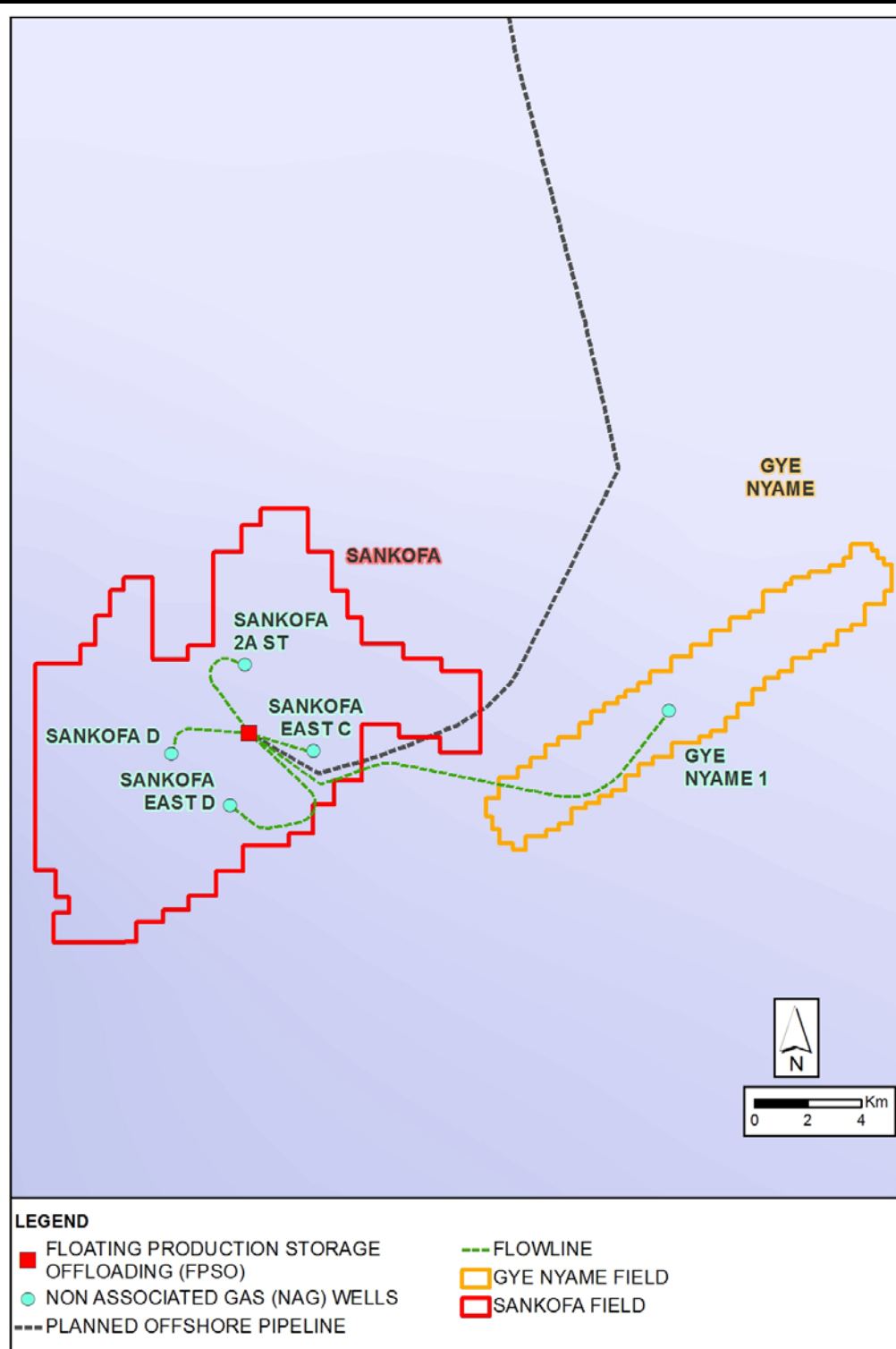
The onshore facilities will include permanent facilities such as the ORF (90000 m²), the permanent accommodation camp (27000 m²), the helipad, roads and pipelines (outlined in pink and red) and temporary construction facilities (TCF), such as ORF temporary construction facility, temporary accommodation camp and construction camp (outlined in blue).

Figure 1.2 Onshore facilities layout



Source: eni, 2015

Figure 1.3 NAG wells and flowlines layout



Source: ERM, 2014

1.3.2 Project Schedule and duration

Project construction will last approximately three years commencing from the end of 2016 to the end of 2019. The Project will be phased with the aim to produce gas from two of the five wells in February 2018 with a raw gas rate of 190 MMSCFD. In order to maintain peak production, two new wells will be put in production during the fourth quarter of 2019 while the fifth well will be started in 2028.

Plateau duration is estimated for 13.5 years and the design life for new installations is set to be 20 years.

1.3.3 Project Activities

The Project will comprise the following main activities.

Site preparation

As a first step, the site of the onshore facilities will be prepared. This will involve equipment mobilization, material transport, site clearance and infilling for the ORF, the onshore pipelines and temporary facilities and construction of internal roads for the ORF, the accommodation camp and temporary facilities.

Construction phase

For the offshore part of the project, this phase will include:

- Well drilling, re-entry, completion and testing;
- Subsea system installation;
- FPSO mooring and hook up;
- Gas export pipeline laying;
- Pre-commissioning and commissioning activities (FPSO commissioning, pipeline hydrotesting, subsea system testing).

The offshore construction phase will require the use of a drilling rig, pipeline laying barges for shallow and deep waters, support and supply vessels and tugs.

For the onshore part of the project, the following activities are foreseen:

- Gas export pipeline installation (underground);
- ORF construction;
- Permanent accommodation camp and helipad construction;
- Temporary facilities construction;
- Pipeline from ORF to GNGC pipeline (underground);
- Pre-commissioning and commissioning activities (ORF commissioning, pipeline hydrotesting).

This phase will require use of cranes, excavators, earthmoving equipment, trucks, vehicles, generators, concrete mixers.

Operation phase

During operations gas extracted from the wells will be treated on the FPSO and sent to the ORF through the gas export pipeline. At the ORF gas will be received, fiscally metered, compressed and delivered to the GNGC gas sales line through a tie-in.

The proposed Project has an operational lifespan of 20 years.

Maintenance of project facilities will be performed during normal operation. The maintenance will be performed on site, the machines will be equipped with dedicated systems including the remote condition monitoring and sparing philosophy, aimed to ensure the requested plant availability. Moreover, the design will allow easy access to the main equipment for major maintenance.

Decommissioning

After the 20 years lifespan of the project, the facilities will be decommissioned and abandoned in accordance with Ghana laws and regulations and international guidelines for abandonment of oil and gas facilities. A detailed programme of abandonment and decommissioning will be prepared.

1.3.4 Project Alternatives

Project alternatives were evaluated during design to maximize and ensure environmental and social sustainability of the project.

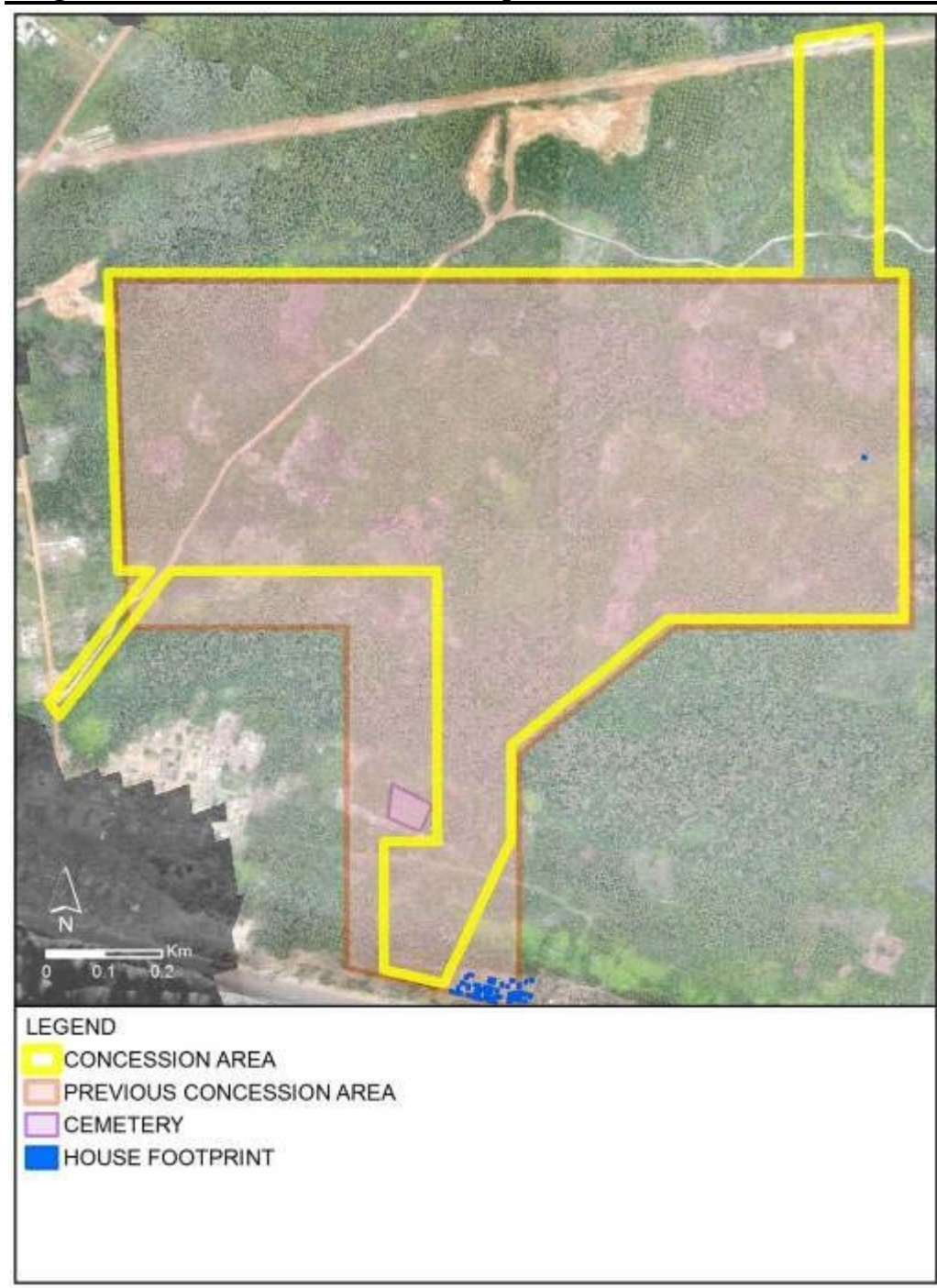
The no-project alternative was evaluated together with alternative designs, layouts and technologies. This alternative implies that only the oil reservoirs will be exploited (Phase 1), while gas reservoirs will be left in place, without additional benefits to the economy.

Locations for the FPSO were evaluated and the preferred option allows minimization of flow lines and umbilicals lengths. The spread mooring option was selected in order to allow the possibility to anchor the FPSO outside a subsea canyon (even if her location is exactly on the canyon) and assure a high level of flexibility in the plant configuration.

Locations of onshore facilities were deeply evaluated prior to selecting the proposed project location on the basis of environmental, social, technical and logistic data. The investigated area for the onshore plant runs along Ghanaian Western Coast from town of Takoradi to the Ivory Coast Border for 4-5 km inland. A desk-based study was performed and then site surveys were performed.

Moreover in the selected area near Sanzule, the onshore concession was selected in order to minimize physical resettlement of people and interferences with cultural sites. The final footprint was modified on the basis of detailed site surveys. Some areas were excluded from the concession in order to avoid impacts on inhabited areas located to the east of the gas export pipeline corridor (see houses footprints in blue) and the cultural heritage area (see cemetery footprint in pink) located to the West of the onshore pipeline section, as can be seen in Figure 1.4.

Figure 1.4 Onshore concession footprint reduction from 2014 to 2015



Source: ERM, 2015

Some design and layout options were evaluated:

- Rigid and flexible subsea flow lines, risers and umbilicals were considered. Flexible type was selected as it is able to accommodate irregularities of the seabed morphology.
- Two compression station operation conditions were selected in order to assure maximum flexibility to the compression station.

1.3.5 Emissions, Discharges and Wastes

Air emissions

During construction phase airborne emission will be pollutants from the exhausted gas of heavy equipment, vehicles and vessels. The main pollutants produced will be NO_x, CO, PM₁₀ and SO_x. Dust will also be produced during earth moving, excavation and transport activities.

During well production tests, gas from the tested wells will be flared for a limited period (4.5 days).

During operation phase, offshore air emission sources are related to the FPSO operation such as gas turbines for power generation and gas compression. As the project has adopted a “zero flaring” design philosophy, flares will be used only in emergency or plant upset conditions and thus for very limited periods.

For the ORF main air emission sources will be gas turbines, diesel power generation units and gas compression. The vent at the ORF will be used only during commissioning, start-up, shut down and emergency conditions for the pipeline and plant depressurization.

Wastewater discharges

During the construction phase, the vessels (including pipe laying barges and drilling rig) will adhere to MARPOL regulations and will be equipped with waste water treatment units for the treatment of civil wastewater.

The seawater used during offshore pipeline hydro testing will be discharged to the sea. Only environmentally friendly inhibitors will be used and their discharge concentrations will be in line with local and international standards.

For onshore construction activities, no waste water discharge is foreseen as disposal off site is foreseen for any liquid produced during this phase.

During operation, FPSO will generate different streams: some of them, such as cooling water, domestic water, service water, bilge water will be discharged to the sea after treatment on the FPSO, while produced water will be re-injected in reinjection wells.

The waste water effluents from the ORF operation will be mainly civil water and storm water, as the ORF processes only the gas stream and thus no liquids will be generated and no chemicals will be added into the gas stream. Main industrial sources of wastewater will be accidental contamination with diesel (for emergency power generation) and lube oil (from turbines and compressors) and turbine blade washing. The wastewater effluents will be removed and disposed of in appropriate treatment plants.

Noise

During the offshore construction phase noise emission will be produced by drilling and completion activities and by the support vessels.

During onshore construction noise will be generated mainly by heavy equipment and ORF items installation.

During commissioning phase, noise sources are compressors and pumps for the hydro testing.

During operations offshore noise will be generated mainly by the FPSO processing equipment, while onshore the ORF will generate continuous noise emission sources with gas turbines, diesel power generators and the compressors. Some discontinuous noise sources will be present in the ORF: operation valves, filters and air coolers.

The ORF design will be developed assuring that all the equipment is in compliance with the applicable limits and, where necessary, noise attenuation packages will be used.

Waste

In the OCTP project, only waste management companies approved by Ghanaian authorities will be used for transportation, recycling and disposal of produced wastes. A Waste Management Plan is in place at eni Ghana.

During offshore construction phase wastes are produced by drilling and completion activities (used drilling muds, drilling fluids, and cuttings), domestic and other solid waste (oily rags, empty cans, batteries).

Seawater drilling mud will be discarded to the seabed, while Non Aqueous Drilling Fluid (NADF) will be treated on the rig and discharged at water depths equal or greater than 500 m. Discharge will be in compliance with IFC EHS Guidelines for Offshore Oil and Gas Development. All the other waste produced during the construction activities will be collected on the drilling vessel and brought onshore for appropriate treatment and disposal.

During onshore construction activities, all waste materials will be collected, stored and transported separately in appropriate and approved containers. For pipeline construction, most of the excavated soil will be used to backfill the trenches. Excess soil will likely be spread out and contoured along the route. Wastewater and solid waste from the work and construction sites will also be generated and disposed of accordingly with local and international standards.

During FPSO operations, limited quantities of waste will be produced mainly due to equipment maintenance and operation. Waste will be collected, unloaded and transported onshore to suitable facilities to be disposed in line with the local regulations and best practice.

During ORF operation, small quantities of waste will be produced from the ORF from equipment maintenance and operation. Domestic waste will also be generated. Both waste types will be handled accordingly to local regulations and best practice.

1.3.6 Personnel requirements

During construction phase a total peak of workforce demand for onshore construction will be approximately 400-600 people, while for offshore activities about 300 workers will be employed for drilling activities, 210 for FPSO mooring and 200 for gas export pipeline laying. During construction phase, Ghanaians will be involved mainly in ORF construction activities, while offshore activities will involve mainly expatriates.

During operations, permanent employee on the FPSO will be approximately 65, mainly Ghanaians (49 people), while in the ORF 45 people will be employed (20 percent expatriates, 80 percent Ghanaians).

Depending on professional profile and required skills, local people will be recruited. Preference will be given to people of the project area. If some profiles cannot be recruited in the project region, they will be recruited in other Ghana regions.

1.3.7 Health and Safety

The OCTP Project Phase 2 will be developed and will operate in compliance with safety requirements included in all applicable conventions and codes that cover maritime activities and Ghanaian legislation and regulations that cover onshore operations.

Moreover it will adhere to the eni Ghana HSE Integrated Management System, as well as eni HSE standards and project HSE documentation.

Facilities design will aim to reduce risks for health and safety and minimise hazards, and thus the adoption of intrinsic safety principles will be maximized during design of project installations.

The process control system and the emergency system will be operated on functionally independent basis and the “fail safe” principle will be applied.

The principle of “double block and bleed” will be adopted in case of toxic fluids and flammable gases or when operators could be exposed to hazards due to high pressure/temperature.

A Supervisory Control and Data Acquisition (SCADA) system will be installed on the FPSO and in the ORF, in order to monitor and control plant processes.

Personnel transfer will occur typically by helicopter or boat. Specific safety procedures for helicopter and vessel transport of personnel will be implemented.

Safety equipment will be provided to all personnel at each project facility.

1.4 STAKEHOLDER CONSULTATION

The preparation of a Stakeholder Engagement Plan (SEP) is a key component of sustainable development and the ESHIA process. It is a requirement of the Ghana EIA regulations and it is also required by international lenders.

Stakeholder engagement involves those stakeholders interested in, or affected by a proposed development working to actively identify opportunities, risks and issues of concern. Stakeholder engagement assists in accounting for locally relevant conditions rather than imposing potentially insensitive processes and designs onto an existing social, health and biophysical environment.

For the Project, the primary objectives of stakeholder engagement are as follows:

- Ensure that adequate and timely information is provided to stakeholders;
- Provide sufficient opportunity to stakeholders to voice their opinions and concerns, and to ensure that these concerns influence Project decisions; and
- Establish a relationship and form of communication between the proponent, eni Ghana, and affected communities for the lifetime of the Project.

Stakeholders were identified on the basis that they would have an interest in the Project and would also have knowledge through which to provide insight into possible issues and concerns related to the Project. Further stakeholder groups were identified through consultation.

During scoping, numerous meetings were held with stakeholder groups. Stakeholders consulted included national, regional and district authorities, traditional leadership, Non-Governmental Organisations (NGOs), international organisations and fisher associations. A full list of the stakeholders consulted, including the stakeholder register, is provided in Annex A of this EIS.

1.5 ENVIRONMENTAL BASELINE

1.5.1 Onshore Biophysical Components

Climate and Meteorology

The regional climate of southwest Ghana is driven by the Inter Tropical Convergence Zone (ITCZ), resulting during the boreal (northern hemisphere) winter in a climate dominated by dry and continental air from the Sahara. On the contrary, humid and warm maritime air from the Atlantic Ocean is prevalent during the boreal summer. This alternation leads to the existence of two well-marked seasons: a dry season, between December and April; and a wet season, between May and July and September and November.

Air Quality

There are no major industrial activities in the Project area and thus no significant sources of air pollutant emissions. The majority of emissions to air arise from the smoke of cooking fires, exhaust of generators used for power supply, and vegetation burning to clear land for farming. The existing levels of NO₂, CO₂, TSP and VOC were generally within Ghana EPA and IFC limit values. High levels of SO₂ were instead monitored, as a result of the fish smoking process or waste burning.

Light, Noise and Vibration

Light and vibration levels in the Project area are currently low due to the general lack of industrial activities in the area. Current levels of noise are associated to domestic activities and natural sounds such as the ocean, waves, wind, and insect noise. Relatively high day-time noise levels for a rural location were measured in the Project area without significant variations between day time and night time.

The main contribution to the noise levels are reported to come from fishing activities (beach seine), which together with vehicle movements, occasional music and sea waves breaking at the beach were the main noise sources observed in the vicinity of the settlements.

Surface Water

The Western Region of Ghana is characterized by the presence of many brackish and freshwater lagoons and wetlands in the low lying coastal areas due to the high level of annual rainfall. In the Project AoI, the main watercourse is the Amansuri River which flows eastward from about 1.4 km northeast of the Project site until it enters the sea approximately 7 km east of the eni concession area.

Water quality in the Project area is as follows:

- The average turbidity recorded during the wet season was higher than that of dry season, indicating the presence of inorganic and organic particles from surface run-off from flooding and rains into water courses.
- Elevated concentration of nutrients were sampled; this is an indication of run-off from agricultural soils and other agro-chemicals as well as organic matter contaminating the water.
- Concentrations of metals (Cu, Cd, Cr and As) in surface freshwater samples were within the WHO guideline limits, except for Hg. The source of Hg pollution remains unknown.
- There were no significant concentrations of TPH or oil and grease detected in the samples analyses.

- Generally, there was a widespread load of total coliforms and faecal coliforms in water samples as well as E.coli and total heterotrophic bacteria.
- The low values of chlorophyll a suggest better water quality in terms of organic pollution and eutrophication.
- Fresh water plankton analysis showed a relatively small number of taxa with small numbers of individual zooplankton species.

Ground Water

Two main hydrogeological provinces are found within Ghana, namely the Basement Complex (consisting of Precambrian crystalline igneous and metamorphic rocks and covering 54 percent of Ghana) and Voltain Formation (a Paleozoic consolidated sedimentary formation and covering 45 percent of Ghana).

Ground water quality in the Project area is as follows:

- The average BOD5 levels recorded for groundwater samples was higher than the EPA's permissible limit for industrial discharge into natural water bodies, and is an indication of organic matter contamination.
- High levels of phosphorus concentration show some level of impact on the groundwater in the area due to human activities in the area.
- For groundwater samples the concentrations of heavy metals were generally low with the concentrations of As, Cr, Cd and Cu all below detection limit and below the WHO guideline limits during both the wet and dry season sampling. Concentrations of Zn, Pb, Mn and Fe were found to be above the WHO limits at few monitoring points.
- There was no significant concentrations of TPH or oil and grease in either the dry or wet season.
- In terms of total and faecal coliforms, none of the water samples conformed to the WHO Guidelines and Ghana Standards.

Geology, Topography and Soils

Soils observed within the Project area are predominantly sandy soils indicating a well-drained substrate. The onshore Project area is a flat area of low altitude (0-10m) with very few headlands or rocky outcrops. The ground elevation increases from the sea for several meters within the beach up to around 4m high when it decreases again below 2m high resulting on the generation of flat and low-lying area that occupies the central section of the ORF site. The higher grounds are located at the north-western most corner of the ORF site with 8.9m elevation, while the site generally varies between 3.9 and 4.6m.

In the vicinity of the Project area, the coastal low lying areas extend inland for several kilometers. As a result little rock removal and little land levelling are expected for the development of the onshore Project facilities.

1.5.2 Offshore Biophysical Components

Oceanography

Water circulation in offshore Ghana is dominated by an eastward superficial flow known as the Guinea Current that runs parallel to the coast from Senegal to Nigeria.

The main oceanographic feature in the area is the existence of two periods of upwelling each year, one major upwelling between June and October and a minor one between January and February. This phenomenon is considered key for the sustainability of marine life in the area as it contributes to an increase in productivity.

The bathymetry of the Project area ranges from a minimum depth of 0 m in the north at the landfall location to a maximum of 1,390m in the south-west part. Seafloor is mostly flat with slope gradients that vary between 0.5° and 2°, with the only exception of the submarine canyons and the continental slope where gradients may reach more than 10°. Additionally, there are certain topographic features, including complex canyon systems, sedimentary mounds, scour features and high standing knolls.

Seabed Sediments

Seabed sediments along the pipeline route and in the vicinity of the wells ranged from poorly sorted, coarse silt to moderately sorted, coarse sand with a general trend showing more sandy sediments in shallower areas and more silty on greater depths. Metal concentrations in sediments were generally low, though in the vicinity of the proposed wells sediments present higher levels of metals, especially chromium, nickel and barium. Specifically, barium levels at station 41, located 340m from the Gye Nyame-1 exploration well, are highly indicative of possible past drilling-related contamination from the drilling muds, however it is notable that other metals are not equally elevated at this location suggesting drilling muds used are not heavily contaminated with impurities.

Hydrocarbon concentrations in sediments are also generally low along the whole Project area. At Station 41 however, levels are considerable high (787 µg/g) probably as a result of past drilling activity.

Seawater

Seawater quality in the whole offshore Project AoI is generally good, showing low or very low levels including those samples taken in the intertidal area more subject to be influenced by anthropogenic pressure. Total hydrocarbon concentrations (THC) and aromatic hydrocarbons (PAH) were also low at all stations, though they were a bit higher in the area where the wells are planned and could be detected in the analysis suggesting certain degree of pollution, probably related to shipping activities or a dispersed effect arising from the numerous wells in the area. Nutrients, total dissolved solids, biochemical oxygen demand, phenol index, cyanide and faecal coliforms are also low at all stations and depths analyzed.

1.5.3 Onshore Biological Components

Habitats

The habitat within the concession area consists largely of modified habitats with a large proportion of the area covered by degraded coconut palm plantations, degraded vegetation and wet evergreen forest with palms. The coastal areas are dominated by regenerating vegetation comprising of palm trees and thorny shrubs.

To the east of the concession is a natural habitat that is classified as Swamp and Mangrove Forest. Sensitive habitat occurs along the coastal beaches where turtles nest.

Flora

Ghana forms part of the Upper Guinea forest ecosystem, a region once characterized by dense forests which have shrunk in response to human influence and the growth of cities. The coastal region also includes vegetation comprising of palm trees and thorny shrubs.

A total of 86 plant species belonging to 46 families and 79 genera were identified in the Project area during the wet season survey, with the dominant vegetation type being trees (44.19 percent of the total). During the dry season, a total of 148 plant species in 124 genera belonging to 56 families were recorded. The family *Euphorbiaceae* dominates the flora with 12 species. This was followed by *Papilionaceae* with 11 species, *Rubiaceae* (10 species), *Apocynaceae* (eight (8) species) and *Annonaceae* (six (6) species). Pioneer species formed the majority of the species present.

With regards to IUCN status, only three species encountered are listed as Vulnerable: *Albizia ferruginea*, *Coffea macrochlamys* and *Hallea stipulosa*. The majority of the species in the Project area have not yet been assessed by the IUCN.

Fauna

Ghana has large and viable populations of wildlife and a natural environment that support a growing ecotourism industry to complement the nation's strong cultural and historical attractions. Most of these wildlife sanctuaries are located in the Western Region due to the suitable microclimate and diverse habitats provided by the evergreen forest found in most parts of the Region.

A field survey was conducted across the ORF site and at various locations within the AoI to identify fauna.

There were eight individuals of three species of small mammals belonging to the order *Rodentia* (rodents) identified through live-trapping. The species captured were Temminck's pygmy mouse (*Mus musculoides*), soft-furred rats (*Praomys tullbergi*) and the multimammate mouse (*Mastomys erythroleucus*). No large mammals and very few spoor were directly observed. The information on large mammals came mainly from interviews conducted with the locals of the area, that report the presence of five orders of large mammals (*Pholidota*, *Primates*, *Carnivora*, *Artiodactyla* and *Hyracoidea*) consisting of 21 species. The majority of the large mammals recorded are listed as Least Concern by the IUCN. The exception are two pangolin species (*Phataginus tricuspis* and *Smutsia gigantea*) and the hyrax (*Dendrohyrax dorsalis*), listed as Near Threatened by the IUCN.

Amphibians and reptiles (herpetofauna) are common and widespread throughout Ghana. During the surveys, 29 herpetofaunal species belonging to 15 families were recorded at the Project site.

The west coast of Africa forms an important section of the East Atlantic Flyway, an internationally-important migration route for a range of bird species, especially shore birds and seabirds. The highest concentrations of seabirds are experienced during the spring and autumn migrations, around March and April, and September and October.

Protected and Designated Areas

The Ankasa Conservation Area and the Cape Three Points Forest Reserve are the most significant protected areas in the general area of the Project (25 and 42km respectively).

The Ankasa Conservation Area hosts at least nine primate species, viable populations of large mammals such as the forest elephant, bongo and yellow backed duiker, giant forest hog, giant

pangolin, water chevrotain and leopards. It also has a diverse avifauna population and up to 600 butterfly species.

The Cape Three Points Reserve was designated to protect the last remnant of primary coastal forest, in which in the past extended along major segments of the coastline of the Gulf of Guinea (CRC-URI, 2010). It is known to provide habitat for over 170 species of birds (Dowsett-Lemaire, 2005; Ntiemoa-Baidu et al, 2001).

In addition to the officially designated areas, the onshore components of the Project area lie within the boundaries of the Amansuri wetland Important Bird Area (IBA). An IBA is an area considered relevant due to its natural values, and especially for their importance for the avifauna. The main element of interest of the IBA is the Amansuri Lake (located 15km northwest of the site). However, the IBA also includes the floodplains of the Amansuri River up to the coast and the beach (where the project is located), the coastal Amansuri River lagoon and estuary, and the sandy Esiam beach, between the Amansuri and Ankobra Rivers.

1.5.4 Offshore Biological Components

Plankton

The phytoplankton community is dominated by microflagellates and diatoms. Phytoplankton abundance is generally greater at 1 m and 100 m sample depths and denuded at 200 m as a result of reduction in light. Zooplankton community is dominated by copepods. Both phytoplankton and zooplankton biomass seem lower in offshore stations may be due to the lower phosphate concentrations, compared to the inshore sites.

Benthos, Corals and Seagrass

Benthic macrofauna is characterized by low abundance and low diversity assemblages in the wells area and moderate diversity and abundance along the pipeline route in the shallower stations. Annelida is the dominant group, representing half the abundance recorded. The total number of species at each station appears to be negatively correlated with depth.

No important benthic communities were identified along the proposed pipeline route, in the vicinity of the wells and in the near shore area. As a result no critical habitats, such as coral reefs, sea grass beds or chemosynthetic communities, are present in the area surveyed. Communities recorded are therefore related to muddy and sandy bottoms and mainly formed by Annelida followed by crustaceans and molluscs.

The presence of corals, according to the several surveys conducted, is limited to isolated individuals, including two in the vicinity of the pipeline route

Fish

Ghanaian waters host several species of fish, including some of important commercial value. The distribution, abundance and composition of the fish assemblages is largely influenced by the seasonal upwelling that occurs in this area, as it increases nutrient availability and plankton production which allows to sustain larger populations of fishes that are attracted to the area. .

Marine Mammals

The AoI of the Project may also host up to 18 cetacean species belonging to five families. Their distribution and ecology in the area remains widely unknown, though it has been considered that most of them could be present throughout the year and especially during the upwelling season when food availability increases. It is known, however, that the humpback whale migrates to

Ghanaian continental shelf for breeding, remaining in the region mainly from August to December.

Turtles

The Gulf of Guinea serves also as an important migration route, feeding ground, and nesting site for sea turtles, where five species may be observed, though only three are known to regularly nest in the AoI of the Project, as whole coastline between Ivory Coast border and Axim is considered as a suitable site for nesting turtles. As a result the beaches in the area are considered a critical habitat for the conservation of turtles, with the exception of the beach sections where fishing activities take place, that usually correspond to the area where the villages are located. Nesting activity in the area is reportedly more intense between October and January.

1.6 FISHERIES BASELINE

1.6.1 Marine Fish Landings

The composition and distribution of fish species found in Ghanaian waters, and the wider Gulf of Guinea, is influenced by the seasonal upwelling. The transport of colder, dense and nutrient-rich deep waters to the warmer, usually nutrient-depleted surface water during periods of upwelling stimulates high levels of primary production in phytoplankton. This primary productivity in turn increases production zooplankton and fish.

The fish species found in Ghanaian waters can be divided into groups, namely:

- Small pelagic species;
- Large pelagic species (tuna and billfish);
- Demersal (bottom dwelling) species;
- Molluscs and crustaceans; and
- Deep sea species.

In general, marine fish landings in Ghana are declining, especially landings of small pelagics. The landings of large pelagics have remained fairly stable, demersal species show a general increase, while landings of molluscs and crustaceans have remained consistently low.

The key small pelagic fish species found in the Ghanaian waters are sardinella, anchovy and chub mackerel. These species are commercially important and represent approximately 80 percent of the total catch landed in the country.

The large pelagic fish species include the tuna, billfish and some sharks. These species are highly migratory and occupy the surface waters of the entire tropical and sub-tropical Atlantic Ocean. They are important species in the ecosystem both as predators and prey, as well as providing an important commercial resource for industrial fisheries.

The most important demersal species commercially (in terms of catch volumes) are cassava croaker, bigeye grunt, red pandora, Angola dentex, Congo dentex and West African Goatfish.

A variety of molluscs and crustaceans are known to be present offshore Ghana. These include the common cuttlefish, pink cuttlefish, common squid, common octopus and the royal spiny lobster, deep-sea rose shrimp and other shrimps.

1.6.2 Marine Fishing Fleet

The Ghanaian marine fishing fleet can be classified into four main groups: artisanal, near shore and inshore, industrial/offshore and tuna. Additionally there is a group of vessels dedicated to the fishing of sharks for their fins.

The vast majority of vessels operating in Ghana are involved in the artisanal sector (more than 95 percent), highlighting its importance in terms of employment.

1.6.3 Fish Catch Surveys

Two fish catch surveys have been conducted in Sanzule and Bakanta, near where the onshore Project area, in April 2014 (dry season) and October 2014 (wet season).

In April 2014 a total of 34 different species of fish, cephalopods and crustaceans was caught, including 26 species at Bakanta and 22 species at Sanzule. Most common species of fish of commercial importance include the two species of sardinella (round and flat), pompanos, croakers, bumpers, and groupers. The catch included also rays, flounders, crabs and puffer fishes. In October 2014, three hauls were sampled, one in Sanzule and two in Bakanta, with a total of 21 species recorded. Only three fish species, namely, *Caranx chrysus*, *Sphyrna sphyraena*, and *Trichirus lepturus* were common to all the three catches.

None of the species captured in any of the surveys were of conservational importance as listed in IUCN in Ghanaian waters.

1.6.4 Socio-Economic Aspects of the Fishing Sector

The fishing industry in Ghana is based on fishery resources from the marine and to a lesser extent, inland or freshwater fisheries and aquaculture. There is a long tradition of both artisanal and distant-water fishing fleets. The fisheries sector contributes 4-5 percent to agricultural Gross Domestic Product (GDP) and offers employment to about 10 percent of the population and their dependents.

Fishing, fish processing and fish trade are among the most important sources of livelihood not only in coastal communities of the Western Region but also in communities inland.

Fish and fish products provide the greatest proportion of animal protein in the country contributing over 60 percent of the total animal protein intake. Average per capita consumption is estimated to be between 27kg and 31kg annually, thus, rating Ghana as the 3rd highest consumer of fish worldwide. Marine fisheries contributes over 80 percent of all fish consumed and exported in and from the country and approximately 75 percent of the total domestic production of fish is consumed locally. Thus, the extensive population dependency on fishing constitutes a critical factor; consequently, impact on fisheries should be seen as one of the main potential impacts of this project.

A 2010 rapid assessment of 89 selected fishing communities in the six coastal districts of the Western region, including 17 fishing communities in the Ellemabelle district, indicated that fish landings in most of the fishing communities like Sanzule, Atuabo, Bakanta etc., have declined in recent years, and this has led to declining fishery livelihoods in the fishing communities. The decline in fish catch is attributed, among other issues, to increasing population leading to over-fishing, and use of damaging or illegal fishing methods.

1.7 SOCIO-ECONOMIC BASELINE

The Project is located in the Ellemabelle District of the Western Region Ghana. A socio-economic study was undertaken in the communities of Sanzule, Bakanta, Krisan, Eikwe and Atuabo and was

based on a review of available secondary information and primary data collected from key informant interviews, village level surveys and focus group discussions. The geographic focus of the socio-economic Direct Area of Influence (DAoI) has been defined based on the location of the Project and description of the Project components. It consists of the communities of Sanzule, Bakanta, Krisan and Eikwe located within a 3km radius of the ORF site as well as Atuabo as it is a larger or better serviced settlement likely to be impacted by the Project.

1.7.1 Administrative Structures

There is a dual system of governance in Ghana made up of formal government structures and traditional leadership structures. These systems of authority are recognized as complementary structures with different responsibilities.

The government administration in Ghana is decentralized and is made up of ten administrative Regions. Regions are further subdivided into Metropolitan, Municipal or District areas. Each District has an administrative assembly (known as the District Assembly) comprised of a combination of appointed and elected officials.

The project is located in the Western Region and in the Ellemebelle District. The District is administered by the Ellemebelle District Assembly (EDA) headed by the District Chief Executive. The EDA is, therefore the highest administrative and political body in the District.

Traditional Authority Structures

Traditional Authorities are the custodians of local tradition, morals, and traditional practices. The traditional system of authority is managed at a national level through the Ministry of Chieftaincy and Culture. At the local level, the Paramount Chiefs is the traditional head of the people and custodian of the land. The Paramount Chief carries great influence locally.

Despite changes and challenges to the traditional structures, in most cases the Chief continues to wield considerable authority, respect and influence at the local level, including in a quasi-judicial role.

The Nzema East, Ellemebelle and Jomoro Districts constitute the Nzema Manle Council in the District House of Chiefs. The Ellemebelle District is covered by the Eastern Nzema Traditional Council. The Paramount Chiefs Awulae Amehere Kpanyinle II who is situated in Atuabo.

Local Administrative Structure

The Paramount Chief of the Eastern Nzema Traditional Area exerts control over the divisional and sub-chiefs. The traditional structure is hierarchical and inheritance is by matrilineal descent. In each town in the DAoI, there is traditional council that assists the Chief to administer his area of jurisdiction. The Council is typically comprised of the Chief, the Queen Mother, various family heads and a linguist. The Council is the supreme organization of the stool and must approve all decisions taken by the Chief.

1.7.2 Macroeconomic Context

As a result of the economic challenges of the 1970s, 80s and 90s, Ghana struggled with the huge foreign debt and until recently was regarded by the World Bank as “poor”, with a per capita annual income of less than 1 USD per day. On 1 July 2011 the World Bank reclassified Ghana from a low-income to lower middle income status country, in response to the recent discovery and production of oil in Ghana (World Bank, 2011). Ghana is reportedly positioned as the fastest growing economy in Sub-Saharan Africa for 2012, with a forecast GDP growth of 13.4 percent (World Bank, 2012).

The Western Region is the highest contributor to the country's GDP (55 percent) (Ghana Government Portal, 2012), with a wide variety of mineral deposits and the largest producer of various agricultural products. The discovery of oil off the coast of the Western Region has already enhanced its significance within the National economy. This Project will help to focus development in the Ellembele District as an industrial node.

1.7.3 Land Tenure and Land use

Ghana maintains a dual land tenure system, comprised of customary and statutory land tenure. Customary tenure is based on local practices and norms, which are flexible and vary according to location. Such tenure is typically unwritten and is managed by a traditional ruler (the paramount chief or local chiefs); a council of elders; or family or lineage heads.

Under the 1992 Constitution, three distinct land tenure systems are recognized: public lands, stool or customary lands and private freehold lands. Public lands are owned by the government and are for public use. Stool Customary lands are communal and are held by traditional communities or groups thereof and are characterized by various land tenure. Finally, Private Freehold land is not owned by government or a traditional authority, but rather an individual or entity and includes the building and the land it is built on.

The land acquisition area is customary land and the land in the DAoI is in the "customary ownership" of chiefs, who dispense and allocate it on behalf of their people.

Land uses within the DOaI primarily include infrastructure (households, schools, hospitals) and farming. There is a small settlement located adjacent to the south-eastern border of acquisition area. The housing structures in the settlement are temporary in nature, constructed from raffia poles and leaves. The remainder of the acquisition area consists primarily of cultivated palm groves, croplands or the remains of natural vegetation and water bodies.

1.7.4 Demographics and Settlements Patterns

According to the 2010 Population and Housing census, Ghana had an estimated population of 24 658 823 people, with a population density of 114 people per km² (Ghana Statistical Service, 2013). The Western Region comprises nine percent of the total population (2.3 million people) and has a population density of 97 people per km². (Ghana Statistical Service, 2012). The Ellembele District has a population of 95 306, with a population density of 80 people per km², lower than both the national and regional population density.

The Western Region has a larger proportion of the population living in rural areas than the national average, with 57.6 percent of the population living in rural areas (Ghana Statistical Service, 2012). The Ellembele District is considered largely rural, with 84 percent of the population living in rural areas.

Populations of the communities in the DAoI vary in population size, and are generally between 700 and 1600 in size.

1.7.5 Ethnicity and Religion

Akan is the dominant ethnic group in the Region and represents 89 percent of Ellembele's population with Twi and Fante being the dominant languages. In the DAoI Nzema is the dominant group and the major language spoken is Nzema; other dialects like Ewe and Gwira, Fante and Twi are also widely spoken. The ability to speak Nzema is also emphasised as important for cultural continuity.

Nationally, Christianity is the main religion practiced by the majority of the population, and this trend is reflected in the three communities by the high number of churches in the Project affected communities. There are also small numbers of Muslims present in the communities in the DAoI. People also reported that there many traditional rituals and beliefs remain even those people following monotheistic religions.

1.7.6 Migration

There is a significant amount of internal migration within the Western Region with people migrating to areas with employment opportunities such as Ahanta West, Takoradi (Modern Ghana, 2012) and Cote d'Ivoire. The Ellembelle District experiences a surge of in-/out-migration related to seasonal fishing activities and mining and a similar migration trend exists across the Study Area. The population figures swell during peak fishing season (July-October) when migrants from the north of Ghana and even from Cote d'Ivoire, mainly men, come to work in the area. There are also two refugee camps in the Western Region and one in Krisan.

The population of coastal towns in the DAoI continues to increase from natural and influx growth. Atuabo and Anochi in particular have seen in-migration of workers and job seekers into their community because of activity associated with the development of the GNGC gas plant at Atuabo. These migrants exert pressure on the limited social services especially, water, sanitation and housing.

In terms of out-migration, youth are reported to be leaving to take menial jobs in bigger towns like Abidjan, Takoradi, Sekondi, Tarkwa. This is perceived to be a result of declining community livelihoods (declining farming yields and fish catch) and rising poverty in local communities.

1.7.7 Utilities and Social Infrastructure

Education

All communities in the DAoI have a public primary school financed by the government. However, not all communities with public primary schools have Junior High Schools. For example, Bankanta does not have a JHS. There are no SHS or tertiary educational facilities in the communities.

The education sector faces numerous challenges in the DAoI. These include finances as government grants are often inadequate; lack of trained teachers; inadequate school facilities (classrooms, equipment, and teacher accommodation); school attendance (pupils often leave to cost of schooling).

Water and Sanitation

There are three major sources of drinking water: piped (inside, outside, tanker supply), well (well, borehole) and natural (spring, river, stream, lakes, rainwater, dugout). There is a huge difference in access between the urbanised and rural households. The Western Region has a low access to piped water (32 percent). In Rural areas over 60 percent of households use rivers, streams, wells, spring or rainwater as their main source of water. Access to water and sanitation in the Ellembelle District has improved in recent years, however water access still centres on bore holes wells. In terms of sanitation, approximately 70 percent of Ellembelle households do not have toilets.

The majority of households in the DAoI obtain drinking water from a source considered to be 'improved' (ie, private or public tap/borehole). Typically females are responsible for collecting drinking water, however, it is also not uncommon to see children (either male or female) collecting drinking water for the household.

Energy

Ghana has an installed power generating capacity of approximately 2,100 MW, 59 percent of which is generated by hydroelectric plants, and 41 percent from fossil fuels. In the Western Region, electricity and kerosene lamps are used as the main sources of lighting. Rural households are also gradually gaining access to electricity through a rural electrification programme. Charcoal and fuel wood are the main sources of cooking fuel in the Region (including urban dwellers). All the towns within the DAoI are connected to the national electricity grid and most households are also reportedly connected.

Waste Disposal

Waste disposal is a challenge in Ghana, particularly in the rural areas. In the Western Region and the Ellembele District, the most common way of disposing of household waste is to dump it at specified community dumping sites or in the absence of such sites, ad hoc disposal on open land. The Ellembele District has limited waste handling facilities and equipment and inadequate capacity. It has only two formal waste disposal sites for both solid and liquid wastes at Aiyinase.

Some towns in the DAoI have specifically allocated waste sites. These are informal in structure, unlined, and once full they are covered over and a new area is opened for use. Zoom lion (waste removal company) is contracted to remove waste in the DAoI however, the service does not extend in to all the communities adequately.

Telecommunications

Fixed line and mobile telephone systems are in operation in Ghana, as well as wireless, radio telephone and satellite communication systems. According to the National Communication Authority (NCA), in August 2012, the total cellular/mobile subscriber base in Ghana stood at 24 438 983, which was 98 percent of the population at the time (Ghana Statistical Service, 2013). Mobile telephone network coverage received in most of the communities and most adults reported owning a cellular phone.

1.7.8 Economic Activity and Livelihoods

Farming, fishing and fish mongering and agro-processing are the key livelihood activities in the Study area, and most communities report consuming small amounts for subsistence, while selling the larger proportion for cash. There are very few formal employment positions.

Fishing and Fish Mongering

The largest income-generating livelihood activity in all of the DAoI communities is fishing and therefore the primary livelihood activity with both men and women involved, although they are divided by gender in their roles. There are two fishing seasons, towards the end of June and peaking during August and September and towards the end of November, peaking between late January and March. April to May is a rest period for mending nets, boat repair and fishermen engage in onshore artisanal work to supplement their income.

Fish mongering is also an important livelihood activity for women who process fish by salting and drying or smoking. The women buy fish locally and transport for sale at Aiyinasie. Large catches are also sold to hotels in Axim. Income from fish mongering is reduced due to lack of cold storage such that fish prices are lowered by the high levels of supply during fishing seasons.

Fishermen reported locally declining catches over the past number of years, attributed to increased human populations and consumption, increase in fishing activities, increase in fishing canoes

working the area and illegal fishing. Many community members in the Study Area believe that the offshore oil production activities have contributed to the decline in fisheries.

Farming

Almost every household in the towns participates in small-scale and subsistence agricultural activities, with men clearing and preparing fields and women involved in the sowing of seeds and in harvesting. Some individuals (generally the elderly or unwell) employ labourers. Cultivation is done manually and the size of plots depends on the strength of the individual or family. There are no irrigation systems and farming is done using slash and burn methods. The majority of planting is done in March and April before the rainy season in June and July and a second smaller season of planting takes place in September and October with two seasons of planting (March-April and September-October).

The major crops cultivated are maize, pineapple, cassava, plantain, rice and other staples. Vegetables such as garden eggs, pepper and tomatoes are also cultivated. Coconut and oil palm are grown on mainly commercial scales.

Livestock

Pig rearing is a main commercial livestock activity, in particular in the town of Atuabo.

Livestock at a community level is generally for subsistence. Almost everybody in the community will keep at least one type of animal (goat, pig or poultry) predominantly for domestic consumption. The grassland area between Atuabo and Asemadasuazo is used for grazing in the dry season by Fulane Hersdman.

Trade, Employment, Industry and other Livelihood Strategies

Small scale or petty trading is undertaken, mainly on the side of the main roads, and is focussed on fishing and agriculture products but also includes some manufactured goods, household goods, medicines, clothing and food and beverages. A small number of local residents are formally employed in the Study Area in jobs including District assemblyman, teachers, waste management activities, fishing crews, farm labourers as well as hairdressers, carpenters, drivers and electricians.

The major industrial projects in the area are the GNGC gas plant at Atuabo and Anochi and the export pipeline. There is also liquefied petroleum gas (LPG) terminal at Anochi. A small number of local residents are employed at these facilities

Other livelihood strategies include remittances from migrant workers/ family members, rent from land or property, and pensions.

Tourism

Tourism in Ghana has become a major socio-economic activity and an important and fast growing sector of the Ghanaian economy. The tourism potential in the Western Region is related to the number and extent of tropical beaches as well as wildlife parks, forests and game reserves, inland lakes, and rivers. Currently none are being exploited for tourism in the DAoI. The Nzulezu stilted village is a prominent tourist attraction near the project on Lake Tadane about 3.5 km inland of Atuabo (on the UNESCO World Heritage Site tentative list). Other tourists' sites, include estuaries, forts and natural fauna and flora.

There are hotels in the area which have been built to serve tourists visiting these sites as well to meet growing demand for accommodation from the oil and gas industry.

Income, Expenditure and Financial Services

Household income in the DAOI are mainly derived from fishing and fishing related activities, followed by farming, waged employment, petty trading, artisanal work, livestock, rent and remittances in order of importance. The two main areas of expenditure for households in the project area are food and education. There are no banking institutions in or near to the DAOI except for Eikwemanle microfinance

1.7.9 Marine Infrastructure

The nearest port to the DAOI is the Port of Takoradi. The Port receives high traffic volumes and in 2012 handled 31percent of national sea borne traffic. Major import commodities include clinker, wheat, and quicklime and major exports are cocoa, bauxite, and manganese.

In addition, there are several existing and planned submarine cables and pipelines offshore Ghana. There is an existing subsea pipeline from the Jubilee Field to the Ghana Gas Plant at Atuabo.

1.7.10 Safety and Security

Politically, Ghana is a stable democracy that has had five elections since 1992 and two peaceful transitions of power between political parties. The last elections took place in 2012 and while there was some sporadic election-related violence, it took place in a relatively peaceful context. Road safety is a concern in Ghana due to poorly maintained and unpredictable driving habits. In addition, Ghana to date has not been subject to any major acts of piracy. However, with the discovery of oil its coastline is now at increased risk.

At community level; common crimes reported to occur in the area are break-ins and petty thievery. Most of the communities however, reported fairly low crime rate except Atuabo. The community agreed that the petty crime has increased at Atuabo since the onset of the GNGC Gas Plant project. There no police stations in the DAOI, therefore to report crimes one must travel to Ayinasie or Beyin.

1.7.11 Community, Identity, and Relationships

The majority of the people living in the DAOI are Nzema. Like most Akans, the Nzema culture is manifest in its traditional rites and practices, music and dance, cuisine, religion, chieftaincy system, and livelihood activities. Nzema society is hierarchical. People are respected because of their age, experience, wealth and/or position. Young address their elders as mother or father. Older people are viewed as wise and are respected in the community. Though Christianity and Islam are being practiced among majority of the Nzemas, African Traditional Religion is still actively practiced. Deities in the form of trees, islands, water bodies are worshipped, and shrines, sacred groves and fetish priests are still patronized today.

1.7.12 Cultural Heritage

In Ghana, the National Commission on Culture and the Museums and Monuments Board are responsible for administering cultural sites.

Known tangible resources in the Project area include places of formal religious worship (churches, mosques) as well as places and locations associated with traditional religious practices (sacred forest groves, lagoons, the sea). Also identified in the Project area are places of burial and worship. This includes the Branvien Shrine and cemeteries at the coastline at Sanzule and one to the east of the community, designated for burial of relations of the traditional royal family.

1.7.13 Vulnerable Groups

Vulnerable groups in the Project area include the elderly, children, women (particularly Female-headed households), disabled people, and orphans. Children and the elderly are the most vulnerable in respect of their susceptibility to malnutrition as a result of being reliant on others to provide for them, and to diseases such as malaria.

Baseline engagement suggests that sharecroppers, crop farmers, refugees and fishermen are potentially also vulnerable in this area, due respectively amongst other reasons, to their lack of formal rights to land and their sensitivity to changes in climate and reportedly declining farming yields and fish catch. Finally, migrant fishing communities in the area should be considered especially vulnerable given they have little or no formal security of tenure, limited access to land for farming and are almost solely dependent on marine fishing for their incomes and subsistence.

1.8 HEALTH BASELINE

A health study was undertaken for the communities within the DAoI: Eikwe, Krisan, Sanzule, Anwolakrom and Bakanta and was based on a review of available secondary information and primary data collected from key informant interviews, village-level surveys, focus group discussions and direct observations.

1.8.1 Health Infrastructure

The health facilities within the Area of Influence include: one hospital at Eikwe (St Martin de Porres hospital) and two CHPS compounds (one in Atuabo and the other in Sanzule). In addition, there are six active traditional birth attendants assisting the communities.

The St Martin the Porres hospital was established in 1959 and currently serves as the District hospital, covering a population of over 100,000. The hospital is specialized in obstetrics and gynecology but also offers other services. It has 200 beds with an overall bed occupancy rate of 93 percent in 2013. The Atuabo CHPS compound serves Atuabo and Asemda-Suazo while the Sanzule CHPS compound serves Sanzule, Bakanta and Anwolakrom communities. Krisan community goes to St Martin de Porres hospital in Eikwe to seek medical attention.

1.8.2 Traditional Medicine

Traditional medicine in the Area of Influence is mainly practiced by spiritualist (also known as faith healers) and Herbalist. Healers use non-timber forest products as medicine to cure various ailments, including malaria, typhoid, fever, diarrhea, arthritis, rheumatism, and snake bites.

The dominant faith healers operate under the 12 apostle Church locally called “Nakaba”. These operate prayer camps where healing is sought from.

From the key informant interviews performed with health professionals and focus groups it emerged that the use of traditional medicine is high in the Area of Influence as there is a high tendency for people to associate certain illnesses to spirits. Thus, at the initial stage, people resort to traditional remedies from spiritualists and herbalists before seeking medical care at the CHPS or hospitals. Cases may therefore present late with potentially avoidable complications.

1.8.3 Common illnesses and Associated Issues

The most common diseases treated at the hospital and in the CHPS compounds in the Area of Influence are: malaria, respiratory infections, anemia and diarrhea.

With regards to communicable diseases, the tuberculosis notification rate was of 278/100,000 population in 2013 which is much higher than the overall case notification rate in Ghana (63/100,000 population) for all forms of Tuberculosis. Pneumonia and other Acute Respiratory

Infections constitute 4.2 percent of morbidities seen at St. Martin de Porres hospital (2013). In both CHPS zones, Atuabo and Sanzule, it is second to malaria among the top five causes of morbidity which is consistent with the regional pattern for the period 2011-2013. Hyper-tension, asthma and cardiovascular diseases are the most common non-communicable diseases in the DAoI.

The national HIV prevalence in 2013 is 1.3 percent and the prevalence in the Western Region in 2013 was 2.4 percent (2013 HIV sentinel survey report in Ghana). According to the KII performed in the area, HIV /AIDS are relatively common in the Area of Influence. One of the reasons for this is its proximity to Ivory Coast which has a higher prevalence of HIV/AIDS. During the community meetings and KIIs it emerged that there is a concern between the population for a potential increase of the prevalence of HIV/AIDS and other Sexually Transmitted Infections (STIs) related to increased influx of people associated to the current and future developments in the area.

1.8.4 Sanitation Conditions and Associated Diseases

The provision of sanitation facilities is poor in all the communities within the DAoI. All the communities have access to shared toilet facilities but only a very few of households has their own improved sanitation facility. Open defecation (in the bush and on the beach) was reported in focus groups within all the communities surveyed. Drinking water is obtained from boreholes or purchased (processed water from private providers). Some communities reported their concerns regarding the number and conditions of the existing boreholes. Groundwater availability was also reported to be limited during the months of November, to January.

There is no public waste collection or formal disposal waste system, instead waste is dumped either at specified sites or indiscriminately.

Regarding diseases associated with poor environmental sanitation, it is worth noticing that malaria and diarrheal disease are among the top ten causes of admissions to St Martin the Porres hospital and among the top five causes of morbidity in the two CHPS zones (Atuabo and Sanzule).

1.8.5 Maternal and Child Health

The millennium development goal 4 (MDG4) demands governments to reduce by two-thirds the under-five mortality rate by 2015 (ie. less than 50 deaths per 1,000 births). According to the State of The World's Children 2015 Country Statistical (UNICEF, 2013), the under-five mortality rate in Ghana reduced from 128 percent in 1990 to 78 percent in 2013 (most recent data available). The only data available on reproductive and child health in the Area of Influence are the indicators provided by the Eikwe sub-District hospital, St Martin de Porres. The percentage under five years who are underweight in 2013 was of 2.9 percent and the number of under-five deaths over the number of under-five admission at the Hospital was of 4.8 percent in 2013.

1.9 IMPACT IDENTIFICATION AND ASSESSMENT

Identification and assessment of the Project's environmental and social impacts has been conducted in a phased approach applied throughout all the different phases of the Project (construction, operation and decommissioning) as well as unplanned events.

The significance of each impact (positive or negative), has been assessed through the application of the following criteria:

- Temporal scale of the impact (i.e. temporary, short-term, long-term, permanent);
- Spatial scale of the impact (i.e. local, regional, national, trans-boundary);

- Sensitivity, resilience and/or importance of the receptor/resource that is being impacted;
- Number of elements (including individuals, households, enterprises, species and habitats) that could be affected by the impact.

Many impacts arising from the onshore/offshore project operation phase, and listened below, have been classified as medium, this is mainly due to the temporal scale of the operational impacts that the *eni standard impact methodology* classified as Critical, as life of the project is more than 10 years.

Proper mitigation measures have been identified and taken into account in the definition of residual impacts for each environmental and social components analyzed in the impact assessment.

1.9.1 Environmental Impacts

Onshore Environmental Impacts

The construction of the onshore part of the Project will lead to medium residual impacts on all environmental components, with the remaining impacts being of low significance due to the temporary nature of the construction activities and the low and medium sensitivities of the onshore biophysical aspects.

The impacts expected to occur during the onshore Project operation and maintenance phase are summarized below:

- Medium impacts on local air quality due to the airborne pollutant emissions from ORF facilities (power generators and compressors) and vehicles exhaust emissions are foreseen. The resulting Medium impact significance is mainly a consequence of the duration of the impact.
- Medium impacts on ambient acoustic conditions due to the noise emissions from ORF facilities (e.g., generators, compressors, pumps) and from vehicles movements are foreseen. The resulting Medium impact significance is mainly a consequence of the duration of the impact.
- It is not expected the production of significant GHG emissions during the normal operation activity, in particular from flaring that may be required to deal with process upsets (i.e., facilities start-up). Moreover, the Project will implement a Zero-Permanent Flaring policy which will limit the GHG emissions from flaring to the process upsets and usually relatively short in duration.
- Low significance impacts on surface water resources associated with improper waste handling and spills.
- Medium impacts on groundwater resources are expected during operation, namely, reduction of groundwater resources, lowering of groundwater levels, reduction in water quality due to improper waste handling (all low) and unplanned spills (medium) of fuels or chemicals.
- Medium impacts on soil resources are expected related to potential contamination and compaction impacts.
- Low impacts on flora are foreseen as a result of degradation of the abiotic environment and introduction of alien species.
- Low and Medium landscape and visual impacts are foreseen due to the presence of the onshore infrastructure and offshore activities, including lighting.

- Medium impacts on fauna are expected and as a result of the negative effects of pollution, traffic risks and hunting.

Offshore Environmental Impacts

The impacts due to atmospheric emissions on the offshore component of the Project have been assessed as **low** for construction and **medium** for the operation phase given the duration of the impacts.

The impacts on the seawater component, due to Project installation/construction activities have been assessed as **low** given the moderate sensitivity of the receiving environment in terms of water quality, the volumes to be discharged and the localized areas expected to be affected with regards to drill cuttings and muds discharges and sediment re-suspension.

The project works on the seabed such as pipeline laying, deposition of drill cuttings and especially seabed intervention works and well drilling, will lead to impacts in terms of increase of seawater turbidity and potential release of contaminants and nutrients, including Cr, Zn and as recorded in in several sampling locations. The impact of the cutting piles on the seabed will be limited to the vicinity of the well and any potential toxicity introduced will likely remain deposited there. Impact to seabed has been assessed as **medium**.

The deposition of cuttings in the seabed is also expected to lead to smothering of benthic communities in the vicinity of the wells, though impact is considered **low** given the absence of known relevant benthic communities and the expected quick recovery of them after a first re-colonization by opportunistic species.

Underwater noise disturbance related to drilling, vessels and FPSO installation phase is expected to be **low** during construction phase and *medium* on the operation phase given its semi-continuous nature along the duration of planned activities. However, its direct negative effect on marine fauna are expected to be restricted to behavioral changes and avoidance patterns of a few individuals of marine mammals and turtles given noise levels expected and mobility nature of the species.

During the project operation phase the production of solid and liquid waste and air emissions from the FPSO and the discharge from vessel operations will lead to **medium** residual impacts on seawater and air quality. Similarly, impacts on seabed in terms of potential contamination of soil by hazardous and non-hazardous spill and waste, and of sediment accumulation and/or scouring/erosion during the operation phase are assessed as **medium**. It has to be noted that these impacts are not significant and have been classified as medium mainly for the temporal scale of the impacts due to project lifespan.

Potential alteration of coastal processes, such as accretion and erosion of sand beaches due to the installation of the pipeline have been assessed as **low**, given the temporary interruption of existing sediment transport dynamics and the mitigation measures considered.

1.9.2 Social Impacts

The socio-economic impacts have been discussed for the three main phases of the Project in this ESHIA, namely, construction, operation and decommissioning. However, impact significance ratings have only been assigned to impacts for the construction and operation phases. These impacts are summarized below. In most instances, decommissioning impacts are expected to be similar to those of construction, however there will also be negative economic impacts associated with the demobilization of the workforce. The significance of impacts associated with decommissioning cannot accurately be determined at this stage, therefore they have not been assessed as part of this ESHIA.

Employment and Economy

The Project will have a range of positive impacts for employment and the economy; these have been identified as the following:

- Increased government revenue;
- Employment opportunities and skills enhancement;
- Increased procurement; and
- Enhanced hospitality and tourism business potential.

While these impacts will have an overall positive impact on employment and the economy at a national level, the impact at the local level may not be felt as intensely. The lack of skills and education, and formal business opportunities with the DAOI will limit the extent to which local community members will be able to benefit from employment and procurement opportunities. Through the implementation of enhancement measures, the benefits for communities in the DAOI can be increased.

During construction, the impacts of increased government revenue, and increased procurement have been assigned a **high positive** significance rating, while employment opportunities and skills enhancement are anticipated to be of **medium significance** and the impact of enhanced tourism potential of **low significance**.

During the operation phase increased government revenue will have a **critical positive** significance, employment opportunities and skills enhancement, as well as increased procurement will have a **high positive** significance rating, while the impact of enhanced hospitality and tourism business potential is foreseen to have a medium significance.

The negative impact of increased price inflation and economic vulnerability has been assigned a significance rating of **medium** during the construction and operation phase, while the impact of workforce demobilisation at the end of the construction phase has been assigned a significance rating of **medium**.

Land and Livelihoods

The Project will lead to the economic displacement of land-based livelihoods in the land acquisition area (crop cultivation, animal rearing, and aqua-culture) and the economic displacement of marine fishing-based livelihoods due to offshore pipeline construction and reduced access to fishing grounds as a result of exclusion zones around offshore Project infrastructure. The following impacts on land and livelihoods were assessed as part of this ESHIA:

- Economic displacement of farming in land acquisition area;
- Restricted access to offshore fishing grounds due to exclusion zones;
- Disruption of onshore and near-shore fishing activities;
- Damage to fishing gear; and
- Infrastructure lighting.

Of all affected communities in the DAOI the households of Sanzule will be proportionally the most vulnerable to loss of livelihoods due to loss of access to 213 acres of farmland used by approximately 180 farmers. The exact proportions of the loss this land take will represent, relative to the total population of those farming and to the total agricultural land available to the Sanzule community, cannot yet be quantified.

An assessment of the proportional scale of livelihoods losses to Sanzule, along with information on the availability of alternative agricultural land in the DAoI to allow for like-for-like replacement of acquired farmland, will be confirmed following supplementary baseline livelihoods survey work to be conducted by ERM in parallel with the resettlement planning process in April 2015. For the moment, other alternatives such as compensation of both the leased land and the assets, and future alternative livelihood training activities and specific investment projects at Sanzule are foreseen. With information available, economic displacement during construction and operation has been assigned a **high** significance.

With the correct implementation of mitigation measures, none of the remaining above mentioned impacts are anticipated to have a high or critical significance rating during the construction and operation phase. The disruption of onshore and near-shore fishing activities, and damage to fishing gear have been assigned a significance of **medium**, while restricted access to offshore fishing grounds due to exclusion zones and the impact of infrastructure lighting are anticipated are anticipated to have a **low** significance.

Changes to Cultural and Social Norms

An oil and gas project of this nature is expected to bring about some change to DAoI. There will be an influx of Project workers and jobseekers into the DAoI, each with their own associated cultural and social norms. The impacts identified in this regard are:

- changes to cultural and social norms;
- increased anti-social behaviour; and
- tension and conflict between villages.

The impacts listed above are all been assigned a significance rating of **medium** during both construction and operation after the implementation of mitigation measures.

Cultural Heritage

Project will be located in rural setting and an industrial project of this kind will alter the sense of place for local residents who may value the rural characteristics. Communal and religious cemeteries as well as shrines are found in across the DAoI and may be disturbed or damaged by the Project. The Project may have impacts on:

- cultural heritage resources; and
- sense of place.

eni had re-aligned the land acquisition area to avoid the Royal Cemetery near Sanzule. This has resulted in the impact on cultural heritage resources being assigned a **low** significance rating during construction, while the impact on sense of place is anticipated to be of **medium** significance.

During the operation phase both impacts have been assigned a significance rating of **medium**. However, this is largely due to the extended duration of the impacts, and not the sensitivity of the receptors.

Social Infrastructure

The Project will increase the population in the DAoI during construction, and to a lesser extent during operation, largely through introduction of a migrant workforce but also through other economic in-migrants settling in the area with the intention of securing employment with the

Project or seeking other economic opportunities. This has the potential increase demand on services and existing infrastructure in the DAoI. The Project will result in impacts on:

- social infrastructure;
- road infrastructure;
- health infrastructure; and
- marine traffic and infrastructure.

The Project will be self-sufficient during all phases, which will reduce the negative impact it could potentially have on social infrastructure in the DAoI. This, together with the correct implementation of the mitigation measures has resulted in the impacts listed above being assigned a **medium** significance during both construction and operation phases. The significance rating of medium for operation is however, largely due to the extended duration of the impacts, and not the sensitivity of the receptors.

Security

Finally, the use of public and private security forces to police the ORF, the FSPO and the pipelines RoW to prevent encroachment from other uses could cause conflict, in particular with local fishermen.

In conclusion, the only Phase 2 Project negative impact associated with the social environment that has received a significance rating higher than medium is economic displacement. The positive impacts associated with the Project range from medium positive significance, to critical positive significance, indicating that the Project will have an overall positive impact on employment and the economy.

1.9.3 Health, Safety and Security Impacts

Community Health and Safety and Security

The impact assessment undertaken on community health and safety indicates that there are a number of impacts on health and safety that are considered to be medium after mitigation during both construction and operation phases.

The presence of an external workforce and the increased of economic migrants could lead to the increased transmission of STIs including HIV/AIDS as well as communicable diseases or even introduction of new ones within the communities. Furthermore, poor quality housing and sanitation facilitate the transmission of diarrheal disease, especially in children. The existing health resources to deal with STIs and communicable diseases are limited in the Project Area of Influence.

The increased traffic and presence of heavy vehicles on local roads increase the risk of road traffic accidents occurring which could result in injuries or fatalities to drivers and passengers.

Moreover, even if the worker camp will have its own medical facility, the potential increased transmission of diseases, increased accidents and increased numbers of people accessing care for routine activities may lead in an increased in pressure on health care resources mainly during the construction phase, where the influx of workers will be higher.

The impacts on community health, safety and security associated with the Project range from medium to low significance.

Worker's health and Safety and Rights

Due to the nature of the activities being undertaken during construction, worker health and safety is a key risk with the potential for accidents that may result in injuries and fatalities as well as lost man-hours. Within Ghana, companies do not always meet national and international standards around worker health and safety. Workers may also be at risk of acquiring communicable diseases, vector borne diseases in particular malaria and sexually transmitted infections due to the existing baseline health conditions of communities in the Project area and the potential for worker community interactions.

Although Ghana labor laws are in line with international labor laws and Ghana has ratified the eight core ILO conventions, enforcement of labor laws is hampered by a lack of capacity within companies as well as within the labor inspectorate and judiciary. Furthermore, due to the employment situation in Ghana there is evidence that workers are willing to sacrifice their rights in order to find and maintain employment. As such, there is a risk that contractors and suppliers will not be operating in line with national or international best practice.

Despite improvements in recent years, child labor, especially in its worst forms remains a major concern for the Government of Ghana. In this regard there is the potential that nationally based suppliers (who may form part of the supply chain) could be using child labor in their operations or are employing under 18's to undertake hazardous activities. Again, this is a particular risk in companies where the use of informal and day workers is more prevalent

The correct implementation of the mitigation measures has resulted in the impacts listed above being assigned a low significance during both construction and operation phases.

A number of mitigation and monitoring measures to minimize health impacts have been included in the EIS and will be implemented by eni Ghana when granting with the environmental authorization for the project. For instance: provision with primary health care and basic first aid at construction camps / worksites, conduct pre-employment screening protocols and regular health screenings to all employees, training on Security and Human Rights and driving codes, development of a Traffic Management Plan, road maintenance and the implementation of a grievance mechanism as part of the programme of stakeholder engagement.

1.9.4 Unplanned Impacts

Formal risk assessment tools are to be developed to identify assess and mitigate risks in subsequent stages of engineering design. However, partial assessments have been undertaken.

For the offshore component, the events with the most significant potential consequences are, blow out of a well with gas and or oil spills, and rupture/failure of pipes/flow lines at different sections.

In terms of gas blow out, given the very low probability of this event happening and the relatively low expected consequences, good engineering practices (standard well monitoring and control etc) are to be implemented at this stage. For the rupture/failure of pipelines, a combination of some engineering measures has been identified as needed to be implemented, in order to decrease the fire risk. This includes the installation of a Subsea Safety Isolation Valve, already implemented.

In terms of spills of hazardous materials, given the extremely low probability of blow outs involving massive oil spills, the overall risk derived from this unplanned event has been assessed as Medium. Mitigation for this type of accidental events can be those that decrease the probability of the event, in general adoption of industry standard systematic operational and maintenance practices and procedures, and those aimed at reducing the consequences of a potential oil spill, such as an Oil Spill Contingency Plan (OSCP).

For the onshore component of the project (ORF and pipelines), at this stage and based on the preliminary data available, it is not expected to pose a significant risk to humans or the environment from accidental events. The segment of pipeline immediately onshore from the landfall will deserve a focused attention given the short distance to inhabited settlements. In case of need, several engineering and management measures are available to design the pipeline to appropriate safety standards.

1.9.5 Cumulative and Trans boundary Impacts

In line with best practices and IFC standards, particular attention is paid in this EIS to potential cumulative and trans-boundary impacts. A cumulative impact of major significance has been identified on livelihoods and ecosystem services, in particular related to fisheries and farming based livelihoods. Moreover, the following impacts assessed as of medium significance have been identified:

- Surface water pollution related to the additive effects of changes to the surface water flow and unplanned spills which could affect the Amansuri River system;
- Increased pressure in social infrastructure and service delivery;
- Increased price inflation.
- Increased potential for habitat degradation / land use change.
- Physical and social sense of place.
- Economic and psychological cumulative impact resulting from post-decommissioning.
- Health community and safety.

No significant trans-boundary impacts are expected to occur as a result of construction and normal operations. The only potential trans-boundary impact would occur in case of an accidental large oil spill (blow out). As previously mentioned, the overall risk of these spills has been assessed as Medium risk.

In order to mitigate the negative cumulative impacts of the development of oil and gas projects in the DoI, it is recommended that the Project in conjunction with other projects in the area and local/regional and national government work together for a sustainable resources management, spatial planning and land development as well as efficient land administration. In addition, it is recommended the development with other operators and public authorities of an Influx Management strategy and the design of a national or regional Oil Spill Prevention Plan, including the port, which could benefit from coordinated plans and actions to manage any accident.

1.10 DECOMMISSIONING AND ABANDONMENT

At the end of the economic life of the Project, it will be decommissioned to restore the site to a safe condition that minimizes potential residual environmental impacts and permits reinstatement of activities such as fishing, unimpeded navigation at the offshore site, and agriculture onshore. The decommissioning activities are planned to be completed in two years.

Decommissioning will be performed according to the Petroleum (Exploration and Production) Law (Act 84 of 1984) that is the main current legislation covering oil and gas developments within Ghana, and to Ghana environmental and marine laws and regulations that are in place at the time of decommissioning.

A project-specific Decommissioning and Abandonment Plan (DAP) will be prepared, including decommissioning methods and procedures for individual components of the OCTP Project

facilities and infrastructure and waste management requirements. The plan will address potential environmental and social impacts, as well as health and safety issues identified by a risk assessment. It will also include details on a post-decommissioning survey and monitoring programme.

1.11 ENVIRONMENTAL, SOCIAL AND HEALTH MANAGEMENT PLAN

The ESHIA process defined a range of mitigation measures, management actions and monitoring to be implemented during the Project. Delivery of these will be through the project Environmental, Social and Health Management Plan (ESHMP).

With respect to the significant impacts identified by the ESHIA, the ESHMP provides the linkage between each significant impact, the relevant mitigation measures and the monitoring approach. The ESHMP will provide an outline of the procedures and processes that will be incorporated into project activities to check and monitor compliance and effectiveness of the mitigation measures to which the Project has committed. The key element of the ESHMP will be a series of Environmental Management and Monitoring tables, reported in detail in Chapter 12 of the ESHIA.

1.12 SUMMARY AND CONCLUSIONS

The findings of the EIS presented in Chapter 10 indicate that there are no issues of Major significance that could not be mitigated such that the proposed project was not acceptable from an environmental and socio-economic perspective. The significance of all negative impacts could be reduced to Medium or Minor significance through design, use of control technology and operational management controls with the exception of the economic displacement of farming in land acquisition Area

For this impact, an assessment of the proportional scale of livelihoods losses to Sanzule, along with information on the availability of alternative agricultural land in the direct area of influence to allow for like-for-like replacement of acquired farmland, will be confirmed following supplementary baseline livelihoods survey work to be conducted in parallel with the resettlement planning process in April 2015.

For the moment, other alternatives such as compensation of both the leased land and the assets, and future alternative livelihood training activities and specific investment projects at Sanzule are foreseen.

For other impacts, the residual effect of a number of activities from the construction and operation phases is expected to remain Medium despite the mitigation measures proposed. For this reason, eni Ghana should pay special attention to these activities and ensure that practicable, feasible and cost-effective mitigation is implemented wherever practicable.

The EIS also identified a number of positive impacts. Increased government revenue was assessed as having the potential benefit of High significance during construction and Critical positive during operation. Other positive impacts of High significance are increased procurement during construction and operation phases and employment and skills development during operation phase.

Granting of environmental authorization for the eni Ghana OCTP Block Phase 2 Project by the EPA will be contingent on a series of conditions. These are likely to include the implementation of the safeguard measures described in the EIA and a programme of monitoring for potential environmental, social and health impacts.