SASOL PETROLEUM MOZAMBIQUE

AREA CATEGORISATION OF NHANGONZO, INHAMBANE, MOZAMBIQUE

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IMPACTO
PROJECTOS E ESTUDOS AMBIENTAIS

Non Technical Summary

In 2014, ecologists working for Sasol identified a possible Critical Habitat between Vilanculos and Inhassoro, consisting of a coastal stream (known as Nhangonzo) and its associated catchment. In 2015, this assessment was supported by a second team of ecologists, while making it clear that there was still some uncertainty associated with the Critical Habitat designation. In authorising the drilling of two wells proposed by Sasol within the boundaries of the possible Critical Habitat, MITADER stipulated that a management approach for Nhangonzo must be finalised to guide any oil and gas activities, including the preparation of a Biodiversity Management Plan. This plan was to take into consideration options for biodiversity management, in conjunction with other stakeholders with interests in the area, to minimise the impact of oil and gas development in the Nhangonzo catchment.

The present Area Categorisation study (hereafter referred to as 'the study') was commissioned as a final detailed review of the designation of the Nhangonzo area as a provisional Critical Habitat, taking into consideration new information and understanding of IFC Performance Standard 6 and the changing legal and policy context for managing biodiversity in Mozambique. The study was also required to reassess the previously proposed options for managing the Nhangonzo area (as workshopped with stakeholders in 2015), in consultation with the district and national stakeholders who were involved in the earlier studies. Consideration was also to be given to confirming and/or revising the restrictions on additional oil and gas development in the area. The final task of the study brief, subject to the findings regarding Critical Habitat, was to prepare a Biodiversity Management Plan (BMP) for the Nhangonzo area.

The reassessment of the status of the Nhangonzo catchment has found that most of the habitats in the area, including the coastal wetland system, do not meet the IFC criteria for Critical Habitat. Only 63.4 ha of Coastal Dune Thicket / Forest, located in a narrow strip along the north and south side of the Nhangonzo Estuary warrants designation as Critical Habitat under Criterion 2 (Endemic and Restricted Range species), based on the presence of at least three highly localised endemic plant species. In terms of Sasol's existing license requirements, which prohibit oil and gas activities within 500 m of the coast, the entire coastal Dune Thicket / Forest Critical Habitat in the Nhangonzo study area is already effectively protected from Sasol's activities.

The Nhangonzo coastal stream and its catchment is mostly Natural Habitat rather than Critical Habitat. Sasol's residual impacts on biodiversity in the Nhangonzo area to date are not considered to be significant. Most of the flow lines; old seismic lines and recent 3D seismic lines are in Natural Habitat, totalling 64 ha (70%); while 26 ha (29%) are in Modified Habitat. While only 0.3 ha (an old seismic line) overlaps the mapped Dune Forest/Thicket Critical Habitat there is no evidence to suggest that this habitat has been negatively affected by Sasol's activities. When habitats are categorised by sensitivity, of the total Sasol footprint of 90.7 ha, 61 ha is in medium sensitivity habitat; 26 ha is in very low sensitivity habitat; and less than 4 ha is in habitats of high or very high sensitivity; the latter is largely due to old seismic lines and which is reduced to 2 ha, assuming 50% recovery.

The study concludes that the biodiversity mitigation measures implemented by Sasol in the Nhangonzo area have complied with the approved EMPs and Emergency Response Plans for the PSA; are fit for purpose, and have successfully minimised impacts in the Nhangonzo area, resulting in no significant adverse impacts on biodiversity to date. This is due, in particular, to the requirement for hand-cutting of seismic lines to a maximum of 2 m width; restriction of wells to more than 250m from the wetland margin, and exclusion of exploration activities outside of the 500 m coastal no-go zone.

The study confirms that no biodiversity offset is required for residual impacts at the local scale of the Nhangonzo catchment. While some of the components of the biodiversity management options identified in the previous reports on the Nhangonzo area may still contribute to biodiversity and ecosystem services protection, the merit of implementing these measures at such a local scale is questionable. The management of Sasol's impact on biodiversity should rather be considered in the context of its PSA license area or a concession-wide scale of assessment, as recommended in the FEAD EIA (Golder, 2017), and as further described below.

In the light of the above findings, the study recommend**s** that:

- Sasol should prepare a standalone BMP for its PSA license area (rather than solely for the Nhangonzo area) as a means of consolidating all approved biodiversity-related mitigation and monitoring measures from all existing EMPs covering Sasol's various project activities (seismic acquisition; construction of infrastructure, drilling and operation) into one document (with cross referencing back to the EMPs). The BMP will be 'generic', based on the known environmental sensitivities in the PSA and the typical activities undertaken by Sasol for exploration and development. Addendums to the BMP would need to be prepared for future specific project proposals in the course of the required Environmental Assessments for these projects.

  This generic BMP would provide stakeholders, including authorities, with an easily accessible document and fulfil IFC recommendations related to BAPs/BMPs.

- MITADER should revoke the conditions related to the provisional Nhangonzo Critical Habitat subject to implementing a wider scale biodiversity management plan (as per the bullet above) ***Note:*** *MITADER revoked the referred conditions in a letter to Sasol on 31 July 2018.*

- Sasol should assess any future oil and gas exploration and development activities in the Nhangonzo area (that are not already licensed) according to the habitat sensitivity classification set out in the FEAD EIA (Golder, 2017)[1]. The FEAD EIA provides a consistent biodiversity sensitivity rating for all of the vegetation classes and land types in Sasol's license areas. The regional habitat and sensitivity classification should be updated with the more detailed information for the Nhangonzo area provided in the present assessment (as well as any additional recent information obtained for other parts of Sasol's concession area).

- Sasol should consider revising the location of the approved well, I-G6PX-1, to a position slightly (100 m) to the south-west to avoid habitat of one data deficient plant species.

The study further recommends that Sasol considers its commitment to implementing the recommendations made in the FEAD EIA (Golder, 2017) for a biodiversity impact assessment to assess the cumulative residual impacts (direct and indirect) of all its activities in its license areas and determine potential offset requirements or other appropriate compensation measures. The FEAD EIA recognises the limitations of project-specific EIA's - which generally do not adequately consider cumulative impacts - and its recommendations are in line with Mozambique's developing legal and policy frameworks for biodiversity and an aggregated approach to offsets. The FEAD EIA (Golder, 2017) was approved by MITADER in July 2018 as the basis for framing future environmental work done for specific Sasol projects.

[1] *This document is available to stakeholders on request from Impacto Ltd. or by accessing the following web address: www.impacto.co.mz*

Following meetings between Sasol, IMPACTO, MITADER and ANAC on 26 June 2018 and again between Sasol, Impacto and MITADER on 27 July 2018, MITADER has confirmed its acceptance of the study findings and recommendations. In a letter to Sasol dated 31 July 2018, MITADER indicated that it:

- accepts that the majority of the Nhangonzo area is Natural Habitat and not Critical Habitat, based on the studies conducted, and that only a small portion is Critical Habitat, coinciding with the “no-go coastal area” not impacted by Sasol´s activities;
- revokes all conditions related to the preparation of a Biodiversity Management Plan (BMP) for the Nhangonzo area, set out in their original letter of approval of 16 March 2016; and
- agrees with the consultants’ recommendation that Sasol should prepare a BMP for the entire PSA License Area.

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2D	Two dimensional
3D	Three dimensional
ACA	Additional Conservation Action
ANAC	Mozambican National Administration of Conservation Areas *(Administração Nacional de Areas de Conservação)*
AWD	Accelerated Weight Drop
BAP	Biodiversity Action Plan
BANP	Bazaruto Archipelago National Park
BBOP	Business and Biodiversity Offsets Programme
BMP	Biodiversity Management Plan
BOMP	Biodiversity Offset Management Plan
CBD	Convention on Biological Diversity
CEAGRE	Centro de Estudos de Agricultura e Gestão de Recursos Naturais
CES	Coastal and Environmental Services
c-EMP	Construction Environmental Management Plan
CH	Critical Habitat
COMBO	Conservation, Mitigation and Biodiversity Offsets
CPF	Central Processing Facility
CR	Critically Endangered
CSI	Corporate Social Investment
DBH	Diameter at Breast Height
DD	Data Deficient
d-EMP	Drilling Environmental Management Plan
DINAB	National Directorate of Environment
DUAT	*Direito do Uso e Aproveitamento da Terra (*Right of Use and Benefit of Land in Mozambique)
EA&D	Exploration, Appraisal and Development
EBA	Endemic Bird Area
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
EN-1	National Highway from south to north
EOO	Extent of Occurrence
ERM	Environmental Resources Management
ESO	Environmental Site Officer
FEAD	Future Exploration, Appraisal and Development (EIA)
FGD	Focus Group Discussions
FSO	Floating, Storage and Offloading
GIS	Geographic Information Systems
GN6	IFC Guidance Note 6
GoM	Government of Mozambique
GPS	Global Positioning System
ha	Hectare
HCV	High Conservation Value
IBA	Important Bird and Biodiversity Area
IFC	International Finance Corporation

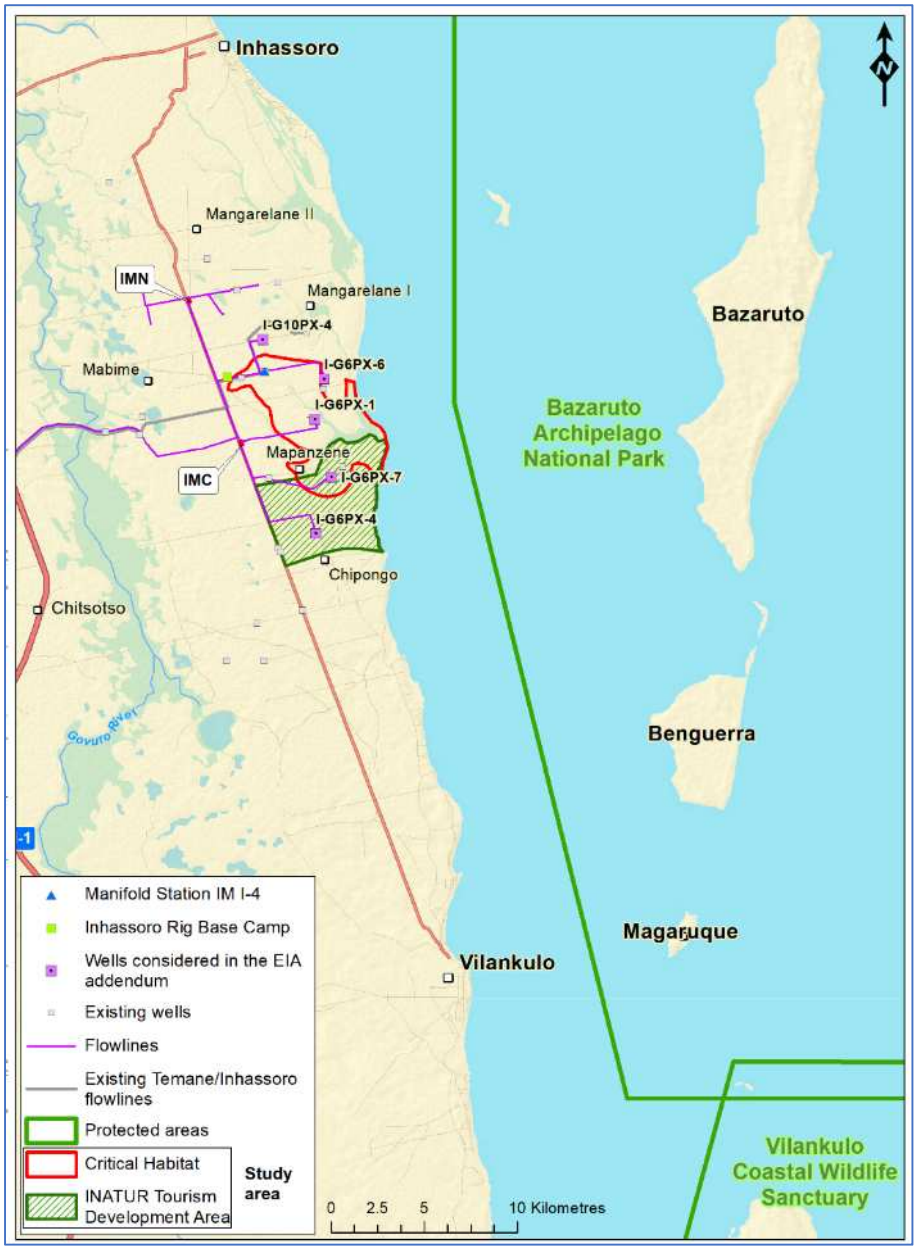
IFC PS	International Finance Corporation Performance Standards
INATUR	*Instituto Nacional do Turismo (*Mozambican Tourism Authority)
INP	*Instituto Nacional de Petróleo* (Mozambican National Petroleum Institute)
IUCN	International Union for Conservation of Nature
km	Kilometres
km^2	Square kilometres
LNG	Liquefied Natural Gas
LPF	Liquids Processing Facility
LPG	Liquefied Petroleum Gas
LPP	Liquids Processing Plant
m	Metres
mamsl	Metres above mean sea level
mm	Millimetres
m/s	Metres per second
m^3	Cubic metres
MEF	Ministry of Economy and Finance
MICOA	*Ministério para a Coordenação da Acção Ambiental* (Ministry for the Coordination of Environmental Affairs) (Old Name)
MIREME	Ministry of Mineral Resources and Energy
MITADER	*Ministério da Terra, Ambiente e Desenvolvimento Rural* (Ministry of Land, Environment and Rural Development)
MPA	Marine Protected Area
MSP	Mozambique-Secunda Pipeline
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-governmental Organisation
NGP	Natural Gas Project
NT	Near-threatened
NTS	Non-technical Summary
O&G	Oil and Gas
o-EMP	Operational Environmental Management Plan
PPA	Petroleum Production Agreement
PSA	Petroleum Sharing Agreement
RDL	Red Data List
SEA	Strategic Environmental Assessment
s-EMP	Seismic Environmental Management Plan
SEPI	Sasol Exploration and Production International
UN	United Nations
VU	Vulnerable
WCS	Wetland Consulting Services
WCS	Wildlife Conservation Services
ZIT	Zone of Tourism Interest

1. INTRODUCTION

1.1 Background

The Nhangonzo Coastal Wetland / Stream and most of its associated catchment located within Sasol's Petroleum Sharing Agreement (PSA) license area between Vilankulo and Inhassoro in Mozambique, was identified as a potential Critical Habitat on a precautionary basis in the Environmental Impact Assessment (EIA) studies for the PSA (Golder, 2014) (Figure 1-1). The area was further investigated by EOH (2015a)[2], the results of which were set out in a series of specialist reports and a summary report. The objective of these studies, and two workshops with key stakeholders (held in June and November 2015), was to find an initial solution to the competing land uses in the Nhangonzo catchment, which included Sasol's rights for oil and gas exploration and development, interests in tourism development, rural habitation and conservation.

Figure 1-1. Location of Nhangonzo area (red outline) in relation to the coastline and Bazaruto Archipelago National Park



Source: EOH, 2015

[2] *Reported in Golder (2015)*

The additional specialist studies (EOH, 2015a) supported the Golder (2014) findings that the Nhangonzo Area is a Provisional Critical Habitat based on available biodiversity knowledge at the time. It acknowledged that there is a risk of over-applying the concept to protect areas of high conservation value from development. EOH (2015a) also indicated in their Summary Report that there may be other similar or larger coastal streams elsewhere along the Mozambique coast that are equally important, but which have not been studied and tested against the International Finance Corporation (IFC) qualifying criteria for Critical Habitat. They accepted that the designation could not, in this case, entirely exclude the use of land from other development (oil industry and tourism), and that these uses should be permitted, subject to careful planning and ongoing management.

To guide further planning and management, taking into account the widely differing interests in the area and the findings of the EOH (2015a) report, Golder (2015b, App.4) developed an Options Analysis for discussion with key stakeholders, consisting of a range of possible management strategies. While the finalisation of these strategies was left for further investigation to complete, it was agreed that in the interim Sasol could proceed with its initial proposals for exploration, as set out in the Golder (2015) EIA Addendum.

The proposals included four wells (two of which were in the Critical Habitat), as well as associated roads and flowlines and further seismic acquisition. MITADER authorised the activities on 16 March 2016. The authorisation included the requirement to prepare and submit a specific plan for biodiversity management in the Nhangonzo area for submission to the National Directorate of Environment (*Direcção Nacional do Ambiente* – DINAB), National Administration of Conservation Areas (*Administração Nacional das Áreas de Conservação* – ANAC) and National Petroleum Institute (*Instituto Nacional do Petróleo* - INP).

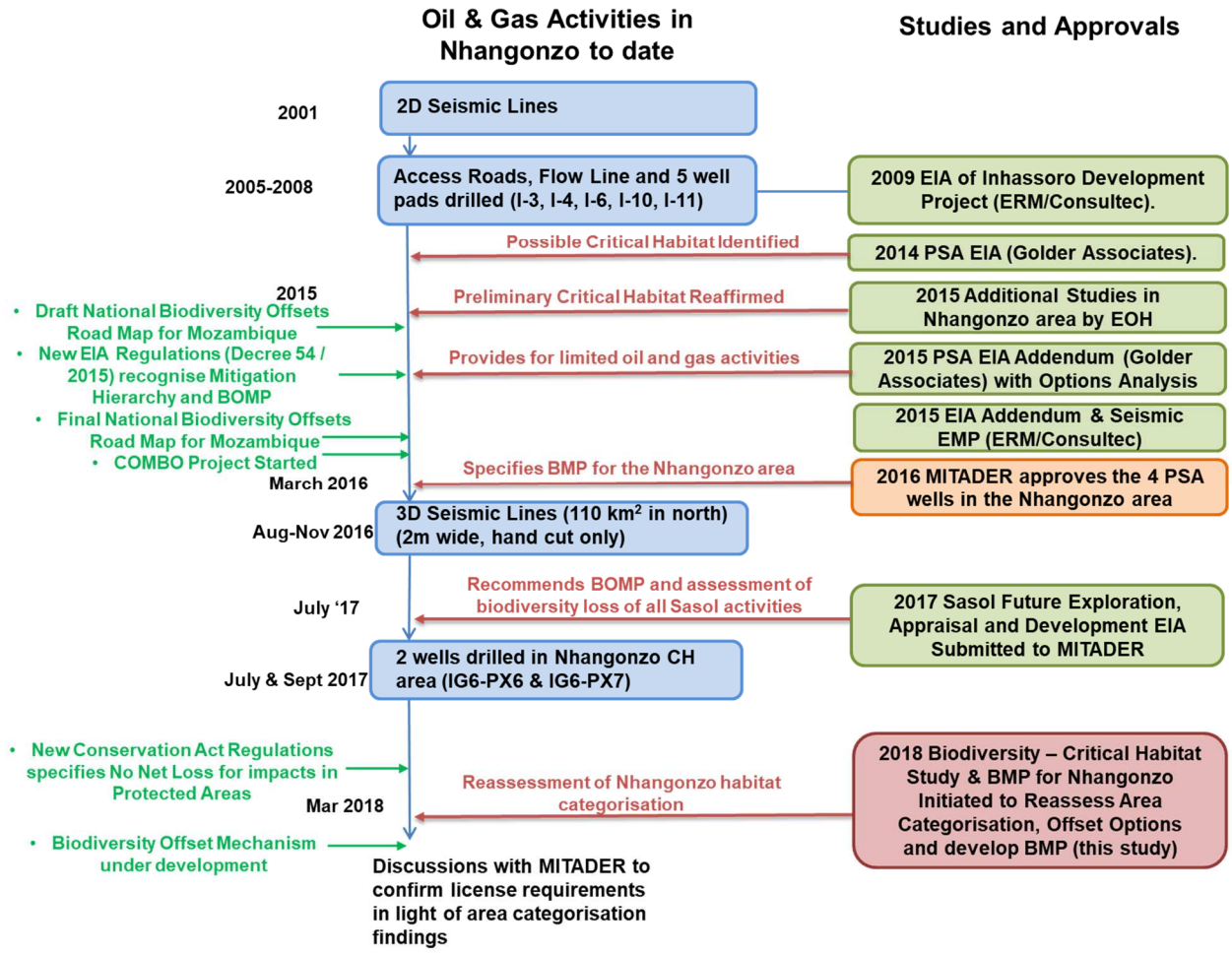
Sasol's Operational EMP (Golder, 2015d), provides more detailed requirements:

- Sasol shall prepare a long-term biodiversity monitoring and evaluation programme for the Critical Habitat, in accordance with IFC PS6 requirements.
- Sasol shall plan any future wells in the Nhangonzo area to be drilled from existing well pads to the greatest extent possible. Any deviation from this principle shall be specifically motivated to MITADER.
- Sasol shall continue to facilitate the dialogue about conservation of the Nhangonzo area and alternative strategies, initiated during the EIA Addendum for the PSA Development and LPG Project in 2015.
- With the participation of key stakeholders, Sasol shall finalise an agreed joint strategy for conservation of the CH, or an alternative 'offset strategy'.
- Sasol shall develop an implementation and financing model for its contribution to a preferred strategy.
- Sasol shall provide financial support to the selected conservation alternative (and, if required, management assistance) for the lifetime of the PSA Development and LPG Project.

1.2 Context of Sasol's Activities in the PSA in Relation to the Nhangonzo Area

Figure 1-2 provides a flow chart of activities, studies and approvals relating to Nhangonzo area that contextualise the present study in relation to previous work. Since development in Critical Habitats are linked to biodiversity offsets, the context of the developing framework with respect to Net Gain, No Net Loss and biodiversity offsets is included in the left-hand column in green.

Figure 1-2. Flow chart of activities, studies and approvals relating to the Nhangonzo area and relevant offset framework and initiatives in Mozambique



1.3 The Present Study

1.3.1 Approach to the Overall Study

To comply with MITADER's license conditions for additional exploration in the Nhangonzo area, Sasol invited consultants to submit proposals for the preparation of a management strategy for the Nhangonzo area. Impacto Ltd. was appointed to do the work. The final agreed scope of work included the following key tasks:

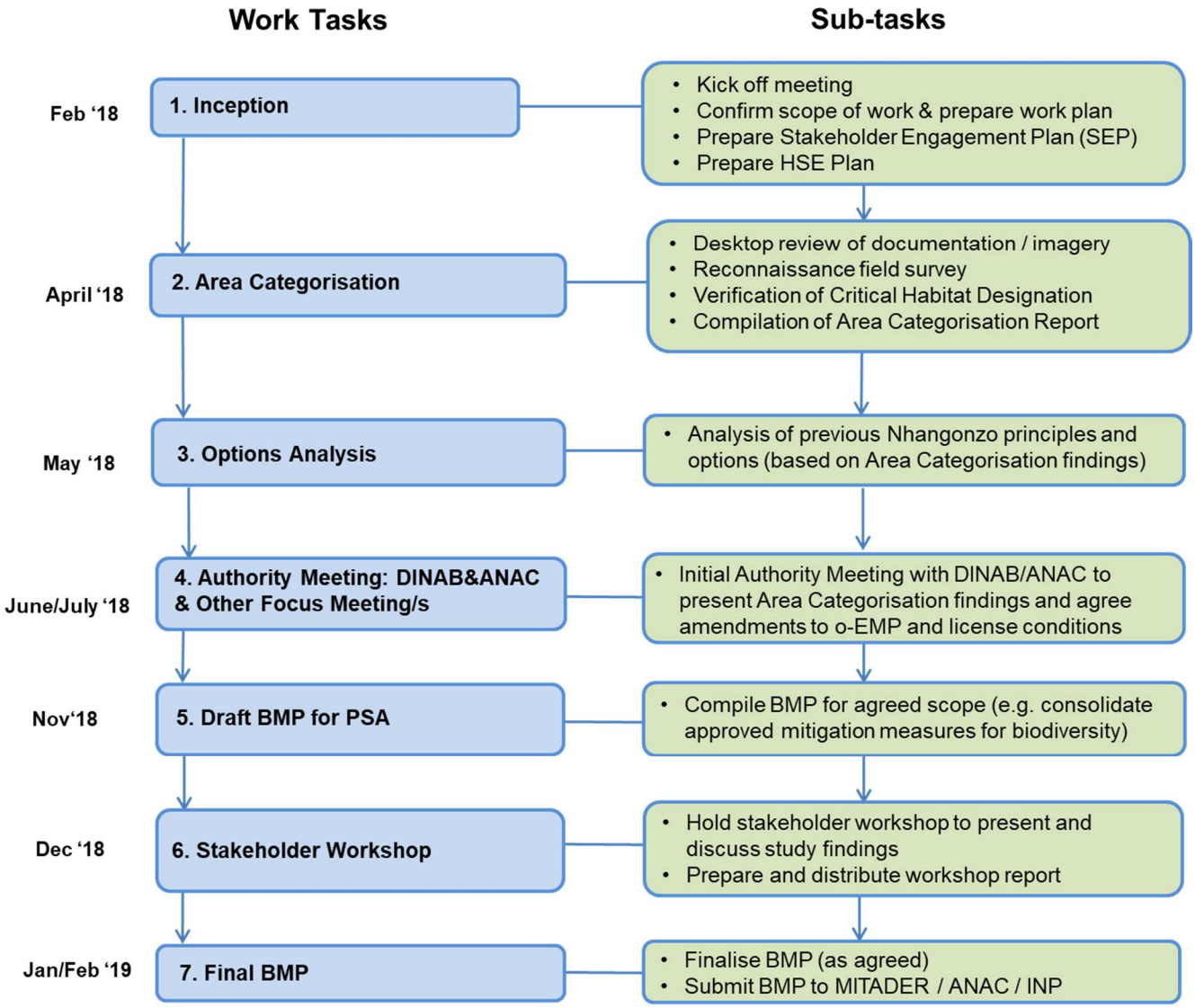
- Review of the categorisation of the Nhangonzo coastal stream and surrounding catchment as an IFC 'Critical Habitat', taking into consideration accumulating international experience in the use of the IFC's criteria for designating Critical Habitats. The previous work in the Nhangonzo area was a high-level assessment of the biodiversity features of the area against IFC PS6 2012 criteria with the primary motivation for Critical Habitat based on Criterion 4 (Unique and Highly Threatened Ecosystems). More detailed investigation and articulation is warranted using the IFC Criteria 1-3 and in the context of future proposed revisions to the thresholds in Guidance Note 6 (GN6). These relate to the presence of critically endangered/endangered species (Criterion 1); endemic / range restricted species (Criterion 2) and migratory/congregatory species (Criterion 3).

- Reassessment of the previously proposed options for managing protection of the Nhangonzo area in the light of the findings of the Area Categorisation and the ongoing initiatives for offsetting in Mozambique;

- Confirmation and/or revision of the restrictions on additional oil and gas development in the Nhangonzo area based on the previous work, current management measures, and findings of the Area Categorisation task;
- Compilation of a Biodiversity Management Plan (BMP) for the Nhangonzo area.
- Workshops with national and district stakeholders to present the findings of the Area Categorisation and Options Analysis tasks; and
- Finalisation of the BMP for submission to MITADER (DINAB), ANAC and INP.

The tasks and subtasks of the overall study are summarised in Figure 1-3.

Figure 1-3. Flow chart of tasks and sub-tasks for the overall study



1.3.2 Area Characterisation

The objective of this report is to verify the provisional Critical Habitat status of the Nhangonzo area, and to reassess the options that were previously proposed based on the findings of the Area Categorisation.

The approach has involved detailed independent review of the evidence used to designate the Nhangonzo area as a potential Critical Habitat against the IFC (2012) PS6 criteria and the thresholds in Guidance Note 6 (GN6). The analysis was supplemented by a focussed field search for specific priority plant species that were expected to occur in the area. The results of the Area Categorisation have informed the review of the Options Analysis task in Section 6.

The team comprised members with expertise in the application of IFC PS6 criteria and biodiversity offsetting to guide the review and verification of Critical Habitat and review of options, and independent ecologists to verify the ecological basis for its previous designation, who were not previously involved in the earlier Critical Habitat assessments. The profiles of team members involved in the study are contained in Annex C.

Scope and Approach to the Area Categorisation Task

Area Categorisation comprised four sub-tasks:

- Sub-task 2.1: Desktop review of documentation and preparation of mapping;
- Sub-task 2.2: Reconnaissance site visit;
- Sub-task 2.3: Assessment of Critical Habitat designation; and
- Sub-task 2.4: Report compilation.

Sub-task 2.1: Desktop review of documentation and preparation of field mapping

The team collated and reviewed available documentation, data and mapping relevant to the Nhangonzo catchment area, including relevant conservation policy and strategy documents. The following activities were undertaken:

1. Collation of data and mapping relevant to designation of the area as Critical Habitat was assembled as the basis for field verification. This included other plant species that have been identified in the wider area and which may occur in the Nhangonzo area for focussed field checking. An initial tabulation of the species and habitat data used as the basis for the previous Critical Habitat designation by the EOH specialist team (EOH, 2015a) was compiled for each IFC criterion as a framework for further analysis and reporting.
2. Mapping of Sasol's activities (e.g. seismic lines, flow lines, access roads and well pads) in the Nhangonzo area as a basis for confirming any residual impacts.
3. Review of Mozambican legal and policy documents related to biodiversity to confirm the current and future requirements related to biodiversity offsetting. Additional discussions were held between team members and the COMBO project which is working with ANAC and MITADER to revise the legislation related to biodiversity management to align with IFC requirements.
4. Communication with INATUR to confirm the current and planned status of the INATUR / ZIT tourism development proposals (which overlap with the southern portion of the Nhangonzo area).

Sub-task 2.2: Reconnaissance field survey

The team undertook a five-day reconnaissance level site visit from 25-29 March 2018 during which the following activities were carried out:

1. Various habitat types across the area were visited, including:
    - The estuary, mangroves and mudflats to confirm the type and numbers of water birds to verify whether IFC Criterion 3 for migratory / congregatory species might be triggered;
    - Points along the lower, middle and upper wetland area to check habitat type, condition, and presence of open water, and associated birds/mammals;
    - Checks and collection of GPS points for habitat types to assist with further revision of the regional vegetation mapping and confirm additional restrictions on oil and gas activities in the area; and
    - Specific searches of priority plant species in various pre-selected locations of miombo woodland and dune thickets in the north and south of the study area to confirm Critical Habitat status based on Criteria 1 and 2.
2. Collection of additional vegetation data points to verify and revise the regional vegetation mapping.
3. Verification of the recovery of Sasol works areas and induced impacts, including:
    - Checks along existing access roads and seismic lines to verify the status of seismic line recovery and evidence of human use; and
    - A check of natural rehabilitation success of an old well pad cleared in or around 2004.

    This provided an opportunity to verify the impacts of Sasol's oil and gas activities in the area as a basis for possibly redefining the limits and restrictions on these activities, if appropriate.
4. Team discussions on the biodiversity offset initiatives in Mozambique and implications for Sasol.

Sub-task 2.3: Re-assessment of Critical Habitat designation

Activities undertaken in this sub-task have involved the reassessment of the Critical Habitat status, revision of vegetation mapping, and quantification of impacts on the habitats of the Nhangonzo area.

1. **Critical habitat assessment** - Data for the area (both existing and that collected during the planned surveys) has been assembled and used in a systematic and structured format as the basis for the reassessment of the area as a Critical Habitat. Species and habitat data previously used to motivate Critical Habitat was interrogated and contextualised against known or likely distribution patterns, assessed threat status and uniqueness along the Mozambique coastline with a primary focus on IFC Criteria 1-3. This task was primarily based on the team's expert judgement and experience in Mozambique - particularly in the wider Sasol concession area -as well as additional focussed field searches for priority plant species, additional expert consultation and available reference data.

    In addition, the justification of the wetland habitats as Critical Habitat based on Criterion 4 (highly threatened and unique ecosystems) was based on the team's independent review of its characteristics and supported by available literature on similar coastal ecosystems in Mozambique.
2. **Habitat mapping and quantification** - Comparison of previous land cover / habitat mapping compiled by GeoTerraImage at a regional scale (Golder, 2015f) and by EOH (2015a,b) and WCS (2015) for the Nhangonzo area were reviewed, verified and integrated based on the additional field data points and post-field Google imagery verification. The revised vegetation communities mapping was used as the basis for assigning sensitivity and habitat status classes, and for quantifying the hectares of each class in the provisional Critical Habitat boundary.

In order to assess changes in the extent of cultivated area (Modified Habitat) recent Sentinel 10-m resolution imagery was used to re-map cultivated areas in the Nhangonzo area as a basis for comparison with previously mapped cultivation from late 2014 and early 2015 imagery. This was used to confirm the degree of change and infer whether any observed increases can be linked to improved access created by Sasol's activities.

The revised vegetation mapping was used to prepare habitat status and sensitivity mapping and which provided the basis for quantifying the direct footprint of Sasol's activities (i.e. access roads, well pads and flow lines).

3. **Team meetings and discussion**s were held to review the findings of the Area Categorisation and consider the implication for the remaining study activities for Sasol. This included the range of options that were previously proposed for the Nhangonzo area.

Sub-task 2.4: Compilation of the Area Categorisation Report

Based on the work described in sub-tasks 1-3, the report[3] provides an explicit, clearly articulated basis for defining the habitat status of the Nhangonzo area against IFC Criteria 1-3, as required by the Scope of Services. It also provides a qualitative analysis of the Nhangonzo wetlands in relation to Criteria 4 and 5 supported by available regional wetland information. The report sets out the implications for Sasol of the Area Categorisation findings in the context of the requirements of its existing license agreements and provides recommendations in this regard.

1.3.3 Options Analysis

The various management options for the Nhangonzo area that were previously considered and presented to stakeholders in 2015 and documented in Golder (2015b, Appendix 4,6 & 7), together with their underlying principles, were reviewed and re-assessed based on the Area Categorisation findings. The options analysis was aimed at closing out those options (or elements of options) that are no longer relevant and highlighting those that remain applicable for consideration for the Nhangonzo area or Sasol's broader area of exploration and operation.

The findings of this report will be distributed and communicated to district and national stakeholders as a basis for discussion and to inform the way forward.

1.3.4 Assumptions and Limitations

1. The scope of work for the Area Categorisation task specified a focus on IFC Criteria 1 to 3. However, since the original Critical Habitat designation was based largely on the uniqueness of the wetland under Criteria 4 and 5, the basis for its assessment under these criteria has been subject to additional review based on available literature, and subject to limitations described in points 2 and 3 below.

2. No focussed regional wetland assessment based on more extensive field surveys along the coastline has been undertaken for this study to verify the uniqueness of the Nhangonzo wetland system and to confirm the presence of peat in other wetland systems. A regional wetland study, while desirable to further scientific knowledge of Mozambique's coastal wetlands, would require extensive field effort, including peat auguring, and was beyond the scope for this study. The study has relied on available sources of information to contextualise the wetland and its regional significance. It should be noted that the presence of peat in a wetland *per se* does not justify its designation as Critical Habitat, as many different types of wetlands globally contain peat: other biodiversity triggers would need to be present to warrant Critical Habitat status under IFC criteria.

3. No specific wetland field assessments were undertaken under this study to investigate the functioning of the wetland system and its links to surface water and groundwater flows, as was

[3] *This report is effectively a document that confirms the area as Natural Habitat or Critical Habitat and can be considered similar to a Critical Habitat Assessment.*

recommended by the previous wetland study (WCS, 2015). Such studies are costly and would require borehole drilling and monitoring, with associated additional impacts. Monitoring of groundwater quality at existing or new well pad boreholes is a requirement of the existing drilling EMP (Golder, 2015d).

4. Mapping to confirm changes in habitat condition linked to Sasol's project activities was limited to use of freely available imagery at 10 m resolution, and comparison with earlier mapped cultivation and settlement extent from 2014 (Golder, 2015f). No detailed analysis of vegetation biomass to confirm changes in habitat condition linked to selective harvesting of timber was attempted given the focus of this study on the Nhangonzo area. Such a task should be considered under the scope of a more in-depth study to confirm longer term changes in different habitats across Sasol's license areas. A key challenge of such study will be to find ways of distinguishing natural rates of land use change from changes induced by the project. This will require close examination of the history of creation of new access routes and identification of those that have continued to be used and those that have been closed (deliberately or naturally).

5. Quantification of the length and area of previous seismic lines to determine Sasol's total footprint within the Nhangonzo area is constrained by incomplete mapping of the exact location and timing of cutting of some of the older lines. While the majority of seismic lines were mapped and checked on imagery, it is possible that some old seismic lines that are no longer visible on imagery may have been missed. Therefore, the area footprint calculations used to quantify residual impacts should be considered approximate but sufficiently accurate for the purposes of this study.

6. The review of the Options Analysis is limited to a reassessment of the principles and options presented for biodiversity management in relation to the Nhangonzo area as drafted and workshopped with stakeholders in 2015 (Golder, 2015b, Appendix 6 & 7). It does not propose additional management requirements or protection measures for other areas, which is the scope of a separate study to fulfil the recommendations of the FEAD EIA (Golder, 2017).

2. BACKGROUND TO THE PREVIOUS WORK AT NHANGONZO

2.1 Introduction

In 2014, ecologists working on the EIA for the PSA Development and LPG Project EIA identified the 4,359 ha Nhangonzo coastal wetland area as a provisional Critical Habitat for its high conservation, functional and biodiversity value within a local and regional (Inhambane Province) context, and possibly national context. It was primarily designated as a potential Critical Habitat for the pristine wetland system of the Nhangonzo coastal stream, with its peat substrate, and the absence of observable human impact due to its inaccessibility to local villagers and loggers. It was considered the only "substantial and relatively natural estuarine mangrove swamp along the 90 km stretch of coastline between Ponta Chiuzine bay, south of Vilankulo, and the Govuro River to the north" (EOH, 2015a; WCS, 2015).

Although the direct physical effect of the proposed PSA oil and gas development in the area was considered minor, the 2014 EIA (Golder, 2014) acknowledged the complexity of the land use decisions and pressures facing the area and the difficulty of managing the human induced impacts linked to the improved access created for Sasol's infrastructure and for proposed tourism development. A large tourism development was identified as far back as 2008 (ERM/Consultec, 2009) for a 2,750 ha site overlapping the southern portion of the proposed Critical Habitat (see Section 2.3). Local community demands for natural resources to support livelihoods was considered a key driver of indirect impacts that would be facilitated by the increased access created by seismic lines, flow lines and roads. The 2014 EIA recognised that sustainable solutions to managing the area would need to balance the various competing interests including conservation, oil and gas activities, tourism development, and community land uses. It concluded that additional studies and stakeholder consultation were required to determine and justify decisions about options for permissible uses and oil and gas restrictions in the Nhangonzo area.

This led to more detailed field investigations of the proposed Critical Habitat as part of an Addendum to the PSA and LPG EIA (Golder, 2015). EOH and their specialists (2015a) undertook these studies on behalf of Golder, and confirmed Nhangonzo's status as a 'provisional' Critical Habitat on a precautionary basis for reasons summarised in Section 2.2.2 and evaluated in more detail in Section 4. However, the integrated Critical Habitat summary report (EOH, 2015a) was not definitive in its findings on the status of the Critical Habitat and concluded that similar and larger areas may occur along nearby sections of coast. It further confirmed that expansion of subsistence land use pressures leading to loss and degradation of untransformed woodlands and increased hunting and fishing pressures in the catchment, river system and estuary pose the greatest threat to the Nhangonzo system. The EOH report concluded that oil and gas and tourism land uses should not be totally excluded from the area.

The EOH (2015a) findings were widely discussed with key stakeholders in the Government of Mozambique (GoM) and civil society in mid to late 2015. The report was circulated to all relevant parties and there followed an exercise, agreed with stakeholders, to consider alternatives for the joint use of the area (including the provisionally designated Critical Habitat and the INATUR anchor tourism area). An Options Analysis was prepared for discussion with stakeholders (Golder, 2015: Appendix 4), which identified possible alternatives for the future use of the area. This analysis included a full range of future land use options, varying from:

- A major conservation option, designed to limit all access in the Critical Habitat (including access by Sasol, communities and INATUR);
- An option to work with INATUR in order to minimise future oil industry / tourism conflict and to assist communities to develop agricultural resources outside of the Critical Habitat. A trust for managing and funding such a strategy was suggested;

- A broadening of focus beyond the Critical Habitat, with Sasol contributing to ongoing research and management efforts of all land use in the area of its footprint east of the Govuro River, between Vilankulo and Inhassoro, all of which can be regarded as ecologically sensitive; and
- An 'offset' type option, the rationale for which was that the area could not reasonably be fully conserved, given the various interests that must be accommodated, and that Sasol would do better to contribute to conservation elsewhere, such as the adjacent Bazaruto Archipelago National Park (BANP), which is under-funded[4].

These are further discussed in Section 2.4 and reassessed in Section 6 in the light of the Area Categorisation findings.

Due to the need to meet Sasol's schedules for environmental authorisation of the wells and associated infrastructure in the Nhangonzo area, the process was split into Sasol activities that could reasonably proceed on the basis of the current level of agreement with stakeholders (i.e. the two PSA wells (I-G6PX-1 and 6), and associated infrastructure); and further oil and gas development that should ideally depend on finalisation of these discussions and reaching agreements about future use and responsibilities.

On 16 March 2016, MITADER approved the PSA EIA Addendum which included the two well locations in the Nhangonzo Critical Habitat for the PSA development, and an additional two wells in the area outside of the revised Critical Habitat boundary (I-G6PX-4 and I-G6PX-6). It was anticipated that other future Sasol activities (wells, seismic acquisition etc.) that could cause significant direct or indirect impact in the Nhangonzo area should be completed only after there is final agreement about the future of the area and associated restrictions.

2.2 Designation of Nhangonzo Critical Habitat

2.2.1 Previous Studies

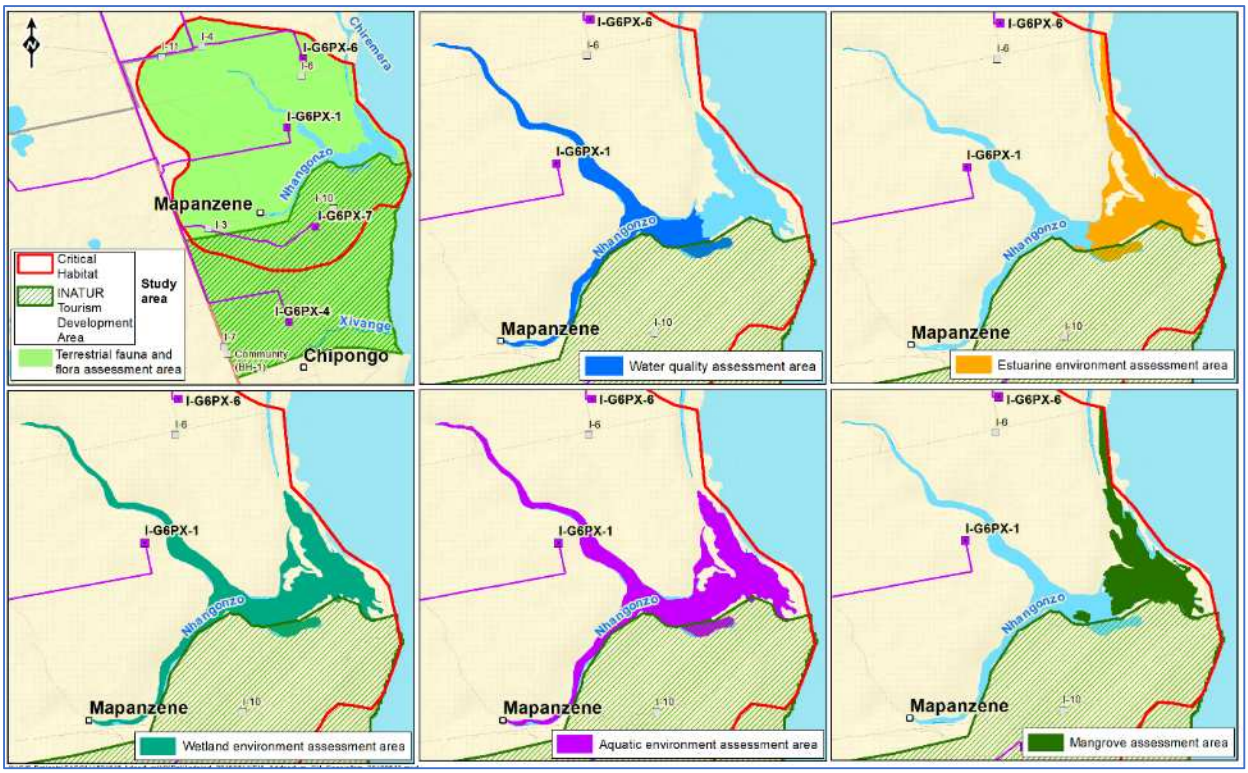
EOH commissioned six specialist studies focussed on the Nhangonzo catchment and coastal stream to provide additional verification of the status of the area as a Critical Habitat (Figure 2-1). These were undertaken from 16-23 March 2015, and included baseline assessments on the following aspects:

- Vegetation and Flora (EOH, 2015b)
- Terrestrial Fauna (mammals, birds and reptiles) (EOH, 2015c)
- Fish and Aquatic Habitat (A Bok, 2015)
- Wetlands (WCS, 2015)
- Mangrove Forest (EOH, 2015e)
- Water Quality (EOH, 2015d)
- Estuarine Baseline Assessment (Golder, 2015c: Report 8).

The findings of these studies are contained as Volume 3 of the PSA EIA Addendum (Golder, 2015c) and summarised in Annex A.

[4] *Management of the BANP has since been taken over by African Parks*

Figure 2-1. Focus areas for additional specialist studies on Nhangonzo (EOH, 2015a)



Source: Golder, 2015

The results of these studies, particularly the fauna and wetland studies, led to the specialists defining the Nhangonzo area as a provisional Critical Habitat. The basis for this is summarised in Section 2.2.2 and reassessed in Section 4.

2.2.2 Summary Basis for Assigning Provisional Critical Habitat Status

EOH (2015a) conducted a high-level Critical Habitat assessment of Nhangonzo catchment using IFC PS6 criteria. In summary, the primary reason for its designation as Critical Habitat was the perceived uniqueness and threatened status of the peat-based wetland system under IFC Criterion 4, with additional support motivated by:

- The presence of a 'concentration' of vulnerable species, primarily fossorial lizards (used as motivation under Criterion 1 (Critically Endangered and Endangered species);
- The presence of endemic, range-restricted lizards used as motivation under Criterion 2 (Endemic and Restricted Range species);
- The presence of two data deficient plant species (*Diospyros inhacaensis, Eulophia petersii)*; and
- The possibility that the peat wetland system may be important for key evolutionarily processes (Criterion 5) largely due to the complexity of the wetland system and its hydrology, the age of the peat, and the presence of 'taxonomic novelties' (i.e. lizard species and a potentially unique grass ecotype).

Additional IFC criteria used to motivate support for Critical Habitat status in various places in the EOH (2015a) report were:

- The presence of an endemic plant, *Xylia mendoncae*, found west of the Govuro River but considered likely to occur in the Nhangonzo coastal stream catchment area;

- Presence of 'pristine coastal vegetation' considered unusual along the coastline, and specifically the high level of diversity of mangroves and level of threat to these systems;
- The area was mooted as a refugia or sanctuary for endemic reptiles, the range-restricted lemon-breasted canary and the Near-Threatened Mozambique tilapia (fish);
- The importance of the catchment in protecting the groundwater hydrological processes that support the peatlands; and
- the high scientific value of the area, containing concentrations of species (mainly reptiles) new and/or little known to science;
- The high conservation value of the area due to its pristine peatlands and other areas of high biodiversity; its untransformed mangrove forest and its role as a fish refuge; and the importance of the mudflats and sea grass beds for waders and their support role for dugongs.

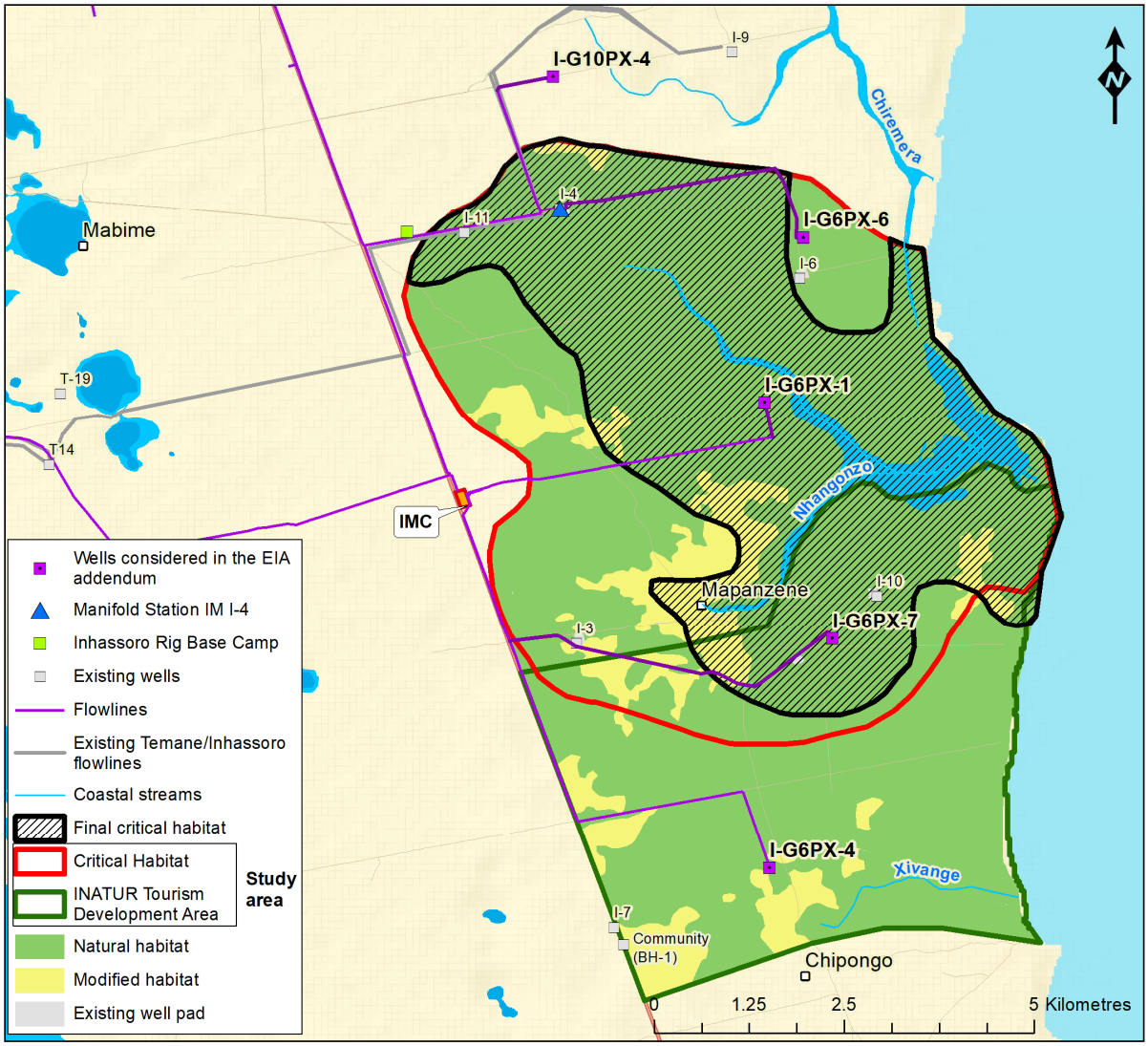
A reassessment of the Nhangonzo area as Critical Habitat based on the reasons provided by the EOH specialist team against IFC criteria is provided in Section 4.

2.2.3 Basis for the EOH (2015) Original and Revised Critical Habitat Boundaries

The original boundary of the Nhangonzo Critical Habitat was defined in the PSA EIA (Golder 2014) as the catchment of the Nhangonzo stream, and formed the catchment divide with the Govuro River to the west, the Chimera stream to the north and the Xivange stream to the south.

Following the additional specialist studies in March 2015, the EOH team agreed that the boundary could be amended to remove portions of the miombo woodlands in the upper catchment which do not warrant Critical Habitat status but which were included as a buffer for protection of the wetland system. This reduced the area by 33% from 43.6 km^2 to 29.4 km^2 (Figure 2-2).

Figure 2-2. Original and revised boundaries of the Nhangonzo Critical Habitat showing Natural and Modified Habitat



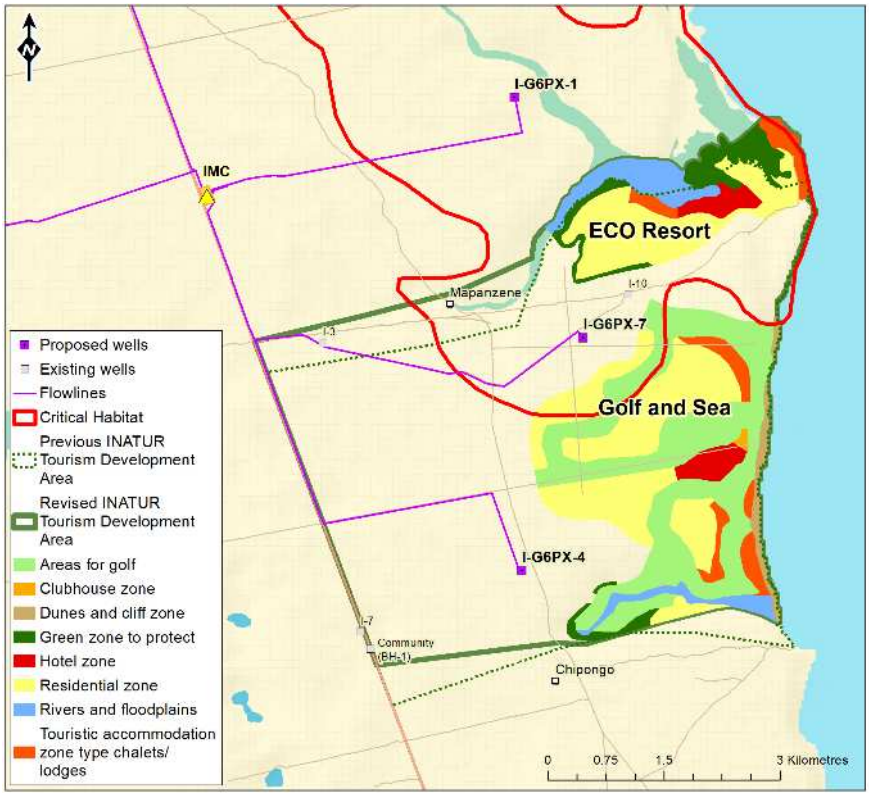
Source: Golder, 2015a

2.3 Tourism Development Zone

The Ministry of Tourism's Strategic Plan for the Tourism Sector (2005-2013) considers the development of sustainable tourism as being crucial and to be developed with respect to conservation and protection of biodiversity. The Tourism Interest Zones (ZIT) Regulations, approved in December 2009 (Decree 77/2009), enable the government to reserve land of strategic importance for tourism development. The Inhassoro ZIT was defined in studies undertaken on behalf of INATUR in 2010, and the Vilankulo-Bazaruto area (incorporating Inhassoro) is identified as the third spatial priority for tourism development in the second tourism strategy for Mozambique (Ministry of Tourism, 2015).

Decree No°75/2010 (of 31 December) conferred ZIT status on the 2,750 ha Mapanzene / Chipongo area, incorporating the Inhassoro Anchor Site. A zonation plan was prepared for the ZIT in 2010 (Coastal & Environmental Services (CES) & SAL CDS), and conceptual planning for the Anchor Site was undertaken by the IFC (2012). These plans were superseded by a preliminary draft Inhassoro Master Plan (undated) by a consortium (Line of Business, Central Indica, Plural and McKenzie & Ebert) (Figure 2-3 and Figure 2-4). The proposed resort includes a mix of residential housing, tourist chalets/villas and two hotels, around a golf course. An estimated 1,160 accommodation units with 6,050 rooms have been proposed.

Figure 2-3. Draft Spatial Development Plan for the Inhassoro Anchor Site



Source: Golder 2015b; Appendix 7

Figure 2-4. Preliminary Master Plan Layout of Inhassoro ZIT

Source: Inhassoro Master Plan (undated)

The PSA license area straddles the Inhassoro ZIT and the Nhangonzo Critical Habitat area. The legal study (Golder 2015b: Appendix 2), concluded in June 2015, shows that Sasol's rights under the PSA agreement were not annulled as a result of the ZIT declaration but, in the event of conflict between oil and gas concessions and tourism development, the matter would need to be settled by negotiation between the parties and other relevant Government stakeholders. If agreement could not be reached, the Government would need to intervene to ensure a decision is reached. On the basis of the current spatial development plan for the ZIT (Figure 2-3 & Figure 2-4), Sasol's PSA wells assessed in Golder (2014, 2015) will have little impact on planned tourism, with the key areas of tourist development being separated from the proposed well locations (I-G6PX-4 and I-G6PX-7).

Consultation with INATUR on 28 May 2018 confirmed that there had been no further progress to date with securing funding for the tourism development and that the IFC are no longer involved in the proposal. INATUR further confirmed that oil and gas and tourism activities are not mutually exclusive and can coexist in the ZIT.

2.4 Stakeholder Engagement and Options Analysis

Because Sasol's PSA concession area straddles the Inhassoro ZIT and the Nhangonzo area, provisionally considered to be Critical Habitat (Golder, 2014; EOH, 2015a), Sasol undertook stakeholder engagement to chart an agreement for joint and sustainable use of the area. Sasol's activities in the Nhangonzo area were predicted to have minor residual negative impacts (Section 5)(Golder, 2014; 2015) and to present a small risk of accidental damage to ecosystems. Any significant residual negative impacts and risks need to be compensated through a range of possible interventions to satisfy Mozambique law and policy, as well as the IFC Performance Standards.

Two stakeholder workshops were held to present the outcomes of the biodiversity study on the area described as potential Critical Habitat, and to identify and evaluate possible options for future use of this area. The results of the first workshop were used to prepare a draft Options Analysis report (Golder, 2015b: Appendix 4) as the basis for discussion in the second workshop, which was made available to all stakeholders prior to this workshop. The second stakeholder workshop was held on 30 September 2015, at which options for the future of the area were discussed in further detail (Golder, 2015b: Appendix 7).

A number of guiding principles to be applied during investigation of options for the future of this area were identified at the outset by stakeholders, and grouped into legal, social, protection, financial and development categories. These principles are set out and evaluated in Table 6-1 in Section 6.

Delegates to the options analysis workshop agreed that exclusive use of the two areas for tourism, conservation or oil and gas development was not an appropriate solution and that sustainable co-existence should be sought. Priority options and activities are shown in Table 2-1 below.

Table 2-1. Priority options and activities

Priority options	Priority activities
■ Integrated development with the assurance of keeping the ecosystem integrity ■ Establish a conservation area managed by entities such as BIOFUND, ANAC, others ■ Partnership between Sasol and INATUR for the development of the ZIT ■ Create a good partnership between Sasol and tourism ■ Develop the area prioritising the conservation of Natural Habitats ■ Support an existing conservation area that has a similar biodiversity (a biodiversity offset)	■ Develop an integrated master plan ■ Establish a regular monitoring system ■ Compensation for physical and economic displacement of communities ■ Integrated management plan for the area ■ Integrated environmental evaluation of the area ■ Environmental education ■ Quantify residual impacts

A total of nine options were proposed for consideration, which looked at the Critical Habitat area only (six options), or at the Critical Habitat area plus the ZIT (two options), and at an Integrated option looking at a wider coastal area east of the Govuro River (one option). High-level strengths/ benefits and weaknesses/ disadvantages of each option were documented. All options need to meet current legal requirements.

Smaller meetings were held with most workshop invitees prior to the second workshop to ensure that the different options were understood. A Final Options Analysis report was then prepared (Golder, 2015b: Appendix 4), reflecting agreement with stakeholders and associated recommendations about Sasol's wells in the Critical Habitat and INATUR areas.

The outcome of the second workshop was that:

- Most participants preferred a combined option for the area, suggesting that they wish to see an integrated approach to the planning and development of both the Critical Habitat and the INATUR ZIT which includes establishing a conservation/ development trust to be run with Sasol's involvement.
- Some participants favoured supporting conservation initiatives/ areas elsewhere in Mozambique, rather than focusing on the Critical Habitat area.
- The next best option involves Sasol and INATUR working together to integrate land use planning and minimise land use conflicts, but without the development of a conservation/ development trust.
- A number of participants favoured the integrated option, which widens the focus of Sasol's contribution to conservation and planning in the sensitive area between the Govuro River and the coastline, in which Sasol's PSA activities are taking place.

Following the workshop, an integrated options analysis report was compiled and included in the PSA EIA Addendum to inform decision-making on the PSA and LPG Project. The operation EMP specifically required Sasol to: i) continue to facilitate dialogue about conservation of the Nhangonzo area and alternative strategies"; ii) to finalise an agreed joint strategy for conservation of the Critical Habitat or an alternative 'offset' strategy; and iii) to develop an implementation and financing model for its contribution to a preferred strategy. This led to MITADER approving the PSA and LPG Project subject to these requirements.

In Section 6, the options previously assessed and ranked by stakeholders are described and reviewed in the context of the Nhangonzo Area Categorisation findings and the updated legal and policy context.

3. LEGAL AND POLICY CONTEXT AND INITIATIVES RELATED TO BIODIVERSITY

The main legal requirements in Mozambique with regard to biodiversity are addressed below, together with an overview of biodiversity offset initiatives which are shaping the regulatory environment. In addition to meeting legal requirements, Sasol aims to meet the International Finance Corporation's Performance Standards (IFC PS), including PS6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources. The requirements of IFC PS6 are presented in a separate section (Section 3.3) below.

Sasol's current and planned future operations are taking place in a changing regulatory context. In this respect, it is useful to note that:

a) Policies and the legal framework in Mozambique related to EIA and biodiversity conservation have recently been updated. MITADER is currently preparing a specific biodiversity mechanism and regulation on offsets. Although regulations on biodiversity offsets are not yet in place, some of the requirements associated with No Net Loss or Net Gain of biodiversity are already incorporated in the current legislation.

b) Environmental regulation of petroleum activities is currently undergoing revision; there is an urgent need to align it with the new petroleum law, the EIA regulation (Decree 54/ 2015) and with the recently published regulation of the Conservation Law (Decree 89/2017).

3.1 National Legal Requirements Relevant to Biodiversity

Mozambique recognises biodiversity as an important asset for the country and has ratified the international Convention on Biological Diversity (CBD). In 2015, MITADER published the National Biodiversity Strategy and Action Plan (NBSAP) for the next 20 years (2015-2035), in which reconciling economic development and biodiversity is a key message. The NBSAP focuses on ensuring that EIAs for development projects address biodiversity adequately, including the aspects of compensation for their loss, when this is unavoidable. Priority actions include updating Decree 67/2010 on the Environmental Standards to include compensation and penalties due to biodiversity loss.

The Environmental Act (Law 20/97) is the cornerstone of the legal framework for sustainable development and conservation of the environment in Mozambique. This Law, together with Decree 54/2015 (EIA regulation), is binding on development activities. The latter explicitly requires application of the mitigation hierarchy[5]. It also introduces biodiversity offsets as a last step of this hierarchy, to compensate for significant, but acceptable, residual impacts once all feasible prevention and minimisation actions have been implemented. This Decree requires that a Biodiversity Offset Management Plan (BOMP) needs to be designed whenever necessary to ensure compliance with the mitigation hierarchy[6]. In addition, it includes a requirement to maintain ecosystem services.

The Conservation Law 16/2014, amended by Law 5/2017, is binding on all development activities. It creates a solid foundation to the implementation of the mitigation hierarchy and achieving No Net Loss as a result of the implementation of development projects: those who damage natural resources have a duty to replenish them and/or pay the costs for the compensation of damages caused in order to ensure that there is No Net Loss of Biodiversity or natural resources. The recent regulation of this Law, Decree 89/2017, specifies what is meant by No Net Loss of Biodiversity (Article 125). According to the Conservation Law (16/2014, as amended by Law 5/2017) and its regulation, the creation of conservation areas can be proposed by government agencies, academic institutions, the private sector, non-governmental organisations, or local communities or by citizens, depending on the categories of

[5] *Article 9, Point 2, Article 12 (h and Annex VIII).*
[6] *Article 11, point 2, paragraph o) and Article 22, Point 7.*

conservation area concerned. There are no restrictions to implementing biodiversity offsets inside Protected Areas; regulation 89/2017 creates the conditions to promote that option. The law is thus compatible with the implementation of offsets either as enhancing biodiversity inside Protected Areas, as expansion of these areas, or as new Protected Areas.

There is a relatively new Petroleum Law (Law 21/2014). Environmental regulations (Decree 56/2010) are currently out of date as they were promulgated prior to this new law and the new EIA regulation (Decree 54 / 2015). Legislation related to Oil and Gas activities contains provisions to encourage compliance with the mitigation hierarchy: it establishes as a principle that damage to the environment must be avoided, that impacts must be identified, mitigation measures should be identified, the environment should be restored, and/ or there should be compensation for damage caused to the environment. Environmental Guidelines for Mining Activities and Oil Operations (Onshore and Offshore) are expected to be published soon, under an initiative from the Mining and Gas Technical Assistance Project, whose beneficiaries are MITADER and the Ministry of Energy and Mineral Resources (MIREME). It is likely that they will inform new environmental regulations for the Oil and Gas sector, which are expected to include requirements to assess project biodiversity impacts according to the concept of No Net Loss, the mitigation hierarchy, and biodiversity offsets.

3.2 Overview of Biodiversity Offset Initiatives in Mozambique

In 2016, the World Bank released 'A National Biodiversity Offset System: A Roadmap for Mozambique' (World Bank, 2016), whose objective was to define an approach to achieving No Net Loss in Mozambique, through the application of the mitigation hierarchy, including the creation of an aggregated system for biodiversity offsets[7]. The following are key elements of this Roadmap:

- The emphasis of this aggregated system is on bolstering Protected Areas, which are currently below the desired state of conservation, or expanding the current protected area network to include areas warranting incorporation due to the high value of their biodiversity. The Roadmap explains that 'under an aggregate offsets system, biodiversity offsets would be prepared systematically within a larger landscape context, rather than in an isolated, *ad hoc* manner'. The objective of this strategy is to guarantee that the biodiversity offsets are actually contributing to the national interests, under an approach which is aligned with the NBSAP's targets and priority actions, and not a project by project approach, which is much less efficient in achieving national goals;

- Project COMBO[8] is actively working with a conservation trust fund, BIOFUND, in Mozambique. BIOFUND was established to support the conservation of terrestrial and marine biodiversity and the sustainable use of natural resources, including the consolidation of Mozambique's protected areas system. BIOFUND manages multiple sources of financing, including an endowment fund established to ensure long-term financing for biodiversity conservation. The current main focus of BIOFUND is on biodiversity offsets; i.e. the financial mechanism for offset implementation is essentially in place. BIOFUND is working with partners, government and industries to define appropriate offset mechanisms in accordance with the Roadmap, and is currently developing its Biodiversity Offsets Operations and Execution Manuals;

- A partnership has been developed between COMBO, BIOFUND and BIOFIN (United Nations Development Program (UNDP)) to develop a biodiversity offset mechanism to achieve a policy of

[7] Aggregated offsets are measurable conservation outcomes resulting from coordinated actions arising from more than one development project. Aggregating offsets can optimise the net biodiversity benefit by increasing ecosystem connectivity, preventing future habitat fragmentation and creating large contiguous sites. (UNDP, http://www.undp.org/content/sdfinance/en/home/solutions/biodiversity-offset.html Biodiversity Offsets).

[8] Conservation, Impact Mitigation and Biodiversity Offsets in Africa. COMBO is a consortium comprising The Wildlife Conservation Society (WCS), Forest Tends and Biotope.

No Net Loss of biodiversity in Mozambique, working with MITADER[9]. This is based on the application of the mitigation hierarchy, including biodiversity offsets, in line with the national policies and strategies, international best practice and the Roadmap. It includes a technical component (e.g. developing tools for determining the metrics necessary to calculate residual impacts and quantify biodiversity, multipliers and exchange rules for use in designing offsets), as well as financial, administrative and legal components;

- A spatial planning framework is also being developed by COMBO in partnership with BIOFUND and MITADER; no-go areas, avoidance areas and offset areas as proposed in the Roadmap are to be defined. COMBO is also working with the National Directorate for Land Use Planning (DINOTER) to integrate this approach under the new National Plan for Territorial Development;

- A biodiversity mechanism is being developed, based on a decision tree, which allows project developers and their consultants to design a Biodiversity Offset Management Plan and select the offset areas which will compensate for a project's residual impacts. A process, which includes all relevant stakeholders, is being developed during 2018 to have this mechanism technically and legally approved by the Government, including MITADER and the Ministry of Economy and Finance (MEF).

3.3 IFC Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources)

The IFC's Performance Standards are directed towards clients, providing guidance on how to identify risks and impacts. They are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business sustainably, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities (IFC, 2012). Performance Standard 6 recognises that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development (IFC, 2012).

Performance Standard 6 applies to projects located in Modified, Natural, and Critical Habitats. In addition, it applies to projects which potentially impact on ecosystem services over which the client has direct management control or significant influence. IFC PS6 sets out explicit – and different - requirements for projects affecting Natural Habitat and Critical Habitat. However, all the steps of the mitigation hierarchy need to be applied to impact management in both Natural and Critical Habitats, and in both cases biodiversity offsets would be required if there are significant residual (and acceptable) impacts.

- Paragraph 13 defines Natural Habitats as 'areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition'.

- Paragraph 14 specifies 'the client will not significantly convert or degrade natural habitats, unless all of the following are demonstrated:

  - No other viable alternatives within the region exist for development of the project on modified habitat;

  - Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation; and

  - Any conversion or degradation is mitigated according to the mitigation hierarchy.

[9] *WCS/COMBO and MITADER signed a Memorandum of Understanding in June 2017.*

- Paragraph 15 indicates that 'In areas of Natural Habitat, mitigation measures will be designed to achieve No Net Loss of biodiversity where feasible…'.
- Paragraph 17 specifies that client will not implement any project activities in Critical Habitat unless it can be demonstrated:
  - 'no other viable alternatives within the region exist for development of the project on Modified or Natural Habitats that are not critical,
  - the project does not lead to measurable adverse impacts on those biodiversity values for which the Critical Habitat was designated, and on the ecological processes supporting those biodiversity values,
  - the project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time, and
  - a robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.
- Paragraph 18 specifies that 'the project's mitigation strategy will be described in a Biodiversity Action Plan and will be designed to achieve net gains of those biodiversity values for which the Critical Habitat was designated.'

The risks and impacts identification process should consider direct and indirect project-related impacts and identify any significant residual impacts. Impacts should be considered across the potentially affected landscape or seascape. As a priority, clients should seek to avoid impacts, then minimise them, then restore affected biodiversity and ecosystem services and, finally, offset significant residual negative impacts.

The Guidance Notes to IFC PS6 emphasise that, over and above meeting No Net Loss or Net Gain requirements in Natural and Critical Habitats respectively, clients should seek additional opportunities to enhance habitat and protect and conserve biodiversity in all habitats as part of their operations[10].

GN46 refers to Clause 14 (point 3) above and requires that 'on-site mitigation measures should be included in a Biodiversity Management or Ecological Management Plan'. Annex A of IFC GN6 provides guidance on the need for and scope of Biodiversity Action Plans (BAPs) and Biodiversity Management Plans (BMPs). It states the following (bullets and underlining added):

- 'Where biodiversity values of importance to conservation are associated with a project site or its area of influence, the preparation of a Biodiversity Action Plan (BAP) and/or a Biodiversity Management Plan (BMP) provides a useful means to focus a project's mitigation and management strategy.
- The development of a BAP/BMP might be required under a company's own biodiversity policy, or International Finance Institutions (IFI or "Lenders") might request a BAP/BMP to help demonstrate compliance with Lender standards. Other parties, such as government agencies, conservation organisations or Affected Communities, might also be interested in the development of a BAP/BMP to address a specific topic of concern.
- A stand-alone BAP/BMP sends a clear message to stakeholders not only on a company's selected mitigation strategy, but also on its working philosophy and its ability to operate responsibly in areas of known conservation value.

[10] *e.g. clause GN34 of the IFC GN6.*

- Companies might also opt to incorporate biodiversity-related mitigation and management measures into other, more general, Environmental Management Plans or Action Plans. The risk in this case is that commitments might appear less evident or buried among many others, and possibly be less focused.

- The development of a BAP is a Performance Standard 6 requirement when operating in critical habitats and should be developed when operating in natural habitats. A BMP is highly encouraged in both. A BAP/BMP may also be useful in modified habitats if biodiversity values of importance to conservation are associated with those areas.'

3.4 Summary and implications

The recent legislative developments in biodiversity management in Mozambique are expected to be included in the revised oil and gas regulations, which are currently under revision to align them with the more recent changes to the EIA and Conservation Regulations. This has the following implications for Sasol's activities in Inhambane Province:

- The revised regulations for the preparation of EIAs in the oil and gas sector will include requirements for the assessment of No Net Loss and the application of the mitigation hierarchy and concept of biodiversity offsets. This is already partly covered by the current Mozambican policy and legal framework for developments other than mining and oil and gas (EIA Regulations; Decree 54/2015), which requires developers to apply the mitigation hierarchy to all project impacts, using offsets as the last resort after other mitigation has been considered. Where significant residual impacts on biodiversity or ecosystem services remain after avoidance, minimisation and restoration have been taken into account, they should be counterbalanced using biodiversity offsets, in line with international best practice. Recent legislation related to the Conservation Law (Law 16/2014 amended by Law 5/2017 and Decree 89/2017) has been approved and describes how No Net Loss of biodiversity should be achieved in Protected Areas and buffer zones. This legislation does not differentiate between impacts on different habitat types; it focuses on offsets to compensate for significant residual negative impacts on all biodiversity.

- A specific mechanism for implementing offsets in Mozambique is currently being developed under the COMBO project, as well as regulations and guidance, based on the recommendations of the Roadmap for biodiversity offsets proposed by the World Bank to Mozambique. This will assist companies such as Sasol to assess and apply the concepts.

- In accordance with the IFC's Performance Standard 6, when assessing a project's impacts, practitioners will need to consider not only Critical Habitats but also Natural Habitats. The mitigation hierarchy will have to be applied to the sum total of residual impacts on biodiversity in the whole of the affected area to determine requirements for biodiversity offsets. Significant residual adverse impacts on Critical Habitat require Net Gain while those on Natural Habitat require No Net Loss of biodiversity; the latter can also require a biodiversity offset.

- The IFC GN6 recommends a BAP / BMP in Natural Habitats as a way of demonstrating adherence to the mitigation hierarchy; meeting lender and regulatory requirements and drawing focussed attention and demonstrating to stakeholders the company's commitment to implementation of biodiversity mitigation and management measures.

This changing policy and regulatory landscape suggests that Sasol will need to broaden its focus in evaluating project impacts in future. For Sasol to be fully aligned with the expected regulations and the IFC PS6 requirements, it would need to apply the mitigation hierarchy to all its impacts on biodiversity and ecosystem services across its concession area(s) in Natural and Critical Habitats, quantify significant residual negative impacts, and, where required, plan appropriate biodiversity offsets to achieve No Net Loss or Net Gain. Habitat Assessments should not be restricted to specific portions of a concession, as in

the case of the Nhangonzo study, but should cover the full area of influence of proposed activities. This would fulfil the recommendation of the FEAD EIA (Golder, 2017), which was recently approved by MITADER as the basis for framing future environmental work done for specific Sasol projects.

A BMP/BAP in line with IFC requirements to consolidate Sasol's existing and approved biodiversity mitigation and monitoring measures for the PSA area (including Nhangonzo) in a standalone document is an initial step towards providing a framework for expansion to other parts of Sasol's concession/s. Such document would go some way towards making Sasol's biodiversity commitments more accessible to stakeholders, including regulatory authorities.

4. AREA CATEGORISATION / CRITICAL HABITAT ASSESSMENT

Section 4 re-evaluates the characterisation of the Nhangonzo stream and associated catchment as an IFC Critical Habitat, providing a summary of the Nhangonzo area and its habitats, its ecological / biodiversity importance and sensitivity to development, and the constraints that should inform future development.

4.1 Vegetation Overview

4.1.1 Vegetation Classification and Habitat Mapping

The FEAD EIA (Golder, 2017) has reclassified the vegetation types and land use classes in Sasol's license areas, based on analysis of Spot 6/7 satellite imagery and extensive ground truthing. The mapping resulting from this study provides a consistent regional framework for use in studies at local level.

Table 4-1 compares the terminology used in the FEAD EIA with the classification done for Nhangonzo in the earlier studies. Table 4-2 and Figure 4-1 provide a revised classification for the Nhangonzo area, re-defined to be consistent with the regional framework but providing a greater level of detail, based on the comprehensive fieldwork done in the area.

Table 4-1. Comparison of different vegetation type classification used for the Nhangonzo catchment

Current Study (Impacto 2018)	Regional Classification (Golder 2015-2016)	Nhangonzo Catchment (EOH 2015) & WCS (2015)	Nhangonzo Catchment (De Castro 2014 / Retief 2014)
Coastal Streams	Permanently to Seasonally Wet Coastal Streams	Riparian vegetation/Coastal stream	Coastal Streams
Low Thicket	*Julbernardia globiflora* Low Thicket	Short closed miombo woodland and thicket mosaic	*Julbernadia-Brachystegia* Short Woodland and Thicket
Low to Tall Closed Woodland	*Julbernardia globifera - Brachystegia spiciformis* Low to Tall Closed Woodland	Short open miombo thicket mosaic	
Low Mid-dense Woodland	*Julbernardia globifera - Garcinia livingstonei - Hyphaene coriacea* Low Mid-dense Woodland		
Tall Thicket / Forest	*Julbernardia globiflora - Brachystegia spiciformis* Tall Thicket / Forest	Short closed miombo thicket	
Coastal Dune Thicket / Forest	*Mimusops caffra - Diospyros rotundifolia - Euclea racemosa* Low Thicket	Coastal thicket and dune scrub	Dune Forest Community
		Coastal dune forest	Coastal Forest Community
Swamp Forest	*Ficus trichopoda - Barringtonia racemosa* Swamp Forest	Swamp Forest	
Mangroves	*Rhizophora mucronata - Bruguiera gymnorrhiza* Tall Mangroves	Mangroves	Mangrove Swamps
	Avicennia marina – Ceriops tagal Low Mangroves		
Cultivated	Cultivated - Inland	Machamba/disturbed woodland and thicket mosaic	

Each of the revised vegetation types in the Nhangonzo area is described in Table 4-2, which indicates the dominant plant species, plant species of conservation concern and biodiversity value. The measure of 'biodiversity value' integrates the conservation and functional importance of each vegetation type. 'Conservation importance' considers the protection status, relative size, species diversity, presence of species of conservation concern, presence of unique habitat / taxa and present ecological status of the vegetation type, while 'functional importance' takes into account the qualitative value of ecosystem services provided by each vegetation type.

Woodland and thicket are the most widespread structural formations within the Nhangonzo catchment, with Low to Tall Closed Woodland being the dominant vegetation type in the western half of the Nhangonzo catchment. Low Thicket is dominant in the central and northern parts of the catchment and in the vicinity of Nhangonzo stream. Low Mid-dense Woodland is predominant in the eastern half of the catchment.

Patches of Tall Thicket / Forest and Swamp Forest represented in the terrestrial vegetation mapping for Nhangonzo were under-represented in the regional scale mapping, partly because of limitations of mapping scale, which obscured small, fragmented, habitat patches and because of the resolution of the satellite imagery used. The distinctive spectral signatures of the Tall Thicket and Swamp Forest habitats were more clearly evident on the December 2017 Sentinel imagery, used in the present study, which allowed the boundaries of each habitat to be re-defined. In addition, the 2017 imagery was used to map changes in cultivated areas.

Figure 4-1. Revised vegetation map for Nhangonzo catchment in alignment with the regional vegetation map for Sasol's license areas

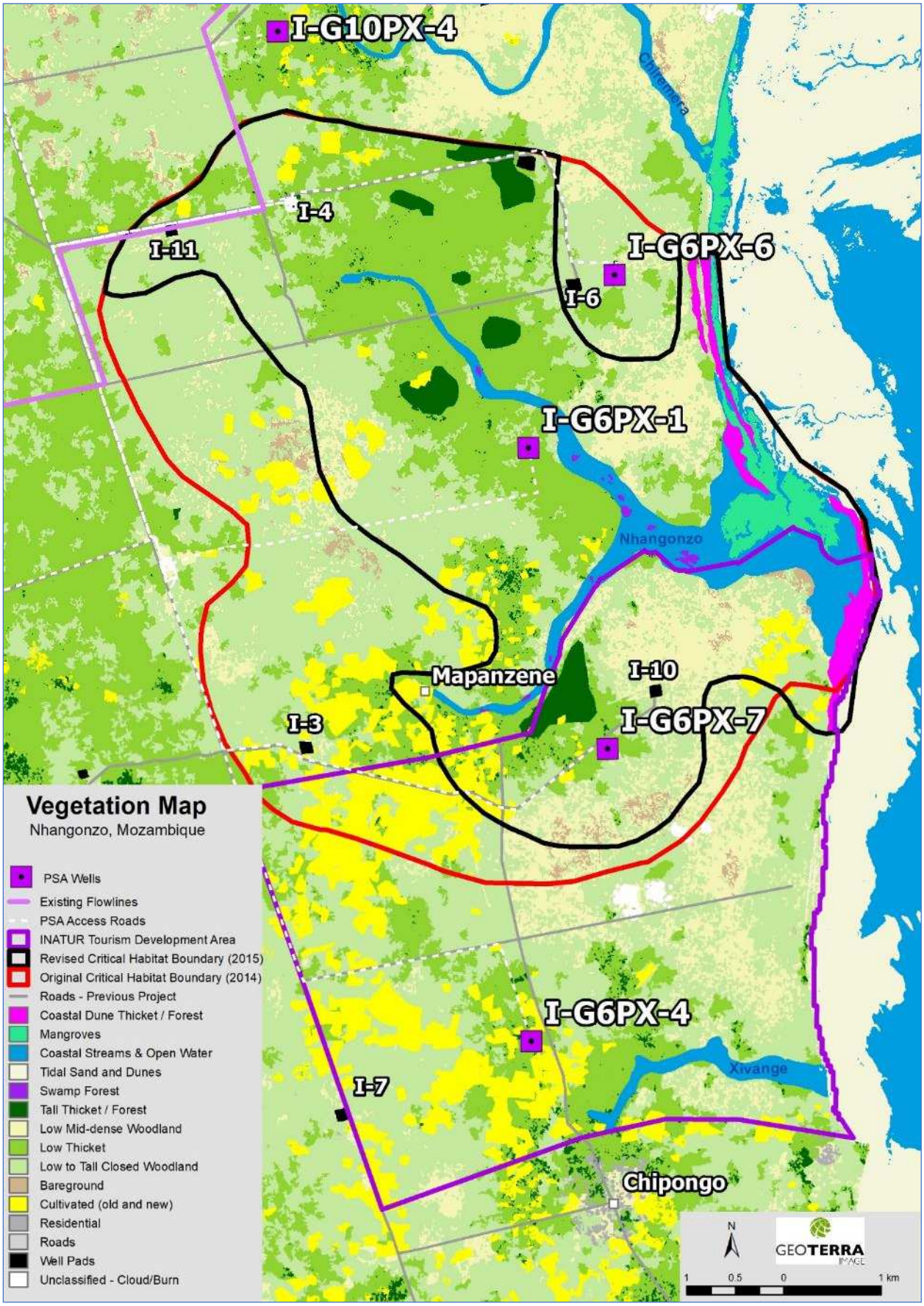


Table 4-2. Summary description of vegetation types and biodiversity value in the Nhangonzo area

Vegetation Communities	Key Characteristics	Dominant Species and Species of Conservation Concern	Photographs	Biodiversity Value
1. Forest / Thicket Formations				
Forest is here defined as vegetation dominated by trees and shrubs, with a closed canopy, usually with interlocking crowns, and with clearly definable strata below the canopy and an herbaceous layer. Thicket is also a vegetation formation dominated by trees and shrubs, but with no definable sub-canopy strata and usually a poorly defined herbaceous layer.				
Coastal Dune Forest / Thicket Extent (and %) in Nhangonzo: Occurring in a narrow strip along coastal fore dunes and secondary dunes along the eastern boundary, covering 63 ha (2% of the study area)	**Terrain Features**: Low undulating dunes, sometimes reddish sand cliffs. **Soil Types***:* Deep, white sands on dunes above littoral zone. **Vegetation Structure***:* Low thicket, forming Low Forest on high ancient dune system west of current coastal dunes. Canopy cover 80-100%. Canopy height 2-7 m.	**Dominant Species**: *Mimusops caffra, Diospyros rotundifolia* and *Euclea racemosa* **Species of conservation concern**: *Carissa praetermissa* (DD); *Afzelia quanzensis* (NT). Several range-restricted endemic species, such as *Zanthoxylum delagoense* and *Triaspis suffulta*. Numerous protected species such as *Mimusops caffra, Brachystegia torrei* and *Balanites maughamii*.		Very High
Tall Thicket / Forest Extent (and %) in Nhangonzo: Occurring in several discrete patches across the central part of the area, covering 116 ha (4% of the study area)	**Terrain Features**: Level to undulating plains. **Soil Types***:* Deep, white Aeolian sands. **Vegetation Structure***:* Tall thicket, sometimes tall forest. Canopy cover 100%. Canopy height 4-8 m.	**Dominant Species**: *Julbernardia globiflora* and *Brachystegia spiciformis* **Species of conservation concern**: *Afzelia quanzensis* (NT) Numerous protected species such as *Julbernardia globiflora, Brachystegia spiciformis* and *Afzelia quanzensis*.		High
Swamp Forest Extent (and %) in Nhangonzo: Found in several discrete, fragmented patches within Nhangonzo coastal stream, none larger than 2 ha and covering a total area of 6 ha (0.2% of the study area)	**Terrain Features**: Riverbanks, groundwater seepage zones. **Soil Types***:* Deep dark loam soils in permanently wet areas. **Vegetation Structure***:* Low to Tall Forest. Canopy cover 100%. Canopy height 3-8m.	**Dominant Species**: *Ficus trichopoda, Barringtonia racemosa* **Species of conservation concern**: A few protected species, such as *Erythrophloeum lasianthum, Trichilia emetica* and *Syzygium cordatum*.		High

Vegetation Communities	Key Characteristics	Dominant Species and Species of Conservation Concern	Photographs	Biodiversity Value
Low Thicket Extent (and %) in Nhangonzo: The dominant vegetation type in the centre of the area, covering 931 ha (32% of the study area)	**Terrain Features**: Level to undulating plains. **Soil Types***:* Deep, white Aeolian sands. **Vegetation Structure***:* Low thicket, sometimes merging with Low closed woodland. Canopy cover 80-100%. Canopy height 2-5 m.	**Dominant Species**: *Julbernardia globiflora* **Species of conservation concern**: *Xylia mendoncae* (VU) outside of the Critical Habitat. Numerous protected species such as *Julbernardia globiflora, Brachystegia spiciformis, Albizia versicolor* and *Antidesma venosum*.		Medium
2. Mangrove Formations				
Mangroves Extent (and %) in Nhangonzo: Occurring at the Nhangonzo estuary and along the coastline adjacent to the estuary, covering 75 ha (2.5% of the study area)	**Terrain Features**: Estuaries, littoral zone. **Soil Types***:* Fairly deep mud along shoreline or at river mouth. **Vegetation Structure***:* Low to tall thicket. Canopy cover 80-100%. Canopy height 2-8m.	**Dominant Species**: *Rhizophora mucronata, Bruguiera gymnorrhiza, Avicennia marina, Ceriops tagal* **Species of conservation concern**: Protected species, including: *Rhizophora mucronata, Avicennia marina* and *Bruguiera gymnorrhiza*		Very High
3. Woodland Formations				
Woodland is loosely defined here as vegetation dominated by trees and woody shrubs with an open to closed canopy, but not with interlocking crowns, and a well-developed grassy understory.				
Tall Mid-Dense Woodland (not mapped or quantified due to localised extent)	**Terrain Features**: Edges of coastal streams. **Soil Types***:* Not sampled. **Vegetation Structure***:* Tall mid-dense woodland. Canopy cover 40-60%. Canopy height 4-7m.	**Dominant Species:** *Syzygium cordatum, Syzygium guineense, Uapaca nitida* **Species of conservation concern**: Several protected species such as *Syzygium cordatum* and *Syzygium guineense*.		Medium

Vegetation Communities	Key Characteristics	Dominant Species and Species of Conservation Concern	Photographs	Biodiversity Value
Low to Tall Closed Woodland Extent (and %) in Nhangonzo: Dominant vegetation type in western half of the area, covering 913 ha (31% of the study area)	**Terrain Features**: Undulating to level plains. **Soil Types***:* Deep white to light brown sands. **Vegetation Structure***:* Low to tall closed woodland. Canopy cover 60-80%. Canopy height 4-7m.	**Dominant Species:** *Julbernardia globifera, Brachystegia spiciformis* **Species of conservation concern**: One range-restricted endemic species, *Chamaecrista paralias*. A number of protected species such as *Julbernardia globiflora, Brachystegia spiciformis, Parinari curatellifolia* and *Albizia versicolor*.		Medium
Low Mid-Dense Woodland Extent (and %) in Nhangonzo: Dominant vegetation type in eastern half of the area, covering 353 ha (12% of the study area)	**Terrain Features**: Undulating to level plains and moist depressions. **Soil Types***:* Deep white sands. **Vegetation Structure***:* Low open to mid-dense woodland. Canopy cover 40-60%. Canopy height 3-7m.	**Dominant Species:** *Julbernardia globifera, Garcinia livingstonei, Hyphaene coriacea* **Species of conservation concern**: One range-restricted endemic species, *Chamaecrista paralias*. Numerous protected species.		Medium
4. Grassland / Shrubland Formations				
These formations are characterised by a lack of trees and woody shrubs, or the presence of sparsely scattered low shrubs; the primary vegetation layer is herbaceous and is dominated by grass species				
Low Herbland (Not mapped due to small spatial extent)	**Terrain Features**: Low fore dunes between coastline and vegetated dunes. **Soil Types***:* Deep white sand. **Vegetation Structure***:* Low Closed to mid-dense herbland. Canopy cover 70-100%.	**Dominant Woody Species:** *Sophora inhambanensis* **Species of conservation concern**: None recorded.		High

Vegetation Communities	Key Characteristics	Dominant Species and Species of Conservation Concern	Photographs	Biodiversity Value
5. Wetlands				
These comprise permanently or seasonally wet vegetation communities that are usually dominated by grass and / or sedge species, with trees and shrubs being absent or sparsely scattered				
Coastal Streams Extent (and %) in Nhangonzo: Dominant vegetation type along the Nhangonzo stream, covering 262 ha (9% of the study area)	**Terrain Features:** Valley bottom wetlands that are channelled or unchannelled **Soil Types:** Deep wetland soils, peat soils in some systems **Vegetation Structure:** Grass-sedge meadows, reed-sedge meadows	**Dominant Species:** Ferns such as *Lycopodiella caroliniana* and *Cyclosorus interruptus,* sedges such as *Cladium mariscus* and *Cyperus* spp., grasses such as *Andropogon eucomus* and *Imperata cylindrica* **Species of Conservation Concern**: Unique ecotype of *Trichopteryx dregeana*		Very High

4.2 Re-assessment of Nhangonzo Critical Habitat Status

In this subsection, the criteria that were used to designate the Nhangonzo area as a provisional Critical Habitat are reviewed. Where additional species information has become available it is included in the evaluation.

The IFC Guidance Note to Performance Standard 6 (GN6) specifies five criteria for determining Critical Habitat:

- Criterion 1: Critically Endangered and Endangered Species
- Criterion 2: Endemic and Restricted Range Species
- Criterion 3: Migratory and Congregatory Species
- Criterion 4: Highly Threatened and/or Unique Ecosystems
- Criterion 5: Key Evolutionary Processes

GN 6 defines quantitative thresholds for Criteria 1-3 and guidance for the application of Criteria 4 and 5. GN 56 and 57 provide additional criteria that may inform the designation of an area as Critical Habitat. All of these criteria have been re-assessed in the sections below.

4.2.1 Criterion 1: Critically Endangered or Endangered Species (IFC PS6: GN71-78)

IFC Criteria

Criterion 1 refers to the presence of species threatened with global extinction and listed as Critically Endangered (CR) and Endangered (EN) on the IUCN Red List of Threatened Species. This criterion also applies to species listed nationally or regionally as CR or EN in countries that have adhered to IUCN guidance. In special circumstances, and through consultation with a recognised species specialist, the guidance provided for Criterion 1 may be extended to some subspecies; but this requires rigorous consensus-based justification and cannot simply be the opinion of a single taxonomist.

There are two tiers of Critical Habitat defined under Criterion 1: Tier 1 and Tier 2. These are separated by quantitative thresholds. Tier 1 Critical Habitats have a greater percentage of the global and national population size, or proportion of a known species range or distribution, than Tier 2. Tier 1 Critical Habitat is the most highly threatened category and is of significant global importance for the long-term survival of qualifying species. The thresholds for qualifying species under Tier 1 and 2 are:

Criterion 1: Critically Endangered or Endangered Species	
Tier 1	**Tier 2**
(a) Habitat required to sustain ≥ 10% of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species	(c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies.
(b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management units for that species.	(d) Habitat of significant importance to CR or EN species that are wide ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.
	(e) As appropriate, habitat containing nationally/regionally important concentration of an EN, CR or equivalent national/regional listing.

Re-evaluation of Criterion 1

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
1	The area supports concentrations of Vulnerable (VU) species and endemic fossorial reptiles (*Panaspis* sp., *Atractaspis* sp.), whose conservation status have not been formally assessed, but which have very restricted Areas of Occupancy, which would qualify them for Vulnerable status or possibly even Endangered status under existing IUCN criteria.	**There are no confirmed CR or EN species within the Nhangonzo area**. Concentrations of VU species where their status is uncertain is an additional IFC criterion that is addressed in Section 4.2.6. See further information on the reptiles used by EOH as motivation for Critical Habitat, under Criterion 2 below.	Critical Habitat status is not upheld for Criterion 1.
2	-	***Additional Species Considered*** **Flora**: One EN species - *Ecbolium hastatum* - was located by W. McCleland as part of the FEAD EIA (Golder, 2017), subsequent to the EOH (2015) studies. This species occurs in dune thicket to the north of the Nhangonzo area and potentially in the same habitat within the Nhangonzo area. Limited fieldwork has been conducted in dune thicket within the area to locate this species. **Birds**: There is a low likelihood of Madagascar Squacco Heron, which is classified as EN, occurring in the Critical Habitat, although the Nhangonzo wetland habitat is too dense for this species to use the habitat regularly (McCleland, *pers. obs*.) and the species does not winter regularly south of Beira. If it does occur, which is unlikely, it would be as a very infrequent vagrant.	Critical Habitat status is not upheld for Criterion 1.

Implications for Critical Habitat Status and Sasol

Based on current knowledge of plant and animal distribution in the Nhangonzo catchment, none of the habitats qualifies as Critical Habitat under Criterion 1. Should *E. hastatum* be found It would be unlikely to be anywhere other than in the dune thicket, which occurs in the Nhangonzo catchment in a narrow strip approximately 150 m wide along the coastline. While this would qualify as Critical Habitat under Criterion 1, it falls within the 500 m coastal buffer zone[11] within which all of Sasol's seismic and drilling activities are prohibited, and even if present the species would not be impacted by Sasol's activities.

4.2.2 Criterion 2: Endemic and Range-Restricted Species (IFC PS6: GN79-84)

IFC Criteria

Criterion 2 provides thresholds to determine whether endemic or range restricted species should be assigned to Tier 1 or Tier 2 depending on the degree to which a species is restricted or localised in its distribution. A Tier 1 habitat might typically be the only known locality for a species.

Currently, an endemic species is defined as one that has ≥ 95 percent of its global range inside the country or region of analysis (GN79). This has often led to species that may be endemic to a country or large region being invoked as a trigger for Critical Habitat regardless of how widespread or abundant it may be. Current thresholds for endemic and range-restricted species in the IFC GN6 (2012) are as follows:

- For terrestrial vertebrates, extent of occurrence is 50,000 km^2 or less.
- For marine systems, extent of occurrence is 100,000 km^2 or less.

[11] *The 500 m buffer zone is an existing management measure in Sasol's existing EMPs that prohibits oil and gas activities within 500 m of the coast.*

- For freshwater systems, standardised thresholds have not been set at the global level. However, an IUCN study of African freshwater biodiversity applied thresholds of 20,000 km^2 for crabs, fish, and molluscs and 50,000 km^2 for odonates (dragonflies and damselflies). These can be taken as approximate guidance, although the extent to which they are applicable to other taxa and in other regions is not yet known.
- For plants, restricted-range species may be listed as part of national legislation.

Criterion 2: Endemic and Range-Restricted Species	
Tier 1	**Tier 2**
(a) Habitat known to sustain ≥ 95% of the global population of an endemic or restricted range species where that habitat could be considered a discrete management unit for that species (e.g. a single-site endemic)	(b) Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement

Re-evaluation of Criterion 2

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
1	The area has high scientific value containing concentrations of species new and/or little known to science (*Panaspis* sp., *Atractaspis* sp.), and a new southern limit for the Bronze Skink (*Trachylepis boulengeri*).	The three reptile species used to motivate Criterion 2 have been discounted as valid biodiversity trigger species for the following reasons: ▪ *Panaspis* sp. – a snake eyed skink - was thought to be a potential new species but is now considered to be part of the 'wahlbergi' clade and therefore no longer valid as a putative new species (Prof W.R. Branch, *pers. comm*.) and therefore not a viable trigger species. ▪ *Atractaspis* sp.: it is not clear whether this burrowing snake taxon was actually collected within the study area by Branch or not; it does not appear on the study area species list in the appendices and is not on the list of any reptiles trapped during fieldwork; it appears that it was mentioned because of collections on Bazaruto and San Sebastian Peninsula by Jacobsen *et al*. (2010); according to herpetologist Luke Verburgt (*pers. comm*.), this taxon is now considered to be merely a form of the widespread *Atractaspis bibronii* with no unique taxonomic status. It is thus discounted as a viable trigger species. The Bronze Skink occurs in mesic habitats from Tanzania to central Mozambique. A southern range extension for Bronze Skink *Trachylepis boulengeri* is not relevant to Criterion 2.	Critical Habitat status is not upheld for Criterion 2 for the three reptile species
2		***Additional Information:*** **Reptiles**: An additional two species of reptile were proposed as potential triggers of Criterion 2, but neither of these two species were collected in the Nhangonzo study area during EOH (2015) field work and are thus not valid triggers for the area within the study area boundary. This is dealt with in more detail below: ▪ *Acontias aurantiacus* – a golden burrowing skink – was not confirmed to occur within the Critical Habitat but was found in secondary thicket near the Govuro River to the west. According to Prof. Branch, the skinks that he caught showed morphological features of both the nominate subspecies (which is endemic to southern	Unlikely, but there is a high degree of uncertainty on the known distribution of reptiles recorded in the project area due to lack of sufficient survey data. Further, the genetic variability in reptiles has led to uncertainty in the species status of several specimens. However, based on current information Critical Habitat for reptiles is not supported.

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
		Mozambique) and *A. a. bazarutoensis* (which is endemic to the Bazaruto archipelago and San Sebastian peninsula). There is significant uncertainty in the precise taxonomy and genetic identity of these individuals. Nonetheless, the species itself is not endemic to Mozambique (less than 95% of its range), also occurring in South Africa. ▪ *Mochlus lanceolatum* – a writhing skink, this is a range-restricted species that is endemic to the islands of Bazaruto, Benguerra and Magaruque (Broadley, 1990b, 1992), but was subsequently recorded from Vilankulo Coastal Wildlife Sanctuary (Jacobsen *et al.,* 2010). Prof. Branch collected *Mochlus* cf. *afrum* in one pitfall trap within the study area and notes that it is morphologically similar to *M. lanceolatum*, but he did not actually collect this range-restricted endemic species during fieldwork in the Nhangonzo area. While this would be a relevant Criterion 2 trigger species under Tier 2 thresholds, it has not been confirmed to occur in the Nhangonzo area and is therefore not relevant to this Critical Habitat assessment.	
3		***Additional Information:*** **Plants**: Only two of the locally endemic or range-restricted plant species mentioned by De Castro have been confirmed to occur within the Nhangonzo area (*Carissa praetermissa,* and *Chamaecrista paralias*), while one species (*Xylia mendoncae*) occurs in adjacent areas in habitat represented in the Nhangonzo area but has not been recorded within its boundary. Although these three species are all legitimate Criterion 2 triggers (Tier 2) having an Area of Occurrence (AOO) of less than 50,000 km^2, *X. mendoncae* has not been confirmed within the study area and *C. paralias* is widespread and common through the coastal plain east of the Govuro River between Inhassoro and Vilankulo, occurring in various habitat types. Thus, the only strong candidate for triggering Criterion 2 is *C. praetermissa* (which is dealt with in more detail in Table 4-5). Subsequent fieldwork in the Nhangonzo area in March 2018 confirmed the presence of *Zanthoxylum delagoense* and *Triaspis suffulta*, both range-restricted endemics confined to Inhambane province. Both these species are confined to Coastal Dune Thicket, which is the only habitat in which *C. praetermissa* was found in the Nhangonzo area. Two other range-restricted species have also been confirmed to occur within the Dune Thicket community between Nhangonzo and Inhassoro (*Ecbolium hastatum, Trainolepis sancta*) and both are potentially present in this habitat type in the Nhangonzo area.	Tier 2 Critical Habitat confirmed for Dune Forest/ Thicket for the presence of at least three range-restricted plants (*C. praetermissa, Z. delagoense, T. suffulta*), and a high likelihood of other plant species being present (i.e. species that have been found in close proximity in the same vegetation type).

Implications for Critical Habitat Status and Sasol

At least three range-restricted and endemic plant species, as well as several other potentially occurring range-restricted endemic species, are restricted to coastal dune thicket / forest habitat, which supports the designation of that vegetation type as Critical Habitat (Tier 2). The three reptile species that were previously considered to be Criterion 2 trigger species have been discounted, as well as the additional two range-restricted reptile species dealt with in the above table, and none of these reptile taxa supports the designation of Critical Habitat. The result is a significantly reduced Critical Habitat within the Nhangonzo area, located entirely within the 500 m 'no go' zone for oil and gas activities, as required of Sasol's existing EMPs (Figure 4-2).

4.2.3 Criterion 3: Migratory and Congregatory Species (IFC PS6: GN 78)

IFC Criteria

Migratory species are those where a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem). Congregatory species are those whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis. These include species that live in or form colonies for breeding, foraging or roosting purposes; those which migrate through bottleneck sites for a concentrated period of time; those with clumped distributions where many individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed; or source populations where certain sites hold populations of species that contribute significantly to the recruitment of the species (e.g. marine species).

The thresholds for assigning migratory and congregatory species to Tier 1 and 2 are summarised below.

Criterion 3: Migratory and Congregatory Species	
Tier 1	**Tier 2**
(a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that species.	(b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgement.
	(c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.
	(d) For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species.
	(e) Source sites that contribute ≥ 1 percent of the global population of recruits.

Re-evaluation of Criterion 3

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
1	Indicated as Not Applicable	**Congregatory Birds**: While no bird counts were conducted, the mudflats around the estuary were estimated to support several thousand migratory waders during the March 2018 survey, mostly non- threatened species such as Whimbrel and Grey Plover. Other wetlands and estuaries along the coastline and on the Bazaruto archipelago support much higher numbers, such as Inhambane Bay. The estuarine habitats adjacent to the Critical Habitat do not appear to support significant enough numbers of migratory and congregatory species to trigger this criterion.	Critical Habitat status is not upheld for congregatory birds under Criterion 3.

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
2		**Migratory Birds**: As indicated under Criterion 1, there is a low likelihood of the migratory Madagascar Squacco Heron, which is classified as EN, occurring in the Critical Habitat, although the Nhangonzo wetland habitat is too dense for this species to use the habitat regularly (McCleland, *pers. obs*.) and the species does not winter regularly south of Beira. If it does occur, which is unlikely, it would be as an infrequent vagrant.	Critical Habitat status is not upheld for migratory birds under Criterion 3.

4.2.4 Criterion 4: Highly threatened and Unique Ecosystems (GN90-93)

IFC Criteria

As defined by the IFC PS6 (GN90), highly threatened or unique ecosystems are those:

- that are at risk of significantly decreasing in area or quality;
- with a small spatial extent; and/or
- containing unique assemblages of species including assemblages or concentrations of biome-restricted species.

GN90, further states 'Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by government bodies, recognised academic institutions and/or other relevant qualified organisations (including internationally-recognised NGOs) or that are recognised as such in existing regional or national plans such as the NBSAP, would qualify as Critical Habitat per Criterion 4'. An example of a highly threatened ecosystem would be one losing a high percentage of its area each year, while an example of a unique ecosystem would be one that occurs in very limited numbers in the region.

IFC GN93 indicates that to implement this criterion, the client must conduct a substantive literature search and consult relevant ecosystem mapping that includes the site. If such mapping is not available, the client could obtain expert opinion to determine the significance, uniqueness, and/or rarity if the ecosystem with respect to national, regional and/or international scale.

IUCN's Commission on Ecosystem Management has put together criteria and categories of threatened ecosystems. Rodriguez *et al*. (2015) and Bland *et al*. (2016) provide a methodology for evaluating threatened ecosystems using five criteria: declining (geographic) distribution; restricted distribution; abiotic degradation; biotic degradation and probability of collapse.

Assessment of the Nhangonzo area in terms of Criterion 4 has involved a high-level qualitative analysis using available information of each structural vegetation type represented in the area against the three IFC criteria for evaluating highly threatened and unique ecosystems (Table 4-3).

Re-evaluation of Criterion 4 (in relation to wetlands)

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
1	The wetland system associated with the Nhangonzo coastal stream can be classified as a type of peatland, or mire, also known as a 'fen', which is essentially pristine. Peatlands are uncommon in the southern African context, and the extent and occurrence of other similar peatland systems in similar circumstances in Mozambique/southern Africa is not well understood. Thus, based on	The motivation by WCS (2015) for the Nhangonzo peat wetland system as a Critical Habitat under Criterion 4 is not based on the IFC and IUCN threatened ecosystem criteria, listed above. Little supporting evidence based on regional mapping or from expert-led literature sources is presented in WCS (2015) to substantiate the premise that the Nhangonzo coastal wetland is unusual or potentially threatened to the extent that it warrants designation as a Critical Habitat under Criterion 4.	Insufficient evidence exists to support the designation of the Nhangonzo coastal wetland system as a unique or highly threatened ecosystem based on criteria below.

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
	current knowledge, and adopting a precautionary approach this is an unusual, potentially threatened, ecosystem.	Further assessment of the peat wetlands using IFC criteria is described below.	
2	Additional Information in specialist reports (e.g. WCS, 2015; as Appendices to Golder (2015c)) that is potentially relevant to re-assessment of the wetland system as a Critical Habitat under each criterion is indicated below: i) **At risk of significantly decreasing in area or quantity:** • The freshwater peat mire streams were found to be in near-pristine condition, with most open-water areas relatively inaccessible to people due to the surrounding dense wetland vegetation and soft, marshy, substrate. Man-induced impacts include isolated instances of pollution (clothes washing and seepage of sewage from adjacent villages) and the clearing and disturbance of small sections of the riparian zone for crops. The mangrove trees are also harvested by local villagers, mainly for building purposes. However, these existing impacts do not affect the hydrology or the functional integrity of this aquatic ecosystem and can be considered insignificant.	Peat-based coastal wetland systems (peatlands[12]) are under threat across their distribution from northern KwaZulu Natal/ Maputaland (Brito *et al.* 1998); and across Mozambique primarily for cultivation due to their year-round water availability. The extent and rate at which peat-based wetland systems are declining have not been mapped or properly assessed for Mozambique. However, as indicated by EOH (2015a), there is no evidence to suggest that the hydrology or integrity of the Nhangonzo wetland is under threat currently, despite a long period of shifting cultivation in the area to the south and west of the wetland (which appears to be increasing). It is possible that this wetland system may not be suited to cultivation, perhaps because of higher salinity levels in this tidal system.	Insufficient evidence to support the designation of the Nhangonzo coastal wetland system as a unique or highly threatened ecosystem.
3	**ii) With a small spatial extent:** • Peatlands are uncommon in the southern African context, and the extent and occurrence of other similar peatland systems in similar circumstances in Mozambique/southern Africa is not well understood. • The streams contain peat mires (actively forming peatlands), the only confirmed peat deposits north of Maputo in Southern Mozambique. • There are nine coastal streams along 90 km of coastline from the mouth of the Govuro River in the north to Ponta Chiuzine bay (south of Vilankulo). Three of these, and a part of the catchment of a fourth, are within the project area (Nhangonzo, Cherimera and Xivange) (Golder, 2014).	Markov *et al.* (1988) refer to peatland along the Indian Ocean coast. Bord na Mona (1984) and Shrier (1985) (referring to Pereira Coutinho (1949)) refer to extensive but unquantified peat deposits in mangrove swamps and in river valleys and estuaries along the coast. They state that formations ('machongos') associated with depressions along old coastal dunes contain peat - either relatively pure or mixed peat and alluvium. Grundling (cited in 2004[13]) indicated there could be between 1500 and 2500 km^2 of peatland in the coastal plain of Mozambique. While no regional surveys of coastal wetlands appear to have been done which include peat sampling, another larger wetland system with peat was recorded south of Inhassoro but which was more reed-dominated (W McCleland, *pers. comm*.). Additional peat wetlands have been identified recently in coastal areas in Zambézia and Cabo delgado Provinces (between Pebane to Pemba) and ranging in size from 3 to 900 ha (Avis, EOH, *pers. comm.).* Further, Hughes & Hughes (1992) indicates riverine wetlands to be numerous with riparian floodplains and swamps to be located on almost every lowland river, represented by reed and papyrus swamps but also	Insufficient evidence to suggest that peat wetland systems are rare or can qualify as being of sufficiently 'small spatial extent' on the coastal plains of Mozambique to qualify under this criterion.

[12] Peatlands refer to those wetland ecosystems characterised by the accumulation of organic matter (or peat) derived from dead and decaying plant material under conditions of permanent water saturation (Grundling, 2010)
[13] http://www.imcg.net/media/download_gallery/gpd/africa/mozambique.pdf

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
		"extensive patches of riverine swamp forest". It therefore appears likely that additional surveys in the region may reveal similar, potentially more significant, peat wetland systems.	
4	**iii) containing unique assemblages of species including assemblages or concentrations of biome-restricted species** • Various plant species are largely or entirely restricted to the peat mire habitats. Three of the four new records for Mozambique and one of two probable ecotypes were recorded only from mires (WCS 2015; appended to Golder, 2015c).	While it cannot be disputed that the peat mires have some unique species within the context of the Nhangonzo system, there are not sufficient data from similar surveys along the coastal plain between Inhambane and the Save River to be able to state that: i) there are no other areas within the region that have peat mires with similar species diversity; and ii) the three new records for Mozambique (*Rhynchospora rubra* subsp. *africana*, *Frimbristylis bivalvis* and *Schoenus nigricans*) and the two ecotypes (*Trichopteryx dregeana* and *Chysopogon serrulatus)* do not occur elsewhere on the coastal plain. In summary, no species have been confirmed during previous surveys which are specifically associated or unique to the wetland system.	Not upheld.
	iv) Irreplaceable or high priority areas based on systematic conservation planning or that are recognised as such in existing regional or national plans, such as the NBSAP • WWF have classified this eco-region (Southern Zanzibar-Inhambane Coastal Forest Mosaic which stretches for 2200 km along the east coast of the African continent from southern Tanzania to Xai-Xai) as being Critically Endangered on a worldwide spatial scale (Schipper and Burgess, 2015). This broad classification and the severity of impacts from activities such as clearing of vegetation for agriculture is difficult to predict due to a lack of information in Mozambique. The classification is therefore precautionary in nature (EOH 2015).	The Mozambique NBSAP (2015-2035) and the Fifth National Report on the implementation of the CBD in Mozambique (MICOA, 2014) acknowledge the coastal lagoons, swamps and marshes flooded in the rainy season, located behind the coastal dune system of the south of Mozambique, to be important aquatic ecosystems (Hatton, 1995; Hart & Boane, 2004). It indicates that over 100 of these lakes occur between Vilankulo and Ponta do Ouro and mentions that some of the largest and most important for biodiversity, fisheries and tourism are the lagoons of Bilene, Nhambavale, Quissico, Inharrime and Piti. All of them are important feeding and nesting places for birds. It acknowledges the threats to these systems by farmers for cultivation. Mapping of Critical Habitat in Mozambique by CEAGRE (2015) for BIOFUND mapped the Nhangonzo area as Natural Habitat, although acknowledged that mangroves and wetlands should be considered Critical Habitats under IFC Criterion 4. Peat wetland systems are not mentioned in the National Biodiversity Strategic Action Plan (NBSAP) or the Fifth National Report for the Convention on Biological Diversity (CBD), most likely because these ecosystems are understudied in Mozambique. The Offsets Roadmap (World Bank, 2016) emphasises Mozambique's aquatic ecosystems and wetlands as critical for biodiversity conservation, specifically mentioning the southern coastal lake systems as important, including those in Maputo Special Reserve and others in northern Zambezi and southern Nampula that are incorporated into the MPA of Primeiras and Segundas Archipelago. No mention is made of the importance of the coastal wetlands of the Inhambane Province.	Criterion 4 not upheld. Regional or national plans do not specifically prioritise coastal wetland systems for priority management and protection.

High level evaluation of Criterion 4 for all habitats

The table above specifically responds to the earlier motivation for Critical Habitat for wetland habitat (EOH (2015a) and WCS (2015)). A high-level analysis has been done to assess all the habitats represented in the Nhangonzo area against Criterion 4 drawing upon the IFC criteria of: i) at risk of significantly decreasing in area or quality; ii) small spatial extent; and/or iii) containing unique

assemblages of species including assemblages or concentrations of biome-restricted species. A summary of this analysis is presented in Table 4-3. Only Coastal Dune Thicket / Forest potentially triggers Critical Habitat under Criterion 4 but which mainly provides additional support for its designation as Critical Habitat under Criterion 2.

Table 4-3. Qualitative assessment of habitats in the Nhangonzo area against Criterion 4

Habitat Type	Assessment against IFC Criterion 4 Criteria	Criterion 4 Triggered
Coastal streams	As indicated by EOH (2015a), there is no evidence to suggest that the hydrology or integrity of the Nhangonzo wetland is under threat currently. There is insufficient evidence to show that peatlands are rare or can qualify as being of sufficiently 'small spatial extent' on the coastal plains of Mozambique. The plant species presented by EOH (2015) as being potentially unique to this system are more widely distributed elsewhere, even though they have either not previously been recorded in Mozambique, or not previously been noted in peatland habitat.	No
Mangroves	At a global scale, mangroves are widely distributed across 123 countries in the tropics but comprise only 1% of tropical forest types (cited in Martin *et al*., 2015). Due to the rate of habitat destruction globally (estimated at 20% between 1980 and 2005; Spalding *et al*., 2010 in Martin *et al.,* 2015) they have been assessed as 'Likely Critical Habitat' under Criterion 4 (Martin *et al*., 2015). Globally, 11 of the 70 mangrove species (16%) are at elevated threat of extinction, particularly along the Atlantic and Pacific coasts of Central America, where as many as 40% of mangrove species present are threatened with extinction (Pomidoro *et al*., 2010). Mangrove species occurring along the East African coastline are more widely distributed and none is threatened with extinction. At a national scale, Mozambique's Fifth National CBD report (MICOA 2014) cites East African Mangroves as having a 'Critical' Conservation Status (following Burgess *et al*. 2004) and reports a decline in mangroves from 408,000 to 357,000 ha over a 32-year period from 1972 to 2004 i.e. 12.5%, or 1,593 ha per year (Marzoli, 2007 in MICOA, 2014). Other data in FAO (2015) suggests a decrease from 404,000 to 337,000 over 25 years between 1990 and 2015 (i.e. 16.5%); a rate of loss of 2,644 ha per year (equivalent to 28.5% over 50 years)[14]. These rates are under the >30% threshold used by Bland *et al*. (2016) to classify a Vulnerable ecosystem and thus could be classified as nationally Near Threatened. Some locations in Mozambique, such as the Zambezi River mouth, have shown an increase in mangrove species: Shapiro *et al* (2015) found an increase of 37,034 ha of mangroves between 1994 and 2013, equivalent to 3723 ha per year over 19 years. World Bank (2016) states that "Due to their role in coastal protection and their importance in the reproduction of many marine species, mangroves should always be categorized at least as critical habitat". The CEAGRE (2015) mapping of Critical Habitats also considered mangroves as a Critical Habitat under IFC Criterion 4 (Highly Threatened and Unique Ecosystem) and included the mangrove systems from the Govuro Estuary along the coast to Beira (and the entire BANP and San Sebastian Peninsula) but did not include the Nhangonzo estuary (which was probably overlooked due to its small size given the scale of mapping). While all mangrove systems undoubtedly have high conservation value for their ecological role in coastline and estuarine protection and fishery maintenance, their biodiversity and functional ecological value at a local scale is linked to their areal extent, species diversity, size of trees, provision of refugia for biome-restricted or threatened species (e.g. dugong), and role as nursery breeding refugia for fish. A national strategy and action plan for mangrove management in Mozambique is in its final stage of approval and allows for the sustainable use of mangroves. One of the proposed strategic objectives is to review existing legislation and create specific legislation relating to mangrove management and protection.	No

[14] *A current study is underway by the University of Eduardo Mondlane to map and quantify the extent and rate of mangrove deforestation (H Costa, pers. comm.)*

Habitat Type	Assessment against IFC Criterion 4 Criteria	Criterion 4 Triggered
	. At a local scale, the mangrove forest in the Nhangonzo area occupies a relatively small extent of ~75 ha (e.g. as compared to the 12,500 ha Govuro/Save wetland system located 90 km to the north, which qualifies as Critical Habitat in the CEAGRE mapping). This small system is largely intact with only limited evidence of mangrove cutting and appears to have remained stable at least since 2005 (Golder, 2015d, report 8). Tree diversity is relatively high with 7 of the 10 mangrove tree species recorded for Mozambique (EOH, 2015e). However, none of these mangrove species is threatened (six of the seven are listed Least Concern by IUCN, and one is not listed). In addition, the trees are shorter than average (compared to the 20-30 m tree height recorded on other mangrove forests elsewhere in Mozambique), possibly linked to the sandy substrate and reduced nutrient inputs associated with the predominantly groundwater-fed system of the Nhangonzo catchment (EOH, 2015e). The Nhangonzo estuary and associated mangrove habitat does play an important role as a refuge and breeding ground for fish species, although no recorded estuarine fish species from this system are threatened. As with similar mangrove systems elsewhere in the region, it also assists with water purification and nutrient supply to the seagrass beds and tidal flats, supporting associated waterbirds and other estuarine dependent biota. Dugongs (IUCN=Vulnerable) which are more closely associated with seagrass than mangroves, are recorded more frequently further north between Inhassoro and the Save River estuary and the northern part of Bazaruto Island (Guissamulo, 2006). Given the small extent of the Nhangonzo mangrove system, its minor role in providing habitat for known threatened species (such as dugong) and the absence of any unique assemblages of restricted or threatened species, and the low risk of its decreasing in area or quality, it is not assessed as Critical Habitat. It should rather be considered as high value Natural Habitat.	
Seagrass	As for mangroves, seagrass is referred to as a Critical Habitat in Mozambique in the Roadmap for Biodiversity Offsets (World Bank, 2016) where it has an estimated extent of 439 km^2 (MICOA, 2014) and is threatened by seabed disturbance, pollution and smothering by sediment. In the wider project area, seagrass is fairly widespread along the nearshore between Nhangonzo and the Save River where it fulfils important roles in water purification and nutrient supply, serves as a refuge for fish; and food source and habitat for turtles, dugongs and waders. Of the 13 seagrass species, only two species were reported in the Nhangonzo estuary (Golder, 2015c, report 8). The seagrass meadows in the Nhangonzo estuary contribute to the overall biodiversity importance of this ecosystem type in the region. However, this estuary is not considered unique or of specific importance for threatened fish, turtles or dugongs in the local area. Dugongs are more typically sighted further north between Inhassoro and the Save River and closer to Bazaruto and Benguerua Island (Guissamulo, 2007). It is thus not assessed as Critical Habitat but should rather be considered as high value Natural Habitat.	No
Swamp Forest	There is no evidence that the hydrology or integrity of the Nhangonzo wetland is under threat currently and there is no evidence of a decrease in spatial cover of swamp forest in the Nhangonzo stream since 2005 (Google Earth). Within Sasol's PSA region swamp forest it is very localised and confined to the Govuro River floodplain and several coastal streams south of Inhassoro. Swamp forest is expected to have limited spatial extent throughout Mozambique, but no reliable data are available. While swamp forest does have a high proportion of habitat specialists, most of these species occur in swamp forest habitat elsewhere and in other forest types, and this is not strictly a unique assemblage. No concentrations of biome-restricted species are present.	Unlikely
Coastal Dune Thicket / Forest	There is evidence of a limited and insignificant decrease in area and quality of this vegetation type between Vilankulo and Inhassoro (W. McCleland, *pers. obs.*), mostly in the vicinity of fishing villages or coastal towns, but no evidence of a significant decrease. Occupies a very localised habitat and has an estimated AOO of less than 20 km^2 between Inhassoro and Xai-Xai (McCleland & Massingue (2018)). Three range-restricted endemic species and a number of habitat specialists were confirmed to occur in this habitat, which elevates the probability that a unique assemblage of species is supported.	Probable. Supports designation under Criterion 2

Habitat Type	Assessment against IFC Criterion 4 Criteria	Criterion 4 Triggered
Tall Thicket / Forest	Few of the Tall Thicket / Forest patches in the study area have been impacted by cultivation and there is no evidence of a significant decline in area and quality of this habitat either in the study area or in Sasol's PSA. This is one of the most extensive Tall Thicket / Forest types in the PSA, covering over 7,000 ha (Golder, 2017) and occurring elsewhere in southern and central Mozambique; it does not qualify as an area of "small spatial extent". Few range-restricted or endemic species occur in this habitat and the dominant species are also dominant in other widespread woodland and thicket habitat types, thus not qualifying as containing a unique assemblage of species.	No
Low Thicket	This habitat is regularly cleared for cultivation but is not farmed for long before soil fertility drops, allowing time for sufficient habitat restoration. Low Thicket has high resilience to disturbance and recovers quickly when rested. Under current human population density in the study area there has not been a significant loss of area or quality of the vegetation type. This is a widespread vegetation type in the PSA, covering ~39 000 ha (Golder, 2017), and does not qualify as an area of "small spatial extent". Few habitat specialist species occur and the dominant species are also common in other widespread woodland and thicket habitat types, thus not qualifying as containing a unique assemblage of species.	No
Low Mid-dense Woodland	Located on deep infertile sands close to the coast and rarely cultivated for any length of time, thus not significantly impacted by cultivation. No evidence of a decline in the area or quality of this vegetation type in the study area or the PSA region. A widespread vegetation type along the coastline of Inhambane province, although of more limited spatial extent than other woodland types in the study area. While no habitat specialist species were recorded in this vegetation type, it is a habitat favoured by the biome-restricted Lemon-breasted Canary. However, it does not support any concentrations of biome-restricted endemic species.	No
Low to Tall Closed Woodland	This is another vegetation type that is frequently cleared for cultivation but is also not farmed intensively for long periods due to low soil fertility. While it is not as resilient to disturbance as Low Thicket (W. McCleland, *pers. obs.*), there is still evidence of woodland habitat restoring without human intervention in the PSA region and there no evidence of a significant decline in habitat extent or quality in the region. This is a fairly widespread vegetation type in the PSA and does not qualify as having "small spatial extent". Few habitat specialist species occur in this woodland type and the dominant species are also dominant in other widespread woodland and thicket types, thus not qualifying as containing a unique assemblage of species.	No

4.2.5 Criterion 5: Key Evolutionary Processes (GN94-97)

IFC Criteria

Areas with key evolutionary processes refer to the following kinds of examples:

- Isolated areas (e.g., islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct
- Areas of high endemism often contain flora and/or fauna with unique evolutionary histories (note overlap with Criterion 2, endemic and restricted-range species).
- Landscapes with high spatial heterogeneity are a driving force in speciation as species are naturally selected on their ability to adapt and diversify.
- Environmental gradients, also known as ecotones, produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity.
- Edaphic interfaces are specific juxtapositions of soil types (e.g., serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities characterised by both rarity and endemism.

- Connectivity between habitats (e.g., biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from "crest to coast."

- Sites of demonstrated importance to climate change adaptation for either species or ecosystems are also included within this criterion.

Re-evaluation of Criterion 5

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
1	The Nhangonzo coastal stream and its surrounding catchment is an unusual ecosystem. Groundwater and terrestrial ecosystems drive the integrity and health of the Nhangonzo stream, estuary and shallow marine ecosystem. Seagrass beds in the shallow marine ecosystem contribute to the total, limited, habitat available for the threatened Dugong, the only viable remaining southern Indian ocean population of which is concentrated in the Nova Mambone / Bazaruto area. Such a complex system may be associated with key evolutionary processes. The unusual number of known and suspected taxonomic novelties in the region also points to an area that may exhibit key evolutionary processes.	The Nhangonzo coastal streams and associated habitats have high conservation value and need careful management in order to remain functionally intact. However, without a detailed regional survey of coastal wetland systems, particularly south of Vilankulo, there is insufficient data to claim that this system is isolated enough to support unique evolutionary processes despite the spatial heterogeneity in the habitats of the area. The EOH (2015a) reference of the importance to the Nhangonzo coastal stream to maintenance of sea grass and dugongs is tenuous as it is highly unlikely that any dugongs frequent the area around the small Nhangonzo estuary. However, extensive mangrove systems at the mouth of the Govuro and Save Rivers do fulfil this role. The reptiles recorded from the area have not been upheld to be 'taxonomic novelties' (refer to Section 4.2.2).	Criterion 5 for Evolutionary Processes is not upheld

4.2.6 Additional Criteria

IFC Additional Criteria (GN56)

IFC GN6 (GN56) specifies a number of additional high biodiversity values besides the five standard criteria which can be used to support a Critical Habitat designation for use on a case by case basis. These are evaluated below.

Re-evaluation of Additional Criteria

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
1	***Areas required for the reintroduction of CR and EN species and refuge sites for these species (habitat used during periods of stress (e.g. flood, drought or fire)*** Is a habitat of significant importance to some of the few reptiles endemic to Mozambique *(Acontias aurantiacus bazarutensis* and *Mochlus lanceolatum),* as well as the range-restricted lemon-breasted canary *(Crithagra citrinipectus).* The Mozambique tilapia (*Oreochromis mossambicus*) is listed in the IUCN Red List as Near Threatened, due to hybridisation with Nile tilapia (*Oreochromis niloticus*), which is being widely spread out of its natural range by anglers and aquaculture. These small, isolated coastal streams thus provide a sanctuary area for Mozambique tilapia, as well as for the genetic	None of the species motivated for under this criterion are CR or EN and therefore the area does not qualify as a refuge for such species. Further, as indicated under Criterion 1 in Section 4.2.1, no IUCN-assessed EN or CR species have been recorded in Nhangonzo. Mozambique tilapia occurs widely in southern to east Africa from South Africa to Malawi and is threatened by hybridisation in less than half of its range. However, there is no evidence to suggest the likelihood of speciation of this freshwater fish or any other aquatic biota of the Nhangonzo stream.	Not upheld

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
	isolation and potential speciation of the freshwater species present.		
2	***Ecosystems of known special significance to EN or CR species for climate adaptation purposes*** *n/a*	As above – no EN or CR species confirmed.	Not upheld
3	***Concentrations of Vulnerable (VU) species in cases where there is uncertainty regarding the listing, and the actual status of the species may be EN or CR*** It is a habitat of importance to *Xylia mendoncae*, a plant species endemic to the Inhambane Province with a restricted range, found in the study area (although this plant has been found elsewhere west of the Govuro River). Very little information is available on the threats to this species although its status suggests that it is facing a high risk of extinction in the wild in the medium-term.	Only one species is mentioned as an example to support 'concentrations of VU species'. While *Xylia mendoncae* was assessed as VU by Izidine &Bandeira (2002) its status is urgently in need of re-assessment. It is possible that the species may warrant EN status based on a quick assessment using GeoCat and known sites for this species. However, the occurrence of this species within the actual boundary of the study area could not be confirmed. *Zanthoxylum delagoense*, which was located during the March 2018 site visit, has also been classified as Vulnerable by Izidine & Bandeira (2002) and may also warrant relisting as EN or CR.	Not upheld
4	***Areas of primary/old-growth/pristine forests and/or other areas with especially high levels of species diversity*** A significant section of the study area is comprised of pristine coastal vegetation that is threatened by development. This is unusual along this coastline, which is generally impacted by anthropogenic activities, including tourism development. Eighty percent (8 out of 10) of the mangrove species likely to occur in Mozambique occur within this estuary, indicating a high level of diversity. The high diversity shows that, despite evidence of harvesting, this is a fully functioning, near – pristine, system. Given the rapid global loss of mangroves (which shows their vulnerability to change), and the critical status of mangroves in the East African eco-region, the conservation of this system is extremely important.	While the mangroves in the Nhangonzo area are quite diverse in comparison to other mangrove systems along the coast, the mangroves at the Govuro Estuary (~45 km north) exhibit a similar diversity and support the same species (McCleland *pers. obs*.). The only remarkably diverse habitat within the Critical Habitat is the coastal dune thicket / forest community which occurs in a narrow stretch north and south of the estuary. The high diversity of this community was evident from surveys for the regional study (Golder, 2017) where this vegetation community had one of the smallest spatial coverages but supported the second highest species list for the entire region. Therefore, it is only the Dune Forest/Thicket habitat that could represent Critical Habitat for this criterion (and Criterion 2 as described in Section 4.2.2).	Not upheld for mangroves. Coastal dune thicket can be considered Critical Habitat for its high plant diversity.
5	***Habitat necessary for the survival of keystone species*** n/a	No keystone species occur in the Nhangonzo area.	Not upheld
6	***Landscape and ecological processes (e.g., water catchments, areas critical to erosion control, disturbance regimes (e.g., fire, flood)) required for maintaining Critical Habitat*** The hydrology of peatlands is principally groundwater based. Without protection of much of its groundwater catchment, the wetland is likely to be threatened, particularly if increased habitat disturbance were to change the runoff characteristics of the catchment and the quantity and quality of groundwater entering the system. While the groundwater catchment of the wetland has not been explicitly determined through groundwater modelling and additional costly and time-consuming studies, it is clearly vital to the functioning of the system.	While the Nhangonzo Catchment is important for the hydrological processes that maintain the coastal stream system, this criterion is relevant to the processes that support a Critical Habitat. Since the peat wetland system is not upheld as a Critical Habitat for other reasons, this criterion is not relevant.	Not upheld.

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
7	***Areas of high scientific value such as those containing concentrations of species new and/or little known to science*** It is an area which provides habitat for Vulnerable (VU) species (endemic reptiles), whose conservation status have not been formally assessed, but which have very restricted known Areas of Occupancy, which would qualify them for Vulnerable status under existing IUCN criteria or possibly even Endangered status. It is an area of high scientific value containing concentrations of species new and/or little known to science *(Panaspis sp., Atractaspis sp.),* and a new southern limit for the Bronze Skink *(Trachylepis boulengeri).* It is an area which may be associated with key evolutionary processes due to the unusual number of known and suspected taxonomic novelties in the region.	Discounted for reasons provided in Section 4.2.2 under Criterion 2.	Not upheld
8	***An area of known high concentrations of natural resources exploited by local people*** The wetland and mangrove are relatively isolated, which accounts for the near – pristine status of the system. The system is not capable of providing large quantities of natural resources. The indicator is therefore not applicable	Not applicable. Limited use of the wetland and mangrove area by local populations, apart from its support in fishing activities.	Not upheld
9	***Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites.*** The area may meet the criteria for a Category II protected area as it is in a "natural" state with a relatively low risk of successful invasions by non-native species, and it is of sufficient ecological quality to maintain ecological functions and processes that will allow species and communities to persist for the long term, with minimal management intervention. However, further baseline studies over multiple seasons would be required to determine this status.	It is unlikely that this area would meet IUCN Protected Area Management categories purely for its natural status and ecological functions.	Not upheld
10	***Key Birding Areas (KBAs), which encompass inter alia Ramsar Sites, Important Birding Areas (IBAs), Important Plant Areas (IPA) and Alliance for Zero Extinction Sites*** The diversity of wetland and terrestrial habitats support Palaearctic and intra-African migratory bird species, including the globally Near Threatened (NT) European roller and sooty falcon.	The study area is immediately adjacent to the Bazaruto archipelago IBA (MZ004) and does support some of the waterbirds that are present in that IBA, but not at the same densities. The high number of waterbirds is one of the primary triggers for designation of that IBA (BirdLife International, 2018).	Not upheld
11	***Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognised academic institutions and/or other relevant qualified organisations (including internationally-recognised NGOs*** No data available	NBSAP and CBD, as well as the Biodiversity Offsets Roadmap for Mozambique highlight the importance of mangroves which are referred to in these documents as a 'Critical Habitat' (but which is not defined). The coastal wetland systems are identified in the CBD (Fifth report) as important for medicinal plants and for high degree of endemism. However,	Not upheld

#	Basis for Provisional Critical Habitat	Reassessment of Critical Habitat	Summary
		the wetlands of the Inhambane area were not highlighted as irreplaceable or high priority.	
12	***High Conservation Value (HCV) areas*** The peatlands contain areas of swamp forest that are pristine and/or other areas with particularly high levels of biodiversity. The Nhangonzo coastal stream and estuary support the largest area of untransformed mangrove forest in 90 km of coastline. The mangroves have a particularly high value as a refuge for juvenile marine fish. It is expected that with further detailed seasonal investigation, a large number of marine species would be found to use the estuary as a nursery (over 120 marine fish species have been recorded in Mozambican estuaries). From an ecological point of view, and from the point of view of nearshore fisheries, the system fulfils a critical role in the area. It is also noted that the Nhangonzo estuary lies directly adjacent to the Bazaruto Marine National Park. The adjacent mudflats and sea grass beds provide habitat for thousands of waders and, together with the large areas of seagrass around the Save river estuary, support the only viable Dugong population in Mozambique.	The Nhangonzo coastal streams and coastal areas undoubtedly have conservation value. However, the basis for motivating Nhangonzo as Critical Habitat for high HCV has been discounted under Criterion 4 in Section 4.2.4 and under Criterion 5 in Section 4.2.5.	Not upheld

4.3 Revised Assessment of Critical Habitat

Table 4-4 summarises the reconsideration of the Nhangonzo area as Critical Habitat based on the IFC Criteria in Section 4.2.

Table 4-4. Summary of Critical Habitat Reassessment against IFC Criteria

Criterion	Summary of Nhangonzo Biodiversity Triggers for Critical Habitat	Result
Criterion 1: Endangered and Critically Endangered Species	No confirmed endangered or critically endangered species.	Not Triggered
Criterion 2: Endemic or Range-Restricted Species	Dune Forest / Thicket habitat occupying 63.4 ha along the coastal margin north and south of the Nhangonzo estuary has at least three localised range-restricted plant species.	**Triggered** (Tier 2)
Criterion 3: Migratory and/or Congregatory Species	Large numbers of waders occur in the estuary but not in sufficient numbers to trigger Critical Habitat.	Not Triggered
Criterion 4: Highly Threatened and/or Unique Ecosystems	Habitats in the area are represented in similar ecosystems along the Mozambique coastline. While no detailed study has been conducted, the habitats represented are not considered sufficiently small, threatened or with unique species assemblages to trigger this criterion. However, the species assemblage of dune thicket/forest support the designation of this habitat as Critical Habitat under Criterion 2.	Not Triggered
Criterion 5: Areas Associated with Key Evolutionary Processes	No sufficiently unique taxa or habitats occur that suggest the area is unique, evolutionary significant area.	Not Triggered

Taking into account the findings in Section 4.2, the spatial extent of the Critical Habitat in the Nhangonzo area is greatly reduced compared with the size of area proposed in the previous studies. The Nhangonzo coastal stream has been re-assessed as a sensitive high value Natural Habitat, but it does not qualify for Critical Habitat status under IFC PF6 criteria. In the absence of the stream as a Critical Habitat,

the surrounding catchment, which was included largely as a buffer to protect the stream, is not considered to be Critical Habitat either.

The Coastal Dune Thicket / Forest in the Nhangonzo area fulfils the requirements for Critical Habitat status under Criterion 2 (Tier 2), based on the confirmed presence of three range-restricted plants, each of which is summarised in Table 4-5. Additional support for this vegetation type as Critical Habitat is provided under Criterion 4, specifically because of its small spatial extent in southern Mozambique (dune thicket along 550 km of coastline between Inhassoro and Xai-Xai was calculated as less than 20 km^2 by McCleland & Massingue, 2018). It is, however, not restricted to the Nhangonzo area (where it's extent of occurrence (EOO) is limited to 64 ha), nor is its distribution related to coastal streams - rather, it occurs in a narrow belt on the coastal dune system along the coastline.

Table 4-5. Plant Species Triggers for coastal dune thicket as Critical Habitat

Species	Habitat	Distribution (incl. number of known sites)	Occurrence in Nhangonzo	IUCN Status	Moz Red Data List (RDL)	Criterion 2 Endemic & Restricted Range Species	Tier 1 or 2 Critical Habitat	Rationale for Tier status
Carissa praetermissa 	Small shrub that appears to be confined to Coastal Dune Forest in the study area	Southern Mozambique (4 sites)	Found at one site in the north-eastern corner of the study area	N/A	DD	RR, E	Tier 2 (b)	Criterion 2, Tier 2: Habitat sustains ~25% of global population of this range-restricted and endemic species
Zanthoxylum delagoense 	Small shrub that was only located in Coastal Dune Thicket in the study area	Southern Mozambique (less than 10 sites)	Found in one narrow strip of low dune thicket near the village at Nhangonzo estuary	N/A	VU	RR, E	Tier 2 (b)	Criterion 2, Tier 2: Habitat sustains ~10% of global population of this rang-restricted and endemic species
Triaspis suffulta 	An easily overlooked slender climber that was only located in Coastal Dune Thicket	Southern Mozambique (3 sites between Inhassoro, Temane and Vilankulo	Found in one narrow strip of low dune thicket near the village at Nhangonzo estuary	N/A	DD	RR, E	Tier 2 (b)	Criterion 2, Tier 2: Habitat sustains ~ 30% of global population of this range-restricted and endemic species

4.4 Habitat Status and Sensitivity

The extent of different vegetation and land use types in the Nhangonzo study area[15] is described in this section, together with habitat status and sensitivity in relation to development (specifically bush clearing). This serves as a basis for quantifying the residual impacts of Sasol's activities, and their responsibility to meet IFC PS6 requirements to prevent biodiversity loss. It is also used to inform biodiversity management requirements in the area and to determine constraints affecting future development activities.

4.4.1 Extent of Vegetation and Land Use Types

Table 4-6 describes each habitat type in the Nhangonzo area according to its physical extent, sensitivity and habitat status, as set out in Sections 4.4.2 and 4.4.3.[16]

Three main vegetation types cover 75% of the study area. The dominant vegetation type is Low to Tall Closed Woodland, covering just over 40% of the study area in the west, while Low Thicket predominates in the central and northern parts and in the vicinity of Nhangonzo stream, covering 24%. Low Mid-dense Woodland is predominant in the east, covering just over 11% of the study area.

Table 4-6. Summary of vegetation types and extent in the Nhangonzo study area

Value	Vegetation Type	Sensitivity	Status	Area (Hectares)	% of Area
1	Coastal Dune Thicket / Forest	Very High	Critical	63,38	1,44
2	Mangroves	Very High	Natural	74,53	1,69
3	Coastal Streams & Open Water	Very High	Natural	261,54	5,94
4	Tidal Sand and Dunes	High	Natural	42,94	0,98
5	Swamp Forest	High	Natural	6,04	0,14
6	Tall Thicket / Forest	High	Natural	119,00	2,70
7	Low Mid-dense Woodland	Medium	Natural	511,58	11,62
8	Low Thicket	Medium	Natural	1058,51	24,04
9	Low to Tall Closed Woodland	Medium	Natural	1782,33	40,49
10	Bare Ground	Very Low	Modified	46,68	1,06
11	Cultivated (old and new)	Very Low	Modified	396,12	9,00
12	Residential	Very Low	Modified	0,17	0,00
13	Roads	Very Low	Modified	23,00	0,52
14	Well Pads	Very Low	Modified	14,05	0,32
15	Unclassified - Cloud/Burn	Unclassified	Unclassified	2,41	0,05
				4402,29	**100**

4.4.2 Habitat Status

In assigning habitat status, the following IFC PS6 definitions are used:

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

[15] *The original and revised Critical Habitat defined by EOH (2015) is henceforth referred to as the Nhangonzo area to avoid confusion with the much reduced size of the defined Critical Habitat in this study limited to the Dune Forest/Thicket habitat type along the coast.*

[16] *Note: where habitat types are covered in vegetation they are referred to as vegetation types in this report.*

Modified Habitat *is defined as "areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition".*

Critical Habitat is an area with high biodiversity value that fulfils at least one of five IFC criteria, each of which is dealt with in detail in Section 4.2.

Field observations of each habitat type were used to assess whether habitats were Natural or Modified according to the above definitions, while a more extensive process was followed to assign Critical Habitat status as covered in Section 4.2 and 4.3. The spatial extent of Natural, Modified and Critical Habitat is displayed in Figure 4-2 and summarised in Table 4-6.

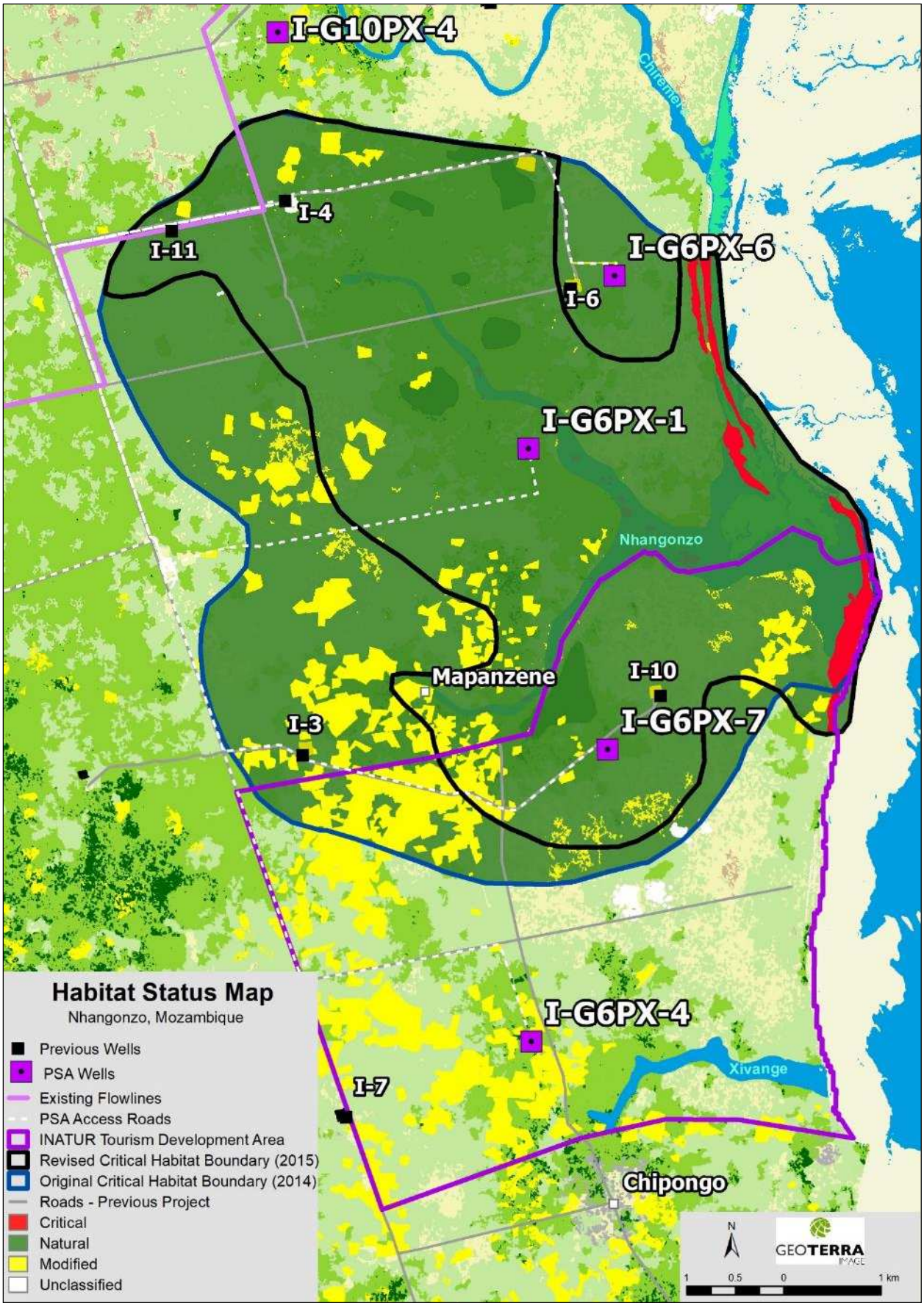
Most of the Nhangonzo area (87.6%) is covered by Natural Habitat, represented by seven vegetation types and one non-vegetated habitat (Tidal Sands and Dunes), while Modified Habitat covers 10.9% of the study area and comprises Bare Sand, Cultivated Areas, Residential Areas, Roads and Well Pads. The revised Critical Habitat covers only 1.4% of the Nhangonzo area and comprises Coastal Dune Thicket / Forest

The habitat status of the vegetation types in the Nhangonzo area is summarised in Table 4.7.

Table 4.7. Summary of habitat status extent in the Nhangonzo area

Value	Habitat Status	Area (Hectares)	% of Area
1	Critical	63,38	1,44
2	Natural	3856,47	87,60
3	Modified	480,03	10,90
4	Unclassed	2,41	0,05
		4402,29	**100**

Figure 4-2. Revised habitat status map for the Nhangonzo area



4.4.3 Habitat Sensitivity and Constraints to Development

Habitat Sensitivity

The present study defines Habitat Sensitivity as a function of Biodiversity Conservation Value and Transformation Level, following the same approach used in the FEAD EIA (Golder, 2017). Biodiversity Conservation Value is based on the conservation importance and functional importance of habitat types. Conservation importance is based on protection status, habitat size, species diversity, species of conservation concern, unique habitat or taxa and present ecological status. Functional importance is based on the value of the four groups of ecosystem services (provisioning, regulating, supporting and cultural) derived from a specific habitat type.

The extent of Habitat Sensitivity is summarised in Table 4.8 and mapped in Figure 4-3. Most of the Natural Habitat in the study area is classified as Medium Sensitivity, covering 76.6% of the study area. Although certain vegetation types, such as Low Thicket, have a relatively high conservation value (and were rated as Highly Sensitive by EOH (2015a), they have high resilience and are able to recover from damage without human intervention if the activities causing degradation are removed, and are thus classified in this study as having Medium Sensitivity. Modified Habitat comprising mainly areas of current or previous cultivation has very low conservation value in the study area and is functionally compromised from an ecological perspective and has thus been allocated Very Low sensitivity. Under 3% of the study area comprises High Sensitivity habitat, represented by Tall Thicket / Forest, Swamp Forest and Tidal sand and dunes. Areas of Very High sensitivity comprise 9% of the area and include the entire Nhangonzo stream and associated mangroves, as well as the adjacent Coastal Dune Thicket / Forest.

Table 4.8. Summary of habitat sensitivity in the Nhangonzo area

Sensitivity	ha	%
Very High	395,18	9,07
High	125,02	2,87
Medium	3339,75	76,62
Very Low	498,82	11,44
Total	**4358,77**	**100,00**

Constraints

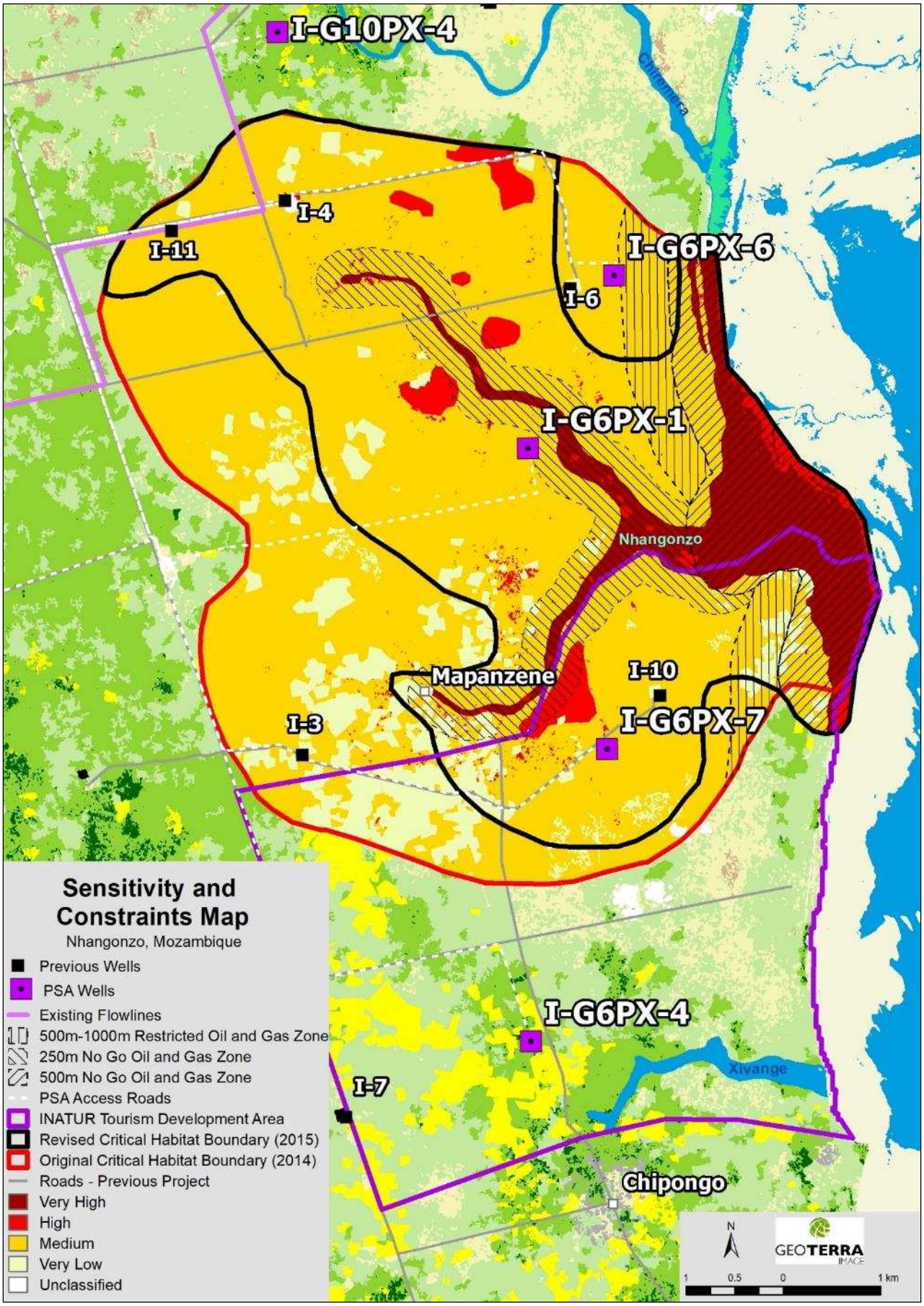
Based on the habitat sensitivity classification and mapping shown in Figure 4-3, and consideration of potential impacts, buffer zones representing constraints to oil and gas (and other) development have been placed around the Nhangonzo coastal stream and coastline (representing areas of high and very high sensitivity). The zones are based on the buffer distances recommended in the PSA EMPs (Golder, 2015d) and FEAD EIA[17] (Golder, 2017). In this way, the habitat sensitivity informs the management of activities in the Nhangonzo study area to limit Sasol's potential impacts. Three development constraint zones overlay the Habitat Sensitivity map in Figure 4-3 and are defined as follows:

- 500 m No Go Zone – comprises a zone from the coastline to 500 m inland, which also incorporates the mangrove habitat. No oil and gas exploration or development activities should be permitted within this zone.

[17] The FEAD EIA was approved in July 2018

- 250 m No Go Zone – comprises a buffer around the outer edge of the Nhangonzo Coastal Stream habitat within which no oil and gas exploration or development activities permitted, with the exception of seismic receiver tails, which are laid by hand.
- 500- 1000 m Restricted Zone – this is an **additional** 500 m wide buffer along the 500 m No Go Zone. Sasol wells and access roads are prohibited within this zone, unless it can be demonstrated that there no reasonable alternatives. Any proposed wells and access roads need to be clearly motivated and all potential negative impacts effectively mitigated, requiring substantial motivation and EIA approval from MITADER. Seismic testing permitted subject to restrictions on cut-lines to 4 m width.

Figure 4-3. Revised sensitivity and constraints map for the Nhangonzo area



4.4.4 Location of Drill Site I-G6-PX6

The current site for the proposed (and approved) well pad I-G6-PX1 is located on a gentle slope approximately 250 m from the edge of the Nhangonzo wetland and located in evergreen thicket. At least one species of conservation concern, *Eulophia petersii* – listed as data deficient by IUCN – was recorded on the well pad location. While this species is not considered threatened, it is recommended that the drill site be relocated to the immediately adjacent position approximately 100 m higher up the slope in more open woodland, if technically feasible, as shown in Figure 4-4 with coordinates in Table 4-9. Shifting the site slightly west and upslope would minimise impacts on *E. petersii* and further reduce any risks of subsurface seepage on the wetland system.

Figure 4-4. Proposed revised location of I-G6PX1 drill site

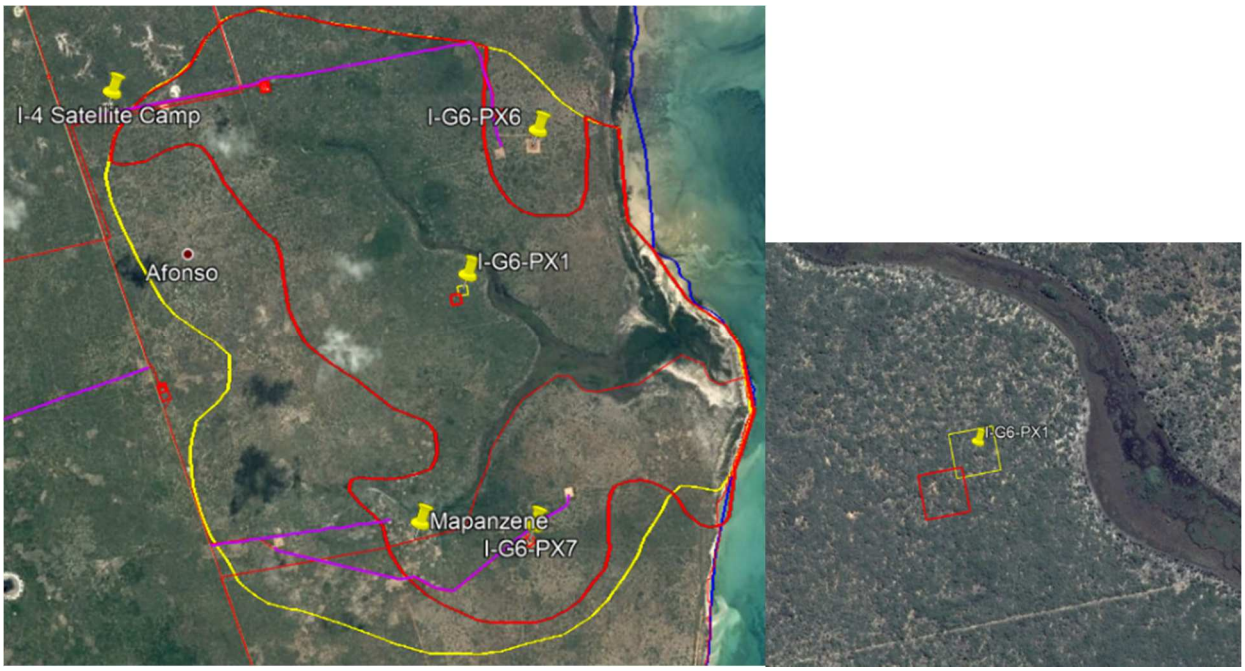


Table 4-9. Approximate coordinates for proposed new well site location

Corner	Latitude	Longitude
NE	21°43'15.55"S	35°14'57.44"E
SE	21°43'19.53"S	35°14'58.14"E
NW	21°43'16.20"S	35°14'53.28"E
SW	21°43'20.18"S	35°14'54.15"E

5. ALIGNMENT WITH MITIGATION HIERARCHY AND DETERMINATION OF RESIDUAL IMPACTS

5.1 Introduction

Sasol's activities and predicted impacts on biodiversity in the Nhangonzo area are described in the PSA EIA (Golder 2014), and the PSA EIA Addendum (Golder 2015), and for seismic acquisition in the seismic EIA (ERM, 2016).

Impacts can be broadly categorised as follows:

- **Direct impacts** are impacts that are directly linked to a project activity and typically occur at the same time and in the same place as the project activities, such as those resulting from clearing of vegetation, use of water, and pollution from emissions and discharge of wastes. These impacts could have indirect or secondary impacts on local communities who rely on these resources for their health, safety, livelihoods or cultural activities or on ecosystems downstream of the direct project footprint.

- **Indirect impacts** tend to occur later or at some distance from the project and are at least one step removed from a project activity in terms of cause-effect linkages, and generally result from a change that a project causes to the environment. Examples include clearing of land causing increased erosion, in turn resulting in sedimentation of nearby watercourses and reduced downstream water quality, or changes in populations of local fauna caused by habitat fragmentation and/ or clearing. In some cases, the significance of indirect and induced impacts may exceed that of direct impacts.

- **Induced impacts** are a form of indirect impact and tend to occur as a result of opening up access to inaccessible areas and/or attracting people into the area in search of work, and/ or catalysing harmful activities which would not materialise without the project (e.g. new access creates opportunities for commercial logging). Induced impacts caused by Sasol's activities are most likely related to increased access of people along new roads, tracks and seismic lines for harvesting of resources or opening new areas for cultivation or settlement.

- **Cumulative impacts** are those that result from incremental changes caused by other past, present, or reasonably foreseeable actions which combined to cause a greater effect than a single project on its own. In cases where the project's viability relies on the development of other, supporting facilities; the impacts of those facilities should also be assessed. Examples may include: reduction of water flows in a watershed due to multiple withdrawals; habitat loss due to the combination of other activities in the same area (e.g. logging, road-building), resulting traffic and induced access.

5.2 Mitigation Measures and Application of the Mitigation Hierarchy

The previous EIA and Addendum to the EIA (Golder, 2014; 2015) assessed potential impacts of Sasol's different activities, namely exploration, construction, drilling and operation. Measures to mitigate these impacts were identified and incorporated in a range of EMPs. The construction EMP (c-EMP), drilling EMP (d-EMP) and operational EMP (o-EMP) (Golder, 2015d), and the earlier seismic acquisition EIA and seismic-EMP (s-EMP) (ERM, 2016) specify measures to avoid and minimise impacts on biodiversity in the Nhangonzo area, rehabilitate disturbed areas, and monitor the effectiveness of the prescribed mitigation measures to inform corrective or adaptive management.

Information from seismic close-out reports, imagery review and field observations have been used to assess the effectiveness of the prescribed mitigation measures as the basis for confirming alignment

with the mitigation hierarchy[18] and determining residual impacts[19]. The key measures are listed below. The degree to which Sasol's management measures for seismic, construction and drilling activities in the Nhangonzo area are aligned with the mitigation hierarchy of avoidance> minimisation>rehabilitation/ restoration are summarised in Appendix A.

5.2.1 Mitigation for Impacts of Seismic Acquisition

Mitigation requirements specified for seismic acquisition in Nhangonzo Critical Habitat and wetlands (in general) in the s-EMP (ERM, 2015) are:

Avoidance

- Camps shall not be located in the vicinity of sensitive sites, pristine vegetation or within 100 m of any watercourse, nor in any area that could cause nuisance or safety hazards to surrounding landowners, inhabitants or the general public.
- No vehicles of any description are permitted within the Nhangonzo Critical Habitat (except along existing access roads and tracks) or within defined wetland areas;
- Temporary bridges or tracks across wetlands to access seismic areas on the opposite side shall not be permitted. Existing crossings shall be used or vehicles shall be routed around the wetland; and
- Source lines shall not be located in wetlands or along the riparian fringe of wetlands. A minimum buffer of 50 m from the perimeter of wet areas shall be maintained for source lines.

Minimisation

- General Habitat Protection:
  - Any required vegetation clearance for access to lay source and receiver lines shall be hand-cleared and shall be minimised as far as practical. Vegetation clearance for seismic lines shall not exceed 2 m in width;
  - Explosive charges that can be laid by hand shall be used;
  - Opening the canopy in areas of thicket shall be avoided wherever possible. Clearing height shall be limited to that necessary for personnel to walk upright;
  - No trees of diameter at breast height (DBH) > 20 cm shall be cut down in order to gain access to areas for laying of the lines and the explosive charges;
  - A qualified / experienced ecologist shall accompany the surveyors to identify any threatened species within the area of bush clearing and where necessary, to adjust the alignment of the seismic line to avoid them, and do whatever other measures are necessary to temporarily protect them during seismic work; and
  - A handbook shall be prepared for use by the Environmental Site Officer (ESO), which is to guide him/her in determining acceptable and unacceptable actions during seismic acquisition. The ESO is to be trained in the implementation of the handbook in advance of the seismic contract. Contractor training is to be in accordance with the existing s-EMP.

[18] *The sequence of actions to anticipate and avoid, and where avoidance is not possible, minimise, and, when impacts occur, restore, and where significant residual impacts remain, offset for biodiversity-related risks and impacts on affected communities and the environment (CSBI, 2015)*

[19] *Residual impacts are project-related impacts that might remain after on-site mitigation measures (avoidance, set-asides, management controls, abatement, rehabilitation/restoration, etc.) have been implemented. Any reliable determination of residual impacts on biodiversity needs to take into account the uncertainty of outcomes due to mitigation measures (CSBI, 2015)*

- Wetland areas:
  - Receiver lines may be laid, by hand, up to the perimeter of 'wet' areas. This perimeter would be considered to be within the area defined as a 'wetland' on the basis of soils and wet season extent. Dry season seismic acquisition will therefore extend the area over which the receiver lines can be laid. Any small areas of necessary vegetation clearance shall be minimised as far as practical and shall be done by hand. Clearance shall not exceed 2 m in width; and
  - Minimise removal of trees. No riparian trees of DBH > 20 cm shall be cut down for the purposes of laying receiver lines.

Rehabilitation and Restoration

- Minimise top soil clearance to less than 15 cm for seismic lines; decompact soils and profile land to natural contours on completion; reseed if natural regeneration does not occur, and monitor for erosion;
- Seismic lines at intersections with roads or tracks shall be closed using branches or by digging trenches, mounding soil and filling with logs and branches where wider seismic lines are implemented (i.e. outside Nhangonzo area); and
- Control alien plant spread by inspecting and washing vehicles prior to entering the project area and implement an eradication programme to curb the spread of prickly pear and other alien species in project-affected areas.

Examples of mitigation measures that have been implemented and the vehicles used during the 2016 seismic surveys are shown in Figure 5-1 and Figure 5-2.

Figure 5-1. Examples of mitigation measures implemented for seismic acquisition in the Nhangonzo area

Photo 1. Marking to restrict vehicle access

Photo 2. Avoidance of cutting large trees. Note: picture taken outside the Nhangonzo area

Photo 3. Deviation around termite mounds

Photo 4. Demarcation of Nhangonzo Critical Habitat boundary

Source: Sasol, 2017

Figure 5-2. Comparison of light AWD truck compared to standard vibroseis vehicle

Photo 1. Light AWD vehicle used in Nhangonzo along 2 m hand cut seismic lines

Photo 2. Vibroseis truck used outside of Nhangonzo

5.2.2 Mitigation for Construction Activities, and Drilling and Operation of Wells

Mitigation for impacts of site clearance for drill sites, and construction of roads, flow lines and trunk lines on biodiversity in the PSA EIA and the various EMPs (Golder, 2015a,d), and relevant to the Nhangonzo area include:

Avoidance

- No oil and gas activities permitted within 500 m of coastline or within 250 m of the Nhangonzo coastal wetland.
- Any future wells in the Critical Habitat should be drilled from existing well pads to the greatest extent possible. Any deviation from this principle shall be specifically motivated to MITADER.
- Avoid the removal of trees with DBH of >30 cm and removal of all *Afzelia quanzensis* (Pod Mahogany) trees with a DBH of >20 cm, where possible.
- Avoid pollution of water resources from construction activities by avoiding storage of chemicals, fuels, lubricating oils and any other hazardous materials within 100 m of a surface water body; 100 m the floodplain of rivers, wetlands or any area of temporary inundation; 10 m of any stormwater drainage system or 100 m of any sub-surface drinking water source.
- Prohibit the disposal of drilling waste on the well pads within the Critical Habitat (I-G6PX-1 and I-G6PX-7). Drilling mud waste is to be removed and disposed of in accordance with a method statement developed as a requirement for all drilling waste and submitted to MITADER for authorisation.

Minimisation

- Minimise spread of alien plant species by washing all vehicles and equipment brought to site or as advised by the ESO / EC when work has occurred in areas inside the project area where alien plants are present; develop alien plant control programme, and control invasive alien plants along flowlines roads or infrastructure footprints from construction through to operation;
- Minimise duration that excavations (e.g. flowline trenches) are left open and check daily (especially once the rainy season begins) and remove and release any animals trapped in the trench;

- Prohibit the placement of cleared woody vegetation adjacent to large trees to prevent damage to these trees in the event of a fire. Cleared woody vegetation should be baled and provided to the nearest local community for their use;
- Route the access for PSA well site I-G6PX-1 through the Central Manifold Station (CMS) to prevent public vehicle access to it from the main gravel access road between Vilankulo and Inhassoro. (Note: neither the CMS or I-G6PX-1 has been constructed yet);
- Re-instate unproductive or dry wells in accordance with the construction-EMP for infrastructure;
- Monitoring and Emergency Prevention measures include:
  - Monitor water quality in the boreholes on the well pad monthly during drilling in accordance with the requirements of the d-EMP, and twice annually during operation as per specifications of the o-EMP.
  - During operation, conduct six -monthly groundwater monitoring at boreholes on well pad and nearby community boreholes as per variables specified in o-EMP.
  - Update Sasol's Emergency Response Plan to cover the prevention and management of major oil spills and shall include:
    - a risk assessment for wells I-G6PX-1, I-G6PX-6 and I-G6PX-7, where critically important environmental resources could be affected with potential consequences affecting the coastal drainage lines, mangroves and the Bazaruto Archipelago National Park;
    - Immediate Response Plan – covering the immediate short-term actions that are to be taken in the event of a loss of well control; and
    - Well Control (Blowout) Contingency Plan (regional for most wells but site specific for wells I-G6-PX-1, I-G6PX-6 and IG6PX-7.
- Management of population influx through ongoing communication with local leaders and District Government in terms of curbing influx, and obtaining their support and suggestions in this regard, including national coverage from time to time, and information meetings in all affected villages, explaining the negative impacts of population influx, and harnessing their support to reduce influx of work and opportunity seekers, communicating the following Sasol policies:
  - All *ad hoc* unskilled employment will be, without exception, from local villages, verified by community leaders;
  - -No hiring on site for job seekers and no procurement at the gate; and
  - Maximising local content in procurement i.e. from local people and towns.

Rehabilitation / Restoration (including ongoing monitoring)

- Strip and store topsoil from upper 150 mm of and store separately in mounds of less than 2 m in height, protect from wind and water erosion, and use in future landscaping or reinstatement. Loosen compacted soils by plough or scarifier not deeper than 100 mm.
- Consider hand clearing and hand-trench excavation in areas where the smaller flow lines are to be constructed to minimise unnecessary removal of plant rootstock and facilitate more rapid recovery of vegetation in those areas where reinstatement is planned.
- Restore trenches and construction right of way to natural contours of the ground and allow for normal surface drainage. Keep photographic records before and after construction.

- Provide proper drainage along and under roads to cater for storm events flooding and minimise any standing / slow-moving water and erosion through use of drains, contours, berms, culverts etc.
- Revegetate reinstated areas by encouraging natural process of succession through conservation, de-compaction and reinstatement of top soils, with appropriate drainage protection. Avoid the use of commercial seed mixes and fertilisation on the reinstated construction right of way.
- Control access along flowlines and access roads that lead to areas containing sensitive habitats by measures agreed with MITADER (specifically the National Forestry Directorate).
- Sasol shall prepare a long-term biodiversity monitoring and evaluation programme for the Critical Habitat, in accordance with IFC PS6 requirements.
- Conduct annual vegetation monitoring of seismic lines, flowlines, access roads and borrow pits in accordance with monitoring and intervention procedure.

Figure 5-3. Photographs of roadside erosion and flow line recovery alongside existing access road

Photo 1. Erosion along well site access road

Photo 2. Good recovery along flowline

Source: Golder, 2015a

5.3 Quantification of Sasol's Footprint and Residual Impact in the Nhangonzo CH Area

5.3.1 Footprint Areas

Data and mapping provided by Sasol were used to quantify the loss of habitat caused by seismic lines, flowlines, access roads and well pads in the Nhangonzo catchment. The mapping was verified by cross checking against recent high-resolution satellite imagery, which provides a clear visual indication of where Sasol's activities have taken place.

Table 5-1 divides Sasol's land take into permanent, semi-permanent and temporary categories. Well pads and roads are regarded as permanent, flow lines and old seismic lines (with widths of 10 m) as semi-permanent, and 2 m-wide seismic lines cut by hand as temporary[20]. Activities that are planned and approved, but which have not yet been implemented, are included. The total estimated footprint is

[20] *The categorisation of land take is conservative but is reasonable as the basis for an assessment of habitat loss. The well pads will eventually be rehabilitated but the impact is long term, and for the purposes of this study, permanent. Roads may be left in situ after the project closes, depending on requests from the Government. Partial rehabilitation of old 10 m wide seismic lines is based on field evidence which shows that older lines have not all fully rehabilitated. By way of contrast, the 2-m-wide 3D seismic lines, cut by hand in late 2016, have rapidly recovered and have resulted in minimal residual impact. I-G6PX-6 is included in Table 5-1, although it is just outside of the 2015 revised Critical Habitat boundary. I-G6PX-4 is well outside of the Critical Habitat boundaries, being in the INATUR ZIT and is not included in the data in Table 5-1. There may be a few historic seismic lines that have not been accounted for, but these have largely recovered and are not included in the statistics.*

90,73 ha, of which 55,74 ha (61,4%) is permanent. Of the footprint, all but well I-G6PX-1 and its associated access road already exists.

Table 5-1. Summary of Sasol's total footprint and residual impact in the Nhangonzo area

Sasol Infrastructure & Seismic lines	Date	Length (km)	Original Impact Area (ha)	Residual Impact Area (ha)
Permanent Land Take				
Previous well pads:				
I-3	Prior to 2009		1,50	1,50
I-10	Prior to 2009		1,40	1,40
I-6	Prior to 2009		1,73	1,73
I-4	Prior to 2009		1,32	1,32
I-11	Prior to 2009		1,29	1,29
Old Well Pad	Prior to 2004		3,66	3,66
Subtotal (previous well pads):			**10,90**	**10,90**
I-G6-PX-1	Planned		1,24	1,24
I-G6-PX-6	Jul-17		2,67	2,67
I-G6-PX-7	Sep-17		2,79	2,79
Subtotal (new PSA well pads):			**6,71**	**6,71**
Subtotal (all well pads)			**17,60**	**17,60**
Roads:				
Existing road infrastructure (8 m)	Prior to 2009	24,80	15,91	15,91
PSA additional roads (built) (8 m)	2017	1,50	1,20	1,20
PSA additional roads (planned) (8 m)	2018	3,42	2,74	2,74
Subtotal (all roads):			**19,85**	**19,85**
Semi-permanent Land Take				
Flowlines (10 m)	Prior to 2009	2,41	2,35	1,17
Semi-Permanent Old Seismic Lines (8 m)	2004-2008	48,49	35,25	17,12
Subtotal (Flowlines and old seismic lines)			**37,60**	**18,29**
Temporary Land Take				
Seismic Lines (2 m)	78360,2	78,36	**15,68**	**0,00**
TOTAL:			**90,73**	**55,74**

5.3.2 Residual Negative Impacts on Sensitivity and Habitat Status

Total and residual negative impacts in habitats of varying sensitivity

Table 5-2 divides the areas affected by Sasol's footprint into habitat sensitivity classes, based on the sensitivity mapping in Figure 4-3. The breakdown of Sasol's activities follows the categorisation in Table 5-1, ranging from permanent through semi-permanent to temporary. Of the total Sasol footprint of 90.7 ha, 61 ha is in medium sensitivity habitat and 26 ha is in very low sensitivity habitat. Less than 4 ha is in habitats of high or very high sensitivity (largely due to old seismic lines), and is reduced to 2 ha, if a 50% recovery is assumed.

Table 5-2. Summary of Sasol's direct footprint on habitat sensitivity in the Nhangonzo area

Habitat sensitivity	Sasol permanent infra-structure	% of Class	Semi-permanent infra-structure	% of Class	Semi-permanent seismic	% of class	Temporary seismic	% of class	Total	% of Total
	Roads and well pads (ha)		Flow lines (ha)		Other seismic lines (ha)		3D seismic lines 2016 (ha)		(ha)	
Very High	0,07	0,19	0,00	0,00	1,00	2,83	0,27	1,70	**1,33**	**1,47**
High	0,25	0,67	0,00	0,00	1,83	5,20	0,47	2,98	**2,55**	**2,81**
Medium	17,17	45,85	1,91	81,35	27,65	78,43	14,19	90,51	**60,92**	**67,15**
Very Low	19,96	53,29	0,44	18,65	4,77	13,54	0,72	4,57	**25,88**	**28,53**
Unclassed	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,23	**0,04**	**0,04**
Subtotal ha:	**37,45**	**100**	**2,35**	**100**	**35,25**	**100**	**15,68**	**100**	**90,73**	**100**
Total ha:	**90,73**									

Total and residual negative impacts in habitats of different status

Table 5-3 divides the areas affected by Sasol's footprint into areas defined by their habitat status, based on the habitat status mapping in Figure 4-2. The breakdown of Sasol's activities follows the categorisation in Table 5-1, ranging from permanent through semi-permanent to temporary.

Most (59%) of the permanent infrastructure (roads and well pads) is located in Modified Habitat while 40% is in Natural Habitat. There is no permanent infrastructure in the (coastal Dune Thicket/ Forest) Critical Habitat (as defined in this study). Several of the roads when first constructed would have been located in Natural Habitat; but over the years, with increasing expansion of cultivation, particularly in the south, these areas are now categorised as Modified Habitat.

Most of the flow lines; old seismic lines and recent 3D seismic lines are in Natural Habitat, totalling 64 ha (70%); while 26 ha (29%) is in Modified Habitat, and only 0.3 ha (old seismic line) is in the Dune Forest/Thicket Critical Habitat.

Table 5-3. Summary of Sasol's direct footprint on habitat status in the Nhangonzo area

Habitat status	Sasol permanent infra-structure	% of Class	Temporary infra-structure	% of Class	Semi-permanent	% of class	Temporary	% of class	Total	% of Total
	Roads and well pads (ha)		Flow lines (ha)		Other seismic lines (ha)		3D Seismic lines 2016 (ha)		(ha)	
Critical	0,00	0,00	0,00	0,00	0,19	1,21	0,09	0,26	**0,28**	**0,31**
Natural	15,19	40,57	1,91	81,35	13,36	85,23	33,43	94,85	**63,90**	**70,43**
Modified	22,26	59,43	0,44	18,65	2,13	13,56	1,64	4,66	**26,46**	**29,17**
Unclassed	0,00	0,00	0,00	0,00	0,00	0,00	0,08	0,23	**0,08**	**0,09**
Subtotal ha:	**37,45**	**100**	**2,35**	**100**	**15,68**	**100**	**35,25**	**100**	**90,73**	**100,00**
Total ha:	**90,73**									

*Taking into account an estimated 50% recovery of old seismic lines and 100% recovery of hand-cut 3D seismic lines, the **residual negative impact is reduced to an estimated 24 ha of Natural Habitat and 26,4 ha of Modified Habitat, and negligible impact on Critical Habitat (0,05 ha).** The total residual negative impact amounts to approximately 50 ha of habitat.*

5.3.3 Significance of Residual Negative Impacts of Sasol's Activities

The PSA EIA and Addendum (Golder, 2014; 2015) concluded that the residual negative impacts of Sasol's activities on ecosystems, species and ecosystem services would be of low significance, and would have little material impact on the health of the Nhangonzo area. The present study supports this conclusion. The required mitigation, and the extent to which this has been implemented (described in Annex B and supplemented by close out reports and field observations), shows that Sasol has effectively minimised its residual impact on biodiversity in the Nhangonzo catchment. Furthermore, the residual negative impacts on the habitat now categorised as Critical Habitat (estimated at 0.3 ha) have had no measurable adverse effect on the biodiversity values that triggered the categorisation of the Coastal Dune Thicket/ Forest as Critical Habitat, or on the ecological processes supporting these values.

5.3.4 Indirect and Induced Impacts

The residual long-term risks of Sasol's existing activities in the Nhangonzo's area are linked primarily to:

- Spread of alien invasive plants along roads, flow lines and seismic lines, which are currently at very low levels and which can be monitored and effectively managed through regular removal (should invasions occur);
- Increased natural resource harvesting of firewood/ timber to unsustainable levels, which requires monitoring and possible additional controls; and
- Increased human influx over time along existing 2D seismic lines and well access roads, which may result in spread of cultivation and settlement, and further loss of habitat and biodiversity, including bushmeat hunting. This induced impact is notoriously difficult to manage and control and would require wide support and intervention by government and district stakeholders.

The following section looks specifically at assessing induced impacts resulting from Sasol's seismic lines or flowlines, and new access roads in terms of habitat clearance.

Induced human access along seismic lines and access roads and the associated clearance for fields, and timber harvesting and hunting are widely reported to be a major cause of indirect impacts associated with oil and gas development in the region. Construction of new roads or use of seismic lines as tracks have led to uncontrolled harvesting and sale of wood and charcoal in some parts of Sasol's concession, particularly in areas with dense thicket and more desirable hardwood species. This has proved difficult to control as Sasol do not have the authority to restrict public access along these lines or roads, and previous attempts to do so on pipeline servitudes have been unsuccessful. However, the links between oil and gas activities and induced access and resultant biodiversity impacts are difficult to verify without thorough evidence-based investigations involving stakeholder consultation, to understand the land use and population dynamics. Time-series imagery analysis and checks on use and recovery of roads and seismic lines over time, together with verification of the reasons for any observed third-party activity by consulting with communities, would be necessary to establish cause-effect relationships.

In the Nhangonzo area, the system of shifting agriculture is prevalent on the margins of the Critical Habitat area, particularly around existing settlements, such as Mapanzene. The mosaic of cultivation and secondary regrowth fluctuates from year to year but typically shows a net increase over time as settlements expand and soils are cultivated and depleted, and woodland is cleared for new farmland.

Review of historic google imagery between 2004 and 2016 for the Nhangonzo area shows a significant increase in agriculture in the southern portion of the Critical Habitat around the settlement of Mapanzene after the road to the 1-10 well site was constructed through relatively untransformed woodland in 2008 (Figure 5-4). However, prior to 2008 there appeared to be more cultivation in the centre of the site (just south of I-G6PX-1). It is therefore unclear the extent to which the road to I-10

may have encouraged a shift in cultivation towards and south of this road, but it is possible that the central part of the Nhangonzo site was found to have poorer soils and crop yield and this, in combination with improved road access and increasing population size nearer the coast, may have encouraged expansion of cultivation to the south. However, given the extent of cultivation in the adjacent areas around Mapenzene, it is likely that some of the woodland areas would have been cleared for agriculture in the absence of the new road access to well pad I-10 over time.

Further, it is also possible that the more rapid expansion in cultivation seen between 2014 and 2017 (confirmed from comparison of land cover mapping done in 2014 with new analysis for this study using December 2017 imagery) could be related to the prevailing drought conditions and the need for community members to expand their machambas due to poor crop yields. In summary, there are multiple factors that may contribute to the patterns of shifting agriculture in the Nhangonzo area, and creation of new road access by Sasol is only one of these. In the absence of more information (such as inputs from community members and soil conditions) it is difficult to confirm the contribution of Sasol's footprint to the overall land use dynamics that have occurred.

A long-term time series analysis of changes in land use and land cover has not been done for the Nhangonzo area to confirm the links between earlier drilling and seismic activities and potential induced land use changes. However, comparison of the extent of cultivation between mapping compiled from 2014-2015 spot imagery and sentinel imagery from December 2017 shows an increase in cultivation over the three-year period of almost 100% from by an additional 199 ha to a total of 402 ha of which ~31% is old crop land (Table 5-4 and Figure 5-4). Not all of this cultivated area will be actively farmed and much of the old cultivation may remain as fallow land or which has partially regrown as secondary woodland.

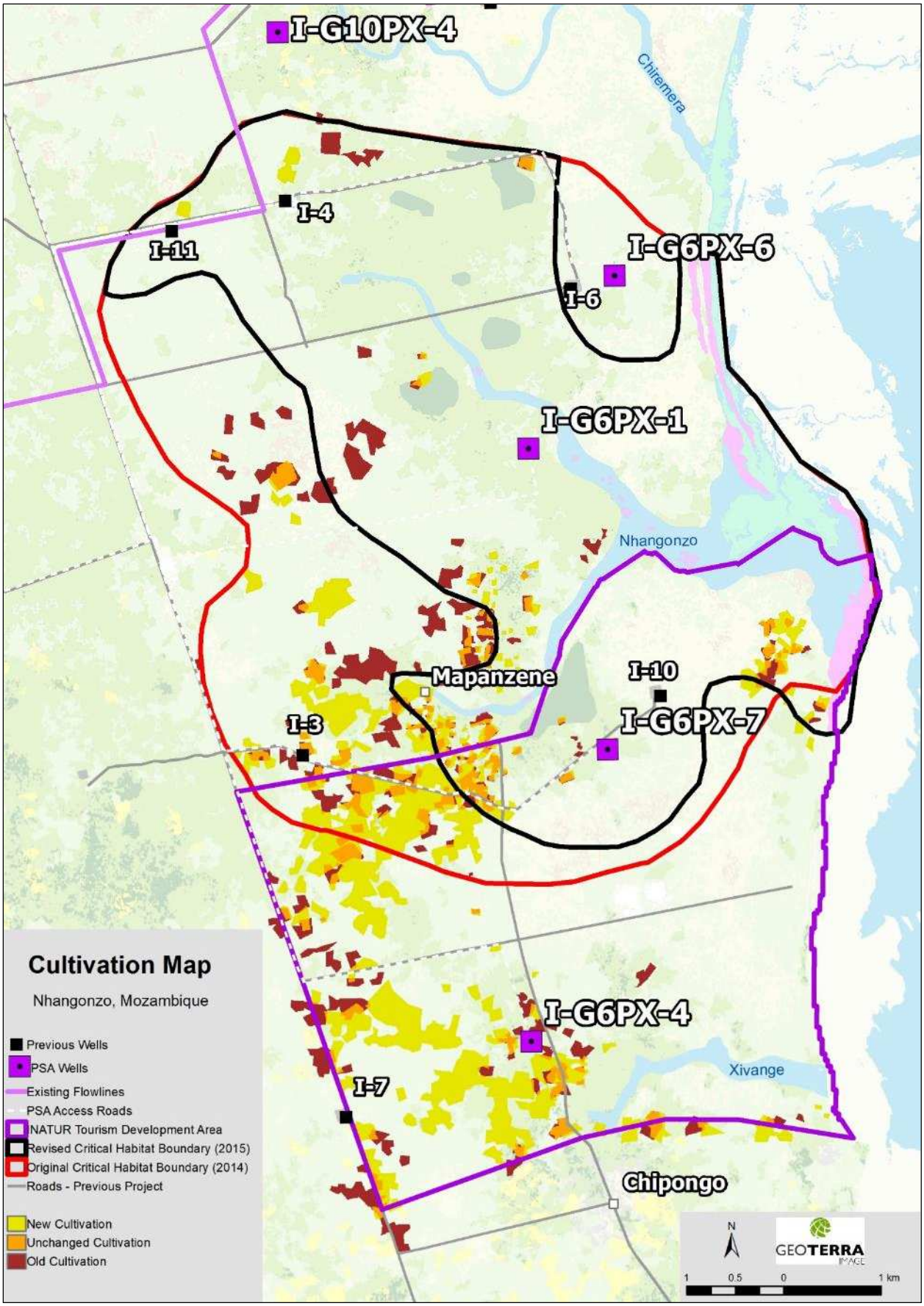
Table 5-4. Summary of cultivation changes between 2014 and 2017

Cultivation Class	Area (Hectares)	% of Cultivated Area
New Cultivation	199,04	49,48
Unchanged Cultivation	78,72	19,57
Old Cultivation	124,51	30,95
Total:	**402,27**	**100**

The implementation of 3D seismic lines by hand-cutting 2-m wide lines and restricting vehicle access does not appear to have led to induced impacts, although it is difficult to assess whether there has been increased access for bushmeat hunting. Even the old 8 m-wide seismic lines from east to west across the north and central part of the Nhangonzo area, constructed prior to 2009, show no evidence of increased access for cultivation or settlement.

In summary, there is no obvious correlation of increasing settlement and cultivation with Sasol's expanding footprint in the Nhangonzo area to date, possibly due to the poor soils in the area. However, in other parts of Sasol's concession, such as Pande Block and along the Mozambique-Secunda Pipeline (MSP), seismic lines and flow lines have increased access for resource harvesting and resulted in increased woodland clearance for cultivation in areas with more desirable red soils.

Figure 5-4. Comparison of old (2014) and new cultivation areas



5.3.5 Unplanned Events

Potential unplanned events associated with the PSA project activities in the Nhangonzo area that could arise include:

- Potential groundwater contamination from well drilling could affect the hydrological processes that maintain the coastal wetland system, but which can be monitored by means of groundwater boreholes downslope of well pads; and
- An unplanned event such as a well blow out, uncontrolled release or spill which have been assessed in the PSA EIA (Golder 2014, 2015) to be acceptably low risks under effective management.

6. OPTIONS ANALYSIS

Section 6 provides a review and reassessment of the principles and management options for Nhangonzo previously proposed and assessed by stakeholders in 2015 in the context of the findings of the Area Categorisation (Section 4), and the updated legal and policy framework for biodiversity offsets in Mozambique (Section 3).

6.1 Review of Options Analysis Principles

The principles used previously as the basis for identifying options for the management and protection of the Nhangonzo area are summarised and reviewed, and revised principles are presented in Table 6-1.

The revised principles would apply to existing and any future oil and gas activities in the Nhangonzo area provided they remain outside the reclassified Critical Habitat, and Sensitivity and Constraints areas mapped in Figure 4-2 and Figure 4-3, respectively.

Table 6-1: Principles for identifying options and implications of the findings of the Area Categorisation

	Category	Original Principles	Implications of the Area Categorisation findings	Reworded Principles for the Nhangonzo area
1	Legal	Any option or combination of options should adhere to Mozambique legislation.	Remains applicable. The principle should also include a requirement to align with Mozambique policies relating to biodiversity management and offsets.	Any option or combination of options should adhere to Mozambique legislation and align with Mozambique's policy framework on biodiversity management and offsets.
2	Social	■ Support to communities using the land ■ Community involvement in options analysis and following selection of an option in integrated management of the area ■ Socio-economic sustainability ■ Social responsibility and preservation of the environment ■ Community consultation ■ Community must be involved in the integrated management ■ No resettlement.	All the social principles are applicable to the options identified for mitigating or compensating for Sasol's residual impacts in Nhangonzo (as well as other areas of exploration and operation). The existing mitigation measures in the PSA EIA, EMPs, Emergency Response Plan, and Corporate Social Responsibility (CSR) plan address and support many of these principles.	■ Support to communities using the land ■ Community involvement in options analysis and following selection of an option in integrated management of the area ■ Socio-economic sustainability ■ Social responsibility and preservation of the environment ■ Community consultation ■ Community must be involved in integrated management initiatives for the area ■ No resettlement
3	Protection	Manage activities in Nhangonzo catchment by way of a sustainable natural resource use plan that will achieve the following: ■ Protect the Nhangonzo stream ■ Protect peat and other wetlands ■ Sustainable harvesting of trees and other vegetation ■ Sustainable fishing in estuary	The principle of protecting the priority biodiversity and ecosystem services features of the Nhangonzo catchment remains valid. Mitigation measures in the PSA EIA, EMPs, Emergency Response Plan and CSR measures support many of these principles. For example, the 500 m buffer zone along the coast already prevents oil and gas activities which could	Manage activities in Nhangonzo catchment by way of developing and implementing an integrated management plan focused on sustainable use of natural resources that will achieve the following: ■ Protect the Nhangonzo stream and its aquatic and wetland habitats ■ Sustainable harvesting of trees and other vegetation

	Category	Original Principles	Implications of the Area Categorisation findings	Reworded Principles for the Nhangonzo area
		■ Protect mangroves which are the breeding ground for fish and species ■ Keep the dunes intact ■ Prevent pollution ■ Achieve a net gain by improving the biodiversity value of the area ■ Consider the ecosystem goods and services provided by the area.	damage the coastal dunes, while the 250 m buffer around the wetland protects the Nhangonzo stream and wetlands from Sasol activities. Additional measures to monitor human influx and resource extraction along Sasol's cut lines, flowlines and access roads are required. <u>Due to the apparent lack of significant adverse impacts on biodiversity in the Nhangonzo area from Sasol's activities to date and the recategorisation of the area as largely Natural Habitat, there is no requirement</u> to achieve Net Gain in terms of IFC PS6. Therefore, this specific reference in relation to the Nhangonzo area can be reworded.	■ Sustainable fishing in estuary ■ Protect mangroves which are the breeding ground for fish and species ■ Keep the dunes intact ■ Prevent pollution ■ Achieve No Net Loss of the significant biodiversity values of the area ■ Safeguard the ecosystem goods and services provided by the area.
4	Financial	■ Should be financially feasible – no undue burden on government, Sasol or other parties.	Financial contribution by Sasol for any agreed option/s must be commensurate / proportionate with the residual negative impacts and risks of future harm associated with Sasol's activities in the area. The responsibilities of government with regard to sustainable land and resource management must be recognised and respected. It must also be recognised that Sasol has no direct management control over land use.	■ Additional conservation actions that are considered should be over and above a developer's responsibilities for implementation of the mitigation hierarchy and should be financially feasible – no undue burden on government, Sasol or other parties.
5	Development	■ Limited Oil and Gas development allowed provided the guidelines of IFC Performance Standard 6 for development in Critical Habitat can be met. ■ Tourism development allowed provided the guidelines of IFC PS 6 for development in Critical Habitat can be met. ■ Integrated management by more than one party should be feasible.	Current oil and gas development in the Nhangonzo area has not impacted on the Dune Thicket/Forest Critical Habitat and has not (to date) had significant residual negative impacts on Natural Habitat. Currently, therefore, No Net Loss or Net Gain requirements are not applicable to the existing Sasol activities in the Nhangonzo area and a biodiversity offset is not required. Future activities for oil and gas and tourism development should ensure that there are no negative impacts on Critical Habitat, and that any residual impacts on Natural Habitat should achieve no net loss at minimum thus conforming with IFC requirements. This principle should be reworded to include Natural Habitat requirements in IFC PS6.	■ Limited Oil and Gas development allowed provided the guidelines of IFC Performance Standard 6 for development in Natural and Critical Habitat can be met. ■ Tourism development allowed provided the guidelines of IFC PS 6 for development in Natural and Critical Habitat can be met. ■ Integrated management by more than one party should be feasible.

6.2 Review of Previous Options for the Nhangonzo Area

The previous management options proposed and assessed for the Nhangonzo area in 2015 (Golder, 2015[21]) are evaluated in the last column of Table 6-2 based on the findings of the Area Categorisation, and current legal and policy framework for offsets in Mozambique.

Table 6-2: Evaluation of previously proposed management options for Nhangonzo based on the Area Categorisation findings

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
CH1: **Meet national legislation** Sasol develops wells where they are most suited for oil field development with no specific reference to other land uses or the Nhangonzo coastal stream. No extra measures applied over and above legal compliance. **Sasol does not propose to consider this option**	■ Meets national legal requirements. ■ Considers the lack of a legal status of this area (not a conservation area). ■ Does not require additional costs for the conservation of the area. ■ Does not require effort by the government for the conservation of an area not legally recognised / declared.	■ This option will not meet Sasol's stated intent to comply with IFC Performance Standards.	■ No residual impacts on biodiversity values in re-defined Critical Habitat and no significant residual significant negative impacts in Natural Habitat (for approved oil and gas activities). Therefore, no requirements to achieve No Net Loss or Net Gain for biodiversity impacts in terms of IFC PS6; i.e. no biodiversity offsets are needed. ■ However, opportunities to benefit biodiversity through Additional Conservation Actions (ACAs) could include support by Sasol for integrated land use planning for sustainable use of natural resources). ■ Legal requirements met: EIA applied mitigation hierarchy, EMPs and Emergency Response Plan prepared. ■ The BMP required of Sasol by MITADER for the Nhangonzo area will respond to the habitat sensitivity and constraints map, and the biodiversity management and monitoring measures in the existing EMPs and the Emergency Response Plan. Biodiversity impacts associated with induced access from people's use of Sasol's access roads, and flow and seismic lines, should be monitored as part of its standard environmental management practices.	■ **CH1: Rejected** (does not cover the need to meet IFC requirements for activities in Natural Habitat)

[21] *Appendix 4 of PSA EIA Addendum called 'Nhangonzo Critical Habitat Options Analysis; (Golder, 2015)*

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
CH 2: **Meet National legislation and largely meet IFC Performance Standard 6 requirements** Sasol implements its two wells in the Nhangonzo area (I-G6PX-7 and I-G6PX-1) and associated access roads in accordance with best practice and monitors its impacts on the Critical Habitat	■ Sasol publicly committed to adhere to the IFC's requirements (PS6). ■ The Environmental Management Plan incorporates the need to monitor the status of the *Critical Habitat*.	■ Ignores the impacts caused by other parties on the *Critical Habitat* (increased use of resources by the community; some of which possibly due to access provided by Sasol). ■ Possible conflict in the long term between Sasol, tourism industry and communities. ■ Some level of residual risk remains during drilling and operation of wells, which cannot be mitigated and requires long term monitoring. ■ Does not fully comply with IFC PS 6 in respect of Paragraph 18, which requires a Biodiversity Action Plan, designed *to achieve a positive net balance of biodiversity values for which the critical habitat was created.*	■ No residual negative impacts are expected on biodiversity values in the re-defined Critical Habitat, and no significant residual negative impacts are expected in Natural Habitat. Therefore, no requirements for No Net Loss or Net Gain to be satisfied in terms of IFC PS6, i.e. no biodiversity offsets are needed for the Nhangonzo area. ■ This option, together with preparation of a BMP covering the approved oil and gas activities in the Nhangonzo area in compliance with MITADER's requirements, would fulfil the legal and IFC PS6 requirements. Sasol should monitor the biodiversity impacts associated with induced access from use of its access roads and flow and seismic lines as part of its standard environmental management practices. ■ This option may not meet the expectations of stakeholders who may require Sasol to contribute, at minimum, to an integrated land use plan for the area as an ACA. ■ Most of the Nhangonzo area is high-value Natural Habitat that is similar to other parts of Sasol's wider area of influence. There is a need for Sasol to consider residual negative impacts across the wider area of influence of its activities and plan appropriate offsets /compensation (as recommended in the FEAD EIA (Golder, 2017).	■ **CH2: Minimum acceptable option** (subject to approved EMP and adequate monitoring of pollution and population influx (i.e. induced impacts))

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
CH 3: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and establish a Conservation/ Development Trust aimed at Conserving the Nhangonzo Catchment and improving Livelihoods of Communities (for Nhangonzo area only)**. This would include funding for community food security and skills development initiatives, community education on sustainable resource management and agreement with communities to limit unsustainable resource use.	■ It provides funding for projects which meets the needs of livelihoods of communities. ■ Contributes to a reduction in pressure on the Critical Habitat. ■ Removes onus from the GOM to manage the area for conservation. ■ Provides funding for targeted conservation actions. ■ Provides funding to build community capacity for self-sufficiency, leaving a legacy even after the project is complete (sustainable development).	■ Assigns funds for conservation of an area that is not officially recognised by the GoM. ■ May give rise to disagreements between communities competing for the provision of funds. ■ Requires an exit strategy (for Sasol) and a well-articulated sustainability framework. ■ Provides no guarantee that the interventions will reduce the impact of third party *use of the Critical Habitat*.	■ No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat (i.e. Dune Thicket/Forest) and no significant residual negative impacts are predicted in Natural Habitat from the approved Sasol's activities. Therefore, no specific requirements (e.g. biodiversity offsets) are needed to achieve No Net Loss or Net Gain in terms of IFC PS6 over and above the existing EMP requirements. ■ Sasol does not have direct management control or significant influence over land and resource use in the affected area; this is a GoM role. ■ Financial provision by Sasol for conservation in the area, given absence of significant residual negative impacts, is of questionable merit and poorly defined targets or beneficiaries. ■ There is an existing conservation trust fund in Mozambique (BIOFUND) which would be best placed to receive funds for conservation. ■ Sasol should consider supporting opportunities to benefit biodiversity in the Nhangonzo area through ACAs, as a form of compensation for operating in the area. These ACAs could include support for integrated land use planning for sustainable use of natural resources, and community education projects under the CSR programme.	■ **CH 3: Could meet legal and social principles** as long as funds are not misdirected from other priority areas for biodiversity, recognised by the GoM, which could be targeted by aggregated offsets for Sasol's residual impacts in its wider area of operation.

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
CH4: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and initiate an offset which contributes to conserving a similar ecosystem elsewhere** This option envisaged that Sasol would contribute to the restoration or expansion of a similar wetland/coastal stream habitat elsewhere.	▪ Concentrates conservation efforts into areas which have the best chance of support. ▪ Provides funds to support the GoM's efforts, based on the assumption that the area of biodiversity counterbalance is an area of major importance for conservation. ▪ Meets IFC (PS 6) and other international guidelines for the development of offsets where conservation of the affected area is not practical.	▪ Sasol will have no influence on the resource use made by third parties in *the Critical Habitat* but can still be held responsible for changes in land use and the loss of biodiversity in this area. ▪ May not be an area recognised by the GoM as having conservation status. ▪ Requires the identification of an identical but damaged area which may be difficult to ascertain in the absence of *an approved offset system* in Mozambique. ▪ De-links Sasol's funding from its area of direct influence.	▪ No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat (i.e. Dune Thicket/Forest) and no significant residual negative impacts are predicted in Natural Habitat from the approved Sasol's activities. Therefore, no specific requirements (e.g. biodiversity offsets) are needed to achieve No Net Loss or Net Gain in terms of IFC PS6 over and above the EMP requirements. ▪ This option would best support the recommendation in the FEAD EIA (Golder, 2017) for Sasol to undertake a wider study to quantify its overall impacts in the region and prioritise areas for focussed biodiversity mitigation – including offsets – and management.	▪ **CH4: Not relevant for Nhangonzo area alone**. However, this option would be applicable to consideration of Sasol's residual impacts across its entire concession area/s. This option also accords with the legal and policy framework for biodiversity conservation in Mozambique, by concentrating offsets for Sasol's aggregated impacts in identified priority areas for wetland restoration or protection, and ensuring that funds target these areas.
CH5: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and support an unrelated but worthy alternative conservation initiative elsewhere in Mozambique**. This option envisaged Sasol would account for its residual impact and compensate for them by contributing to an established conservation initiative elsewhere, such as the Bazaruto Archipelago National Park (BANP). Funding would be channelled through	▪ Sasol demonstrates a commitment to a conservation area with recognised conservation value. ▪ It contributes to a proclaimed conservation area that is located near Sasol's area of influence (if selected, the BANP).	▪ Removes the connection between funds provided by Sasol and its direct area of influence (if the BANP is not selected). ▪ Does not adhere strictly to the IFC guidelines concerning the *establishment of biodiversity offsets.* ▪ Sasol has no influence on third party uses in the *Critical Habitat* but may still be seen to be accountable for land use change and loss of biodiversity in the area.	▪ Most of the Nhangonzo area is not Critical Habitat. No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat and no significant residual negative impacts are predicted in Natural Habitat from Sasol's approved activities. Therefore, there is no need for a biodiversity offset, or No Net Loss or Net Gain to be satisfied in terms of IFC PS6. ▪ However, should Sasol commit to investigate its residual impacts in its broader area of operations, as recommended by the FEAD EIA (Golder, 2017), this is considered a viable option as it supports the	▪ **CH5: Not relevant for Nhangonzo area alone.** However, this option but would be applicable to consideration of Sasol's residual impacts across its entire concession area/s, as it accords with the legal and policy framework for biodiversity management in Mozambique and ensures funds are

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
recognised administrative structures (both Government and NGO) to remove the burden from Sasol.			▪ approach promoted by COMBO to pursue aggregated offsets in Protected Areas or their buffer zones. This option was also the second most preferred option supported by stakeholders at workshops in 2015. ▪ There is an existing conservation trust fund in Mozambique (BIOFUND) which would be best placed to receive funds for conservation.	invested in priority conservation areas.
CH6: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and proclaim the Critical Habitat as a Dedicated Conservation Area in terms of the Mozambique Biodiversity Act** This option envisaged giving the Nhangonzo area formal legal protection aimed at joint use by communities (sustainable resource harvesting) while permitting limited development of the oil field. Stakeholders rejected the possibility of proclaiming a conservation area that would link up with the BANP.	▪ Provides legal mechanisms for control of land use in the *Critical Habitat*.	▪ Channels the GoM's capacity away from existing recognised conservation areas in need of funding. ▪ The area is too small to be preserved as an ecologically viable conservation area. ▪ Prohibits effective development of the onshore oil field. ▪ Loss of GoM and Sasol revenue from oil field. ▪ Diverts GoM capacity away from existing recognised conservation areas which need funding. ▪ Does not restrict continued community *use of the Critical Habitat* which is one of the principal future threats to biodiversity.	▪ Most of area is not Critical Habitat. No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat and no significant residual negative impacts are predicted in Natural Habitat from the approved Sasol's activities. Therefore, there is no need for a biodiversity offset, or No Net Loss or Net Gain to be satisfied in terms of IFC PS6. ▪ Would not be aligned with biodiversity offset Roadmap and proposed mechanism for providing offsets in Mozambique, which focuses on enhancing biodiversity in existing Protected Areas, expanding them or creating new Protected Areas where areas have recognised high value biodiversity.	▪ **CH6: Rejected** This option does not accord with Mozambique policy framework to invest in aggregated offsets in priority conservation areas.
CHZIT 1: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and assist in coordinating the integrated planning over the larger Zone of Tourism (ZIT) area.** This option envisaged that Sasol and INATUR would contribute to	▪ INATUR will also recognise the Nhangonzo *Critical Habitat.* ▪ Adjusts the development plan for the tourism project to the sensitivity of the area. ▪ Encourages Sasol and INATUR to make reasonable compromises	▪ Ignores other local areas of high conservation value (Govuro River, endorheic pans, barrier lakes, other coastal streams) between Vilankulo and Inhassoro within the Sasol oil field development area.	▪ Most of area is not Critical Habitat. No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat and no significant residual negative impacts are predicted in Natural Habitat from the approved Sasol's activities. Therefore, there is no need for a biodiversity offset, or No Net Loss or Net Gain to be satisfied in terms of IFC PS6.	▪ **CHZIT 1: Acceptable option as an Additional Conservation Action** for Sasol to compensate for its ongoing activities in Nhangonzo and to meet stakeholder expectations. Such

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
integrated planning and management in the Nhangonzo and larger ZIT areas. Sasol would drill its proposed wells, and Sasol and INATUR would minimise their impacts in both areas. The potential for the ZIT to generate local employment and alleviate poverty were recognised in this option, while managing water supply and runoff to the golf course and resorts.	that provide for the joint development of oil exploration activities and tourism in the ZIT.		■ Sasol is not responsible for integrated land use planning or tourism planning and does not have direct management control or significant influence over land use in the affected area. However, Sasol could support, finance and/or provide inputs into a study to prepare an integrated land use (and zoning) plan, including ACA initiatives that could be implemented under its CSR programme. ■ The lack of progress with securing funding for the INATUR development may limit opportunities for a meaningful partnership with INATUR in developing an integrated land use plan.	initiative should not detract from the need for Sasol to conduct a wider investigation of residual impacts and offset requirements.
CHZIT 2: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and establish a conservation trust managed by a credible body which targets conservation initiatives in the Nhangonzo catchment and integrated planning with INATUR.** As per previous option but includes a commitment from Sasol to fund a conservation / development trust for the area. It envisages that Sasol and INATUR work together to promote development in the local area with funds contributed by Sasol to assist households.	■ It provides funding for initiatives specifically designed with the community in the Nhangonzo Critical Habitat and INATUR development areas for projects which meets the needs of livelihoods of communities. ■ Encourages and promotes tourism initiatives in the area that will most likely be the mechanism for job creation and poverty alleviation in local communities. ■ Fully complies with IFC PS 6 regarding Critical Habitats (refer to final paragraph of Note 8) if successfully implemented. ■ Encourages reasonable working solutions to joint	■ Ignores other local areas with high conservation value (Govuro river, other coastal streams) between Vilankulo and Inhassoro. ■ May give rise to disagreements between communities competing for the provision of funds. ■ May be difficult to implement with little guarantee of success.	■ Most of the Nhangonzo area is not Critical Habitat. No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat and no significant residual negative impacts are predicted in Natural Habitat from the approved Sasol's activities. Therefore, there is no need for a biodiversity offset, or No Net Loss or Net Gain to be satisfied in terms of IFC PS6 ■ Sasol is not responsible for integrated land use planning or tourism development. Neither does it have direct management control or significant influence over land use in the affected area; this is GOM's role. Further, the lack of progress with securing funding for the INATUR development would suggest limited opportunity for a meaningful partnership with INATUR. ■ Sasol could contribute information and funds to support the preparation of an	■ **CHZIT 2: Acceptable option as an Additional Conservation Action** for Sasol to compensate for its ongoing activities in Nhangonzo and to meet stakeholder expectations. Such initiative should not detract from the need for Sasol to conduct a wider investigation of residual impacts and offset requirements.

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
	land-use decision-making with INATUR. ■ Provides funding to assist INATUR in start-up activities for the development of the ZIT.		integrated land and natural resource use management plan of the area as an ACA through its CSR programme. ■ Sasol could also investigate and prioritise CSR projects to be implemented in communities in the Nhangonzo area to support sustainable natural resource use harvesting. ■ Financial provision by Sasol for conservation initiatives in the area, beyond CSR projects, is of questionable merit given the absence of significant residual negative impacts of its operations in the area. ■ While the existing conservation trust fund in Mozambique (BIOFUND) is best placed to receive funds for conservation it is unlikely to be a suitable vehicle for the Nhangonzo area as this area is not a priority conservation area for aggregated offsets.	
ICA 1: **Meet national legislation and largely meet IFC Performance Standard 6 requirements and Sasol commits to funding and regularly updating a 'state of the environment' report to monitor and analyse social and environmental trends.** This option envisaged that Sasol would fund a State of the Environment Report (SoER) and monitoring and trend analysis of its activities covering its wider area of operation, including the Govuro River system to the estuary. This option would thereby shift the	■ Extends the area that will benefit from monitoring to cover other areas of environmental sensitivity. ■ Aligns Sasol's expenditure with the boundaries of the area in which the oil field will be developed. ■ Provides data for planning and interventions in this area by the GoM.	■ Does not provide any direct management intervention related to the preservation of the *Critical Habitat*. ■ As a useful tool for future planning and intervention, it relies on Government's capacity to use the information to plan interventions in the area. ■ Possibly considered by stakeholders to be an action that Sasol should undertake anyway, as a part of its PSA monitoring.	■ Most of the Nhangonzo area is not Critical Habitat. No residual impacts on biodiversity values are predicted in the re-defined Critical Habitat and no significant residual negative impacts are predicted in Natural Habitat from the approved Sasol's activities. Therefore, there is no need for a biodiversity offset, or No Net Loss or Net Gain to be satisfied in terms of IFC PS6 specific to this area. ■ Funding a State of the Environment Report (SoER) makes no material *or in situ* contribution to environmental protection *per se*, unless additional management requirements identified in the SoER are implemented.	■ **ICA1: Not relevant for Nhangonzo area alone.** Acceptable if the option is aimed at quantification of Sasol's wider impacts across its concession areas, and identification of, and planning for, offsets.

Original Options	*Strengths / Benefits*	*Weaknesses / Disadvantages*	*Implications of Area Categorisation Study*	*Result*
focus away from the Nhangonzo area alone.			■ Sasol is not responsible for integrated land use planning or monitoring the State of the Environment in the areas in which it operates (besides its own activities and impacts). To some extent, implementation of the recommendations in the recent FEAD EIA (Golder, 2017) would partially fulfil this option for Sasol's entire concession area/s. ■ This option should be expanded to include a concession-wide study to: identify and map all Critical, Natural and Modified habitats; assess and quantify Sasol's residual direct and indirect impacts; identify habitat metrics for determining any additional compensation or offset requirements; and, where required, identify suitable offset options and plan for their implementation.	

6.3 Summary Implications for Sasol

Several of the previously proposed biodiversity management options for the Nhangonzo area are no longer appropriate or relevant in the light of the revised Area Categorisation. The categorisation of the area as mostly Natural Habitat rather than Critical Habitat, and the fact that Sasol's approved activities in the area to date have had minimal residual adverse impacts based on application of the existing EMPs for the approved oil and gas exploration activities, means no biodiversity offset is required. However, any options (often referred to as Additional Conservation Actions (ACAs)) that may be considered to compensate for Sasol's footprint should be commensurate with Sasol's residual negative impacts, its level of influence and management control in the area, the expectations of stakeholders, and compliance with Mozambique and IFC requirements.

There are components of the various options that remain applicable and could still be considered depending on the scale of analysis, and the nature and extent of significant residual impacts. A high-level summary of each option and their relevance to Sasol's activities and impacts in the Nhangonzo area, and their possible applicability at the scale of Sasol's wider concession area/s, is provided in Table 6-3.

Ultimately, pursuit of any of the proposed options for the Nhangonzo area should be considered in the context of a wider biodiversity assessment across Sasol's entire concession area/s as recommended in the FEAD EIA (Golder, 2017).

Table 6-3: Summary of Option Components that remain Valid for Sasol's Activities in Nhangonzo and Other Parts of its Concession/s

Option	Valid for Nhangonzo Area	Valid for Sasol's Wider Concession Area/s
CH1	No. Does not comply with IFC PS6 requirements for Critical and Natural Habitat and to adhere to restrictions on placement of infrastructure.	No. Does not comply with IFC PS6 requirements for Critical and Natural Habitat and to adhere to restrictions on placement of infrastructure
CH2	Yes. Minimum acceptable option (subject to BMP and adequate monitoring of pollution and population influx along Sasol's roads, flow lines and cut lines). May not meet stakeholder expectations for Additional Conservation Actions (ACAs).	No. Not applicable as specific to approved activities in Nhangonzo area.
CH3	Possibly. Supporting community conservation actions in Nhangonzo is not a requirement of Sasol but could be considered as ACAs under its CSR programme to contribute to sustainable natural resource use in the area. However, such actions should be identified, prioritised and selected through a concession wide scale of assessment.	Yes. This option could be undertaken in other parts of Sasol's concession areas, subject to results of a concession-wide scale of assessment to prioritise appropriate interventions.
CH4	No. The option of expanding wetland protection to another area of higher conservation priority is not a required form of compensation or offset for Sasol's impacts in the Nhangonzo area.	Possibly. The option of extending protection to other priority wetland/coastal stream areas, such as the Govuro River and estuary, could be a potential compensation or offset measure applicable to Sasol's residual impacts in its wider area of exploration and operation. This option should be considered as part of a wider study to investigate Sasol's residual impacts and possible offset requirements.
CH5	No. The option of investing in an unrelated conservation area, such as the BANP, is not a required compensation or offset measure for the impacts of Sasol's activities in Nhangonzo.	Yes. The option of extending protection to other priority conservation areas could be an offset measure that may be applicable to Sasol's residual impacts in its wider area of exploration and operation and should be considered as part of a wider study as recommended by the FEAD EIA (Golder, 2017).

Option	Valid for Nhangonzo Area	Valid for Sasol's Wider Concession Area/s
		BIOFUND is an existing conservation trust fund that can provide a funding vehicle for implementation of biodiversity offsets.
CH6	No. The option of formalising the Nhangonzo area as a protected area is a) not required as a compensation or offset measure for the impacts of Sasol's activities in Nhangonzo and b) does not accord with Mozambique's policy framework for aggregated offsetting in priority conservation areas.	No. Formalising the Nhangonzo area as a protected area does not accord with Mozambique's policy framework for aggregated offsetting in priority conservation areas.
CHZIT 1	Possibly. The option of Sasol and INATUR contributing to the development and implementation of an integrated land use plan may be an acceptable ACA to support sustainable land use in the Nhangonzo area and may satisfy some stakeholder's expectations. However, the lack of funding and developers for the ZIT may undermine the viability and usefulness of such initiative.	No. Not directly relevant to Sasol's activities elsewhere in its concession area/s.
CHZIT 2	Partial. The option of establishing a conservation trust fund for targeted conservation actions in the Nhangonzo area combined with Sasol and INATUR contributing to the development and implementation of an integrated land use plan (as per CHZIT 1) may result in mis-directed allocation of funding to an area that is not identified as a high conservation priority in Mozambique. Identification of any conservation initiatives in Nhangonzo should be defined based on a structured biodiversity assessment of Sasol's wider residual impacts across its concession areas. The validity of supporting integrated land use planning under this option is discussed under CHZIT1.	No. Not directly relevant to Sasol's activities elsewhere in its concession area/s.
ICA 1	Partial. The option of compiling a State of the Environment Report (SoER) for Sasol's wider area as a basis for ongoing monitoring of trends could be a valid contribution to understanding Sasol's impacts regionally but is not a requirement to compensate for its localised impacts in the Nhangonzo area.	Partial. The option of compiling a SoER for Sasol's wider area as a basis for ongoing monitoring of trends should be re-scoped to fulfil the recommendations made in the FEAD EIA (Golder, 2017). This could include mapping of habitat status (Critical, Natural and Modified); analysis and quantification of Sasol's direct and indirect impacts with reference to the mitigation hierarchy, and identification of possible compensation and offset requirements for residual significant impacts.

7. CONCLUSIONS AND RECOMMENDATIONS

1. The reassessment of the status of the Nhangonzo catchment has found that most of the habitats in the area, including the coastal wetland system, do not meet the IFC criteria for Critical Habitat. Only 63.4 ha of Coastal Dune Thicket / Forest, located in a narrow strip along the north and south side of the Nhangonzo Estuary warrants designation as Critical Habitat under Criterion 2 (Endemic and Restricted Range species), based on the presence of at least three highly localised endemic plant species. In terms of Sasol's existing license requirements, which prohibit oil and gas activities within 500 m of the coast, the entire coastal Dune Thicket / Forest Critical Habitat in the Nhangonzo study area is already effectively protected from Sasol's activities.

2. The Nhangonzo coastal stream and its catchment is mostly Natural Habitat rather than Critical Habitat. Sasol's residual impacts on biodiversity in the Nhangonzo area to date are not considered to be significant. Most of the flow lines; old seismic lines and recent 3D seismic lines are in Natural Habitat, totalling 64 ha (70%); while 26 ha (29%) are in Modified Habitat. While only 0.3 ha (an old seismic line) overlaps the mapped Dune Forest/Thicket Critical Habitat there is no evidence to suggest that this habitat has been negatively affected by Sasol's activities. When habitats are categorised by sensitivity, of the total Sasol footprint of 90.7 ha, 61 ha is in medium sensitivity habitat; 26 ha is in very low sensitivity habitat; and less than 4 ha is in habitats of high or very high sensitivity; the latter is largely due to old seismic lines and which is reduced to 2 ha, assuming 50% recovery.

3. The study concludes that the biodiversity mitigation measures implemented by Sasol in the Nhangonzo area have complied with the approved EMPs and Emergency Response Plans for the PSA; are fit for purpose, and have successfully minimised impacts in the Nhangonzo area, resulting in no significant adverse impacts on biodiversity to date. This is due, in particular, to the requirement for hand-cutting of seismic lines to a maximum of 2 m width; restriction of wells to more than 250m from the wetland margin, and exclusion of exploration activities outside of the 500 m coastal no-go zone.

   The study confirms that no biodiversity offset is required for residual impacts at the local scale of the Nhangonzo catchment. While some of the components of the biodiversity management options identified in the previous reports on the Nhangonzo area may still contribute to biodiversity and ecosystem services protection, the merit of implementing these measures at such a local scale is questionable. The management of Sasol's impact on biodiversity should rather be considered in the context of its PSA license area or a concession-wide scale of assessment, as recommended in the FEAD EIA (Golder, 2017), and as further described below.

4. In the light of the above findings, the study recommends that:

   - Sasol should prepare a standalone BMP for its PSA license area (rather than solely for the Nhangonzo area) as a means of consolidating all approved biodiversity-related mitigation and monitoring measures from all existing EMPs covering Sasol's various project activities (seismic acquisition; construction of infrastructure, drilling and operation) into one document (with cross referencing back to the EMPs). The BMP will be 'generic', based on the known environmental sensitivities in the PSA and the typical activities undertaken by Sasol for exploration and development. Addendums to the BMP would need to be prepared for future specific project proposals in the course of the required Environmental Assessments for these projects.

     This generic BMP would provide stakeholders, including authorities, with an easily accessible document and fulfil IFC recommendations related to BAPs/BMPs.

- MITADER should revoke the conditions related to the provisional Nhangonzo Critical Habitat subject to implementing a wider scale biodiversity management plan (as per the bullet above). ***Note:*** *MITADER revoked the referred conditions in a letter to Sasol on 31 July 2018.*
- Sasol should assess any future oil and gas exploration and development activities in the Nhangonzo area (that are not already licensed) according to the habitat sensitivity classification set out in the FEAD EIA (Golder, 2017)[22]. The FEAD EIA provides a consistent biodiversity sensitivity rating for all of the vegetation classes and land types in Sasol's license areas. The regional habitat and sensitivity classification should be updated with the more detailed information for the Nhangonzo area provided in the present assessment (as well as any additional recent information obtained for other parts of Sasol's concession area).
- Sasol should consider revising the location of the approved well, I-G6PX-1, to a position slightly (100 m) to the south-west to avoid habitat of one data deficient plant species.

5. The study further recommends that Sasol considers its commitment to implementing the recommendations made in the FEAD EIA (Golder, 2017) for a biodiversity impact assessment to assess the cumulative residual impacts (direct and indirect) of all its activities in its license areas and determine potential offset requirements or other appropriate compensation measures. The FEAD EIA recognises the limitations of project-specific EIA's - which generally fail to adequately consider cumulative impacts - and its recommendations are in line with Mozambique's developing legal and policy frameworks for biodiversity and an aggregated approach to offsets. The FEAD EIA (Golder, 2017) was approved by MITADER in July 2018 as the basis for framing future environmental work done for specific Sasol projects.

Following meetings between Sasol, IMPACTO, MITADER and ANAC on 26 June 2018 and again between Sasol, Impacto and MITADER on 27 July 2018, MITADER has confirmed its acceptance of the study findings and recommendations. In a letter to Sasol dated 31 July 2018, MITADER indicated that it:

- accepts that the majority of the Nhangonzo Area is Natural Habitat and not Critical Habitat, based on the studies conducted, and that only a small portion is Critical Habitat, coinciding with the "no-go coastal area" not impacted by Sasol´s activities;
- revokes all conditions related to the preparation of a Biodiversity Management Plan (BMP) for the Nhangonzo area, set out in their original letter of approval of 16 March 2016; and
- agrees with the consultants' recommendation that Sasol should prepare a BMP for the entire PSA License Area.

[22] *This document is available to stakeholders on request from Impacto Ltd. or by accessing the following web address: www.impacto.co.mz*

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Appendix 1 Terms of Reference of Specialist Studies
Appendix 2 Public Participation Report
Appendix 3 Construction Environmental Management Plan (CPF)
Appendix 4 Construction Environmental Management Plan (Infrastructure)
Appendix 5 Drilling Environmental Management Plan
Appendix 6 Operational Environmental Management Plan
Appendix 7 The SEPI Compensation and Resettlement Procedure for Mozambique
Appendix 8 The SEPI Communications Plan for Mozambique
Appendix 9 The SEPI Waste Management Plan for Mozambique
Appendix 10 Sasol Petroleum Limitada Emergency Response Plan

2014c Volume 2 Final Specialist Studies
Specialist Study 1 Air Quality
Specialist Study 2 Noise
Specialist Study 3 Geohydrology
Specialist Study 4 Surface Hydrology
Specialist Study 5 Soils
Specialist Study 6 Waste

2014d Volume 3 Final Specialist Studies
Specialist Study 7 Risk (Govuro River)
Specialist Study 8 Risk (Well Blowout)
Specialist Study 9 Botanical Diversity
Specialist Study 10 Terrestrial Fauna
Specialist Study 11 Aquatic Ecology
Specialist Study 12 Social and Health
Specialist Study 13 Cultural Heritage
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Appendix 1: Site Selection Review of the Proposed PSA Produced Water Disposal Well

Appendix 2: Air Quality Impact Assessment of Changes to the PSA Liquids Plant (Airshed)
Appendix 3: Legal Considerations for Decisions on the Future of the Critical Habitat (Golder)
Appendix 4: Updated Nhangonzo Critical Habitat Options Analysis Report No. 1521646-13714-56 (Final) (Golder)
Appendix 5: Public Participation
Appendix 6: Stakeholder Workshop on the Nhangonzo Biodiversity Area
Appendix 7: Stakeholder Workshop on PSA EIA Addendum and Future of the Critical Habitat

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2 Vegetation and Floristic Baseline Survey (EOH CES)
3 Baseline Terrestrial Faunal Study (EOH CES)
4 Wetlands (WCS)
5 Baseline Fish Fauna and Aquatic Habitat Study (Anton Bok Aquatic Services)
6 Surface Water Quality (EOH CES)
7 Mangroves (EOH CES)
8 Estuarine Study (Golder)

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2 **Construction Environmental Management Plan (Infrastructure**) (c-EMP): Construction of the Infrastructure associated with the PSA Development and LPG Project, including Well sites, Flowlines, Trunklines and Access Roads (excluding Well Drilling) in Inhambane Province, Mozambique.
3 **Onshore Drilling Environmental Management Plan** (d-EMP): Drilling Operations associated with the PSA Development and LPG Project, Inhambane Province, Mozambique.
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1 Seismic Management Plan (s-EMP)
2 Drilling Management Plan (d-EMP)
3 Construction Management Plan (Infrastructure) (c-EMP)
4 Operational Management Plan (o-EMP)

5 Communication Plan
6 Decommissioning and Rehabilitation Plan
7 Onshore Compensation and Resettlement Plan
8 Waste Management Plan
9 Emergency Response Plan
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Annex A: Summary of Key Biodiversity Features of the Nhangonzo Area

The biodiversity features of the Nhangonzo Catchment that provided the basis for EOH's support of the Critical Habitat designation are described below and are discussed in more detail in Section 4 of the report.

Vegetation and Flora

Plant species recorded by EOH (2015) included:

- Two IUCN Red-listed species that are classified as Near Threatened (*Dalbergia melanoxylon, Pterocarpus angolensis*) and one that is classified as Data Deficient (*Xylia mendoncae*);
- Four species listed in the Mozambique Red Data list, one of which is Vulnerable (*Xylia mendoncae*), one which is Near Threatened (*Afzelia quanzensis*), and two that are Data Deficient (*Diospyros inhacaensis, Eulophia petersii*). However, *Xylia mendoncae* was recorded to the west of the site near the Govuro River and was not confirmed in the Nhangonzo area.
- One species is classified as Declining in the South African Red Data List (*Crinum stuhlmannii*); and
- Three species recorded by Castro & Grobler (2014) within the Nhangonzo stream which were new records for Mozambique, but do not have threatened or near threatened status.

No species of flora that have been assessed as endangered or critically endangered were found during the EOH surveys.

Alien invasive plants were limited to areas around settlements and along roads, and mainly comprised *Lantana camara* and *Opuntia ficus-indica*, besides the various exotic trees of cashew nut, mango and casuarina mainly in or near settlements.

Habitat Types

Terrestrial vegetation mapping by EOH 2015 in the Critical Habitat identified eight vegetation types (Figure A-1), with their extents in the Nhangonzo original Critical Habitat boundary summarised in Table A-1. More detailed mapping of the wetland vegetation within the coastal stream is provided in Section 4.

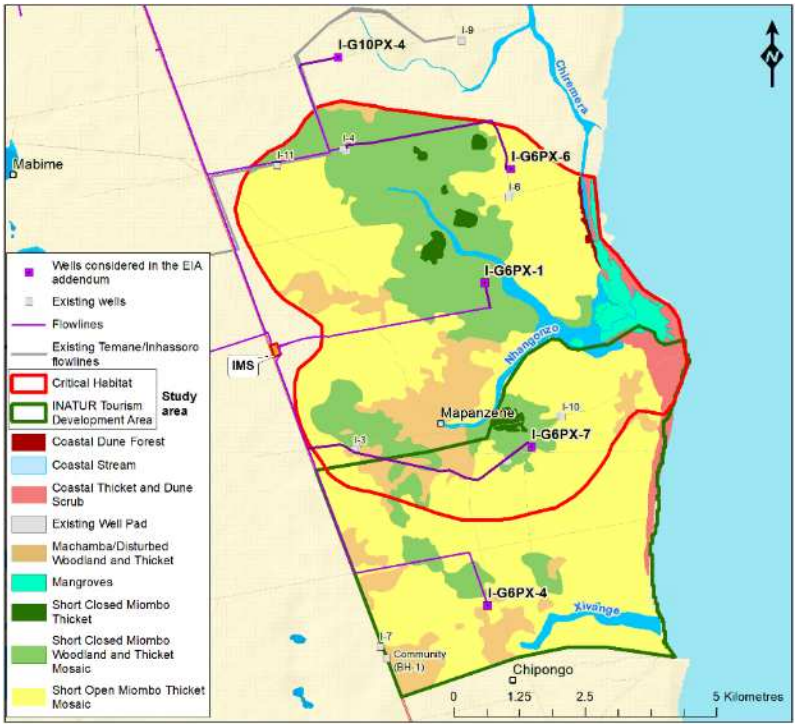
Table A-1. Summary of vegetation types and extent in original Critical Habitat Boundary (Source: EOH, 2015)

Terrestrial Vegetation Type	Total Critical Habitat Area (ha)	% Critical Habitat
Short Open Miombo Thicket	2141.5	49.3
Short Closed Miombo Woodland and Thicket Mosaic	1257.2	28.9
Machamba (Fields) / Disturbed Woodland and Thicket	462.2	10.6
Coastal Stream	145.6	3.4
Coastal Thicket and Dune Scrub	133.7	3.1
Coastal Dune Forest	12.56	0.29
Mangroves	128.8	3
Short Closed Miombo Thicket	64	1.5
Total	**4345.6**	**100**

The majority of the area comprises Miombo Woodland (80%) separated into Short Open Miombo Woodland (49%) and Short Closed Miombo Woodland and Thicket Mosaic (29%), while a mosaic of Machamba and disturbed woodland and thicket covers almost 11%. The coastal stream and mangrove habitats makeup a combined 6.4% of the Critical Habitat, while short closed miombo thicket and coastal dune forest / dune scrub covers 1.5 and 0.3%, respectively.

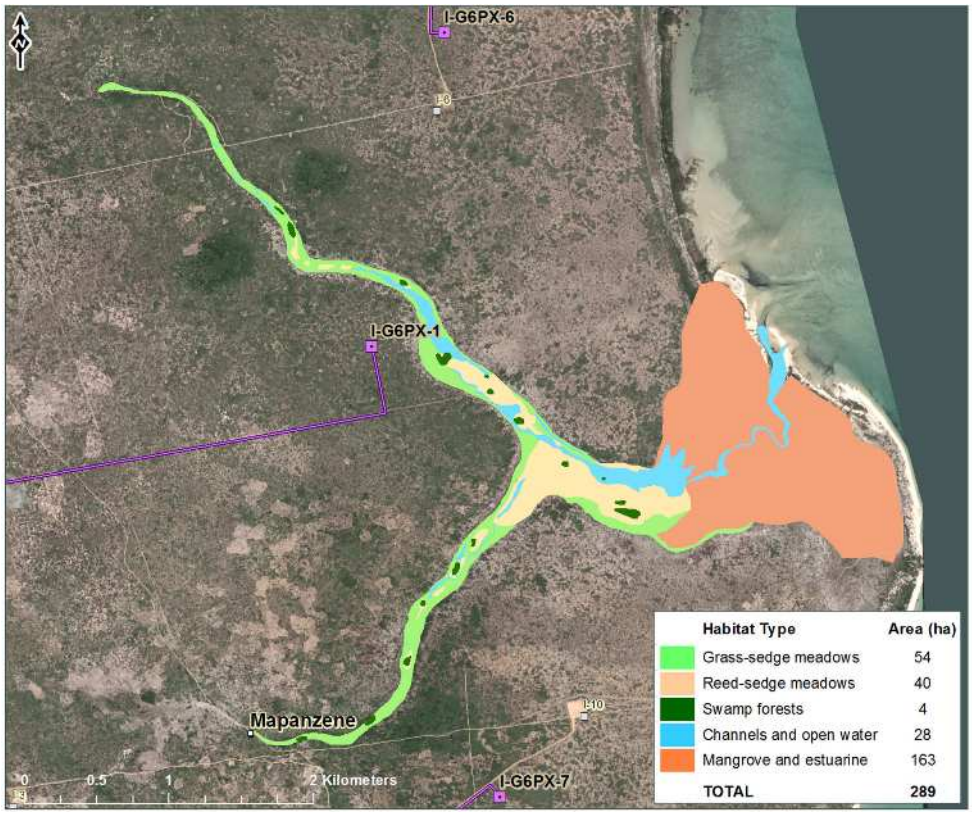
Note: The classification of the terrestrial and wetland vegetation types has been aligned within this study to accord with the regional vegetation and land cover mapping done for Sasol's entire concession, as described in Table 4-1 of Section 4.

Figure A-1. Terrestrial vegetation types mapping in Nhangonzo Critical Habitat



Source: EOH, 2015

Figure A-2. Wetland habitat types in Nhangonzo Critical Habitat



Source: WCS, 2015 (in Golder, 2015)

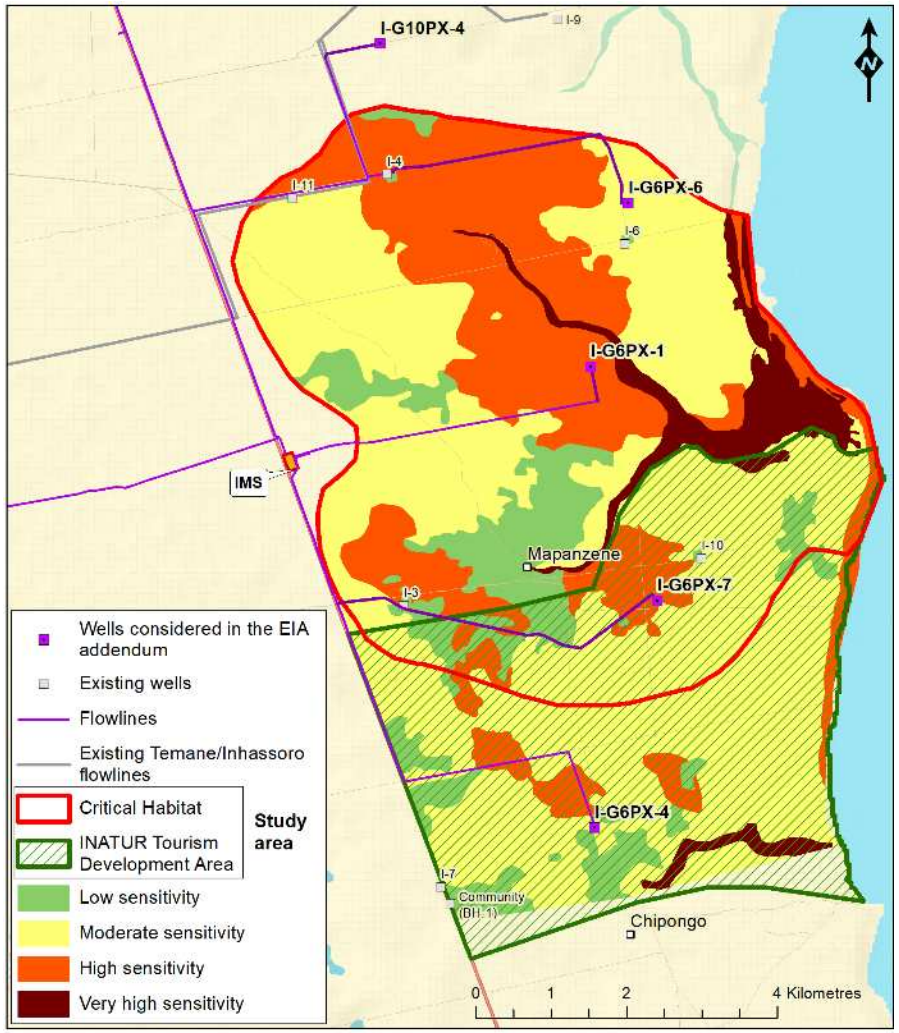
Habitat Sensitivity and Development Constraints

Habitats in the Nhangonzo area were assessed and mapped by EOH (2015) in terms of habitat sensitivity and constraints to development as shown in Figure A-3 and Figure A-4, respectively. Note: development constraints were only considered in relation to the ecological value of an area, rather than social land use considerations (which may pose additional constraints).

- The sensitivity of the vegetation types was assessed as follows:
  - Very High Sensitivity - Riparian vegetation / Coastal stream, Mangroves)
  - High Sensitivity - Short closed miombo woodland and thicket mosaic, Short Closed Miombo Thicket, Coastal Thicket and Dune Scrub, Coastal Dune Forest)
  - Moderate Sensitivity (Short Open Miombo Thicket Mosaic)
  - Low Sensitivity (Machamba/disturbed woodland and thicket mosaic)
- Areas of sensitivity designated above were assigned a rating of constraint to development, as follows:
  - Areas of Very High constraint were the habitats of very high sensitivity within which it was recommended that no development should be permitted as it is considered unlikely that impacts can be mitigated effectively to avoid significant residual impacts. The Nhangonzo coastal stream and mangrove communities were assigned a 250 m buffer around these vegetation types/habitat units (Figure 4-3).
  - Areas of High constraint were the habitats of high sensitivity in which development is not recommended as mitigation may not be effective and will require considerable effort (and expense) to design out or mitigate negative impacts and manage environmental impacts.
  - Areas of Moderate constraint were habitats which can accommodate some degree of development, but mitigation and management will be required to reduce significant environmental impacts to acceptable levels and the location of facilities will need to be carefully selected during project level EIA's to minimise environmental impacts.
  - Areas of Low constraint were the transformed habitats which can be more easily developed where little (ecological) mitigation and management would be required.

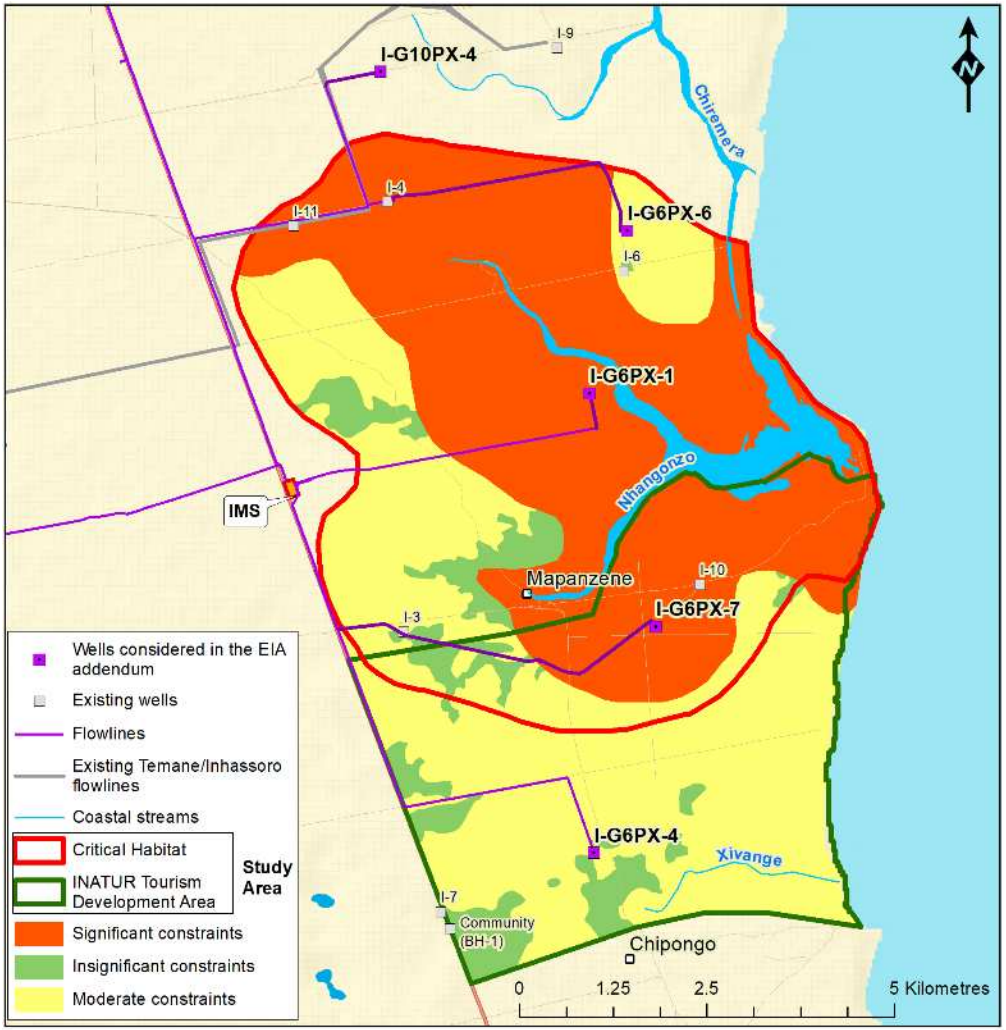
The sensitivity and constraints mapping was proposed as a guide to future development and informed the revision of the Critical Habitat boundaries (see Section 2.2.3).

Figure A-3. Habitat Sensitivity of the Nhangonzo Critical Habitat



Source: EOH, 2015a

Figure A-4. Constraints Mapping of the Nhangonzo Critical Habitat



Source: Golder, 2015

Wetlands

- The Nhangonzo coastal wetland system was classified as a valley-bottom wetland that is predominantly ground-water fed and is representative of peatlands or mires; peat occurs throughout the freshwater section of the wetland to a maximum depth of 2.8 m, although most samples were 0.5-1 m deep.
- Five main wetland habitats are found within the Nhangonzo stream system:
  - Grass-sedge meadows – these comprise seasonal footslope seepages, seasonal grass-sedge meadows and permanent sedge meadows; high floristic diversity
  - Reed-sedge meadows – permanently saturated wetlands that usually occur between grass-sedge meadows and open water; moderate floristic diversity
  - Swamp forests – fragmented forest type situated in permanently saturated peat, usually adjacent to reed-sedge meadows or open water habitat; low floristic diversity
  - Channels and open water – permanently inundated channels with areas of open water
  - Mangroves and estuaries (dealt with in next section)
- Present Ecological State (PES) of the Nhangonzo system is Category A, i.e. natural or unmodified.
- Ecological Importance and Sensitivity (EIS) of the system is Very High; the wetland specialist considered this to be relevant at a national scale.
- Nhangonzo stream system is considered to have Very High Conservation Value on the basis of sensitivity to flow and system modifications, and the significant role of moderating the quantity and quality of water to other systems to which they are linked, especially the mangrove and estuarine system.

Mangroves, Estuary and Water Quality

- The Nhangonzo Estuary is near-pristine, with limited human impacts such as wood harvesting in the mangroves;
- Mangrove habitat in the Nhangonzo Estuary covers approximately 128 ha and is the only significant mangrove system within the 90 km stretch of coastline between Vilankulo and the Govuro River to the north. The Nhangonzo mangroves occur within a sand-dominated system which does not retain as many nutrients as systems with a smaller particle size distribution, and is considered more vulnerable to change;
- Eight out of the ten known mangrove tree species in Mozambique were recorded, which can be regarded as high diversity for mangrove habitat. The mangroves were confirmed to be successfully regenerating based on the proportions of young plants of most species; two species showed low recruitment rates, thought to be because of factors such as high salinity or light intensity.
- The Nhangonzo mangroves were rated as having Very High Sensitivity as a result of near-pristine condition, evidence of successful regeneration despite being harvested by local communities, relatively high diversity of tree species, and the restricted local distribution of mangroves;
- Low levels of phytoplankton chlorophyll-*a* were recorded throughout the estuary (average 0.053 µg.ml-1), indicating low primary productivity, a typical feature of healthy estuarine systems;
- Species composition of macro-invertebrate assemblages in the estuary indicates that macro-invertebrates originate in mangrove habitats and then migrate to the seagrass meadows and

uncovered sandbanks along the estuary; high diversity of zooplankton larvae groups indicate good connectivity between habitats and life cycles of the organisms;

- Surface water quality was sampled at 10 sites and following findings are relevant:
  - Physical and chemical parameters that were sampled were within suitable ranges for human consumption as drinking water;
  - Ammonia, dissolved aluminium, dissolved iron and dissolved zinc exceeded the thresholds for aquatic ecosystems, but it was stated the underlying reason was likely to be natural processes, and *E.coli* was present in all samples;
  - The extent of the saline intrusion from the estuary into the wetland was not confirmed.

Birds

- 132 bird species were recorded within the Nhangonzo catchment during late summer / autumn fieldwork;
- No threatened bird species were recorded during fieldwork, but one Vulnerable bird species was confirmed during previous surveys in 2014, namely Martial Eagle;
- One biome-restricted bird species, Lemon-breasted Canary, was recorded from the western part of the Nhangonzo catchment;
- The riparian wetlands were found to have relatively low bird diversity as a result of the lack of large areas of open water, while the estuarine habitats such as mangroves, sandbanks and tidal mudflats supported a greater diversity and abundance of waterbirds and habitat specialists, including migratory species, such as Whimbrel, Grey Plover and Sanderling.

Mammals

- Previous surveys reported 21 mammal species in the Nhangonzo catchment area (De Castro & Grobler 2014);
- Only four small mammal species were recorded during the EOH survey, two of which were caught in trap arrays, and no medium-sized or large mammals were observed; certain mammals, such as nyala and leopard, reported by De Castro and Grobler (2014) were confirmed to no longer be present in the study area during discussions with local communities;
- The paucity of medium-sized and large mammals has been attributed to a long history of subsistence hunting and habitat loss due to slash-and-burn cultivation and livestock grazing.

Herpetofauna

- Seven frog species and 19 reptile species were recorded in the study area, although at least 40 species of herpetofauna are expected to occur (with lower numbers linked to the timing of the survey);
- While no frog species of conservation concern were observed, several reptile species of conservation concern were recorded:
  - A Snake-eyed Skink species resembling *Panaspis wahlbergi*, that could represent a new species;
  - Golden Legless Skink *Acontias aurantiacus*, which has features resembling the subspecies *A. a. bazarutoensis* that was previously thought to be endemic to the Bazaruto archipelago;
  - A Writhing Skink species resembling *Mochlus lancelatum*, a range-restricted species endemic to the Bazaruto archipelago and San Sebastian Peninsula.

- The most significant threat to reptiles in the study area is habitat loss due to slash-and-burn agriculture. Evidence of illegal harvesting of Green Turtles was found at the mouth of the Nhangonzo stream but no turtle nesting sites were reported in the study area.

Annex B. Mitigation Hierarchy Tables

Table B-1. Alignment of Sasol's Biodiversity Management Activities with the Mitigation Hierarchy

#	Impacts	Type of Impact	Mitigation Measures	Status	Effectiveness	Residual Impact in Nhangonzo
1.	**AVOIDANCE MEASURES**					
1.1	**Seismic Acquisition**					
1.1.1	Loss of Natural Habitats for construction or fly camps	Direct	• No construction or fly camps implemented in Nhangonzo area. Only disturbed areas specified for camps. • All camps used during seismic surveys were located on disturbed land near Inhassoro or Vilankulo.	Implemented	Effective - no camps in Nhangonzo	No loss of Natural Habitat for camps.
1.1.2	Potential loss of dune forest/thicket habitat along coastline for seismic activities	Direct	• Buffer zone of 500 m declared along coastline within which no seismic vehicles allowed. Only receiver lines can be laid by hand in this buffer zone restricting vegetation clearance to 2 m.	Implemented	Effective - no evidence of activities in coastal belt	No loss of dune thicket / forest habitat for seismic activities
1.1.3	Potential loss of wetland, mangrove and estuarine habitat for seismic activities	Direct	• No seismic activities allowed within 50 m of wetlands. Only receiver lines may be laid, by hand, up to the perimeter of 'wet' areas (based on soils and wet season extent). • No vehicles permitted in wetland areas. • No temporary bridges or tracks across wetlands permitted. Only existing crossings shall be used or vehicles shall be routed around the wetland.	Implemented	Effective - no seismic activities or vehicle access in Nhangonzo wetland.	No damage or loss of wetland habitat
1.2	**Construction and Drilling Activities**					
1.2.1	Loss of Natural Habitats for construction or fly camps	Direct	• Inhassoro drill rig camp located outside Nhangonzo Critical Habitat near well pad I-11 in disturbed habitat.	Implemented	Effective	No loss of intact habitat for drill camp
1.2.2	Potential loss of high conservation value dune forest/thicket habitat along coastline	Direct	• Buffer zone of 500 m declared along coastline within which no oil and gas activities permitted (Golder, 2014; PSA EIA). • No well sites permitted in dune hummock vegetation (Mark Wood Consultants, 2002; EIA of Pande & Temane).	Implemented	Effective – no evidence of activities within coastal belt.	No loss of dune thicket / forest habitat
1.2.3	Potential loss of wetland, mangrove and estuarine habitats	Direct	• Increase the minimum distance of an oil well to perennial drainage lines, barrier lakes, from the current minimum of 50 m provided for in the c-EMP (Infrastructure) for gas wells, to a provisional minimum of 250 m for oil wells (as a larger buffer for the protection of the natural resource in the event of a major liquid spill) (Golder, 2014; PSA EIA). • Buffer zone of 500 m along coastline within which no drilling activities are allowed to protect estuarine / coastal habitats.	Implemented	Effective – no evidence of activities within coastal belt.	No loss or damage to mangroves/ estuarine habitats

#	Impacts	Type of Impact	Mitigation Measures	Status	Effectiveness	Residual Impact in Nhangonzo
			• Do not locate wells (oil or gas) closer than 100 m to the annual seasonal extent of wetlands (including drainage lines, floodplains and barrier lakes) under any circumstances (Golder, 2014, PSA EIA). • No drilling permitted within buffer zone of 50 m from seasonal wetland extent or within 100 m of river or inundation area (Mark Wood Consultants, 2002; EIA of Pande & Temane).			
1.2.4	Risk and potential loss or damage of wetland for well pad (I-G6PX-1) (not yet drilled)	Direct	• Relocate well pad (I-G6PX-1) from within 90 m of the wetland edge to 250 m to minimise risks of a pollution event on the wetland and estuary (Golder, 2014; PSA EIA). Buffer of 250 m recommended for oil wells from wetland areas.	Planned. Well site relocated but not yet drilled	Expected to be effective (if well site drilled).	No damage or loss of wetland habitat expected from routine construction and operation.
1.2.5	Risk and potential habitat impacts from well pad (I-G6PX-6)-	Direct	• Relocate well at-I-G6PX-6 (located near a sensitive Coastal Stream, Dune Forest and Mangrove Forest and within the original boundaries of the Critical Habitat) to a less sensitive site on the existing access road to I-6.	Not implemented for technical reasons	Well site moved 1 km from coastline but not to site on access road.	Site located in 600 m from dune thicket
2.	**MINIMISATION MEASURES**					
2.1	**Seismic Acquisition**					
2.1.1	Loss of predominantly woodland and thicket habitats for seismic lines	Direct	Seismic-EMP (ERM, 2015) specifies the following measures: • No vehicle access along seismic lines by contractors; • Buffer zone of Critical Habitat marked and sign-posted to inform contractors of boundary of restricted area; • No use of explosives for seismic activities. Small all-wheel drive used to create vibration instead. • All seismic lines hand cut and no wider than 2 m (compared to standard 8 m width) to enable light AWD access; • No cutting of tress of >20 cm at breast height; • Restrictions on opening of canopy in thicket vegetation to head height to enable walking passage only; • Lines deviated around large trees and termite mounds where possible, or restricted width of lines over termite mounds to 1 m width for laying geophone cable.	Implemented	Effective – no evidence of 2016 seismic lines during field survey in March 2018	Minimal. Possibly limited to slight opening of woodland habitats that are invisible. Seismic footprint reduced by 75% from 8 m wide to 2 m wide.
2.1.2	Loss or damage to high biodiversity value coastal zone vegetation	Direct	• Activities restricted within buffer zone of 500-1000 m of coastline. • Receiver lines for seismic activities can be laid by hand within the 500 m coastal zone with essential vegetation clearance by hand and limited to 2 m width. Disturbance of coastal dune vegetation must be minimised.	Implemented	Effective – no evidence of activities in coastal zone dune vegetation	No loss of dune vegetation.

#	Impacts	Type of Impact	Mitigation Measures	Status	Effectiveness	Residual Impact in Nhangonzo
2.1.3	Loss or damage to wetland habitats	Direct	• Source lines shall not be located in wetlands or along the riparian fringe of wetlands. A minimum buffer of 50 m from the perimeter of wet areas shall be maintained for source lines.	Implemented	Effective - No 3D seismic lines were laid through wetlands, pans or lakes during 2016 seismic surveys	No evidence of damage to wetland habitats
2.1.4	Disturbance of fauna	Direct & Indirect	• All noise disturbances, especially seismic activities should take place between the months of May to October, to avoid displacement of shy intra-African migrants and breeding species.	Implemented.	Effective - 3D seismic activities undertaken from May-Nov 2016	None expected
2.2	**Construction and Drilling Activities**					
2.2.1	Loss of habitat	Direct	• Minimise	Implemented	Effective – all new well sites drilled between July and November	No damage to wetlands
2.2.2	Damage to wetland habitats	Direct	• All work within wetlands shall be done during the dry season (April and November). • Extraction of water from coastal stream/ lakes prohibited.	Implemented	Effective – all new well sites drilled between July and November	No damage to wetlands

2.2.3	Pollution risks to wetlands, water sources, or high conservation value habitats	Direct & Indirect	• No laydown or refuelling area shall be located in any area of pristine vegetation, nor within 100 m of any watercourse or floodplain.
			• No storage of chemicals, fuels, lubricating oils and any other hazardous materials within:
			  • 100 m of a surface water body
			  • 100 m the floodplain of rivers, wetlands or any area of temporary inundation
			  • 10 m of any stormwater drainage system
			  • 100 m of any sub-surface drinking water source
				Implemented	Effective – no evidence of construction disturbance near water bodies	No pollution of water bodies

2.2.4	Disturbance of fauna and flora by construction workers	Direct & Indirect	• Construction workers are prohibited from:
			  • Collecting/harvesting natural resources
			  • Hunting or harassing animals
			  • Purchasing of wild animals for food
				Implemented	Effective – no camps were located in Nhangonzo	No impact expected. Remaining wildlife scarce.

2.2.5	Habitat loss for burn pits adjacent to well pads	Direct	• An area of ~100 m x 100 m may be cleared behind each burn-pit outside of the fenced area. Vegetation in these areas should be stripped to ground level, but not uprooted, with the permission of the Environmental Co-ordinator. • All dry and dead vegetation from site clearance in the area behind the burn pit shall be removed to prevent spontaneous combustion.	Implemented	Effective – extent of clearing for burn bits and fire break appear modest and limited to fire safety hazards	Some direct loss of woodland habitat of moderate sensitivity
2.2.6	Spread of alien invasive plants	Indirect	• All vehicles to be washed down to remove alien seeds/plants where brought in from areas with alien plants.	Unknown	Unknown – no alien plants seen along access tracks / seismic	Minimal based on observations

#	Impacts	Type of Impact	Mitigation Measures	Status	Effectiveness	Residual Impact in Nhangonzo
					lines in Nhangonzo except near settlements	
3.	**REHABILITATION / RESTORATION MEASURES**					
3.1	**Seismic Acquisition**					
3.1.1	Natural rehabilitation success of 2016 3D seismic lines	Direct	Mitigation measures relevant to rehabilitation specified for 2016 seismic lines: • Minimise top soil clearance during seismic acquisition to less than 15 cm depth during cutting of seismic lines to aid rehabilitation; • Decompact soils and profile land surface to natural contours. • Closure of seismic lines intersecting with roads or tracks by branches to obscure entrance to encourage rehabilitation and discourage human access. Note: outside the Nhangonzo area where vibroseis was used and wider tracks created, Sasol closed entrance to seismic lines by digging trench, mounding soil at the access and filling trench and area with available logs and branches. • Monitoring of seismic lines to check for erosion.	Implemented	Effective – 3D seismic lines of 2 m width naturally rehabilitated. No mounding of soils, erosion or excavations evident during March 2018 site visit (although may occur in places not visited)	Minimal impact of 3D seismic lines. No evidence of 2016 3D seismic lines

3.1.2	Partial rehabilitation of historic 2D seismic lines	Direct	• 2001 EIA requirements for rehabilitation specified:
			  • Closure of seismic lines using brush and logs in where access to sensitive areas may be gained.
			  • Scarifying compacted soils where required to enable rehabilitation.
			  • Reseeding if natural regeneration does not occur.
				Partial implement-ation	Partially effective – old seismic lines still visible but have reduced to ~50% width through natural regrowth of grass, shrubs and small trees. Some used as tracks near Mapanzene	27 km of seismic lines reduced by estimated 50% width resulting in residual impact of ~ 107 ha.

3.1.3	Risk of alien plant spread and invasion of Natural Habitats	Indirect	Summarised measures related to alien invasive plants include: • Inspect and wash all equipment (including de-mining and vegetation clearance vehicles) that has been used outside the concession area prior to entering the project area to ensure they are free of alien species propagules and seeds; • Implement an eradication programme to curb spread of sweet prickly pear and sisal plant species in the areas disturbed by the exploration; • Remove and dispose of any non-native soils or vegetation that may be observed on imported equipment.	Unknown	Appears effective to date - no evidence of alien invasive plant spread along seismic lines observed (but may occur along lines nearer Mapanzene settlement)	Minimal, if any
3.1.4	Potential use of 2D and 3D seismic lines by local communities for hunting, wood harvesting and land clearance for agriculture.	Indirect / Induced	• Access to seismic lines obscured by cutting 'dogs leg' at road or track intersections to reduce visibility; • Restrictions on width and closure of seismic lines (under 1.1.2 and 1.1.3 above) have been effective in minimising risks of induced community access.	Implemented	Effective - No evidence of community use of 2016 3D seismic lines; no vehicle tracks were seen along old seismic	Minimal to none

#	Impacts	Type of Impact	Mitigation Measures	Status	Effectiveness	Residual Impact in Nhangonzo
					lines and little expansion of agriculture evident in the northern area where seismic lines were cut	
3.2	**Construction and Drilling Activities**					
3.2.1	Loss of top soil from construction areas and reinstatement of construction areas and drill sites	Direct & Indirect	Rehabilitation and restoration measures specified for construction and drilling areas include: • Remove and store top soil from the upper 150 m layer of works areas for rehabilitation. • Spread topsoil evenly spread at a uniform depth over the areas from which it was removed. • Any topsoil imports shall be of the same type as the soil being replaced and free of all invasive alien and invader plant species. • Spread vegetation across exposed areas in random fashion to protect soil and encourage revegetation (and discourage induced access). • Scarify / loosen compacted soils to encourage natural revegetation.	Implement-ation limited to flowlines	Partially to mostly effective – evidence of some erosion along access roads and exposed soil berms around recently drilled well sites	Minimal
3.2.2	Exposed soils and partial restoration of historic well sites / construction areas	Direct	Similar to 3.2.1 above. • Unsuccessful exploration well sites to be closed and abandoned including ripping of soils and revegetation.	Partial – only one apparent well site abandoned and allowed to revegetation naturally	Partial – one well site drilled prior to 2004[23] in Nhangonzo area has been abandoned. Berms remain in place suggesting no active restoration. Vegetation cover established but plant biodiversity is low	1.2 ha of woodland vegetation, partially recolonised by succession species
3.2.3	Alien plant spread	Direct & Indirect	As for 3.1.3 above.	Unknown	Effective – no or limited evidence of alien invasive plants at well sites or along roads away from villages and fields	
3.2.4	Potential use of access roads to new well pads by local communities for hunting, wood harvesting	Indirect / induced	• Planned access road to proposed well site (I-G6PX-1) in centre of Nhangonzo will be made inaccessible to local residents by locating the manifold station at the intersection of the Vilankulo – Inhassoro Road and restricting access to the well site through the manifold enclosure.	Planned	Unknown as yet, but expected to be effective if no tracks allowed to join the access road on	Minimal (expected)

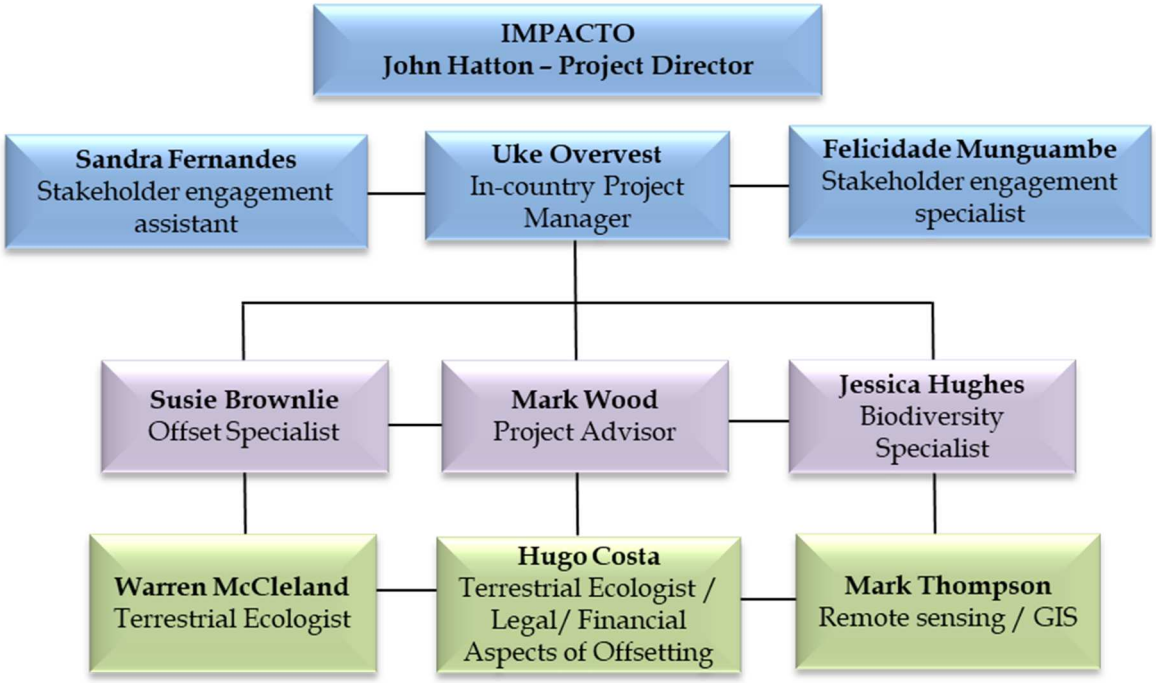
[23] *It is unknown if this well site was drilled or just cleared and if it was done by Sasol or possibly Arco or other operator prior to 2001.*

#	Impacts	Type of Impact	Mitigation Measures	Status	Effectiveness	Residual Impact in Nhangonzo
	and land clearance for agriculture.		• All other roads to existing well pads remain open to public access.		either side of the manifold station	

3.2.5	Old roads to well pads I-6 and I-10 created prior to 2004 are used by local communities for harvesting and stockpiling of wood for collection and sale.	Indirect / Induced	• All roads to existing well pads remain open to public access.
			
			Mitigation measures to manage human influx specified in o-EMP are:
			• Prepare and implement communication program that communicates the following Sasol policies:
			  • No hiring of job seekers on site
			  • No procurement at the gate
			  • Maximising local content in procurement i.e. from local people and towns.
			• Maximise hire of local labour and verify local employment through Community Liaison Forum.
			• Sasol shall communicate and coordinate with local leaders and District Government to curb population influx, obtaining their support and suggestions in this regard.
			• Hold information meetings in all affected villages, explaining the negative impacts of population influx, the company's recruitment policy and verification process for appointing only local people, and harnessing their support to reduce influx of work and opportunity seekers.
			• Keep records of communication initiatives at national, province and district and 10 nearest communities.
			• Maintain records of the number of construction jobs awarded to local people and from the District, Province and Nationally.
			• Obtain survey results from interviews with village leaders about increases in numbers of new arrivals.
				Planned	Limited – evidence indicates that 10 km of well pad roads constructed prior to 2005 are used for harvesting and collection of firewood. Current level of harvesting appears to be at acceptable levels and has resulted in open woodland mosaic (rather than widespread clearing for fields)	Opening of woodland and thicket mosaic of moderate biodiversity value along 10 km of road (particularly on the road to well pad I-6)

Annex C: Team Structure and Profiles

Team Structure for the Study:



Team Profiles – Core Team

John Hatton – Project Director

John Hatton is one of the founding partners of Impacto and is Deputy Managing Director of the company. He is a Senior Consultant with 20 years of experience in carrying out EIAs in Mozambique, Angola and Nicaragua.

He has acted as Project Manager, Environmental Consultant and biological lead consultant in a wide variety of EIAs. His experience has involved baseline and impact assessments for Environmental and Social Impact Assessment (ESIA) for offshore and onshore oil and gas industry, mining & minerals, power, large hydroelectric projects, ports, roads and other infrastructure projects. Through this experience he has accumulated knowledge of coastal, marine and terrestrial ecosystems and biodiversity throughout Mozambique and the consultant is fully cognisant of Mozambican legislation and international guidelines related to all aspects of EIA and public consultation.

Mr Hatton is considered an integrated scientist and, although specialising in ecology, he has acquired extensive knowledge related to social impact assessment and natural resource use patterns by local communities.

Uke Overvest – Project Manager

Uke Overvest is a senior consultant and a qualified environmental scientist. She has over 18 years of work experience in Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA); Environmental Management Plans (EMP); Ecological Risk assessment; Environmental Auditing and Monitoring; Environmental Management Systems; Emergency Response Plans; Environmental Policy Formulation and Project Management.

The Consultant has a background in Biological Sciences and holds an MSc degree in Environmental Assessment and Management (2001) by the Oxford Brookes University in the United Kingdom and several other certificates, including in Environmental Auditing.

As an environmental practitioner, Uke Overvest has participated in several environmental studies mainly in the Oil & Gas, mining, energy, tourism, sugar cane and roads & bridges sectors. Her roles varied from providing technical input into the biophysical and socio-economic components of the studies to team coordination and project management.

Mrs. Overvest is the top Mozambican expert in Oil & Gas (O&G) EIA's and has managed and carried out various environmental and socio-economic impact assessments and baseline surveys for O&G development projects throughout Mozambique, such as the EIA for the Anadarko LNG Project, Environmental and Social Impact Assessment (ESIA) Study for the proposed Sasol´s Exploration activities in Area A, Inhambane, Mozambique, EIAs and several Addenda to EIAs for Exploration Drilling activities both onshore and offshore as well as seismic acquisition, for companies such as Sasol, Anadarko, Eni, Petronas, DNO and Bang.

Felicidade Salgado Munguambe – Stakeholder Engagement Lead

Felicidade Munguambe has a degree in Biological Sciences from Eduardo Mondlane University in Mozambique and an M.Sc in Environmental & Natural Resources Planning and Management (correspondence course) at the Universidade Politecnica de Madrid, Spain.

Between 1995 and 2007 Felicidade worked with the Ministry for the Coordination of Environmental Affairs (MICOA). For six years she held the post of National Director for the National Directorate of Environmental Impact Assessment in the Ministry.

In this capacity she was responsible for review and approval of Terms of Reference for Environmental Impact Assessments (EIAs), EIA Reports, Environmental Management Plans (EMPs) and Environmental Monitoring and Audits for activities such as oil and gas, coal mines, aluminium factories, roads and bridges, dams, among others. During her 13 years with MICOA she coordinated, and participated in, the formulation of various legal instruments such as: Environmental Impact Assessment regulation; hazardous waste regulation; bio-medical waste regulation; environmental standards regulation; environmental auditing regulation; environmental impact assessment regulation for the mining sector (all now in force).

Felicidade has a large experience in Stakeholder Engagement and Public Consultation especially for large scale projects requiring careful mediation between civil society, NGOs, government agencies and investors. Due to her earlier working relationship with MICOA she is highly respected in Mozambique which equips her ideally for liaising between government agencies, civil society and the private sector. She has a considerable experience in stakeholder's engagement and has prepared the Public Participation Plan for Anadarko Liquid Natural Gas project. Felicidade has conducted several Public Consultations Processes throughout Mozambique for, inter alia, SASOL, PETRONAS, JINDAL, Riversdale, Statoil, GLENCORE, National Directorate of Water (Moamba Major Dam) and the Boroma-Lupata Hydro-electric project on the Zambezi River.

Mark Wood – Technical Advisor

Mark Wood has led many of Sasol's major EIAs in Mozambique including the EIA's and EIA Addendum for the PSA (on behalf of Golder Associates) in 2014 and 2015. He appointed the biodiversity consultants (Coastal Environmental Services) and managed the Critical Habitat Assessment undertaken for the EIA Addendum in 2015, and wrote the subsequent Critical Habitat Options Analysis on which the stakeholder discussions and MITADER agreements were based.

He has been involved in Sasol's Mozambique Natural Gas project since its early planning in 2002, when, with Impacto, he prepared the EIAs and ESMPs for the Phase 1A CPF, production wells, flowlines and export line to South Africa. Over the past 13 years, he has remained involved in disclosure of the environmental and social performance of the Natural Gas Project, writing the Integrated Disclosure Report published annually on the World Bank Infoshop website.

He has extensive experience in oil and gas projects worldwide. He is currently responsible for preparing the Integrated ESIA for a major oil development on the shores of Lake Albert in Uganda (on behalf of Golder Associates). He is a registered consultant with the World Bank in their South East Africa region, which includes Mozambique, where he supports the Bank across a wide range of projects.

Jessica Hughes – Biodiversity Lead

Jessica Hughes has over 24 years of experience in undertaking a wide range of biodiversity studies in the mining, oil and gas, power and infrastructure sectors in Africa, including Mozambique, Angola, Cameroon, Namibia, Sierra Leone, and South Africa. She has a Master of Science Degree in Zoology (1991) and a Master of Philosophy in Environmental Science (1993). Jessica is familiar with global best practice guidance for biodiversity, including application of IFC Performance Standard 6 through having coordinated several ecological studies to IFC standards on projects that triggered Critical Habitat. These include the biodiversity role she played on the Sasol FSO and pipeline ESIA (with ERM) in 2016, and in her role as project manager for biodiversity and ecosystem services

studies of a coastal road in northern Mozambique which involved preparation of a Critical Habitat assessment and Biodiversity Management Plan (BMP). She is very familiar with Sasol's project activities in Mozambique through having worked with Mark Wood in the compilation of annual Integrated Disclosure Reports in 2008, 2009 and 2010; compilation of the EIA for offshore drilling of two wells in Sofala Bay (2011) and the EIA for the ROMPCO loopline project in 2014, and the baseline reporting of the Regional ESIA for ERM.

She has also coordinated many biodiversity baseline and monitoring studies, Critical Habitat assessments, biodiversity impact assessments, and management and monitoring plans. In 2015, she assisted a major oil and gas client to develop their internal biodiversity and ecosystem services good practice guidelines in line with IFC and IPIECA standards. She also has experience with systematic conservation planning tools, and the use of these spatial planning outputs in identifying biodiversity importance and application in screening infrastructure projects.

Jessica has attended biodiversity offset training workshops with Business and Biodiversity Offset Programme (BBOP) members (including by Susie Brownlie); and presented two papers at IAIA 2015 in Florence including a case study of a biodiversity offset for a mine in South Africa as well as a paper on application of the mitigation hierarchy for linear development in Lesotho at IAIA 2018. In 2016 she was an invited participant and presenter in the IFC led Lessons Learned Workshop on PS6 in the UK together with a select group of leading global biodiversity experts. This workshop reviewed the challenges with IFC PS6 implementation and provided the basis for revisions to the Guidance Note 6 that is currently underway.

Susie Brownlie – Biodiversity Offset Specialist

Susie Brownlie has an MSc in Environmental Studies from the University of Cape Town, awarded with distinction. She has worked as an environmental assessment practitioner for over 30 years on a range of development types in both private and public sectors in developed and developing countries. Susie is professionally registered with the South African Council for Natural Scientific Professions as an environmental scientist, and is a certified Environmental Assessment Practitioner (EAP) with the Interim Certification Board for EAPs in South Africa.

For the past 25 years she has worked independently in a 2-person consultancy, deVilliers Brownlie Associates, undertaking a wide spectrum of projects. Susie is a past co-chair of IAIA international's Biodiversity and Ecology Section, and has been a member of the international BBOP's advisory group for the past 7 years. She has also held positions on the boards of the Southern African Institute of Ecologists and Environmental Scientists, CapeNature, the Advisory Committee of the Botanical Society's Conservation Unit, and the Scientific Programmes Advisory Committee of the South African National Biodiversity Institute. She has published a number of papers in peer-reviewed journals on biodiversity-inclusive impact assessment, decision-making for sustainability, and biodiversity offsets, and is the author of a number of guidelines on impact assessment review, biodiversity-inclusive assessment and offsetting.

Susie was part of a Netherlands EIA Commission team which undertook a review of proposed transport options for a heavy mineral sand mining project near Xai Xai in 2003. She is familiar with the IFC Performance Standards, in particular Performance Standard 6 (PS6), and has contributed to giving input to the IFC on behalf of both IAIA and BBOP during their drafting in 2011. Susie has acted as an independent reviewer of the ESIA and an advisor with regard to biodiversity offsets for a proposed port facility in Ghana with regard to meeting IFC PS6. She has also helped to prepare a biodiversity management plan and investigated the need for, and feasibility of delivering, a biodiversity offset for a proposed hydropower in Zambia. She has worked on more than five biodiversity offset projects in South Africa, including mining and major infrastructure projects, and was the lead author in preparing draft guidelines for biodiversity offsets in three provinces. In addition, Susie has contributed to a number of BBOP publications.

Warren McCleland – Terrestrial Ecologist

Warren has been conducting biodiversity surveys since 2005 for Environmental Impact Assessments throughout sub-Saharan Africa. He is both a botanist and zoologist, and surveys have covered flora and vertebrate fauna (mammals, birds, reptiles and amphibians). Many of the projects undertaken in recent years have been in accordance with IFC Performance Standard 6, with prominent projects including Mkuju Uranium Mine (Selous Game Reserve, Tanzania), Kamoa Copper Mine (Kolwezi, DRC), Kalana Gold Mine (Yanfolila, Mali), and projects in Mozambique such as the Pemba – Palma Coastal Road (Cabo Delgado Province, Mozambique) and SASOL's Pande and Temane Seismic Exploration Blocks (Inhassoro, Mozambique).

Prior to becoming a full-time specialist Warren worked as a professional bird guide for four years, leading birding tours throughout southern and south-central Africa. He is co-author of the acclaimed "Field Guide to the Trees and

Shrubs of Mpumalanga and Kruger National Park", published by Jacana in 2002, for which he received the Marloth Medal from the Botanical Society of South Africa in 2014. During the last five years he has been accredited with the discovery of several new plant species to science, two of which have been described (*Gladiolus diluvialis* Goldblatt & Manning, *Barleria lebomboensis* Darbyshire, McCleland & Froneman) and one of which is in the process of being described (*Streptocarpus sekhukhuniensis* ms.).

Hugo Costa – Legal Framework and Financial Mechanisms

Hugo Costa has a degree in Biology and a Masters in Environmental Impact Assessment. He has over 16 years of professional experience, having participated in projects in Mozambique, South Africa, Angola, Portugal, Poland, Finland and Venezuela. Co-founder and Executive Manager of Bio3, Lda. (Portugal) between 2005 and 2015, he was also the founder, senior consultant and Executive Director of Biodinâmica, S.A. (Mozambique) between 2012 and early 2017. Hugo is currently working for the Wildlife Conservation Society as the COMBO Project Director for Mozambique. Hugo has undertaken consultancy services in several areas, having conducted and/or coordinated over 500 biodiversity monitoring programmes and ecological assessments for different types of projects such as wind farms, dams, power lines, power stations, pipelines, roads, railways, mining, solar and wave energy projects, agriculture, forest, ports, industry, among other infrastructure. Hugo has been actively engaged in the planning, design and implementation of mitigation and offset programmes, identification and valuation of biodiversity and ecosystem services, biodiversity action plans and biodiversity and land management planning since 2007. Besides consultancy and technical-scientific advisory Hugo is co-author of 1 book, 12 peer-reviewed scientific papers and 16 technical papers.