plan ms hse 019 eni Ghana r01 – Biodiversity Management Plan

Sea Turtles Biodiversity Action Plan

Appendix B

TITLE:
Sea Turtles Biodiversity Action Plan (BAP)
NOTE:
The document is applicable to eni Ghana Exploration and Production Limited activities.

DATE OF ISSUE:		EFFECTIVE DATE:	
31 August 2017		31 August 2017	
PREPARED BY:	**CHECKED BY:**	**REVIEWED BY:**	**ENDORSED BY :**
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REVISION SHEET

Rev.	Date	N. pages	Change Description	Prep.	Ver.	Appr.
00	August 2016	93	Final issue	David Marsh and Jason Sali	Thomas Maddox and Pippa Howard	Pippa Howard
01	31–08-2017	95	Revised BAP to account for material change to pipeline design and installation (see note below)	David Marsh	Pippa Howard	Pippa Howard

Note:

The Sea Turtle BAP has been updated to reflect relevant changes in the project design and construction methods that occurred at the OCTP Project since the preparation of the first version of the BAP (Rev.00). These changes refer to the change of construction methodology of the Export Sealine at the landfall area, from an open trench to a trenchless method, Direct Pipe method.

The changes to the project construction methods are expected to avoid direct impacts to the nesting beaches associated with the conventional open cut-and cover technique. The Direct Pipe method has been included in this document as a spatial avoidance mitigation measure.

APPENDIX B – SEA TURTLES BIODIVERSITY ACTION PLAN

EXECUTIVE SUMMARY

This sea turtle Biodiversity Action Plan (BAP) has been developed by eni Ghana as part of its Framework Environmental, Social and Health Management Plan (ESHMP). IFC/WBG/MIGA performance standards apply to the eni Ghana OCTP project (collectively WBG PS in this document). The sea turtle BAP is one of several complementary plans to the Biodiversity Management Plan (BMP). Sea turtles were identified as high priority biodiversity components and qualifying species for natural habitat. The BAP is a Company commitment and in line with the requirement of the World Bank Group Performance Standard 6 (WBG PS6) when operating in critical habitat and is recommended when operating in natural habitats.

The over-arching goal of the BAP is to ensure adequate management, control and monitoring of project activities that pose a risk to sea turtles and nesting habitat in the project Area of Influence (AoI) in accordance with WBG PS6. In line with eni's internal technical guidelines and best practices, the BAP addresses mitigation measures, including additional conservation actions (ACAs), to drive continuous performance improvement towards maintaining and contributing to the long-term regional persistence for these species in recognition of their irreplaceable ecological and social value.

This report outlines an action plan for Eni Ghana to mitigate the possible impacts on turtle biodiversity resulting from the Offshore Cape Three Points (OCTP) project activities related to the construction and operation of the Onshore Receiving Facility (ORF) and pipeline landfall across the identified Area of Influence (AoI); in other words, to reduce impacts to sea turtles to as low as reasonably possible and design/implement measures that will achieve no net loss as required.

The scope of this document is limited to the nearshore/onshore habitats. Offshore aspects are addressed in the Marine Mammals and Sea Turtles protection Policy and Plan and the Marine Mammal and Sea Turtle Monitoring Programme for the Offshore Cape Three Points (OCTP) Project.

This report starts by describing the baseline situation. It introduces the five turtle species known to inhabit the coastal waters in the western region of Ghana and outlines what is known of their local ecology, the likely threats and the key stakeholders of relevance. Of these five, initial monitoring has demonstrated that the Olive ridley turtle (*Lepidochelys olivacea*) constitutes the large majority of turtles nesting in the area of influence, defined as 2.5 km strip of beach each side of the landfall point. Additionally Green (*Chelonia mydas*), and Leatherback turtles (*Dermochelys coriacea*) have also been positively identified using the beach for nesting, while Loggerhead (*Caretta caretta*) and

Hawksbill (*Eretmochelys imbricata*) have been recorded offshore but appear to be uncommon onshore visitors, with no recent confirmed nesting occurrences.

The three species (Olive ridley, Green, and Leatherback turtles) appear to use the beach for nesting at different times with some overlap; with October-February generally the peak period and April and May the lowest period. The 5 km beach section of the AoI is estimated to support 50 nests of various species per year; nesting density is estimated at about one per 100m per year. Key threats to sea turtles are largely anthropogenic, including: egg poaching, beach/nest disturbance, targeted exploitation and entanglement in fishing nets.

Egg poaching is a particular threat, with at least 16% of all observed nests having been raided according to data collected by local NGO, Wildseas, in an adjacent area (an action that may also include the harvest of the adult). Sea turtles are also occasionally caught in fishing nets, although the frequency of this and the extent to which they are returned to the sea is unknown. Key stakeholders include local NGOs dealing with turtle conservation, local resorts, local settlements and fishermen.

The report reviews the potential impacts during the construction and operation phase of the Onshore Receiving Facility (ORF), based on impacts and areas of influence detailed within the ESHIA report and follow-up surveys. The report identifies four potential direct impacts associated with the project prior to any mitigation taking place: disturbance of existing nests during construction, loss of nesting habitat for future nesting animals during and post-construction, impacts of artificial lighting on nesting behaviour during construction, and disturbance and/or mortality of turtles due to machinery, rubbish or human presence. It also considers one possible indirect impact: increased egg poaching and turtle mortality resulting from the influx of the workforce. The report also addresses the cumulative impacts from induced migration triggered by the employment opportunities and economic enhancement that the project is expected to bring to the region.

Although data are sparse, the report attempts to quantify un-mitigated direct impacts as far as possible, initially assuming an un-mitigated scenario. Based on existing reports, the unmitigated scenario assumes direct impacts from the originally proposed conventional open trench method (with excavation and dredging) would result in disturbance up to 300 m either side of the pipeline landfall site for a period of three years (a four to six month construction period followed by two and a half years of rehabilitation before the beach is suitable for turtles to resume nesting). Using the precautionary principle it has been assumed the combined direct impacts will prevent all nesting in the 600 m impact zone for the full three years and that those turtles will not be able to successfully nest in another location. On this basis, in an un-mitigated scenario (before considering the adoption of new trenchless pipe methods and other mitigation actions) it is estimated that up to 12 sea-turtle nests could be directly impacted (either by damaging the existing nest or preventing the successful establishment of a nest) in the first year and a further six in the two following years.

The indirect impact of worker influx on harvesting and egg collection, as well as the cumulative impacts induced by in-migration are not quantified since the available data do not allow loss/gains calculation against a conclusive baseline and induced in-migration estimates are not available.

The report then outlines a set of objectives for managing the impacts identified, following the mitigation hierarchy. Key action steps to mitigate impacts include:

- Avoidance of impacts by using a trenchless method of micro-tunneling with Horizontal Direct Drilling (henceforth HDD) which avoids direct beach habitat loss associated with trench construction, eliminates the need for the construction of an access road along the beachfront and the need for construction equipment and trenching on the beach itself.
- Minimization of impacts through the design and implementation of the bush meat action plan; support local beach patrols performed by local NGOs; Locating HDD operations to within the eni ORF concession will also reduce the noise level detectable from the turtle nesting beach and either reduce or completely eliminate light spill.
- Restoration of the beach will not be required with a trenchless DP method.
- Offset / Additional conservation actions including establishing beach surveillance through collaboration with a local NGO, effectively communicating that the harvest of eggs and turtles is an illegal activity to the community, engage and contribute to existing community-based turtle conservation programmes and support the establishment of a biodiversity committee between the relevant development projects in the district.

Following the avoidance, minimisation and restoration activities, the successful implementation of offset/additional conservation actions will be sufficient to demonstrate No Net Loss on local turtle populations, also taking into account indirect and induced cumulative impacts, and other unplanned impacts that are not accounted for.

A summary of the predicted losses is shown in the table below. All estimates will be subject to iterative review on an annual basis as data from the monitoring and evaluation of mitigation activities and the suggested BAP actions become available. The new pipeline installation method is expected to avoid direct beach habitat loss associated with trench construction.

Table A - Preliminary estimation of impacts to turtles (nest losses/year) based on the extrapolation of secondary beach survey data.

	Estimated loss of turtle nests / year					
	Year 1		Years 2-3		Operational phase	
Source of Impact:	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
1. Direct loss of access to nesting beach;	6	0	6	0	0	0
2. Disturbance of existing nests during construction;	6	0	0	0	0	0
3. Disturbance and/or mortality of sea turtles (i.e. due to machinery);	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
4. Artificial illumination on nesting beaches;	Unknown	0	Unknown	0	Unknown	0
5. Harvesting of adult and juvenile turtles by the project workforce	Unknown	0	Unknown	0	Unknown	0
6. Indirect and cumulative impacts from induced migration	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Total	12	0	6	0	0	0

The BAP recommends following the final step of the mitigation hierarchy and establishing compensatory activities whereby eni Ghana supports local NGOs and communities to address the adult harvesting/egg poaching threat that occurs independently of eni's operations. Due to the paucity of available data the potential conservation gains from these activities have not been estimated at this point.

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ACRONYMS

AoI	Area of Influence
BAP	Biodiversity Action Plan
BMP	Biodiversity Management Plan
CRC	Coastal Resources Center
EIS	Environmental Impact Study
ESHIA	Environmental, Social and Health Impact Assessment
ESHMP	Environmental, Social and Health Management Plan
ESL	ESL Consulting
FFI	Fauna and Flora International
FoN	Friends of the Nation
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
GNGC	Ghana National Gas Company
GPS	Global Positioning System
GWD	Ghana Wildlife Division
GWS	Ghana Wildlife Society
HDD	Horizontal Directional Drilling
LTE	Land Termination End
MIGA	Multilateral Investment Guarantee Agency
NGO	Non-government organisation
NNE	Non-nesting emergence
OCTP	Offshore Cape Three Points
ORF	Onshore receiving facility
PS	Performance Standard(s)

REDO	Resource and Environment Development Organization
RMU	Regional Management Unit
SWOT	State of the World's Sea Turtles
WBG	World Bank Group

1 INTRODUCTION

1.1 Purpose

This sea turtle Biodiversity Action Plan (BAP) has been developed by eni Ghana as part of its Framework Environmental, Social and Health Management Plan (ESHMP). The sea turtle BAP is one of several complementary plans to the Offshore Cape Three Points (OCTP) Project Biodiversity Management Plan (BMP). Sea turtles were identified as high priority biodiversity components and nesting beaches as natural habitat according to WBG PS6. The BAP is a requirement for the WBG PS6 when operating in critical habitat and is recommended when operating in natural habitats, and is an integral component in eni's internal biodiversity and ecosystem service management approach[1].

The over-arching goal of the BAP is to ensure adequate management, control and monitoring of project activities that pose a risk to sea turtles and nesting habitat in the Area of Influence (AoI) in accordance with WBG PS6. In other words reduce the potential impacts to sea turtles to as low as reasonably possible and design/implement measures that will achieve no net loss. In addition, where it is feasible, eni Ghana will aim to contribute to ongoing conservation efforts aimed at maintaining and contributing to the long-term regional persistence for these species and their habitats.

The BAP outlines potential impacts and consequences specific to sea turtle species that utilise the beaches within the AoI for nesting. The BAP also outlines appropriate mitigation measures and a monitoring programme. The scope of this document is limited to the nearshore/onshore habitats. Offshore aspects are addressed in the Marine Mammals and Sea Turtles protection Policy and Plan and the Marine Mammal and Sea Turtle Monitoring Programme for the OCTP Project.

1.2 BAP objectives

The overall objectives of the Sea Turtles BAP are to:

[1] eni Upstream and Technical Services and FFI, as authors of the Sea turtle Biodiversity Action Plan (BAP), acknowledge the definitions of critical habitat (CH) suggested by the World Bank Group (WBG) within Critical Habitat Assessment (CHA) of OCTP Block, Ghana, and as interpreted by the WBG according to their Performance Standard 6. These interpretations have been adhered to in the CHA according to WBG's guiding principles and recommendations.
It is also acknowledged by FFI and eni, that there are also species within the OCTP area of influence that are considered by local and international experts, and according to their regional and national conservation status, as highly sensitive on the basis of local threat status, vulnerability, irreplaceability and their role in the health and persistence of locally important ecosystems. These species include sea turtle species (Green Turtle (*Chelonia mydas*) Endangered; Hawksbill Turtle (*Eretmochelys imbricata*) Critically Endangered and Olive Ridley Turtle (*Lepidochelys olivacea*) Vulnerable). In these cases, in line with eni's internal technical guidelines and best practices, the BAP addresses mitigation measures, including additional conservation actions (ACAs), to drive continuous performance improvement towards maintaining and contributing to the long-term regional persistence for these species and their habitats.
Given that monitoring activities will be part of the delivery of the BAP and that measurement of benefits will be determined over time throughout the implementation of the BAP, Eni will take an iterative approach to revisit the status and relevance of these activities relative to the improved knowledge gained for all marine turtles.

- Ensure adequate management, control and monitoring of project activities that pose a risk to sea turtles and their nesting habitats;
- Ensure that project direct and indirect impacts do not contribute to sea turtle declines in the region;
- Design/implement measures that will achieve no net loss which ensures that project direct and indirect impacts do not contribute to sea turtle declines in the region; and
- Undertake actions by contributing to sea turtle conservation in the region through supporting additional conservation actions.

The specific objectives of the sea turtle BAP are to:

1. Avoid harm to turtle nests during construction and for the duration of the project;
2. Maintain the viability of nesting beaches in the AoI and prohibit the harvest of eggs and females by the project workforce within the AoI;
3. Establish a robust sea turtle baseline and monitoring program in the project Area of Influence (AoI);
4. Limit adverse behavioural impacts to nesting turtles and hatchlings as a result of artificial lighting;
5. Limit direct disturbance and mortality of sea turtles to that which is reasonably practical (target of zero incidents);
6. Undertake additional conservation actions through the establishment of partnerships with local NGOs to reduce the harvest of turtles and eggs by local communities; and
7. Use reasonable efforts to assess and work in collaboration with other large-scale developments in the district to address cumulative impacts.

1.3 BAP target species

Three sea turtle species are known to utilise the beach habitat for nesting and are the focus of the BAP including the Olive ridley (*Lepidochelys olivacea*), Leatherback (*Dermochelys coriacea*) and Green turtle (*Chelonia mydas*) (Armah et al., 1997; Amiteye, 2002; Agyekumhene, 2009; OCTP Sea Turtles Pre-construction Survey Report; data provided by local NGOs undertaking beach surveys - Ghana Wildlife Society (GWS) and Wildseas). An additional two sea turtle species are known to inhabit the coastal waters in the western region of Ghana including loggerhead (*Caretta caretta*), and Hawksbill (*Eretmochelys imbricata*). All sea turtles are listed as critically endangered, endangered or vulnerable by the IUCN Red List of Threatened Species (see Table 1.1). The three species (Olive ridley, Leatherback and Green turtle) do not meet the required threshold triggering critical habitat in accordance with WBG PS6. Table 1.1 outlines the global and regional IUCN conservation status for relevant sea turtles. The status of

conservation of several sea turtles is likely to be reviewed in the near future and include a status for sub-populations or regional management units[2] (RMU). Red List assessments at the regional population level are much more meaningful for conservation planning than those done solely at the global scale, especially for wide-ranging species like sea turtles. In addition, all sea turtles are wholly protected under the Ghana Wildlife Conservation Regulation, 1971, L.I. 685. The First Schedule, (Series B - Reptiles) includes the order 'Chelonia' which (in older use) covers all sea turtles.

Table 1.1 Sea turtles known to occur in Ghanaian waters

Common name	Scientific name	IUCN – Global Status	IUCN – Regional Status	Likelihood of occurrence
Olive ridley	*Lepidochelys olivacea*	VU	NA RMU – East Atlantic	Offshore, Confirmed nesting
Green turtle	*Chelonia mydas*	EN	NA RMU – East and South Central Atlantic	Offshore, Confirmed nesting
Leatherback turtle	*Dermochelys coriacea*	VU	DD RMU – Southeast Atlantic	Offshore, Likely nesting
Loggerhead turtle	*Caretta caretta*	VU	EN RMU – North east Atlantic	Offshore
Hawksbill turtle	*Eretmochelys imbricata*	CR	NA RMU – East Atlantic	Offshore

Source: IUCN Red list of threatened species database and Wallace et al. 2010)
*IUCN Conservation Status (Critically endangered (CE); Endangered (EN); Vulnerable (VU); Near Threatened (NT); Data deficient (DD); Not available (NA).

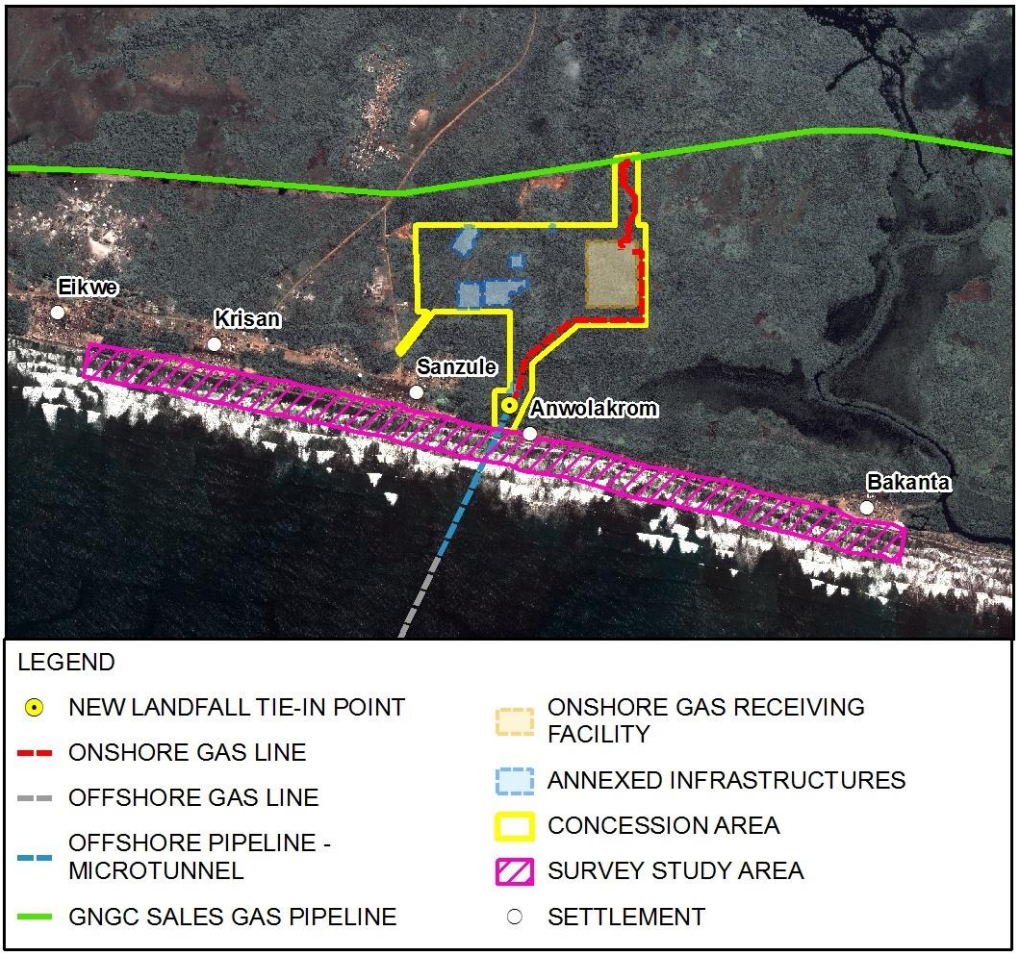
1.4 Project Area of Influence

For the purpose of the sea turtle survey studies conducted under the ESIA, the Project AoI, was taken to extend for approximately 2.5 km either side of the pipeline landfall location, in order to consider any disturbance associated with pipeline installation activities as well as potential indirect impacts derived from the construction and operation activities in the ORF, or due to the

[2] Regional management unit = a geographically explicit population segment based on geographic boundaries to distribution derived from studies on genetics, tag returns, satellite telemetry and other data (Wallace et al. 2010).

increased human pressure in the area (Figure 1.1). This area includes the beaches of Bakanta, Anwolakrom, Sanzule, Krisan and Eikwe villages. Sea turtles may also be impacted by offshore activities off the beach. Offshore aspects are addressed in the Marine Mammals and Sea Turtles protection Policy and Plan and the Marine Mammal and Sea Turtle Monitoring Programme for the Offshore Cape Three Points (OCTP) Project.

Figure 1.1 Project Area of Influence (AoI) for estimated direct and indirect/induced impacts to turtle nesting sites (source ERM)



2 SEA TURTLE ECOLOGICAL ASSESSMENT

2.1 Overview of onshore sea turtle surveys and information

Desktop and field surveys have been performed in order to establish baseline information for sea turtles in the project Area of Interest (AoI). There was limited published scientific data on sea turtle activity available for the Project area prior to the commencement of the ESHIA.

ESHIA - OCTP Phase 2 (Chapter 6 – Environmental baseline)

The Phase 2 ESHIA (2015) undertook desktop and field surveys to determine the likelihood of occurrence of sea turtle species in the AoI. The ESHIA was supplemented by the Appendix E: Sea turtle Report prepared by ESL Consulting (ESL) in January 2016. The desktop assessment established that five species of turtles were potentially present in the area.

A turtle survey of beaches within the Project AoI was undertaken (as defined in the Dry Season Environmental Baseline Report compiled for the Project in 2014) to inform the Phase 2 ESHIA. The field survey involved 30 structured community interviews from two communities in the project area (Sanzule and Batanka) and direct observations along the stretch of beach between Sanzule and Bakanta. Field observations confirmed that the Project area is a suitable nesting site for sea turtle. The beach featured a gentle slope and the back beach was characterised by 'mainly coconut with no dense grass underneath'. The lack of dense understorey vegetation is likely to improve successful nest construction.

Interviews with the local community indicated that Olive ridley, Leatherback and Green turtles had been seen nesting in the area in the last 3 -10 years. The interviews confirmed that sea sightings in the area take place throughout the year, though mostly between October and December. The initial ESHIA surveys identified when the predicted peak nesting period (see Section 2.3) occurred however the survey was conducted outside this period and no sea turtles were observed.

Pre-construction survey

The aim of the sea turtle pre-construction survey was to obtain information to assess the conservation importance of the beaches in the Project AoI for sea turtles. The pre-construction turtle survey was undertaken between 24 November and 1 December 2015. The nesting sea turtle survey study area covered the beaches within the Project AoI, ex- tending approximately 2.5 km either side of the pipeline landfall location (Figure 1). At the time of survey, the beach in the project area between Sanzule and Anwolakrom was considered suitable for sea turtle nesting. Within the project AoI, the survey team encountered four activities (three nests and one non-nesting emergence) which were attributed to Olive ridley turtles. Nesting was noted to be more frequent to the west of the AoI. No nesting activity

was observed in the direct area of disturbance of the pipeline landfall works (taken to be a 300 m buffer around the pipeline centreline). No sign of nesting activity was recorded for the four other sea turtle species (Leatherback, Green, Loggerhead and Hawksbill) documented to use Ghana's coastal area for feeding and nesting.

Additional supplementary information was collected for adjacent beaches (approximately 12 km to the west and three km to the east) and nesting data was also obtained from local non-governmental organization (NGO)s. Nesting activity was encountered on six occasions on adjacent beaches (but outside the AoI). At the time of the pre-construction survey 10 Olive ridley nests had been relocated to local beach resorts and GWS had observed another four nests between Krisan and Sanzule. GWS and Wildseas also observed Green turtles within the AoI. ESL believe the identification of Loggerhead and Hawksbill is a result of misidentification of hard shelled sea turtle species (ESL pers comm). Community members and Wildseas also reported that Leatherback turtles also currently nest in the area, but in low numbers.

Community engagement highlighted that many local community members perceived sea turtles as a source of meat or income when sold or for tourism. Fishermen stated that they believed turtles destroyed their fishing nets which allowed the catch to escape.

Field visit undertaken by FFI/ERM/ESL

FFI, ESL and ERM undertook field work in the AoI between 8 and 12 March 2016. The field visit took place in order to verify impacts, confirm habitat suitability, assess non- project threats, and to assess the capacity of local NGOs to implement any community- based monitoring program that may be required. The survey was undertaken outside of the peak nesting season (see Section 2.3) and comprehensive daily beach patrols were not undertaken.

FFI/ESL undertook a night survey on the 9 March 2016, primarily to assess the existing levels of artificial illumination within the AoI, which is known to have adverse impacts on nesting behaviour of gravid females and cause disorientation among hatchlings. The results have been provided in Table 2.1. The lighting assessment has been added to the habitat data collected during the preconstruction survey. The fishing communities within the AoI generally have one bright light on a pole per community. The community of Anwolakrom contained no light sources during the preconstruction survey however it has recently installed several lights along the coastal street. Light sources were assessed on a level of intensity as outlined in Section 6.3.

FFI/ESL undertook a dawn survey on the 11 March 2016 to verify the extent and quality of the nesting habitat and to quantify the area of nesting habitat that will be potentially impacted in the project footprint. The eni concession is situated on the boundary of Anwolakrom. At the time of the survey the beach habitat was being used for beach seining. The beach had been compacted by a combination of fishing activity, storage of fishing boats and foot/vehicle traffic. Beach softness was assessed as 'hard' and 'medium' (Varela-Acevedo et al. 2009). However as with the majority of beach habitat within the AoI it provides suitable habitat for

sea turtle nesting.

Beach naturalization was observed at the Ghana National Gas Company (GNGC) pipe landfall site. Three years after construction, understorey vegetation has re-established. The back beach appears to have stabilised and juvenile palm trees are present. It is understood that passive regeneration was undertaken.

Nesting and poaching activities were directly observed during an ESL survey undertaken in January 2016. This survey was undertaken for the adjacent AFP project, also within the AoI. An adult Green turtle was observed within the Krisan cemetery. The Green turtle had been removed from the beach and carried inland by a local community member. ESL and GWS secured the release of the turtle (ESL pers comm).

The assessment of the capacity of NGO stakeholders undertaken during the field visit and recommendations for future engagement is included Section 3.

Table 2.1 Characteristics of survey beach

Community Name	GPS Location		Nature of slope	Width		Beach Vegetation (Dominant)	Available Beach for turtle nesting	Anthropogenic activities on beach	Artificial illumination	Threats to sea turtle nesting on beach
	Northern	Western		Intertidal	Back Beach					
Eikwe	04.96319°	002.4737°	Mainly gentle; small section outside the community has cliffs under coconuts	18 m	5 m	*Cocos nucifera* (Coconut palm)	Limited About 2m wide	Beach Seine fishing (D/N)	1 x yellow light shielded from beach (intensity 2[3]) 1 x yellow light (intensity 3) 3 x white lights (intensity 1) 1 x yellow light 400 m east of Krisan (intensity 3)	Inundation of nests; eroding beaches evident in roots of coconut showing in the air
Krisan	04.96138°	002.46461°	Gentle beach	2 m	14 m	*Cocos nucifera*; Ipomea pes caprea	Narrow	Beach Seine fishing (D/N); Sand mining (D)	1 x yellow light which spills on the football pitch and back beach (intensity 3)	Artificial Light from the main ECG Pole in the community
Sanzule	04.95960°	002.45587°	Mainly gentle	9 m	32 m	*Cocos nucifera*; Ipomea pes caprea	Wide	Beach Seine fishing (D/N); Sand mining (D); Block moulding (D)	1 x yellow light (intensity 3)	Debris (Plastic, fallen coconut branches, old fishing nets); vehicular movement at back beach
Project footprint	04.95799°	002.44868°	Gentle beach	25 m	21 m	*Cocos nucifera*; Ipomea pes caprea	Wide	Beach Seine fishing; boat storage; access road	1 x recently installed yellow light facing the project footprint from the edge of Anwolakrom (intensity 3)	Plastic and waste debris, vehicular movement on the back beach

[3] Intensity scale follows method outlined in Varela-Acevedo et al. 2009.

Community	GPS Location		Nature	Width		Beach	Available	Anthropoge	Artificial illumination	Threats to sea
Anwolakrom	04.95733°	002.44559°	Mainly gentle	21 m	15 m	*Cocos nucifera*	Wide	Beach Seine fishing (D/N); Lobster fishing (N); Fire wood collection and selling (D); Resting sheds for fishermen (D)	3 x recently installed yellow lights (intensity 3) 2 x yellow lights facing away from the beach (intensity 2)	Vehicular movement at back beach. Reduction area available for female nesting from firewood gathering at the beach.
Bakanta	04.95343°	002.42966°	Mainly gentle	25 m	17 m	*Cocos nucifera*	Wide	Beach Seine fishing (D/N); Resting sheds for fishermen (D);	1 x yellow light (intensity 2)	Vehicular movement at back beach

2.2 Sea turtle distribution and ecology

In order to estimate the impact and determine suitable mitigation measures, an in-depth understanding of the relevant species is required. This section describes the species likely extent, preferred nesting habitat, seasonality and existing threats. All five species are assessed in this section however only three sea turtle species are currently known to utilise the beach habitat for nesting and are the focus of the BAP including the Olive ridley, Leatherback and Green turtle. The proposed monitoring programme (Section 6) will help to establish whether or not other species are present.

Olive ridley turtle

The Olive ridley has the highest relative abundance along the Ghana coast and was confirmed nesting in the AoI during pre-construction surveys (four individuals) and NGO beach patrols (Agyekumhene, 2009; Amiteye, 2002). The IUCN's Marine Turtle Specialist Group has determined that the global population of Olive ridley turtles can be divided into eight regional management units (RMU). Species that inhabit Ghanaian waters are likely to belong to the East Atlantic RMU (Wallace et al. 2010).

Preferred nesting habitat is described as tropical mainland shores and barrier islands, often near river mouths (Eckert et al. 1999). The beach habitat observed within the AoI is likely to be suitable for nesting for Olive ridley turtles. Females migrate to tropical waters several weeks prior to the nesting season (Lutz et al. 2002). In contrast to other sea turtle species, the reproductive cycle is nearly annual (over 60% of turtles nest every year) (Márquez 1990). Solitary nesters oviposit on 14 day cycles whereas arribada[4] nesters approximately every 28 days (Pritchard 1969, Kalb and Owens 1994, Kalb 1999). Kalb (1999) found that within a nesting season solitary nesters may use multiple beaches for oviposition but arribada nesters display strong nesting beach fidelity. Arribadas only occur at a few select beaches globally and this behaviour is highly unlikely to occur in Ghana.

Following nesting female Olive ridley turtles in other locations are known to quickly migrate back to oceanic waters (post-reproductive migrations). The species is a nomadic migrant that does not follow a consistent migration corridor from a single feeding area like other sea turtle species (Plotkin 2007).

Leatherback turtle

The Leatherback turtle was not observed in the AoI during the pre-construction surveys however community interviews and local NGO beach patrols indicate the species does utilize the AoI for nesting in low numbers. The species was observed nearby in offshore

[4] Arribada = highly aggregated nesting behaviour is characterized by large numbers of nesting females, as well as by high nesting density and the, as yet unexplained, nesting synchrony of participating individuals. (Eckert et al. 1999)

waters in 2015 according to local fisheries capture data provided by Wildseas. The IUCN's Marine Turtle Specialist Group has determined that the global population of Leatherback turtles can be divided into seven RMUs. Species that inhabit Ghanaian waters are likely to belong to the Southeast Atlantic RMU (with some potential overlap with the Northwest Atlantic RMU) (Wallace et al. 2010).

Preferred nesting habitat is described as wide, long, tropical beaches with a steep slope, deep rock-free sand, and an unobstructed deep water or soft mud bottom approach (Eckert et al. 1999). The beach habitat observed within the AoI is likely to be suitable for nesting for Leatherback turtles. Inter-nesting intervals for Leatherback turtles is likely to range from 9-10 days (Alvarro and Murphy 1999). Gravid[5] females will occupy inshore waters during the inter-nesting season however outside of this period will occupy oceanic waters. Females of this species are unlikely to nest every year. Generally, following a reproductive season a turtle will only nest again in 2 – 4 years (Alvarro and Murphy 1999).

Green turtle

The Green turtle was observed (one individual) in the AoI in January 2016 during ESL surveys for the adjacent AFP project. In addition community interviews and local NGO beach patrols indicate the species does utilize the AoI for nesting. The IUCN's Marine Turtle Specialist Group has determined that the global population of Green turtles can be divided into seventeen RMUs. Species that inhabit Ghanaian waters are likely to belong to the East and/or the South Central Atlantic RMU (Wallace et al. 2010).

Preferred nesting habitat is described as ranging from large, open beaches to small cove beaches; preferably with an open offshore approach (Eckert et al. 1999). The beach habitat observed within the AoI is likely to be suitable for nesting for Green turtles. Inter-nesting intervals for Green turtles are likely to range from 12-15 days (Alvarro and Murphy 1999). Females of this species are unlikely to nest every year. Generally, following a reproductive season a turtle will only nest again in 2 – 4 years (Alvarro and Murphy 1999).

Loggerhead turtle

The Loggerhead turtle was not observed during the pre-construction survey and local NGO/community interviews suggested the species does not utilize the beaches within the AoI. The species was observed nearby in offshore waters in 2015 according to local fisheries capture data provided by Wildseas. The current nesting status of Loggerhead turtles is unknown in Ghana (Agyekumhene, 2009; Amiteye, 2002). The most recent confirmed nesting of Loggerhead in Ghana was on the eastern coast approximately 250

[5] Gravid = carrying eggs or young; pregnant.

km from the AoI (Allman et al. 2012). The IUCN's Marine Turtle Specialist Group has determined that the global population of Loggerhead turtles can be divided into ten RMUs. Species that inhabit Ghanaian waters are likely to belong to the Northeast Atlantic RMU (Wallace et al. 2010).

Preferred nesting habitat is described as generally extensive mainland beaches and barrier islands; a moderately steep beach profile is preferred (Eckert et al. 1999). The beach habitat observed within the AoI is likely to be suitable for nesting for Loggerhead turtles. Inter-nesting intervals for Loggerhead turtles are likely to range from 12-15 days (Alvarro and Murphy 1999). Females of this species are unlikely to nest every year. Generally, following a reproductive season a turtle will only nest again in 2 – 4 years (Alvarro and Murphy 1999).

Hawksbill turtle

The Hawksbill turtle was not observed during the pre-construction survey and community interviews suggested the species does not utilize the beaches within the AoI. The local NGO, GWS, has recorded the species nesting on the beach however ESL consultants do not believe the species identification for these records are accurate. Nesting status of Hawksbill turtles in Ghana is unknown (Agyekumhene, 2009; Amiteye, 2002). The IUCN's Marine Turtle Specialist Group has determined that the global population of Loggerhead turtles can be divided into thirteen RMUs. Species that inhabit Ghanaian waters are likely to belong to the East Atlantic RMU (Wallace et al. 2010).

Preferred nesting habitat is almost exclusively located in tropical regions. The species utilizes narrow, more heavily vegetated, low profile beaches on islands or mainland shores with reefs obstructing offshore approach. Hawksbill nesting habitat is often separated (spatially or temporally) from that used by other turtle sea species (Eckert et al. 1999). Heavily vegetated beach margins and offshore reefs do not occur in the AoI. As such the AoI is likely to represent suboptimal nesting habitat for Hawksbill turtles. Inter-nesting intervals for Hawksbill turtles are likely to range from 12-15 days (Alvarro and Murphy 1999). Generally, following a reproductive season a turtle will only nest again in 2 – 4 years (Alvarro and Murphy 1999).

2.3 Nesting seasonality

Nesting periods are reported to differ for each sea turtle species in Ghana. Olive ridley is documented to nest year round while Leatherbacks nest primarily between November and February (Agyekumhene, 2009; Amiteye, 2002), with a few recorded in October, March and July, suggesting early and late nesters (Agyekumhene, 2009). Green turtle nesting in Ghana has been recorded between June and August and also between November and December. In the absence of sea turtle monitoring data in the project area, ESL undertook interviews in the coastal communities. Sea turtles were observed by

the respondents throughout the year. Sighting were highest during the month of October (27.1%), November (20.3%) and December (15.3%) with least sightings in April (1.7%), May (1.7%) and July (1.7%).

Table 2.2 below shows the likely nesting periods of those species of turtles which currently nest in the Western region of Ghana.

Table 2.2 Key nesting periods of sea turtles in the Western region of Ghana

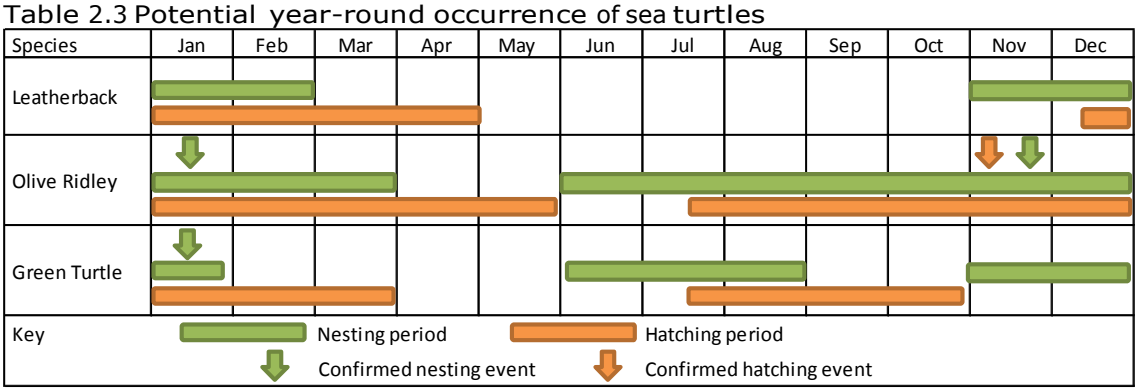
Species	J	F	M	A	M	J	J	A	S	O	N	D	Nesting Status in Western Ghana
Leatherback													Reported by GWS
Olive Ridley													Confirmed: (Reported by GWS/ WildSeas: Confirmed by ESL)
Green turtle													Confirmed: (Reported by GWS/ WildSeas: Confirmed by ESL)
Hawksbill													No Information
Loggerhead													No information

Key: Confirmed Likely Reported

Source: ESL Pre-construction survey report

For the three species that are known to nest, the potential year-round occurrence of nesting activity, as well as egg and hatchling presence on the beach is illustrated in Table 2.3 below.

Table 2.3 Potential year-round occurrence of sea turtles



2.4 Threatening processes / Major threats

The primary threats to the survival of the global sea turtle population are mostly anthropogenic (IUCN 2006). Based on the results of the ESL field survey reports and

desktop assessments, sea turtles and nesting habitat are exposed to the following anthropogenic threats in the AoI/region:

- Collection of sea turtle eggs. Olive ridleys and/or their eggs are used along the entire coast of West Africa and consumed or sold in local and regional markets (Fretey 2001). Within the AoI eggs are seldom sold and rather are for subsistence needs. However some beach resorts have paid (up to GH₵ 100 a clutch) for the relocation of eggs to beaches directly in front of the resorts.
- Harvest of adult sea turtles occurs for food, sale and/or incidental capture in fishing gear. Harvesting of adult turtles especially gravid females is the most significant threat to the long-term persistence of sea turtles in the area. Oil from sea turtles is collected as it is believed to be of medicinal value (Mangar and Chapman, 1996, Amiteye, 2002). During the preconstruction survey community members mentioned both poachers who hide and capture turtles for sale. ESL and GWS observed the attempted poaching of a Green turtle in Sanzule in January 2016. Community members are also known to collect turtle eggs for sale to beach resorts to bury in front of their hotels for tourists to see the hatchlings emerge from these nests. During interviews in March 2016, Wildseas estimated that adult Leatherback turtles are currently sold for GH₵300, Green turtles GH₵150-200 and Olive ridley GH₵100-150.
- Changes to nesting habitat and beach morphology from coastal infrastructural development can alter long-shore drift and vegetation cover. The Atuabo Free Port project has the potential to alter the prevailing coastal conditions.
- Accidental mortality due to fisheries interaction is a pressing issue (Eckert 1997; Spotila et al. 2000; Lewison et al., 2004; James et al., 2005).
- Artificial illumination on nesting beaches by local communities and beach resorts was directly observed during the survey period. However at present a limited number of lights are present in the community that extend to the beach.
- Sand mining was directly observed in the AoI during the survey period and field visit. Sand mining diminishes the beach profile, degrades nesting habitat and can directly disturb nests. Sand mining and block moulding were observed at all communities in the AoI.
- Driving on the beach or back beach was directly observed during the survey period. Vehicles can crush or entrap hatchlings as a result of a collapse of airspace. Vehicles/motorcycles were observed driving on the beach during low tide.
- Beach seine fishing was observed within the AoI. This fishing method has been implicated in the capture and mortality of sea turtles (NRC, 1990). Entanglement

and drowning are expected to be insignificant. However significant mortality can occur as a result of fishermen who kill turtles for meat. Turtles caught by fisherman are harvested in the AoI and broader region.

- Nests deposited in the Project AoI are susceptible to erosion or inundation by the high tides due to the narrow nature of some sections along the beach. Erosion and exposure of coconut tree roots was observed between Eikwe and Sanzule which under current conditions would prevent female turtles accessing the back beach.
- Accumulation of beach debris such as timber at present is not deemed an issue. However general rubbish such as plastic bottles was prevalent throughout the AoI. Debris (e.g., rope, fishing line, fishing nets, plastic, and Styrofoam), recreational and work equipment and other obstacles have the potential to entrap, entangle, and impede nesting turtles and their hatchlings.
- Predation of eggs by native or introduced species. However no threats to nests are reported from dogs in the AoI since the communities do not keep dogs. Dogs were not observed during the field visit and are reportedly not allowed in certain communities. Dogs were, however, reported to predate eggs along beaches outside the Project AoI by GWS tour guides. Pigs are also known to predate turtle eggs and were observed at the refuse dump in Krisan. GWS tour guides also reported predation of eggs by wild animals such as hawks, kites, crows and crabs.

2.5 Limitations of baseline knowledge

The project is located in an area in which few baseline surveys have been previously undertaken. Limited publically accessible reports or surveys are available to improve to project's understanding of sea turtle presence, extent and behaviour. The field surveys undertaken by the project and knowledge acquired from other regions of Ghana have enabled a initial level of understanding however data collection during peak nesting season was limited to seven days, and knowledge gaps are still present. These gaps have been recognised and will be addressed by Objective 4 - Establish a robust sea turtle baseline and monitoring program in the project Area of Influence (AoI) (Table 5.3). Recognised knowledge gaps include:

- Understanding the local nesting cycles and seasonality of the different turtle species found in the AoI.
- Understanding the size of the sea turtle populations that utilise the AoI for nesting.

- Understanding whether turtle nesting/presence of turtles is declining in the AoI and broader region.
- Understanding the baseline poaching rate of adult females and eggs in the AoI and the wider area.
- Understanding the location and threats of sea turtle foraging and inter-nesting habitats region
- Understanding the accuracy of sea turtle data collected by local NGO's in the AoI and broader region.

3 STAKEHOLDER ASSESSMENT/ENGAGEMENT

eni Ghana made all reasonable efforts to engage constructively and maintain healthy relationships with local stakeholders, governmental and non-government organisations (NGOs) and all affected or interested members of the public in proximity to the project. Important stakeholders that have relevance to the biodiversity features in particular the sea turtles are outlined in Table 3.1.

Table 3.1 Relevant stakeholders in sea turtle conservation

Stakeholder	Relevance to sea turtle BAP
Ghana Wildlife Society (GWS) Mr. Bernard Azane Eholade (representative of Ghana Wildlife Society in the area and Tourist Officer)	GWS has an ongoing sea turtle conservation programme, which includes research and conservation. GWS has been conducting sea turtle conservation since 2002 and actively worked in the Jomoro District (west of the AoI) between 2005 and 2008. It currently operates three hatcheries, one each at Beyin, Anorchie (started in October 2015) and Krisan, (started in August 2015). The Beyin hatchery was no longer operational however the Krisan hatchery was still active and contained one relocated nest during the preconstruction survey (Nov 2015). This hatchery is suitable for relocations in the AoI (in accordance with the translocation protocol) however will require some modifications in order to improve emergence success as per requirements outlined in Annex 1. GWS currently has a 15 member (six in the AoI) sea turtle taskforce that conducts beach patrols in the Ellembelle District. There are taskforce members in all the communities along the beach areas where they operate, including Krisan and Bakanta; within the AoI. The taskforce is reliant on donor funding and was recently revived in August 2015 with a grant from IUCN which concludes in October 2016. Members of the Taskforce are paid GHS 100.00 per month to conduct monitoring patrols along designated beaches and are also provided with some equipment including clothing and torches as required. The sea turtle taskforce conducts dawn and dusk patrols along designated beaches to determine nesting activities and deter poaching activity during the peak nesting season (GWS consider the peak season to be late August to February). The beach to be patrolled by each volunteer usually starts from the community where the volunteer lives and ends at the next community from where another volunteer also begins. Walks are conducted at high

Stakeholder	Relevance to sea turtle BAP
	tide since, according to the volunteers, that is when they see turtles. Time of patrol therefore varies each day. During the low season volunteers may patrol the beach once a week or if GWS is notified of nesting activity. Recommendation: GWS operate a community-based monitoring and surveillance that extends along the AoI. An assessment of the task force capacity demonstrated that members had received training and were competent, but further practical training in the field and alignment of data collection with that required by eni Ghana is necessary. GWS is the only NGO that currently operates in the AoI. It is recommended that eni Ghana engage GWS and collaborate to undertake beach patrol and monitoring activities (with support from competent sea turtle specialists). In addition, where nest relocations are necessary, eni Ghana should utilise the GWS hatchery once improvements and practical relocation training have been implemented.
Wildseas NGO, who run a turtle conservation programme ('Bahari Karuna')	The Wild Sea's Bahari Karuna project aims at conserving the sea turtles and sharks through community work and involvement. The Bahari Karuna project undertakes a sea turtle conservation program in the Beyin community. Project activities include night beach patrols, education (in schools and communities), sea turtle tourism, law enforcement and hatchery operation. Wild Sea's collaborates with the Beyin Beach Resort in the conservation of sea turtles in the area. Night beach patrols are undertaken between Atuabo and Elloyin (west of the AoI) with the aim to deter and report poaching activities. Volunteers patrol the beach at night and receive a small stipend in return. The participants can patrol every second night but are not permitted to relocate nests and inform Wild sea's employees of nesting activity. In 2014, Wild Sea's employees and volunteers encountered over 50 Olive ridley and Green turtle activities, but only one Leatherback. In 2015, only 20 sea turtle activities had been encountered up to December 2015 (Note: additional data would have been collected for the rest of the nesting season). Wildseas currently provides treatment to injured sea turtles with basic medical supplies. At this time of the field visit, conducted in March 2016, the NGO was looking at options to establish a sea turtle hospital.

Stakeholder	Relevance to sea turtle BAP
	Recommendation: At present Wildseas operate to the west of the concession and outside of the AoI. Wildseas has capacity and monitoring experience and could be engaged in the future if GWS's circumstances change. It is not anticipated that eni construction activities will lead to significant injury to turtles (see impacts and mitigation section) however it is worth noting that Wildseas intends constructing a sea turtle hospital in the region and has turtle rehabilitation experience. At this stage it is recommended that eni obtain Wildseas data for 2015 and 2016/2017 season for comparison to the AoI and estimate of poaching activities.
Friends of the Nation (FoN) Programme - Hen Mpoano (Our Coast)	Friends of the Nation (FoN) were Ghanaian partners for the Coastal Resources Centre (CRC) project from 2009 to 2014 with the slogan Hen Mpoano (Our Coast). Their project worked with coastal communities in the Western region to ensure inclusive and integrated management of Ghana's coastal and marine ecosystems. Their work in the Western Region has been instrumental in spreading the message of nature conservation (including sea turtles) to local communities. They are based in Takoradi and occasionally conduct education programmes and mangrove restoration in the AoI. FoN have 23 permanent staff but focus on building capacity in coastal communities through a community selected representative who reports to FoN (including a representative for Sanzule). Recommendation: FoN confirmed that the organisation participates in turtle monitoring through its community representatives however not specifically in the AoI and not in a regular structured way suitable to implement BAP actions. However FoN would be a suitable NGO to assist in community awareness and educational programmes.
Resource and Environment Development Organization (REDO)	REDO is the first NGO to have conducted extensive sea turtle conservation work in Ghana, primarily on the eastern part of Ghana's coastline. Associates of REDO also work for ESL and could therefore offer training assistance to the staff of the NGOs. Recommendation: eni Ghana may choose to utilise training material generated by REDO. This training material should be familiar to and made available to the competent turtle specialist(s) contracted by eni Ghana to support the implementation of management and

Stakeholder	Relevance to sea turtle BAP
	mitigation measures outlined in this document.
Ghana Wildlife Division (GWD) of the Forestry Commission	The GWD is mandated to deal with all issues relating to the conservation of sea turtles in Ghana. GWD is a public agency that is embedded within the Forestry Commission of Ghana which is responsible for the regulation of utilization of forest and wildlife resources, the conservation and management of those resources and the coordination of policies related to them. Note: all sea turtles are fully protected in Ghana GWD is responsible for the management of all wildlife in the country and administers protected areas including 16 Wildlife-Protected Areas (PAs), five coastal Ramsar Sites and the Accra and Kumasi Zoos. The organisation is also responsible for administering permits which allow organisations to undertake monitoring and management of sea turtles. Recommendation: No action required at present
Beyin Beach Resort (located west of the village of Beyin, between Bakanta and Atuabo).	Local resort with beachfront access. Eight nests were recorded in front of the Beyin Beach Resort. These nests were relocated from the wild by egg collectors and community volunteers to areas in front of the beach resorts and enclosed in wooden boxes. Recommendation: No action required at present
Tenak Beach Resort (located east of the village of Beyin, between Bakanta and Atuabo).	Local resort with beachfront access. Two nests were located in front of the Tenak Beach Resort. These nests were relocated from the wild by egg collectors and community volunteers to areas in front of the beach resorts and enclosed in wooden boxes. Recommendation: No action required at present
Local community	Local community members in the Project AoI encounter sea turtles both at sea and on the beaches. Community members encounter nesting turtles when they go to the beach to walk, wash or fish (beach seine). There are no traditional beliefs or cultural norms which promote the protection of sea turtles in the communities. Interviews indicated that community members perceived sea turtles as a source of meat. Sea turtles were mentioned by respondents as being important because they provide food, income when sold,

Stakeholder	Relevance to sea turtle BAP
	tourism and bring fish. Chief fisherman and task force members stated that many community members were not aware that is was illegal to harvest turtles and/or eggs. It was suggested by local community members that clear and continuous education may be effective at reducing the incidents of poaching. Recommendation: Recommendations outlined in Section 5.4
Local fisherman	Fishermen encountered sea turtles at sea when fishing. Interviews indicated that turtles did on occasion destroy their fishing nets when entangled in the net and allowed their catch to escape. Respondents reported that recently the occurrence of turtles was very rare. The ESL/ERM fish catch survey team observed a sea turtle (Green or Olive ridley) being released from a beach seining catch. This may suggest that some fishermen are aware of the existing laws governing the protection of sea-turtles. Recommendation: Recommendations outlined in Section 5.4

4 IMPACT ASSESSMENT

This section provides a summary and discussion of potential impacts to relevant sea turtle species from the construction and operation of the onshore pipeline and On-shore Receiving Facility (ORF). Onshore facilities that have the potential to impact sea turtles include the ORF, permanent worker accommodation camp, roads and pipelines, temporary construction site, temporary accommodation camp. The ESHIA (Appendix E) estimates that five km of nesting beach may be impacted by direct and indirect activities associated with the project, including impact of project induced in-migration.

4.1 Direct loss of nesting beach during pipeline landfall construction

The construction methodology of the Export Sealine at the landfall area has been changed from an open trench method to a Direct Pipe method (trenchless). The Direct Pipe method will avoid direct impacts to the beachfront by simultaneously drilling and installing the export pipeline underneath the beach. This will be achieved by horizontal directional drilling and inserting a 48" casing pipe commencing from a location within the planned footprint of the ORF (200m landward from the shoreline). The pipeline installation methodology has been selected to reduce risks associated with construction such as reducing possible downtime from inclement weather and heavy seastate and reducing adverse impacts to the adjacent fishing communities. In addition, the selected methodology will avoid and/or substantially reduce adverse environmental impacts during construction including the direct loss of nest beach habitat.

The previously considered (base-case) pipeline methodology involved laying the pipe into a trench, requiring the construction of a causeway, cofferdam and dredging in the nearshore marine environment, pull-in of the pipe from the lay barge to the Land Termination End (LTE) and then backfilling of the trench with engineered material (gravel and reclaimed soil). This base-case approach was expected to temporarily reduce the spatial extent of suitable nesting habitat in the AoI. Direct construction impacts were predicted to potentially extend up to 300m either side of the planned trench line[6]. The nesting habitat would have been affected during construction (approximately four months) and then for up to three years afterwards, based on observations made at the GNGC pipeline landfall site where understorey vegetation and juvenile coconut trees are present three years after construction and the beach appears to have naturalised.

The newly selected trenchless Direct Pipe method will move the LTE behind the coastal swamp at a distance of approximately 200m from the shoreline (100m further than previously proposed) and further inland from the nesting habitat. The drilling equipment and operation will be based at the LTE and will tunnel out to sea as far as the offshore pipeline exit point after 1km (at a water depth of approximately 7.5m bsl). The maximum depth of the installed pipeline from the surface (ground level or sea bottom) will not exceed 8-10m. As a result, the surface of the terrestrial, coastal and marine habitat along this subsurface drill line will not be disturbed. The site preparation activities will start

from Mid August, 2017 and the horizontal direct drilling activity is likely to commence in the second week of November 2017 to the end of 2017. Waste management of HDD activities will follow applicable best practices employed throughout the initial/current OCTP Project phases in regards to selection of drilling fluids and additives. Management will be aligned with Eni's Project Waste Management Plan (pln ms hse 005HSE PLAN 005).

Favourable nesting habitat is critical for sea turtle reproduction. Female sea turtles exhibit high site fidelity with females returning to the same beach, and often emerge within a few hundred yards of where they last nested during previous seasons. Therefore, it is important for the Project to limit the loss and disturbance of nesting beach habitat. The new trenchless Direct Pipe method is expected to avoid any direct habitat loss. Furthermore, project activities are now not anticipated to cause temporary or long term changes to the beach morphology or coastal vegetation.

4.2 Disturbance of existing turtle nests during landfall construction

Under the previously considered pipeline construction methodology (open trench) sea turtle nests laid in the construction area up to 60 days prior to mobilisation were likely to be destroyed by excavation and/or operation of heavy

[6] ERM, ESL (2016) Ghana OCTP Block Sea Turtles Pre-construction Survey Report.

machinery. The incubation period in Ghana has been found to be around 60 days from the time of deposition (Agyekumhene, 2009). The Direct Pipe method will not result in trenching or dredging in the beach or nearshore marine habitat. The pipelines will be tunneled approximately 8-10 m below the surface. This should be a minimum of 5 m below the depth of a standard turtle nest. As such it is not anticipated that the Project will directly disturb sea turtle nests.

There is limited general information available on the impacts of tunnel vibrations on nest development. Tunneling will occur during peak nesting season. However, tunneling is expected to create extremely low vibration levels which will be almost non-detectable. Furthermore, the tunneling is very localized and will only occur for the duration of the drilling campaign (35 days).

As a precautionary measure nesting activity and success should be monitored but it is unlikely that nests/eggs will be required to be translocated as a result of the tunneling activity. Where eggs do need to be translocated this should be undertaken by a qualified person(s) to a suitable location such as a sea turtle hatchery. Guidelines suggest that eggs should be collected and moved within a few hours of being laid (Eckert et al. 1999; Translocation Protocol), however, mid-term clutches can be moved if it is unavoidable, but must be handled with extreme care to prevent the embryonic membrane tearing and embryo mortality.

4.3 Disturbance and/or mortality of sea turtles.

Anthropogenic disturbances from construction and to a lesser degree operational activities such as equipment noise and/or the presence of people and vehicles may increase the frequency of non-nesting emergences (NNE); where a gravid female will crawl up the beach and return to the ocean without nesting, and may displace females into less preferential nesting areas. Each NNE event carries the risk of poaching or predation while nesting in sub-optimal habitat may result in a reduced hatchling emergence or survival rate. . Onshore construction noise is expected to be short-term, localised and noise levels are not expected to exceed 70 db (A), at the Eni Ghana concession boundary during the entire construction period (see Phase 2 ESHIA, table 10.8), due, in part to the sandy conditions rather than rocky substrate and surrounding natural vegetation that may dampen sound.

There is potential for adult sea turtles and/or hatchlings to interact with onshore or nearshore vessels resulting in injury and mortality. Most common forms of injuries include boat strikes and propeller injuries. As the vessel activity increases in the area, the incidences of strikes are likely to also increase. Turtles are most likely to be hit by the vessels when they come close to the surface to breathe or bask or in shallow waters. The new trenchless pipe design will reduce the potential for adverse interactions with both onshore and nearshore vessels. The Direct Pipe laydown area will be located 200 m from the shoreline limiting the need for construction related vehicles on the beach. The pipe will only reach the surface of the sea floor 1 km out to sea which will also limit the need for marine vessels in the shallow nearshore environment where collisions with marine fauna is most likely.

In addition, ingestion of plastic materials not correctly disposed and/or contamination and pollution on the site can cause injury or mortality to sea turtles. Accumulation of debris along the beach may also prevent female turtles from ascending the nesting beaches.

4.4 Artificial illumination on nesting beaches during construction, operation and Worker accommodation

It is well documented that artificial illumination of nesting beaches can have an adverse impact on nesting behaviour. Females attempting to nest will avoid beaches with artificial lighting or may abort a nesting attempt whilst onshore. The presence of artificial illumination may displace sea turtles into less-than-optimal nesting areas.

Artificial illumination also has the potential to adversely impact hatchling emergence. Under natural conditions hatchlings will emerge in low light conditions and orient to the ocean by crawling away from dark, landward silhouettes towards the brighter, low seaward horizons (Bourgeois et al. 2009). Hatchlings can become disorientated by artificial lighting which disrupt natural cues leading individuals inland rather than out to sea. Disorientation will increase the probably of mortality from predation, exhaustion and dehydration. Hatchlings that are drawn into well lit construction areas are highly unlikely to survive.

At present there is limited light disturbance in the AoI. Artificial lights are restricted to the communities and apart from Anwolakrom, each community generally has one main light along the coast. The project will require lighting during construction and operational activities to enable work to be undertaken in a safe manner, lighting for accommodation facilities and for security purposes. However, lay down areas for the Direct Pipe method at the LTE will be located approximately 200 m from the beach. Furthermore, the LTE is surrounded by thicket vegetation which will limit light shine. Additional mitigation measures such as shielding is outlined below. As such direct impacts from project related is likely to be limited. It is also understood that no flaring will be undertaken and as such no impacts from artificial illumination will occur from this source. Additional illumination in the surrounding coastal communities is likely to occur as a result of population increases and associated infrastructure in the AoI and surrounding area.

4.5 Harvesting of adult and juvenile turtles by the project workforce

The project will engage workers during both the construction and operation phase. The temporary accommodation camp will be constructed to house approximately 400 to 600 workers during the three year construction phase. The permanent accommodation camp will house about 45 workers involved in the operation of the onshore facilities. In the absence of mitigation measures these employees have the potential to exacerbate threats outlined in Section 2.4 in particular the harvest of nesting females and the collection of sea turtle eggs.

4.6 Induced and Cumulative impacts

Induced impacts are a form of indirect impact and refer to impacts that result from other activities (which are not intended as part of the Project) but which arise as a consequence of the Project. Induced impacts include the accelerated influx of people to the area in the form of job seekers and small business that are attracted by the potential economic benefits expected from the project. Induced impacts are associated with increased pressure on natural resources and ecosystem services; since migrants are unlikely to have rights to own and farm land and are therefore more likely to make use of common property goods such as fishing and collection food and fuel from forested areas. The ESHIA did not provide an estimate of potential project induced migration in terms of expected population growth, and subsequently induced impacts are speculative at this time.

The communities of Atuabo and Anochi have already experienced influx associated with the GNGC gas plant; and it is likely that this will be replicated within the AoI. The influx of people to Atuabo and Anochi has also been linked to an increase in petty crime; it is presumed therefore that some may also engage in illegal wildlife poaching, including the harvesting of turtles and turtle nests.

In addition to potential increases in poaching rates, indirect impacts are likely increase the threats highlighted in Section 2.4 including increased human disturbance on nesting beaches (foot traffic, vehicles, sand mining), changes to nesting habitat and beach morphology, artificial illumination from increased housing and social infrastructure along nesting beaches, increased number of people fishing, predation of eggs by domestic animals and the degradation of beach habitat by the accumulation of beach debris and general rubbish such as plastic bottles.

eni defines cumulative impacts as the aggregate effects of all stressors affecting a specific biodiversity feature in the project landscape. Cumulative effects can be similar in nature (e.g. emissions to air from multiple projects) or distinct (e.g. the cumulative effect of habitat loss, habitat fragmentation, and vehicular mortality on a species of wildlife). While the impact of individual developments considered in isolation may be insignificant, the cumulative stress, for example, where the "additional" impact reduces a species to below what is considered the minimum viable breeding populations, can result in biodiversity loss.

Other developments and activities in the area include:

- Atuabo Gas Plant and Free Port and associated industries.
- Increased shipping and potential for collisions.
- Industries that will be attracted by the port.
- Large scale road construction and big increase in heavy vehicle traffic.
- Tourism development in the form of beach resorts to support visitors to above

developments.

The eni Biodiversity and Ecosystem Service (BES) management process[7] suggests that consideration of cumulative impacts for a BES assessment are undertaken in the context of a Regional Study Area that encompasses direct, indirect and potential cumulative impacts. Sea turtles exhibit strong nesting beach fidelity, and therefore may be additionally vulnerable to cumulative impacts along the beachfront. A cumulative impact assessment, addressing the need for a regional study area, is beyond the scope of this BAP, but is a suggested priority for eni in collaboration with other industries and the
WBG.

[7] Doc reference AMTE TG 013 r00. December 2015

4.7 Impact accounting

The current estimations suggests that nesting beaches within the five km AoI are utilised by up to 50 Olive ridley, and to a lesser extent by Leatherback and Green turtles per year[8]. The following estimates assume that beach habitat is uniformly selected by nesting females, with a frequency of one nest per 100 m of beach habitat in the AoI, per year, and that turtles will not be able to successfully nest in another location. Although the inability to nest does not lead to the direct mortality of the adult female, for the purpose of impact accounting, it is considered equivalent to the direct loss of one adult (comparable to other direct impacts such as a vessel strike). The accounting for impacts does not consider the variable influence of other factors such as; the natural variation in turtle breeding cycles, specific beach morphology (and the effect of coastal erosion), the likelihood of human disturbance and other factors that may influence the suitability of nesting sites.

4.7.1 Direct loss of nesting beach during pipeline landfall construction:

Estimates for the distance of beach likely to be disturbed as a result of the previously considered pipeline design and implementation has ranged within the ESHIA from 34m to 600m. An extrapolation of this suggests that the construction activities, in the absence of mitigation measures including the new Direct Pipe method, may result in an impact equivalent to one turtle nest per 100 m of beachfront impacted corresponding to the direct loss of six turtle nests over the 600 m stretch of beach[9] for 3 years required for passive restoration; 18 nests in total.

Any reduction in the extent of beach affected by the construction activities (or the use of the beach for access by construction vehicles) is estimated to result in a loss reduction at a corresponding ratio of 1 nest / year each 100 meters reduction. The new Direct Pipe method will tunnel 8 – 10m below the beach and inshore marine habitat, avoiding any disturbance with the surface. Therefore, pipeline installation and construction activities will avoid the direct loss of any area of the beach for sea turtle nesting. Additional mitigation measures include nightly beach patrols and other protective measures outlined in Table 5.1. The outlined mitigation measures in particular the trenchless pipe method which avoids the beach habitat should reduce the residual impact to zero.

Beach monitoring and actions outlined in Table 5.3 will improve the understanding of how many sea turtles are likely to utilise this 600 m beach and the rest of the AoI. This additional information should be used to update the impact accounting as required.

[8] This estimate is an extrapolation of the ESL survey data taken over seven days, across the five km AoI suggests that approximately 50 turtles may nest per year, and is broadly supported by Wildseas survey data from a similar beach extent. Both are based on one season of data collection, and subsequently are not reliable with statistical confidence. This highlights the requirement for ongoing monitoring to better inform both estimates of project direct and indirect losses. Mechanism to assess gains must be incorporated into the community-based conservation programmes that, at this point, are necessary to compensate for project losses.

[9] While assuming that the beach is uniformly selected, it is observed that the planned construction site is located within a stretch of beach between two villages and therefore less affected by noise, light, debris and other influences that may deter nesting. The beach in front of the ORF, may therefore be considered as prime nesting habitat.

4.7.2 Disturbance of existing turtle nests during landfall construction

It is likely that without effective mitigation measures such as the new pipeline methods sea turtle nests laid in the construction area up to 60 days prior to mobilisation will be destroyed by excavation and/or operation of heavy machinery. Without mitigation (including the new Direct Pipe method), this impact has the potential to affect one nest per 100m of beach disturbed by the construction work (as above), up to a total of 6 nests. As detailed above, reducing the extent of beach affected by the construction activities can reduce this potential loss to a rate of 1 nest per 100m of beachfront disturbed. The new Direct Pipe method will tunnel 8 – 10m below the beach and inshore marine habitat. This should be a minimum of 5 m below the depth of a turtle nest. As such it is not anticipated that the Project will directly disturb sea turtle nests.

Limited information is available on the vibration levels or impacts of tunnel vibrations on nest development. Tunneling will occur during peak nesting season but vibrations are expected to be localized and minimal at the nest depth and will only occur for the duration of the drilling campaign (35 days). Similarly, localized noise levels are expected to be elevated during the pipeline construction phase. However, the coastal thicket vegetation situated between the lay down areas and the beach (200m away) are expected to dampen noise reaching the beach. It is not expected to be significantly higher than the background levels from the nearby fishing community, Anwolakrom.

Additional mitigation measures are captured in Table 5.1.

4.7.3 Disturbance and/or mortality of sea turtles:

Minimal inshore disturbance is expected because there is no shallow foraging habitat in the area, limited operational vessels will be required and strict speed limits will be enforced. The use of the Direct Pipe method will further reduce the need for marine vessels to operate in the nearshore area because the pipeline will only come to the seabed approximately 1 km offshore. Mitigation measures additional to those outlined in this document will be included if stranded and/or turtles with carapace damage consistent with propeller strike are reported. The likelihood of interactions leading to injury and / or mortality is dependent on a wide number of variables such as number of vessels, timing, noise levels and the level of care taken by operators of vessels and construction machinery.

Therefore no quantifiable impact is estimated from this activity, although it is suggested that any incidents or unplanned events be recorded to help inform the review of the BAP. Suggested mitigation actions to ensure that direct disturbance and mortality to turtles is outlined in Table 5.2.

4.7.4 Artificial illumination on nesting beaches:

There is no data to suggest that the existing low levels of lighting within villages along the beach are deterring turtles from nesting on the beaches within the AoI. Lighting during the construction phase and during the 24 hour operation of the ORF has the potential to affect hatchlings as they emerge from the nest. However, the Direct Pipe laydown area will be 200 m from the shoreline and behind thicket vegetation which will limit light spill reaching the beach. The ESHIA (annex G) also contains several references to the use of directional lighting and other measures to reduce the effect of light pollution, and the assessment provided assumes, as a base- case, that these mitigation measures will be applied, resulting in an overall estimate of no significant impact. The potential impact of a no-mitigation scenario is not considered.

Therefore, providing mitigation measures outlined in the BAP are applied project lighting is unlikely to act as a deterrent to nesting or result in a measurable impact on hatchling ability to reach the ocean. No quantifiable impact is estimated from this activity. Nevertheless, suggested mitigation actions to achieve this no-impact scenario are detailed in Table 5.4.

4.7.5 Harvesting of adult and juvenile turtles by the project workforce

eni has a level of responsibility and control over the actions of direct employees and contractors who may engage in the action of poaching or purchase of products from third parties. This BAP document outlines several mitigation measures that address this issue including prohibiting the collection and consumption of bush meat by project personnel. In addition a dedicated bush meat plan outlines several principles including the prohibition of the following activities:

- Buying, trading or consuming any bushmeat on the Project site/in Project- controlled areas;
- Buying, trading or consuming any bushmeat outside Project-controlled areas;
- Transporting bushmeat, or allowing / facilitating transport of bushmeat by third parties;
- Engaging in, or facilitating hunting, selling, or purchasing bushmeat, live wild animals or animal parts; and
- Possessing firearms or snares, and setting wildlife snares/traps in any area.

No quantification of the effectiveness of these measures can be provided at this stage however will be updated with the baseline understanding of poaching rates and ongoing monitoring of poaching amongst eni staff. Additional conservation activities are proposed to compensate for project personnel (if any) which undertake prohibited activities i.e. the collection and consumption of sea turtles or eggs.

4.7.6 Indirect and Cumulative impacts (especially harvesting of eggs from nests and adults).

There is currently considerable pressure on both marine and terrestrial natural resources in the region and the AoI. The influx of additional people into the region will increase pressure on natural resources. No quantitative poaching data is currently available for the AoI. However as an indication of potential poaching rates, Wildseas undertook night patrols on a five km stretch of beach west of the AoI and reported that of 50 nests observed/relocated in 2015, eight had been subjected to poaching. Wildseas believed this is an underestimate and only represents observed poaching activities[10].

Estimating the baseline rate within the AoI during the pre-construction period would be useful to establish a more robust estimate of existing threat prior to the commencement of the project. This is highlighted as a knowledge gap (Section 2.5) and actions required to improve the understanding are outlined in Table 5.3. For example, data collected by GWS/Wildseas within the AoI will be obtained and analysed in order to improve the understanding of pre-construction poaching rates. Further discussions with these two organisations and other regional experts may help to determine the actual extent of poaching.

An influx of people to the project AoI is likely to lead to the increased rate of predation on adult turtles and turtle eggs. Mitigation measures applied (see Table 5.2) would be aimed at avoiding any increase in the baseline rate of poaching, while the offset / additional conservation measures (sponsored beach patrols) shall target an overall reduction in poaching rates. An increased awareness in the ecological and social value of turtles can demonstrate additionality and provide adequate compensation for project losses that may be incurred.

[10] John Flynn, Wildseas Sea Turtle and Shark Conservation, personal communication 25/3/2016

5 DEVELOPMENT OF OBJECTIVES, TARGETS AND ACTIONS

This section outlines the process to generate an action plan based on a review of the results of the ecological, threat and impact assessments.

5.1 Objective development

Following a review of the target species likely to occur, significant threats and impacts, objectives have been assigned as well as a series of associated targets that align with WBG PS6, and international and sectoral best practices. BAP objectives are outlined in Section 1.2. The objectives have been established to address one or more project impacts.

Performance against the progress of the objectives and targets will be assessed as part of the BAP review process. If it is determined that the prescribed actions have failed to adequately meet targets, then existing targets will be amended and/or additional actions developed, to ensure long-term and continual conformance with objectives and targets.

5.2 Identifying actions to achieve the objectives

Following the development of objectives and targets, a series of mitigation measures was generated with the goal of achieving the targets. Mitigation measures have previously been described in various project documentation including the ESHIA, Appendix E: Sea turtle report prepared by ESL Consulting, preconstruction survey report and offshore management plans. Mitigation measures and additional conservation actions identified in the BAP are outlined in Table 5.1 - Table 5.7.

Each action includes:

- Description of the activity
- Action source
- Mitigation type
- Action target (based on 'SMART' methodology)
- Indicator measure
- Responsible person(s) for ensuring the action is implemented and tracked as planned; and, resources required for effective completion.
- Resources Required
- Action Progress
- Due date for completion

- Extent of habitat loss or gain.

5.3 Identifying indicators to measure success

The final step in the development of the action plan involved the development of a series of performance indicators. Performance indicators are used to measure and track performance against the effectiveness of mitigation and control measures described in this Plan. General performance indicators may also be relevant, such as training and awareness numbers. The indicators were developed specifically with the long term sustainability of the biodiversity feature as the long-term outcome.

The BAP implementing institution (Contractor) may, subject to agreement with eni Ghana, modify or add to these indicators to enhance the implementation plan, based on lessons from the performance indicators.

Table 5.1 Objective Statement 1: Avoid harm to turtle nests during landfall construction and for the duration of the project

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Avoid surface disturbance of beach or nearshore habitat	Complete the installation of the pipeline via the trenchless Direct Pipe (DP) method. The drilling equipment and operation will be based at the LTE (200m from the shoreline) and will tunnel out to sea as far as the offshore pipeline exit point after 1km (at a water depth of approximately 7.5m bsl). As a result, the surface of the terrestrial, coastal and marine habitat along this subsurface drill line will not be disturbed. The installation of the drill worksite at LTE is expected to take 3 months (commencing September 2017 and the horizontal direct drilling activity is likely to occur over 35 days (commencing December 2017).	Direct Pipe method for Shore approach – engineering change technical note (Doc. No. 351505DERCS4083)	Spatial Avoidance	Installation of the pipeline to avoid all disturbance to beach and nearshore habitat	Drilling completed as per technical note	eni HSEQ Manager Contractor	Drilling contractor	Design phase	Sept – Dec 2017
Complete pre and post- work inspections during pipeline construction	Pre and post work inspection of the beach adjacent to the work area should be performed daily by a suitability trained ecologist(s) (at night and dawn) for 300 days prior, during and 30 days following the pipeline construction. All sea turtle nesting activity must be recorded (and disturbance) and hatching success monitored. Undertake consultation with an ecology specialist as required and following internationally accepted relocation protocols if required (refer to nest translocation protocol below)	Field report ESHIA Phase2 AnnexG Section G.5.6.3	Minimisation	Ensure emergence success close to the laydown area equivalent to the rest of the coastline	Mean Emergence Success %	eni HSEQ Manager Contractor NGO partner	Turtle specialist / NGO partner	No progress required at present	Sept - Dec2017

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Develop and implement a nest translocation protocol	Develop a nest translocation protocol and determine the suitably of local hatcheries especially GWS operated hatchery at Krisan.	BMP	Minimisation	Complete and implement translocation where deemed necessary by suitably trained staff	Protocol document approved by an internationally recognised turtle conservation body	eni HSEQ Manager NGO partner	Turtle specialist	Ongoing	March 2017
Undertake any other construction activities required to occur on the beach outside of the peak nesting season and during the day during nesting season	Construction and pipeline installation is not expected to occur within 200 m of the beach. However where any future project activities are required in beach habitat, activities should be prioritized to occur outside of peak nesting season during the day, when less likely to encounter or disturb sea turtles.	ESHIA Phase2, Appendix E	Minimisation	Preferably, No beach construction undertaken during peak nesting season or at night	Construction schedule	eni HSEQ Manager Contractor	no	No progress required at present	Dec 2017

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Provide training of sea turtle requirements to all relevant staff and contractors (including the site environment	A sea turtle specialist should be engaged to provide training to the site environmental officer. Training should include turtle identification, turtle handling procedures, legislation related to turtles, safe nest translocation protocol. Also, provide sufficient information to all staff in sea turtle protocols.	FFI	Minimisation	All staff receive necessary training/sensitisation	Audit attendance	eni HSEQ Manager All Project Personnel (eni and contractors)	Turtle specialist	No progress required at present	Ongoing

Table 5.2. Objective Statement 2: Maintain the viability of nesting beaches in the AoI and reduce the harvest of eggs and females by the future project workforce in the AoI.

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resource Required	Action Progress	Date for completion
Establish conservative setback requirements for project buildings	Establish conservative setback requirements for project buildings to avoid the need for coastal armouring (i.e. sea walls and gabions) which will alter beach morphology. A setback of approximately 50 m is appropriate on relatively stable beaches (Eckert et al. 1999).	FFI	Minimisation	Buildings located appropriate distance from shore line (>200 m)	Distance from shoreline	eni HSEQ Manager	no	Complete	December 2015
Acquire sand for construction from responsible inland sources	Do not source sand required for construction from nesting beaches. The use of beach sand in construction provides inferior results, including corrosion of steel support elements and electrical components (Witherington 1999).	FFI	Minimisation	No sand acquired from nesting beaches	Purchase records	eni HSEQ Manager	no	No progress required at present	Construction period

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resource Required	Action Progress	Date for completion
Design and implement bush meat action plan	A project wide bush meat action plan will be designed and implemented to prevent all activities of staff and contractors related to capture and trade of animal protein, including turtle eggs and live specimens. The bush meat action plan should include the following measures for sea turtles: - Prohibit and enforce the harvest of adult and juvenile turtles in the project area for employees & contractors. This should be communicated in employee induction (in addition to other illegal activities), and included in the disciplinary policy (i.e. that possession can be grounds for disciplinary action or dismissal). - Reinforce message to community that it is prohibited by law and contribute to local conservation education programs.	plan ms hse 014 eni Ghana - STMM Plan ESHIA Phase2 AnnexG Section G.4.8.3 WBG PS6	Minimisation	No turtles or eggs harvested in the AoI by employees or contractors	Number of known nests and adults observed or reported poached by project staff or contractors	All Project Personnel - eni and contractors	no	In progress	June 2016
Utilise security personnel to patrol beach in construction area	Unarmed security personnel will patrol the onshore facility for the purpose of general security. The personnel will also be given instructions to patrol on the beach in the concession at night during peak nesting period (June–August and October–February) as part of their regular circuit. Ensure that security personal are trained and motivated to perform surveys.	plan ms hse 009 eni Ghana Framework Environmental, Social and Health Management Plan WBG PS6	Minimisation	Beach patrol included in security duty	Number of patrols undertaken	eni HSEQ Manager Security contractor	no	No progress required at present	Construction period

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resource Required	Action Progress	Date for completion
Ensure beach and back beach are restored	Construction and pipeline installation is not expected to occur within 200 m of the beach. Therefore, restoration of beach habitat is unlikely to be required. However, were beach habitat is disturbance, the project must ensure the characteristics of the beach and back beach are restored to as close to original condition as possible. Habitat monitoring will be undertaken to assess the progress.	Ghana Liquid Natural Gas Studies and Design Screening Report	Restoration	Beach habitat restored following temporary construction disturbance.	Habitat parameters	eni HSEQ Manager	Environmental specialist	No progress required at present	Following final completion of construction
No planting of alien species	No planting of alien species will occur in the beach beaches within the AoI or within the ORF concession.	BMP ESHIA Phase2 AnnexG Section G.4.7.3 Work Instruction Prevention and Control of AIS (Alien Invasive Species)	Minimisation	No intentional introduction of alien species	Presence of alien species	eni HSEQ Manager	no	As required	Ongoing
Monitor alien species in nesting habitat	Monitor the presence or spread of alien species in turtle nesting habitat	FFI	Data collection	Undertaken twice a year as part of the habitat assessment	Habitat assessment report	eni HSEQ Manager	Environmental Consultant	No progress	Ongoing

Table 5.3. Objective Statement 3: Establish a robust sea turtle baseline and monitoring program in the project AoI

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Establish and commence sea turtle monitoring programme	Establish and commence sea turtle monitoring programme that incorporates local NGO beach surveillance and monitoring as well as sea turtle specialists for the first year to ground truth data collected by the local NGO. Refer to Section 7.	ESHIA Phase 2 Annex G	Data collection	Design and implement monitoring programme	Complete first year monitoring effort	eni HSEQ Manager	Turtle specialist	In progress – commence by August 2016	March 2018
Undertake turtle nesting surveys during June - August to determine Green turtle presence	Monitoring of the nesting beach will be undertaken during the period from June to August when Green turtles are considered likely to nest on the beach. Mitigation measures such as avoiding construction in the months of June to August should be considered where viable based on the results of this monitoring activity. Refer to Section 7. This action will improve the understanding of local nesting seasonality which was highlighted as a knowledge gap in Section 2.5.	FFI	Data collection	Monitoring surveys undertaken in June - August.	Presence or absence of nesting Green turtles	eni HSEQ Manager	Turtle specialist	In progress	June - Aug 2017
Review and adapt sea turtle monitoring programme after the first	Undertake an analysis and review of the data collected after the first year of the sea turtle monitoring programme. Determine whether the	ESHIA Phase2 AnnexG	Data collection	Complete review and implement changes	Revised monitoring programme	eni HSEQ Manager	Turtle specialist	No progress required at present	March 2018

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
year	frequency, duration is appropriate given the results of the first year. Extend for a minimum of four years.								
Collect and collate historic data from local NGO programs	Obtain primary historic data and methods from local NGOs (including GWS and Wildseas) to improve the baseline understanding including number of nesting females, current emergence success and number of nests poached (percentage). This action will improve the understanding of baseline poaching rates in the local context which was highlighted as a knowledge gap in Section 2.5	FFI	Data collection	Obtain and collate additional data	Data obtained and analysed	eni HSEQ Manager	no	In progress	August 2016
Establish sea turtle incident register and reporting procedure for injured, stranded or dead marine fauna	All sightings of dead, injured or healthy sea turtles in the Project AoI will be recorded in an incident register (for both offshore and onshore incidents). All project personnel must record incidents. Reports from community members should be investigated by a site environmental officer. Incidents will be reported to the Ghanaian EPA using a predefined call-in	plan ms hse 014 eni Ghana - STMM Plan	Data collection	All incidents recorded and reported	Audit of incident register	eni HSEQ Manager	no	No progress required at present	Implement prior to offshore construction (Sept 2017)

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
	procedure, (including a brief description and location of the event and the species and number of individuals affected)								
Engage sea turtle specialist(s)	Engage sea turtle specialists to undertake training and capacity building of the local NGO tasked with beach surveillance in the AoI. Other tasks include review and analysis of Year 1 monitoring results, advice on updating monitoring programme and improving mitigation measures.	ERM/FFI	Data collection/ management	Engagement of turtle specialist	Engagement of suitably qualified turtle specialist	eni HSEQ Manager	Turtle specialist	No progress	August 2017

Table 5.4 Objective Statement 4: Limit adverse behavioural impacts to nesting turtles and hatchlings as a result of artificial lighting

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Minimize light sources on nesting beaches	Where possible, turn off lights during peak nesting and hatching periods (June – August and October – March). Where this is not practical or could compromise security/safety the following measures will be implemented: - Invest in light sources that are 'turtles friendly' including very short wavelength light sources (i.e. pure yellow and red sources). Low-pressure sodium-vapour lighting (LPS) are the purest yellow light source and recommended due to being the best commercially available solution (Witherington and Martin 1996). - Install security lights on motion-sensitive switches - Provide shielding between sensitive beach habitat and light sources. For example improve native vegetation buffer so that light is effectively screened (i.e., not directly visible) from the beach. - Use of directional lighting during installation of the pipeline landfall, on the ORF and all associated infrastructure such as worker accommodation to minimize the spill of light onto	AppendixE ESHIA Phase2 AnnexG Section G.5.6.3	Avoidance / Minimisation	No increase in number or intensity of beach lighting	Number and intensity of light sources	eni HSEQ Manager Contractor	no	No progress required at present	Sept 2017

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
	the beach. - Lightning at the ORF will be downward and limited to the minimum required for safety and security. Where possible lights will not be mounted high on buildings or poles.								
Undertake lighting assessment	Undertake a lighting assessment (as per Section 6.3) prior to the landfall construction. Whilst doing construction on landfall, a close monitoring of temporary lighting will be undertaken, should night activities be necessary.	FFI	Data collection,	Establish baseline and lighting inspection	Monitoring records	eni HSEQ Man-ager	Turtle specialist	In progress	Ongoing
Restrict bonfires	Prohibit staff having bonfires or fire pits on the beach or in line-of-sight of the beach	FFI	Minimisation	All staff receive necessary awareness training	Training records	eni HSEQ Man-ager	no	No progress required at present	Implement restrictions prior to construction

Table 5.5 Objective Statement 5: Limit direct disturbance and mortality of sea turtles to that which is reasonably practical (target of zero incidents)

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Restrict access and apply speed limits	Restrict all personnel from driving on the beach or back beach during peak nesting season (June – August and October – February). Where vehicle access is required for emergency or essential management only low-pressure tires should be used (Elkert et al. 1999). Apply and enforce site speed limits on project roads and for staff. Sign post high risk areas – beach and back beach.	BMP ESHIA Phase2 AnnexG Section G.4.8.3 WBG PS 6	Minimisation	Reduce vehicle numbers and incidents	Number of vehicle tracks and known damaged nests observed during monitoring	eni HSEQ Manager All Project Personnel (eni and contractors)	no	No progress required at present	March 2017
Restrict domestic pets and animals	Restrict project workforce from keeping domestic pets and animals that may interference with nesting turtles, hatchlings or eggs	WBG	Minimisation	No domestic animals owned by project workforce that may interference with nesting turtles, hatchlings or eggs	Number of domestic animals owned by project workforce	eni HSEQ Manager All Project Personnel (eni and contractors)	no	No progress	Ongoing

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Marine incident procedure	Boat operators who hit a sea turtle should immediately contact a suitable veterinary hospital (Investigate existing animal hospitals or rehabilitation facilities in Takoradi). Transportation of injured turtles should consider the following to decrease stress: - Do not move individuals by flippers, rather lift using both sides of the carapace. Or use a stretcher to adequately support weight. - Individuals should be transported in a plastron down position. - Placement of a damp towel on carapace to keep the individual moist (do not transport in water to avoid the risk of drowning). and will be carried out depending on safety issues and operating conditions.	ESHIA Appendix E – Sea Turtle Report FFI	Minimisation	Injured sea turtles transported to suitable facilities, as far as reasonably practicable	Audit of incident register and photographs of turtles or relevant aspects of incidents	eni HSEQ Manager Vessel operators	Collaboration with a Suitable veterinary facility	No progress required at present	Implement prior to offshore construction
Correctly dispose of waste and debris associated with the project	Ensure all rubbish, equipment, debris, cleared vegetation is removed from the nesting habitat during or after construction or disposed of in waterways. Locate waste storage sites away from nesting habitat to reduce encouraging predators/scavengers into the area. Compliance with Project Waste Management Plan requirements.	ESHIA Phase1 AnnexG Sections G.7.2.2 and G.8.1.1	Minimisation	No construction or operation waste or debris left on the beach or back beach	Project-related waste and debris observed during monitoring	eni HSEQ Manager Contractor	no	No progress required at present	Ongoing

Table 5.6 Objective Statement 6: Undertake additional conservation actions through the establishment of partnerships with local NGOs to reduce the harvest of turtles and eggs by local communities

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Establish beach surveillance through a collaboration with local NGO	Establish beach patrols/surveillance in collaboration with locally active NGOs to protect eggs in situ and nesting females. Presence of surveillance personnel on the nesting beach can reduce or even eliminate a variety of threats including egg poaching and depredation. Beach patrols should be undertaken in conjunction with nesting beach surveys. Refer to Section 5.4 for additional details	Precon-struction report	Minimisation/ additional conservation action	A decline in the number of clutches and adults harvested or predated based on analysis of GWS/Wildseas data/ and 2016 monitoring data((Table 5.3)	Number of known nests observed poached or predated during monitoring	eni HSEQ Manager Local NGO partner	Local NGO partner	In progress	Sept 2016
Provide training of sea turtle requirements to relevant NGOs, Company and staff of priority contractors	Provide training to relevant NGOs, company and/or staff of priority contractors to ensure accurate collection of data	ESHIA Phase2 AnnexG	Data collection/ additional conservation action	All participants able to accurately identify species and have knowledge of nesting requirements and life cycles stages	Capacity subjectively assessed in the field Pre-and post-training knowledge evaluation	eni HSEQ Manager	Turtle specialist	Ongoing	Ongoing
Engage and contribute to existing community-based turtle conservation programme	Support broader community based conservation. Communicate and educate communities on threats to sea turtles (poaching, sand mining etc), importance and benefits of conservation and illegal activities. Refer to Section 5.4 for additional details.	FFI	Minimisation/ additional conservation action	Increasing number of community members and others familiar with the sea turtle conservation program. Reduction in eggs and adults harvested	Community members involved in education and/or outreach programmes.	eni HSEQ Manager Local NGO partner	local NGO partner	No progress	Ongoing

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resources Required	Action Progress	Date for completion
Communicate that harvest of eggs and turtles is an illegal activity	Directly support GWS to communicate and/or erect suitable signs in the ORF and in the communities warning about illegal activities including harvest of sea turtles and eggs	FFI	Minimisation/ additional conservation action	Install sign prior to nesting season	Signs successful erected and maintained	eni HSEQ Man-ager	no	No progress required at present	December 2016

Table 5.7 Objective Statement 7: Work in collaboration with other large-scale developments in the district to address cumulative impacts

Action	Action description	Action source	Mitigation type	Action Target	Performance indicator	Responsibility	Resource Required	Action Progress	Date for completion
Promote the establishment of a committee to address biodiversity issues with relevant development projects in the district	Raise the issue of cumulative impact management, within the relevant operator / regulator round table forum and encourage the establishment of a cross-industry group in which potential cumulative impacts to biodiversity management committee can be addressed	FFI	Minimise/ Additional conservation action	Have the issue of cumulative impact management included within the agenda of a suitable forum and make a presentation the potential environmental, social and business benefits.	Forum identified Agenda item accepted Presentation made/	Eni HSEQ Manager WBG	WBG	No progress	Dec 2017

5.4 Additional conservation actions

Support community based conservation activities

Community-based conservation activities are reported to be occurring in the AoI and in the broader region. Stakeholder engagement has identified several local NGOs operating in the area (Section 3). The GWD and GWS have previously conducted regular patrols to prevent illegal killing of wildlife including sea turtles, and recommenced beach patrols within the AoI in August 2015. In addition other NGOs including Wildseas, FoN and REDO are involved in a variety of conservation activities including patrols outside the AoI. There is an opportunity for eni Ghana to partner with these organisations in order to achieve joint conservation outcomes and undertake the following tasks:

Beach surveillance

Night beach patrols will be established within the AoI during nesting season to reduce the harvest of nesting females, removal of eggs and collect monitoring data (Section 6). It is suggested that given their presence in the AoI, GWS be engaged by eni to undertake beach patrol and monitoring activities. GWS employ local community members and this may also support employment creation in the community. Current beach patrol members are endorsed by the Village Chief of the communities which gives GWS the backing and support of the existing village governance structures. eni should directly support the contracted local NGO (s) through funding, supply of equipment necessary to perform relevant mitigation measures, access to turtle specialists to assist in the implementation of the monitoring programme and the provision of training.

The beach patrols shall be undertaken in accordance with measures outlined below:

- Patrol members must receive suitable training. Classroom training was provided in March 2016. Additional practical training will be provided at least twice a year by a competent turtle specialist.
- Patrols must occur during the known major nesting season (June – August and October - February).
- Disguise tracks and nests with a palm frond rake (after monitoring data collected).
- Only relocate nests in accordance with the relocation protocol (Annex 1).
- If evidence of poaching is observed, beach patrols should be scheduled at random intervals so poachers don't determine pattern of surveillance.
- Monitoring requirements outlined in Section 7.

Community awareness and education

Education can play a significant role in protecting sea turtle nests and hatchlings by shifting the habits of coastal communities in which natural resources are a vital source of income. Whilst not considered an in-situ protection, measure changing the habits of local community can have the same result as in-situ measures. For example campaigns to promote not dumping rubbish on the beach might reduce scavengers that eat turtle eggs and communicating that it is illegal to harvest sea turtles may encourage fisherman to throw turtles back rather than risk enforcement. Public education campaigns have been observed to enhance the success of virtually all nest protection programs (Marcovaldi and Thome 1999).

The public should be made aware of beach patrols, monitoring and mitigation measures and the significance of these actions through avenues of communication deemed best suited to the local community, such as print and electronic media, school curricula, public signage, and local gatherings (Eckert et al. 1999). Local community member can also be encouraged to support nest protection by reporting illegal activities.

eni Ghana should collaborate and support existing NGOs (i.e. FoN or GWS) to provide education presentations and materials to the coastal and inland communities within the AoI. Education presentations should be integrated with other project concerns such as avifauna and bush meat and should be designed for target audiences such as fishermen, school children, and coastal landowners. Applied methods of environmental education may include specific courses for targeted audiences and activities that involve youth groups (e.g., paper recycling, release of hatchlings, selective garbage collection, junior ecological tour guiding and community gardens). eni support should include funding to develop and implement awareness and education programmes and access to eni contracted turtle specialists to assist in developing educational material.

The broad objective of such actions is to create an attitude of stewardship that will foster compliance with conservation and management strategies. Key messages include:

- Harvesting of sea turtles and their eggs is illegal (Reduce consumption of turtle meat and turtle eggs in the targeted communities).
- Role of the sea turtle in the ecosystem
- Sea turtle biology, lifecycle and decline
- Potential benefits of nature based tourism
- Methods to reduce incidental catch in fisheries
- Community-level by-laws should be encouraged in the area to further protect the sea turtles.

As part of community awareness, investigate and promote culturally acceptable practices that protect turtles (i.e. non-consumptive) and their habitats, whilst at the same time benefiting coastal communities. All proposed practices must be linked and integrated with the broader community development plans.

6 MANAGEMENT, MONITORING AND EVALUATION – SEA TURTLE MONITOR- ING PROGRAMME

An ongoing monitoring program will be established to evaluate project performance against performance indicators and targets (as per Table 5.1 - Table 5.4). The aim of the sea turtle monitoring programme is to conduct surveys with careful design, which enables survey results to be comparable between seasons, study sites, and observers. Other considerations are that the programme be cost effective, replicable, quantitatively rigorous and easily taught to local NGOs who will undertake the monitoring over the long-term.

6.1 Study area

The sea turtle surveys will extend for at least 2.5 km along the beach front from each side of the pipeline landfall location in order to cover the AoI of the offshore pipeline works (Figure 1). This is consistent with the pre-construction study area to allow direct comparison. A buffer area of 300 m each side of the landfall location should be considered the "direct or primary" impact zone, consistent with previous estimates. The remaining area may be considered the secondary area of influence. Relevant environmental data sharing agreement should be promoted through a biodiversity committee between the relevant development projects in the district. This will allow the comparison of the data against control sites in the district. For example Wildseas currently undertake monitoring between Atuabo and Elloyin (in the vicinity of the Atuabo Free Port development). The biodiversity committee may also be inclined to investigate control sites that are not likely to be influenced by the development projects in the district.

The AoI will be partitioned along the beach into equal segments or zones. This will allow data to be grouped depending on proximity to construction area and will be useful in order to evaluate the effects of the project on nesting success. The ability to analyse survey data by zone is particularly useful when evaluating or assessing the effects of habitat alteration on nesting success (e.g., pipeline landfall) (Shroeder and Murphy
1999). One partition should overlap with the construction area. It is important that all
personnel involved in the survey are aware of the start and endpoints of the various zones. In order to collaborate with the GWS community-based monitoring it is recommended that key community structures are used as markers to establish zones. It is important that subsequent use the same start and end points to support data comparison.

Wildseas operates to the west of the AoI between Atuabo and Elloyin (west of the AoI). Data collected in 2016 from this monitoring program should be obtained and used to investigate broader regional trends and leakage[11] from the project area.

6.2 Reference documents

The following documents are useful to inform the management, monitoring and evaluation of the sea turtle conservation programme:

1. SWOT Scientific Advisory Board (2011). The State of the World's Sea Turtles (SWOT): Minimum Data Standards for Nesting Beach Monitoring, version 1.0
2. Eckert, K. L., K. A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.
3. Choi, Ga-Young and Karen L. Eckert. 2009. Manual of Best Practices for Safeguarding Sea Turtle Nesting Beaches. Wider Caribbean Sea Turtle Conservation Network (WIDECAST) Technical Report No. 9. Ballwin, Missouri. 86 pp
4. Varela-Acevedo, Elda, Karen L. Eckert, Scott A. Eckert, Gillian Cambers and Julia A. Horrocks (2009). Sea Turtle Nesting Beach Characterization Manual, p.46-97. In: Examining the Effects of Changing Coastline Processes on Hawksbill Sea Turtle (*Eretmochelys imbricata*) Nesting Habitat, Master's Project, Nicholas School of the Environment and Earth Sciences, Duke University. Beaufort, N. Carolina USA. 97 pp;

6.3 Methodology

Different species of sea turtles share many behaviours, especially those involved in reproduction. For this reason, methodologies for monitoring sea turtles at the nesting beach will be applied for all the species.

Habitat assessment

The aim of the habitat assessment is to provide information on the nature of beach, identify physical changes to nesting habitat and monitor threats to sea turtles. A habitat assessment should be undertaken to assess the physical parameters of nesting habitat twice a year at the six existing locations in the AoI (outlined in Table 2 and the preconstruction field report). Data should be collected at low tide to enable comparison to the preconstruction survey. The following characteristics should be measured at each

[11] i.e. displacement of nesting females to beaches outside of the AoI

transect partition with accompanying GPS coordinate and photographs. Information to assist in undertaking a habitat assessment can be found in 'Sea Turtle Nesting Beach Characterization Manual' (Varela-Acevedo et al. 2009).

Beach characteristics:

- Date and tide;
- Wave or weather conditions which might influence beach characteristics;
- Width of intertidal area and width of the back beach;
- Beach slope and sketch the beach profile including the boundary parameter;
- Beach vegetation including presence of alien species;
- Available beach area for nesting sea turtles;
- Presence and location of anthropogenic activities and threats on the beaches including evidence of sand mining, predation, rubbish, debris, egg poaching and interaction with nesting adults;
- Sand softness at 50 cm deep (at the landfall site); and
- Identify sources of light and relative intensity (ranked following procedures described by Knowles (2007, downloadable at www.widecast.org).

Inland characteristics:

- Current inland habitat; and
- Presence / absence of human activity (recorded and differentiated during the daytime and at night); including interviews with local people to ensure any seasonal activity in the area is also considered.

Sea turtle nesting surveys (Year 1)

The aim of the nesting surveys are to provide information relative to the diversity and seasonality of species utilizing the nesting beach, number of nests deposited annually, the number of nesting females that are reproductively active annually, and poaching activity. In order to be of value over a long period of time, surveys on nesting beaches must be cost-effective, reproducible, quantitatively rigorous, and easily taught to others who will continue the surveys.

Surveys to record turtle nesting activity will be conducted by patrolling the beach on foot within the Project AoI (Figure 1). Surveys will be conducted at dawn (starting at sunrise) and at night (starting at 7pm and ending at 12am). The dawn surveys will allow data collection of nocturnal activity before removal by the tides/human activity, while night surveys will allow direct observation of adult turtle presence, species identification and potentially poaching activity.

Nests and non-nesting emergences (NNE) will be located by following tracks left behind by the turtle during ascent and descent on the beach. The tracks will be used to determine the species of turtle (Annex 2). For both nests and NNEs, the location will be recorded using a Global Positioning System (GPS). The position of the nest on the beach relative to the tide mark should be recorded using a 15-m flexible tape measure.

Community-based beach surveillance and monitoring effort undertaken by local NGO

In order to establish a cost effective monitoring programme that obtains data throughout the peak nesting seasons it is proposed that eni Ghana collaborate, and data share with a local NGO (such as GWS) operating in the project area. eni Ghana should formally contract a local NGO to undertake beach surveillance and provide suitable training to volunteers and survey participants (see Section 7.2). GWS has been assessed to be a suitable candidate. The required survey effort will include the following:

- Undertake throughout the peak nesting season (currently between late August and February but will be extended to June). At present GWS patrols every day during peak nesting season. A minimum survey effort of three days per week is expected. Refer to Table for scheduling.
- Undertake just after sunrise for the best viewing of crawls as track signs begin to deteriorate as the sun dries out the sand (Shroeder and Murphy 1999). Also easier to correctly identify crawls during daylight.
- Undertake night patrols to collect data but also to deter poachers and record their activity.

- Count and photograph all crawls regardless of age. Photographs taken of adult females to confirm identification (care taken not to alter nesting behaviour and camera flash must be avoided).
- Surveyors should move along the beach at the level of the last high tide.
- Mark crawls that have been recorded by sweeping feet across the track. This will avoid double counting in subsequent days. Marks should be consistent and familiar to all survey personnel.

Ground truthing to be undertaken by a competent sea turtle specialist

Ground truthing by suitably qualified turtle specialists is required to improve the accuracy of the community based monitoring project at least for the first year. It is proposed competent turtle specialists conducts a one week survey in the survey area during the reported Green turtle nesting period, two week (s) in the peak nesting season for Olive ridley and leatherbacks and one week during peak hatchling periods for the first year (i.e. minimum four weeks total). The sea turtle specialist will also be required to provide training and support to the community-based beach surveillance/site environmental officers, which is in addition to the survey timeframes outlined above (see Section 7.1).

The minimum data to be collected is outlined in the list below:

- Date and time observed.
- Direct recording of turtle nesting activity, including species identification and if they are nesting.
- Record of unsuccessful nesting emergence, termed non-nesting emergence (NNE) – i.e. returned to ocean without nesting.
- Location and habitat characteristics of nests found and unsuccessful nesting attempts, including the reason for this, if known (Nest location on the beach, across the beach and Nest location habitat (e.g. bare sand, grass, under vegetation).
- Data on estimated clutch size, if it is possible to directly observe the turtle nesting.
- Details of any stranded sea turtles, if found, (including species identification, state and carapace measurements).
- Identification of any direct human or predator interference to nesting. A depredated nest will generally be characterized by eggshells or partially consumed eggs littering the nesting site. Depredated nests must be counted as nesting emergences during the survey, but should be noted as depredated if quantifying nest success.

Data collection forms for nesting beaches should be simple and straightforward and all surveyors should use the same data form for a particular beach. Sea turtle specialist (s) and relevant NGOs will examine the current local NGO data sheet and eni Ghana data requirements and establish a suitable data sheet for the nesting beach.

Hatchery data collection

Hatchery data should be collected and analysed to determine the success of the reproductive effort at the hatchery and inform management decisions and adaptive management. The following parameters should be collected and recorded during laying (or reburial):

- Nest tag number
- Date and time laid
- Nest depth – Top (to first egg in the egg chamber)
- Nest depth – Bottom (to bottom of egg chamber)
- Nest location along the beach
- Nest location across the beach
- Nest location habitat (e.g. bare sand, grass, under vegetation)
- Number of eggs laid – clutch count (yolkless eggs should be counted and reported separately. Multi-yolked should be counted as one egg. Also record number eggs broken during excavation or transport)
- Sand temperature
- Egg diameter (greatest and least diameter of 10 eggs chosen at random)
- Egg weight

The following parameters should be collected and recorded after emergence of hatchlings:

- Nest tag number
- Date laid
- Date emerged (incubation length)
- Time of emergence
- Number of hatchlings that incubate successfully – Hatchling success %
- Number of hatchlings that emerge from the nest - Emergence success %
- Number of hatchlings that cross the beach and reach the water

6.4 Schedule and duration

Table 6.1 outlines the proposed monitoring and beach surveillance schedule for year 1.

Table 6.1. Proposed monitoring (and beach patrol) schedule for the first year (commencing March 2017)

Responsible party	June 2017	July	Aug	Sept	Oct	Nov	Dec	Jan 2018	Feb	March	April	June			
Sea turtle specialists (e.g ESL))		One week (Green turtles)				Two week (s) (Olive ridley,		One week (hatchling success and hatchery)							
Sea turtle specialist or Local NGO					**Pre, during and post construction survey** – Monitoring undertaken daily for 30 days prior, during and 30 days after the construction of the pipeline laydown and tunneling is undertaken. The local NGO may be capable of undertaking this survey but should be										
Local NGO – beach patrol and monitoring	Monitoring and beach patrol undertaken											Recommence in June 2018 depending of the results of the Green turtle monitoring			

6.5 Personnel requirements

The beach nesting surveys require at least one experienced and qualified biologist with proven experience in sea turtle surveys to be present during all surveys. However training and mentoring will be provided to GWS staff during year 1 by a competent sea turtle specialist. Specific training will also be provided to the eni site environmental officer (as per Table 5.1). After the first year of monitoring local NGO staff will be assessed for competency. Training requirements outlined in Section 8

Equipment – standardised data sheets, writing utensils, digital camera to confirm species identification or unusual findings, GPS, 15-m flexible tape measure, head torch - using red light headlamp to prevent the disturbance of turtles from white light.

6.6 Review and adaptive management

The BAP design process should be an iterative process to allow for a continuously improving action plan which will evolve over time as information and understanding of the biodiversity features of the landscape improve.

Survey monitoring requirements and effectiveness of mitigation measures will be assessed after the first year (and subsequent years) of monitoring by eni Ghana and formally appointed sea turtle specialist(s). There is potential to reduce the survey duration if it has been found that no Green turtle nesting is occurring in the June to August period as has been reported. However any decision should be undertaken based on the precautionary principle given that numbers of actively nesting females vary enormously from year to year for environmental reasons not well understood (Eckert et al. 1999). Year-to-year fluctuations are common and should be thoughtfully reviewed and considered rather than immediately construed as absolute indications of the status of the population. Also nesting survey data should not be assumed constant in a temporal sense, data collected over a specified time interval cannot be extrapolated to large, unsurveyed time intervals (Shroeder and Murphy 1999).

Performance against the actions in the BAP should be assessed on an annual basis and reported to the eni Ghana HSEQ Manager. Formally appointed sea turtle specialist(s) should be involved in the assessment to ensure that internationally acceptable standards are being maintained, and are up to date with any changes/new approaches to turtle conservation. At a minimum, the review should include the following:

- Review the abundance and diversity of species utilizing the AoI.
- Confirm the accuracy of the nesting seasonality.
- Confirm the seasonality and presence of Green turtle nesting in the AoI.
- Assess the capacity and performance of the GWS survey effort.

- Consider the extent of poaching activity observed and the effectiveness of GWS night patrols.
- Assess the length of incubation period in this region. This information will influence when pre-clearance surveys are required.

7 INTEGRATION AND IMPLEMENTATION

Actions outlined in this BAP should be incorporated into the broader BMP to be completed by eni/relevant contractors.

7.1 Implementation of community-based monitoring and beach survelliance

GWS operate a community-based monitoring and surveillance that extends alone the whole AoI. An assessment of the task force capacity demonstrated that members had received training and were competent. GWS is the only NGO that currently operates in the AoI. It is recommended that eni Ghana engage GWS and collaborate to undertake beach patrol and monitoring activities (with training and support from a competent turtle specialist). FFI, ESL and ERM met with GWS during the recent field visit. GWS expressed a willingness to work with eni Ghana and agreed with the monitoring structure documented in this report. In addition to the monitoring, where nest relocations are necessary, eni Ghana should utilise the GWS hatchery once improvements have been implemented to the Krisan hatchery.

Recommendations for the GWS engagement include:

- Practical training in the field will be provided by a competent turtle specialist during sea monitoring activities (two in 2016). Time spent training local NGO participants should be in addition to monitoring effort outlined in Section 6.4. Training must include both class room theory and practical application in the field such as field identification, data collection and tagging.
- Clearly articulate the monitoring protocol and data collection which is required in the BAP.
- Update the existing GWS data sheet to align with eni Ghana data needs. GWS have provided their data sheet and are willing to adapt it as needed.
- Required equipment (taskforce already have clothing, footwear and waterproof clothing) for the taskforce include robust (red) head lamp, disposable cameras, phone credit (to allow members to report poaching and for safety, tape measure, light bag to carry equipment in the field, clipboard and stationary. A suitable container such as a bucket should be provided to those trained to relocate nests.
- Increase allowance from the current GH₵ 100 to align with the relevant eni labour policies.
- Ensure that GWS have the correct permit to undertake the necessary tasks from Ghana Wildlife Division. Permits must be renewed on an annual basis.

- Establish a security procedure if poachers are encountered in the field, including not to engage with poachers, and who to notify.
- Upgrade the existing sea turtle hatchery at Krisan as per requirements outlined in Annex 1. One required improvement is to install netlon mesh[12] on the inside of the fence to protect against crabs and other small burrowing predators.
- Ensure all members are fully aware of the nest translocation protocol and competent turtle specialist to provide practical training to task force on how to best undertaken relocation.

7.2 Training requirements

All GWS staff undertaking sea turtle monitoring and/or beach patrols should be fully trained prior to conducting surveys on their own. A training program will include a classroom (theory) session and field (practical) sessions (Shroeder and Murphy 1999).

Theory training should include photographs of species and of various types of crawls for each of the species that are known to nest on the survey beach. Identification guides will be provided. Practical sessions should be led by experienced surveyors (competent turtle specialist to mentor staff during ground truthing surveys). New staff should work side- by-side with experienced surveyors until they are fully confident of their ability to identify nesting emergences from false crawls and distinguish among the species using the survey beach (Shroeder and Murphy 1999).

Table 7.1 Training requirements

Position (from all companies involved)	Training Topic	Action Progress	Date for completion	Frequency
eni HSEQ manager	BAP requirements and role-specific responsibilities.	No progress	February 2017	Once
eni site environment officer	BAP requirements specific to beach patrols and monitoring included in field mentoring from competent turtle specialist Translocation protocol Data management	No progress	February 2017	Once
Construction workers	BAP requirements specific to the construction phase.	No progress	February 2017	Once

[12] i.e. a fine mesh the is small enough to prevent crabs entering the nest chamber

Local NGO	BAP requirements specific to beach patrols and monitoring including in field mentoring and tagging from competent turtle specialist Translocation protocol Data management General field procedures, such as the use of GPS, photographing techniques, understanding the tides and sourcing online tide data	In progress	July 2017	Ongoing

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ANNEX 1. NEST TRANSLOCATION PROTOCOL

Developed using the following sources:

Mortimer, J.A. 1999. Reducing Threats to eggs and hatchlings: Hatcheries

Boulon, R.H. 1999. Reducing threats to eggs and hatchlings: In situ protection

Miller, J.D. 1999. Determining clutch size and hatchling success, Eckert, K. L., K. A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle
Specialist Group Publication No. 4.

Overview

Eggs should never be handled (such as with the intent of relocating them to hatchery enclosures) without explicit training, oversight by local sea turtle experts and without appropriate permits from Government. The preferred option is always the least manipulative intervention. Collecting and reburying eggs should be considered only as a last resort. Hatcheries have the following limitations that must be considered: hatchling success is usually lower than natural nests, requires well-trained staff and improper hatchling release can cause high mortality rates.

When should sea turtle eggs be translocated?

The following circumstances may warrant the removal of eggs from the nature burial chamber:

- Nests located at sites that are known to encounter severe and predictable erosion (i.e. high risk areas).
- Nests laid very near (quantify) to the sea may be lost prior to term due to inundation.
- Sea turtle eggs should not be currently removed due to fear of poaching.
  Community engagement findings suggest that poaching does occur but was not witnessed during the preconstruction survey and is likely to be opportunistic. The presence of recently established beach surveillance and awareness might be enough to deter the majority of poaching activity. This situation should be closely monitored and adapted where circumstance on the ground change.
- Nests laid within the project area 60 days prior to construction and during construction should be removed (quantify distance during field visit).

Use of a sea turtle hatchery

- Located as close as possible to the nesting beach in order to reduce transport trauma, reduce time out of the sand and allow for imprinting.
- Hatcheries should be positioned to include a range of microhabitats utilized by nesting turtles to allow for a range of representative temperature regimes.
- Located at least 1 m above the highest spring tides and away from areas that might get inundated.
- Enclose the hatchery with wire mesh to prevent human or predator intrusion.
- Bury a 1 – 2 m wide strip of netlon mesh (1 cm mesh) to a depth of 0.5 along the inside of the fence to protect against crabs and other small burrowing predators.
- The same hatchery site should only be used for 2 consecutive years to prevent issues with fungus and bacteria.

Translocation steps

Best accomplished using regular beach patrols enabling collection at deposition.

1. Collection of eggs

- Gently collect eggs at deposition and place in a clean bag and bucket. The container must be strong enough to reliably carry up to 12 kg of eggs. Hands should be removed of all chemical residues such as sun screen and insect repellent.
- Alternatively position a plastic bag in the hole to receive the eggs. Tie the bag prior to burial by the female to exclude sand. Efforts should be taken to reduce the amount of sand collected with eggs. Sand will abrade the egg shells an can reduce hatch success.
- Care taken not to disturb the turtle or collapse the egg chamber.
- Swiftly dig up eggs as soon as egg-laying is complete.
- Record nest depth and diameter of the neck of the nest so original dimensions can be replicated (measurement must be consistent).

2. Transport of eggs

- Transport eggs immediately. Secure and cushion from vibrations during transport.
- When transported eggs must be covered to reduce moisture loss.

- Special care provided for eggs that are longer than 2 hrs old or mid-term clutches that become threatened. The embryonic membranes can be easily torn if rotated or jarred. Mark the top of the egg with a soft grease pencil and maintain upright. Transfer eggs in an inflexible container rather than a sack to ensure not rotated.

3. Reburial process (hatchery)

- All eggs should be planted in the hatchery within 2 hours of being laid. No clutch should remain unburied for longer than 6 hrs.
- Do not to locate the nest too near (<1.0m) other translocated clutches or natural nests.
- As far as possible, attempt to replicate microhabitat in the hatchery to that of the natural nest. Replicate the natural nest depth and diameter.
- Sweep aside dry surface sand to expose damp surface (approximately 5-10 cm) to prevent it sifting into the excavation.
- Very dry weather can cause cave-ins during nest excavation. To improve stability pour fresh water into the unfinished nest and then continue nest construction.
- Do not pour eggs into the nest. Place a few at a time if less than 2 hours old. If older than 2 hrs then place one at a time.
- Once eggs are in place cover eggs with excavated damp sand. Apply layers of 8-12 cm and firming tamp sand in place.
- Do not allow dry sand to come in contact with the eggs. Only use during the final stages of covering the nests.
- Number and record each nest.
- Construct a cylindrical mesh enclosure around the nests. Use netlon mesh (<1 cm) rather than chicken wire which is too large and can cause injury. Recommended that mesh is 40cm high and 195 cm in length and secured with a metal stake (0.25 cm). Bury 10 cm into the sand to reduce crabs.

4. Hatchling release

- Hatchlings should be released as soon as possible after emerging from their nests.
- Delays in release can cause exhaustion, desiccation and possibly injury or death from predators.

- To prompt natural imprinting hatchlings should be allowed to crawl across the beach and enter the sea unassisted.
- Release sites should be randomized and occur at a different location (100 m away) to the last release site to avoid creating feeding stations.
- Hatchery staff should anticipate the arrival of hatchlings and check mesh enclosures are regular hourly intervals.
- When release is impossible (such as during the middle of a hot day) hatchlings should be kept in a soft, damp cloth sack and kept in a cool, dark, quiet location.
- Do not keep hatchling in water as they with engage in swim frenzy and exhaust energy resources required for ocean swimming.

5. Data collection

Hatchery data should be collected and analysed to determine the success of the reproductive effort at the hatchery and inform management decisions and adaptive management. The following parameters should be collected and recorded during laying (or reburial):

- Nest tag number
- Date and time laid
- Nest depth – Top (to first egg in the egg chamber)
- Nest depth – Bottom (to bottom of egg chamber)
- Nest location on the beach
- Nest location across the beach
- Nest location habitat (e.g. bare sand, grass, under vegetation)
- Number of eggs laid – clutch count (yolkless eggs should be counted and reported separately. Multi-yolked should be counted as one egg. Also record number eggs broken during excavation or transport)
- Sand temperature
- Egg diameter (greatest and least diameter of 10 eggs chosen at random)
- Egg weight

The following parameters should be collected and recorded after emergence of hatchlings:

- Nest tag number

- Date laid
- Date emerged (incubation length)
- Time of emergence
- Number of hatchlings that incubate successfully – Hatching success %
- Number of hatchlings that emerge from the nest - Emergence success %
- Number of hatchlings that cross the beach and reach the water

ANNEX 2 IDENTIFICATION KEYS AND TEMPLATES

1. SIMPLIFIED KEY TO ADULT AND SUB-ADULT TURTLES

2. KEY TO IDENTIFICATION OF HATCHLINGS

3. IDENTIFICATION OF TRACKS AND NESTS

4. FIELD ID GUIDE

1. SIMPLIFIED KEY TO ADULT AND SUB-ADULT TURTLES

Sourced from Pritchard and Mortimer 1999

1. Leathery, scuteless black or spotted carapace, posteriorly pointed and with prominent longitudinal ridges; carapace length to about 180 cm; all oceans, temperate or tropical
.....
.....*Dermochelys coriacea*

1'. Carapace hard with large scutes, rounded or elongate but not posteriorly pointed; carapace length less than 120 cm
.....
.....see paragraph 2

2. Carapace wide and almost circular; head width to about 15 cm; dorsal coloration grey to olive-green, unmarked; maximum carapace length to about 70 cm.....see 3

2'. Carapace not so wide as to be almost circular; coloration variable; maximum carapace length to 120 cm.....
..... see 4

3. Carapace very flat and wide, coloration relatively light, juveniles grey, circular in outline; maximum carapace length 72 cm; Gulf of Mexico, eastern USA, vagrant of western Europe (Not Ghana).....
.....*Lepidochelys kempii*

3'. Carapace relatively steep-sided, especially in eastern Pacific; typically dark olive; juveniles grey, circular in outline (similar to L. kempii); maximum carapace length 72 cm; Pacific, Indian and South Atlantic Oceans (Trinidad to Brazil; West Africa)
..... *Lepidochelys olivacea*

4. Head very large (width up to 28 cm in adults); carapace broadest anteriorly, elongate, and posteriorly narrowed, with a hump at the fifth vertebral scute; colour uniform reddish-brown; maximum carapace length 105 cm; usually temperate waters of all oceans, including Mediterranean and US Atlantic, occasionally in tropics
.....
.....*Caretta caretta*

4'. Head not very large (width to 12-15 cm in adults); carapace not broadest anteriorly, lacking hump at fifth vertebral scute; colour variable, carapace often boldly marked, typically with dark brown or black streaks, or plain olive; tropical seas
.....
..... see 5

5. Head small, anteriorly rounded; carapace heart-shaped
..... see 6

5'. Head either very narrow and anteriorly pointed or medium and broadly triangular; carapace either relatively narrow or broadly oval.....
.....see 7

6. Carapace smooth and wide (modest incurving above hind limbs), coloration variable but usually with radiating streaks, or spots in some large adults; maximum carapace length 120 cm; tropics and subtropics, all oceans
.....
..... *Chelonia mydas*

6'. Carapace typically narrowed by strong incurving above hind limbs, colour almost black, plain or spotted; carapace length to 90 cm, usually less; eastern Pacific, with rare vagrants further west (Not Ghana).....
.....Chelonia sp. (Black turtle)

7. Head narrow, with pointed bird-like beak (head width to 12 cm); carapace relatively narrow and lacking upturned sides, often well marked, scute borders obvious and overlapping, posterior margin of carapace usually strongly serrated; carapace length to

about 90 cm; tropical waters, all oceans
.....
.....*Eretmochelys imbricata*

7'. Head broadly triangular and relatively flattened (width to 15 cm); carapace broadly oval, very flat with upturned sides, without markings, scute borders often indistinct, and edges of shell smooth; carapace length to about 100 cm; tropical Australia (Not Ghana)..... *Natator depressus*

2. KEY TO IDENTIFICATION OF HATCHLINGS

Sourced from Pritchard and Mortimer 1999

The key characters for identifying hatchlings (apart from colour) are similar to those used for subadults and adults, although samples of hatchlings show greater variation in the numbers and configuration of the carapace scutes. Following is a species identification key for hatchling turtles.

1. Carapace covered with large horny plates; longitudinal carapace ridges, if present, not more than three in number and not of contrasting colour; forelimbs much shorter than length of carapace; plastron colour uniform or nearly so; carapace usually less than 60 mm (except in Natator)
..... see paragraph2

1'. Entire surface of the animal (carapace, plastron and extremities) covered with small, soft, polygonal scales; seven longitudinal carapace ridges (including edges of shell) boldly outlined in white against a black background; forelimbs extremely long (almost as long as the carapace); plastron mottled black and white; typical carapace length (SCL)
60 mm (range 55-63 mm)..... *Dermochelys coriacea*

2. Ventral coloration light; costal scutes four pairs
..... see 3

2'. Ventral coloration dark; costal scutes four to nine pairs
..... see 5

3. Overall coloration light: dorsum light olive-yellow and plastron white with a peripheral yellow band; broadly oval carapace; postorbital scales three pairs; relatively large size, typical carapace length (SCL) 61 mm (range 56.5-65.5 mm); tropical Australia (Not Ghana)..... *Natator depressus*

3'. Carapace black or blue-black, typically with a white margin; plastron white; heart- shaped carapace (some posterior narrowing); postorbital scales usually four pairs (but

sometimes three); typical carapace length smaller than Natator; tropical and subtropical seas including Australia ..... see 4

4. Forelimbs outlined in white; head scales blackish with narrow light (whitish) borders; postorbital scales usually four pairs; plastron pure white; typical carapace length (SCL) 49 mm (range 46-57 mm); distribution tropical and subtropical, not East Pacific region ..... *Chelonia mydas*

4'. Forelimbs and head scales sometimes outlined in white, but white edges may be reduced or absent; postorbital scales typically four pairs (but sometimes three); plastron initially white, but soon darkens; typical carapace length (SCL) 47 mm (range 41-52 mm); distribution Galapagos Islands and Meso-America (Not Ghana).....
.....Chelonia sp. (Black turtle)

5. Colour brown (dark to light) above and below; inframarginal scutes typically three or four pairs.....
..... see 6

5'. Colour very dark grey to black above and below; inframarginal scutes typically four pairs
.....
..... see 7

6. Costal scutes four pairs; oval carapace; inframarginal scutes typically four pairs; typical carapace length (SLC) 42 mm (39-46 mm)
.....Eretmochelys imbricate

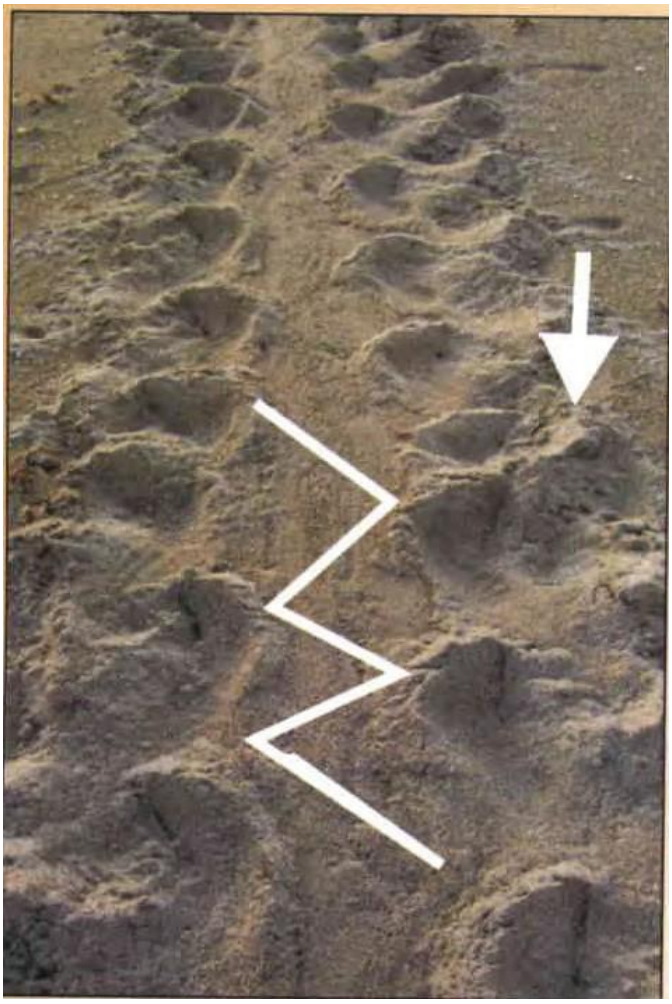
6'. Costal scutes five pairs; carapace broader in shoulder region than in Eretmochelys; inframarginal scutes typically three pairs; typical carapace length (SLC) 45 mm (38-50 mm).....
..... *Caretta caretta*

7. Costal scutes usually five pairs; typical carapace length (SLC) 43 mm (38-46 mm); expected distribution of hatchlings Tamaulipas, Vera Cruz and South Texas (rare strays in southeastern USA)
.... *Lepidochelys kempii*

7'. Costal scutes usually six to nine pairs (sometimes five); typical carapace length (SLC) 42 mm (38-50 mm); distribution circumtropical, mostly mainland shore, not Gulf of Mexico and east
US..... ..... *Lepidochelys olivacea*

3. IDENTIFICATION OF TRACKS AND NESTS

The following descriptions of tracks and nests typical of each turtle species will serve as a guide for field workers trying to identify the tracks they encounter. Nevertheless, the tracks of different species can be difficult to tell apart.



Asymmetrical tracks

Three species of sea turtle leave asymmetrical or alternating tracks, sometimes referred to as "zipper crawls".

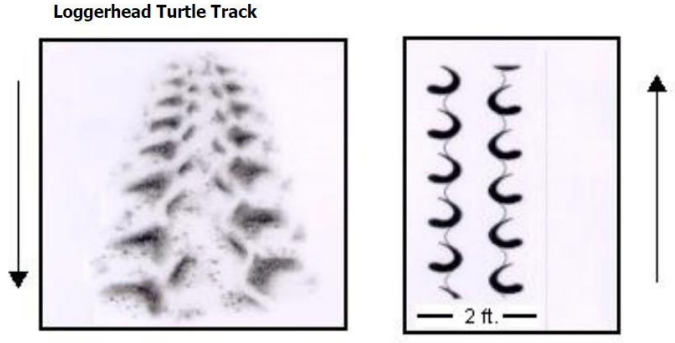
These turtles – the Olive ridley (as well as the Loggerhead and hawksbill) – alternate the movement of their front flippers so that the front and rear flippers on opposite sides move together.

Please note that the Olive ridley is the most likely to nest on these beaches. A faint tail drag running through the middle of the tracks may or may not be present.

If the track is fresh and the sand crisp, an exact measurement of maximum track width can provide yet another clue as to species:

<u>Species Track Width (widest point)</u>

- Olive ridley 70-80 cm
- Hawksbill 70-85 cm

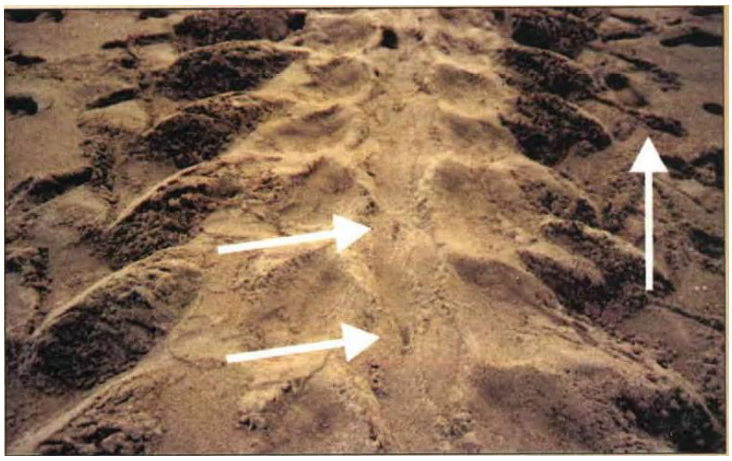


Source: *Sea Turtle Conservation Guidelines* (FFWCC 2007).

- Loggerhead 80-90+ cm

Symmetrical tracks

The tracks of the remaining two species - Green and Leatherback sea turtles move their front flippers at the same time, literally dragging themselves above the high-tide line.



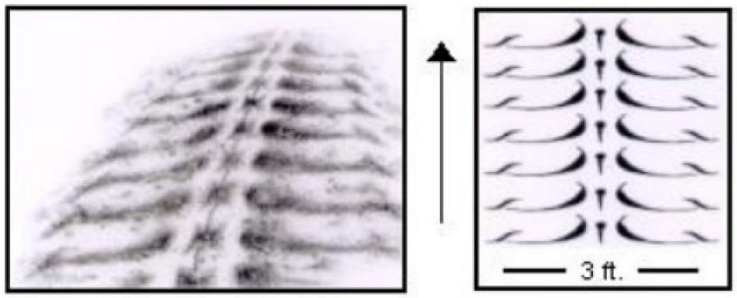
Hind flippers create matching parallel mounds in the middle of the track. Both species tend to drag their tails, leaving behind either solid or broken lines with accentuated points.

The track sizes of these turtles differ noticeably, the track of the Leatherback is much larger. Potentially confused only in the case of a very large Green turtle or a very small leatherback:

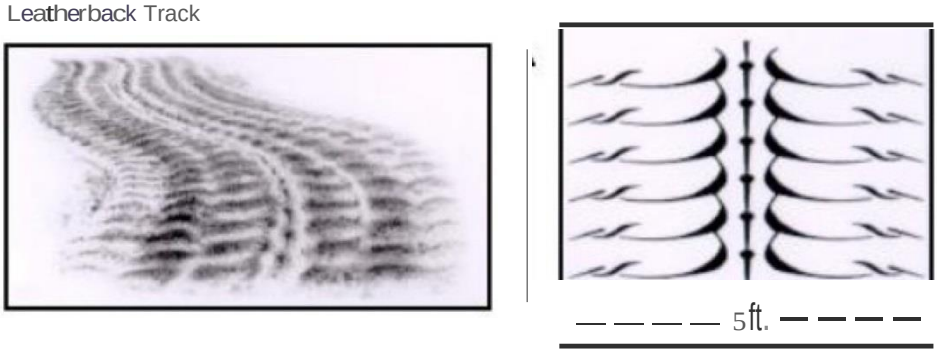
SpeciesTrackWidth(widestpoint)

- Leatherback 150-230+ cm
- Green 70-130 cm

Green Turtle Track



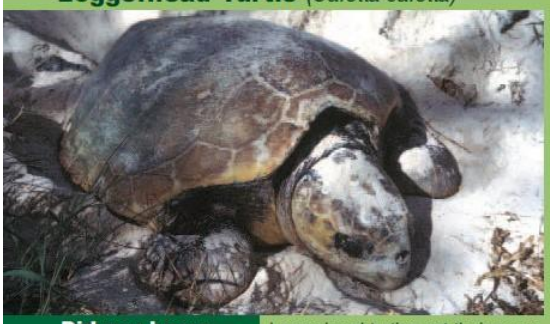
Leatherback Track



Source: *Sea Tl11tle ConsetVation Guidelines* (FFWCC 2007).

4. FIELD ID GUIDE
Material adapted from the Great Barrier Reef Marine Park Authority

Loggerhead Turtle *(Caretta caretta)*



Did you know . . . Loggerhead turtles get their name because of their large square heads and strong jaws.

Olive Ridley Turtle *(Lepidochelys olivacea)*

© Scott Handy

Did you know . . . Olive Ridley turtles are the smallest of all the marine turtles and their shell is shaped like a heart.

Leatherback Turtle *(Dermochelys coriacea)*

© Scott Handy

Did you know . . . Leatherback turtles are the largest of all the marine turtles with a leather-like shell up to 2.5m in length.

Hawksbill Turtle *(Eretmochelys imbricata)*

Did you know . . . Hawksbill turtles have thick overlapping scales and a distinctive beak. Their shell was once used to make 'tortoiseshell' jewellery.

Five (5) sea turtle species are found in Ghana.
The Olive Ridley Turtle, Leatherback Turtle and Green Turtles are found in the ocean and nest on the beaches between Eikwe and Bakanta.

The Loggerhead Turtle and Hawksbill Turtle are found in the ocean but are not likely to be found on the beach.

Green Turtle *(Chelonia mydas)*

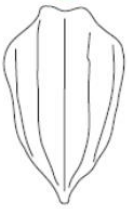
Did you know . . . Green turtles get their name because their fat is coloured green. They mainly eat algae and other marine plants.

Egg Facts Marine turtles lay between 50 and 200 eggs per clutch. Eggs take about 60 days to hatch.

Identification Key

The identification key below will help you identify the marine turtles of the Great Barrier Reef. Follow the flow chart and match the carapace (shell) and/or the pre-frontal scales on the head to the turtle in question.

Carapace ridges, no scales



Leatherback

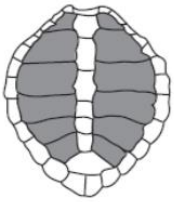
Carapace scales

4 pair costal scales

5 pair costal scales
Colour red-brown to brown

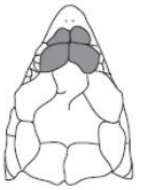
Loggerhead

6 pair costal scales
Colour grey-green



Olive Ridley

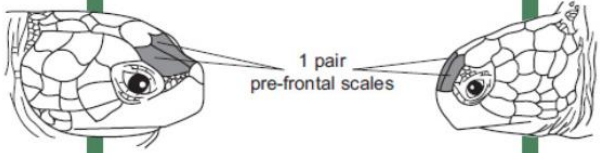
2 pair pre-frontal scales
Thick overlapping carapace scales



Hawksbill

1 pair pre-frontal scales
No thick overlapping carapace scales

The Flatback Turtle is not found in Ghana



Please report sick, injured, stranded or dead turtles to the Ghana Wildlife Society

Carapace low domed with upturned edges
Colour olive grey

Flatback

Carapace high domed
Colour light to dark green
with dark mottling

Green