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ENVIRONMENTAL IMPACT ASSESSMENT FOR SASOL PSA AND LPG PROJECT

Botanical Diversity and Habitat Impact Assessment

ADDENDUM

Specialist Report 9



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1.0 INTRODUCTION

1.1 Background

This report is an addendum to the 'Botanical Biodiversity and Habitat' baseline specialist report (De Castro & Grobler, May 2014) which was compiled on the basis of a field survey conducted in February 2014. The current addendum provides the findings of a brief (4.5 day) field survey conducted between 2 and 6 May 2014 as required by the guidelines of IFC Performance Standard 6. The purpose of this addendum is to describe and discuss the findings of the May field survey, without repeating the detailed background information, baseline description and impact assessment provided in the baseline report (De Castro & Grobler, May 2014). The information provided here must be read in conjunction with the baseline report to provide the necessary context to this addendum. (De Castro & Grobler, May 2014).

1.2 Scope of the study

The objectives of the May field survey were to gather additional information on the flora and habitats of selected parts of the greater study area, with emphasis on the area of Critical Habitat identified during the baseline survey and on the forest habitat around proposed gas well T-G8 PX-5 where threatened plant 'species of conservation concern were found during the baseline survey (De Castro & Grobler, May 2014). A total of three days was available for plant identification, data analysis and reporting.

1.3 Details of the Authors

The authors of the baseline specialist report (De Castro & Brits, May 2014) and the current report were Antonio De Castro and Retief Grobler.

Mr. De Castro has a B.Sc Hons. degree in Botany from the Rand Afrikaans University (RAU) and is a registered Pr. Sci. Nat professional natural scientist in the fields of Botanical Science and Ecological Science (Reg. no. 400270/07). He has extensive working experience in Mozambique, and has performed a variety of specialist studies related to plant taxonomy, floristics, plant utilisation, threatened species; and vegetation descriptions and analyses in Inhambane Province. Over the last thirteen years he has undertaken ecological and botanical assessments on several Sasol related pipeline and natural gas exploration projects, including the 520 km pipeline route alignment extending from the Temane CPF to Ressano Garcia, the Seismic Exploration Block on the northern bank of the Save River, and the 256 km Sasol ROMPCO Loopline alignment.

Mr. Grobler has a B.Sc Hons. degree in Botany from the University of Pretoria (cum laude), and an M.Sc (cum laude) from the Department of Plant Sciences (UP) with a focus on peatland wetland systems located on the coastal plain of Maputaland, in north-eastern South Africa. He is a registered Pr. Sci. Nat professional natural scientist in the fields of Botanical Science and Ecological Science (Reg. no. 400097/09), and has been working as a consultant based in Gauteng with wetland-related work experience throughout South Africa over the past nine years. Areas of specialisation include wetland and related watercourse assessments, with a particular interest in headwater and peatland systems. Pipeline wetland-related experience includes bio-monitoring and rehabilitation assessments on the 550 km Transnet NMPP pipeline in South Africa in the past five years.

2.0 APPROACH AND METHODOLOGY

2.1 Approach

The timing of the field survey (2 to 6 May 2014) was based on the IFC Performance Study 6 requirement for a winter survey when various plant species are still in fruit and species of some plant families (e.g. *Acanthaceae*) are in flower and on the need to accommodate the requirements of project scheduling.

The available time in the field was focussed on the following aspects:

- searching for additional plant species, with emphasis on 'species of conservation concern' (*sensu* Raimondo *et al.*, 2009);



- expansion and verification of the preliminary plant species list included in the baseline report through surveying 15 selected sites (see **Appendix A**), fourteen of which were situated within the identified area of Critical Habitat and adjacent Coastal Streams and one of which was located in Thicket and Forest habitat around gas well *T-G8 PX-5*;
- obtaining data on the depth and organic content of peat substrates at three sites within mires of Coastal Streams (Vegetation Unit 3.2); and
- obtaining information on mammal assemblages (not part of the original 'Terms of Reference' for this study) of the area of Critical Habitat.

The methods used during the May field survey were largely the same as those described in detail in the baseline report (De Castro & Grobler, May 2014). A brief summary of the methodology used during the current survey, with emphasis on methods not used in the Baseline survey, is provided below.

2.2 Expansion and verification of species list and searches for 'species of conservation concern'

Floristic surveys were conducted at 15 selected sites (see Appendix A) located as follows:

- sites within Coastal Forest (Vegetation Unit 2) patches, Coastal Streams (Vegetation Unit 3.2), and Mangrove Swamps (Vegetation Unit 3.4) within the identified area of Critical Habitat;
- two sites in the Coastal Stream situated directly to the north of the area of Critical Habitat; and
- one site in Thicket and Forest habitat (Vegetation Unit 1) around gas well *T-G8 PX-5*.

Each surveyed site was geo-referenced using a hand-held GPS-receiver (see Appendix A) and photographed (see Appendix C). At each surveyed site, the 'timed meander search' method (Huebner, 2007) was used to compile a list of all identifiable species and to search for plant 'species of conservation concern'. Emphasis was placed on searching for and recording potentially occurring species not recorded during the February survey. The 'timed meander search' was conducted for a minimum of 45 minutes at each site.

Determination of whether a species constitutes a new record for Mozambique was carried out by using the available regional and national flora treatments [i.e. Da Silva et al. (2004), Leistner (2005) and the various published volumes of Flora Zambesiaca].

2.3 Collection and analysis of peat samples

Peat depth and 'soil organic carbon' (SOC) were assessed at three sites (M2, M3 and M14b) located in mires within Coastal Streams. A hand operated Russian peat auger, with a 2.2 m handle, was used to determine the depth of the peat and to collect core samples at selected depths. The SOC of two of the collected peat samples was determined through use of the Walkley-Black method (Walkley & Black, 1934), by the Institute for Soil Climate and Water (ISCW) in Pretoria, South Africa.

Soil organic matter (SOM) percentages were calculated from SOC values through the use of the conventional Van Bemmelen factor of 1.724, as well as a revised factor of 2, as recommended by Pribyl (2010). Recorded samples with greater than 30% (dry mass) of dead SOM are regarded as peat according to Joosten & Clark (2002). The location of each of the three sites where peat samples were collected is provided in **Appendix A**, photographs of the peat samples are provided in **Appendix D** and the SOC and SOM values obtained through laboratory analysis are also provided in **Appendix D**.

2.4 Collection of data on mammal assemblages of the identified Critical Habitat

The presence of mammals at the twelve selected sites situated within the identified area of Critical Habitat (Sites M4 to M14b), was recorded on the basis of direct observations, field signs and informal interviews with local inhabitants. Interviews were conducted with two fishermen from the Nhagonzwene village (at the mouth of the Coastal Stream forming the core of the Critical Habitat) and with a man collecting reeds at Site 14,



further upstream along the same watercourse. The three men interviewed were shown pictures of mammals suspected to occur in the area, and as a control they were also shown pictures of similar mammals known to be absent from the study area. The control method indicated that all three interviewed men had an excellent knowledge of the mammalian fauna of the area and there were no contradictions between the data gathered from the three individuals who were separately interviewed.

3.0 RESULTS AND DISCUSSION

An annotated list of all 15 selected survey sites is provided in **Appendix A** and photographs of sites are provided in **Appendix C**. An updated species list is provided in **Appendix B**. The results of laboratory analysis of collected peat samples, and photographs of peat core samples, are provided in **Appendix D**.

3.1 Species list

A total of 389 indigenous plant species were recorded within the study area during the baseline survey conducted in February 2014. Six plant 'species of conservation concern' (www.iucnredlist.org, accessed in March 2014, and Izidine and Bandeira, 2002) were included in the baseline plant species list (De Castro & Grobler, April 2014).

During the May 2014 field survey, an additional 19 plant species were recorded, all of which are indigenous, none of which are endemic to Mozambique, and none of which are currently regarded as 'species of conservation concern' (www.iucnredlist.org, accessed in March 2014, and Izidine and Bandeira, 2002). Therefore, a total of 412 plant species, 408 of which are indigenous and 4 of which are alien species (indicated by an asterisk) that invade untransformed or secondary indigenous vegetation, have thus far been recorded for the 47 419ha study area.

The species list provided in the report is not fully comprehensive, since the study was undertaken within the time frames typical of environmental assessments, which preclude the opportunity to gather comprehensive seasonal data over an extended period of time. While the combined summer (February) and winter (May) surveys cover two seasons, more comprehensive long term field survey would be necessary for an exhaustive account of species occurrence.

The species list consisting of the plant taxa identified during both field surveys contains approximately 85% of common and characteristic species present, and provides a good representation of the type of flora found within the study area.

3.2 Plant 'species of conservation concern'

No additional 'species of conservation concern' were recorded during the May 2014 winter field survey. However, *Croton inhambanensis* (VU) and *Pavetta gracillima* (DD) were again recorded within Short Thicket and Forest vegetation around gas well T-G8PX-5 at Site M1, where both species are common within a 100 m radius of the Site (near Site 7 of the February survey). The findings of the May 2014 survey therefore support the findings of the baseline survey and are repeated below:

'Within the study area Croton inhambanensis (VU) and Pavetta gracillima (DD) are species of dense Short Thicket and Forest and were recorded from Site 7 on Section A of the flow line alignment at the proposed site for the well pad for gas well T-G8PX-5. Both species are fairly common at this site and likely to occur elsewhere in dense Short Thicket within Vegetation Unit 1. Seemingly similar dense Short Thicket habitat for this species extends over thousands of hectares around Site 7 and along Section A as well as to the north of the greater study area, but this habitat is under severe threat from clearing for cultivation.'

3.3 'Critical Habitat' (sensu IFC)

The following findings and observations support the findings of the baseline survey regarding the biodiversity value and conservation importance of the identified area of Critical Habitat (sensu IFC Performance Standard 6).



New records for Mozambique from the mire habitats of the Coastal Streams

Four of the plant species recorded within the 47 419 ha study area during the baseline survey (De Castro & Grobler, April 2014), were new records for Mozambique.

During the current field survey (May 2014), **an additional three species** that are new records for Mozambique were recorded, namely the sedges *Eleocharis variegata* and *Scleria catophylla* and the Menyanthaceae hydrophyte *Nymphoides thanbergiana*.

All three new records for Mozambique were recorded from mires in the Coastal Stream situated within the identified Critical Habitat (Sites M14a and M14b) and in the Coastal Stream situated directly to the north of the Critical Habitat (Sites M2 and M3). These three species quite possibly represent additional 'ecotypes' (Molles, 2005) to the two probable ecotypes (*Trichopteryx dreagena* and *Chrysopogon serrulatus*) identified in the study area during the baseline survey (De Castro & Grobler, May 2014).

Flora of Coastal Forest

During the baseline survey (De Castro & Grobler, May 2014), only two sites were surveyed within Coastal Forest patches. Recorded emergent trees (up to 18m in height) were *Adansonia digitata*, *Balanites maughamii*, *Sclerocarya birrea* and *Albizia adiantifolia*. Dominant trees include *Milletia stuhlmannii* and *Julbernardia globiflora*. Common trees include *Erythrophleum lasianthum*, *Brachystegia spiciformis*, *Ozoroa obovata*, *Sclerocarya birrea* and *Sideroxylon inerme*.

During the current survey, the largest (ca. 12 ha) patch of Coastal Forest identified from aerial imagery within the Critical Habitat and the study area as a whole (site M13) was briefly surveyed (**Appendix A**). The data gathered confirms the accuracy of the broad description of Coastal Forest provided in the baseline survey. The dominant emergent trees at Site M13 were *Adansonia digitata* (up to 20 m) and *Albizia versicolor* (up to 16 m). Common to dominant trees in the approximately 11 m canopy include *Azelia quanzensis*, *Brachystegia spiciformis*, *Brachystegia torrei* and *Milletia stuhlmannii*.

The ca. 12 ha forest patch at site M13 is currently being encroached upon by low density settlement and is being cleared for cultivation. Furthermore, this forest patch contains some of the largest remaining *Azelia quanzensis* and *Milletia stuhlmannii* trees recorded within the study area. These trees will become increasingly vulnerable to harvesting as local resources of these severely over-exploited species are further depleted and regional sawmills accept smaller and smaller logs (De Castro & Grobler, May 2014).

Cutting of mangrove trees

The estuarine mangrove forest at the mouth of the Coastal Stream which forms the core of the identified Critical Habitat is some 70 ha in extent and is continuous with an approximately 25 ha area of estuarine mangrove forest at the mouth of the coastal stream immediately to the north. These estuarine mangrove forests are the only remaining mangrove forests along an approximately 90 km stretch of coastline extending from the Govuro River in the north to the Ponta Chiuzine bay in the south and are amongst the most species rich recorded on the east African coastline (<http://ramsar.wetlands.org>). In 2001, Barbosa (Barbosa et al., 2001) estimated that the deforestation of mangroves in Mozambique was occurring at a rate of 1 820 ha per year and Menomussanga and Balidy (2011) found that uncontrolled mangrove deforestation was occurring in the adjacent (to the north) Govuro district.

At all sites selected during the May 2014 survey within the estuarine Mangroves Swamps at the mouth of the Coastal Stream which forms the core of the identified Critical Habitat (sites M6, M7, M9, M10, M11 and M12), evidence of extensive historical and ongoing unsustainable cutting of mangrove trees was recorded. At site M6 recorded densities of cut stumps of small trees (up to 10 cm basal stump diameter) was as high as 35 stumps per 100 m². The highly durable poles obtained from these mangrove trees are used for the construction of houses and fish traps, some of which extend for over a kilometre along the tidal flats at the mouth of the Coastal Stream. Though these mangrove communities are still dense, ecologically functional and likely to contain their pre-disturbance species richness, and thus still remain of great biodiversity value and conservation importance, such harvesting is unsustainable and poses a severe threat to these mangrove communities if it is not controlled.



Peat substrates of the Coastal Streams

Peat depth and 'soil organic carbon' (SOC) were assessed at three sites (M2, M3 and M14b) located in mires within Coastal Streams. At site M14b, situated in a mire of the Coastal Stream forming the core of the identified Critical Habitat, peat depth was measured using a hand operated Russian peat auger, with a 2.2 m handle (see **Appendix D**). The bottom of the peat layer could not be reached indicating that the peat is at least 2.2 m deep and possibly far deeper. The location of each of the three sites where peat samples were collected is provided in **Appendix A**, photographs of the peat samples are provided in **Appendix D** and the SOC and SOM values obtained through laboratory analysis are also provided in **Appendix D**.

Peat accumulation may differ across different climates and landscape settings from cold alpine environments to tropical coastal systems. The annual accumulation of peat is however slow in all cases, and peatlands of several metres thick can take thousands of years to develop (Rydin & Jeglum 2006). In a southern African context the C¹⁴ derived peat accumulation rate for nine different peatlands in Maputaland, Northern KwaZulu- Natal, varies from 0.28 mm/year to 6.54 mm/year, while the average accumulation rate over the last 7 000 years of the Holocene is approximately 1.06 mm/year (Grundling 2004).

Grundling (2004) determined a high degree of correlation between peat depth and peat age for nine Maputaland (coastal South Africa) coastal plain peatlands, as determined through C¹⁴ dating, with a resultant regression value of 0.94. The C¹⁴ age of peat at different depths varied from 130 ± 45 years Before Present (BP) at a depth of 0.85 m, to 7 000 ± 80 years BP at 8.58 m.

A recorded peat depth of at least 2.2 m within the identified Critical Habitat area has an age that is suspected to be centuries old, and likely to be greater than 1000 years (Grundling 2004). Further coring will be required to determine the maximum depth of peat in the mires of the Critical Habitat and the rest of the study area, and the corresponding age at its deepest point via C¹⁴ dating. The long period of time required for peat accumulation in a peatland deeper than 2 m, highlights the uniqueness and irreplaceability of largely pristine coastal mires within the Critical Habitat area. It also supports the contention that these coastal mires play an important role in evolutionary processes such as speciation.

Mammal diversity in the area of Critical Habitat

The baseline survey contained the following statement:

'The Critical Habitat comprises the most important remaining habitat for ungulates, and probably other mammals, within the study area to the east of the Govuru. This is reflected by the fact that the only troop of Chacma Baboons remaining in the study area was recorded within this Critical Habitat.'

During the May 2014 field survey, the presence of mammals was recorded on the basis of direct observations, field signs and informal interviews with local inhabitants at the twelve selected sites situated within the identified area of Critical Habitat (sites M4 to M14b). The following large and medium mammals were recorded through direct observation and field signs within the area of Critical Habitat: Chacma Baboon, Bushpig, Grey Duiker, Red Duiker, Porcupine, Banded Mongoose and Water Mongoose. A troop of Baboons numbering at least 40 individuals was photographed at site M6 (Figure 1).

The following additional mammal species were recorded on the basis of interviews with local inhabitants: Southern Impala, Nyala and Leopard. All three of the interviewed individuals confirmed that Impala and Leopard were present within the Critical Habitat, and stated that Impala are still fairly common within the relatively remote parts of the Critical Habitat situated directly to the north of the Coastal Stream and in the area between the two branches of the coastal stream. All three interviewed locals stated that Leopard also occurred in the above-mentioned area and two of the individuals had heard of rare instances of Leopard taking goats belonging to local villagers. Two of the three interviewees claimed that Nyala were present in the aforementioned parts of the Critical Habitat, and both stated that the animals were rare and seldom seen.



Though the mammal assemblages of the area of Critical Habitat are depauperate in comparison to their likely pre-disturbance state, they nevertheless comprise the largest and most diverse assemblages of medium to large mammals recorded within the 47 49 ha study area, in particular in the coastal parts of the study area situated to the east of the Govuro where few larger mammals remain. The mammalian fauna of the identified Critical Habitat is also very likely to be the most abundant and diverse remaining along the approximately 90 km stretch of coastline extending from the Govuro River Mangroves in the north to the Ponta Chiuzine bay in the south. Despite having conducted numerous ecological surveys along the aforementioned 90 km stretch of coastline over the last 14 years, the author has never before obtained records of Baboon, Impala, Nyala or Leopard in this relatively heavily settled coastal area.

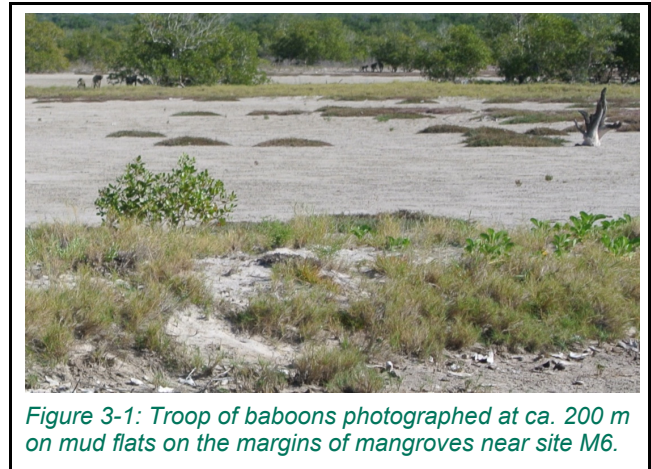


Figure 3-1: Troop of baboons photographed at ca. 200 m on mud flats on the margins of mangroves near site M6.

4.0 CONCLUSIONS

The findings of the brief May 2014 field survey support the findings and recommendations provided in the baseline report (De Castro & Grobler, May 2014), particularly with regards to the following important aspects:

- gas well T-G8PX-5 should be relocated to the east as recommended in the baseline report in order to mitigate impacts to Short Thicket and Forest communities and the threatened plant species recorded within these communities, and
- the identified area of Critical Habitat (*sensu* IFC Performance Standard 6) has high biodiversity value, is of great conservation importance and should form the focus of conservation efforts within the study area.



5.0 REFERENCES

- Barbosa, F.M.A., Cuambe, C.C. & Bandeira, S.O. (2001). Status and distribution of Mangroves in Mozambique. *South African Journal of Botany* 67.
- Da Silva, M.C., Izidine, S. and Amude, A.B. (2004). A preliminary checklist of the vascular plants of Mozambique. *Southern African Biodiversity Network Report No. 30*. SABINET, Pretoria.
- De Castro, A. & Grobler, R. (April 2014). Environmental Impact Assessment for the Sasol PSA and LPG Project: Botanical Biodiversity and Terrestrial and Wetland Habitat. Specialist report prepared by De Castro & Brits c.c. for Mark Wood Consultants on behalf of Sasol.
- Grundling, P., (2004). The role of sea level rise in the formation of peatlands in Maputaland. In: Momade, F., Achimo, M., Haldorsen, S. (eds.), *The Impact of Sea-level Change; Past, Present, Future*, Vol. 43. *Boletim Geológico*, pp. 42–48.
- Huebner, C.D. (2007). Detection and Monitoring of Invasive Exotic Plants: a comparison of four sampling methods. *Northeastern Naturalist*: 14 (2): 183-206.
- Izidine, S. and Bandeira, S.O. (2002). Mozambique. In: Golding J. (ed.); *Southern African Plant Red Data Lists*. *Southern African Biodiversity Network Report No. 14*.
- Joosten, H. & Clarke, D. 2002. Wise use of mires and peatlands. International Mire Conservation Group and International Peat Society, Saarijärven Offset Oy, Saarijärvi, Finland.
- Leistner, O.A. (2005). Seed plants of southern tropical Africa: families and genera. *Southern African Botanical Biodiversity Network Report No. 26*.
- Mackinder, B. (1990). Menyanthaceae (*Thunbergia*). *Flora Zambesiaca* 7 (4).
- Menomussanga, M. & Balidy, J.H. 2011. Situational Description (State of the Natural Resources and Socio-Economy), Zoning and Management Plan for Natural Resources in Govuro (Nova Mambone Administrative Post) .MICOA/CDS Zonas Costeiras. Ministry For The Coordination Of Environmental Affairs Centre For Sustainable Development Of Coastal Zones. Republic of Mozambique.
- Molles, M.C. Jr. (2005). *Ecology: Concepts and Applications* (3rd edition ed.). New York: The McGraw-Hill Companies, Inc.
- Pribyl, D.W. 2010. A critical review of the conventional SOC to SOM conversion factor. *Geoderma*. 156: 75-83.
- Raimondo, D., van Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kanundi, D. & Manyana, P.A. (Eds.) 2009. *Red Data Book of South African Plants*. *Strelitzia*.
- Rydin, H. & Jeglum, J.K. (2006). *The Biology of Peatlands*. Oxford University Press, England.
- Walkley, A. and I. A. Black. 1934. An examination of Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. *Soil Sci.* 37:29-37.

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APPENDIX A

Locality of each of the 15 vegetation survey sites, and a brief synopsis of the habitat and vegetation characteristics



BOTANICAL DIVERSITY AND HABITAT

Locality of each of the 15 vegetation survey sites, and a brief synopsis of the habitat and vegetation characteristics (refer to Figure A-1 below)

Site no.	Co-ordinates	Flowline Section well site	Vegetation/habitat Type and notes
M1	21°40'36.4"S 35°03'02.2"E	A near T-G8PX-5	Vegetation Unit 1. In understory of dense Short Thicket, approximately 60m north of the centre point for the T-G8PX-5 well pad.
M2	21°40'01.3"S 35°14'54.8"E	J	Vegetation Unit 3.2. In large peatland (mire) which can be described as a 'wetland flat' and which forms the source of a 'coastal stream'.
M3	21°40'34.6"S 35°15'25.4"E	J	Vegetation Unit 3.2. In a peatland (mire) at the confluence of the two branches of a 'coastal stream' (same stream system within which Site 2 is situated).
M4	21°43'23.7"S 35°16'38.9"E	K near Section K	Vegetation Unit 3.4. Beach Mangroves approximately 300m north of Nhagonzwene village, within identified IFC Critical Habitat.
M5	21°43'30.5"S 35°16'46.2"E	K near Section K	Vegetation Unit 3.4. Mangrove swamp near Nhagonzwene village, at the mouth of the coastal stream situated within the identified IFC Critical Habitat.
M6	21°43'31.6"S 35°16'40.6"E	K near Section K	Vegetation Unit 3.4. Mangrove swamp near Nhagonzwene village, at the mouth of the coastal stream situated within the identified IFC Critical Habitat.
M7	21°43'30.3"S 35°16'38.0"E	K near Section K	Vegetation Unit 3.4. Mangrove swamp near Nhagonzwene village, at the mouth of the coastal stream situated within the identified IFC Critical Habitat.
M8	DELETED	DELETED	DELETED
M9	21°43'28.8"S 35°16'37.5"E	K near Section K	Vegetation Unit 3.4. Mangrove swamp near Nhagonzwene village, at the mouth of the coastal stream situated within the identified IFC Critical Habitat.
M10	21°43'45.6"S 35°16'19.6"E	K near Section K	Vegetation Units 3.4 and 2. Mangrove swamp along the lower reaches coastal stream situated within the identified IFC Critical Habitat. Site on the macro-channel bank of the stream where five mature, 7m tall <i>Azelia quanzensis</i> , which are marginally suitable for harvesting for timber, were recorded.
M11a	21°43'42.5"S 35°16'18.2"E	K near Section K	Vegetation Unit 3.4. Mangrove swamp along the lower reaches coastal stream situated within the identified IFC Critical Habitat. Site on the active-channel bank of the stream.
M11b	21°43'43.3"S 35°16'13.4"E	K near Section K	Vegetation Unit 3.4. Mangrove swamp along the lower reaches coastal stream situated within the identified IFC Critical Habitat. Site on the active-channel bank of the stream where transition zone between Mangroves and freshwater wetland begins.
M12	21°43'35.7"S 35°16'05.7"E	K near Section K	Vegetation Units 3.2 and 3.4. Near upstream limits of Mangrove swamp along the lower reaches coastal stream situated within the identified IFC Critical Habitat.
M13	21°44'42.0"S 35°15'06.5"E	K near Section K	Vegetation Unit 2.1. Large patch of 'coastal forest' within identified IFC Critical Habitat, near coastal stream.
M14a	21°43'53.6"S 35°15'31.2"E	K near Section K	Vegetation Unit 3.2. In a peatland (mire) near the confluence of the two branches of the 'coastal stream' situated within the identified IFC Critical Habitat.
M14b	21°43'53.4"S 35°15'30.9"E	K near Section K	Vegetation Unit 3.2. In a peatland (mire) near the confluence of the two branches of the 'coastal stream' situated within the identified IFC Critical Habitat.



BOTANICAL DIVERSITY AND HABITAT

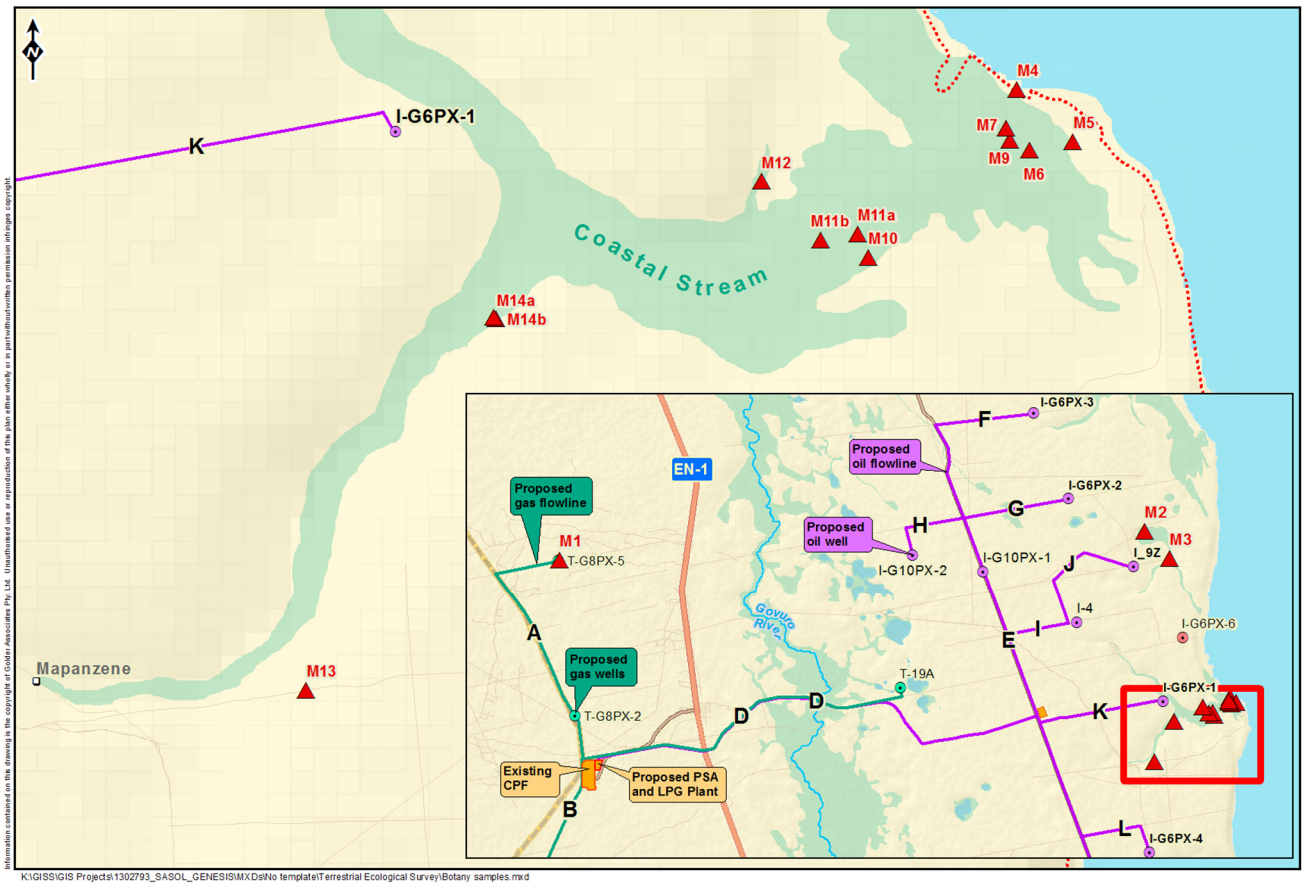


Figure A-1: Location of the Monitoring Sites (refer to the table above)



APPENDIX B

**Preliminary list of indigenous and alien invasive plant species
recorded within the study area**



BOTANICAL DIVERSITY AND HABITAT

A total of 393 plant species, 4 of which are alien species (indicated by an asterisk) that invade untransformed or secondary indigenous vegetation (i.e. 'environmental weeds' *sensu* Henderson, 2001), were listed in the baseline botanical biodiversity specialist report (De Castro & Grobler, April 2014). A total of 389 indigenous plant species were therefore recorded within the study area during the baseline survey. Alien, ruderal and agrestal weeds (restricted to areas of severe human disturbance such as cultivated lands and road verges) were not included in the list.

The six plant 'species of conservation concern' (www.iucnredlist.org, accessed in March 2014 and Izidine and Bandeira, 2002) included in the baseline plant species list (De Castro & Grobler, April 2014) are highlighted in red. Four of the species recorded during the baseline survey are endemic to Mozambique, and three of these are also endemic to the Inhambane Province. **During the May 2014 field survey, an additional 19 plant species were recorded, all of which are indigenous and none of which are currently regarded as 'species of conservation concern' (www.iucnredlist.org, accessed in March 2014 and Izidine and Bandeira, 2002). These 19 additional species recorded during the May survey are shaded in grey. Therefore, a total of 412 plant species, 408 of which are indigenous species and 4 of which are alien species (indicated by an asterisk) that invade untransformed or secondary indigenous vegetation, have thus far been recorded for the 47 419ha study area.**

Sites and sections listed for each species are only examples and are not all inclusive, except in the case of endemic species or 'species of conservation concern'. Site numbers with an 'M' prefix are sites surveyed in May. Sections given for each species does not necessarily imply that the species was recorded directly adjacent to the alignment or well site; in some cases the nearest section of the alignment to the site where the species was recorded is provided (e.g. in the case of sites along the coast which are not directly affected by the alignment). As a result of large size of the study area, time constraints in field, lack of comprehensive seasonal coverage (list based a survey in February and a brief survey in May) and the fact that fieldwork focused only on areas directly adjacent, or in close proximity to proposed infrastructure, the species list provided is not comprehensive. The species list does however contain the vast majority of common and characteristic species and provides a good indication of the type of flora found within the study area.

FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
Ferns and fern allies (Lycopodiophyta and Pteridophyta)				
LINDSAEACEAE				
<i>Lindsaea ensifolia</i>	ADC 1362	1	F	
LYCOPODIOPHYTA				
<i>Lycopodiella caroliniana</i>	ADC 1359	1	F	
POLYPODIACEAE				
<i>Microsorium scolopendria</i>	ADC s.n.	41	D, E	
THELYPTERIDACEAE				
<i>Cyclosorus interruptus</i>	ADC s.n.	1	E, F	
Monocotyledons				
AGAVACEAE				
* <i>Agave sisalana</i>		53	I (km 1.2)	
ALOACEAE				
<i>Aloe cf. cryptopoda</i>				
AMARYLLIDACEAE				
<i>Crinum stuhlmannii</i>		15	C	
ARACEAE				
<i>Gonatopus angustus</i>			C	
<i>Gonatopus boivinii</i>			C	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
<i>Stylochiton</i> cf. <i>natalensis</i>		3	All sections	
ARECACEAE				
<i>Hyphaene coriacea</i>		1	All sections	
<i>Phoenix reclinata</i>		34, 27, 57	D, L	
ASPARAGACEAE				
<i>Asparagus</i> cf. <i>falcatus</i>		51	D, E, K	
<i>Asparagus</i> cf. <i>plumosus</i>		M1	A	
<i>Asparagus</i> sp. 2 [small, linear, densely clustered cladophylls]			D	
COLCHICAEAE				
<i>Gloriosa superba</i>		2	A	
COMMELINACEAE				
<i>Commelina</i> sp.	ADC s.n.	22	D	
<i>Murdannia simplex</i>		1	F	
CYPERACEAE				
<i>Bulbostylis</i> cf. <i>hispidula</i>		22	D	
<i>Cladium mariscus</i>		1, 27, 32	F, D	
<i>Mariscus congestus</i>		1, 32	F, D	
<i>Cyperus crassipes</i>		58	I	
<i>Cyperus natalensis</i>	ADC 1385	1, 59, 60, 65	D, E, F, G, H, I, J, K, L	
<i>Cyperus obtusiflorus</i>			D, F, G, H, I, J, K	
<i>Cyperus prolifer</i>		1	F	
<i>Cyperus</i> cf. <i>sphaerospermus</i>		31	D	
<i>Cyperus</i> cf. <i>tenax</i>		41	E, F, J, K, L	
<i>Cyperus</i> sp.		4	A	
<i>Eleocharis acutangula</i>		32	D	
<i>Eleocharis dulcis</i>	ADC 1386	32	D	
<i>Eleocharis variegata</i>	ADC s.n.	M3	J	
<i>Fimbristylis bivalvis</i>	ADC 1391	1	F	
<i>Fuirena umbellata</i>	ADC 1387	27	D	
<i>Kyllinga alba</i>		22	D	
<i>Pycnus nitidus</i>	ADC s.n.	M3	J	
<i>Rhynchospora brownii</i>	ADC 1367	1	D	
<i>Rhynchospora holoschoenoides</i>	ADC 1390	1	F	
<i>Rhynchospora rubra</i> subsp. <i>africana</i>	ADC 1366 & 1389	1, 52	F, K	
<i>Scleria catophylla</i>	ADC s.n.	M2	J	
<i>Schoenoplectus scirpoides</i>		M11	K	
<i>Schoenus nigricans</i>	ADC 1388	27, 52	D, K	
DIOSCOREACEAE				
<i>Dioscorea</i> cf. <i>dregeana</i>	ADC s.n.		A, B, C	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
DRACAENACEAE				
<i>Sansevieria concinna</i>	ADC 1360	1	D, F, J, K	
<i>Sansevieria hyacinthoides</i>	ADC s.n.		D, E	
ERIOCAULACEAE				
<i>Eriocaulon</i> sp.		1	F, J	
FLAGELLARIACEAE				
<i>Flagellaria guineensis</i>			D	
IRIDACEAE				
<i>Gladiolus dalenii</i>		15	C	
JUNCACEAE				
<i>Juncus kraussii</i>		26, 62a, M2	D, K, J	
ORCHIDACEAE				
<i>Ansellia africana</i>		7	A	
<i>Eulophia angolensis</i>		62b	-	
<i>Eulophia speciosa</i>		28	D	
<i>Oeceoclades maculata</i>		Near 16	C	
Cf. <i>Angraecopsis parviflora</i>		21	B	
Orchid sp. 1 (20cm epiphyte)			E (km5.7)	
POACEAE				
<i>Andropogon</i> cf. <i>appendiculatus</i>		32	D	
<i>Andropogon eucomus</i>		1, 32	D, F	
<i>Andropogon schirensis</i>	ADC 1384	29	D, E, F, I, J, K	
<i>Andropogon</i> cf. <i>huillensis</i>		1	F	
<i>Aristida</i> sp.		12	B	
<i>Botriochloa insculpta</i>		20	B	
<i>Botriochloa bladhii</i>		32	D	
<i>Brachiaria arrecta</i>	ADC 1378	32	D	
<i>Brachiaria brizantha</i>			B	
<i>Brachiaria deflexa</i>		10	E	
* <i>Cenchrus incertus</i>			F	
<i>Chloris</i> sp.			D	
<i>Chrysopogon serrulatus</i>	ADC 1374	27, 29, 32	D	New record for coastal Mozambique
<i>Craspedorhachis africana</i>		1, 25	D, F	
<i>Cynodon dactylon</i>				
<i>Dactyloctenium aegyptium</i>		2	A, D	
<i>Dactyloctenium geminatum</i>			D	
<i>Dactyloctenium giganteum</i>			D	
<i>Digitaria diagonalis</i>		10	B	
<i>Digitaria milanijana</i>	ADC 1382	3	All sections	
<i>Digitaria rukwae</i>	ADC 1373	66	G (barrier lake)	
<i>Diplachne fusca</i>		32	D	
<i>Echinochloa pyramidalis</i>		32	D	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
<i>Eragrostis chapelieri</i>			E	
<i>Eragrostis inamoena</i>		25, 27	D	
<i>Eragrostis rigidior</i>		20	B	
<i>Eragrostis superba</i>		4	A, B	
<i>Heteropogon contortus</i>		2, 4, 35	A, B, C, D	
<i>Hyparrhenia filipendula</i> var. <i>filipendula</i> .	ADC 1383	10	B	
<i>Hyperthelia dissoluta</i>		3	A, B, C, D	
<i>Imperata cylindrica</i>		1	F	
<i>Ischaemum fasciculatum</i>		1	F	
<i>Leersia hexandra</i>		26	D	
<i>Melinis repens</i>		2	A	
<i>Oplismenus</i> cf. <i>hirtellus</i>				
<i>Panicum maximum</i>		2, 5	A, B, C	
<i>Panicum parvifolium</i>	ADC 1376	52	K	
<i>Panicum</i> cf. <i>repens</i>		57, 66	G, L	
<i>Paspalum scrobiculatum</i>		27	D	
<i>Perotis patens</i>		6	A	
<i>Phragmites australis</i>			D, E, I, J, K,	
<i>Pogonarthria squarrosa</i>				
<i>Rottboellia cochinchinensis</i>		4	A, B, D	
<i>Schizachyrium lopollense</i>	ADC 1380	1	F	
<i>Schizachyrium sanguineum</i>	ADC 1381	26	D	
<i>Schoenfeldia transiens</i>			D (Govuru floodplain)	
<i>Setaria</i> cf. <i>megaphylla</i>		3	A	
<i>Sorghum bicolor</i>		4	A	
<i>Sporobolus pyramidalis</i>		3	A, B, D	
<i>Sporobolus virginicus</i>		58	I	
<i>Tricholaena monachne</i>	ADC 1377	50	E, K	
<i>Trichopteryx dregeana</i>	ADC 1375	52	K, I, J	New record for Mozambique
<i>Triraphis schinzii</i>		59	J	
<i>Urochloa mosambicensis</i>		2, 5	A, B, C, D	
<i>Vetiveria nigriflora</i>		32	D	
TACCACEAE				
<i>Tacca leotopetaloides</i>		34	D	
TYPHACEAE				
<i>Typha capensis</i>		27	D	
XYRIDACEAE				
<i>Xyris</i> sp.	ADC 1375	M2	J	
Dicotyledons				
ACANTHACEAE				
<i>Asystasia gangetica</i>		12	B, F, J, I, K, L	
<i>Barleria</i> sp.		50	K	
<i>Hygrophila</i> cf. <i>auriculata</i>		26	D	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
AMARANTHACEAE				
<i>Kyphocarpa</i> sp.		6	A	
ANACARDIACEAE				
* <i>Anacardium occidentale</i>			All sections	
<i>Lansea</i> cf. <i>discolor</i>			A, B	
<i>Lansea schweinfurthii</i> var. <i>stuhlmannii</i>		51	A, B, C, D, E, K, I	
<i>Ozoroa obovata</i>		1	All sections	
<i>Rhus</i> cf. <i>guenzii</i>		14	B	
<i>Rhus natalensis</i>			A, D	
<i>Sclerocarya birrea</i>		12	All sections	
ANNONACEAE				
<i>Annona senegalensis</i>		2	A, B	
<i>Artabotrys brachypetalus</i>			All sections	
<i>Cleistochlamys kirkii</i>			A, B, C	
<i>Monanthon affinis</i>		7	A, C	
<i>Monodora junodii</i>		7	A	
<i>Sphaerocoryne gracilis</i>			A, B	
<i>Uvaria gracilipes</i>		7	A, B	
APIACEAE				
<i>Centella asiatica</i>		27	D	
APOCYNACEAE				
<i>Ancylobotrys kirkii</i>			All sections	
<i>Callichilia orientalis</i>			A, B	
<i>Carissa praterissima</i>		2, 6, 7, 8, 9, 12, 13, 16, 56,	A, B, C, D, I	Data Deficient ((Izidine & Bandeira, 2002); Endemic to Mozambique.
<i>Carissa tetramera</i>		M1	A	
<i>Landolphia petersiana</i>			A, B	
<i>Sarcostemma viminale</i>		22	D	
<i>Strophanthes</i> cf. <i>luteolus</i>		12	A, B	
<i>Tabernaemontana elegans</i>		5, 23	A, D	
ARALIACEAE				
<i>Hydrocotyle bonariensis</i>		32	D	
ASTERACEAE				
<i>Brachylaena discolor</i>		21	B	
<i>Helichrysum kraussii</i>		22	D	
<i>Helichrysopsis septentrionale</i>	ADC 1394	31, 66	D, G	
<i>Litogyne gariepina</i> [<i>Epaltes alata</i>]			D, E	
<i>Mikania</i> cf. <i>natalensis</i>		2, M1	A	
<i>Nidorella</i> sp.		27	D	
<i>Pluchea dioscorides</i>			D	
<i>Vernonia colorata</i>		2	A	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
AVICENNIACEAE				
<i>Avicennia marina</i>		58	I	
BALANITACEAE				
<i>Balanites maughamii</i>		45, 46, 51	E, K, IMS	
BIGNONIACEAE				
<i>Kigelia africana</i>		4, 13	A, B, D	
<i>Markhamia zanzibarica</i>		M1	A	
<i>Tecomaria capensis</i>		M1	A, IPF	
BOMBACACEAE				
<i>Adansonia digitata</i>		2, 54	A, B, I	
BORAGINACEAE				
<i>Cordia goetzii</i>		16	C	
<i>Ehretia amoena</i>		2	A, B	
<i>Heliotropium</i> sp.		4	A	
BURSERACEAE				
<i>Commiphora africana</i>			A, B	
<i>Commiphora edulis</i>			A, B	
<i>Commiphora schlechteri</i>			D	
CAPPARACEAE				
<i>Capparis erythrocarpos</i>		14	B	
<i>Cladostemon kirkii</i>				
<i>Maerua angolensis</i>			B	
<i>Maerua kirkii</i>			A, B	
<i>Maerua</i> cf. <i>triphylla</i>				
<i>Thilachium africanum</i>		14, 51	A, B, K	
CELASTRACEAE				
<i>Elaeodendron transvaalense</i>	ADC s.n.	56	E, L, IMS	
<i>Gymnosporia mossambicensis</i>	ADC s.n.	M1	A	
<i>Gymnosporia senegalensis</i>			B, D, E	
<i>Hippocratea</i> cf. <i>pallens</i>			B	
<i>Hippocratea</i> sp.		9	A	
<i>Salacia leptoclada</i>		56	I	
CHRYSOBALANACEAE				
<i>Parinari curatellifolia</i>		26	D, F	
CLUSIACEAE				
Cf. <i>Porospermum</i> sp.		48, 55	L	
<i>Garcinia livingstonei</i>		1	F	
COMBRETACEAE				
<i>Combretum apiculatum</i>		6, 14	A, B	
<i>Combretum</i> cf. <i>bracteosum</i>		13	B	
<i>Combretum hereroense</i>	ADC s.n.	3	A, B, IPF	
<i>Combretum imberbe</i>		5, 12	A, B, C	
<i>Combretum molle</i>		4	A, B	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
<i>Combretum microphyllum</i>			D	
<i>Combretum cf. pisoniiflorum</i>			D (E of Govuru)	
<i>Lumnitzera racemosa</i>		58	I	
<i>Pteleopsis myrtifolia</i>		6	A	
<i>Terminalia sericea</i>		36	B, IPF	
CONVOLVULACEAE				
<i>Convolvulus cf. sagittatus</i>		22	D	
<i>Cuscuta campestris</i>	ADC s.n.	M3	J	
<i>Ipomoea pes-caprae</i>		58	I	
<i>Paralepistemon shirensis</i>	ADC s.n.	M1	A	
<i>Seddera suffruticosa</i> var. <i>suffruticosa</i>		19	B	
CUCURBITACEAE				
<i>Citrullus lanatus</i>			C	
DROSERACEAE				
<i>Drosera</i> sp.		1	F	
EBENACEAE				
<i>Diospyros loureiriana</i> [<i>D. usumbarensis</i> subsp. <i>usumbarensis</i>]		3	A, B, C	
<i>Diospyros mespiliformis</i>		3	A, B, C	
<i>Diospyros natalensis</i>		22	D (E of Govuru), J, I, K	
<i>Diospyros rotundifolia</i>	ADC s.n.	55, 58	IMS, E, I, K	
<i>Euclea divinorum</i>		2	A	
<i>Euclea natalensis</i>			All sections	
ERYTHROXYLACEAE				
<i>Erythroxylum emarginatum</i>	ADC s.n.	20	B	
EUPHORBIACEAE				
<i>Alchornea laxiflora</i>		7	A	
<i>Antidesma venosum</i>		4	A, B	
<i>Bridelia cathartica</i>		50, 54, 59	K, I, J	
<i>Cleisanthus schlechteri</i>		12	B, C	
<i>Croton cf. gratissimus</i>	ADC s.n.		C	
<i>Croton inhambanensis</i>	ADC s.n. & ADC s.n.	7, M1	A	Vulnerable D2 (Izidine & Bandeira, 2002); Endemic to Inhambane Prov.
<i>Croton madandensis</i>	ADC s.n.	21	B, C	
<i>Dalechampia</i> sp.				
<i>Drypetes natalensis</i>		2	A, B	
<i>Flueggea virosa</i> [<i>Securinega virosa</i>]		15	C	
<i>Hymenocardia ulmoides</i>	ADC s.n.	2	A, C	
<i>Margaritaria discoidea</i>		5	A	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
<i>Phyllanthus reticulatus</i>		4	A	
<i>Pseudolachnostylis maprouneifolia</i>		1	F	
<i>Sclerocroton integerrinum</i> [<i>Sapium integerrinum</i>]		5, 54	A, I	
<i>Spirostachys africana</i>		2, 4, 14, 15	A, B, C	
<i>Suregada zanzibariensis</i>			All sections	
FABACEAE				
CAESALPINIOIDEAE				
<i>Afzelia quanzensis</i>		2, 9, 12	A, B	Lower Risk – near threatened (Izidine & Bandeira, 2002)
<i>Brachystegia spiciformis</i>		43, 64	C, D, E, F, G, H, I, J, K, L	
<i>Brachystegia torrei</i>		56	I	
<i>Cassia afrofitula</i>		3, 4	A, B, C, D	
<i>Caesalpinia bonduc</i>			-	
<i>Caesalpinia</i> sp.	ADC s.n.	21	B	
<i>Chamaecrista biensis</i>	ADC s.n.		A, B	
<i>Chamaecrista mimosoides</i>		4, 20, 57	A, B, C, D, K, I	
<i>Chamaecrista paralias</i>	ADC 1361	1, 38, 39, 40, 41, 42, 43, 48, 61, 63, 64, 65, 66, 68	D (east of Govuru), E, F, G, H, I, J, K, L (km 1.8)	Endemic to Inhambane Prov.
<i>Dialium schlechteri</i>	ADC s.n.		A	
<i>Erythrophleum lasianthum</i>		59, 60, 61	J	
<i>Julbernardia globiflora</i>		42	D, E, F, G, H, I, J, K, L	
<i>Piliostigma thonningii</i>		3	A, B, C	
<i>Senna petersiana</i>				
<i>Tamarindus indica</i>		2, 16	A, B, C	
<i>Tylosemma fassoglense</i>	ADC s.n.		B	
MIMOSOIDEAE				
<i>Acacia grandicornuta</i>		2, 4	A, B, C.	
<i>Acacia kraussiana</i>	ADC s.n.	6, 40	A, E, IPF	
<i>Acacia</i> cf. <i>natalitia</i>		58	I	
<i>Acacia nigrescens</i>		12	B	
<i>Acacia nilotica</i>			B	
<i>Acacia robusta</i> subsp. <i>clavigera</i>		6, 32	A, D	
<i>Acacia senegal</i> var. <i>rostrata</i>				
<i>Albizia adianthifolia</i>		22, 37	D, E	
<i>Albizia forbesii</i>		2, 9	A	
<i>Albizia versicolor</i>		3, 6, 32	All sections	
<i>Dichrostachys cinerea</i>			All sections	
<i>Elephantorrhiza goetzii</i> subsp. <i>goetzii</i>		68	F	
<i>Mimosa pigra</i>		27	D	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
<i>Xylia mendoncae</i>		23, 26, 44, 45, 46, 47	D, E	Data Deficient (IUCN Red List); Vulnerable D2 (Izidine & Bandeira, 2002); Endemic to Inhambane Prov.
PAPILIONOIDEAE				
<i>Abrus precatorius</i>		2, 7, 8	All sections	
<i>Alysicarpus</i> cf. <i>ovalifolius</i>	ADC s.n.	3	A	
<i>Baphia massaiensis</i>		M1	A	
<i>Bolusanthus speciosus</i>		9, 12	A, B	
<i>Canavalia maritima</i>		58	I	
<i>Cordyla africana</i>		12	B, C	
<i>Craibia zimmermannii</i>		57	I	
<i>Crotalaria monteiroi</i>			D, F, G, H, I, K	
<i>Crotalaria</i> sp. [50cm, corky bark]			D, L	
<i>Dalbergia melanoxyylon</i>		12, 13, 19, 20	B	Lower Risk – near threatened (IUCN Red List)
<i>Dalbergia</i> cf. <i>nitidula</i>		6	A	
<i>Dialium schlechterii</i>	ADC s.n.			
<i>Erythrina humeana</i>			C	
<i>Indigofera podophylla</i>		22, 23	A, B, D	
<i>Indigofera</i> sp.	ADC s.n.	4	A	
<i>Milletia stuhlmannii</i>		5, 28, 54	A, D, I	
<i>Philenoptera violacea</i> [<i>Lonchocarpus capassa</i>]		12	B, D	
<i>Rhynchosia</i> sp.		2	A	
<i>Sesbania sesban</i>			D	
<i>Sophora inhambanensis</i>	ADC s.n.	58	I	
<i>Sophora tomentosa</i>	ADC s.n.	58	I	
<i>Tephrosia</i> sp. 1		2	A	
<i>Tephrosia</i> sp. 2 [perennial herb]		4	A	
<i>Vigna</i> cf. <i>reticulata</i>	ADC s.n.	4	A	
<i>Vigna</i> sp.	ADC s.n.	37	E	
<i>Xeroderris stuhlmannii</i>		12	B	
FLACOURTIACEAE				
<i>Dovyalis longispina</i>		58	I	
<i>Flacourtia indica</i>	ADC s.n.		D, IPF	
<i>Xylothea kraussiana</i>		9	B	
GENTIANACEAE				
<i>Swertia</i> cf. <i>lastii</i>		52	F, I, J, K	
<i>Neurotheca congolana</i>	ADC s.n.	52, M2	F, I, J, K	
GOODENIACEAE				
<i>Scaevola plumieri</i>		58	I	



BOTANICAL DIVERSITY AND HABITAT

FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
HALORAGACEAE				
<i>Laurembergia tetrandra</i>		34, 35	D, F, I, J	
ICACINACEAE				
<i>Pyrenacantha kaurabassana</i>			A	
KIRKIACEAE				
<i>Kirkia acuminata</i>				
LAMIACEAE				
<i>Hoslundia opposita</i>	7	A, B		
<i>Leonotis</i> sp.	32	D		
<i>Ocimum americanum</i> var. <i>americanum</i>		B		
<i>Vitex buchananii</i>	ADC s.n.	20	B	
<i>Vitex doniana</i>	ADC s.n.	32	D	
<i>Vitex ferruginea</i>	ADC s.n.	2, 3, 7	A, B, C	
<i>Vitex payos</i>		3	A, B, C, D	
LENTIBULARIACEAE				
<i>Utricularia scandens</i> subsp. <i>scandens</i>	ADC 1393	1	F	
<i>Utricularia firmula</i>	ADC 1392	1, M2	K	
LINACEAE				
<i>Hugonia orientalis</i>		2	A, B, C, H, I, K	
LORANTHACEAE				
<i>Erianthemum dregei</i>	ADC s.n.			
<i>Tapinanthus dependens</i>	ADC s.n.	23	D	
<i>Tapinanthus forbesii</i>	ADC s.n.			
LYTHRACEAE				
<i>Galpinia transvaalica</i>	ADC s.n.	18	B	
MALVACEAE				
<i>Azanza garckeana</i>			B	
<i>Hibiscus tiliaceus</i>		58 (near site)	I	
<i>Pavonia</i> sp.		5	A	
MELASTOMATACEAE				
<i>Antherotoma phaeotricha</i>		1	F	
MELIACEAE				
<i>Trichelia emetica</i>		28, 32	D	
<i>Turraea nilotica</i>		12	A, B, C	
<i>Xylocarpus granatum</i>		58	I (mangrove)	
MENISPERMACEAE				
<i>Cissampelos torulosa</i>		1	A, B, F	
MENYANTHACEAE				
<i>Nymphoides forbesiana</i>		26, 27, 32	D	
<i>Nymphoides thunbergiana</i>	ADC s.n.	M2	J	
MOLLUGINACEAE				
<i>Hypertelis bowkeriana</i>			B	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
MORACEAE				
<i>Ficus bussei</i>			B (km10.9)	
<i>Ficus exasperata</i>		32, 34	D	
<i>Ficus stuhlmannii</i>		4	A, B, C, D	
<i>Ficus trichopoda</i>	ADC s.n.	60	J	
<i>Maclura africana</i> [<i>Cardiogyne africana</i>]		6	A	
MYRTACEAE				
<i>Eugenia capensis</i>	ADC s.n.		D, E, F, G, H, I, J, K, L, IMS	
<i>Syzigium guineense</i> subsp. <i>guineense</i>	ADC s.n.	1, 25	D, F	
<i>Syzigium cordatum</i>		1, 25	D, F	
MYRSINACEAE				
<i>Myrsine serrata</i>	ADC s.n.	1, 52	F, K	
NYMPHAEACEAE				
<i>Nymphaea nouchali</i> var. <i>zanzibariensis</i>			D	
OCHNACEAE				
<i>Ochna</i> cf. <i>barbosae</i>			A, B	
OLACACEAE				
<i>Olax dissitiflora</i>			All sections	
<i>Ximenia caffra</i>			D, J	
OLEACEAE				
<i>Jasminum fluminense</i>			IPF	
OROBANCHACEAE				
<i>Cycnium tubulosum</i> var. <i>tubulosum</i>			J	
<i>Striga</i> sp.			B	
PASSIFLORACEAE				
<i>Adenia digitata</i>		9	B	
<i>Adenia gummifera</i>		9	B	
PEDALIACEAE				
<i>Dicerocaryum senecioides</i>		22	D, E, F, G, H, I, J, K, L	
<i>Sesamum alatum</i>		22	D	
PLUMBIGNACEAE				
<i>Plumbago zeylanica</i>		23	D	
POLYGALACEAE				
<i>Polygala</i> sp.		23	D (hygrophyte, Govuru floodplain)	
<i>Polygala capillaris</i> subsp. <i>capillaris</i>		M2	J	
<i>Securidaca longipedunculata</i>		12	B	
POLYGONACEAE				
<i>Oxygonum delagoense</i>		22	D	
<i>Persicaria</i> sp.			D	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
PTAEROXYLACEAE				
<i>Ptaeroxylon obliquum</i>		M1	A	
RHAMNACEAE				
<i>Berchemia discolor</i>		16	C	
<i>Rhamnus</i> cf. <i>stado</i>				
<i>Scutia myrtina</i>		51	E, I, K	
<i>Ziziphus mucronata</i>		9	A, B	
RHIZOPHORACEAE				
<i>Ceriops tagal</i>		58	I	
<i>Bruguiera gymnorhiza</i>		58	I	
<i>Rhizophora mucronata</i>		58	I	
RUBIACEAE				
<i>Agathisanthemum bojeri</i>		15	C, D, E, F, G, H, I, J, K, L	
<i>Canthium setiflorum</i> subsp. <i>setiflorum</i>		21	B	
<i>Catunaregam obovata</i>	ADC s.n.	55	I, K	
<i>Catunaregam taylorii</i>	ADC s.n.	9	B	
<i>Coddia rudis</i>			D, E, F, G, H, I, J, K, L	
<i>Tarenna junodii</i>		55	I	
<i>Coptosperma littorale</i> [<i>Tarenna littoralis</i>]		55, 56	I	
<i>Coptosperma supra-axillare</i> [<i>Tarenna supra-axillaris</i>]	ADC s.n.	16	C	
<i>Crossopteryx febrifuga</i>			B	
<i>Gardenia ternifolia</i>			A, B	
<i>Heinsia crinita</i>		7	A	
<i>Hyperacanthus amoenus</i>			B	
<i>Hyperacanthus</i> cf. <i>microphyllus</i>			A	
<i>Kohautia</i> sp.		4	A	
<i>Kraussia floribunda</i>			A	
<i>Leptactina delagoensis</i>	ADC s.n.	55	I	
<i>Lagynias dryadum</i>			B	
<i>Oldenlandia cephalotes</i>	ADC s.n.	M14b	K	
<i>Oldenlandia</i> sp.		50	D	
<i>Oxyanthus latifolius</i>	ADC s.n.		D, K, I, J	
<i>Pavetta gracillima</i>	ADC s.n.	7	A	Data Deficient (Izidine & Bandeira, 2002)
<i>Pentas</i> sp.		8	A	
<i>Pentodon pentandrus</i>			D	
<i>Psychotria pumila</i>	ADC s.n.	50	D, I, J, K	
<i>Pyrostria bibracteata</i>	ADC s.n.	9	B	
<i>Tricalysia sonderiana</i>		58	I	
<i>Vangueria madagascariensis</i>			B	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
RUTACEAE				
<i>Teclea myrei</i>		16, 21	B, C	
<i>Vepris carringtoniana</i> [<i>Teclea pillosa</i>]		55	I	
<i>Zanthoxylum cf. leprieurii</i>		M1	A	
SALVADORACEAE				
<i>Azima tetracantha</i>			B	
<i>Salvadora persica</i>			B	
SAPINDACEAE				
<i>Deinbollia xanthocarpa</i>		2	A	
<i>Lecaniodiscus fraxinifolius</i>		7, 50	A, K	
<i>Pappea capensis</i>		3	A, B, C	
SAPOTACEAE				
<i>Inhambanella henriquesii</i>		26	D	
<i>Manilkara concolor</i>		56	I	
<i>Manilkara mochisia</i>		21	B	
<i>Mimusops caffra</i>		58	I	
<i>Mimusops obtusifolia</i>			D, E, F, G, I, J, K, L	
<i>Sideroxylon inerme</i>			All sections	
SONNERATIACEAE				
<i>Sonneratia alba</i>	ADC s.n.	58 (near site), M4	I, K	
STERCULIACEAE				
<i>Hermannia</i> sp.		50	K	
<i>Heritiera littoralis</i>		58 (near site)	I	
<i>Melhanina cf. forbesii</i>		2	A	
<i>Sterculia rogersii</i>		9, 15	B, C	
<i>Waltheria indica</i>		39	E, F, G	
STRYCHNACEAE				
<i>Strychnos henningsii</i>			B	
<i>Strychnos madagascariensis</i>		2, 42	All sections	
<i>Strychnos potatorum</i>		2	A	
<i>Strychnos spinosa</i>			A, B, C, D, E, F, H, I	
<i>Strychnos xantha</i>	ADC s.n.	2	D	
THYMELAEACEAE				
<i>Synaptolepis kirkii</i>			All sections	
TILIACEAE				
<i>Grewia bicolor</i>		15	C	
<i>Grewia gracillima</i>		2	A	
<i>Grewia inaequilatera</i>		14	B	
<i>Grewia occidentalis</i>			B	
<i>Grewia sulcata</i>		5	A, B	



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FAMILY & SPECIES	VOUCHER NO.	SITE NO.	SECTION	ENDEMICITY AND CONSERVATION STATUS
<i>Triumfetta</i> sp.		2	A, B	
VERBENACEAE				
<i>Chascanum</i> sp.		18	B	
* <i>Lantana camara</i>		16	A, B, D, IPF	
<i>Lantana rugosa</i>			A, B	
<i>Lippia javanica</i>		4	A, B, C	
* <i>Phyla nodiflora</i>		35	D	
VITACEAE				
<i>Cissus cornifolia</i>		3	A, B, C	
<i>Cissus quadrangularis</i>		6	A	
<i>Cissus rotundifolia</i>				
<i>Clerodendrum glabrum</i>		2, 5	A	
<i>Cyphostemma</i> sp.	ADC s.n.	20	B	
<i>Rhoicissus revoilii</i>		3	A, B, C, D, I, J	
<i>Rhoicissus tomentosa</i>		7	A	



APPENDIX C

Photographs of surveyed sites



Figure 1: Short Thicket at Site 1.



Figure 2: Mire in coastal stream at Site 2.



Figure 3: Mire in a coastal stream at Site 3.



Figure 4: Beach Mangrove community at Site 4 at the mouth of the coastal stream situated within the identified Critical Habitat.



Figure 5: Mangroves along channel at mouth of coastal stream at Site 5. Within Critical Habitat.



Figure 6: Site 6. Mangrove Low Thicket community at mouth of coastal stream situated within Critical Habitat.

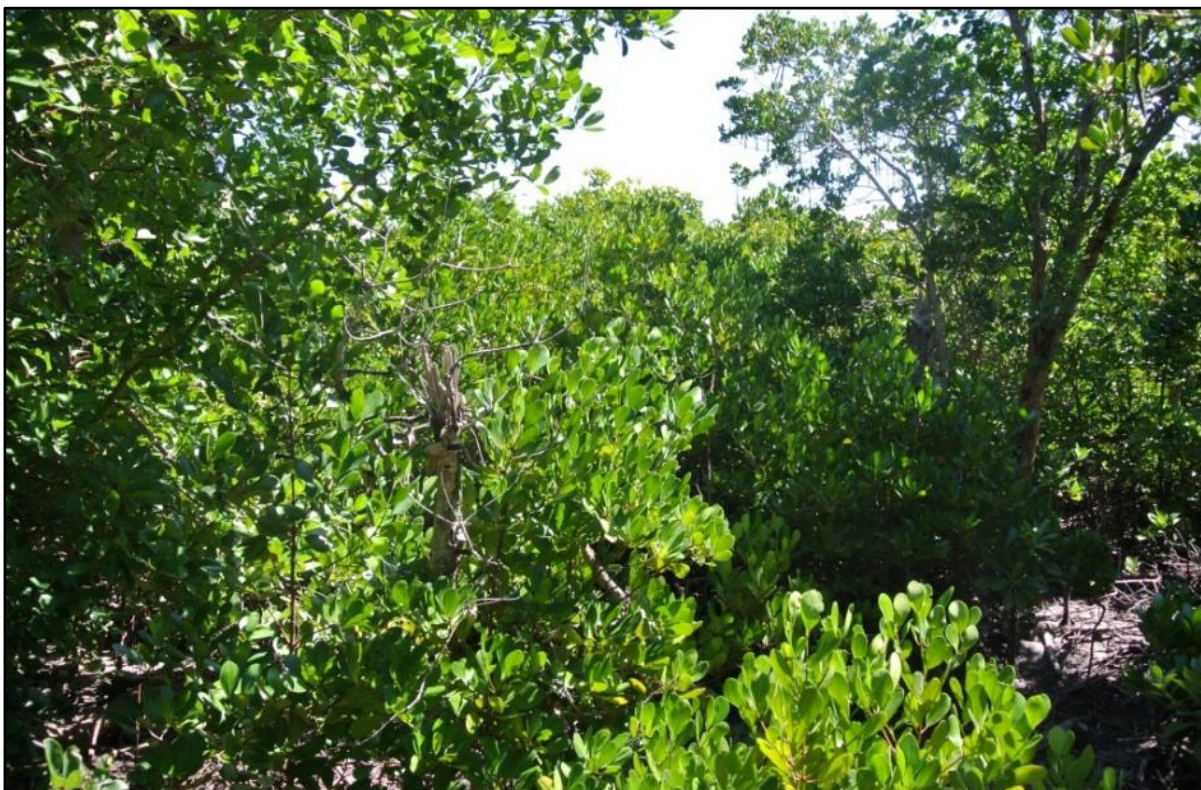


Figure 7: Mangrove community at Site 7 at mouth of coastal stream situated within Critical Habitat.



Figure 8: Mangrove community at Site 9 near the mouth of coastal stream situated within Critical Habitat.



Figure 9: Afzelia quanzensis on macro-channel bank of lower reach coastal stream with Mangrove community. Site 10.



Figure 10: Mangroves along lower reaches of coastal stream situated within the identified Critical Habitat. Site 11a.



Figure 11: Mangroves along lower reaches of coastal stream situated within the identified Critical Habitat. Site 11a.



*Figure 12: Transition zone between Mangroves and freshwater marsh of mires along lower reaches of coastal stream situated within the identified Critical Habitat. Site 11b. Emergent sedge is *Schoenoplectus scirpoides**



Figure 13: 'Coastal forest' at Site 13, within identified Critical Habitat.



Figure 14: Mire in a coastal stream situated within identified Critical Habitat. Site 14.



APPENDIX D

Data and photographs for peat samples



Table 1: Soil organic carbon (SOC) percentages based on the Walkley-Black method (Walkley & Black 1934) for selected sample points located in identified and suspected wetlands; soil organic matter (SOM) values have been calculated through the use of the conventional Van Bemmelen factor of 1.724, as well as a more updated factor of 2 as recommended by Pribyl (2010). Recorded samples with greater than 30% (dry mass) of dead SOM are regarded as peat according to Joosten & Clark (2002).

Site no.	Coordinates	Flowline Section	Soil Organic Carbon (SOC) % (Walkley-Black Method)	Soil Organic Matter (SOM) % - Converting factor of 1.724	Soil Organic Matter (SOM) % - Converting factor of 2
2			18.50	31.89	37
3			20.89	36.01	41.78



Figure 1: Peat sample taken from a depth of 2m in a mire in a coastal stream at Site 3.



Figure 2: Peat sample taken from a depth of 2m in the mire in the coastal stream situated within the identified IFC Critical Habitat at Site 14b.

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