

**Addendum to the 2014 Nearshore Seismic  
Environmental and Social Impact Assessment (ESIA)  
for the  
Staatsolie Nearshore 3D Seismic Acquisition Project**



Prepared for:

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## Abbreviations

|       |   |
|-------|---|
| 2D    | Two Dimensional   |
| 3D    | Three Dimensional   |
| BO    | Board Supervisor ( <i>Bestuursopzichter</i> )   |
| CCU   | Corporate Communications Upstream   |
| DC    | District Commissioner ( <i>Districtscommisaris</i> )  |
| EA    | Environmental Assessment  |
| EMP   | Environmental Management Plan   |
| ESIA  | Environmental and Social Impact Assessment  |
| ESL   | Environmental Sciences Limited  |
| ESMP  | Environmental and Social Management Plan  |
| LBB   | National Forestry Service ( <i>'s Lands Bosbeheer</i> )   |
| LVV   | Agriculture, Animal Husbandry, and Fisheries ( <i>Landbouw, Veeteelt en Visserij</i> )  |
| MFO   | Marine Fauna Observer   |
| MMO   | Marine Mammal Observer  |
| NB    | Nature Conservation ( <i>Natuur Beheer</i> )  |
| NIMOS | National Institute for Environment and Development in Suriname ( <i>Nationaal Instituut voor Milieu en Ontwikkeling in Suriname</i> ) |
| OBC   | Ocean Bottom Cable  |
| OBN   | Ocean Bottom Nodes  |
| OBO   | Under Board Supervisor ( <i>Onder Bestuursopzichter</i> )   |
| OWTC  | Public Works, Transport and Communications ( <i>Openbare Werken, Transport en Communicatie</i> )                                      |
| ToR   | Terms of Reference  |

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## Executive Summary

This document presents the results of the Environmental and Social Impact Assessment (ESIA) for the Staatsolie Nearshore 3D Seismic Acquisition Project. This document is presented as an Addendum to the 2014 Nearshore Seismic Environmental and Social Impact Assessment (ESIA).

This Addendum has been prepared conform the EA guidelines of the National Institute for Environment and Development in Suriname (NIMOS, 2009), as well as international best practice. The assessment and the resulting were prepared according to the approved Staatsolie Terms of Reference (ToR) and the screening results by the National Institute for Environment and Development in Suriname (NIMOS). The Staatsolie Corporate Standards have also been considered.

Up to date, several ESIA's, specialist studies and compliance reports have been produced within or near the proposed project area. Also, Staatsolie has been granted several environmental permits previously for the execution of nearshore seismic studies. Therefore, the current project has been classified by NIMOS as a Category B-path 2 project, whereby only an Addendum ESIA is required.

Staatsolie is currently executing the Nearshore Drilling Project in the nearshore area. The nearshore is a legally defined area, north of Suriname's coastline, which has been assigned to Staatsolie for the distinct purpose of hydrocarbon exploration. The nearshore area used to be divided into seven blocks, but currently consists of four blocks A-D and stretches across Suriname's coastline, covering an area of approximately 11,250 km<sup>2</sup>, extending up to 28-40 km off the shore. The water column ranges between depths of 0-30m.

Up to seven (7) wells are planned to be drilled between April and December 2019, within and around pre-determined focus areas. In case of a discovery, the 3D Seismic Acquisition Project will be done as a follow-up project. The purpose of the seismic research is to provide even more detail of the oil potential. In general, the seismic survey will be carried out within a radius of 10km of discovery wells. However, larger survey areas will be required for the bigger prospects, such as the Kankantrie prospect. Seismic acquisition is planned to start in the first quarter (Q1) of 2020 with an expected duration of 3-5 months and will consist of a combined Seismic Streamer, Ocean Bottom Cable (OBC) or Ocean Bottom Nodes (OBN) technology depending on the water depths, costs and the capacity of selected contractor.

Because of the fact that only an Addendum to the 2014 Nearshore Seismic Environmental and Social Impact Assessment (ESIA) is required, the current study has predominantly been conducted as a desk study, supplemented by stakeholder consultations.

### **Conclusions drawn from this study include:**

The analysis of the impacts for previous seismic projects has learned that virtually all impacts that were identified and assessed for previous seismic projects also apply for the current project. A few additional impacts were identified and assessed, but mitigation measures are already included to mitigate related activities for previous projects. This implies that the specifications table and associated procedures in the Nearshore 2D Seismic ESMP (NEC 2014a) are also valid for the current project. The only changes to the ESMP are the specific plans that should be in place, which are to some extent specific for a certain company. These plans, like the waste management plan, the emergency response plan, spill response plan, the traffic plan and other supporting plans as relevant will be submitted by the Seismic Contractor. Upon request of Staatsolie, the format of the Nearshore 3D Seismic ESMP will be changed to the format as used for the 2019 Nearshore Drilling ESMP (ESL 2018).

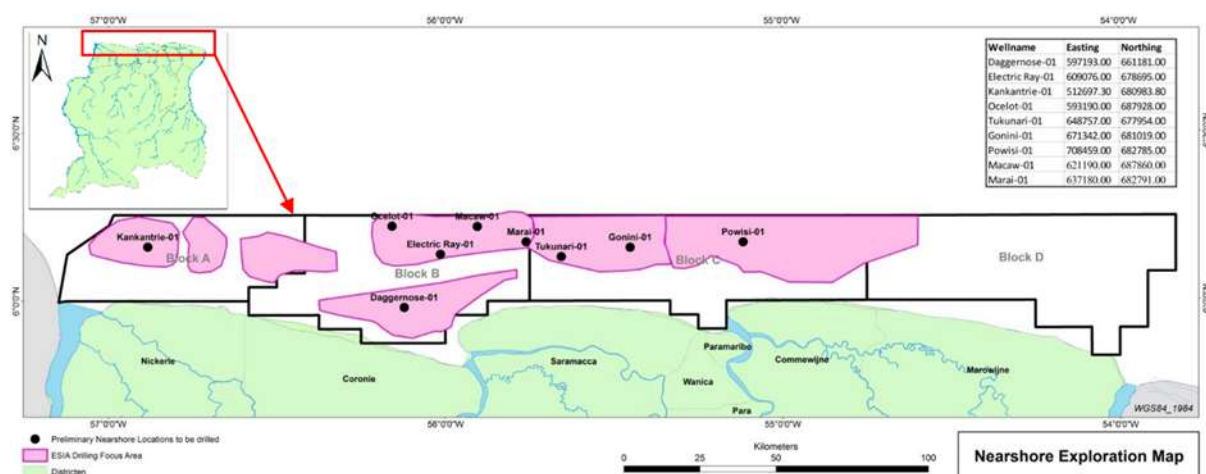
# 1 Introduction

## 1.1 General

This document presents the results of the Environmental and Social Impact Assessment (ESIA) for the Staatsolie Nearshore 3D Seismic Acquisition Project. This document is presented as an Addendum to the 2014 Nearshore Seismic Environmental and Social Impact Assessment (ESIA).

The nearshore is a legally defined area, north of Suriname's coastline, which has been assigned to Staatsolie for the distinct purpose of hydrocarbon exploration. The nearshore area used to be divided into seven blocks, but currently consists of four blocks A-D and stretches across Suriname's coastline, covering an area of approximately 11,250 km<sup>2</sup>, extending up to 28-40 km off the shore (**Figure 1**). The water column ranges between depths of 0-30m.

Staatsolie is currently executing the Nearshore Drilling Project. Up to seven (7) wells are planned to be drilled between April and December 2019, within and around pre-determined focus areas (pink areas in **Figure 1**). In case of a discovery, the 3D Seismic Acquisition Project will be done as a follow-up project. The purpose of the seismic research is to provide even more detail of the oil potential. In general, the seismic survey will be carried out within a radius of 10km of discovery wells. However, larger survey areas will be required for the bigger prospects, such as the Kankantrie prospect.



**Figure 1: Overview of the nearshore blocks (A-D) and pre-determined focus areas (pink colored) for the Nearshore Drilling Project and the Nearshore 3D Seismic Acquisition Project, along Suriname's Atlantic coastline.**

This Addendum has been prepared conform the EA guidelines of the National Institute for Environment and Development in Suriname (NIMOS, 2009), as well as international best practice. The assessment and the results were prepared according to the approved Staatsolie Terms of Reference (ToR) and the screening results by the National Institute for Environment and Development in Suriname (NIMOS). The Staatsolie corporate standards have also been considered.

## 1.2 Project background and scope

Staatsolie was founded in 1980 as a limited liability company under Surinamese Law.

In 2008-2009, Staatsolie conducted a successful Regional (onshore) 2D Seismic Acquisition Program in the coastal plain of Suriname, reaching from the Corantijn River up to and including the district of Commewijne. Based on an evaluation of the produced geological and geophysical data, a seismic knowledge gap was identified in areas within the onshore and nearshore blocks. In the last quarter of 2012, Staatsolie initiated the River Seismic Project in river estuaries and nearshore blocks, in order to close this knowledge gap.

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In 2014, the Nearshore 2D Seismic Project was carried out with data collected in five out of the six planned blocks (roughly covering current blocks A to C). This study was geared towards filling the areas in the nearshore where the density of seismic coverage is low in areas that might be prospective. It also formed the initial phase of exploration with the goal to image and to define structural/stratigraphic features that may be progressed to drillable prospects. Based on the latter information ten prospect areas were identified, and currently exploration wells are being drilled in these prospect areas. In case of a discovery, Staatsolie plans to execute a 3D-seismic Acquisition Project within/around these pre-determined focus areas (see pink colored areas in Error! Reference source not found.).

Up to date, several ESIA's, specialist studies and compliance reports have been produced within or near the proposed project area. Also, Staatsolie has been granted several environmental permits previously for the execution of nearshore seismic studies:

- November 2010, ESIA for the Block IV 2D/3D Seismic Survey.
- March 2014, EIA for the 2D Seismic Survey.
- April 2015, ESIA for the Block IV Nearshore Exploration Drilling.
- November 2018, ESIA for the Nearshore Exploration Drilling Project 2019

Therefore, the current project has been classified by NIMOS as a Category B-path 2 project, whereby only an Addendum ESIA is required.

The scope of the current study includes:

- To identify gaps in the 2014 EIA for the 2D Seismic Survey
- To present the additional project activities
- To identify and consult new and already known stakeholders about the current activities.
- To detail certain sections of the baseline based on findings of past monitoring as required.
- To determine whether the previous impact assessments also apply to the current project, and if not so, to make additional assessments.
- To validate that the existing ESMP is also applicable for the current project, and if necessary to modify or include additional issues.

### 1.3 Project and study area

The area in which the project activities will take place is shown in Figure 1. The project area comprises the Staatsolie Blocks A, B, C and the western part of Block D. These blocks cover an area of about 11,250km<sup>2</sup>. The southern boundary is formed by the shoreline while the northern boundary extends approximately 28-40km out to the sea.

The coast of Suriname is classified as a mud coast. The mud contains an immense amount of clay that occurs in the form of suspended particles (turbid water) or sling mud, while in addition a lot of mud is found in coast-attached mud banks. The coast is very dynamic with a variety of land accretion and erosion linked to the continuous movement of the mud banks that migrate to the west, driven by currents and waves.

Sensitive ecosystems along the coast include mud banks, mangroves, lagoons ("pannen") and sandy beaches. Mud banks cover a 200 to 1000m wide strip along parts of the coast where they occur. The mud banks are formed by soft, gray and salty mud and its highest parts fall dry at low tide. The earlier mentioned ecosystems together form the estuarine zone. The mangrove forests form a zone of 1 - 6 km wide along the coast. Locally a low vegetation of salt-tolerant plants is found. Beaches are mainly found to the east of the Commewijne River. They are bare or have low, open herb vegetation. The mangrove ecosystem and the adjacent mud banks form an important 'nursery' for early stages of sea fish and macro-invertebrates (such as shrimp) and therefore the area is important for sustainable sea fishing.



The five species of sea turtles, which are known to lay eggs along the coast of Suriname, are internationally and locally protected species. They are mainly present in the coastal waters of Suriname from February to August. The laying beaches are located in Eastern Suriname, with Braampunt as the most westerly location, situated in the estuary of the Suriname River. The laying activities can be influenced by seismic surveys.

The estuarine zone of Suriname is further characterized by a large wealth of birds, both in terms of number of species and total numbers. The dry mud banks offer a food area, while the adjacent mangrove forests are used as breeding place, resting place and hiding place.

The project area largely falls within the brown water zone, which contains mud from the Amazon River. The zone is roughly located between the 30 m depth line and the coastline. Smaller parts in the north may fall within the green water zone which is characterized by an abundance of green algae. This zone has a water depth between 30 and 60m but can be shallower.

The project area is common domain for fisheries. Along the coast fishermen with a license are allowed to fish in water depths between 0-16.6 m. Industrial fishing takes place in the deeper (from 18.3 meters deep) parts of the sea area. The project area is crossed by sailing routes to and from Suriname (mainly to Paramaribo), and along the coast by ships coming from Brazil with destination Caribbean or vice versa.

## 1.4 Methodology

The ESIA process conform the NIMOS guidelines has been followed. There are four phases in the ESIA process, namely Screening, Scoping, Environmental Assessment and NIMOS review.

The Screening Phase of the Project was completed by Staatsolie. The current project has been classified by NIMOS as a Category B-path 2 project, whereby only an Addendum ESIA is required.

Following this the Addendum Scoping Phase was undertaken, resulting in a Scoping Report that was submitted to NIMOS on the 15<sup>th</sup> of August 2019. Given the fact that the project area and the potential impacts from seismic surveys are already well known from numerous previous ESIA studies, it was decided that a Scoping meeting was not required. Instead, only key stakeholders have been consulted again as part of the Scoping Phase. By accepting the Scoping Report on the 11<sup>th</sup> of September 2019 the methodology for impact assessment as well as the methods used to gather baseline data have been approved by NIMOS.

Because of the fact that that only an Addendum to the 2014 Nearshore Seismic Environmental and Social Impact Assessment (ESIA) is required, the current study has predominantly been conducted as a desk study, supplemented by stakeholder consultations. Public consultation is a key component that runs throughout the process. The results of the stakeholder consultations are included in **Appendix 1**.

## 1.5 Team of experts

Staatsolie has appointed ILACO Suriname NV (ILACO) to undertake the ESIA for the Nearshore 3D Seismic Acquisition Project. The team of experts includes:

|                             |                                      |
|-----------------------------|--------------------------------------|
| Dirk NOORDAM, M.Sc.         | Sr. ESIA Expert                      |
| Shareen KOENJBIHARIE, B.Sc. | Team Leader/Environmental Specialist |
| Rachelle BONG A JAN, M.Sc.  | Social Expert                        |

## 2 Project Description

The Exploration & Development Asset of Staatsolie intends to conduct a 3D Seismic Program within the nearshore area in order to determine the extent of the hydrocarbon reservoirs with the blocks (A-D). Staatsolie is currently conducting an Exploration Drilling Program in the nearshore area. In case of successful oil finds, the most prospective find(s) will be further mapped by acquiring 3D seismic data.

It should be noted that until Staatsolie has selected a contractor to conduct the seismic survey, the full details of the project cannot be provided. Therefore, the project description is presented in a more general way. Further details will come only available after the Seismic Contractor has been appointed. At that point the ESIA and ESMP may need some more additions, and company or site-specific information (waste management plan, traffic plan, emergency plan, and other supporting plans as relevant) will be incorporated in the ESMP.

### 2.1 Location and size of seismic surveys

The possible locations and sizes of the 3D Seismic Program are presented in **Table 1**, **Table 2** and **Figure 2**.

**Table 1: Overview of the coordinates of possible 3D seismic surveys**

| Number                            | Prospect name | South-Western corner |        | South-Eastern corner |        | North-Western corner |        | North-Eastern corner |        |
|-----------------------------------|---------------|----------------------|--------|----------------------|--------|----------------------|--------|----------------------|--------|
|                                   |               | X                    | Y      | X                    | Y      | X                    | Y      | X                    | Y      |
| <b>UTM zone 21, WGS '84 datum</b> |               |                      |        |                      |        |                      |        |                      |        |
| 1                                 | Electric Ray  | 599016               | 674835 | 616399               | 674835 | 599016               | 690070 | 616399               | 690070 |
| 2                                 | Daggernose    | 590096               | 655629 | 607936               | 655629 | 590096               | 670343 | 607936               | 670343 |
| 3                                 | Ocelot        | 585344               | 685448 | 607415               | 685448 | 585344               | 696906 | 607415               | 696906 |
| 4                                 | Kankantrie    | 493283               | 672101 | 553051               | 672101 | 502724               | 693521 | 553051               | 693651 |
| 5                                 | Powisi        | 695405               | 677544 | 715156               | 677544 | 695405               | 693591 | 715156               | 693651 |
| 6                                 | Gonini        | 658653               | 675965 | 681896               | 675965 | 658653               | 690005 | 681896               | 690005 |
| 7                                 | Tukunari      | 638340               | 672622 | 655203               | 672622 | 638340               | 686094 | 655203               | 686094 |

**Table 2: Area size of possible 3D surveys**

| Number | Prospect name | 3D Area (sqkm) |
|--------|---------------|----------------|
| 1      | Electric Ray  | 265            |
| 2      | Daggernose    | 262            |
| 3      | Ocelot        | 253            |
| 4      | Kankantrie    | 1182           |
| 5      | Powisi        | 317            |
| 6      | Gonini        | 326            |
| 7      | Tukunari      | 227            |

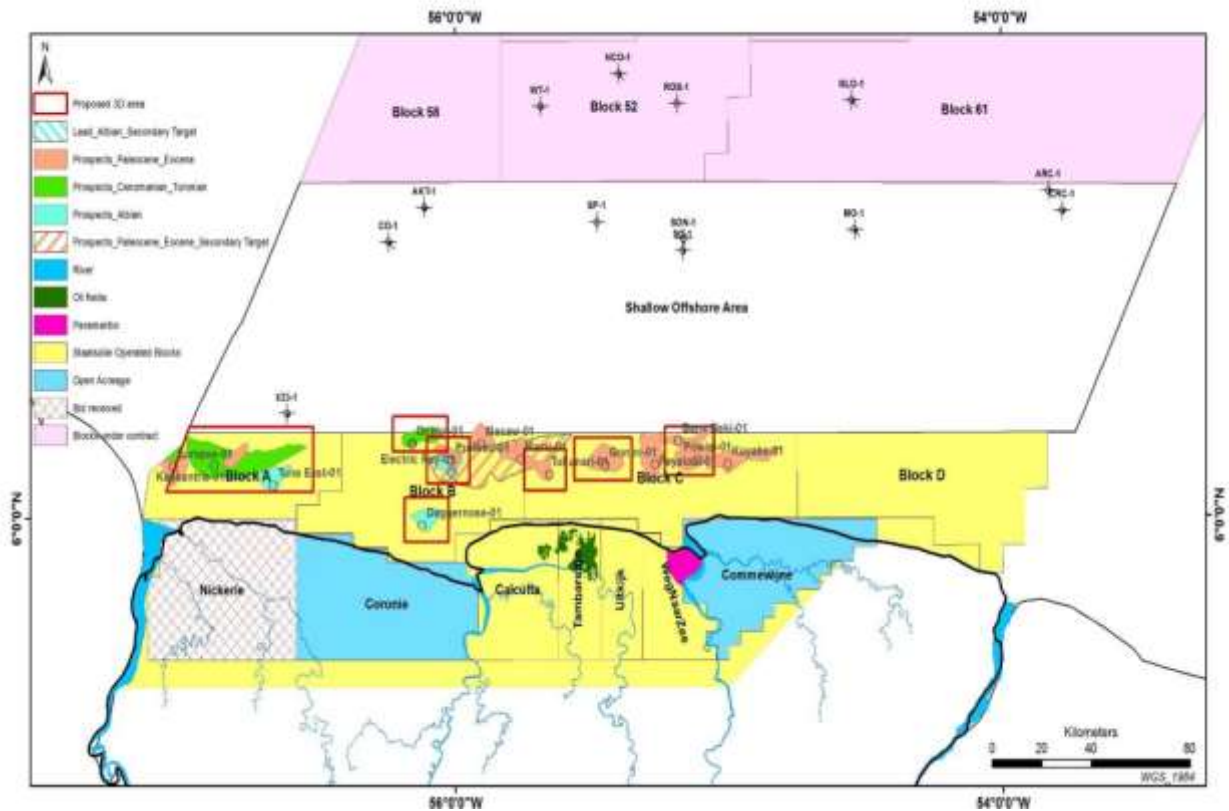


Figure 2: Possible locations and sizes of 3D surveys

## 2.2 Project Components

### 2.2.1 Planning

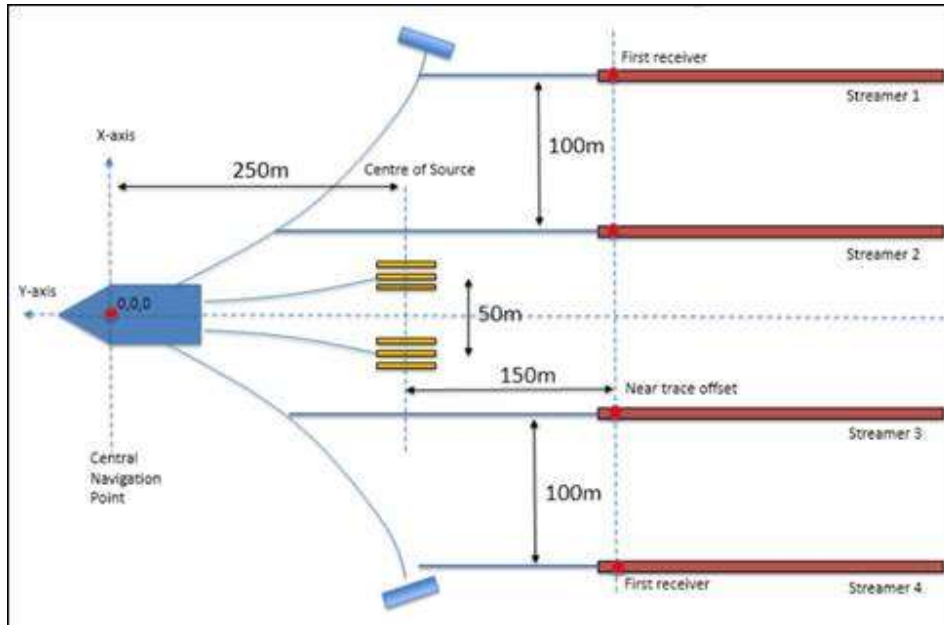
Seismic acquisition is planned to start in the first quarter (Q1) of 2020 with an expected duration of 3-5 months and will consist of a combined Seismic Streamer, Ocean Bottom Cable (OBC) or Ocean Bottom Nodes (OBN) technology depending on the water depths, costs and the capacity of selected contractor.

### 2.2.2 Seismic survey technologies

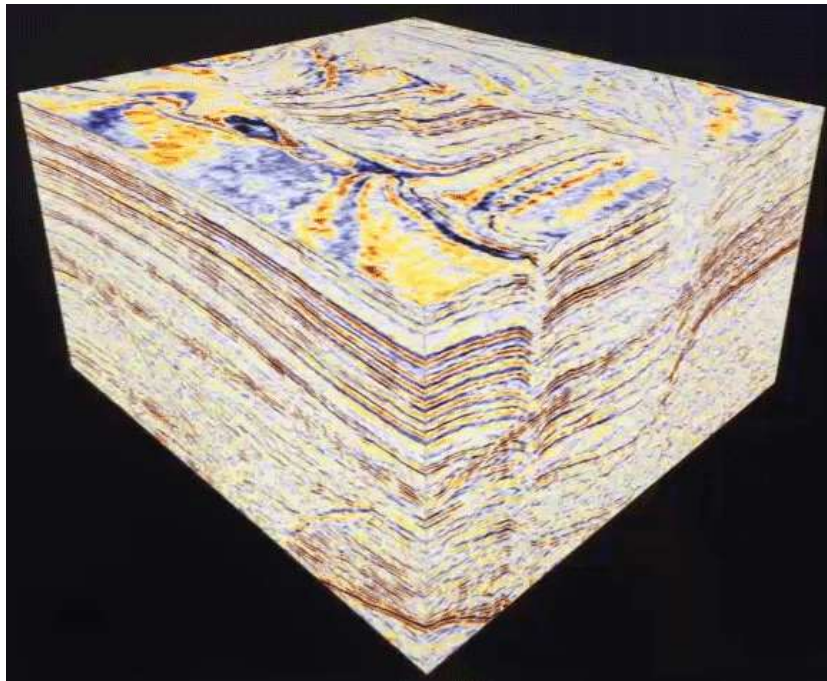
The OBC/OBN technology is applicable for the whole nearshore area (shallow and deep water) but is rather expensive. In the deeper waters, the 3D Streamer technology is proposed. The exact depths for both technologies are not yet known. These abovementioned technologies are not much different in design (parameters such as air gun configuration are similar). They are operated as follows:

#### **3D Streamer technology (Figure 3):**

The seismic data will be acquired with multiple towed streamers. The required streamer length, number of streamers and towing depth will be defined after completion of the seismic acquisition design study. Typical streamers lengths for the nearshore area would be 2000 -3000m, towed at minimally 10 m below the surface. In all cases, the limiting factor of acquisition will be the safe passage of the acquisition vessel over the seabed. Towed streamers are appropriately ballasted to be neutrally buoyant in the waters in which they are deployed. This buoyancy is such that the streamers do not touch the sea floor during acquisition. The result of the streamer technology is a cubic representation of the subsurface (3-dimensional, Figure 4).



**Figure 3: 3D Streamer Technology Operations**

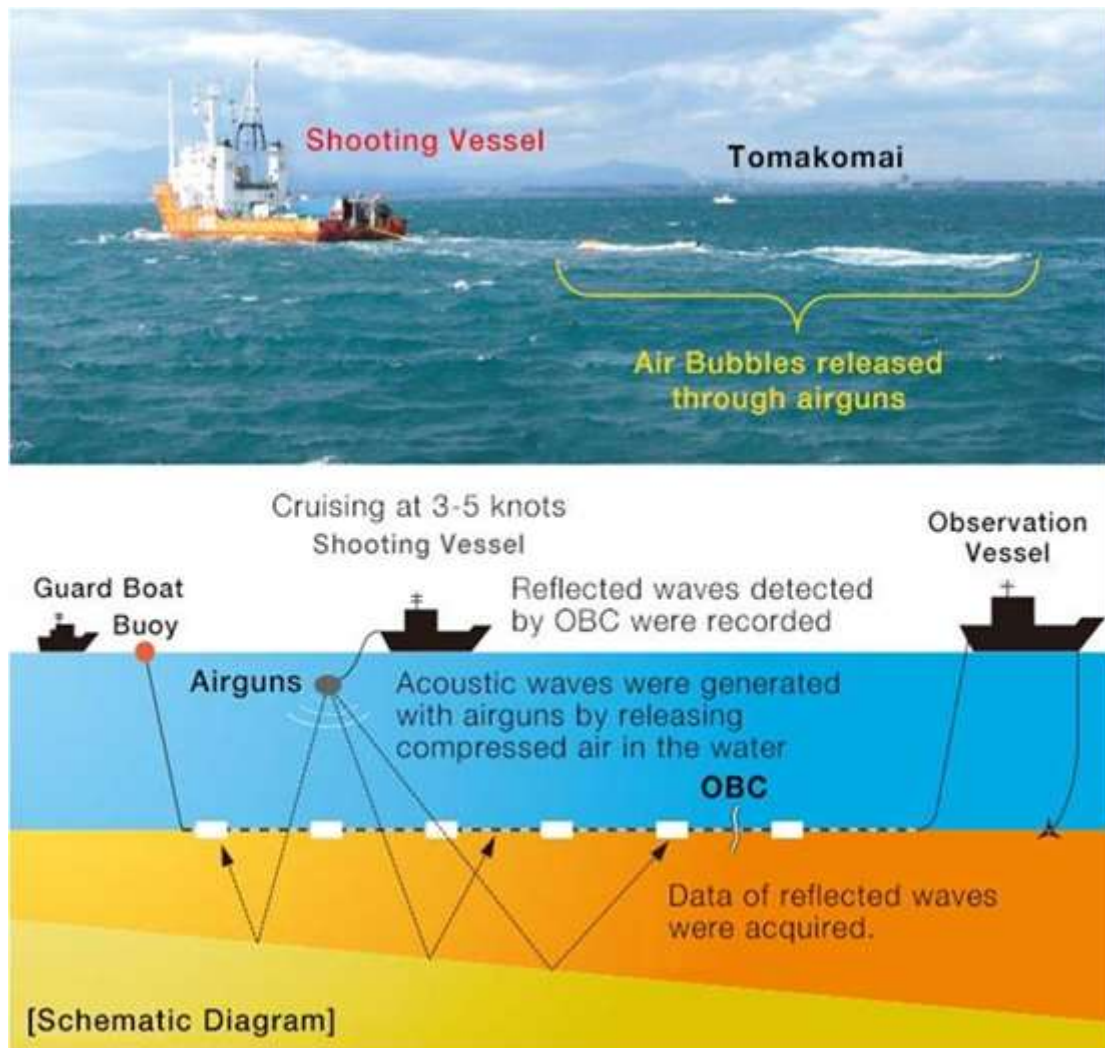


**Figure 4: 3D cubic representation of the subsurface**

**3D OBC/OBN technology (Figure 5 as example for OBC):**

The OBC method is utilized in shallow waters, where streamer technology would be a challenge to apply or for special seismic data acquisition needs, as this technology is able to acquire both shear wave (S-wave) as well as P-wave energy. Typically, streamers would be deployed on the seafloor to record and relay data to a seismic recording vessel. The streamers might be towed on the seabed by the shooting vessel as well. The source would be pulled behind the survey vessel, similar to streamer type operations. Such systems were originally introduced to enable surveying in areas of obstructions (such as production platforms) or shallow water inaccessible to ships towing seismic streamers (floating cables). The OBN method applies battery-powered cable fewer receivers placed on the seabed. The placement of these nodes can be more flexible than the cables on OBC and they are easier to store and deploy. With the OBC technology, the data is recorded simultaneously with the shooting,

while with the OBN technology, data is retrieved within the nodes to be downloaded after the shooting.



**Figure 5: OBC Technology Operations**

In seismic surveys an air gun is used. Under pre-calculated and controlled conditions, energy is released from compressed air under the water surface in order to generate shock waves. Reflected vibrations from rock layers below subsurface are recorded with highly sensitive underwater microphones. In the 3D Streamer technology these microphones are located in a bundle with plastic sheathed cables, which are towed by the vessel. In the 3D OBC technology, the cables with the microphones are placed on the seabed while in the 3D OBN technology the microphones (together with the necessary peripherals in a package about the size of a case) can be placed individually in a fixed pattern on the sea bottom.

### **2.2.3 The operation**

#### **Pre-project site investigations**

In preparation for this program, Staatsolie is conducting a seismic acquisition design study. A specialized contractor will model the seismic acquisition in the area and deliver three solutions for best applicable designs. This will form the basis for contracting a seismic acquisition company. Site inspections have to confirm the accessibility of pre-planned survey lines. The scouting contractor will make observations of the survey area, noting amongst others locations with too shallow water depths, unknown underwater hazards and local fishing areas. Areas of concern will be plotted on the overall design plan, following which adjustments to the survey design will be made if necessary. Also

predominant sea conditions will be previewed in order to determine if the safest and most effective vessel will be used in certain areas. Examples of things that will be observed include the overall sea state, shoals, reefs, tides, currents, width of the rivers, turns in the rivers, etc. Another issue of importance during this stage of the project will be the presence of other actors in the survey areas. Areas of concern, like known congestion spots, where traps and nets are located, when are busy times on the rivers, what routes are strongly traversed, etc., will be identified and where necessary changes to the project design will be made. Scouting of the survey area will take place by a local vessel outfitted with an echo sounder and basic hazard detection apparatus. Optionally side scan sonar can be added with output included as deliverable. Options for carrying out scouting with satellite data might be investigated as well. The scouting will be planned and undertaken in close cooperation with the Maritime Authority Suriname (MAS). The final seismic survey line locations will be delineated on the basis of the reconnaissance results. Survey design results combined with expected water depths will dictate whether streamer or OBC/OBN technology will be applied.

### **Daily Acquisition & Vessel Operations**

Prior to start of the seismic survey all equipment will be calibrated and tested to check its performance according to the required specifications.

The fleet is expected to consist of the following vessels: seismic acquisition vessel, accommodation vessel, chase vessel, supply vessel. The supply ship will probably enter the port every week to take in supplies and to unload waste. The other ships will come in less frequent, probably every 3 weeks. The acquisition vessel will mainly stay in the project area (3D seismic outline) and the other vessels will remain close to the acquisition vessel. Project supplies (food, water, fuel) will be delivered via river transport and purchased from local businesses. The seismic acquisition crew will be accommodated on the accommodation vessel, so that there is no need for accommodation on land. The sailing schedule for seismic surveys will alternate from east to west and vice versa. This happens continuously 1x24 hours. The ship will have to stop operations every 3 weeks for 1-2 days to enter the port for supplies. A shift in the offshore usually takes 12 hours. Staatsolie will have a crew of about 25-30 members involved. It is very likely that either the seismic or support vessel will come to the shore-base for crew change. This information will be confirmed once the Seismic Contractor is selected.

During the investigation, a safety zone is determined of which the size depends on the length and width of the working area. It is forbidden for all local vessels to come within this zone for a certain time period when seismic activities are being carried out. The location of the safety zone will change from day to day during the investigation. Local communities, fishermen and other relevant actors will be informed in advance about the location of the safety zone. A patrol boat will be used to ensure that no other vessels enter this zone. Fishermen and other boats are allowed make use of the area outside the seismic activity zone.

### **Land-based operation and crew**

Landing stages will be established near one of the port facilities along the Suriname River where pilot and port services will be used. However, final selection will be done after scouting of the logistics in Suriname by the contractor. At this moment no detailed information on these landing stages, local transportation, waste management, the crew and their accommodation can be provided yet. This will be submitted as soon as it becomes available.



### 3 Review and Update of Existing Information

The baseline studies of the ESIA for the 2014 Nearshore Seismic project (NEC 2013) and the 2019 Nearshore Drilling project (ESL 2018) have been reviewed in order to determine whether its information is applicable for the current study. These baseline studies cover the same area as the current study. First a gap analysis was undertaken, presented in a table, following which updated information is presented as far as required. Preferably this chapter should be read in combination with the original reports.

#### 3.1 Review of existing information

##### 3.1.1 Legal and institutional framework

A review of the applicable regulations, standards, and regulatory bodies governing environmental quality, health and safety, protection of natural, cultural resources and protected areas was presented in the specialist report for the River Seismic part I study (Del Prado 2012, **Appendix 3**). In addition, an addendum was prepared for the River Seismic part II study, focusing on legislative provisions with regard to the environment, land rights and natural resources. This legal addendum was incorporated in the River Seismic part II ESIA addendum (Appendix A). The regulatory and institutional framework applicable to the nearshore area as well as the description of the recent Staatsolie policies, principles and guidelines, have been fully detailed and included in the ESIA for the Nearshore Exploration Drilling Project 2019 (ESL, 2018). As such no update is required (Table 3).

**Table 3: Gap analysis for the legal and institutional framework**

| Section   | Description/Aspects in baseline study of ESL (2018)                      | Required updating and/or addition this study   |
|---|--|--|
| <b>POLICY, LEGISLATIVE AND REGULATORY CONSIDERATIONS</b>            |  |  |
| <i>National Policy and legislation</i>                              |  | No update required; to be referred to Del Prado, 2012  |
| <i>International treaties and convention</i>                        |  | No update required; to be referred to Del Prado, 2012  |
| <i>IFC and Worldbank Guidelines</i>                                 |  | No update required; to be referred to Del Prado, 2012  |
| <i>Corporate environmental policies and standards of Staatsolie</i> | Health, Safety and Environmental Policy<br>Communication Relation Policy | Recent versions of Staatsolie policies and standards are included in the ESIA for the Nearshore Exploration Drilling Project 2019 (ESL, 2018). |

In addition to the legislation discussed by Del Prado (2012), more recent developments comprise (ESL 2018):

- Wet Maritieme zones S.B. 2017 no. 41 (Maritime Zones Act S.B. 2017 no. 41); This law defines the territorial sea of Suriname at 12 nautical miles from the nearest point on the line of the low-water mark along the shore and establishes, the Exclusive Economic Zone (EEZ; 200 nautical miles) for which Suriname claims sovereign rights concerning the exploration, exploitation, conservation, and management of living and non-living resources. Provisions are also made for the granting and revocation of licenses for activities in the EEZ. The Act gives a detailed description of the measures of enforcement that could be used and also prescribes offences and penalties. This Law may be implemented by Government Decree “if matters dealt within this Law require amending for the sake of its proper execution” (Article 17).

Additionally, Article 17 of this Law of April 2017, states that permission from the State Decree is specially required for the deliberate disposal and storage of wastes and other matter within the EEZ be it from vessels, aircraft, platforms or other man-made structures. It also states that a permit is required to carry out operations in the continental shelf which infringe on the sovereign rights.

- National Biodiversity Action Plan (NBAP) 2013; The National Biodiversity Action Plan (NBAP) 2013, was formulated as per Suriname's National Environmental Policy under the jurisdiction of the then Ministry of ATM. As an elaboration of the NBS, the NBAP 2013 identifies 8 objectives consistent with article 6 of the United Nations Convention on Biological Diversity for the protection of biodiversity.

These objectives are as follows:

- Conservation of biodiversity;
  - Sustainable use of biodiversity;
  - Regulated access to genetic material and associated knowledge, with fair and equitable sharing of benefits;
  - Knowledge acquisition through research and monitoring;
  - Capacity building;
  - Raising awareness and empowerment through education and communication;
  - Cooperation at local and international level; and
  - Sustainable financing.
- Fisheries Management Plan (2014 – 2018); this plan was developed in major consultation with the fishing industry in an effort to manage and protect the fisheries of Suriname. Many of the policies outlined in the plan are based on the experience of the actual fishermen. The application of the precautionary principle was employed due to limited information about the state of fish stocks in Surinamese waters. Where it is established that certain fish stocks are under excessive pressure this plan ensures that measures are employed to reduce this pressure. The plan also devotes attention to the effects of fishing on nature by reducing the amount of unwanted catches. This will be achieved by limiting the number of licenses, technical measures regarding fishing methods; and zoning of the fishery.

According to the Ministry of LVV and the agricultural policy, the following are the objectives with respect to fisheries:

- ensuring food security for the entire Surinamese population;
- ensuring food safety in the fishing industry;
- promoting and developing sustainable fisheries;
- the development of the fisheries sector to food producer and supplier for the Caribbean;
- increasing the contribution of fisheries to the national economy;
- creating spatial conditions for the sustainable development of aquaculture;
- managing the risks and constraints in the implementation of the fisheries.

The Fisheries Management Plan 2014 – 2018 was formulated by developing each of the aforementioned objectives. Section 4.5 of the plan explains that fishing zones and protected areas are established with respect to the type of fishing that can be done in the nearshore coastal and deeper waters off the coast of Suriname. During the execution of the project activities, a safety exclusion zone will be established around each seismic activity zone. As such, the Fisheries Management Plan is pertinent in the event of a potential oil spill and impacts to fishermen.

The latter is a plan with regional implications, which made it necessary to review the national plans with the affiliated countries (Brazil, French-Guyana, Trinidad and Tobago, Guyana and Suriname). The revised version is planned to be submitted in the first quarter of 2020.

### ***3.1.2 The biophysical environment***

The information for the biophysical environment was only taken from the more recent 2019 Nearshore Drilling project (ESL 2018). Upon a gap analysis it turned out that hardly any bio-physical data required updating (Table 4).



**Table 4: Gap analysis for the bio-physical baseline**

| <b>Section</b>   | <b>Description/Aspects in baseline study of ESL (2018)</b>   | <b>Required updating and/or addition this study</b>   |
|--|--|---|
| <b>BASELINE CONDITIONS</b>                               |  |   |
| <b>Physical Environment</b>                              |  |   |
| <i>Geology</i>   | Presents geological outline of the coastal plain and the nearshore area including current processes along the coast; stratigraphy of the sediments, source rocks of oil; oil seepage areas along the coast.  | No update required; geology not subjected to short-term changes.  |
| <i>Topography &amp; Soil Type</i>                        | Describes land and soil along the coastline: mangroves, lagoons, mudflats and beaches, and the continental flat; presents geomorphological processes with cyclic accretion and erosion, and westward moving mudbanks and beaches.  | No update required; study conducted for 2017-2018 and no significant changes expected.  |
| <i>Hydrology &amp; Drainage</i>                          | Presents hydrological characteristics of the main Suriname rivers and tidal influence in rivers.   | No update required; based on historical data; information adequate for the current assessment.  |
| <i>Groundwater Resources</i>                             | Describes three main aquifers in coastal plain   | No update required; groundwater resources not impacted by the project.  |
| <i>Climate &amp; Meteorology</i>                         | Presents precipitation, wind speed and direction, and temperature for representative stations in the northern coastal plain, based on data available in 2017; comprises data from ESL station at Weg naar Zee (July-December 2017). Includes overview of natural disasters.  | No update required; the long-year data properly represent climatic conditions in the study area. Information adequate for assessment. |
| <i>Bathymetry &amp; Seafloor Surface Characteristics</i> | Presents isobaths (1 m intervals for nearshore and 10 meter for deep water) as measured in 2014 and 2017)  | No update required; recent information is adequate for assessment.  |
| <i>Oceanography</i>                                      | Describes tides, waves and currents in the study area. Includes data from ESL collected in the period October-December 2017.   | No update required; historic and recent information is adequate for assessment.   |
| <i>Marine Sediment Quality</i>                           | Describes sediment quality and chemical parameters along the full length of the Suriname coast, but with focus on the study area; 245 stations have been sampled during the dry and the rainy season. Data were compared with 2013 data from the Block IV (western part of current Block C; ESL 2013b).  | No update required; adequate coverage with recent sampling results.   |
| <i>Marine Water Quality</i>                              | Describes water quality and chemical parameters along the full length of the Suriname coast, but with focus on the study areas; 61 stations have been sampled at three depths (top, middle and bottom) during the dry and the rainy season. Data were compared with 2013 data from the Block IV (western part of current Block C; ESL 2013b). Parameters include pH, temperature, dissolved oxygen, salinity, total suspended solids, heavy metals, chlorophyll-a and nutrients. | No update required; adequate coverage with recent sampling results.   |
| <i>Ambient Air Quality (Offshore)</i>                    | Previously conducted studies (ESL 2012 and 2013b) show that offshore ambient air quality is negatively affected in a very insignificant manner, owing to rapid dispersal of potential contaminants by high wind speeds offshore.   | No update required; air quality is good (2017/18) and no new emission sources identified since.                                       |
| <i>Ambient Surface Noise (Above Water; Offshore)</i>     | Expert advice to NIMOS that above-water noise in the nearshore area may not be relevant (no receptors); noise measurements made along coastline and further onshore at 7 locations between west and east Suriname (July 2017).   | No update required; adequate coverage with results of recent measurements.  |

| <b>Section</b>                                   | <b>Description/Aspects in baseline study of ESL (2018)</b>   | <b>Required updating and/or addition this study</b>   |
|--|--|---|
| <i>Underwater Noise.</i>                         | The ambient noise quality (underwater) of the nearshore marine environment of Suriname is described using previously conducted studies (ESL 2012: ambient noise levels, and CSA 2015a: both ambient and noise of airgun output). These studies are deemed sufficient to describe the ambient underwater noise levels within the nearshore marine environment, given that in general there is fairly low activity within Blocks A to D. | No update required; adequate coverage with recent measurement results.  |
| <b>Biological Environment</b>                    |  |   |
| <i>Macro-benthic organisms</i>                   | Describes macro benthic composition for 245 stations along the full length of the Suriname coast, with focus on the study areas; stations have been sampled in triplicate during the 2017 dry and rainy season. Data were compared with data from the Block IV (western part of current Block C; ESL 2013a+b).   | No update required; more than adequate coverage with recent survey results.   |
| <i>Other Benthic Habitats &amp; Fauna</i>        | Other habitats are described from literature, concluding that the soft bottom habitat is dominant, while most other habitats (and fauna) are absent, outside the study areas, or only present as small isolated spots.   | No update required; dominating habitat (and fauna) has been adequately described.   |
| <i>Plankton</i>                                  | Describes phyto- and zooplankton composition at 6 stations during the 2017 dry and the rainy seasons; samples taken at different depths and 2 times of the day (morning and afternoon).  | No update required; adequate coverage.  |
| <i>Marine Mammals</i>                            | Information regarding marine mammals within the nearshore and offshore areas of Suriname is taken from several secondary data sources, including previous ESIA studies within and near the area, and recent observation reports (De Boer 2013, 2015, CSA 2015b). No other formal primary data collection exercise was undertaken.  | No update; most recent information is already included in ESL 2018.   |
| <i>Sea Turtles</i>                               | Information regarding sea turtles within the nearshore and offshore areas of Suriname is taken from several secondary data sources, including previous ESIA studies within and near the area, and observation reports (De Boer 2013, 2015, CSA 2015b). No other formal primary data collection exercise was undertaken, but informal observations have been made during sampling trips.  | Some minor update may be required, based upon recent information by LBB and WWF (see Ch. 3.2.1).  |
| <i>Fish &amp; Shellfish</i>                      | Information about marine fish and shellfish within the nearshore and offshore of Suriname was prepared from a considerable number of sources of published information, and information from the Fisheries department.  | No update to be made; no additional recent information has become available   |
| <i>Vegetation Types &amp; Coastal Ecosystems</i> | A general overview of the terrestrial ecosystems south of the coastline is presented based on Google images (2009-2016 period). The ecosystems directly along the coastline have been checked and detailed by means of aerial photographs (July 2017) and a field survey (February 2018) along the full length of the coastline.   | No update required; no essential changes along the coastline occurred. The zone in which the turtles nesting beaches are present has remained the same, being from the Suriname River till the Marowijne River. |

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| <b>Section</b>                                   | <b>Description/Aspects in baseline study of ESL (2018)</b>   | <b>Required updating and/or addition this study</b>   |
|--|--|---|
| <i>Avifauna</i>                                  | Information about birds (species, numbers, seasonality) within the estuarine zone (including nearshore) and offshore of Suriname was prepared from a considerable number of sources.               | No update required; no records of new species for Suriname reported for the estuarine zone and nearshore area since 2015<br>( <a href="http://www.surinamebirds.nl/php/intro_e.php">http://www.surinamebirds.nl/php/intro_e.php</a> ; accessed July 31, 2019) |
| <i>Terrestrial mammals</i>                       | Very brief and general information on possibly occurring mammals, not focused on estuarine zone  | No update required; considered irrelevant for the current study   |
| <i>Herpetofauna</i>                              | Very brief and general information on possible Herpetofauna species, not specifying for coastal zone.  | No update required; considered irrelevant for the current study   |
| <i>Summary of sensitive species and habitats</i> | Sensitive taxa are listed for marine mammals, sea turtles, fishes and birds. Also sensitive seasons are presented. The estuarine zone is considered to be critical in the support of biodiversity. | No update required; no changes to IUCN Redlist for Suriname since May 2018.   |
| <i>Protected areas</i>                           | Describes four MUMAs and three Nature Reserves along the coast.  | No update required; no change in status of protected areas.   |

### 3.1.3 The socio-economic environment

Results of the review of the 2014 Nearshore Seismic ESIA Social Baseline Study are presented below (Table 5). As the previous Social Baseline was assembled about 5 years ago, it is probable that socio-economic changes have transpired, which may comprise changes in area users, changes in demographics, and type of activities conducted in the project area. The socio-economic baseline conditions presented in the 2014 report were verified by integrating primary and secondary data. As such an update was required for the fisheries sector, shipping traffic and tour operators.

**Table 5: Gap analysis for the social baseline**

| Section                           | Description/Aspects in baseline study of the 2014 Nearshore Seismic Project  | Required updating and/or addition this study  |
|-----------------------------------|--|---|
| <b>Socio-Economic Environment</b> |  |   |
|                                   | Statement: “The coastline of Suriname is uninhabited and there are no communities directly along the coastline.”                     | Updated   |
|                                   | Statement: “No direct impacts will be experienced by stakeholders living in the zone near the sea, given the distance to the ocean.” | Still valid. No update required.  |
|                                   | Statement: “Potential impacts from the seismic project could therefore only arise for other water users in the project area.”        | Still valid. No update required.  |
| <i>Fisheries</i>                  | Artisanal fisheries  | Updated. Some changes in data/statistics may have occurred.   |
|                                   | Traditional fisheries (conducted by the Indigenous Peoples of Galibi)  | Still valid, however not applicable for current study, since the proposed 3D seismic survey areas do not occur in the vicinity of Galibi. |
|                                   | Industrial fishing   | Updated. Some changes in data/statistics may have occurred.   |
| <i>Shipping traffic</i>           |  | Updated. Some changes in data/statistics may have occurred.   |
| <i>Tour operators</i>             |  | Updated. Some changes in data/statistics may have occurred.   |

## 3.2 Update of existing information

This section details the sections that need to be updated for the current study. The introduction has been updated in Chapter 1 and the project description in Chapter 2. The next section presents the updated information of the socio-economic environment.

### 3.2.1 The socio-economic environment

The social environment has again been described in full. The results are presented in **Appendix 1**.

From the report it can be concluded that resource users that can be found within the study area that are likely to be affected by the anticipated project comprise: fishermen, tour operators, tour guides and tourists, oil and gas companies, NGOs (Non-Governmental Organizations) and Community Based Organizations (CBOs), and marine transport users. The shoreline of Suriname is mainly a natural shoreline consisting of mangrove, pans, and mudflats. The coastal population is not settled directly at the shoreline, but a few kilometers land inwards, so there is no man-made infrastructure or direct access to sea except at very few locations such as Weg naar Zee (religious temple), Coronie (dike), and Nieuw-Nickerie (dike).

#### Fisheries

The fisheries sector is divided in artisanal fisheries and industrial fisheries. The artisanal fisheries distinguish two types of fishing licenses: BV (Binnenvaart) for fishing in inland waterways and the

estuarine zone, and Suriname Coast or SK (Suriname Kust) for fishing in the coastal area. In 2018, 544 licenses were granted to the BV fishers and 496 licenses to the SK fishers. According to the Fisheries Department, March – August is considered the high season for the artisanal fishery, with a peak period around mid-July; however, artisanal fishing in the Suriname River and at the river mouth generally takes place during the whole year. Artisanal shrimp fishing occurs during May-August, mostly in the Suriname River, with May and June considered as the peak months. (SRK, 2019). In industrial fisheries, 4 categories are differentiated, namely line fishing, shrimp trawling, Seabob trawling and fish trawling. The number of licenses issued to industrial fishers in 2018 (based on data presented by the Fisheries Department), were as follows:

- Line fishing: 235
- Shrimp trawling: 24
- Seabob trawling: 26
- Fish trawling: 44.

With regard to the industrial fishery, shrimp and fish are caught year round (SRK, 2019).

Overall, the stakeholders from the fisheries sector consulted for the proposed Nearshore 3D Seismic Project agreed that SK (Suriname Kust) / SKB (Suriname Kust Bangamary) boats and Seabob shrimp trawlers have their fishing grounds located in the area under study. It is unlikely that BV fishers will enter the project area; however, they may be impacted if the project affects the coastal fish and shrimp resources. In the interest of safety, it is necessary to share relevant project information with the BV fishermen (and boat owners) together with the other stakeholders from the fisheries sector during project implementation.

#### **Nature conservation and protection efforts**

Consulted stakeholders stated that there is an increase in number of dead marine turtles found on local beaches and in local rivers; it is presumed that these deaths are related to the fisheries by-catch. Also a significant decline in turtle nest numbers was noticed and decreasing numbers with regard to the sub-population of sea turtles in the region (Pers. comm. H. van Lavieren, 20 June 2019). The International Union for Conservation of Nature (IUCN) has recently adjusted the conservation status of the ‘aitkanti’ sea turtle (*Dermochelys coriacea*) from vulnerable to endangered on the so-called ‘Red List’. In Suriname, the ‘aitkanti’ has 90% of its nesting grounds at Braamspunt and the remaining 10% at Galibi. For the ‘krape’ sea turtle (*Chelonia mydas*) it is the other way around.

WWF (World Wildlife Fund), CI (Conservation International), GHFS (Green Heritage Fund Suriname), together with the NCD (Nature Conservation Division – *Natuurbeheer*) are conducting environmental protection and conservation projects in the coastal area together with artisanal fishermen (and other actors) to promote sustainable fisheries and help address abovementioned problems. GHFS and WWF have recently launched an important project together with the MAS that is part of their Marine Spatial Planning (MSP) Program. It is the Participatory Three Dimensional Modelling (P3DM) component of the MSP program.

#### **Freight shipping and ports**

Shipping traffic in the nearshore area involves circa 200 ships traversing the nearshore area each month. In addition to the international shipping traffic, traffic is also generated by wood transports from Nickerie to Paramaribo on pontoons that are hauled by barges. Water traffic in the nearshore and marine areas includes Coast Guard and MAS (Maritime Authority Suriname) patrol vessels, fishing boats, and freight traffic. Freight ships frequent the area beyond 6 nautical miles from the shore and utilize the navigation routes between Trinidad & Tobago, Guyana, Suriname and Brazil to travel between countries. The updated ESIA report for the SRDP (SRK, 2019) conveyed that numerous ports and terminals are situated in the Suriname River including the main port of Suriname, the Dr. Jules Sedney Terminal that processes about 50% of Suriname’s seaborne trade capacity and accommodates on average 35 vessels per month.

**Tourism and recreation**

There are many dolphins (also known as the river dolphins) present at the Suriname River mouth. Ten tour operators, working with approximately 20 boat owners, offer dolphin tours on the Suriname River in possible combination with sea turtle watching tours at Braampunt. During high season (July-December), tour operators run 10-20 tours per month, with up to about 20 persons per tour.

In general, various stakeholders emphasized the importance of timely and appropriate communication of the seismic schedule to key stakeholders, also timely sharing of adjustments made to the schedule of activities. Stakeholders were mostly concerned about the potential impacts on livelihoods of the artisanal fishermen active in the nearshore area as a result of the seismic acquisition (loss of income due to decrease in fish catch, because the fish are being chased away by the seismic survey; and loss of income due to damaged fishing gear). A major environmental concern voiced by consulted stakeholders regarded possible adverse effect(s) of the seismic surveys on the fish and sea turtles. Overall, very few complaints were registered and no relevant incidents reported by stakeholders. Suggestions for improvement of communication, offered by stakeholders, were minor.

## 4 Potential Impacts and Proposed Mitigation

### 4.1 Introduction

In below sections the potential impacts of the Nearshore 3D Seismic Acquisition Project will be evaluated. Due to the resemblance with previous similar projects in the same nearshore area, the evaluation comprised:

- Overview and applicability of the impacts and mitigation measures of the Nearshore 2D Project (NEC 2014) and specific measures for the 3D aspects of the Block IV 2D and 3D Seismic Program (ESL 2011)
- Discussion of additionally identified impacts
- Efficiency of proposed mitigation measures of the Nearshore 2D Seismic Project, based on the monitoring results
- Experience of stakeholders with the Nearshore 2D Seismic Project and possible improvements to be made in the Nearshore 3D Seismic Communication Plan
- Any cumulative impacts

### 4.2 Biophysical

#### *4.2.1 Overview of the potential impacts of previous Nearshore Seismic Projects*

Part of the impacts that were identified for the Nearshore 2D Seismic Project (NEC 2014) come from the River Seismic Project (ESL 2011), while others were specifically identified for the first mentioned project.

Most impacts that were identified for the Nearshore 2D Seismic Project are also applicable for the current Nearshore 3D Seismic Project, but some are no longer relevant because - unlike the Nearshore 2D Seismic Project - the Nearshore 3D Seismic Project will not cover the full length of the Suriname coast and some impacts that are specific for eastern Suriname are discarded.

Because the River Seismic and the Nearshore2D Seismic refer to 2D seismic acquisition, the impacts identified for the 3D seismic acquisition in Block IV (ESL 2011) have been included as additional impacts for the current project.

Mitigation measures presented in above ESIA studies are in principle the same, but some adjustments may occasionally be required in case of specific reference to locations. These adjustments will be included in the Environmental and Social Management Plan (ESMP) for the Nearshore3D Seismic Project. Vessel operators should have their own management plans in place (waste management, oil spill plans, emergency plans and other supporting plans), which should be an integrated part of the ESMP. In addition, reference is made to the existence of a National Oil Spill Contingency Plan (NOSCP) of which NCCR is the owner. In case of a transboundary oil spills, NOSCP will provide the required framework and guidance.

**Table 6: The potential biophysical impacts of the Nearshore2D Seismic Project and their applicability for the Nearshore 3D Seismic Project – impacts originating from the River Seismic project**

| ID RS                   | Description  | Impact          | Applicability for the current project   | Residual impact |
|-------------------------|--|-----------------|---|-----------------|
| <i>Negative impacts</i> |  |                 |   |                 |
| N3                      | Noise impacts on breeding colonies   | Major           | Applicable  | Negligible      |
| NR1                     | Loss of environmental integrity of the Coppename-monding Nature Reserve                          | Major           | Also applicable for the Wia-Wia Nature Reserve, in case the project would move into that area | Negligible      |
| N4                      | Impacts of sound pressure waves on aquatic life  | Major (unknown) | Applicable  | Minor           |
| CUM                     | Simultaneous operation of airguns in other offshore blocks and the Nearshore Seismic survey area | Major (unknown) | Applicable in case of noisy activities elsewhere in the Nearshore or Shallow Offshore         | Negligible      |
| N1                      | Noise impacts on human receptors   | Minor           | Not applicable; no receptors  | Minor           |
| N2                      | Noise impacts on terrestrial fauna (general)   | Minor           | Not applicable; no receptors  | Minor           |
| N5                      | Impacts of underwater sound pressure waves on divers and swimmers                                | Minor           | Not applicable; no receptors  | Negligible      |
| WR1                     | Water contamination around the seismic survey vessels due diesel and gasoline spills             | Minor           | Applicable  | Negligible      |

**Table 7: The potential impacts of the Nearshore 2D Seismic Project and their applicability for the Nearshore 3D Seismic Project – additional impacts identified for the Nearshore 2D Seismic Project**

| Description  | Impact | Applicability for the current project   | Residual impact |
|--|--------|---|-----------------|
| Impacts to sea turtle hatchlings, for instance avoidance behavior and disorientation | Major  | Applicable for the Nearshore area north of the Commewijne and Marowijne districts | Minor           |
| Vessel illumination affects sea turtles and fishes                                   | Minor  | Applicable  | Negligible      |

**4.2.2 Additional potential impacts and additional information on already identified impacts**

Although the Nearshore 3D Seismic Project is conducted in almost the same area as the Nearshore 2D Seismic Project there are some operational differences that require the inclusion of an additional impact. The main differences are:

- The capacity of the airgun array for the current project is currently not yet known, but may exceed the one used for the 2D Seismic Project. This could imply that a potential underwater



noise impact will reach farther from the source. However, the required mitigation measures will be the same.

- The 2D Seismic project was conducted with streamer technology, while for the Nearshore 3D Seismic Project, in addition to the use of 3D streamer technology, OBC and/or OBN technology is considered. OBC has been used for the Block IV Seismic Program.

For the latter issue, the impacts and mitigation measures for the 3D seismic survey of Block IV (ESL 2011) have been reviewed below.

The impacts associated with these issues and the required mitigation measures are discussed and evaluated in below section.

### **Cable Deployment and Retrieval**

OBC (Ocean Bottom Cable) technology involves laying sensor cables (with geophones and hydrophones), attached from the cable boat, along the seabed and attaching receiver cables from the recorder vessel to the sensor cables. Cable retrieval involves detaching the receiver and sensor cables from each other, and lifting the sensor cables off the seabed.

For OBN (Ocean Bottom Nodes) technology nodes with recorder and storage equipment are placed at the bottom in a grid. Contrary to OBC, the nodes are not connected to a recorder vessel, but the information is stored in the node, to be downloaded after retrieval of the nodes.

Cable or node deployment and retrieval will be done frequently and continuously for the duration of the survey. On any given day during the seismic survey, the OBC will be deployed and retrieved over an area of @@<sup>1</sup> km<sup>2</sup>.

Soft bottom dwelling benthic organisms and fisheries may be affected by cable deployment and retrieval.

When the sensor cables or nodes are laid at the seabed, soft bottom dwelling benthic organisms found inhabiting the seabed directly under the cables will be crushed.

Indirectly, soft bottom dwelling benthic organisms adjacent to the sensor cables may be smothered by the seafloor sediments that were displaced during deployment.

The @@ km<sup>2</sup> area for cable and node deployment will be temporarily restricted to other users or activities, namely fishermen or fishing. This 'exclusion zone' will affect fisheries in the same way that an 'exclusion zone' from anchoring would, by restricting the passage of fishing vessels and fishing activity through or within the zone.

The impact on soft bottom organisms is considered minor (Table 6). The bottom organisms have fast regeneration times, so that the negative impacts from cable/node deployment and retrieval will mostly likely only affect a very small portion of their populations and will not threaten the populations as a whole.

**Table 8: Significance of impact of cable/node deployment and retrieval on soft bottom organisms**

|                                      | <i>Intensity</i> | <i>Duration</i> | <i>Scale</i> | <i>Severity</i> | <i>Probability</i> | <i>Significance</i> | <i>Status</i> |
|--------------------------------------|------------------|-----------------|--------------|-----------------|--------------------|---------------------|---------------|
| Without mitigation                   | Medium           | Short-term      | Small        | Low             | High               | <b>MINOR</b>        | neg           |
| <u>Mitigation measures:</u>          |                  |                 |              |                 |                    |                     |               |
| • No mitigation required or possible |                  |                 |              |                 |                    |                     |               |
| With mitigation                      | Medium           | Short-term      | Small        | Low             | High               | <b>MINOR</b>        | neg           |

<sup>1</sup> Not yet known

Potential impact of cable/node deployment and retrieval on fisheries was evaluated to be of **moderate** significance, because the intensity will be medium, short-term and of a medium scale. Probability is medium. Mitigation measures are presented, which require implementation, because otherwise the project cannot proceed (Table 7).

It is noted that the mitigation measures presented in Table 7 are already included in the ESIA and the ESMP for the Nearshore 2D Seismic project, because a similar impact occurs through the presence of seismic activities at the surface e.g. airgun shooting as part of the OBC/OBN data acquisition. Therefore, the mitigation measures presented in Table 7 do not need to be added to the ESMP.

**Table 9: Significance of impact of cable/node deployment and retrieval on fisheries**

|  | <i>Intensity</i> | <i>Duration</i> | <i>Scale</i> | <i>Severity</i> | <i>Probability</i> | <i>Significance</i> | <i>Status</i> |
|--|------------------|-----------------|--------------|-----------------|--------------------|---------------------|---------------|
| Without mitigation   | Medium           | Short-term      | Medium       | Medium          | Medium             | <b>MODERATE</b>     | neg           |
| <u>Mitigation measures:</u>  |                  |                 |              |                 |                    |                     |               |
| <ul style="list-style-type: none"> <li>• In order to ensure the safety of fisher folk and minimize disturbance to fishing activity good communication and open dialogue will be established and maintained between Staatsolie and the fisher folk of the wider study area for the entire duration of the Project. This will be facilitated via Fishing Liaison Officers and the Fisheries Department of the Ministry of Agriculture (LVV).</li> <li>• The selected Seismic contractor will need to develop and implement a Traffic Management and Community Relations Plan as necessary and based on fisher folk concerns and potential fisheries impacts.</li> <li>• Project activities will take place over the shortest time period required.</li> <li>• A chase vessel will be used to ward off approaching vessels and warn them of the restricted areas.</li> <li>• If possible, project activities will take place in a manner which will minimize conflict between Staatsolie and fisher folk (particularly conflicts related to vessel movements). Open communication will be maintained via the Staatsolie Community Relations Department. Fishing Liaison Officers shall communicate with the fishing communities in matters relating to claims and compensation (one of the major losses to fishermen include the destruction of driftnets as a result of vessel movement in the area), and noting the concerns of the fishermen.</li> </ul> |                  |                 |              |                 |                    |                     |               |
| With mitigation  | Medium           | Short-term      | Small        | Low             | Medium             | <b>NEGLIGIBLE</b>   | neg           |

#### **4.2.3 Review of monitoring and compliance information of the Nearshore 2D Seismic Project**

During the Nearshore 2D Seismic Survey in 2014, CSA (2015a) conducted monitoring measurements of the sound pressure level. The seismic survey was initiated on 29 June 2014 and was completed 28 November 2014. Measurements were made along three S-N lines in front of the districts of Commewijne, Saramacca and Nickerie, with three measuring locations along each line. Ambient sound levels ranged from 115 to 125 dB re 1  $\mu$ Pa. At a distance of 500 meter from the sound source array, an average increase of 53 dB re 1  $\mu$ Pa SPLrms above the average ambient noise levels was measured, with values between 171 and 177 dB re 1  $\mu$ Pa. It is concluded that the acoustic output levels of the seismic survey remained below the ESMP criterion of 180 dB re 1  $\mu$ Pa at 500 m.

Marine fauna observations were conducted by CSA (2015b) throughout the seismic survey. The results can be summarized as follows:

- A total of 747 hours of visual observation was conducted.
- A total of 19 recorded live-animal sightings were recorded during production (seismic acquisition phase of the project), which consisted of 2 records of unidentified dolphins, 1 record of false killer whales, 2 records of Atlantic spotted dolphins, 13 records of Guiana dolphins, and 1 adult leatherback turtle.
- There were 4 recorded sightings of dead animals during production: 3 leatherback turtles and 1 unidentified dolphin. All these animals showed moderate to extensive decomposition and

signs of interaction with fishing gear; therefore, they were not killed by activities associated with the seismic survey.

- There were 4 post-production phase sightings, all of which were Guiana dolphins.
- There were no mitigation actions required during the production survey.
- No marine mammals or sea turtles were observed injured or in distress during the post-production surveys, and sighting records described normal behaviour in post-production survey observations.

Monthly compliance reports have been prepared by the HSEQ Division of Staatsolie (2014a, b, 2015) for the full seismic survey period. The results for the last three months have, however, been bundled in one report (Staatsolie 2015). The reports were submitted to NIMOS. Each report is compiled on the basis of the following information:

- Daily MMO summaries
- Monthly MFO Report (annexed to report)
- Waste records
- Monthly Community Relations Reports (annexed to report)
- Weekly HSE checklists

It is noted that no HSE checklists were submitted for the first month (Staatsolie 2014a). Compliance (Y/N) was determined using the specification table in the ESMP, with the addition of a comment where required. All reports indicate 100 % compliance to the specifications stipulated in the ESMP. No environmental incidents have been reported.

## **4.3 Socio-economic**

### ***4.3.1 Overview of the potential impacts of previous Nearshore Seismic Projects***

The impact analysis focused on Project Affected Persons (PAPs), meaning the social groups (e.g. individuals, communities) that inhabit or make use of the area under study and are most likely to be affected (either directly or indirectly) by the planned project. Most impacts that were identified for the Nearshore 2D Seismic Project are also applicable for the current Nearshore 3D Seismic Project

Additional potential impacts were determined based on newly obtained information from primary and secondary sources. The table below shows the result of the updated social impact assessment.

**Table 9: The potential socio-economic impacts of the Nearshore 2D Seismic Project and their applicability for the Nearshore 3D Seismic Project**

| ID RS                   | Description  | Impact   | Applicability for the current project | Residual impact |
|-------------------------|--|----------|---------------------------------------|-----------------|
| <i>Negative impacts</i> |  |          |                                       |                 |
| S1                      | Destruction of fishing gear  | Moderate | Applicable                            | Negligible      |
| S2                      | Loss of income for artisanal fishers, including the boat owners                      | Moderate | Applicable                            | Negligible      |
| S3                      | Short- or long-term loss of income for the tourism industry                          | Moderate | Applicable                            | Negligible      |
| S4                      | Vessel accidents   | Major    | Applicable                            | Negligible      |
| S5                      | Hindrance of harbor traffic and industrial fishers                                   | Moderate | Applicable                            | Negligible      |
| S6                      | Impacts on conservation research and management of protected areas                   | Minor    | Not applicable; no river sections     | Negligible      |
| S7                      | Pirate attacks   | Major    | Applicable                            | Negligible      |
| <i>Positive impact</i>  |  |          |                                       |                 |
| S8                      | Income generation for businesses near places where the research crew will be hosted. | Minor    | Applicable, also for other services   | Moderate        |

**Table 10: Additional impacts identified for the Nearshore 3D Seismic Project**

| Description   | Impact                       | Applicability for the current project | Residual impact |
|---|------------------------------|---------------------------------------|-----------------|
| Simultaneous operation of SRDP and Nearshore Seismic in Block C   | Major (unknown significance) | Applicable                            | Moderate        |
| Simultaneous operation of exploration drilling near Block A, in the border area with Guyana, and Nearshore Seismic survey | Major (unknown significance) | Applicable                            | Moderate        |

**4.3.2 Additional potential impacts and additional information on already identified impacts**

Two additional impacts were identified for the Nearshore 3D Seismic Acquisition Project:

- One potential cumulative impact exists in Block C if the SRDP and Nearshore Seismic are conducted at or around the same time.
- One potential cumulative impact may be experienced if there is simultaneous operation of exploration drilling near Block A, in the border area with Guyana, and Nearshore Seismic survey.

### Cumulative impact **CUM1: Simultaneous operation of SRDP and Nearshore Seismic in Block C**

Description: In the early 2000s the State of Suriname embarked on studies for the proposed Suriname River Dredging Project (SRDP). Project proponent MAS now intends to reactivate the SRDP that is expected to commence in September 2019 (Pers. comm. MAS, 26 June 2019). The project area covers a 68 km stretch of the lower section of the Suriname River and entails capital (initial) dredging, to remove sediment from the sections of the riverbed and deepen and widen the shipping channel, and maintenance (on-going) dredging, to maintain the channel depth. Capital dredging will last for up to 6 months after commencement. Maintenance dredging will be undertaken periodically during the subsequent 5-year period (SRK, 2019).

Possible mitigation measures: The MAS (as project proponent of SRDP) and Staatsolie must come together to discuss the best way to attune and adjust schedules. Additionally, determination of those stakeholders/stakeholder groups that most likely will be impacted by both projects and formulation of suitable mitigation measures including timely and effective communication to avoid or minimize adverse impacts to those stakeholders and the propagation of positive benefits for revealed stakeholders.

### Cumulative impact **CUM 2: Simultaneous operation of exploration drilling near Block A, in the border area with Guyana, and Nearshore Seismic Survey**

Description: Potential cumulative impacts may arise at the Suriname-Guyana border if Seismic activities will take place in that border area at the same time as Oil and Gas activities conducted by the Guyanese.

Possible mitigation measures: Staatsolie must see to it that if any activities are planned near the border of Guyana, the Staatsolie will timely communicate this with relevant Guyana parties through the Suriname Ministries of Natural Resources and Foreign Affairs and in close engagement with the Suriname Coastguard. Although the probability that seismic and other exploration activities of Staatsolie will be executed simultaneously in the study area is minimal (Pers.comm. N. Poeketi, 4 June 2019), this should be further investigated and avoided where possible by Staatsolie. It should be mentioned that a committee has been installed on both sides of the Suriname-Guyana border and that the countries have initiated discussions (facilitated by Suriname Coastguard/NCCR) around notification protocols and preparedness for joint response efforts in case of an oil spill.

### ***4.3.3 Review of monitoring and compliance information of the 2014 Nearshore Seismic Project***

With regard to the execution of the 2014 Nearshore Seismic Project stakeholders' feedback were also gathered. Feedback was collected from the consulted stakeholders about aspects such as: how the communication took place with Staatsolie, how they were informed about the project, and complaints received and shared with Staatsolie. Suggestions for improvement were also collected from stakeholders.

According to the CCU department of Staatsolie<sup>2</sup> with regard to the 2014 Nearshore Seismic Project, Staatsolie implemented several measures to improve stakeholder engagement and consultation, which were as follows:

- Staatsolie worked with a policy that included guidelines for stakeholder meetings.
- Staatsolie utilized a complaints procedure/system to manage the complaints received. The complaints procedure is mentioned at each stakeholder meeting. At public sessions standard procedures such as Grievance Mechanism are communicated. The complaints procedure has been utilized by stakeholders. A project-specific procedure based on the general CCU Corporate procedure was developed for Nearshore Drilling. Staatsolie has noticed a decline in the number of complaints registered.

<sup>2</sup> Pers.comm. S. Alfaisi, 28 June 2019; Document transfer, 28 June 2019; and Email correspondence, 9 July 2019

- Staatsolie communicated with stakeholders in a variety of ways. Mainly through announcements made in the local media (radio, newspapers etc.), stakeholder meetings, and one on one meetings. In 2014 Staatsolie facilitated stakeholder consultation meetings that were led by the consultant(s) in charge of the social study. During the Nearshore Drilling Project, the CR officer from Staatsolie was also involved in an App group with the fishermen to communicate important messages in a timely manner.
- The Fisheries Department was approached to assist with the mobilization of the local community at Boskamp. In Galibi, Staatsolie visited the community and explained the seismic project. The local community wanted Staatsolie to honour the FPIC (Free and Prior Informed Consent) process and Staatsolie followed suit.
- Fishermen who claimed that their fish nets were damaged due to project activities were financially compensated by Staatsolie, even though guilt was not proven. As part of the communication plan drafted for the 2014 Nearshore Project, the Community Relations Department settled the matter with the complainant (Pers.comm. N. Poeketi, 4 June 2019).
- Staatsolie hired foreign environmental experts to monitor the situation and to conduct measures for minimization of negative impacts to the environment.

Overall, very few complaints were registered and no relevant incidents reported. Minor complaints and/or input given by stakeholders can be summarized as follows:

- Some stakeholders were not properly or timely informed.
- Lack of follow-up or much delayed feedback in responding to inquiries or presented issues.
- Changes in the seismic acquisition not communicated in a timely manner.
- Fish are chased off by the seismic survey.
- Fisheries Liaison Officers (FLOs): issues with logistics organization e.g. late delivery of PPE for the FLOs and dissatisfaction with the remuneration of the FLOs.

At the beginning of the project the fishermen complained about nuisance coming from the vessels that were delivering project supplies; at times project crew boats were going too fast on the river, and that fishermen did not always receive flyers (Email correspondence Staatsolie, 9 July 2019). After the 2014 Nearshore Seismic Project was finished, fishermen claimed that their fishing nets were damaged by one of the seismic vessels. These fishermen were financially compensated, even though Staatsolie's culpability was not proven, but the case was approached from a social perspective (Pers. comm. S. Alfaisi, 28 June 2019).

Review of the communication plan drafted by the social assessment consultants for the 2014 Nearshore Seismic SIA, together with analysis of feedback obtained from consulted stakeholders for the 3D Nearshore Seismic and review of the ESIA report produced for Nearshore Exploration Drilling (ESL, 2019) suggests that the project proponent has executed the Communication Plan as proposed by Noordam Environmental Consultancy (2014). Hence, suggestions for improvement offered by stakeholders were minor.

#### **4.4 Conclusion**

The analysis of the impacts for previous seismic projects has learned that virtually all impacts that were identified and assessed for previous seismic projects also apply for the current project. A few additional impacts were identified and assessed, but mitigation measures are already included to mitigate related activities for previous projects. This implies that the specifications table and associated procedures in the Nearshore 2D Seismic ESMP (NEC 2014a) are also valid for the current project. The only changes to the ESMP are the specific plans that should be in place, which are to some extent specific for a certain company. These plans, like the waste management plan, the

emergency response plan, spill response plan, the traffic plan and supporting plans as relevant will be submitted by the Seismic Contractor. Upon request of Staatsolie, the format of the Nearshore 3D Seismic ESMP will be changed to the format as used for the 2019 Nearshore Drilling ESMP (ESL 2018).

## 5 Public Consultation

Public consultation is a key component that runs throughout the ESIA process. During the first phase of the process, key stakeholders were identified and consulted; also see the previous section and **Appendix 1**. All minutes of initial consultations have been included in **Appendix 2A**.

The ESIA Public Consultation Meeting was held on the 4<sup>th</sup> of October 2019, after this document was submitted to NIMOS for review. In this meeting the Environmental and Social Baseline conditions together with the Impacts Assessment of the proposed project from this document were presented to the stakeholders. The comments of the stakeholders and NIMOS have been processed in this document to complete the final ESIA report for the Staatsolie Nearshore 3D Seismic Acquisition Project.

In total 27 persons attended this meeting. Additional feedback was given on the following:

- In the ESIA the peak for marine turtle season is March until June, but it actually lasts longer for a few months.
- Mitigation measures for instance having Marine Mammal Observers/Marine Faunal Observers on board of the vessels have been considered but these are only applicable for the adult sea turtles. Turtle hatchlings are not visible to MMO/MFO and they emerge from the nests after about 2 month.
- The International Union for Conservation of Nature (IUCN) has a so-called Red List of Threatened Species (also known as the IUCN Red List or Red Data List that specifies the conservation status of a species) and recently the ‘aitkanti’ status has been adjusted from vulnerable to endangered.
- WWF/GHFS together with the MAS have recently launched an important project that is part of the Marine Spatial Planning (MSP) Program. It is the Participatory Three Dimensional Modelling (P3DM) component of the MSP program. A lot of information has been received from different stakeholders during this project, but the feedback from Staatsolie was poor or lacking.

In return, Staatsolie explained that they will consider the feedback on sea turtles by adjusting the planning for execution of the project. As for the lack of information in the MSP Program, Staatsolie mentioned that all information about water depths has been shared with the MAS. The ESIA minutes of meeting and underlying documents are presented in **Appendix 2B**.



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