STATE OF CONSERVATION REPORT FOR THE iSIMANGALISO WETLAND PARK WORLD HERITAGE SITE (N914)

SOUTH AFRICA

BY THE GOVERNMENT OF THE REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

DECEMBER 2019

IDENTIFICATION OF THE PROPERTY

Identification No: N914

Name of property: iSimangaliso Wetland Park

State Party: South Africa

Province(s): KwaZulu-Natal

Criteria: (vii)(ix)(x)

1. EXECUTIVE SUMMARY OF THE REPORT

This report is the State Party of the Republic South Africa's response to the letter of 03 September 2019 and 23 October 2019 respectively from the Director of the World Heritage Centre. The letter of 03 September 2019 brought to the attention of the State Party information received from third-parties regarding (i) reported water use from Lake Sibaya (ii) prospective mining activities close to the iSimangaliso Wetland Park World Heritage property and (iii) forest destruction within the property and further requested a report on the state of conservation of the property by 01 December 2019.

This state of conservation report highlights the key current threats faced by the iSimangaliso Wetland Park World Heritage Site including the efforts and progress currently made by Management Authority in providing strategic mitigating measures.

2. RESPONSE TO THE CORRESPONDENCE RECEIVED FROM THE WORLD HERITAGE CENTRE, PARAGRAPH BY PARAGRAPH

2.1 PROSPECTING RIGHTS APPLICATION, EYAMAKHOSI RESOURCES (PTY) LTD

As previously reported in April 2019, a proposed prospecting application was lodged by Eyamakhosi Resources Pty Ltd within a portion of Reserve No.4 of farm No.15823 (approximately 500 hectares) below the Maphelane section in the kwaSokhulu Area. The State Party has formally objected to the proposed prospecting application and currently awaiting a response from the competent Department of Minerals and Energy.

The State Party reiterates its commitment to the protection of the world heritage property and will in terms of Paragraph 172 of the Operational Guidelines on the Implementation of the World Heritage Convention inform the World Heritage Centre of further developments in this regard.

2.2 INCREASING WATER USE TO LAKE SIBAYA– REF: CLT/WHC/AFR/2019/257 OF 04 MARCH 2019.

The State Party received a letter dated 04 March 2019 (Ref: CLT/WHC/AFR/2019/257) regarding information received from third parties on the threat of increasing water use on Lake Sibaya. In response, the State Party in April 2019 provided the World Heritage Centre with a consolidated report.

The State Party wishes to inform the World Heritage Centre that the iSimangaliso Wetland Board as the management authority is in the process of appointing Environmental specialists to provide scientific evaluations of the proposals that exist on alternative agriculture activities and their impact on the water resource. The scientific evaluations will further provide advice to the different industries on more acceptable manners of pesticide control etc, sustainable economic opportunities that exist in order to address the challenge of depletion of the water resource as well as water pollution issues arising from the use of agricultural herbicides/ pesticides.

2.2. THE DESTRUCTION OF SWAMP FOREST– REF: CLT/WHC/AFR/2019/257 OF 13 NOVEMBER 2017

Following the report provided to the World Heritage Centre in April 2019, the iSimangaliso Wetland Park Board has convened numerous meetings with community leadership (Traditional Councils, Land Claimants and other affected government departments) to find sustainable solutions and to bring the

situation under control. This intervention by the management authority is an on-going initiative and the State Party will continue to update the World Heritage Centre on further developments.

2.3 STATE OF LAKE ST. LUCIA ESTUARY

The report submitted to the World Heritage Centre in April 2019 provided an overview of the management strategy for the Lake St. Lucia Esturary. As outlined in the world heritage property's Integrated Management Plan (2017-2021) and subsequent Estuarine Management Plans, ecosystem restoration is central to the rewilding strategy of the management authorirty for the next five years. An important focus of this work is the ongoing restoration and monitoring of the Lake St Lucia estuarine system. Another area of rewilding is the restoration of ecological processes, ecosystems and landscapes in order to make them more resilient to threats such as climate change and invasion by alien species. The restoration of natural systems in an effort to improve the resilience of the world heritage property (for example, restoration of the Lake St Lucia estuarine system, interconnection of wetlands, and dune rehabilitation at Sodwana and St Lucia).

Currently there is an inclusive task team that comprises of the Sokhulu Farmers committee UCOSP representatives and iSimangaliso representatives to deal with these challenges. This task team meets regularly to strategize on the various options that need to be considered to address these socio-economic challenges without compromising the ecological gains that were as a result of the St Lucia Estuarine Zone restoration.

To date the St Lucia Estuary Mouth has not been artificially breached and the State Party continues to deliberate on how it can assist the community that is currently farming in a floodplain of the Msunduze River without compromising the efforts gained and achieved from the Global Environment Fund (GEF) restoration project.

In order to deal with the socio economic problem emanating from the flooding, an Environmental Service provider was appointed to advise the management authority. The report purported that the only possibility of considering breaching the mouth could only be for maintenance purposes. A Maintenance Plan (see attached) was developed and approved by the Department of Environment, Forestry and Fisheries (DEFF). The newly approved maintenance plan, pertaining to the breaching of St. Lucia mouth is currently being consulted (see attached).

2.4. GRANTING OF THE ENVIRONMENTAL AUTHORISATION BY THE DEPARTMENT OF MINERAL RESOURCES OF SOUTH AFRICA

The Environmental Authorisation mentioned in the letter dated 23 October 2019 from World Heritage Centre was received by the Management Authority. The proposed Exploration Drilling within Offshore Block ER236 is positioned 75 kilometers (41 nautical miles) south of the nearest point of the iSimangaliso Wetland Park Marine Protected Area. The management authority provided comments during the Environmental Impact Assessment (EIA) commenting process objecting to the proposed exploration drilling.

The State Party will in terms of Paragraph 172 of the Operational Guidelines on the Implementation of the World Heritage Convention inform the World Heritage Centre of further developments in this regard.

3. OTHER CURRENT CONSERVATION ISSUES IDENTIFIED BY THE STATE PARTY WHICH MAY HAVE AN IMPACT ON THE PROPERTY'S OUTSTANDING UNIVERSAL VALUE

There are no other issues identified by the State Party which may have an impact on the property's Outstanding Universal Value.

4. IN CONFORMITY WITH PARAGRAPH 172 OF THE OPERATIONAL GUIDELINES, DESCRIBE ANY POTENTIAL MAJOR RESTORATIONS, ALTERATIONS AND/OR NEW CONSTRUCTION(S) INTENDED WITHIN THE PROPERTY, THE BUFFER ZONE(S) AND/OR CORRIDORS OR OTHER AREAS, WHERE SUCH DEVELOPMENTS MAY AFFECT THE OUTSTANDING UNIVERSAL VALUE OF THE PROPERTY, INCLUDING AUTHENTICITY AND INTEGRITY.

There are currently no major restorations, alterations and/or new constructions intended within the property with potential to negatively impact the Outstanding Universal Value of the property.

5. PUBLIC ACCESS TO THE STATE OF CONSERVATION REPORT

The State Party agree to the full State of Conservation report being uploaded for public access.

6. SIGNATURE OF THE AUTHORITY

Date: 20/12/2019

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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DEA Reference: 14/12/16/3/1/5/98/MP1
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PER E-MAIL / MAIL

Dear Mr. Mbense

APPROVAL OF THE ISIMANGALISO OVERARCHING ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr) REVISION 15 AS A MAINTENANCE MANAGEMENT PLAN IN ACCORDANCE WITH THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014, AS AMENDED FOR THE ACTIVITIES WITHIN THE WORLD HERITAGE SITE OF iSIMANGALISO WETLAND PARK IN THE KWAZULU-NATAL PROVINCE

The final overarching Environmental Management Programme (EMPr) Revision 15 dated August 2019 for the abovementioned project received by this Department on 06 September 2019, refer.

The Department has evaluated the submitted overarching EMPr Revision 15 as a Maintenance Management Plan (MMP) which has adequately addressed the possible impacts associated with the construction and rehabilitation phases of the project. The overarching EMPr Revision 15 as a MMP is hereby approved.

The Maintenance Management Plan was submitted in terms of the following listed activities of GN R.983; GN R.984 and GN R.985 of the Environmental Impact Assessment (EIA) Regulations, 2014 as amended:

Listed Activities Applicable	Activities Description
R. 983, Listing Notice 1 of 2014 as amended: ***Activity No. 18.*** The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square meters, within the littoral active zone, for the purpose of preventing the free movement of sand, erosion or accretion, excluding where — (i) the planting of vegetation or placement of material relates to restoration and maintenance of indigenous coastal vegetation undertaken in	This activity may be required in future. Currently only the Sodwana Bay redevelopment included the restoration of dune vegetation through replanting. This was authorized specifically in a separate Environmental Authorisation process.

Listed Activity/ies Applicable	Activity/ies Description
accordance with a maintenance management plan; or (ii) such planting of vegetation or placing of material will occur behind a development setback	
R. 983, Listing Notice 1 of 2014 as amended: ***Activity No. 19*** *The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic meters from a watercourse; but excluding where such infilling, depositing , dredging, excavation, removal or moving—* *a) will occur behind a development setback;* *b) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.*	The common developments wherein this activity is applicable within the Park being the cleaning of culverts which are commonly clogged or blocked with debri including soil. This is an activity undertaken monthly to ensure infrastructure remains intact and is not compromised. This will also be extended to include any soil removed within the St Lucia Estuary, should any removal be necessary for ecological purposes. It must be noted that such removal will be within the existing area where dredging (removal of dredge spoil) and opening of the mouth has been occurring since the early 1970s. This was included previously in the original DEA approved maintenance plan (this is an amendment to the original to include one additional maintenance activity).
R. 983, Listing Notice 1 of 2014: Activity No. 19A *The infilling or depositing of any material of more than 5 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic meters from—* *(i) the seashore;* *(ii) the littoral active zone, an estuary or a distance of 100 meters inland of the high water mark of the sea or an estuary, whichever distance is the greater; or* *(iii) the sea; —* *but excluding where such infilling, depositing , dredging, excavation, removal or moving—* *(f) will occur behind a development setback;* *(g) is for maintenance purposes undertaken in accordance with a maintenance management plan;*	The common developments wherein this activity is applicable within the Park being the cleaning of culverts which are commonly clogged or blocked with debri including soil. This is an activity undertaken monthly to ensure infrastructure remains intact and is not compromised. This will also be extended to include any soil removed within the St Lucia Estuary, should any removal be necessary for ecological purposes. It must be noted that such removal will be within the existing area where dredging (removal of dredge spoil) and opening of the mouth has been occurring since the early 1970s. This was included previously in the original DEA approved maintenance plan (this is an Amendment to the original to include one additional maintenance activity).

Listed Activities Applied for	Activity (as Described)
(h) falls within the ambit of activity 21 in this Notice, in which case that activity applies; *(i) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.*	
R. 983, Listing Notice 1 of 2014: Activity No. 27 *The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	Typically within the Park this would include removal of vegetation growing along the road verge to maintain integrity of the road infrastructure, management of vegetation growing through infrastructure which may compromise the infrastructure (parking areas, areas around water pipes etc.). The existing road verge which has always been in place since 2007 with a maximum of 1m either side of the roads infrastructure within the Park. This was included previously in the original DEA approved maintenance plan (this is an amendment to the original to include one additional maintenance activity).
R. 984 Listing Notice 2 of 2014: Activity No.15 *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	Typically within the Park this would include removal of vegetation growing along the road verge to maintain integrity of the road infrastructure, management of vegetation growing through infrastructure which may compromise the infrastructure (parking areas, areas around water pipes etc.). This was included previously in the original DEA approved maintenance plan (this is an amendment to the original to include one additional maintenance activity).
R. 984 Listing Notice 2 of 2014: Activity No. 24 *The extraction or removal of peat or peat soils, including the disturbance of vegetation or soils in anticipation of the extraction or removal of peat or peat soils, but excluding where such extraction or*	This work would involve the removal of alien vegetation around and within wetlands to maintain their ecological functionality, however; no removal or moving of peat soils. Working for wetlands rehabilitation projects which are funded by the DEA

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Listed Activities Applicable	Description Relevant
removal is for the rehabilitation of wetlands in accordance with a maintenance management plan.	and have undergone an EIA process driven by Aurecon as the independent Environmental Assessment Practitioner.
R. 985 Listing Notice 3 of 2014: Activity No.12 *The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* ***d. KwaZulu-Natal*** *(i) Trans-frontier protected areas managed under international conventions;* *(ii) Community Conservation Areas;* *(iii) Biodiversity Stewardship Programme Biodiversity Agreement areas;* *(iv) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;* *(v) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;* *(vi) Within the littoral active zone or 100 meters inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas;* *(vii) On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning;* *(viii) A protected area identified in terms of NEMPAA, excluding conservancies;* *(ix) World Heritage Sites;* *(x) Sites or areas identified in terms of an international convention;* *(xi) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;*	Typically within the Park this would include removal of vegetation growing along the road verge to maintain integrity of the road infrastructure, management of vegetation growing through infrastructure which may compromise the infrastructure (parking areas, areas around water pipes etc.). The existing road verge which has always been in place since 2007 with a maximum of 1m either side of the roads infrastructure within the Park. This was included previously in the original DEA approved maintenance plan (this is an amendment to the original to include one additional maintenance activity).

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(xii) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; or	
(xiii) In an estuarine functional zone.	

Please note that the Maintenance Management Plan is agreed to in terms of the NEMA EIA Regulations, 2014 as amended, only for the listed activity mentioned above. If any other listed activities are triggered, an environmental authorisation will have to be obtained in terms of the NEMA EIA Regulations, 2014 as amended. It remains the responsibility of the proponent to determine if any other listed activities are triggered.

All other reconstruction and maintenance activities must be within and must not result in any expansion of the existing footprints of the affected relevant structures.

The fact that the Maintenance Management Plan is agreed to by the competent authority does not absolve you from your general **"duty of care"** set out in Section 28(1) of the NEMA which states that "*Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.*" (Note: When interpreting their "duty of care" responsibility, cognisance must be taken of the principles of sustainability as contained in Section 2 of the NEMA).

The approved MMP should be regarded as a 'living document', which may be amended from time to time as and when the need arises. The proponent is reminded that should new information be presented at any stage, or the development deviate from the project description contained in the MMP, this Department reserves the right to reconsider this approval.

Yours faithfully

Mr Sabelo Malaza
Chief Director: Integrated Environmental Authorisations
Department of Environmental Affairs
Date: 09/10/2019

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OVERARCHING ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

PRE-CONSTRUCTION, CONSTRUCTION, REHABILITATION AND MAINTENANCE ACTIVITIES WITHIN THE iSIMANGALISO WETLAND PARK

Revision 14

Prepared for:

ISimangaliso Wetland Park Authority
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Prepared by:

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The EMPr is revised periodically to reflect best environmental practice, lessons learned, and new or amended legislation and policy

This document also serves as the iSimangaliso Wetland Park Authority's Maintenance Management Plan in line with the Environmental Impact Assessment (EIA) Regulations, 2014.

June 2019

Revised by: ICEBO ENVIRO PROJECTS
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Date: June 2019

COSTING RESPONSIBILITY

The environmental specifications contained in this document are to be costed by contractors appointed to undertake construction, operational and maintenance activities in the iSimangaliso Wetland Park.

These costs are required to be shown as a separate line item in the contractor's fully costed bill of quantities.

Failure to provide sufficient financial resources for the implementation of environmental management, maintenance and mitigation measures will not absolve a contractor from fulfilling environmental responsibilities.

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DETAILS AND EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONERS(EAP) WHO COMPILED THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Table 1: representatives of EAP

Name	Education Qualifications	Professional Affiliations	Experience in Environmental Management
Dr Rolf-Dieter Heinsohn	PhD	South African Association of Botanists International Association of Impact Assessment (South African Chapter) South African Institute of Ecologists and Environmental Scientists Certified Environmental Practitioner with the Interim Certification Board of South Africa Certified with the South African Council for Natural Scientific Professions (400442/04)	> 25 years
Ms Ashleigh McKenzie	MSc	International Association of Impact Assessment (South African Chapter) Certified Environmental Practitioner with the Interim Certification Board of South Africa Certified with the South African Council for Natural Scientific Professions (400026/05)	18 years
Mr Giles Churchill	MSc	International Association of Impact Assessment (South African Chapter)	10 years
Monica Shange	Hons Bsc	Certified with the South African Council for Natural Scientific Professions (Pr Sci Nat)-118085 International Association of Impact Assessment (South African Chapter)	12 years

ACRONYMS AND ABBREVIATIONS

DAFF	Department of Agriculture, Forestry and Fisheries
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EKZNW	Ezemvelo KwaZulu-Natal Wildlife
EMPr	Environmental Management Programme
I&APs	Interested and Affected Parties
SAWQ	South African Water Quality
The Park	iSimangaliso Wetland Park
The Authority	iSimangaliso Wetland Park Authority

DEFINITIONS

Definitions are provided in **Appendix 1.**

1. INTRODUCTION

The iSimangaliso Wetland Park and the iSimangaliso Wetland Park Authority (iSimangaliso) were established in terms of the World Heritage Convention Act, 1999 (Act 49 of 1999) and Regulations published there under and, as such, iSimangaliso is the legal management authority for the Park. Furthermore, iSimangaliso is governed by the National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003) and Regulations published there under and, as such, iSimangaliso is the designated Protected Area Manager for the iSimangaliso Wetland Park. As the authority mandated to protect and develop the iSimangaliso Wetland Park, a proclaimed World Heritage Site, iSimangaliso is required by law to ensure that development and activities taking place within and adjacent to the Park do not negatively affect the Park's World Heritage values or the Principles of Integrated Environmental Management as laid in Chapter 2 of the National Environmental Management Act (NEMA).

To achieve this, iSimangaliso developed its Integrated Management Plan (IMP) for the period 2017-2022 which incorporates an Overarching Environmental Management Programme as one of the key underlying environmental management tools. The IMP was approved by the Minister of Environmental Affairs (then Minister of Water and Environmental Affairs) in 2017.

In order to produce a holistic Overarching Environmental Management Programme that addresses current legislative requirements and objectives, this document was revised to align with the NEMA EIA Regulations published in December 2014 and to provide for management and maintenance activities within iSimangaliso. To this end, the revised Overarching EMPr provides management measures for the following:

- Management measures for all new infrastructure developments within iSimangaliso.
- Management measures for the maintenance of all existing infrastructure within iSimangaliso.
- Management measures for maintenance activities within iSimangaliso consistent with the exclusion
- clausescontained within the December 2014 EIA Regulations as provided for in Section 24(2) and 24D of the National Environmental Management Act. This relates specifically to Listing Notice 1 (R 983) Activities 18, 19, 19A and 27, Listing Notice 2 (R 984) Activities 15 and 24, and Listing Notice 3 (R 985) Activity 12.

This overarching Environmental Management Programme (EMPr) is also submitted and considered as a maintenance management plan (MMP) (revision 14). It has been compiled in accordance with the environmental management impact assessment regulations, 2014, for the construction, rehabilitation and maintenance activities within the iSimangaliso Wetland Park world heritage site. This Overarching Environmental Management Programme (EMPr) covers the principles, responsibilities and requirements applicable in order to implement effective environmental management during pre-construction, construction, site rehabilitation and maintenance activities within the iSimangaliso Wetland Park[1] (the Park). The aim of this Overarching EMPr is to ensure that activities are conducted in accordance with the policies and management practices of the iSimangaliso Wetland Park Authority (the Authority) and the principles of Integrated Environmental Management laid out in Chapter 2 of the National Environmental Management Act. Should any mitigation measures stated in this Overarching EMPr conflict with statements in the Project Specifications that form part of the Tender Documents, suitable mitigation measures are to be agreed upon between the Employer, Principal Agent/Engineer[2], Contractor and the Park Environmental Manager.

1 Formerly known as the Greater St Lucia Wetland Park.

2 The term "Principal Agent" applies to JBCC contracts and the term "Engineer" applies to GCC (2004) contracts. In each case, the term shall be interpreted according to the definition thereof in the reference document.

The aim of the revision of this Overarching EMPr is to also align it with the following plans and policies:

- 2017-2022 approved Integrated Management Plan
- Approved Estuarine Management Plans for the St Lucia, Kosi Bay and Mgobozeleni estuaries within the Park
- The National Estuarine Protocol 2013

It is important to note that this Overarching EMPr covers environmental mitigation measures that are common to activities within the Park. If applicable, additional site specific or project specific mitigation measures relevant to a particular activity or development must be stipulated in an Addendum to this Overarching EMPr (Appendix 4). This includes provision of the following site-specific sub-plans, as applicable and relevant to each specific project:

- **Revegetation and Rehabilitation Plan.**
- **Stormwater Management Plan.**
- **Erosion and Soil Management Plan.**
- **Alien Invasive Plant Management Plan/**
- **Transportation and Traffic Management Plan.**
- **Open Space Management Plan.**
- **Plant Translocation Guidelines.**

Compliance with this Overarching EMPr does not absolve the iSimangaliso Wetland Park Authority, its clients, partners, operators or service providers operating or performing any activities or functions within the Park or on behalf of the iSimangaliso Authority, from compliance with all applicable legal environmental requirements and/or legislation.

2. PROJECT ENVIRONMENT

The projects will be located within the Park, which is a protected area of national and international importance, and a declared World Heritage Site. The natural values for which iSimangaliso was inscribed on the World Heritage List, and the relevant World Heritage Criteria are:

- Ecological processes.
- Superlative natural phenomena and scenic beauty.
- Biodiversity and threatened species.

The Park also contains four RAMSAR sites[3] that are recognised as being wetlands of international importance and valued for both their ecological functions as well as their importance as economic, cultural, scientific and recreational resources.

Maintenance of the ecological integrity of the Park is vital to the protection of its World Heritage Site status and to the success and sustainability of the Park as a nature based tourism destination. The management measures and environmental specifications stipulated in this EMPr seek to minimise risks to these World Heritage values.

3 St Lucia, Kosi and Sibaya lake systems, and the Turtle Beaches/Coral Reefs of Tongaland.

3. ENVIRONMENTAL PRINCIPLES

The principle of sustainable development that guides environmental management in South Africa[4] requires consideration of the following aspects, throughout all phases of the development:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied.
- That the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied.
- That waste is avoided, or where it cannot be altogether avoided, is minimised and reused or recycled where possible and otherwise disposed of in a responsible manner.
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

In the context of the above, it is important to minimise the size (extent) of areas disturbed by construction activities (i.e. the construction footprint). This will assist in limiting construction related environmental impacts and reducing rehabilitation requirements and costs. In addition, all developers shall adhere to all relevant standards relating to international, national, provincial and local legislation, as applicable. This includes requirements relating to waste emissions/discharges (e.g. hazardous, airborne, liquid and solid), waste handling and disposal, noise control, traffic control, etc.

4 As stated in the National Environmental Management Act, 1998 (Act No 107 of 1998), as amended.

4. APPLICABLE LEGISLATION

Several laws and regulations apply to the protection of the environment and contain environmental principles and standards that need to be applied. There are also permits and licences that need to be applied for and obtained. Further detail on particular legal requirements of relevance to projects in the Park, are provided in **Appendix 2.**

Laws applicable to protection of the environment in terms of environmental management (and relating to construction and maintenance activities) include but are not restricted to:

- Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983).
- Environment Conservation Act, 1989 (Act No 73 of 1989).
- Hazardous Substances Act, 1973 (Act No 15 of 1973).
- Human Tissues Act (Act No. 65 of 1983)[5].
- KwaZulu-Natal Heritage Act, 2008 (Act No 4 of 2008).
- KwaZulu-Natal Nature Conservation Management Act, 1997 (Act No. 9 of 1997).
- Marine Living Resources Act, 1998 (Act No 18 of 1998).
- National Environmental Management Act, 1998 (Act No 107 of 1998) (as amended) and relevant Regulations there under, including the EIA Regulations (2014) National Environmental Management: Air Quality Act, 2004 (Act No 39 of 2004).
- National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004).
- National Environmental Management: Integrated Coastal Management Amendment Act, 2014 (Act 36 of 2014) and Regulations: Control of Vehicles in the Coastal Area (GNR 496, 27 June 2014).
- National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003) and Regulation R 1061, 28 October 2005 under Section 86 of the Act.
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) and relevant Regulations there under.
- National Forests Act, 1998 (Act No. 84 of 1998)[6].
- National Heritage Resources Act, 1999 (Act No 25 of 1999).
- National Mineral and Petroleum Resources Development Act, 2002 (Act No 28 of 2002).
- National Veld and Forest Fire Act, 1998 (Act No 101 of 1998) (Section 34).
- National Water Act, 1998 (Act No 36 of 1998).
- Occupational Health and Safety Act, 1993 (Act No 85 of 1993) and Regulations there under.
- Promotion of Access to Information Act, 2000 (Act No 2 of 2000).
- Promotion of Administrative Justice Act, 2000 (Act No 3 of 2000).
- Provincial and Local Government Ordinances and Bylaws (as relevant and applicable).
- Ramsar Convention on Wetlands of International Importance especially as a Water Fowl Habitat.
- Road Traffic Act, 1989 (Act No 29 of 1989).
- Soil Conservation Act, 1969 (Act No 76 of 1969).
- Water Services Act, 1997 (Act No 108 of 1997).
- World Heritage Convention Act, 1999 (Act No 49 of 1999)
- Maritime Zone Act, 1994(Act 15 of 1994)
- National estuarine management protocol 2013

5 Exhumation and reburial of graves must conform to the standards set out in the Ordinance on Excavations (Ordinance No 12 of 1980). Permission must be obtained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and the local police. In addition, permission must be obtained from the landowners (where the graves are located and to where the graves are going to be relocated) before exhumation can take place. Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissue Act (Act 65 of 1983, as amended).

6 A list of protected trees is published in terms of the Act. At the time of this revision, No 716 of 7 September 2012 is applicable.

And all relevant regulations framed under these Acts and amendments thereto.

4.1 Applicable Management Plans

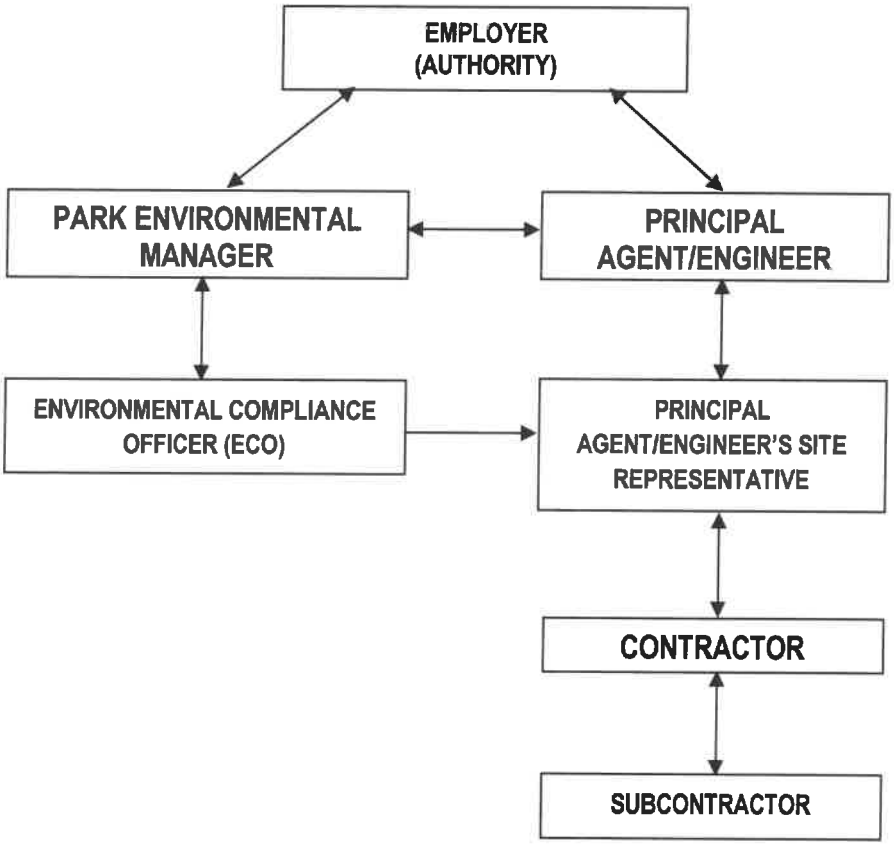
- Kosi Bay Estuarine management plan; 2017
- Lake st Lucia Estuarine management plan; 2017
- Mgobozeleni Estuarine management plan; 2017
- Isimangaliso Wetland Park integrated management plan (2017-2021)

5. PARK RULES

All parties working within the Park are required to comply with Park Rules. Park Rules will be contained in the contract documents or, if not, are obtainable from iSimangaliso via the Principal Agent/Engineer. Activities undertaken outside of what is covered in Sections 7-10 of this Overarching EMPr require written approval from the Authority. This includes both non-consumptive and consumptive activities, such as movement within the Park (on foot or by vehicle) and angling.

6. ENVIRONMENTAL COMPLIANCE – ADMINISTRATIVE AND REGULATORY PROCEDURES

6.1 Communication/reporting relationship with respect to environmental management of contracts and relationships between contract parties



6.2 Indemnity

All Contractors and their staff are required to sign the Park's Indemnity Form prior to commencing work in the Park.

6.3 Roles and responsibilities in compliance

The Authority, as the Employer, is ultimately responsible for ensuring that the terms of the Overarching EMPr are complied with during the Contract. The Authority may appoint a representative (e.g. Principal Agent or Engineer) to oversee this on its behalf. The Principal Agent/Engineer is usually assisted in this regard by the Park Environmental Manager and the Environmental Control Officer (ECO) where one has been appointed. **Appendix 3** outlines the roles and responsibilities of the Principal Agent/Engineer, the Principal Agent/Engineer's Site Representative, the ECO and the Environmental Manager with regard to environmental compliance and compliance monitoring.

6.4 Communication and reporting procedures

It should be noted that all communication on site, with regard to environmental matters, is done via the Principal Agent/Engineer's Site Representative and not directly between the ECO and Contractor. Instructions are to be recorded in the site diary or in the minutes of site meetings. Reporting on environmental matters shall be undertaken as outlined in **Appendix 3.**

6.5 Non-compliance and remedial action

The Contractor and Sub-contractors are deemed not to have complied with the Overarching EMPr and any subsidiary documents (e.g. a Site-Specific Addendum) if:

- There is evidence of contravention of the Overarching EMPr specifications within the boundaries of the construction site, site extensions and haul/access roads.
- There is contravention of the Overarching EMPr specifications that relate to activities outside the boundaries of the construction site.
- Construction/ maintenance activities take place outside demarcated areas.
- Environmental damage occurs due to negligence or intent.
- Failure to comply with corrective or other instructions issued by the Principal Agent/Engineer within a specific time period.

Where the ECO identifies non-compliance by the Contractors and Sub-contractors, this will be discussed at site meetings (or when identified) and remedial actions and associated timeframes specified. The ECO will record these incidents of non-compliance, together with the specified remedial actions and timeframes, in the site inspection checklist (which serves as the environmental compliance report). The Principal Agent/Engineer's Site Representative must also record the relevant instructions for the Contractor(s) in the site diary.

If the specified remedial action has not been carried out by the Contractor(s) within the period stipulated by the ECO, the non-compliance in question shall be dealt with as follows:

- Where non-compliance has resulted in environmental damage to the site which cannot be rectified by the remedial action specified by the ECO, or the Contractor(s) has failed to carry out the remedial work within the prescribed time limit (or permitted extension thereof), the ECO shall convene a meeting between the Principal Agent/Engineer's Site Representative and the Contractor. Appropriate remedial work shall be discussed and agreed, and failing agreement within 10 days, such dispute shall be resolved in accordance with the dispute resolution provisions contained within the Contract.

- In determining appropriate remedial action, the ECO and Principal Agent/Engineer shall make a recommendation to the Authority for decision, and where necessary, obtain specialist input.
- The Principal Agent/Engineer shall issue an instruction to the Contractor to procure execution of the remedial work as agreed between the parties, and the Contractor shall be obliged to procure such remedial work within the prescribed period to the satisfaction of the Principal Agent/Engineer.
- Failure by the Contractor to comply with an instruction from the Principal Agent/Engineer to procure the carrying out of the required remedial work shall constitute a material breach of the Contract, entitling the Authority to contractual remedy.
- Where the Authority has taken action to procure the remediation of such consequences it shall be entitled to recover from the Contractor the full cost of remediation.

6.6 Penalty clause

Any avoidable or unauthorised, in the case of unavoidable circumstances, non-compliance with the Overarching EMPr, Site-Specific Addendum, Environmental Authorisation, Permits or applicable regulations shall be considered sufficient grounds for imposing a sanction. The sanction imposed shall be determined on a case by case basis. Upon receipt of a notice of non-compliance, the Contractor shall correct whatever is the cause of the issuing of the notice, in accordance with the law.

The indicative Rand values of the penalties to be imposed per incident or violation are provided in **Appendix 5**. They reflect first-time incidents of non-compliance only.

Penalties imposed shall be paid to the Authority should the incident occur within the Park or to the landowner should the incident occur on land adjacent to the Park.

The imposition of a penalty by the appropriate regulatory authority does not exonerate or exempt the offender from rehabilitating the damage caused to the environment, if any, or result in the offender not becoming liable to the payment of a fine or imprisonment, or both, and the obligation to rehabilitate the environment or pay the costs of such rehabilitation. These fines and costs for rehabilitation are distinguishable from delay damages the Contractor contractually agrees to pay, if imposed.

7. DESIGN AND PRE-CONSTRUCTION

Various environmental management considerations must be dealt with prior to construction by the Principal Agent/Engineer, ECO and/or the Contractor. Responsible parties are indicated in the sections below.

7.1 Technical design

- Environmental sensitivities identified during the environmental impact assessment (EIA) process[7] must be communicated to the Principal Agent/Engineer by the Park Environmental Manager or relevant Environmental Assessment Practitioner so that, where applicable, project specific mitigation measures may be incorporated into the technical designs.

7.2 Protection of natural drainage and hydrological regimes

In designing bridges, culverts, pipes and/or other structures or landscaping that affect runoff and drainage, adhere to the following:

- Culverts, pipes and channels shall be concrete lined.
- Ensure that drainage systems are kept as natural as possible. Retain natural drainage and normal flow at all times.
- Consider the effect of the structures on the river and flood plain system, and aim to minimise the impacts.
- Design calculations shall prove that the optimum solution is being implemented.
- Consider the effects of backwash and design remedial measures where required.
- Prevent erosion or scouring of any river or stream resulting from road or bridge construction.
- Prevent alteration of groundwater movement patterns.
- Obtain the input of an appropriate expert(s) to ensure the inclusion of wetland protection measures during the detailed design phase of the project.
- Culvert design must encourage their use as underpass crossings for small to medium sized animals.

7.3 Estuarine management, Artificial breaching of watercourses, mouth manipulation and removal of the deposited silt

7.3.1 Estuarine management and breaching

The National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008) ("the ICM Act") which was aassented to by the President on the 9 February 2009 and ccommencement delayed till 1 December 2009, requires estuaries of the Republic to be managed in a coordinated and efficient manner, and in accordance with a National Estuarine Management Protocol ("the Protocol"). Estuaries are subjected to influences from marine, riverine and terrestrial ecosystems. Therefore, estuarine management has to be complex as estuaries require integrated cross-sectorial planning and management. Estuarine management is thus a dynamic process that requires careful implementation of management decisions.

Natural breaching in a pristine system provides the natural variation on which the ecology of the estuary depends for its survival. *This is often not possible at times because of developments in the flood plain of the estuary or river. To protect the biodiversity and for the ecological benefits, artificial breaching is practised, often at very low water levels.* The breaching process requires water level to be as high as possible. The reason for this is that as

[7] Undertaken either via the Park's Internal Scoping process or the environmental authorization process required in terms of the NEMA EIA Regulations.

much sediment as possible should be flushed from the mouth and from the estuary. The potential of flushing of sediments increases exponentially with the increase of outflow velocities after breaching, which in turn increase strongly with the increase in water levels. *There are various ecological benefits and motivation of performing artificial breaching on river mouth/rivers in estuaries and that can be affected by flooding, river bank erosion causing sedimentation etc. .*

7.3.2 Flooding

Flooding can have a variety of direct impacts on the environment and ecosystems contained within a flooded region. Flooding can have a direct impact on the wellbeing of wildlife, livestock, riverbank causing erosion and sedimentation. Large quantities of water can negatively affect natural and farming habitats, as a result of water inundating their habitats.

7.3.3 Riverbank Erosion and Sedimentation

Riverbank erosion is caused by high and fast moving water that exceeds riverbanks. Sediment may act as a form of non-point source water pollution that can clog riverbeds and streams as well as reduce storage capacity for reservoirs and wetlands. Flood waters can carry large amounts of sediment and leave deposits behind once flood waters velocity subsides. As silt causes the level of riverbed to rise, the straight course of the river is disturbed. Therefore the river searches for a lateral path (left or right), changing its course and breaching embankments on the new path.

7.3.4 Siltation

The silt causes the level of riverbed to rise. As a result, the natural longitudinal course of the river is disturbed. Therefore, the river searches for a lateral path (left or right). As a result, it changes its course and breaches the embankments on the new path it has created. Siltation occurs as a result of human activities that lead to fine soil leaching into nearby rivers. This results in an unnaturally large accumulation of silt that stays in that particular area of that river. Rainstorms may also transport these soils into other water sources. Sensitive marine life and freshwater fish may be affected by suspended silt in their native waters. Other harmful impacts of siltation are human health concerns, the loss of wetlands, coastline alterations, and changes in fish migratory patterns.

7.3.5 Embankment breaching

Embankment breaching, an episodic process in fluvial dynamics, is affecting a wide range of physical, ecological and socio-economic issues in the fluvial environment. The main causes of embankment breaching are the use of low quality, unstable material, faulty construction, toe erosion, illegal sand mining as well as inadequate maintenance and improper planning of land use. The river embankments bring adverse impact on the riparian environment by hampering the natural evolution of the floodplain by interfering with the geomorphological processes of the river. The quality of construction of such embankments is never uniformly good, and the embankments themselves deteriorate with time due to erosion by rainfall, interference by humans (e.g., cutting embankments to allow for the passage of irrigation water in the dry season), burrowing of animals, and road or other traffic along and across the structure, etc. Artificial breaching at low water levels is also linked to on-going sedimentation in the river system hence the need to balance the environmental requirements of the estuary with those related to reducing the risks of flooding. Ensure a healthy functional estuary, i.e. open mouth in spring and summer, no fish kills, no excessive algal blooms.

7.4 Environmental authorisations/permits/licences

- The Principal Agent/Engineer is to seek advice and assistance from the Environmental Manager and/or ECO regarding which environmental authorisations/permits/licences may be required, for example8:
- Licences/permits from Department of Minerals and Energy and the Department of Environmental Affairs (DEA) for borrow pits9.
- Water use licences from the Department of Water and Sanitation with respect to river/stream crossings, construction in or near wetlands, abstraction of water, etc.
- Approval from Amafa with respect to heritage resources.
- It must be noted that the Authority, as an Organ of State, is **not** required to obtain permits for the removal/destruction etc. of trees and trees in natural forests protected under the National Forests Act (refer to **Appendix 2**); nor is it required to obtain permits for plants protected under the Natal Nature Conservation Ordinance[10]. However, emphasis will still be placed on the protection of these species during the course of any development in the Park.
- Environmental permits that are likely to be required for various project activities must be obtained before the activity commences and the activity undertaken according to the conditions contained within the permit.
- The applicant of the permit or licence for this project will be the relevant party as defined by the relevant legislation, which in most cases will be the Authority or the Principal Agent/Engineer.

8 Refer to Appendix 2.

9 Note that no mining is allowed within the iSimangaliso Wetland Park. Contractors are to source materials from outside the Park and to ensure that such sources have the relevant legal approvals.

10 Section 216A of the Ordinance says that "This Ordinance shall not bind the State." The term State is given a wide interpretation so as to include Organs of State. The Authority is an Organ of State. (refer Claase v Transnet Bpk 1999 (3) SA 1012).

7.5 Liaison with affected parties

- The Principal Agent/Engineer must ensure that the necessary liaison with landowners, land users, community leaders, service providers and other affected parties has taken place prior to construction and where required, the relevant consent obtained.

7.6 Contractors' camp/site office/accommodation

- Accommodation of labour and Contractors' camps are not permitted in the Park. However, if this is logistically and financially unavoidable, the Contractor will require special permission, which will need to be arranged between the Principal Agent/Engineer and the Authority.
- Whether inside or outside the Park, the following criteria will apply to the selection of a site for Contractors' camps:
  - Landowner permission is required.
  - Select a location that has easy access and which has already been cleared or disturbed by previous human activity (e.g. old fields, abandoned tracks or yards, previous construction camps or stockpile areas).
  - Select a site that minimises nuisance impacts on neighbours or tourists (e.g. visual intrusion, lights at night, noise, dust, movement of people and vehicles, and safety and security risks).
  - Select a level site.
  - Select a site with good drainage.
  - Stay out of river flood plains and drainage lines, and at least more than 50 m away from the edge or banks of water bodies (e.g. streams, wetlands, pans, dams, lakes, etc).
  - Check the area for nests of birds or large burrows of animals and avoid these areas where possible.
  - Select an area that requires the least amount of removal of indigenous vegetation and large trees.

7.7 Construction site layout plan

The Contractor, with assistance from the Principal Agent/Engineer if necessary, is to draw up a construction site layout plan for approval by the Principal Agent/Engineer, ECO and the Authority[11]. This plan must show the positions and extent of all permanent and temporary site structures and infrastructure, including (as relevant):

- Site access (including entry and exit points).
- Roads and haul/access routes.
- Buildings and structures.
- Batching plants.
- Essential services (permanent and temporary water, electricity and sewage).
- Site toilets and ablutions.
- Construction materials stores.
- Vehicle and equipment stores.
- Fuel stores.
- Hazardous substances stores.
- Storm water control measures.
- Borrow areas.
- Excavations and trenches.
- Cut and fill areas.

[11] If, due to the nature of the development, a site layout plan is not deemed necessary (by the Engineer/ ECO) then the items can be discussed and agreed to at the site handover meeting.

- Topsoil stockpiles.
- Stockpile/laydown areas.
- Spoil areas.
- Solid waste storage and disposal sites.
- Rubble and waste rock storage and disposal sites.
- Hazardous waste storage sites.
- Areas where vegetation will be cleared.
- Features and plants to be conserved.

7.8 Site layout and design

The Contractor is to adhere to the following, in terms of site layout and design:

- Limit the size of the site to a minimum.
- Provide suitable drainage to prevent soil erosion from stormwater runoff, as well as to prevent stagnant puddles from forming and harbouring mosquitoes that may carry malaria.
- Locate materials and soil stockpile areas, fuels and chemical storage areas and batching areas away from environmentally sensitive areas and protected from stormwater runoff, fire and access by unauthorised persons.
- Locate and clearly indicate convenient access routes, temporary loading and parking areas, and turning circles so that vehicle movement can be confined to these areas.
- Locate chemical toilets so that they are easily accessible for servicing.
- Locate temporary waste bins and skips so that they are easily accessible for emptying and removal.
- Design the layout to control and reduce noise from source.
- Position components and equipment to limit visual intrusion.
- Select type and colour of roofing and cladding materials to reduce reflection.
- Direct lights so that they do not pose a nuisance to neighbours.

7.9 Plant, animal and heritage resources

- The presence of protected plants and trees must be determined by the Park Environmental Manager during the scoping/design stage and marked off for protection or translocation well before construction activities commence.
- The ECO shall be responsible for ensuring that any required demarcation, removal, relocation and/or rescue of plants, animals and/or heritage resources are undertaken prior to construction activities commencing (refer to Sections 8.5, 8.6 and **Appendix 2**).
- The Principal Agent/Engineer is responsible for timeously notifying the ECO of construction schedules and dates (a minimum of four weeks' notice) so this can be timeously effected.

7.10 Environmental awareness training

- The Contractor and staff are required to attend an environmental awareness training/induction course prior to construction commencing[12] and to keep attendance registers. This course is usually presented by EKZNW and includes a course on Dangerous Animals.
- Environmental training is to be at the cost of the Employer. The trainer is to ensure that the Park Environmental Manager is in agreement with the course content.
- Training programs must include (but not necessarily be restricted to) the following briefs:

[12] If new staff are taken on during the course of construction, they are to attend the course before or as close as possible to the time they start work.

- Basic awareness and understanding of the key environmental features of the work site and environs.
- Understanding the importance of, and the reasons why, the environment must be protected.
- Ways to minimise environmental impacts.
- Requirements of the Overarching EMPr and Site-Specific Addendum.
- Risks and protection from dangerous wild animals.
- Prevention and handling of fire.
- Health risks pertinent to the site, including prevention of diseases such as malaria, cholera and tick bite fever.

7.11 Method statements

- Before a construction activity commences, the Principal Agent/Engineer and ECO will agree which activities require a method statement. In such cases, the Contractor, with assistance from the ECO, if required, will submit a written method statement, which should include the following:
  - The type of the construction activity.
  - Locality of the activity.
  - Identification of activities or aspects that may cause an impact.
  - Identification of impacts that might result from the activity or aspect.
  - Methodology and/or specifications for prevention, minimisation or mitigation of impacts.
  - Emergency/disaster incident and reaction procedures.
  - Rehabilitation and continued maintenance of impacted environment.
- The Contractor may provide such information in advance of any or all construction activities provided that new submissions shall be given to the Principal Agent/Engineer whenever there is a change or variation to the original.
- The Principal Agent/Engineer and ECO will review and approve the construction method statements.

7.12 Construction programme and schedules

- The Principal Agent/Engineer is to provide a programme of project activities and time schedules to the ECO, who is also to be made aware of any amendments to the construction programme or alteration to the scope of work, so that impacts on the environment can be assessed.
- The Principal Agent/Engineer is to ensure that relevant Park staff and other relevant affected parties are made aware of project activities and associated timeframes.

8. SITE ESTABLISHMENT

These specifications are the Contractor's responsibility, except where specifically indicated otherwise.

When establishing the site (this includes the site camp and all areas of operation both inside and outside the Park), the environmental objective is to minimise the footprint of disturbance, retain quality of topsoil, minimise loss of vegetation and prevent pollution. The site must be kept neat and tidy at all times.

8.1 Site handover

- The Principal Agent/Engineer is to timeously notify the ECO of the date for the site handover, so that she/he may attend such a meeting to discuss special requirements of the Overarching EMPr and Site-Specific Addendum, prior to construction commencing.
- Contractors and their staff must sign iSimangaliso's indemnity before commencing work in the Park.

8.2 Site access

- No new tracks may be made in the Park without the written permission of the Authority. Use must be made of existing roads and tracks.
- Crossing of rivers, streams, watercourses, wetlands and pans is not permitted unless indicated on the infrastructure plans. Where unavoidable, crossings must be kept to a minimum and should not permanently alter watercourses or affect flows (flow directions, flow volumes and flow velocities). Where relevant, these crossings must be designed and constructed in accordance with method statements and/or measures specified in the Site-Specific Addendum.

8.3 Contractors' camp and construction workers' accommodation

- Refer to Sections 7.5, 7.6 and 7.7 regarding Contractors' camps/site offices.
- Construction workers must be housed outside of the Park and brought to the site on a daily basis, except where special approval is received from the Authority.
- Environmental management of the Contractors' camp, site offices and/or accommodation facilities, regardless of whether they are situated inside or outside the Park, should be undertaken in accordance with applicable legislation and the relevant controls contained in this Overarching EMPr.

8.4 Stockpile areas

- The same criteria for selecting a site for the Contractor's camp (Section 7.5) will apply to selection of stockpile areas.
- The sites for stockpile areas within the Park are to be agreed to by the Principal Agent/Engineer and the Authority.
- Materials may not be stockpiled underneath or against the trunks of trees.

8.5 Site demarcation

- Demarcate all operational areas (where necessary and practicable) for the duration of construction.
- Clearly demarcate the perimeter of the area, as well as relevant internal areas (e.g. stockpile areas, parking areas, etc) with fencing, poles, hazard tape or other non-permanent marker, as agreed to by the ECO and Principal Agent/Engineer, to prevent sprawl.
- Do not paint or permanently mark natural features such as trees or rocks.
- Prior to clearance, protected tree species and plants must be identified and marked so that they are not interfered with[13]. This is the responsibility of the ECO.
- Prior to clearance, any areas of archaeological or cultural significance[14] that have been identified must be demarcated. This is the responsibility of the ECO.
- Any deviations from the agreed demarcation must be approved by the ECO and Principal Agent/Engineer.

8.6 Site clearance

- Detailed, colour photographs shall be taken of the proposed site before any clearing may commence. These records are to be kept by the ECO to aid in the rehabilitation of the site.
- Prior to site clearance, the ECO must be informed, with 14 days' notice, in order to identify and demarcate any indigenous trees or plants, nesting sites or heritage sites that required protection or translocation.
- Areas of the construction site requiring clearance shall only be cleared immediately prior to construction activities commencing, i.e. at the last practicable stage.
- Clearance of indigenous vegetation must be kept to an absolute minimum.
- No indigenous trees or shrubs may be felled, lopped, pruned or removed without the prior permission of the ECO.
- Pruning of branches of indigenous trees will be properly undertaken under direct, competent supervision and sealant will be applied to cut surfaces in excess of 50 mm in diameter.
- Cutting of trees should be undertaken in a way that no nest (birds or other) is in the cut portion, unless approval has been obtained from the ECO. The ECO should consider the conservation status of the animal species in question before making a decision. Epiphytes (orchids and any other species identified by the ECO) are to be removed and relocated under the supervision of the ECO.
- Avoid clearing and excavating within the drip line (under the canopy) of large trees, as this can lead to root damage and premature death of the tree.
- Brushwood is to be left on site unless otherwise indicated by the ECO.
- Wood obtained from clearing and grubbing operations remains the property of the Authority and must be stacked at sites designated by the ECO. The Contractor shall be required to remove and dispose of any wood from site at a designated site for vegetation disposal, should this be required.

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13 Prior to construction, a suitably qualified specialist shall identify protected trees on site as listed under the National Forests Act, 1998. Removal of these trees is to be avoided. Where unavoidable, they should be translocated if possible. Also, certain indigenous plant and animal species in KwaZulu-Natal are provided with special protection under KwaZulu-Natal nature conservation legislation. Refer to Appendix 2.

14 The area encompassed by the Park and its surrounds is of high significance in terms of heritage resources, particularly archaeological sites. Certain heritage resources are potentially threatened by construction activities. In accordance with the KwaZulu-Natal Heritage, 1997 (Act No 10 of 1997), it is necessary to inform Amafa aKwaZulu-Natali (Amafa), the relevant heritage authority, of proposed projects that may impact on heritage resources. Amafa KwaZulu-Natal will advise whether it is necessary to commission an approved cultural resource management specialist to conduct a survey. Depending on the significance of sites identified, special mitigation measures may be required (e.g. excavation, demarcation or permanent protection). If sites are to be damaged by development, the Employer is required to apply to Amafa for a permit for the destruction of these sites. Construction may only proceed once these permits have been granted.

- Topsoil is to be stripped, together with grass, groundcover and sedges, from all areas where permanent or temporary structures and access roads are to be constructed. Conservation and handling of topsoil is to be in terms of this document (Section 8.7).
- Any cleared topsoil[15] and organic material must be stockpiled separately from subsoil and used for later rehabilitation.

8.7 Conservation and handling of topsoil

- Where imported topsoil is required, this must be from a legally approved borrow pit (refer to **Appendix 2**). The source of this material must also be approved by the ECO and Park Environmental Manager.
- Stockpile topsoil separately from subsoil[16].
- Stockpile in an area that is protected from stormwater runoff and wind.
- Topsoil stockpiles are not to exceed 1.0 m in height and should be protected by a mulch cover.
- Topsoil, which is to be stockpiled for periods exceeding four months, is to be vegetated with a suitable plant material sourced within a radius of 50 km. The area from which this material is taken must be approved by the ECO and must not result in environmental degradation. Approval to use material from further afield or grass seed mix must be obtained from the ECO and Park Environmental Manager, and will only be considered under exceptional circumstances.

8.8 Stormwater drainage

- Establish stormwater drainage measures on site to prevent soil erosion and to divert runoff from materials and soil stockpile areas, fuels and chemical storage areas, concrete batching areas and vehicle maintenance areas, as relevant.

8.9 Storage of harmful or hazardous fuels, oils, bitumen and other chemicals

- All potentially hazardous substances to be used must be approved by the Principal Agent/Engineer and Park Environmental Manager. Handling, storage and disposal procedures must be agreed to prior to application. If not supplied by the Principal Agent/Engineer, the Contractor must provide a method statement detailing the substances/materials to be used, together with storage, handling and disposal procedures.
- Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply.
- Prevent accidental contamination of soil at storage and handling areas for fuels, oils, lubricants, cement and other chemicals and potentially hazardous or harmful substances by placing them above an impermeable liner. The integrity of the liner is to remain intact for the duration of the contract, until removal.
- All storage areas for harmful substances are to be bunded with a suitable collection point for accidental spills.
- Provide drip trays underneath dispensing mechanisms as well as under leaking engines/machinery.
- Store all chemical containers under cover.

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15 Topsoil is defined as the A horizon of the soil profile. Topsoil is the upper layer of soil from which plants obtain their nutrients for growth. It is often darker in colour, due to the organic (humic) fraction. Where topsoil is referred to, it is deemed to be both the soil and grass/ground cover fraction.

16 Subsoil is the soil horizons between the topsoil horizon and the underlying parent rock. Subsoil often has more clay-like material than the topsoil. Subsoil is of less value to plants, in terms of nutrient (food) and oxygen supply, than topsoil. When subsoil is exposed it tends to erode fairly easily.

8.10 Batching sites

- Locate the batching activity in an area of low environmental sensitivity[17] to be identified and approved by the ECO.
- Clear topsoil from the batching site and stockpile for later rehabilitation purposes.
- Cement may not be mixed directly on the ground, but rather on a protective sheet or board.
- Protect the batching plant on the up-slope side by an earth berm or sandbag system to deflect clean surface runoff away from the plant.
- Contain the batching plant on the down-slope side by a trench and earth berm or sandbag system to control contaminated runoff and construction water emanating from within the plant.
- Effluent from concrete batch plants should be treated in a designated sedimentation (sludge) dam to the legally required standards to prevent surface and groundwater pollution.
- Ensure that measures are in place to prevent the overflow of sludge dams during heavy rains and storm conditions.
- Ensure screening and containment are in place to prevent windblown contamination associated with bulk cement silos, loading and batching.

8.11 Water supply

- Use of water resources which flow into the Park, are within the Park or are part of the Park's system must be approved by the ECO, Park Environmental Manager and any other relevant landowner.
- No water may be abstracted from any unapproved water bodies in or outside of the Park for the purposes of construction.
- Ensure that the water use for the project is permissible under the General Authorisation. If not, a water use licence will be required in terms of the National Water Act (refer to **Appendix 2**).

8.12 Power supply

- The power supply to be used is to be approved by the Principal Agent/Engineer and ECO.
- If generators are to be used, establish generators, motors and stored fuel on a hardened, bunded surface and ensure any associated pollution is controlled (Section 9.7).
- Noise from generators must be controlled (Section 9.8.3).

8.13 Sanitation and ablution facilities

- In the absence of permanent ablutions, use portable chemical toilets on site.
- Locate chemical toilets so they can be easily accessed for servicing, but they may not be placed within floodplains, wetlands or closer than 50 m from surface water bodies (unless otherwise directed by the ECO).
- Make provision for regular servicing of chemical toilets. Disposal of the wastes at a formal sewage disposal facility is required. Sewage may not be dumped into the bush.
- Use of the "bush toilet" will not be condoned. Where areas are too remote for the provision and servicing of chemical toilets, the establishment of temporary long drops as an alternative must be

[17] Do not locate batching plants or associated sludge dams within the 1:100 year flood line, or within a horizontal distance of 100 m (whichever is greater) of a watercourse, drainage line or identified wetland, unless unavoidable and approved by the ECO. Do not locate batching plants or associated sludge dams within any riparian vegetation zone.

discussed with the Principal Agent/Engineer and Park Environmental Manager. Strict conditions will apply.

- Water for washing must be provided on site. Site staff are not permitted to use any open water body or other natural water source (e.g. pans) for purposes of bathing, or the washing of clothes, machinery, equipment or vehicles.

8.14 Waste water management facilities

- The Contractor shall design, establish, maintain and operate pollution control facilities necessary to prevent the discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
- Should grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) need to be disposed, link into existing facilities, where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no seepage into wetlands or natural watercourses.

8.15 Solid waste facilities

- Provide a sufficient number of refuse bins/skips that are wind, water and scavenger proof, for the temporary storage of waste.
- Make provision for regular waste collection and disposal (Section 9.4) at a registered waste disposal site.

8.16 Cooking and heating facilities

- No open cooking fires shall be allowed anywhere on site.
- Contained fires (i.e. in a fire drum) shall be allowed for heating and cooking only in designated areas, in other cases cooking is restricted to gas or electrical equipment and shall be located away from flammable vegetation and construction materials.
- Firewood may not be harvested for cooking or heating.

8.17 Fire control facilities and arrangements

- Ensure that the necessary fire fighting equipment is on site, in terms of the requirements of the landowner/manager and surrounding land use and vegetation type.
- Unless stated specifically in the Site-Specific Addendum (**Appendix 4**), the minimum requirements shall include at least rubber beaters when working in "veld" areas and at least one fire extinguisher of the applicable type when welding activities are undertaken, irrespective of the site.
- A minimum requirement for construction in high fire risk areas shall be a water bowser/cart (minimum 5,000 litres) equipped with a pump and hose (minimum 30 m), which shall be permanently on site unless otherwise stated by the ECO.
- The Contractor is to ensure he is aware of the requirements of landowners, especially forestry plantation owners, in terms of fire control regulations on their property.
- Store flammable materials under conditions that will limit the potential for ignition and the spread of fires. Create a fire-break around the storage area, if necessary.
- Observe all regulations governing the storage of flammable materials, including those outlined in the Occupational Health and Safety Act.
- No fires are allowed at the construction site. Cooking and heating facilities, if required, are to be as referred to in Section 8.16.

8.18 Safety and security

- Where relevant, implement security measures to prevent:
  - Access by people with criminal intent.
  - Dangerous animals, such as hippo, rhino, elephant or buffalo, entering the site.
- Comply with the relevant provisions under the Occupational Health and Safety Act, and associated Construction Regulations **(Appendix 2)**.
- Inform staff of the risk of contraction, the symptoms thereof, and the steps for prevention and treatment of the following:
  - HIV/AIDS.
  - Malaria.
  - Tick bite fever.
  - Heat stroke.
  - Cholera (Guidelines for cholera are available from the Department of Environmental Health, Pietermaritzburg).

8.19 Emergency procedures, emergency contact numbers, and first aid

- Provide all site staff with the contact details of organisations and personnel to be contacted in case of emergencies (for example, fire, medical emergencies, chemical spills, vehicle accidents, search and rescue, etc.).
- Pin a laminated notice with these emergency numbers at the construction site, the Contractor's camp and keep a similar notice in the cab of all vehicles used on site.

8.20 Communication with the public and complaints register

- Provide signage in appropriate language(s) at the site or nearest Park entrance gate(s) indicating the contact details of the Principal Agent/Engineer and Main Contractor, in case of public concerns or information requirements. Ensure that all staff are able to provide affected parties or the public with the relevant contact details.
- Provide a complaints register on site and forward such complaints to the ECO on a regular basis.

9. SITE MANAGEMENT DURING CONSTRUCTION

When carrying out the Works during the construction phase, the environmental objective is to minimise the footprint of damage, disturbance and/or nuisance (to the social and biophysical environments), to sustainably manage use of water resources and to prevent pollution. Unless otherwise specified, it is the responsibility of the Contractor to comply with the specifications hereunder.

9.1 Areas occupied and demarcation of site

- Do not use the land forming the site of, or connected with, the works for any purpose whatsoever other than for the proper carrying out of the works under the Contract.
- Maintain demarcation tape/fencing/poles throughout the period of construction.

9.2 Use and maintenance of access facilities

- Record photographically, the state of existing roads that are to be used for access within the protected area, prior to machinery/plant utilising these roads. These are to be reinstated to a state not worse than upon commencement of the project, and to the satisfaction of the Authority and relevant landowner, where applicable.
- No new access roads are to be created within the Park and no temporary deviations will be allowed except under exceptional circumstances and with the prior approval of the Authority.
- Ensure that all existing water attenuation and drainage structures are maintained in a state in which they can optimally perform their function.
- Keep to approved/planned access roads, tracks and turning circles.
- Obey all rules of the road.

9.3 Use of plant and machinery

- At all times, use plant and machinery which is designed for the task in order to minimise the extent of damage to the environment and to minimise the noise levels.

9.4 Solid waste collection and disposal

- Collect all domestic waste in an adequate number of reasonably spaced, scavenger proof litterbins on the Work Site and within the Contractor's camp.
- Keep all Work Sites and the Contractor's camp tidy and litter free at all times.
- Empty litterbins weekly (or as required before they reach capacity).
- No solid waste may be burnt or buried on site or disposed of by any other method on site or within quarries or borrow pits.
- Remove stored domestic waste to the nearest registered solid waste disposal facility.
- Inert, non-toxic building rubble[18] may be stored on site until such time as it can be transported from site to an approved landfill or, with the consent of the ECO, used for levelling or filling purposes.

[18] Building rubble used for filling or levelling purposes is not classed as waste in terms of Waste Regulations as promulgated (GN 1986 GG 12703 of 24 August 1990) under the Environment Conservation Act, 1989 (Act No 73 of 1989).

9.5 Liquid waste

- Grey water may not be discharged directly into any water body (stream, river, dam, wetland, pan etc.) or drainage line.
- No uncontrolled discharges from the site/working area to the watercourse shall be permitted.
- Any water that is discharged from site is to comply with the relevant Water Quality Guidelines implemented by the Department of Water and Sanitation (DWS).
- Where effluent is discharged into the environments of the listed RAMSAR sites in the Park (St Lucia System, Lake Sibaya, Kosi Bay system and the turtle beaches and coral reefs of Thongaland) effluent quality is to comply with DWS Special Limits (Appendix 2) and must have the necessary discharge permits from the Department of Water and Sanitation and the Department of Environmental Affairs (Oceans and Coast).
- Provide suitable, sufficient and conveniently located sanitation facilities as per Section 8.13.
- Toilets are to be regularly emptied and serviced. Sewage must be disposed at an approved wastewater treatment site and may under no circumstances be dumped in the bush or buried. The Contractor will be entirely responsible for enforcing their use and for maintaining all toilets in a clean, orderly and sanitary condition.

9.6 Hazardous substances and hazardous waste

- Ensure compliance with all national, regional and local legislation with regard to the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials. The onus is on the Contractor to identify and interpret the applicable legislation.
- Position hazardous substances stores as indicated on the approved construction site layout plan, in areas not threatening human life or the environment.
- Keep a record of all hazardous substances stored on site for submission to the ECO.
- Store all hazardous substances in secure, safe and weather-proof facilities, underlain by a bunded concrete slab to protect against soil and water pollution.
- Provide for controlled loading/unloading areas, underlain by an impervious paving or PVC sheet to protect against soil and water pollution.
- Ensure that personnel handling hazardous substances have been educated in terms of the correct handling, use and disposal thereof.
- Empty containers in which hazardous substances were kept are to be treated as hazardous waste.
- Drip trays must be used where dispensing mechanisms or stored receptacles may leak.
- Under no circumstances shall the spoiling of bituminous products on the site, over embankments, in borrow pits or any burying be allowed.
- No spillage of bituminous products shall be allowed on site. Special care should be taken to avoid spillage of tar products such as tar prime or pre-coating fluid to avoid water-soluble phenols from entering the ground or contaminating water.
- Unused or rejected bituminous products shall be removed from site and taken to the supplier's production plant.
- Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery should be collected in a holding tank and returned to the supplier.
- All used filter materials should be stored in a secure bin for disposal off site. Hazardous waste shall not be stored or stockpiled in any area other than that designated on the construction site layout.
- Solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste. Refer to Section 9.7 for further specifications on dealing with cement/concrete.
- Regularly dispose of all hazardous waste not earmarked for reuse, recycling or resale (such as oil contaminated with chlorinated hydrocarbons, bitumen, tar, electrical cleaning solvent, certain chemicals and fluorescent tubes) at a registered, licensed hazardous waste disposal site.

9.7 Control of pollution

- Do not locate any depot for any substance which causes or is likely to cause pollution within the 1:100 year flood line, or within a horizontal distance of 100 m (whichever is greater) of a watercourse, drainage line or identified wetland.
- Do not dump waste of any nature, or any foreign material into any river, stream, drainage line or wetland.
- Do not allow the use of any river, stream drainage line or wetland for swimming, bathing, or the cleaning of clothing, tools or equipment.
- Prevent the discharge of water containing polluting matter or visible suspended materials, fines and sediments directly into drainage lines or wetlands.
- Deflect any unpolluted water/runoff away from any dirty area (including plants, maintenance areas, workshops and Contractors' yards).
- Take special care during rainy periods to prevent the contents of sumps and drip trays from overflowing.
- Vehicles may not be serviced or repaired on site (other than emergencies).
- Ensure that an emergency preparedness plan is in place for implementation in the case of a spill or the release of substances that can be harmful to an individual or the receiving environment.
- Ensure that accidental oil or fuel spills or leakages (other than those classed as an emergency) are immediately contained and cleaned up.
- Carefully control all on-site operations that involve the use of cement and concrete (this applies to areas other than the batching plant). Limit cement and concrete mixing to single sites, where possible.
- Use plastic trays or liners when mixing cement and concrete. Do not mix cement and concrete directly on the ground.
- Dispose all visible remains of excess cement and concrete after the completion of tasks. Dispose in the approved manner (solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste).
- Contain water and slurry from cement and concrete mixing operations as well as from batching area wash bays. Direct such wastewater into a settlement pond or sludge dam for later disposal.
- Do not allow the washing of trucks delivering concrete anywhere but within designated wash bays equipped with runoff containment. Direct such wastewater into a settlement pond or sludge dam for later disposal.
- Clean out all sludge dams on a regular basis, and dispose of sludge at a licensed facility.
- Scrape waste concrete and cement sludge off the site of the batching plant on a regular basis, and dispose as inert construction rubble.
- Unused cement bags are to be stored so as not to be affected by rain or runoff events.
- Used cement bags shall be disposed by the Contractor at a licensed waste disposal facility.
- After closure of the batching plant or any area where concrete was mixed, all waste concrete/cement sludge shall be removed together with contaminated soil. The surface shall then be ripped to a depth of 150 mm and the topsoil replaced evenly over the site and re-grassed as per the environmental specification.
- Remove all excess aggregate and sand.
- Fume emissions are to be controlled through servicing of vehicles.
- Where, due to construction requirements, pollution of a water body may potentially occur, ensure protection measures (e.g. attenuation/settlement dams/oil absorbent products) are in place to prevent pollution. Treatment of liquid waste should take place away from the construction site.
- In the event of pollution of a water body (including sediment loading), the Contractor shall provide alternative water supply to users of that water body until the quality of the water body is restored to its previous unpolluted state. For the sake of this Overarching EMPr, pollution is deemed to be a state that is sub-standard to the normal quality of the water body, but is not necessarily in contravention of the South African Water Quality (SAWQ) guideline standards for a prescribed activity.

- The Contractor is liable for the costs of remedying damages resulting from pollution, in accordance with Section 28 of the National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA).

9.8 Nuisance control

9.8.1 General

- Obey Park Rules[19], including adhering to the speed limits indicated for Park roads.
- Operate and secure vehicles and equipment in such a way as to minimise risk to the public.
- No construction staff should approach residents living within or visitors to the Park, for whatever reason, without the knowledge and permission of the Principal Agent/Engineer.
- Conduct all activities with due regard and consideration of Park visitors and staff, minimising interference with the normal activities of the public and Park staff, and disruption of Sense of Place within the Park.

9.8.2 Accommodation of traffic, access and services

- Where relevant, accommodation and control of traffic and access to affected locations in the Park are to be undertaken in accordance with engineering specifications in the Contract documents.
- Disruption of services, e.g. water and electricity, and access to property, must be kept to a minimum at all times. Where such disruption is unavoidable, affected parties must be given two weeks prior notification by the Contractor.

9.8.3 Noise and vibration

- Undertake the necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels[20].
- Construction activities generating output levels of 85 dB (A) or more (excessively noisy), in the Park or near human settlement, are to be confined to working hours (08h00 - 17h00) Mondays to Fridays.
- "Normal" or "noisy" working hours will only be extended with the prior written approval of the Principal Agent/Engineer and ECO who has been notified, at least seven days in advance, of the impending work requiring extension.
- Maintain machinery and vehicle silencer units in good working order. Offending machinery and/or vehicles shall be banned from use on site until they have been repaired.
- Maintain appropriate directional and intensity settings on all hooters and sirens.
- In special cases, such as near crocodile breeding sites, extra measures may be required to reduce noise and vibration. This will need to be discussed on site with the ECO, Principal Agent/Engineer and Contractor.

9.8.4 Dust

- Control dust at all times on the site, access roads, borrow pits and spoil sites with water, chemical soil stabilisers or temporary surfacing as specified by the Principal Agent/Engineer.

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19 Park Rules will be contained in the contract documents or, if not, are obtainable from iSimangaliso via the Principal Agent/Engineer.

20 According to the Environment Conservation Act, 1989 (Act No. 73 of 1989): Noise Control Regulations (No R 1997) and the local by-laws regarding noise. No provincial Noise Control Regulations have been promulgated in KwaZulu-Natal, therefore, the national Noise Control Regulations of the Environment Conservation Act, 1989 (Act No 73 of 1989), Government Notice Number GN 154 of Government Gazette 13717 of 10 January 1992, apply.

- Dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments. These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.

9.8.5 Complaints

- Forward complaints recorded in the complaints register (Section 8.20) to the Principal Agent/Engineer and ECO on a regular basis.
- Complaints from the public with regard to interference from contract staff shall be regarded in a serious light, and the offender(s) should be subject to disciplinary action. The disciplinary action is to be imposed by the Employer or his representative. If the staff member was acting outside of the site of the works and was contravening Park regulations or legislation, action will be taken by the Authority.

9.9 Fire control

- Ensure that the Work Site, the Contractor's camp and all living quarters are equipped with adequate fire fighting equipment, specific to the classes of fire likely to occur.
- No open fires are permitted anywhere on site.
- Do not permit any smoking within 3 m of any fuel or chemical storage area, or refuelling area.
- If fire damage to the Park and/or adjacent area is caused by the Contractor or any staff involved in construction activities, the Contractor will be responsible for the costs incurred for control or repair activities.

9.10 Borrow pits and rock quarries

- Where it is required to import material, this shall be from legal[21] commercial sources or legal borrow areas outside of the Park. Sources of material are to be approved by the ECO, to ensure that no importation of alien invasive plant seeds or other potentially hazardous substances enters the project environment.
- Do not commence with quarrying activities before the necessary DME approvals are in place (**Appendix 2**).
- Comply with the provisions of the environmental management programme for the development, use and rehabilitation of the particular borrow pit. Of particular importance is to:
    - Remove and separately stockpile topsoil and overburden for use during rehabilitation, locating these in areas where they will not be disturbed by the progress of the gravel pit/quarry.
    - Avoid stripping material to bedrock. This limits rehabilitation potential for these areas.
    - Minimise the flow of any surface water or floodwater into borrow areas. Where necessary, protect borrow areas by an earth berm or sandbag system to deflect clean surface runoff away from the excavations.
    - Allow for the natural free drainage of borrow areas. All borrow areas must be drained unless otherwise specified.
    - Bury coarse material incapable of supporting vegetation beneath the finer material.

21 In terms of the requirements of the National Mineral and Petroleum Resources Development Act, 2002.

9.11 Excavations and trenches

- For all excavations, topsoil is to be removed and stockpiled for later rehabilitation.
- For significant (large and/or rare) trees identified by the ECO, trenching must be outside the drip line of the tree as specified by the ECO.
- Excavate and backfill trenches on a progressive basis. Where trenches pose a risk to human or animal safety, they are to be cordoned off to prevent people and animals falling in and getting trapped and/or injured. During breaching the contactor needs to avoid pollution of river water leading to water quality deterioration.
- Stockpiling of sand during the breaching process should be situated on the bank opposite the maintenance area, in order to minimise the stockpiled sand being washed into the River and/or ocean.
- Only temporary stockpiling of excavated sand is allowed during the breaching process and this should be away from the inundation level.

9.12 Management of topsoil

- Topsoil is to be handled twice only: once to strip and stockpile, and once to replace and level.
- Ensure that all topsoil is stored in such a way and in such a place that it will not cause the damming up of water, erosion gullies, or wash away itself.
- Protect topsoil stockpiles from erosion by wind and water.
- Do not compact topsoil in any way.
- Remove exotic/invasive plants and broad leaf weeds that emerge on topsoil stockpiles.
- Ensure that topsoil is at no time buried, mixed with spoil (excavated subsoil), rubble or building material, or subjected to compaction or contamination by vehicles or machinery. This will render the topsoil unsuitable for use during rehabilitation.
- The Contractor will be held liable for the replacement of any topsoil rendered unsuitable for use during rehabilitation, for reasons due to his negligence or mismanagement on site.
- No material stripped or excavated, which is classed in terms of this Overarching EMPr as topsoil, should be used as backfill in any excavation.
- Stockpile topsoil for the minimum time period possible, i.e. strip just before the relevant activity commences and replace as soon as it is completed.
- Topsoil is to be replaced along the contour.
- Topsoil is to be replaced to a depth specified by the ECO by direct return (i.e. replaced immediately on the area where construction is complete), rather than stockpiling it for extended periods, where feasible.

9.13 Spoil

- No spoil sites are to be created in the Park unless the material can be used to rehabilitate previously disturbed areas as part of on-going maintenance or in the construction of other infrastructure. This may only occur at the discretion and with the approval of the Park Environmental Manager.
- Spoil sites outside the Park shall be determined on site in conjunction with the Principal Agent/Engineer, the ECO and affected landowners/residents. The Contractor shall be permitted to use only those spoil areas approved by the Principal Agent/Engineer.
- Dumping of material over embankments is not permitted.
- Position spoil sites as indicated on the approved construction site layout plan. No spoil site shall be located within 500 m of any watercourse, nor in sensitive areas identified by the ECO.
- Position spoil sites on the higher side of a disturbed area, and above a 1:20 year flood line, wherever possible.
- Ensure that all spoil is stored in such a way and in such a place that it will not cause the damming up of water, erosion gullies, or wash itself away.
- Do not store spoil in drainage lines.
- Rehabilitate any permanent spoil dumps as soon as work in that area is complete.
- In general, no slopes steeper than 1(V):3(H) will be allowed.

- Bury the coarser material beneath the finer material, and overlay all permanent spoil heaps with a layer of topsoil at least 200 mm thick.
- Grass as directed by the ECO.

9.14 Erosion control

- Minimise clearance of vegetation. Retain natural trees, shrubbery and grass species, wherever possible.
- Cut slope gradients must not exceed the natural angle of repose for the particular soil type, wherever possible.
- In general, slopes should not be steeper than 1(V):3(H). Where steeper slopes are necessary, they must be stabilised using the most appropriate method and technology as specified by the Principal Agent/Engineer.
- Finish cut and fill slopes as roughened surfaces which emulate the natural surroundings and accumulate soil.
- Do not allow surface water or storm water to be concentrated, or to flow down cut or fill slopes or along pipeline routes without erosion protection measures being in place.
- Line overflow and scour channels with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge must be at a point where there is dense natural grass cover.
- Ensure that channels do not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.
- Protect all areas susceptible to erosion[22] and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
- Repair all erosion damage as soon as possible and, in any case, not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth.

9.15 Weed and invader plant control

- All sites disturbed by construction activities are to be monitored by the ECO for colonisation by invasive alien plant species.
- The Contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction and rehabilitation phase.
- Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion.
- The ECO shall identify those plants that require removal during both the construction and maintenance period, for the Contractor's action.
- The ECO shall provide advice as to effective methods of removal and control of alien plant species, which may be based on Working for Water Guidelines.
- Alien plant control measures are to be carried out at the cost of the Employer unless the area of development is adopted as part of the alien plant control programme implemented by the Authority.

22 This may include:
- Use of approved groundcover or grass.
- Construction of cut off berms (earth and/or rock pack). These are to be angled across the contour and normally would approximate an angle of 30° from the bisector of the contour.
- Placing of brushwood on bare surfaces.
- Other technical methods as directed by the Engineer.

9.16 Cutting of trees

- No protected trees or plants may be cut, disturbed, damaged or destroyed without the necessary permits and/or permission of the ECO (Section 7.3, 8.5, 8.6, **Appendix 2**).
- Any indigenous trees or bush that require removal in terms of the project must be timeously indicated to the ECO and approved prior to work affecting them (Section 8.6).
- Any branches of indigenous trees which require removal are to be properly pruned under direct, competent supervision and sealant applied to cut surfaces bigger than 50 mm in diameter.
- Cutting of trees should be undertaken in a way that no nest (birds or other) is in the cut portion unless approval has been obtained from the ECO. The ECO should consider the conservation status of the animal species in question before making a decision. Epiphytes (orchids and any other species identified by the ECO) are to be removed and relocated under the supervision of the ECO

9.17 Transplanting of indigenous trees and plants

- If required, the Contractor shall transplant designated plants to alternative locations as identified by the ECO, upon the instruction of the Principal Agent/Engineer, at the cost of the Employer. Undertake transplanting as described hereunder.

9.17.1 Removal

- Mark the orientation of the tree/shrub (for example, the north-facing side of the trunk indicated by a small arrow made with indelible ink). Do not scratch a mark on the surface of the trunk.
- Delineate a circle from the trunk with a radius equivalent to the drip-line of the tree, or as indicated by the ECO on site.
- Excavate the tree with an intact root ball.

9.17.2 Replanting

- A hole 500 mm larger in diameter than the anticipated root ball must be prepared in advance of the tree removal in order that the tree can be replanted immediately.
- Fill holes with water, which must be allowed to seep in before planting.
- Position the tree as per its original orientation.
- A planting method known as "puddling" must be employed. This method involves the addition of soil and water simultaneously to expel air from the planting hole. Place the tree in its new hole, making sure the top surface of the root ball is level with the ground level. Place a hosepipe in the hole and leave it running whilst extra soil is added around the root ball.
- "Compact" the tree in the hole and support with stays for stabilisation.
- Water trees at least once a week or as instructed by the ECO.

9.18 Wild animals

- All staff are to attend the course on Dangerous Animals (Section 7.9).
- Make all waste bins scavenger proof and prevent access to sources of food.
- Depending on the specific area of the Park, dangerous animals may include elephant, hippo, buffalo, crocodile and rhino. It is likely that these animals will avoid the sites of construction activity. However, should it be necessary, the Contractor may request the services of an EKZNW field ranger. This must be negotiated, with the assistance of the Principal Agent/Engineer with the relevant EKZNW Officer-in-Charge, and will be at the Contractor's cost.
- Management of bats resident in existing buildings, which are to be demolished or upgraded, will be required. The advice of relevant EKZNW ecological staff and/or outside organisations such as the Bat Interest Group should be sought prior to construction activities commencing. Activities which may harm flightless (baby) bats can be avoided by working outside of the breeding season (March to September). Bat houses may need to be provided to accommodate displaced bats.
- The design of new buildings should aim to prevent bats from entering and taking up residence in roofs/ceilings, etc.
- Under no circumstances may any animals be fed, handled, removed, snared, shot, killed or otherwise interfered with.
- If a particular animal species is perceived to become a pest or hazard, the Contractor may apply to the Principal Agent/Engineer and ECO for a mitigation programme to be established.
- No marine animals should be captured or interfered with during the breaching process
- No fishing should take place at any water courses or within the ocean or River without any relevant authorisation.
- Any vehicle/ machinery/ equipment permitted to operate in watercourses or marine environments will be free of leakages of grease, oils, or other materials that could contaminate watercourses/ the marine environment. Any leaking/ leaked petroleum product reasonably associated with a vehicle/ machinery/ equipment having been in contact with flowing or standing water would constitute non-compliance.
- If threatened or endangered marine species are observed during construction/ maintenance phase, work that could impact these resources shall be stopped and the appropriate officials contacted.
- Disruption to the normal behaviour of marine mammals in the project area during project construction and/or maintenance is prohibited.

9.19 Cultural and natural heritage resources

- If any heritage resources, artefacts, graves and the like are discovered during the course of the work, they should be cordoned off and the provincial or national cultural heritage resources authority must be notified. Further destructive work at these sites may only continue once they have been assessed and the necessary permits granted.

9.20 Special environments

9.20.1 Wetlands

- Working within wetlands and within 32 m of the temporary edge of the wetland zone, is to be avoided.
- Where it is unavoidably required to work in a wetland, obtain the necessary licences from DWS prior to construction commencing (Section 7.3, **Appendix 2**).
- Construction should not permanently alter the surface or subsurface flow of water through the wetland.
- No construction materials are to be stockpiled in any wetland areas.
- No spoil material is to be deposited in wetland areas.

- No toxic or harmful substances may be used without prior approval of the Authority. Should approval be given, strict management thereof must be applied, including meeting legal requirements.
- No vehicles are to be driven through or in wetland areas.
- When trenching through wetlands and drainage lines, return the profile of the wetland/drainage line to one similar to the pre-construction profile. No ridge or channel feature may remain.
- No drains channelling concentrated runoff may be directed into wetlands of any type.
- During construction through a wetland, the majority of the flow of the wetland must be allowed to pass down the stream (i.e. no damming must be allowed to take place). In-stream diversions must allow for continuous water flow. The construction of new channels shall not be allowed.

9.20.2 Indigenous forest and indigenous grassland

- Minimise the footprint of all construction activities when working within or adjacent to indigenous forest or grassland vegetation by implementing the following measures:
  - Clear the working corridor or development site to the minimum required width (and length).
  - Make use of existing cleared or disturbed areas for site camps, stockpiling of materials, vehicle turning points, etc. Do not clear any new areas for these purposes within indigenous forest vegetation.
  - Do not make any new access roads through this vegetation and confine movement of staff and vehicles to designated areas.
- Trim trees where possible rather than removing them. Trimming should be done under skilled supervision.
- No toxic or harmful substances may be used without prior approval of the Authority. Should approval be given, strict management thereof must be applied, including meeting legal requirements.
- The ECO may rescue smaller plants such as herbs, orchids and shrubs for use in a rehabilitation programme. Brush can be used for erosion control. Wood from large trees should be used as specified by the ECO.

9.20.3 Rivers and streams

- A method statement, which is approved by the ECO, is to be provided for river and stream crossings. This should include:
  - Detailed plan of crossing, including pipe protection works.
  - How water flow shall be diverted during construction.
  - Containment of contaminated runoff and waste water.
  - Width of working servitude.
  - Final expected profile of river/stream banks.
  - Reinstatement and rehabilitation of river/stream banks.
- Remove herbaceous riparian vegetation as indicated by the ECO, with their root ball intact. This vegetation is to be kept moist by means of placing it in the shade, covered with moistened hessian cloth until it is replanted.
- Do not modify the banks or bed of a watercourse unless specified by the Principal Agent/Engineer with the approval of the ECO. The Contractor shall not cause physical damage to any aspect of a watercourse, other than that necessary to complete the works specified, and in accordance with the accepted method statement.
- Rocks for use in gabion baskets/reno mattresses may not be obtained from a watercourse.

9.21 Artificial breaching

In order to protect the biodiversity for the ecological benefits, during artificial breaching the following needs to be considered and cautiously practiced during construction/maintenance phase:

- Care should be taken if the water levels in the estuary in spring and summer are between 1.3 and 1.6 m MSL for too long. If the salt marshes during this critical time of their life cycle are inundated for too long they start to die-back and breaching would be advisable.
- It is recommended that breaching should be 3 or 4 days before spring tide. Breaching at this time ensures good additional flushing during the following spring tide.
- A deep and wide trench should be excavated before breaching.
- A considerable amount of water is sometimes needed to flush open a small, narrow trench to a medium sized trench. A larger initial trench will result in higher flow velocities and more sediment being flushed out to sea.
- It is recommended that breaching should be practiced after high tide as possible to allow more water outflow. Breaching during high tide may result in sea water pushing into the estuary especially if there are low flows from the estuary. It is therefore recommended that the ideal breaching that yield maximum results should be done to coincide with the low spring tide as that will allow more time for water to drain into the sea.
- The actual moment of breaching during the tidal cycle is at high tide or, waves permitting, as close after high tide as possible.
- High waves can sometimes interfere with the breaching process at high tide and shortly after high tide. It is therefore important to watch the effect of the waves in front of the mouth. The mouth can be breached as soon as it is considered that the waves will no longer interfere significantly.
- The high outflow after breaching which causes the scouring lasts over several hours and often more than a tidal cycle. The maximum outflow normally occurs approximately 4 to 8 hours after a breaching and the flow velocities will be increased if there is a greater difference in water levels between the estuary and the sea.
- The breaching of a mouth can become difficult and sometimes even impossible when the waves are very high. In such conditions and if direct problems because of flooding do not exist, it may be better to postpone the breaching by a few days.
- The position at which a mouth should be breached should accurately be positioned as there is often considerable controversy concerning the location where a mouth breaching should take place. This should be done even if a greater amount of sediment needs to be excavated, because this is the optimum position for a successful breaching. However in the case where breaching has historically been undertaken at a particular and same point (such as in the St Lucia Estuary system) this must not be altered.
- An estuary mouth is highly dynamic and unforeseen events may require special management actions. For example, if the mouth stays open for a very long period it may migrate and start to cut into dunes.
- No specific levels of height and width of a sand berm at the mouth of an estuary during breaching have been determined at this stage, as this is usually considered together with all the other factors discussed during the practical breaching process and will be included in site specific measures. However precaution on the channels should be considered.
- Appropriate use of machinery within water courses
- Demarcating and fencing-appropriate barricading material should be used to demarcate the site during breaching
- Anti-erosion measures-ISimangaliso Wetland Park authority should instruct the appointed contractor to implement erosion prevention measures, should it be required.
- Fuel and Service areas -storage of any fuel or other petroleum products is prohibited on site
- Refuse-Any boards or barricading material erected must be removed once the work is complete and all waste to be removed to appropriate waste disposal facilities.
- Breaching activity only involves moving sand and therefore no foreign material should be deposited on site.
- Location and timing- breaching should be timed to ensure maximum outflow occurs during daylight hours, to avoid a repeat of a previous incident

- Breaching should be conducted just before high tide to ensure that the tide is receding by the time the outflow starts gaining momentum, reducing any obstruction by the sea. For the same reason, breaching should not take place during high swell and surf conditions, which would also carry flushed sediment back into the estuary.
- Public safety and law enforcement should be considered during breaching process
- Impact on estuarine fish abundance, species richness/ community composition -Artificial breaching may be necessary in order to maintain the ecological functioning of the estuary and its value as a nursery for fish. Recruitment into marine fisheries also depends on juveniles and sub-adults surviving the estuarine environment, including high fishing effort.
- Hazardous spill- Breaching will only be considered if the hazardous substance holds no risk to the near shore environment and the spill is registered as a disaster. In the event of an oil spill at sea, the mouth can temporarily be closed to prevent oil from entering the system.
- Minimum breaching level (water level should be as high as possible before breaching)
- The beginning of spring (September), to ensure ecological functioning and to coincide with the end of the hydrological year. Normally the mouth should be breached about three/four days before a springtide in September. Early in September is more beneficial for fish.
- Consider safety of public during breaching -Care should be taken with the general public to ensure their safety. The area where breaching will take place should be cordoned off with the aid of red and white hazard tape to keep the public out. Ideally an official or security person must man the area in question. Temporarily close the designated area in circumstances that could pose a danger to the human life or property. This must be accompanied by appropriate signage.
- Breaching trench to maximize outflow.
- Disposal of sediment removed during excavation -The sand excavated from the trench should not be stored on the banks next to the trench but rather be pushed out into the sea where wave action will transport it away. Otherwise, the sand stored on these banks will drop back into the excavated channel reducing the effectiveness of the outflow and the wider and deeper scouring of this trench. In the unlikely event of marine sediment remaining on the beach after a breaching, no additional action is required as it will generally wash away after a few high tides.
- Mobilizing machinery and equipment on site during breaching-Equipment and machinery to be utilised in a breaching must be in a good and functional state. The contactor should ensure that oil leaks are not to cause additional pollution.
- Care should be taken to ensure that earth moving equipment do not disturb indigenous vegetation of conservation worthiness en route to the excavation site. Bird nesting areas are to be avoided. Where possible, existing access roads / tracks should be used. Once it has been established that a clear outflow channel has formed and breaching is progressing on its own momentum, the earth moving equipment may be removed from the beach. Implement an appropriate crowd control mechanism,
- Ensure that all users adhere to the local authority By-Laws relating to the designated areas at all times. The legal requirements associated with the use of the designated area must be brought to the attention of all persons that are granted access to the designated area by the applicant.
- Noise & light pollution during a breaching should be kept to a minimum and within the relevant noise control by-laws/regulations of the iSimangaliso wetland park.
- Verifying that the sand berm at the mouth is high enough above the water line that there is no risk of "fluidization" of berm sediment (i.e. turns to quicksand) and associated risk to operator and equipment;

9.22 Health and safety

- Adhere to the requirements of the Occupational Health and Safety Act, and associated Construction Regulations (**Appendix 2**).
- Ensure that emergency numbers and First Aid supplies are always easily accessible.
- Obey speed limits and travel more slowly where conditions dictate.

- Ensure that operators and drivers limit their potential to endanger humans and animals at all times, by observing strict safety precautions.

10. REINSTATEMENT AND REHABILITATION

The objective of reinstatement and rehabilitation is to ensure that all areas disturbed by the project are returned to a state not worse than before the project commenced.

10.1 Areas to be reinstated and rehabilitated

- Reinstatement and rehabilitation are required for all areas disturbed by the project. This includes the entire development site, access roads, construction camps and servitudes for any services that may have been established.
- The Contractor shall reinstate and rehabilitate all disturbed areas outside the demarcated working area at his own cost and to the satisfaction of the ECO.

10.2 Progressive reinstatement and sourcing of plant material

- The concept of progressive reinstatement is fundamental to cost effective (both financial and environmental) rehabilitation of a site. This concept must be followed at all times.
- Where landscaping is utilised, the concept is to use and restore indigenous plants occurring within a 50 km radius to the site, in accordance with the concept of xeriscaping[23].
- The area from which this material is taken must be approved by the ECO and Park Environmental Manager, and must not result in environmental degradation.
- Only in exceptional circumstances will sourcing of plant material from further afield or grass seed mixes be considered and approved by the Park Environmental Manager.

10.3 Housekeeping

- All areas are to be cleared of rubble associated with construction. This includes the removal of surplus materials, excavation and disposal of consolidated waste concrete and concrete wash water, litter, etc.
- All soil contaminated by hydrocarbons, for example, from leaking machines, refuelling spills etc., is to be excavated to the depth of contaminant penetration, placed in 200 litre drums and removed to a licensed hazardous waste landfill site.

10.4 Finishing

10.4.1 Final grading

- Final levels of all disturbed areas are, where feasible, to be consistent with the natural topography of the area.
- All drainage lines affected by construction are to be reinstated to approximate their original profile. Where this is not feasible due to technical constraints, the profile is to be agreed upon by the ECO and Principal Agent/Engineer.
- All compacted (disturbed) areas (including stockpile areas) are to be ripped (along the contour) to a depth of 150 mm prior to the replacement of topsoil, except where otherwise specified in the Site-Specific Addendum to this Overarching EMPr.

[23] Landscaping with vegetation that has a low water usage. The objective is to conserve as much water as possible, whilst still beautifying an area (i.e. conservation and aesthetics). The concept embraces utilising indigenous plants occurring within a 50 km radius of the development site.

10.4.2 Top soiling

- Topsoil is to be replaced to the required depth as specified by the ECO.
- Topsoil is not to be compacted but, once replaced, is to be scarified consistent with the natural contour.

10.5 Reinstatement of wetland areas and water courses

Where water courses or wetlands have been affected by construction activities:

- Ensure that watercourse banks are returned to their original profile.
- The surface reinstatement of wetland areas is to ensure that no depressions remain that could act as channels for preferential water flow (thereby affecting the hydrological regime of the wetland).
- The Contractor shall preserve all riparian and wetland vegetation for use in rehabilitation of those environments. This vegetation is to be kept moist at all times. It is to be placed in the shade and covered with moistened hessian cloth until replanting, which is to be undertaken immediately that surface reinstatement is complete.
- Plants are to be, as nearly as possible, replanted in areas from which they were removed.

10.6 Vegetation re-establishment

- All areas disturbed by contract activities are to be revegetated to the satisfaction of the ECO.
- Refer to Section 10.2 regarding progressive reinstatement, xeriscaping and sources of plant material.
- Methods of vegetation removal and re-establishment, where required, shall be specified by the ECO, in terms of:
  - Removal and storage of vegetation.
  - Source of vegetative material.
  - Ground preparation.
  - Weed removal.
  - Irrigation.
  - Planting times.
- Fertilisers and compost may not be used unless agreed to by the Park Environmental Manager.
- Where there is a possibility of game grazing a rehabilitated site, the game should, as far as is practicable, be excluded for the first three months of re-grassing, by placing brushwood over the rehabilitated areas, as approved by the ECO.

10.7 Alien plant control

- Alien plant control measures are to be carried out at the cost of the Employer unless the area of development is already being controlled as part of the Park's alien plant control programme.
- All sites disturbed by construction activities shall be monitored for colonisation by invasive alien plant species.
- The ECO shall identify those plants that require removal during both the construction and maintenance period, for the Contractor's action.
- The ECO shall provide advice as to effective methods of removal and control of alien plant species, in accordance with applicable legislation (Appendix 2).
- Existing alien plants are to be removed and their spread prevented.

11. COMPLETION OF CONTRACT

- Prior to completion of the Contract, the Principal Agent/Engineer is to timeously notify the ECO and Park Environmental Manager of "Practical Completion" meetings or "snagging" periods, to provide them with the opportunity to identify work outstanding or incomplete (snags).
- The ECO is to timeously submit a snag list prior to the date for completion.
- The Principal Agent/Engineer is to timeously notify the ECO and Park Environmental Manager of "Completion" meetings so that the work can be signed off.

12. MAINTENANCE

iSimangaliso regularly undertakes maintenance activities within the Park. The environmental specifications contained in this EMPr have been specifically designed to be applicable to maintenance activities as supplemented by site-specific mitigation and management measures (where required).

APPENDIX 1 - DEFINITIONS

Alien species
(a) A species that is not an indigenous species.
(b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Artificial Breaching
When used in the context of this document artificial breaching would mean breaching in instances where such an action is required for ecological reasons indicated in this document and also provided for in the approved Estuarine Management Plans of the iSimangaliso Wetland Park.

Contractor
This is a person/company in the employ of the Employer, acting for the Employer or has a written agreement with the Employer. This applies to both principal and sub-contractors.

Employer
Employer" means the client, developer, landowner or land manager commissioning the project.

Engineer
"Engineer" means the engineering company acting through a Director, a Partner or an official authorised thereto in writing responsible for design and project management. (The Engineer is also sometimes referred to as the Project Manager). For certain projects, this role is undertaken by another professional person responsible for the design and/or management of the contract/s, referred to as the Principal Agent.

Engineer's Site Representative
An on-site representative of the Engineer, who is responsible for day-to-day management of the project.

Environmental Control Officer (ECO)
Either a staff member of the Employer or Principal Agent/Engineer, or an Environmental Consultant assigned to the project on a part- or full-time basis. The Environmental Control Officer shall be a member of the core regulatory team and shall advise the Principal Agent/Engineer and Park Environmental Manager on all environmental matters relating to the development.

Environment
"Environment" means the surroundings within which humans exist and that are made up of:
(a) The land, water and atmosphere of the earth.
(b) Micro-organisms, plant and animal life.
(c) Any part or combination of (a) and (b) and the interrelationships among and between them.
(d) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Forest
Includes:
(a) A natural forest, woodland and a plantation.
(b) The forest produce in it.
(c) The ecosystems which it makes up.

Environmental Manager
Appointed representative of the Authority, responsible for environmental management as required by the Authority. For specific projects, this role may be assigned to EKZNW Conservation Staff or an Environmental Consultant.

Interested and Affected Parties (I&APs)
All persons who may be affected by the project either directly or indirectly, or who have an interest or stake in the area to be affected by the project. I&APs include landowners, tribal or local authorities, local residents, tourists, public interest groups, etc.

Natural Forest
"Natural forest" means a group of indigenous trees:
(a) Whose crowns are largely contiguous.
(b) Which have been declared by the Minister to be a natural forest.

Principal Agent
"Principal Agent" means the company acting through a Director, a Partner or an official authorised thereto in writing responsible for the administration of the project on behalf of the Employer. (The Principal Agent is also sometimes referred to as the Project Manager).

Principal Agent's Site Representative
An on-site representative of the Principal Agent responsible for day-to-day management of the project.

Progressive Reinstatement
Reinstatement of disturbed areas to topsoil profile on an on-going basis immediately after selected construction activities (e.g. backfilling of a trench) are completed. This allows for passive rehabilitation (i.e. natural recolonisation by vegetation) to commence.

Prospecting
Intentionally searching for any mineral by means of any method:
- Which disturbs the surface or subsurface of the earth, including any portion of the earth that is under the sea or under water.
- In or on any residue stockpile or residue deposit, in order to establish the existence of any mineral and to determine the extent and economic value thereof.
- In the sea or other water on land.

Rehabilitation
Rehabilitation is defined as the return of a disturbed area to a state, which approximates the state (where possible), which it was before disruption. Rehabilitation for the purposes of this specification is aimed at post-reinstatement revegetation of a disturbed area and the achievement of a stable land surface. Revegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.

Riparian Vegetation
Vegetation occurring on the banks of a river or stream (i.e. vegetation fringing a water body). In this specification, riparian vegetation in terms of removal, storage and replacement is only applied to sedge, grass, groundcover, reed, bulrush, or herbaceous component of riparian vegetation and excludes the woody component.

Solid Waste
Means all solid waste, including construction debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Subsoil
Subsoil is the soil horizons between the topsoil horizon and the underlying parent rock. Subsoil often has more clay-like material than the topsoil. Subsoil is of less value to plants, in terms of nutrient (food) and oxygen supply, than topsoil. When subsoil is exposed it tends to erode fairly easily.

Tree
"Includes any tree seedling, sapling, transplant or coppice shoot of any age and any root, branch or other part of it".

Topsoil
This is defined as the A horizon of the soil profile. Topsoil is the upper layer of soil from which plants obtain their nutrients for growth. It is often darker in colour, due to the organic (humic) fraction. Topsoil is deemed for the purposes of this specification as the layer of soil from the surface to the specified depth required for excavation. Where topsoil is referred to, it is deemed to be both the soil and grass/ground cover fraction.

Waste Water
Means water contaminated by the Contractor's activities.

Water Body
Any open body of water including streams, dams, rivers, lakes, and the sea.

Wetland Vegetation
Vegetation that is indicative of a wetland environment, e.g. sedges, rushes, reeds, hydrophilic grasses and ground-covers, but for the purposes of this specification excludes woody species.

Wetland
A seasonally, temporally, or permanently wet area, which also may exhibit a specific vegetation community. It is often marshy in character.

Woodland
A group of indigenous trees which are not a natural forest, but whose crowns cover more than five per cent of the area bounded by the trees forming the perimeter of the group.

Xeriscaping
Landscaping with vegetation that has a low water usage. The objective is to conserve as much water as possible, whilst still beautifying an area (i.e. conservation and aesthetics). The concept embraces utilising indigenous plants occurring within a 50 km radius of the development site.

APPENDIX 2 – APPLICABLE LEGISLATION

This Appendix provides additional information to that contained in Chapter 4.

A2.1 National Environmental Management Act, 1998 (Act No 107 of 1998) (as amended)

NEMA is South Africa's overarching environmental legislation. It provides the legislative framework for Integrated Environmental Management in South Africa.

In terms of this Act, anyone who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent this and to minimise and rectify such pollution or degradation of the environment (Section 28 - Duty of Care and Remediation of Environmental Damage).

The Environmental Impact Assessment Regulations under NEMA list activities for which environmental authorisation is required before construction can commence and specifies the process to be followed to apply for such authorisation.

A2.2 National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003)

In terms of Regulation No R1061, 28 October 2005 under Section 86 of the Act, written permission is required from the Authority to be able to proceed with proposed developments within the Park. Permission may be subject to conditions pertaining to development activities conducted within the Park.

A2.3 National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004)

This Act provides for the management and conservation of South Africa's biodiversity, to protect species and ecosystems and to ensure sustainable use of indigenous biological resources. Among other provisions, the Act covers alien and invasive species and genetically modified organisms that pose a threat to biodiversity. Regulation No R. 598 published under this Act currently applies, viz. Alien and Invasive Species Regulations, 2014 (1 August 2014). Alien and invasive species are listed in Government Notice No 599 (1 August 2014). The Act also provides for regulations and lists regarding Threatened and Protected Species (TOPS).

A2.4 National Forests Act, 1998 (Act No 84 of 1998)

Under this Act (as amended), a national list of tree species has been declared as protected. Listed tree species and trees in a natural forest may not be cut, disturbed or damaged and their products transported or sold by a person, without a licence from the relevant provincial forestry official. This also applies to trees which are part of a natural forest. However, as an organ of state, Sections 7 and 15 of the Act do not apply to the Authority insofar as it exercises its functions in terms of its own enabling legislation, namely the World Heritage Convention Act, 1999 (Act No. 49 of 1999) but the Act will be enforceable against the Authority insofar as the Authority is required to give effect to the Principles enshrined in the Act (refer to correspondence to Authority from White and Case, International Lawyers, 12 April 2005).

A2.5 KwaZulu-Natal Heritage Act, 2008 (Act No 4 of 2008)

In terms of Section 27(1), any person who intends to undertake a development categorised as one or more of the listed activities under the EIA Regulations, must, at the very earliest stages of initiating such a development, notify Amafa aKwaZulu-Natali (Amafa) and provide details regarding the location, nature and extent of the proposed development. This includes the construction of a road exceeding 300 m in length, the construction of a bridge or similar structure exceeding 50 m in length, and a development, or other activity which will change the character of an area of land, or water exceeding 10,000 m^2 in extent. Amafa must, within 14 days of receipt of a notification, advise the developer whether a heritage impact assessment report is required or not, prior to construction commencing.

If, during construction, archaeological or palaeontological objects or material or a meteorite is discovered, the find must immediately be reported to the responsible heritage resources authority. No person may, without a permit, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite.

A2.6 National Water Act, 1998 (Act No 36 of 1998)

Alteration of a stream or river (i.e. alteration of the course or river bed) requires a Water Use Licence from the Department of Water and Sanitation in terms of Sections 21, 36, 40 and 41 of the National Water Act. In certain cases, a general authorisation is given to impede or divert the flow of a watercourse. Pollution of river water (silt-laden run-off, oil from machines, etc.) is a contravention of the Act and is not permitted. Wetlands are also protected under this Act. No land use shall utilise the vegetation in a vlei or flood area of a watercourse in a manner that may cause damage or deterioration thereof.

A licence is required from the Minister of Water and Sanitation for the abstraction of water where the abstraction exceeds the levels prescribed by a general authorisation. Regulations regarding General Authorisations have been published in terms of Section 39 of the Act, with regard to the taking of water from a water resource, storage of water and discharge of water containing waste. In terms of the Park's Waste Water Policy, Special Limits (as contained in the relevant General Authorisations[24]) are to be adhered to when discharging effluent in the Park.

A Water Use Licence is usually required when infrastructure is constructed within 500 m of the boundary of a wetland.

A2.7 Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983)

Regulations under this Act deal with the control of invasive plants and declared weeds[25]. The regulations applicable in the Conservation of Agricultural Resources Act, Act 43 of 1983 apply in the KwaZulu-Natal Province. Declared weeds or invader plants are defined by the Conservation of Agricultural Resources Act, 1983, Act 43 of 1983 as follows:

- Category 1: Declared weeds. These species must be eradicated from all areas, and are only permitted with written permission from the Executive Officer (as defined by the Act) or in the case of a formally approved biological control reserve.

[24] For example, GN 665 of 6 September 2013 – but note these Regulations are revised periodically and must be checked for updates.

[25] Note that under the NEM: Biodiversity Act, Regulations have also been promulgated regarding alien invasive weed control.

- Category 2: Invader plants. These species are only permitted in specially demarcated areas and should be eradicated in all areas, except where permission has been granted. These species are not permitted to grow within 50 m of the 1:50 flood line.
- Category 3: These plants shall not occur on any land or inland water surface other than in a biological control reserves. No land user shall allow Category 3 plants to occur within 30 metres of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

In terms of Government Notice R 1048, the following regulations are applicable with regards to the control of invasive plants and declared weeds:

Where Category 1, 2 or 3 plants occur, it is necessary for the land user to control the plants using one of the methods of control prescribed by the Regulations. The landowner must immediately take steps to eradicate them by using the methods prescribed in the regulations, namely: (1) uprooting and burning, (2) the application of a suitable chemical weed-killer (herbicide), (3) any other method of permanent eradication.

One may not uproot or remove such plants and dump or discard them elsewhere to re-grow or to allow their seeds to be spread or blown onto other properties.

If a landowner does not comply with the requirements above, a person may be found guilty of a criminal offence.

A2.8 Mineral and Petroleum Resources Development Act, 2002 (Act No 28 of 2002)

In terms of this Act and Regulations there under, mining authorisation is necessary for new borrow pits, quarries and sand pits required for construction materials. No mining is allowed within the Park and materials must be obtained by authorised sources from outside of the Park. A developer must follow the application procedure in terms of the provisions of Sections 16 (application for prospecting right), 20 (permission to remove and dispose of minerals), 22 (application for mining right) and 27 (application for, issuing and duration of mining permit) in respect of any activity to remove any mineral for construction. An Environmental Management Programme for approval in terms of Section 39(4) must also be submitted. The application for environmental authorisation for these activities may entail either a Basic Assessment or an Environmental Impact Assessment process, as prescribed in the NEMA EIA Regulations and Listing Notices.

While an organ of state is exempted from certain provisions of the Act pertaining to applications for mining rights and permits, it is still required to submit an environmental management program for approval in terms of Section 39(4) of the Act.

In terms of this Act, any landowner or lawful occupier of land who lawfully, takes sand, stone, rock, gravel or clay for farming or for effecting improvements in connection with such land or community development purposes, is exempted[26] as long as the sand, stone, rock, gravel or clay is not sold or disposed of.

26 Provided that excavation does not take place in a watercourse or its floodplain. This is a listed activity.

A2.9 National Environmental Management: Air Quality Act, 2004 (Act No 39 of 2004)

There is a schedule of listed activities under Section 21 of the NEM:AQA with 10 categories which require atmospheric emission licensing. This includes processes relating to petroleum products, cement, tar and macadam preparation. A developer must ensure that he has the required licence if he triggers listed activities in the schedule.

A2.10 Occupational Health and Safety Act, 1993 (Act No 85 of 1993)

Construction Regulations (2003) published under this Act apply to construction activities including "the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work". A "health and safety plan" which addresses hazards identified, and includes safe work procedures to mitigate, reduce or control the hazards identified, is required under this Act. A risk assessment must also be undertaken by a qualified person(s) and the Contractor shall ensure that all employees under his/her control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the risk assessment.

A2.11 The National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008) ("the ICM Act")

The act was promulgated in December 2009, and requires estuaries of the Republic to be managed in a co-ordinated and efficient manner, in accordance with a National Estuarine Management Protocol ("the Protocol").The Protocol provides guidance for the management of estuaries through the development and implementation of individual estuarine management plans (EMPs). The EMPs seek to achieve greater harmony between ecological processes and human activities while accommodating orderly and balanced estuarine resources utilisation.

A2.13 Maritime Zone Act, 1994(Act 15 of 1994)

Notwithstanding this Act or any other law the Republic may, in any area of the sea or the airspace above the sea, take such measures as are necessary against any vessel or aircraft in order to protect the coastline of the Republic or related interests, including fishing, from pollution or any threat of pollution resulting from a maritime casualty or an act or omission relating to such a casualty and which may reasonably be expected to result in major harmful consequences.

APPENDIX 3 – ROLES AND RESPONSIBILITIES IN COMPLIANCE MONITORING

A3.1 Roles and responsibilities in compliance monitoring

The Principal Agent/Engineer is responsible for ensuring that the terms of the Overarching EMPr are complied with during the Contract. He is assisted in this regard by the Environmental Control Officer (ECO) and the Park Environmental Manager.

A3.1.1 Principal Agent/Engineer and their Site Representative

The Principal Agent/Engineer's Site Representative assists the Principal Agent/Engineer on site. The Principal Agent/Engineer is ultimately responsible for ensuring compliance with the Overarching EMPr and shall be responsible for the following functions:

- Ensure that the principal and sub-contractors are conversant with the requirements of the Overarching EMPr and that all staff on site have attended the Induction/Environmental Training Course[27].
- Ensure that the Contractor complies with the Overarching EMPr and, if not, ensure that the Contractor bears the costs of damages/compensation resulting from non-compliance with the Overarching EMPr.
- Monitor compliance with the requirements of the Overarching EMPr, with assistance from the ECO. If necessary, on the recommendation of the ECO and/or Park Environmental Manager, instruct the Contractor to suspend any or all works on site, if the Contractor or his Subcontractor/supplier fails to comply with the Overarching EMPr.
- Ensure that the Contractor conducts all activities in a manner that minimises disturbance to the management activities of the Park and adjacent areas, affected local communities and visitors to the protected area and maintain a register of complaints and queries by members of the public at the site office, to be forwarded regularly to the ECO.
- Liaise directly with the ECO in terms of environmental issues and maintain close channels of communication with the ECO regarding foreseeable activities that may require environmental input.
- Attend site handover, monthly site meetings and site completion meetings.
- Ensure that all communication on site concerning the Contractor and environmental matters is directed through the Principal Agent/Engineer's Site Representative and recorded in the site instruction book.
- Monitor and report compliance with the Overarching EMPr and advise the Principal Agent/Engineer and Park Environmental Manager on action to be taken if the specifications are not followed.
- Document the state of the site (photographically) prior to construction activities, during construction and after rehabilitation. This documentation may be in the form of geo-referenced photographs, video recordings and written descriptions.
- Provide technical advice and solutions relating to the speedy resolution of unforeseen environmental issues/problems during the construction phase.
- Maintain records of all site visits and site inspection checklists.
- Ensure that he/she is acquainted with, and consults regularly, the site diary and/or site instruction book.
- Ensure that outstanding environmental actions are included on the snag list prior to completion, and ensure all snags have been attended to prior to issuing of completion certificates by the Principal Agent/Engineer to the Contractor.
- Sign off the environmental work on completion of the contract, and sign off sub tasks during the contract, as required.

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27 A simple induction course for construction staff, amongst other topics, dealing with risks of working within the Park (dangerous animals) is to be held at the site handover meeting on site and will be the responsibility of the Environmental Control Officer.

- Provide a brief report on environmental performance for the Contractor's final certificate, to be approved by the Park Environmental Manager.

A3.1.2 Park Environmental Manager

The Park Environmental Manager will play a regulatory role to ensure that there is sound environmental management in the Park and on adjacent areas which affect the Park. He/she will also provide support to the ECO during projects affecting the Park. His/her responsibilities will be to:

- Advise the ECO about the interpretation, implementation and enforcement of the Overarching EMPr and other related environmental matters, particularly in exceptional circumstances.
- Review monthly environmental checklists/reports submitted by the ECO.
- Attend site handover and site completion meetings.
- Attend monthly site meetings, as required.
- Report on the environmental performance of the contract to the Park Authority CEO, as required.
- Sign off the environmental work on completion of the contract, and sign off sub tasks during the contract as required.

A3.2 Reporting procedure

Reporting on environmental matters shall be undertaken as follows:

- The ECO shall ensure that all communication on site concerning the Contractor and environmental matters is directed through the Principal Agent/Engineer's Site Representative and recorded in the site instruction book.
- The ECO, with the assistance of the Principal Agent/Engineer's Site Representative, shall complete a Project start-up inspection checklist prior to the commencement of each contract and forward it to the Park Environmental Manager.
- The ECO will complete monthly checklists (or more often if required), which will form the basis of the environmental reporting required at site meetings and will be forwarded to the Park Environmental Manager. Special measures discussed at pre-construction on-site meetings or during the construction period should be included on such inspection sheets.
- The ECO will attend monthly site meetings and report briefly on progress and environmental issues that require attention. The monthly checklists and other documentation, as necessary, will be attached to the minutes of the site meeting and will serve as the monthly environmental report for the Contractor, Principal Agent/Engineer and Park Environmental Manager.
- The ECO, with the assistance of the Principal Agent/Engineer or Principal Agent/Engineer's Site Representative, shall complete a site closure report on completion of the contract and forward it to the Park Environmental Manager.
- The ECO will provide a brief report on environmental performance for the Contractor's final certificate, to be approved by the Park Environmental Manager.

A3.3 Record keeping

The following environmental records must be kept by the ECO in good order and be made available to independent auditors and/or DEA, if required:

- Environmental Authorisation from DEA.
- Overarching EMPr and Site-Specific Addendum (if applicable).
- Construction site layout plans.
- Method statements.
- All communications detailing changes of design/scope that may have environmental implications.
- Site inspection checklists (serving as the regular environmental compliance report).
- Environmental awareness training attendance registers and training material.
- Environmental incident and accident reports.
- Environmental performance certificates (written sign off).
- All relevant permits, agreements and legal documents relating to environmental matters.
- Photographic record before, during and after construction.
- Records of non-compliance and corrective action or remedial work should be kept as part of record keeping.
- The isimangaliso wetland park is responsible for continuous monitoring of the conditions in the catchment when water levels become elevated. Communication between the different role players, should take place at a regular basis. This can be done at advisory committee/forum meetings or as email communications summarising critical aspects. The monitoring should include the following aspects:
  - The actual and expected rainfall in the catchment;
  - The water level in the estuary and its rate of increase;
  - The height and width of the sand berm at the mouth;
  - The actual and predicted wave conditions;
  - The availability of equipment (bulldozer) to breach the mouth;
  - Water quality conditions (if applicable);
  - Biotic responses to elevated water levels (e.g. fish aggregations at mouth, formation of algal blooms, die-back of macrophytes, bird nesting behaviour).

- While breaching should be conducted according to an Estuary Mouth Management Plan and an approved Mouth Maintenance Plan, some of the general breaching principles may be waivered under emergency conditions to ensure an expedient breaching constant monitoring of the conditions in the catchment is required when emergency conditions develop. Communication between the different role players, involved, should take place, if time is available, to monitor the situation and in those instances compliance with the relevant prescripts in terms of Section 30 of the National Environmental Management Act is paramount.
- Following an estuary mouth opening a breaching Incidence report needs to be compiled. This report should contain as much as possible information on the breaching motivation and the process followed during the breaching. Annual Breaching Report needs to be presented to all Interested and Affected Parties (I&AP) (relevant authorities and civil society) to communicate progress with the implementation of the MMP. Such feedback sessions provide the opportunity for a critical review of current breaching practises and discussions on possible improvements to future MMPs. The Annual Mouth Breaching Report will also serve as a national reporting document.

APPENDIX 4 – PROJECT SITE-SPECIFIC ADDENDUM (ST.LUCIA ESTUARY)

Where applicable, a Site-Specific Addendum containing project specific measures relevant to a particular development will be provided, and included as Appendix 4.

A4.1 Introduction

A number of rivers flow into the Park, many of them draining into Lake St Lucia. The uMfolozi and uMkhuze Rivers are the largest of these rivers, both of which have significant portion of their catchments outside of the Park boundaries. The smaller rivers and streams entering and within the Park are largely seasonal, being reduced to isolated pools during dry months. The uMfolozi River in the south, is the major source of fresh water to Lake St Lucia. Although artificially separated from Lake St Lucia since 1952 to prevent the inflow of suspended sediment into the main St Lucia system, the link between the uMfolozi River and Lake St Lucia was re-established under a new management approach in 2016, and Lake St Lucia and uMfolozi River mouth have since been managed as one system. iSimangaliso's Estuary Management Plans (EstMP) have been broadly formulated in compliance with Section 34 of the National Environmental Management: Integrated Coastal Management Act (Act No 24 of 2008) (ICM Act), read with the National Estuarine Management Protocol 2013 (the Protocol), as well as the World Heritage Convention Act (Act No 49 of 1999) (WHC Act), and other relevant material and practical experience relevant to the uniqueness of each estuary.

The objective of the Integrated Management Plan (IMP), is to provide measures to protect and manage the World Heritage site in a manner that is consistent with the objectives and principles of the governing Acts. The statutory decision-making framework that the iSimangaliso Authority will use to develop and manage the Park. *Implementation of the policy of minimum interference in the estuarine system to facilitate as much natural functioning as possible, limiting artificial breaching and then only for ecological reasons*

Artificial breaching is the active removal of the sandbar from an estuary by human manipulation. This is usually done in response to rising water levels that rise behind the sand barrier, once the estuary is cut off from the sea. A variety of fish species and invertebrates have life histories geared to the natural cycles of opening and closing, and along with many plants and birds are dependent on these natural cycles. Once estuaries closes, habitat, nutrients and food availability increase dramatically thereby providing ideal conditions for growth and survival.

Artificial breaching in KwaZulu-Natal is most often carried out during winter or when rainfall is low. Unseasonal flushing of these systems reduces the nursery function for many fish and invertebrates by the removal of food resources and premature flushing of juvenile fish and prawns, out into a hostile marine environment while they are still too young to cope.Unmanaged artificial breaching can disrupt the natural cycle resulting in negative effect on the plants and animals within estuaries. Artificial breaching is a convenient, yet it can be disruptive means of altering the natural processes of an estuary. This is often done for the benefit of a few individuals but at the expense of the ecological health and services. Artificial breaching has been recognized as being a highly damaging activity for estuaries. *For this reason the alignment between the Estuarine Management Plans for the Park which provides for breaching only for ecological purposes and the consideration of what constitutes ecological and the associated maintenance risks has been factored into this maintenance management plan. The said maintenance activity (artificial breaching) will bring ecological benefits by encouraging the flow of the Msunduzi River which has been silted up in certain areas by agriculture induced excess (unnatural) sediments. This will subsequently reduce flooding and embankments causing water to be blocked upstream while promoting the water exchange for improving water quality, reduce and facilitate migration of marine organisms.*

A4.2 Background

The aim of the amendment process as discussed earlier is to align the Estuarine Management Plan with the iSimangaliso Overarching EMPr which is also our maintenance management plan. Further to this the site specific maintenance plan then serves to provide more specific detail on a current matter as below. It must be clearly noted that the amendment of the Overarching Maintenance Plan seeks to ensure alignment with the Estuarine Management Plans for the Park. The Site specific addendum provided here is to give the National Department of Environmental Affairs some insight into a current situation we are dealing with which prompted us to also consider our enabling planning tools.

The current flooding and excessively unnatural deposit of silt on the Msunduzi River has negatively impacted on the health and wellbeing of wildlife and livestock; riverbank erosion, agricultural practises and sedimentation within the Msunduzi River. The current silt has caused the level of riverbed to rise. As a result, the natural longitudinal course and flow of the river is disturbed thus inundation of the river. This has had a negative impact on the sensitive marine life and freshwater fish affected by suspended silt in their natural habitat. Sensitive marine life and freshwater fish may be affected by suspended silt. Other harmful impacts of siltation are the loss of associated wetlands, agricultural practices in close proximity and coastline alterations.

Any breaching process requires water level to be as high as possible. The reason for this is that as much sediment as possible should be flushed from the mouth and from the estuary. The potential of flushing of sediments increases exponentially with the increase of outflow velocities after breaching, which in turn increase strongly with the increase in water levels. There are various ecological benefits and motivation of performing artificial breaching of river mouth/rivers in estuaries and that can be affected by flooding, river bank erosion causing sedimentation etc. Sediments are an important part of beach nourishment, thus maintaining the beach profile along the coast.

Breaching provides numerous environmental goods and services to the species situated within and adjacent to them. *Decisions to artificially open the mouth of an estuary often therefore need to achieve a difficult balance between ecological (generally public) interests and proprietary (generally private) interests, a balance which should ideally be informed by the numerous laws, and their associated plans and policies, of direct relevance to protecting and managing estuaries.* Artificial breaching, which is undertaken at lesser water levels, causes major changes in the mouth condition, water levels, salinity distribution and water quality .artificially breached at lower than natural breaching water levels, decreases the volume and duration of water flow out to sea, reduces sediment scouring, disrupts the long-term erosion/depositional cycles in the estuary, results in increased sedimentation in the lower estuary, and changes the estuary's abiotic state from a predominantly open marine system to a predominantly closed marine system.

A4.3 Need for artificial breaching the Msunduzi mouth currently

As indicated above generally there are risks associated with any breaching and in effect this has to always be on a case by case basis and in this instance the aim of breaching is to alleviate the current ecological challenges posed by the unnatural deposition of silt on the Msunduzi River which are as follows:

The prolonged inundation and flooding of the mangrove and swamp forests is causing inhibition of leaf growth, inhibition of stem extension and photosynthesis, senescence and reduced plant productivity. Prolonged inundation slows flowering and subsequent seed. This has serious consequences since, although propagation is predominantly vegetative in salt marsh species, resident seed banks play an important role in the re-establishment of salt marsh communities when water levels drop after protracted flooding. Closed mouth leads to decrease in species richness (absence of marine associated species). Associated decrease in salinity has a

negative impact on invertebrates within the River Estuary which are adapted to life in a more tidal system and loss of recruitment of key species on estuarine invertebrate abundance, species richness/ community composition. The artificial breaching will reduce water level currently cause flooding and subsequently promote water exchange for improving water quality; and facilitate migration of marine organisms. The current inundation has had negative impacts on the KwaSokhulu Farmers who are involved in agricultural practises in close proximity to the River where their agricultural operations have become inundated because of rising water levels of the Msunduzi river. Thus losing their crop production. This is acknowledged however as stated in the principal overarching maintenance management plan, the intention of the amendment of the maintenance plan is to align it with the Estuarine Management Plans for the Park. Where a specific situation arises (such as the KwSokhulu matter) a site specific addendum to the EMPr is then normally submitted for consideration.

APPENDIX 5 – PENALTIES

The amounts are indicative only.

Failure to demarcate working servitudes	R 1,600
Working outside of the demarcated servitude	R 4,000
Failure to strip topsoil with intact vegetation	R 4,000
Failure to stockpile topsoil correctly	R 4,000
Failure to stockpile or spoil materials in designated areas	R 3,200
Pollution of water bodies (including increased suspended solid loads)	R 8,000
Failure to control stormwater runoff	R 8,000
Failure to prevent siltation of natural habitat outside of working servitudes	R 8,000
Failure to provide adequate sanitation	R 8,000
Unauthorised removal of indigenous woody vegetation	R 8,000 basic fine plus R 1,000 per shrub/tree
Failure to erect temporary fences	R 1,600
Failure to provide protection measures for hippopotami or rhinoceros in deep excavations	R 8,000
Failure to provide adequate waste disposal facilities and services	R 8,000
Failure to reinstate disturbed areas within the specified time frame	R 8,000
Failure to rehabilitate disturbed areas within the specified time frame	R 9.600
Failure to obey site protection measures	R 13,000
Failure to maintain demarcation tape	R 1,600
Fire – costs of runaway fires will be borne by the Contractor, should he/she be proven responsible for such fires	Costs to be borne by Contractor
Animal poaching	R 100,000*
Medicinal plant and other plant removal	R 2.400
Any other contravention of the project specific specification	R 8,000
Any other contravention of the particular (general) environmental specification	R 8,000

*And prosecution.

In addition to the penalty, the Contractor shall be required to undertake the necessary rehabilitation/mitigation measures resulting from non-compliance. These will be as instructed by the Principal Agent/Engineer, on the advice of the ECO or the Authority.

APPENDIX 6 – COMMENST AND RESPEONCE REPORT

Comments raised by Economic Development Tourism and Environmental Affairs (EDTEA) dated 20 June 2019

- **Comments raised in regards section 9.21 of the revised EMP on the 3rd bulletin:**

Breaching during high tide may result in sea water pushing into the estuary especially if you have low flows from the estuary, hence the second part of this statement may yield positive results. The ideal breaching that yield maximum results should be done to coincide with the Low Spring tide as that will allow more time for water to drain into the sea.

Response to comment above

Section 9.21 of the revised EMP on the 3rd bulletin has been aligned to EDTEA comments above .The statement has been revised and consolidated to provide a more clear statement, see amended section 9.21 of the revised EMPr on the 3rd bulletin.

- A comment raised in regards section 9.21 of the revised EMPr on the 21st bulletin

This statement seems to suggest that breaching may result in loss of sediments, yet the idea is to flush out sediments that is already the estuary.

Response to comment above

The statement has been rephrased to minimise ambiguity

- Comment raised in regards to appendix 2"applicable legislation " of the EMP document

Appendix 2 of the document "applicable legislation" makes reference to sea shore act .This act was repealed by the Integrated Coastal Management Act, save the section that were assigned to the provinces (see section 98 and schedule 1 of ICM Act).

Response to comment above

The relevant Integrated Coastal Management Act, section 98 and schedule 1 confirms that the sea shore act has been repealed .therefore the sea shore act has since been removed in this EMPr revised document

- For consistency purposes within the report, is the name of the River Umsunduzi or is it Msunduzi?

Response to comment above

The consistency of the name of the river Msunduzi has been rectified and is now consistence within the report.

Comments raised by KZN Wildlife dated 25 June 2019

- **Comment 1:**

Thank you for the opportunity to comment on the iSimangaliso Overarching Environmental Management Programme (EMPr) to check for alignment with the St Lucia Estuarine Management Plan and to highlight potential concerns.

The main concern at this stage and the focus of Ezemvelo's comment for now is specifically on **Appendix 4** – PROJECT SITE-SPECIFIC ADDENDUM (ST.LUCIA ESTUARY) of the EMPr and the proposal to artificially breach the Msunduzi River. It is important to note upfront that it is the consensus of the estuarine scientific community that the geographical boundaries of estuaries in South Africa are defined by the 5 m amsl contour, and that the area enclosed by this boundary is referred to as the Estuarine Functional Zone (EFZ).

(i)In the case of the St Lucia, the EFZ includes the uMfolozi river, the Msunduzi river and the St Lucia systems i.e. these form a single management unit and the components cannot be manipulated individually without adversely affecting the entire Lake St. Lucia estuarine system. Ezemvelo has been part of technical task team revisiting the delineation of estuaries in KZN and supports the delineation of a common boundary for the Lake St. Lucia estuarine system that encompasses the uMfolozi, the Msunduzi and the St. Lucia.
The EMPr is aimed at mitigating impacts of activities undertaken in the Park as espoused in the following statement:

"This Overarching Environmental Management Programme (EMPr) covers the principles, responsibilities and requirements applicable in order to implement effective environmental management during pre-construction, construction, site rehabilitation and maintenance activities within the iSimangaliso Wetland Park (the Park). The aim of this Overarching EMPr is to ensure that activities are conducted in accordance with the policies and management practices of the iSimangaliso Wetland Park Authority (the Authority) and the principles of Integrated Environmental Management laid out in Chapter 2 of the National Environmental Management Act."
It is not meant to provide the policy or strategy to inform decisions to undertake activities such as breaching the estuary. Rather, it is the Estuary Management Plan that informs how to manage the estuary with regard to breaching.

Response to comment above

On the 30 November 2015 Isimangaliso wetland park authority made an application to Department of Environmental Affairs (DEA) to request adoption and approval of the overarching Environmental Management Programme (EMPr: Revision 13) as a maintenance plan plan in accordance with the environmental impact assessment regulations, 2014 for activities within the world heritage site (isimangaliso wetland park).The overarching Environmental Management Programme (EMPr: Revision 13) was approved on the 09 February 2016 .However the approved EMPr did not address issues relating to breaching hence the revision of the proposed EMPr(revision 14) to accommodate breaching activities as part of maintenance activities within the EMPr. Estuary Management Plan have been adopted in the revised EMPr in order to cater for the breaching activities, while aligning with the estuary management plans of Isimngaliso wetland park. Therefore this revised EMPr is not meant to provide the policy or strategy to inform decisions to undertake activities such as breaching the estuary but rather ensure that breaching is considered in the maintenance activities of the revised EMPr within the park. In order to produce a holistic Overarching Environmental Management Programme that addresses current legislative requirements and objectives, this document is revised to align with the NEMA EIA Regulations published in December 2014, approved Kosi bay, lake st.lucia, Mgobozeleni estuary management plans together with isimangaliso wetland park integrated management plan and it provides for management and maintenance activities within iSimangaliso. This Overarching Environmental Management Programme (EMPr)

covers the principles, responsibilities and requirements applicable in order to implement effective environmental management **during pre-construction, construction, site rehabilitation and maintenance activities** within the iSimangaliso Wetland Park (the Park). **The aim of this Overarching EMPr is to ensure that activities are conducted in accordance with the policies and management practices** of the iSimangaliso Wetland Park Authority (the Authority) and the principles of integrated Environmental Management laid out in Chapter 2 of the National Environmental Management Act.

- **Comment 2:**

(ii) There is also misalignment between the St. Lucia Estuarine Management Plan and the EMPr when it comes to artificial breaching when reading the following 2 statements respectively:

(a) "Thus, artificial breaching disrupts the natural cycle and, therefore, has a negative effect on the plants and animals within estuaries (which in one study showed a twentyfold decrease in biomass). Artificial breaching is a convenient, but ecologically disruptive, means of altering the natural processes of an estuary. This is often done for the benefit of a few individuals but at the expense of the ecological health and services that these important systems provide and in this way having a ripple effect through many other lives. It is recognised and has been shown in the literature to be a highly damaging activity for estuaries"1.

(b) "iSimangaliso wetland park authority have opted to artificially open the Msunduzi River to the sea in order to rectify the current ecological depredatory impact on estuarine fish abundance, species richness/ community composition and ecological functioning of the Msunduzi River"2
It is suggested that the estuarine management plan should take the lead in this matter of artificial breaching.

Response to comment above
Comment noted, in order to ensure precise alignment between the St. Lucia Estuarine Management Plan and the EMPr. The above statements within the draft EMPr has since been revised see page 58 and 59 above

- **Comment 3:**

Keeping with the philosophy of a common boundary, it must be recognised that there are no half measures when managing St Lucia together with the Mfolozi River. The Msunduzi River cannot be breached in isolation of the Mfolozi River as they are one system. The St Lucia-Mfolozi cannot be managed as one system without using the natural scouring effect resulting from allowing the water level to back up before flushing. If there is no head of water before the joint mouth breaches to the sea, the sediments will not be scoured out.
If there is artificial breaching, it would mean going back to the former two-mouth system and will require reinstating the dredger and reclamation unit to manage the system. If this is the case, the implication here is that GEF funding used in the St. Lucia Restoration Project would have been spent in vain. The management of the system cannot be compartmentalised. Either the Mfolozi river is linked with St Lucia (requiring water to be backed up in the lower floodplain), or it is not linked and Lake St Lucia will suffer from water starvation. Presently

Lake St Lucia is full and a badly timed artificial breach of the Msunduzi/Mfolozi mouth may inevitably drain the lake.

Response to comment above

This comment is noted and will be considered. It must be noted however that the aim of this document is to ensure alignment of the Estuarine Management Plans for the Park with this Amendment of the Maintenance Plan for the Park. It is aimed at ensuring that all our tools that relate to maintenance (including breaching for

ecological purposes) have a structure and are implemented accordingly. This by no means replaces the legality of the action, whichever mechanizims out to be sought in this regard will be sought.

While Ezemvelo recognizes that there are instances where artificial breaching will be required to improve the ecological condition of the system, Ezemvelo is also aware of the plight of the KwaSokhulu Farmers where their operations have become inundated because of rising water levels of the Msunduzi River. There has been considerable pressure to breach the system as a means to alleviate that backflooding. Both the documents (EMPr and Estuarine Management Plan) are lacking in a management response to this scenario. Interventions that are proposed here must also include exploring all options to assist the local community members who's farming operations are being inundated by rising waters from the Msunduzi River, not only by artificial breaching. The overall negative ecological impacts of artificially breaching on the entire system will almost certainly far outweigh the cost of the loss of production from the flooded areas. The Park Authority therefore needs to explore other alternatives through their community liaison programmes e.g. offer employment through invasive alien control programmes or some other type of compensation or improved livelihood opportunity.

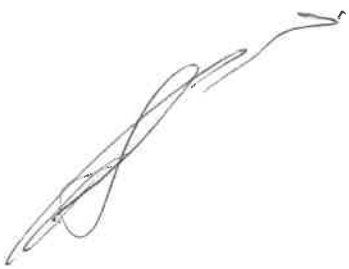
Response to comment above

The implications of breaching thus need to be considered at the full system level, the national level as well as at the international level. In addition to the GEF funding issue, artificially breaching this system may be a violation of a 2017 High Court Judgement that prevented the system from being artificially breached due to sugarcane fields in the floodplain being similarly inundated by rising waters as a result of back flooding. Overall, it must be considered that the improper management of the estuary will result in a Ramsar site being mismanaged and the UNESCO World Heritage site being compromised.

Response to comment above

This comment is noted and again this process aims at ensuring the enabling tools are aligned, by no means does it serve to replace a need to comply with any applicable legislation including any decision of the high court.

End Note



RESPONSE TO UNESCO WORLD HERITAGE CENTRE ON AN ENQUIRY RECEIVED REGARDING THE ISIMANGALISO WETLAND PARK (Ref.: CLT/WHC/AFR/2019/257 AND CLT/HER/WHC/AFR/18/323)

SOUTH AFRICA

BY THE GOVERNMENT OF THE REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF ENVIRONMENTAL AFFAIRS

MAY 2019

1.1 The Department of Environmental Affairs (DEA) received letters dated 17 November 2017 and 12 November 2018 respectively and an email dated 06 July 2018 from the Director: World Heritage Centre requesting the State Party of South Africa to respond to enquiries in relation to iSimangaliso Wetland Park World Heritage Site on the following:

1. State of St. Lucia estuary at iSimangaliso Wetland Park World Heritage Site;

2. Increasing water use at Lake Sibiya

3. Alleged mining activities/application that may have negative impact on the state of conservation of the iSimangaliso Wetland Park World Heritage Site; and

4. The reported swamp forest destruction close to the iSimangaliso Wetland Park World Heritage Site.

1.2 Following engagements with the Management Authority, the State Party responds as follows:

1. State of St. Lucia estuary at iSimangaliso Wetland Park World Heritage Site

Brief background history

- The Lake St. Lucia estuary is the centerpiece of South Africa's first unesco World Heritage Site, the iSimangaliso Wetland park, and has been a Ramsar Wetland of International Importance since 1986. It is South Africa's largest estuary comprising 60% of the estuary area of the country.

- When the property was declared a World Heritage Site, the impact of the hydrological issues facing the Lake St. Lucia estuary were noted in the nomination document. Human interference with the natural processes occurred due to commercial sugar cane farming. The farming activity extended into the lower reaches of the floodplain and was enabled through the drainage of large wetland areas, extensive construction of drainage channels, river diversion and canalization. The amount of water available to the Lake St. Lucia estuary has also been affected by the extensive commercial timber plantations, which have led to a reduction in both surface and ground-water.

- Unfortunately, the uMfolozi river was diverted away from the Lake St. Lucia estuary and artificially breached directly to the sea in 1952 and was maintained as such for sixty years until 2012. This diversion, meant the loss of freshwater from the estuary's largest catchment. Also, the uMfolozi River was no longer able to play its important role in determining when and where the St. Lucia estuary mouth would open, with the result that the estuary mouth closed more frequently and for longer periods.

- With more frequent mouth closure, there was concern about the loss of estuarine function and subsequently there were attempts to keep the St Lucia estuary mouth permanently open to the sea through construction of hard infrastructure and dredging. Some stakeholders, particularly those who fish recreationally, are nostalgic for a time when the mouth was artificially kept permanently open.

- Extensive dredging of the system continued until early 2007 by which time an estimated 2.4 million cubic metres of dredge spoil and other material was amassed in an enormous pile in

the estuary mouth, further separating the uMfolozi River from the estuary. Plants, and even trees, started to grow and become established, establishing this infilled area.

- Between 2003 and 2012 the area experienced a drought. During this period the 352 km2 Lake St Lucia estuary dried, losing 90% of its surface area. This had never happened before and had significant ecological impacts.

- The estuary mouth closed and remained closed for 10 years, interfering with the life cycles of many marine species, causing the collapse of the KZN shallow-water prawn fishery as well as a marked decline in estuarine dependent species up and down the coast. The St Lucia estuary's salinity gradient reversed, and the Lake became extremely salty furthest from the sea in the north, where very few animals were able to survive. Under natural conditions, the Lake St Lucia Estuary would have closed during such a drought but, it is unlikely that it would have stayed closed for such a prolonged period.

Management strategy change

- In 2010, the iSimangaliso Authority initiated a project aimed at restoring the Lake St. Lucia estuary with funding from the Global Environment Facility (GEF) and the South African government. By 2011, independent scientific research had shown that it was not the drought alone that had led to the degradation of the system, but the effects were largely due to the loss of the uMfolozi river from the St. Lucia estuary. On the basis of this research the iSimangaliso Wetland Park Authority adopted a new management strategy in 2012, that would allow the uMfolozi River to follow its natural path back into the St. Lucia estuary.

- Through the GEF project, iSimangaliso commissioned a multi-disciplinary study to recommend a course of action to contribute towards the restoration of the hydrological and ecological functioning of Lake St. Lucia. Funding for implementation of the preferred solution was also made available. The study confirmed that the uMfolozi river was critical for the estuary as a whole and that its connection to the St Lucia estuary should be restored. The study further recommended the removal of the dredge spill that had been placed in the uMfolozi's natural path, and that the artificial breaching of the system be stopped. The removal of the dredge spoil was initiated in 2016 and by the end of the project approximately 1.5 million cubic metres of material had been removed.

- An extensive consultation process took place as part of the project and over 65 meetings, workshops and public open days were held with stakeholders between 2010 and 2017, when the project ended. Newsflashes and email communiques also kept stakeholders up to date with the progress in the project, and the status of the system. Meetings have continued to be held with key stakeholders to provide updates on the changes being observed in the system.

- The project has begun to restore the hydrological functioning of the Lake St. Lucia estuary. Having uMfolozi River back as part of the estuary has led to stability in water levels through 2017 and 2018, including the dry winter months when the shallow lake is prone to evaporate.

- iSimangaliso, as a Management Authority, will continue to monitor the health of the estuary, and scientists anticipate that the natural processes will ultimately re-establish themselves and estuarine functioning will be restored. The plea of the stakeholder for UNESCO to 'open the estuary and lake to the sea' will not be in the best interests of the health of the estuary.

The project to remove the dredge spoil has only recently been completed, and already the benefits to the system are evident. Artificial breaching of the estuarine lake mouth will halt the progress that has been made to reinstate the key driving processes that ultimately take the system to a more healthy and natural state.

- Lastly, South Africa reassures Unesco that the Lake St. Lucia estuary is being managed appropriately, based on rigorous science, careful monitoring and in the best interest of the biodiversity and health of the system, and the World Heritage Site.

2. Increasing water use at Lake Sibiya

- The Proclaimed park boundary of iSimangaliso Wetland Park in respect of Lake Sibiya is the high-water mark. The Integrated Management Plan (2017-2012) submitted to the World Heritage Centre in January 2019, provides clear guidance on how to deal with activities inside the Park and those abutting the Park. The main abstraction activities as correctly indicated by the report from the Wild Equity Foundation (WEF) and Marine and Estuarine Research (MER) emanate from basic human needs created by lack of water infrastructure in the area which the District municipality is currently working on. Mseleni hospital and Mbazwana community are the main beneficiaries of water from this lake system. iSimangaliso, understanding the dire situation where people do not have alternatives to clean portable water, has in conjunction with the Department of Environmental Affairs favourably responded to the request by the District municipality to extend the abstraction points further in as the lake receded from the previous abstraction point. Acknowledging that this was a response to social and basic human needs, iSimangaliso is in a process of engaging the District municipality with an intention of discussing the matter further as well as tracking progress on the infrastructure investment relating to the already constructed 40mg water treatment works in Jozini whose commissioning would grossly ameliorate the current undesirable situation .

- iSimangaliso is currently a member of the Licence Assessment Advisory Committee that is a multi-disciplinary committee which regulates and advises on stream flow reduction activities (such as commercial afforestation) prior to a decision on issuance of licenses. The Authority has, through this structure, unequivocally raised our concerns to the Department of Water and Sanitation (DWS) with regard to licenced commercial and unlicenced afforestation around Lake Sibiya as well as in areas in close proximity to wetlands as one of our main biodiversity threats. The Authority has since realized the discontinuation of the issuing of licences. iSimangaliso is a member of the various water catchment fora established by the Department of Water and Sanitation which also plays a pivotal role in raising awareness to all affected government departments on issues/activities affecting water catchments, this structure is also multi-disciplinary and includes representation from affected communities.

3. Alleged mining activities/application that may have negative impact on the state of conservation of the iSimangaliso Wetland Park World Heritage Site)

Eyamakhosi Resources Pty (Ltd) applied for minerals prospecting rights in terms of the Minerals and Petroleum Resources Development Act (MPRDA) in the Department of Mineral Resources (DMR). The appointed consultant failed to consult with iSimangaliso.

- It is also important to note that the area in question (A portion of Reserve No.4 of farm No. 15823) is a protected area proclaimed by the President of the Republic of South Africa, in Government Gazette No.44 of 2011, dated 22 July 2011 (attached) and in which no prospecting and mining is allowed. The State Party is managing the issues in line with legislation.

4. The reported swamp forest destruction close to the iSimangaliso Wetland Park World Heritage Site

- iSimangaliso has been under severe pressure from communities living in and adjacent the Park. This untenable situation gave rise to a delegation from DEA, sent by the then late Minister of Environmental Affairs to engage with these communities and relevant stakeholders. The unauthorised deforestation and agricultural practices in Sodwana were as a result of this untenable situation.

- The current management is hard at work trying to restore the healthy relationship with the local communities as an endeavour to persuade and encourage conservation friendly behaviour and practices. A lot has been done to date, but it must be appreciated that this is work in progress.

- This intervention by current management of iSimangaliso is an on-going initiative and Unesco will continuously be updated on progress and/or challenges during the course. The Department of Environmental Affairs, as the focal point for the implementation of the Convention as well as being the shareholder of the iSimangaliso Wetland Park Authority, continue to monitor the developments to improve the situation.

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END

REPORT ON SWAMP FOREST DESTRUCTION IN ISIMANGALISO WETLAND PARK WORLD HERITAGE SITE
JUNE 2020

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1. BACKGROUND

Due to the high biodiversity richness specifically of iSimangaliso Wetland Park area, South Africa fully recognizes and appreciates the need to conserve and preserve this international asset. The species diversity and richness within the area, has social, economic, intrinsic biophysical and cultural value which does indeed warrant and qualify its protection, conservation and preservation for current and future generations. These benefits are well documented through various literature and indeed within the iSimangaliso's Integrated Management Plan 2019-2024. What is also key is the sustainable use of natural resources such that these benefits are realized and the ability of the areas to provide such benefits in future is not compromised.

The iSimangaliso Wetland Park Authority as the legal management authority for the Park ensures that the Outstanding Universal Value of the property is maintained over a long period of time and potential threats addressed in line with all relevant national legislation.

The aim of this report is to highlight the key current threats faced by the management authority of the iSimangaliso Wetland Park World Heritage Site including the efforts and progress currently made in providing strategic mitigating measures.

2. THE DESTRUCTION OF SWAMP FOREST

The destruction of the swamp forest is in the Sodwana Section within the Mgobezeleni Estuarine Functional Zone of iSimangaliso Wetland Park. The area is very sandy and not suitable for farming. Community leadership, however, is of the view that the land inside the Park should be given back to the community rather than used for conservation because of its "productivity in agriculture" amongst other reasons. It should be noted that while the communities opted for restoration of land rights in the area, as per Cabinet approval, land use will not change and the land will continue to be managed as protected areas in perpetuity. Communities had also supported this policy decision.

3. EXTENT OF THE AFFECTED AREA

The area affected is about 92ha as indicated in Figure 1 below and is in the core of the world heritage property.

4. PROGRESS MADE IN PROVIDING STRATEGIC MITIGATING MEASURES

As early as 2017, the former late Minister Hon. Edna Molewa sent a delegation from the department led by the Director-General to engage with the affected communities and relevant stakeholders. The current Minister Hon. Barbara Creecy also initiated communication with the provincial Member of Executive Council (MEC) responsible for Cooperative Governance and Traditional Affairs together with the District Traditional

House to find an inclusive and sustainable solution on the matter.

ISimangaliso has established a Committee that comprises of the relevant stakeholders and has held numerous meetings with community leadership, Traditional Councils, Land Claimants and other affected government departments. Given the sensitivity of the situation, the approach is more to engage, build trust and consider other alternatives to rigid law enforcement in order to avoid exacerbating the problem and possibly placing the entire Park at risk. The authority is also working hard to restore a healthy relationship with the local communities as an endeavor to persuade and encourage conservation friendly behavior and practices. The relationship communities has significantly improved since the beginning of the problem.

To oversee the implementation of challenges like this as well as implementation of the World Heritage Convention in general, the Department of Environment, Forestry and Fisheries is represented in the Board of iSimangaliso Park Authority and has scheduled management meetings with the Authority.

5. CONCLUSION

The department together with the Authority is addressing the matter at political and operational level in order to ensure that solutions are inclusive and sustainable for long term protection of the property and confident that the with the level of engagement amongst affected stakeholder is going to yield the required outcomes.

Figure 1: Geographical context of unauthorized clearance of vegetation and agricultural cultivation within a swamp forest and the Sodwana area in relation to the entire iSimangaliso Park.

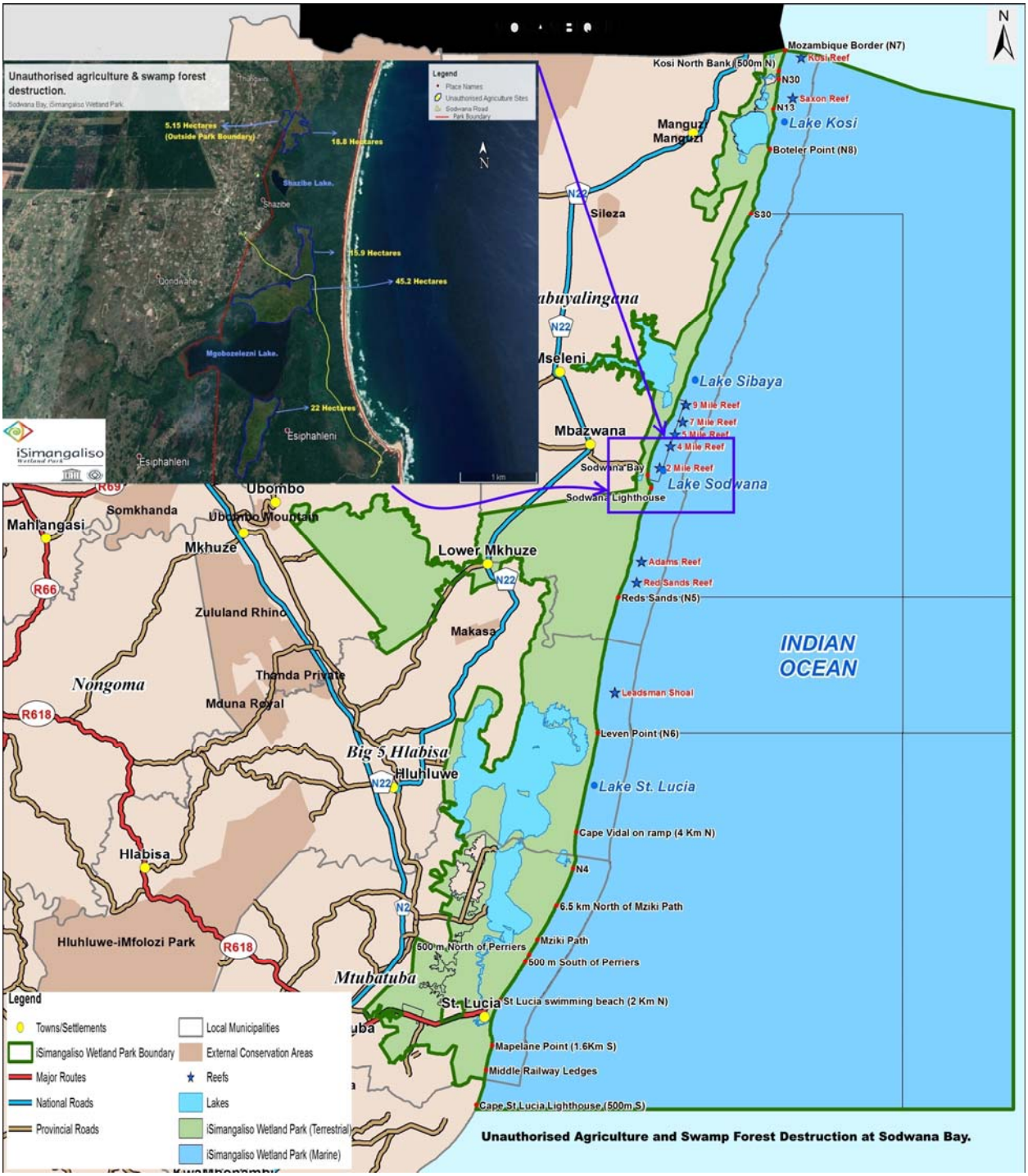
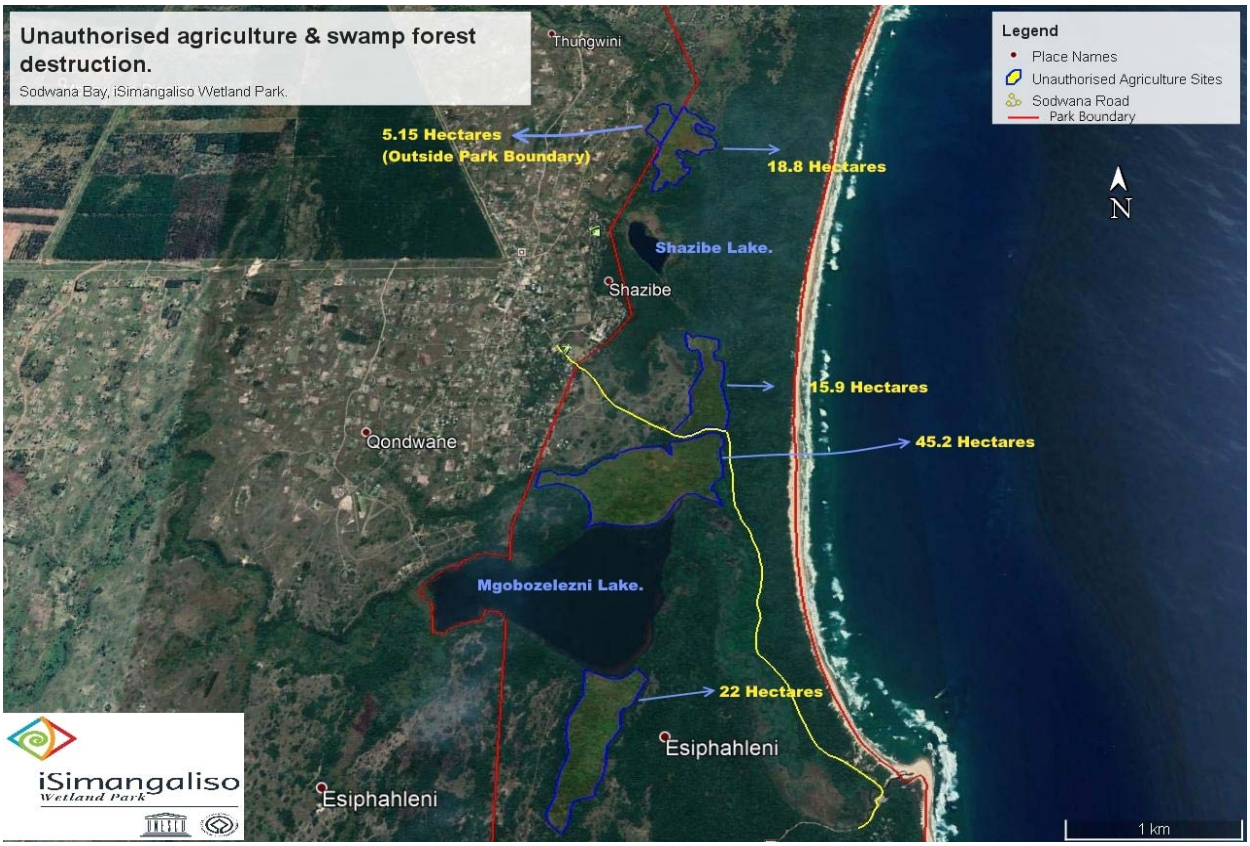


Figure 2: extent of destruction of the Mgobozeleni swamp forest through cutting and burning practices in preparation of the sites for agricultural cultivation.



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Dr Mechtild Rössler
Director: World Heritage Centre
UNESCO

Email: mj.muhammad@unesco.org;

Dear Dr Rössler

SUBMISSION OF RESPONSE TO ENQUIRIES FOLLOWING THIRD PARTY INFORMATION ON ISIMANGALISO STATE OF CONSERVATION

I acknowledge receipt of your correspondence received on 22 February 2021 regarding the recent artificial breaching of the Lake St Lucia Estuary, located within iSimangaliso Wetland Park World Heritage property.

Kindly note that the attached report also covers other enquiries on third Party information that were discussed in a virtual meeting coordinated by the World Heritage Centre on 18 December 2020.

Your unwavering support on the protection and conservation of the World Heritage conditions is greatly appreciated.

Yours sincerely

Ms Nomfundo Tshabalala
Director-General
Department of Environment, Forestry and Fisheries
Letter signed by: Mr Shonisani Munzhedzi
Designation: Deputy Director-General: Biodiversity and Conservation
Date: 16/03/2021

PROGRESS REPORT ON CURRENT THREATS FACED BY THE ISIMANGALISO WETLAND PARK WORLD HERITAGE SITE FEBRUARY2021

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BACKGROUND ON SATE OF CONSERVATION REPORT

The iSimangaliso Wetland Park World Heritage Site and iSimangaliso Wetland Park Authority (iSimangaliso) were established in terms of the World Heritage Convention Act, 1999 (Act 49 of 1999). Furthermore, iSimangaliso is governed by other environmental management legislation including, the National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003) (NEMPAA) and the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA).

Recently, iSimangaliso has experienced challenges that relate to balancing conservation and ensuring subsistence livelihood for communities living in and adjacent to the Park. On 18 December 2020, the World Heritage Centre facilitated a meeting following third party information received regarding threats to the Park.

The aim of this report is to highlight and provide an update on the key current threats faced by the management authority of the iSimangaliso Wetland Park World Heritage Site including the effort and progress made in providing strategic mitigating measures, as resolved by the meeting of 18 December 2020. The report also includes response to the recent enquiry received on 22 February 2021 Ref: CLT/WHC/AFR/21/32 on artificial breaching of Lake St Lucia estuary mouth.

1. THE DESTRUCTION OF THE SWAMP FOREST– REF: CLT/WHC/AFR/2019/595 DATED 3 SEPTEMBER 2019.

1.1 BACKGROUND

The United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Centre has been receiving letters regarding the destruction of swamp forest in the Sodwana Bay section of the iSimangaliso Wetland Park.

Aerial Imagery 1: Swamp forest destruction imagery received from UNESCO in August 2020. The site looks fairly new and shows recent cultivation activities.

Aerial Imagery 2 – taken December 2020 showing Mgobozeleni swamp forest at same position as imagery 1

Aerial Imagery 3 – taken 17 February 2021: showing Mgobozeleni swamp forest at same position as imagery 1

The above photographs (aerial image 3) are new aerial images taken from the same Mgobozeleni swamp forest.

1.2 CURRENT STATUS QUO

Generally, the local method of cultivation in the swamp forest is that the vegetation is slashed and burnt. Due to the area being wet trenches, it will be dug to drain water from the site that is being prepared for cultivation of crops. Thus, if the site is still active the indicator is the expansion denoted by slashing and burning of new vegetation. The monitoring of the Sodwana Bay swamp forest indicates that further expansion has ceased. This may be due to our current weather patterns where we have been experiencing high rainwater levels and

the crops are under water or indeed the current awareness campaigns, we are rolling out are yielding positive results.

The aerial monitoring of the swamp forest destruction was started in December 2020. As indicated above, aerial imagery 1 shows the area where there has been slash and burn activity, which if one looks at aerial imagery 2 and 3 it shows no signs of further slash and burn activities thus indicating there has been no further expansion of the current cultivation within the Mgobozeleni swamp forest.

The iSimangaliso Authority has partnered with the South African Environmental Observation Network (SAEON) and the Expanded Freshwater, Terrestrial Environmental Observation Network (EFTEON) and the Traditional Councils which are South African government entities. The purpose of this partnership is to monitor the impact of swamp forest destruction and the effect of this on the functioning of the Mgobozeleni estuary and a detailed proposal is being put together.

Again, as a reminder, the region was classified by government of the republic as a poverty node, thus it has limited livelihood options, i.e., agriculture and tourism in the main. The situation is also compounded by the challenge that the soil types limit agricultural activities to ecologically sensitive areas such as wetlands and floodplains. In its attempt to alleviate poverty in this area, the iSimangaliso Authority has introduced development and empowerment programs such as the Smalll Medium Enterprise program, craft program, bursaries program, and equitable preferential employment benefiting the local community.

Destruction of the swamp forest has been identified as a threat in the IMP and will be addressed in the Annual Performance Plans of the iSimangaliso Wetland Park Authority, in line with the Integrated Management Plan as approved by the Minister of Environment, Forestry and Fisheries.

2. ST LUCIA ESTUARINE FUNCTIONAL ZONE- REF: CLT/WHC/AFR/21/32 OF 16 FEBRUARY 2021

2.1 BACKGROUND

Lake St Lucia is categorised as an estuarine lake (Whitfield 1998), on the basis of its size and its link to the sea via the twenty-kilometre-long channel known as the ‘Narrows’ (iSimangaliso Wetland Park Authority IMP, 2011). It is a shallow system with fluctuating depths and spatial and temporal salinities. The driver of the natural variability in depth and salinity is seasonal variation in rainfall and consequent run-off. Variations in river flow, particularly in the uMfolozi River, in combination with surf action and longshore sediment movement,

also contribute to variations in the position of the mouth along the 3 km stretch of coastline from Maphelane to St Lucia. The natural variability has been intensified, specifically as regards higher salinity extremes, by abstraction in the catchment and especially by the re-routing of the uMfolozi River away from the St Lucia system.

Sediment accumulation (as a result of inputs from the relatively large catchment and the tributary rivers since the last glaciation) has resulted in a much shallower system having an average depth of less than one metre (which is in contrast to the much deeper coastal lakes of Sibaya and the Kosi system). Although there is no available evidence of anthropogenically accelerated sedimentation in the overall system, the major levels of agricultural development in the uMfolozi flood plain have resulted in concern regarding sediment dynamics in the St Lucia-uMfolozi mouth area. Separate mouths for the two systems were created in 1952 and the policy and practice were maintained until 2012.

Hydrological conditions in Lake St Lucia vary. Inputs are derived from streamflow, rainfall and dune seepage. The amount of water lost by evaporation exceeds the amount received from direct rainfall, even in years of average or above-average precipitation. The major drivers of variation in lake level and salinity are rivers. Lake St Lucia obtains its fresh water supplies from six main river systems. Those entering the lake are the uMkhuze (catchment approximately 6,000 km^2), Hluhluwe (catchment approximately 1,000 km^2), Mzinene (catchment approximately 800 km^2) and the Nyalazi (catchment approximately 7,000 km^2). The Mphate (catchment approximately 65 km^2) enters the Narrows between the Lake and the sea. The uMfolozi River (catchment approximately 10,000 km^2) is a major source of fresh water to the lake, contributing an estimated 60 % of the total runoff from the combined catchments of the Lake St Lucia system. The lower reaches extend into the southern section of the Lake St Lucia system and historically formed a common mouth. This is highly significant in that in this condition, which existed prior to 1952 when the separate mouth policy was implemented, the uMfolozi River was the main driver behind the predominantly open mouth condition of the Lake St Lucia system.

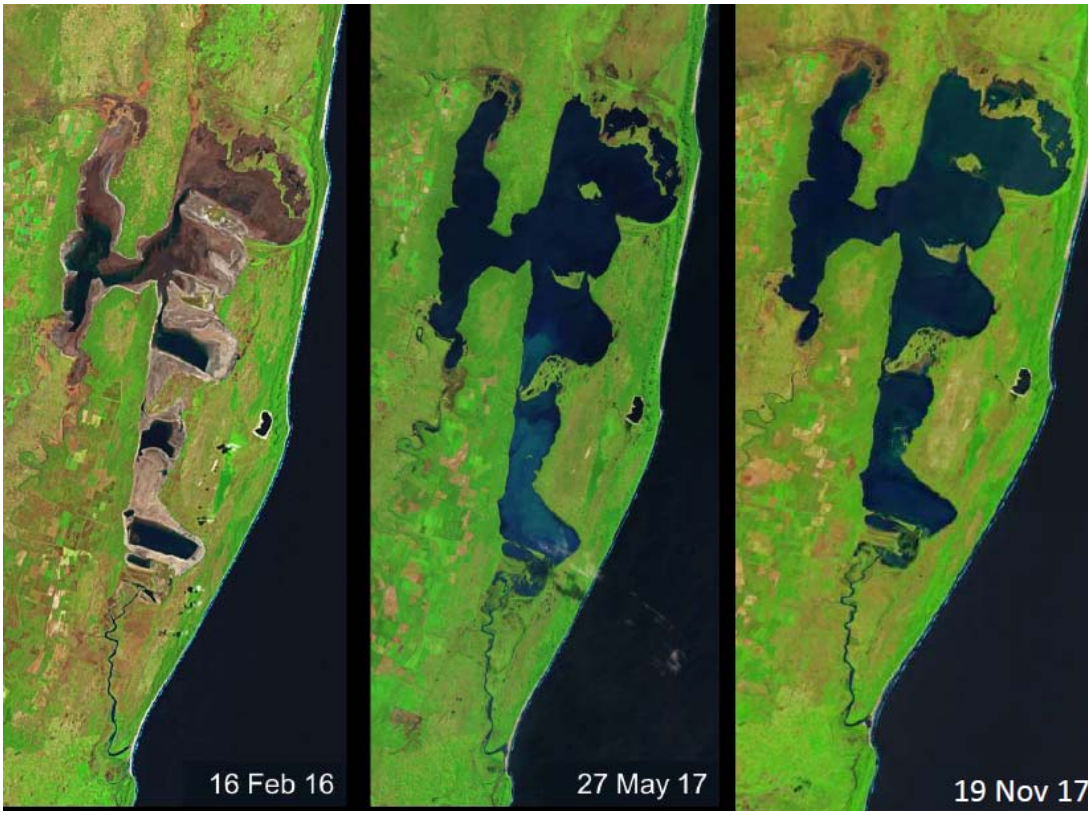
Agricultural developments on the uMfolozi River flood plain, which have involved canalisation and straightening of sections of the original river course, the construction of levees and artificial diversions have transformed the original environment. The canalisation and diversions have accelerated flows in these sections of the river and meant that, during large floods, fine sediments are now largely discharged to the marine environment and not deposited on the flood plain as would occur during natural overtopping of the riverbanks during high flows. In combination with artificial drainage and consequent drying and settling of the

sediments, the ground level in the lower areas of the flood plain has dropped significantly and exacerbated the problem of back flooding into the sugarcane lands during closed mouth conditions or even during high tide periods when the mouth is open.

Most of the rivers are seasonal, flowing during the wet summer months, but may be reduced to isolated pools and subterranean seepage through bed sediments in winter. The Lake St Lucia system is the most downstream point of the five major rivers, making the system vulnerable to flow-reducing activities in the catchments, which have increased through direct abstraction and dry-land agriculture, such as commercial plantations.

The amount of fresh water received from streams and rivers is a major determinant of the salinity state of the overall system, the iSimangaliso Wetland Park Authority has had to reassess management of the St Lucia-uMfolozi mouth area as flow-reducing activities in the catchments supplying the lake have increased through direct abstraction and stream flow reduction activities. As a result, water levels in the lake dropped and salinity levels rose between 2002 and 2011 which necessitated the joining of the uMfolozi mouth to the lake via a front channel spillway in order to supplement water into the lake from the uMfolozi River as it did historically pre-1952. Salinities have since remained within tolerable ranges for fish and invertebrates. The spillway closed in September 2014 but was recently reactivated (mid-February 2015) albeit that it remained open for only a short period of time.

As indicated above the Global Environment Facility (GEF) - 5 Project when it was initiated aimed to reconnect the uMfolozi River with the Lake St Lucia to ensure dire needed fresh water comes into the system as historically even including during the drought period there was no major water contributions into the system. This would be achieved by the removal of dredge spoil in phases to ensure that the point in which there was artificial dredge spoil deposited to separate the uMfolozi River from the Lake St lucia now allows a free flow of fresh water into the Lake. The positive effects of the GEF - 5 project was visible as of February 2016 as can be seen below.



Satellite Images of Lake St Lucia on 16 Feb 2016 (pre GEF-5 project), the dark shaded areas indicate the surface water of the Lake, these isolated pools show the water levels prior to the reconnection of the uMfolozi catchment into the Lake St Lucia system. As evident in the 16 February 2016 image there was almost no water in the Lake St Lucia. From 2017 there was a remarkable increase in surface water levels in the Lake.

2.2 CURRENT CHALLENGES POST THE GEF – 5 PROJECT

The increased inflow of freshwater into the Lake St Lucia system after the connection of the uMfolozi catchment with the Lake, brought with it high levels of sedimentation and lack of connectivity with the sea for over a decade. This led to the lake changing from an estuarine system into a freshwater dominated system.

It must be noted that the freshwater-dominated state of the system (a result of having lost contact with the marine environment) is part of the natural cycle that St Lucia goes through. The system swing is from hypersaline and desiccation to freshwater full of sediments, however accelerated sedimentation was also negatively affecting the overall health of this system. The state of the lake was dire and as follow:

- Accelerated sedimentation – while the restoration project was successful in getting fresh water into the system following prolonged drought conditions, the sediment-rich Mfolozi water has resulted in the Estuary Bay area, Honeymoon Bend and the Narrows becoming silted-up.

- Nutrient accumulation (fertilisers as well as human waste) had increased (Monique Nunes, PhD thesis). It is possible that these nutrients are promoting an increased vegetation response in St Lucia and the lower Mfolozi floodplain. The nutrients as well as increased sediments were facilitating the proliferation of alien plants and animals.
- Proliferation of Vegetation – the system has become freshwater dominated from Fani's Island southwards, with a proliferation of vegetation in the Narrows and in the Estuary mouth region which is further consolidating sediment. This proliferation is also very likely driven by nutrient accumulation in the system. The introduction of seawater in this region is expected to chemically "prune" the vegetation, especially the reeds in the Narrows.
- Invasive Alien Species –the invasive gastropod *Tarebia granifera* that has become established there over the past decade or so. Invasive plant species, whose proliferation is also likely exacerbated by nutrient accumulation, have also become established in the system. *Tamarix ramosissima* is spreading abundantly in the mouth areas of the Mfolozi and now the St Lucía Bay. Inundation by sea water may hinder their development. Other freshwater alien plants such as *Pistia striates* are occurring in the St Lucia Bay and these also may succumb to sea water flooding.
- There are no marine exchanges with the largest estuarine system in southern Africa. By restoring the marine nursery function for many estuary-associated fish and invertebrate species, this will promote overall aquatic biodiversity and species richness. It will also provide a more complete range of ecological functions within the system for marine, estuarine and freshwater biota in different parts of the estuary/lake – which is one of the reasons why St Lucia Estuary is one of the Outstanding Universal Values (OUVs) for which the iSimangaliso Wetland Park was inscribed as a World Heritage Site.

The iSimangaliso Authority subsequently convened a symposium on the 13th to the 15th of October 2020 where the objective of the symposium was to discuss and address the ecological challenges of the lack of proper and natural functioning of the St Lucia Estuary which had a number of knock-on biophysical, economic and social implications.

Upon conclusion the symposium made a number of very critical resolutions which in summary were as follows:

2.3 SYMPOSIUM RESOLUTIONS

- The St Lucia system is a complex dynamic socio-ecological system, the natural functioning of which is critically important for its natural assets (biodiversity and natural resources) as well as to the many other

ecosystem services that it provides to the diverse stakeholders that depend on it (tourism, agriculture, fishing).

- All participants have a strong interest in the restoration and effective management of the St Lucia system, and to work together collaboratively, making compromises, to find best solutions to challenges faced by all stakeholders.
- Embark on an inclusive, co-operative and communicative management path, to work together to implement and achieve a collaborative governance approach. All affected stakeholders need to be consulted regarding the decisions.
- A multi-sectoral multi-disciplinary Task Team should be convened as soon as possible to take solutions forward and develop a time-bound Action Plan by the end of the year, with identified short-term solutions implemented by 31 March 2021.

A task team was convened, and the first meeting was on the 25th of November 2020, the first meeting aimed at establishing the terms of reference and principles of the task team as follows:

2.4 PRINCIPLES AND APPROACHES

The following principles and approaches were proposed for the implementation and activities of the Task Team:

- Multi-disciplinary, multi-sectoral and inclusive
- Ensure gender balance in the Task Team and in stake-holder meetings, including more women.
- Include and ensure voices of all stakeholders are heard, particularly community and not only scientists.
- Need government agencies to speak with one voice and not to work at cross-purposes.
- Must not divide and rule to push agendas but be transparent and inclusive of everyone.
- Scientific information to underpin decisions is critical, but this should include not only ecological but also social and economic information (and scientists should work with communities in gathering information)

2.5 TASK TEAM COMPOSITION

Representatives of the following organisations and sectors were included (those who accepted invitations):

- Relevant Government Organisations – iSimangaliso Authority, Ezemvelo KZN Wildlife, National Department of Environment, Forestry and Fisheries, KZN Department of Economic Development, Tourism and Environmental Affairs, Traditional Authority leadership, Municipalities.

- Non-governmental organisations (NGOs), including Masifundise and WildOceans
- Private sector – businesses, farmers, tourist operators, rate payers, etc
- Community sector representatives – fishing, farming, etc
- Scientists and technical experts and advisors
- Land claimants
- People and Parks structures
- Sugar cane farmers
- Youth Groups
- Small-scale fisheries co-operatives and small-scale fisher representatives

2.6 TASK TEAM TERMS OF REFERENCE

The Terms of reference of the Task Team were as follows:

- The Task Team should be established with a mandate by the symposium, its scope being the estuarine functional zone, and it should carry forward the Resolutions and spirit of the Symposium and should reference the content of all the presentations given at the Symposium (from stakeholders, scientists, consultants and authorities).
- The initial task of the Task Team should be to develop a time-bound Action Plan for short-term solutions (with the plan completed by the end of the year, action and results achieve "on the ground" before 31 March 2021).
- Urgent consideration of a facilitated breach of the mouth must be prioritised, to "assist/nudge" the system as has been done in the past, and the following must be taken into consideration if the Task Team concludes that a breach is desirable:
    - Identification of best potential breach position (if Task team concludes must proceed to breach).
    - Time to breach should be event-driven and adaptable and flexible, not a fixed pre-chosen time but allowing for adaptive flexible responses to events.

- Need to ensure affected rural communities are heard when making final decisions on actions, need to communicate programmes.
- Consider the impacts of actions decided on all, to balance for both the ecosystem and people living around the lake.
- Identify Financial Resources needed (financial, knowledge, etc).

- Consider the legal framework that impacts on possible activities (Action Plan must be crafted within the current legal framework) and communicate the legalities to stakeholders.
- Identify contributing stakeholders and shareholders, those can help financially and other contributions.
- Develop a Communication Plan for ongoing communication between government and stakeholders.
- Community awareness and information provision is important and must be strong.
- Set up processes for longer term solutions to be developed implemented, and ongoing engagement for co-operative decision-making to support, update and implement an adaptive Estuary Management Plan.

During the deliberations of the first task team, it was felt that there are a number of activities as outlined above in the terms of reference of the task team that need to be undertaken. These meant that we need to have specific technical teams that need to be formulated to look into the various task team objectives and report back at the task team meeting of the 15th of December 2020.

The Terms of Reference of each technical task team was as follows:

Scientific Technical Team

Objective:

To assess and recommend the best way to achieve an effective assisted breach, that will connect the St Lucia lake with the sea and the Umsunduzi/Imfolozi system with the sea, resulting in water levels in the lake and rivers matching those of the sea, and reinstatement of tidal and marine influences influences into the system.

Terms of reference:

a. Determine how best to achieve the 3 main goals of stakeholders: 1) connection of the lake to the sea and rivers to improve fishing of marine species in the lake and in the Umsunduzi/Imfolozi estuaries (fishers), 2) removal of silt from the mouth and narrows to allow boating to re-occur (tourism), 3) prevention of back-flooding of farmlands by allowing the freshwater to flow into the sea (farmers).
b. Prepare a recommendation, to report to the Task Team on the 15th of December 2020, with a timeline that can be implemented within this summer rain season (before end March 2021).

Key questions to consider:

- Where along the sandbar between Maphelane and St Lucia would it be best for a breach to occur?
- What would optimal conditions be to achieve this?
- What needs to be in place for this nudge to breach to happen?

- When would be best to breach (month, state of tide and sea condition, level or lake, state of rainfall)?
- How should the breach happen – is dredging, alien plant removal and/or removal of sand from the bar needed, and are all three needed?

How would an assisted breach affect (aid or hinder) future management actions to maintain the connection between the estuaries and rivers and the sea.

Legal and Policy Technical Team

Objective: To look into the enabling legislative framework for an assisted natural breach of the estuary, involving removing alien vegetation and sand from the sandbar/berm to allow a high-tide or an influx of rainwater to breach the mouth, and the dredging out of some of the siltation in the mouth area in both the St Lucia narrow and the iMfolozi/Umsunduzi estuary to create channels to allow water flow. In doing so, consider the existing IMP, Estuarine Management Plan and the court decision about breaching. Recommend actions to be taken should revision to existing Plans or applications to court be necessary to accomplish the objectives set out in 1. Above.

This Team looked at the management documents which are the Integrated Management Plan, St. Lucia Estuary Management Plan, Environmental Management Plan (including 2018 Court Decision) over and above the applicable legislations:

The court decision of 01 October 2018 was based on the relief seeked by farmers of breaching of the uMfolozi mouth in line with the trigger of 1,2 m at the CotCane gauge of the farmers and that the uMfolozi river be breached to the sea before joining the estuary. The Development of the Estuarine Management Plan (EstMP) and that of the Maintenance Management Plan (MMP) for the restoration of the system were also part of the legal documents considered. The Court Decision only disallowed breaching for purposes of dealing with back flooding and inundation of sugarcane. Both the EstMP and MMP allows breaching for ecological purposes hence there is nothing unbecoming with the current skimming of the estuary berm to assist the system to breach on its own.

Financing and Partnerships Technical Team

Objectives:

1. To obtain estimates of the costs of such an assisted breach
2. To identify possible sources of funds to achieve such an assisted breach.
3. To identify other entities or stakeholders who could provide resources to assist with the breach.

Communications Team

Objective:

To develop a Communication Plan for the Task Team, for presentation to the Task Team on 15 December 2020, that seeks to effectively reach all stakeholders, ensuring that appropriate communication mechanisms are identified for the different diverse stakeholders.

The Technical Teams convened and undertook their work as per the terms of reference above and each technical team provided a report back to the Task team on the 15th of December 2020.

2.7 STATE OF THE LAKE ST LUCIA AFTER ASSISTED BREACH

The short-term intervention of an assisted breach was implemented on the 06th of January 2021 with a channel being excavated in line with the recommendations of the scientific technical task team. Both in terms of the exact position for breaching and the depth of the channel.

Figure 1a: showing point of channel excavation linking to the sea.

Figure 1b: showing point of channel excavation linking to the sea – after assisted breach.

2.8 SYSTEM RESPONSE TO ASSISTED BREACH

Immediately establishing the link there was an exchange of sea water with fresh water, this was coupled with an immediate interaction of biotic species such as Zambezi sharks accessing the estuary. Bearing in mind the St Lucia EFZ is an estuarine system, the connection mentioned above began to improve the variation of salinity levels as can be shown in the graph below.

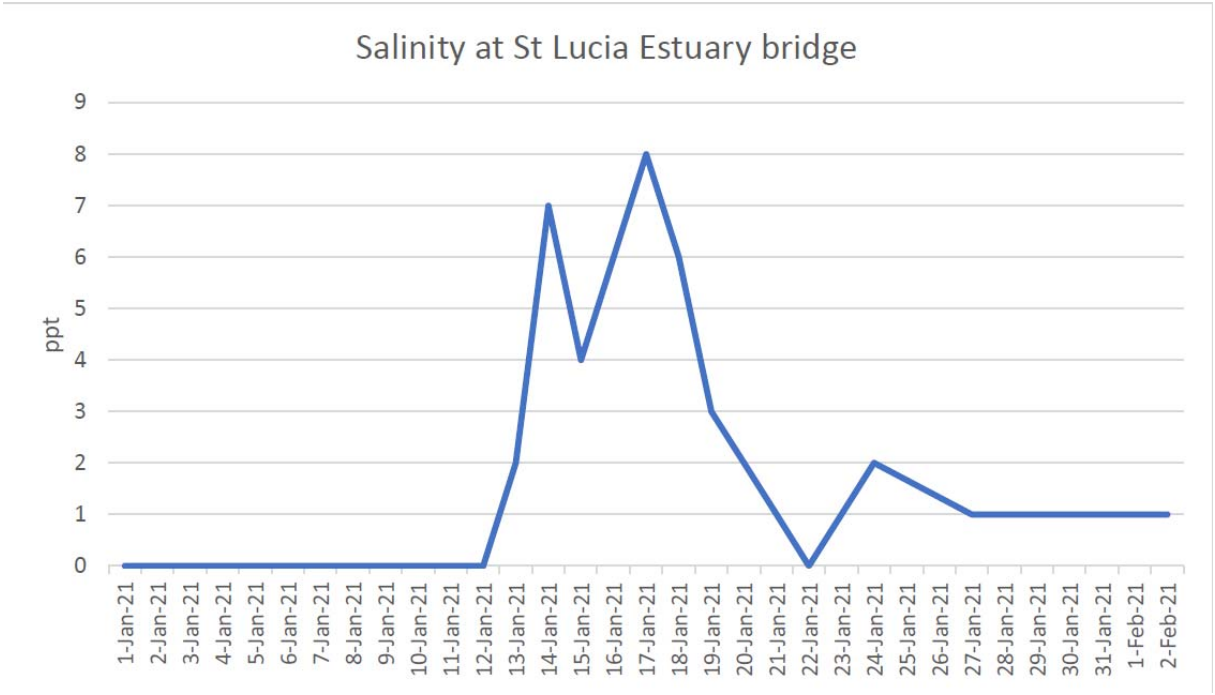


Figure 2: graph depicting fluctuations in salinity levels post 06th of January 2021.

2.9 CONFORMITY WITH PROVISIONS OF PARAGRAPH 172 OF THE OPERATIONAL GUIDELINES

In addition to the Integrated Management Plan of the world heritage property which must be approved by the Minister of Forestry, Fisheries and the Environment, the legal framework also requires that the iSimangaliso management Authority prepare and a Maintenance Management Plan (MMP) that was subsequently approved by the Minister. The Legal and Policy Technical Team mentioned on page 13 of this report refers to the terms of reference of the Team and all relevant legal and policy imperatives that were considered.

It is however also important to note that South Africa considered the assisted breaching as a maintenance exercise rather than "major restorations or new constructions which may affect the Outstanding Universal Value of the property" as indicated in the Operational Guidelines.

2.10 INTERVENTION BY MINISTER OF ENVIRONMENT, FORESTRY AND FISHERIES

Following an outcry by scientists who have a different view to the recommendations made at the symposium held on 13-15 October 2020, the Minister of Environment, Forestry and Fisheries as instructed commissioning of an independent Panel of Experts that will review all the relevant studies, recommendations and decisions taken in relation to the breaching of Lake St Lucia Estuary mouth.

The Panel will among others, advise on:

2.8.1 The significance/impact of the opening of the estuary mouth and how this relates to the implementation of the GEF 5 project interventions and the St Lucia Estuary Management Plan;

2.8.2 The exceptional circumstances, as defined in the estuarine management plan, that lead to the decision to open the mouth, including those of an environmental, social and economic nature;

2.8.3 The impact of the mouth opening on 6 January on the functioning of the estuary system and the wetland system as a whole, as well as the associated environmental, social and economic implications; and

2.8.4 Guidelines for the immediate and ongoing management of the system.

This will be a transparent process and in the interest of all interested and affected stakeholders.

3. THE THREAT OF INCREASING WATER USE TO LAKE SIBAYA– REF: CLT/WHC/AFR/2019/595 OF 3 SEPTEMBER 2019.

It is also important to indicate that the local socio-economic situation of the uMkhanyakude District as a whole in which the iSimangaliso Wetland Park exists is understood in context. This is especially in light of surrounding land uses and changes in the land use over time as evident in the graph below. The region was classified by the government of the republic as a poverty node; thus, it has limited livelihood options, i.e., agriculture and tourism in the main. The situation is also compounded by the challenge that the soil types limit agricultural activities to ecologically sensitive areas such as wetlands and floodplains.

Whilst there is engagement with the uMkhanyakude District Municipality there has also been engagement the National Department of Water and Sanitation who are also dealing with this matter directly with the uMkhanyakude District Municipality. The National Department of Water and Sanitation has also concluded the relevant Ecological Reserve Determinations for stressed resources like Lake Sibaya and will hopefully be providing that to us fairly soon.

What is also of critical note is that commercial forestry surrounding the Lake Sibaya which is arguably the biggest contributor to water loss in this system is being addressed. In this regard the iSimangaliso Authority is part of the License Assessment Advisory Committee chaired by the Department of Water and Sanitation, where a moratorium on issuing of licences for commercial forestry has been and still is in place, the challenge needing a holistic approach is the un-authorised or un-permitted cultivation of commercial forestry plantations outside of the iSimangaliso Wetland Park – World Heritage Site that continues to stress the Lake Sibaya system.

The iSimangaliso Authority has entities and government departments undertaking research on the Lake Sibaya and we are collating relevant data to ensure a holistic approach as opposed to a piecemeal approach to mitigating the water loss being experienced by the Lake Sibaya system is implemented.

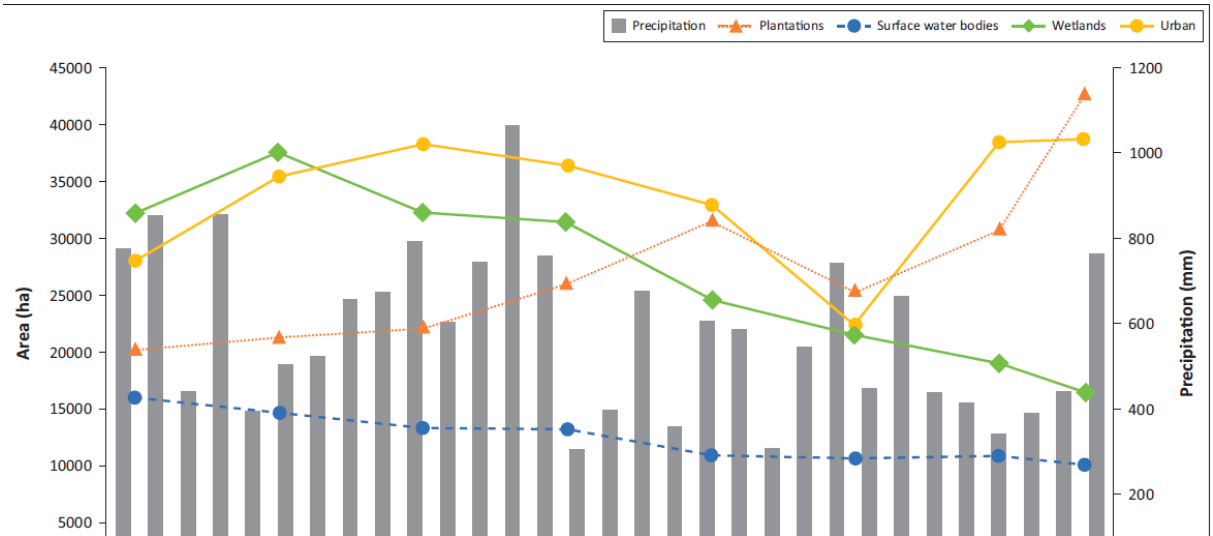


Figure 3: showing area covered by plantations, water bodies and wetlands, as well as annual precipitation.

The iSimangaliso Authority has partnered with the South African Environmental Observation Network (SAEON) and the Expanded Freshwater, the Terrestrial Environmental Observation Network (EFTEON) and the Traditional Councils which are South African government entities. The iSimangaliso Authority is working with SAEON and EFTEON on a proposal for funding to monitor the impact of landuse on the groundwater resources around the Lake Sibaya system. The Department of Water and Sanitation is also working on an Ecological Reserve Determination Study for the catchments which is being finalized imminently.

The iSimangaliso Authority is also working on the gazetting of the iSimangaliso Wetland Park – World Heritage Site Buffer Zone as a tool identify and mitigate/abate such negative impacts. The gazetting process will include consultation with all interested or affected stakeholders. A formal application to the World Heritage Committee will be submitted as soon as all the processes have been followed.

4. CONCLUSION

South Africa is committed to the protection and conservation of all its protected areas including World Heritage Properties, while ensuring a balance with socio economic imperatives for communities, especially those living in and adjacent to the protected areas. This is also enshrined in our Constitution Bill of rights and our environmental laws and policies. Maintaining and sustaining the integrity of the outstanding universal value is also integral to this commitment.

KOEDOE - African Protected Area Conservation and Science
ISSN: (Online) 2071-0771, (Print) 0075-6458

Analysis of three decades of land cover changes in the Maputaland Coastal Plain, South Africa

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Dates:
Received: 08 June 2020
Accepted: 18 Aug. 2020
Published: 09 Nov. 2020

How to cite this article:
Ramjeawon, M., Demlie, M., Toucher, M.L. & Janse van Rensburg, S., 2020, 'Analysis of three decades of land cover changes in the Maputaland Coastal Plain, South Africa', *Koedoe* 62(1), a1642. https://doi.org/10.4102/koedoe.v62i1.1642

The northern half of the Maputaland Coastal Plain (MCP) of South Africa has undergone significant change in land-use over the last five decades, including afforestation, agriculture and rural settlements. To understand the extent of land-use changes that took place in the northern half of the MCP from 1986 to 2019 and its efficacy, various Landsat satellite images that are freely available were processed, analysed and interpreted. The cloud-based Google Earth Engine (GEE) platform was used to determine the land-use changes. The random forest classification algorithm available within GEE was used to classify the Landsat 5 Thematic Mapper, Landsat 7 Enhanced Thematic Mapper Plus and Landsat 8 Operational Land Imager images for 1986, 1991, 1996, 2001, 2006, 2011, 2016 and 2019. The development of plantations was tracked, which indicated that forestry increased by more than 100% between 1986 and 2019. Over the same period, surface water bodies and wetlands decreased by 36.1% and 49.1%, respectively. In addition to forestry, climate had a major impact on water resources in the MCP. Given that the MCP is a predominately groundwater-driven system, the impact of increased plantations on groundwater is an area that requires more investigation. This will improve the understanding of water resources in the area.

Conservation implications: The management, protection and conservation of water resources within protected areas are entwined with land-use decisions and planning outside of its boundaries. The rapid change in land-use experienced outside of protected areas and its impact on water resources disregard boundaries and may transgress on protected areas.

Keywords: Google Earth Engine; Landsat imageries; land-use change; remote sensing; north-eastern South Africa; water resources; random forest classification; land cover.

Introduction

Changes in land use and land cover over time and space indicate socioeconomic change. Population growth and consequent demand for economic development have increased the conversion of natural vegetation. The KwaZulu-Natal Province has experienced an accumulated transformation of 45.6% of natural vegetation between 1994 and 2008 (Jewitt 2012:12). One area that has been affected by land cover transformation is the Maputaland Coastal Plain (MCP) located in the north-east of the KwaZulu-Natal Province of South Africa, which is rich in biodiversity and other natural resources (Orimoloye et al. 2019:3). The MCP has several wetlands, lakes and game reserves, which play an integral role in maintaining a healthy ecosystem. The largest freshwater lake in South Africa, Lake Sibayi, and the iSimangaliso Wetland Park, which is a renowned Ramsar and World Heritage site, are located within the MCP (Weitz & Demlie 2014:1). However, recent studies indicated that surface waters and wetland systems in the MCP are under severe threat because of plantations and water extraction (Everson et al. 2019:1; Orimoloye et al. 2019:9; Smithers et al. 2017:490). A large part of the Lake Sibayi catchment area is covered by plantations (Everson et al. 2019:34; Weitz & Demlie 2014:1). Mbazwana and Manzegwena, the two largest plantations, cover approximately 8500 and 15 000 ha, respectively, and were established in the 1960s by the KwaZulu Department of Forestry (SA Forestry 2012:1).

Pine plantations are deep-rooted, evergreen, non-native tree species that are known to extract soil water from below the root zone, limiting aquifer recharge and resulting in a lowered groundwater table (Kienzle & Schulze 1992:1). As a result of this, the *National Water Act* (Act No. 36 of 1998) of South Africa considers plantations as a streamflow reduction activity, and as such, plantations require a water use license from the government. In coastal areas such as the MCP, favourable solar radiation and air temperatures facilitate year-round growth and provide plantations the opportunity to access the shallow aquifers, resulting in higher water consumption than the surrounding natural vegetation (Everson et al. 2019:34). This has had a significant

impact on surface water and wetland systems in the MCP as many of the surface water systems and wetlands in the MCP are predominately groundwater driven (Kelbe & Germishuyse 2010:124).

Studies as early as the 1990s highlighted the negative impact that plantations had on the hydrology and ecology of the MCP. A study using aerial photography conducted by Rawlins (1991:30) indicated that the size and number of wetlands reduced as a result of the introduction of plantations in the area. Wetlands were reported to exist during the early growth stages of the plantations; however, these dried up as the plantations matured and were only visible for a short period after heavy rainfall (Rawlins 1991:30). Smithers et al. (2017:490) indicated that 35% of the total decrease in the level of Lake Sibayi was a result of forest plantations surrounding the lake. Orimoloye et al. (2019:1) opined that a 38% decrease in wetlands in the iSimangaliso Wetland Park between 1987 and 2017 was because of the impact of plantations. Everson et al. (2019:5–8) investigated the water use of plantations and agroforestry systems in the MCP and deduced that eucalyptus trees use more water in a day when compared with the indigenous vegetation. Modelling results from the study indicated that the removal of forest plantations from the Vasi area of the MCP will result in a 2-m increase in the groundwater table. Furthermore, a 40% increase in water yield was predicted if the plantations were to be removed from the immediate vicinity of wetlands and replaced by agroforestry.

Despite these limited and specific spatiotemporal studies, the long-term impacts of land-use change, including plantations on water resources and wetland systems in the MCP, are not yet well understood and documented. Although land cover information such as the Ezemvelo KwaZulu-Natal Wildlife (EKZNW) maps is available, they do not extend back beyond 2005. Thus, there is a need for regularly updated and long-term land-use data to improve the understanding of changes in the land surface and the impact on water resources including wetlands. Recently, the Google Earth Engine (GEE) platform has been increasingly used in conjunction with earth observation data in change detection studies (Google Earth Engine 2018). As the GEE platform is cloud based, it increases the efficiency of producing long-term records of data. A 40-year collection of Landsat earth observation data is available within the GEE platform, providing an opportunity to produce land-use data over a longer time frame.

Previous studies are limited in their temporal and spatial investigation of afforestation in the MCP. The availability of a long-term data set of afforestation for the MCP provides an opportunity to expand on the outcomes of short-term studies to gain a better understanding of the hydrology over time. This study aims to track the development of plantations over a 30-year period and its potential impacts on surface water and wetlands systems in the MCP using supervised classification.

Description of the study area

Location and climate

The MCP is located in the north-eastern coastal plain of the KwaZulu-Natal Province, South Africa (Figure 1). The coastal plain extends from Mlalazi in the south to Mozambique in the north. The coastal plain is bounded by the Lebombo Mountains in the west and the Indian Ocean in the east. The present study focuses on the region stretching from the northern perimeter of the Mkhuze Swamp in the south to the South Africa–Mozambique national boundary in the north (Figure 1). The MCP falls under the Usutu to Mhlatuze Water Management Area and has a population of approximately 573 353 people (Statistics SA 2011). It is described as one of the most underdeveloped areas in South Africa as unemployment, access to piped water, lack of electricity and low education levels are prevalent in the region (Statistics SA 2011).

The climate of the study area is subtropical and receives summer rainfall, with a 30-year mean annual precipitation of approximately 580 mm (Figure 4) (SAWS 2018). The majority of the rainfall occurs during the summer months, between October and March, and is highly spatially and temporally variable. The rainfall decreases from the coast inland towards the Lebombo Mountains. Mean daily temperatures vary from 21.0 °C to 32.1 °C in summer and 10.9 °C to 26.4 °C in winter (SAWS 2018). The mean potential evaporation rate for the study area is approximately 1458 mm $year^{-1}$ (DWS 2018).

Topography, drainage and land cover

The topography of MCP is generally flat. The highest elevation in the area is approximately 700 m above mean sea level and occurs along the Lebombo mountain range in the western boundary of the study area. From here, the elevation drops to sea level at the coast. The surface water bodies (lakes, rivers and wetlands) are predominately groundwater driven (Kelbe & Germishuyse 2010:124). The main rivers that drain the MCP are the Umfolozi, Mhlathuze, Pongola and Mkuze rivers (Kelbe & Germishuyse 2010:124). The Umfolozi River that once formed part of the St. Lucia wetland has since separated from the wetland. The Mhlathuze River flows into the Richards Bay harbour, and the Pongola River flows into Mozambique towards the Maputo Bay. The Mkuze River, along with the Nylazi, Hluhluwe and Mzinene rivers, flow into Lake St. Lucia (Kelbe & Germishuyse 2010:124). Lake Sibayi and the Kosi Bay lake systems are the two main lakes in MCP (Figure 1). The study area forms part of the Maputaland-Pondoland-Albany Hotspot.

Indian Ocean Coastal Belt (IOCB), savanna and forest are the three biomes covering the study area. The IOCB runs along the coast and up to 20 km inland. It consists of the Maputaland Coastal Belt and Maputaland Wooded Grassland (Mucina & Rutherford 2006:573). The central and western portions consist of vegetation forming the savanna biome. This includes the Maputaland Pallid Sandy Bushveld, Muzi Palm Veld and Wooded Grassland, Tembe Sandy Bushveld, Makatini Clay Thicket, Western Maputaland Sandy Bushveld

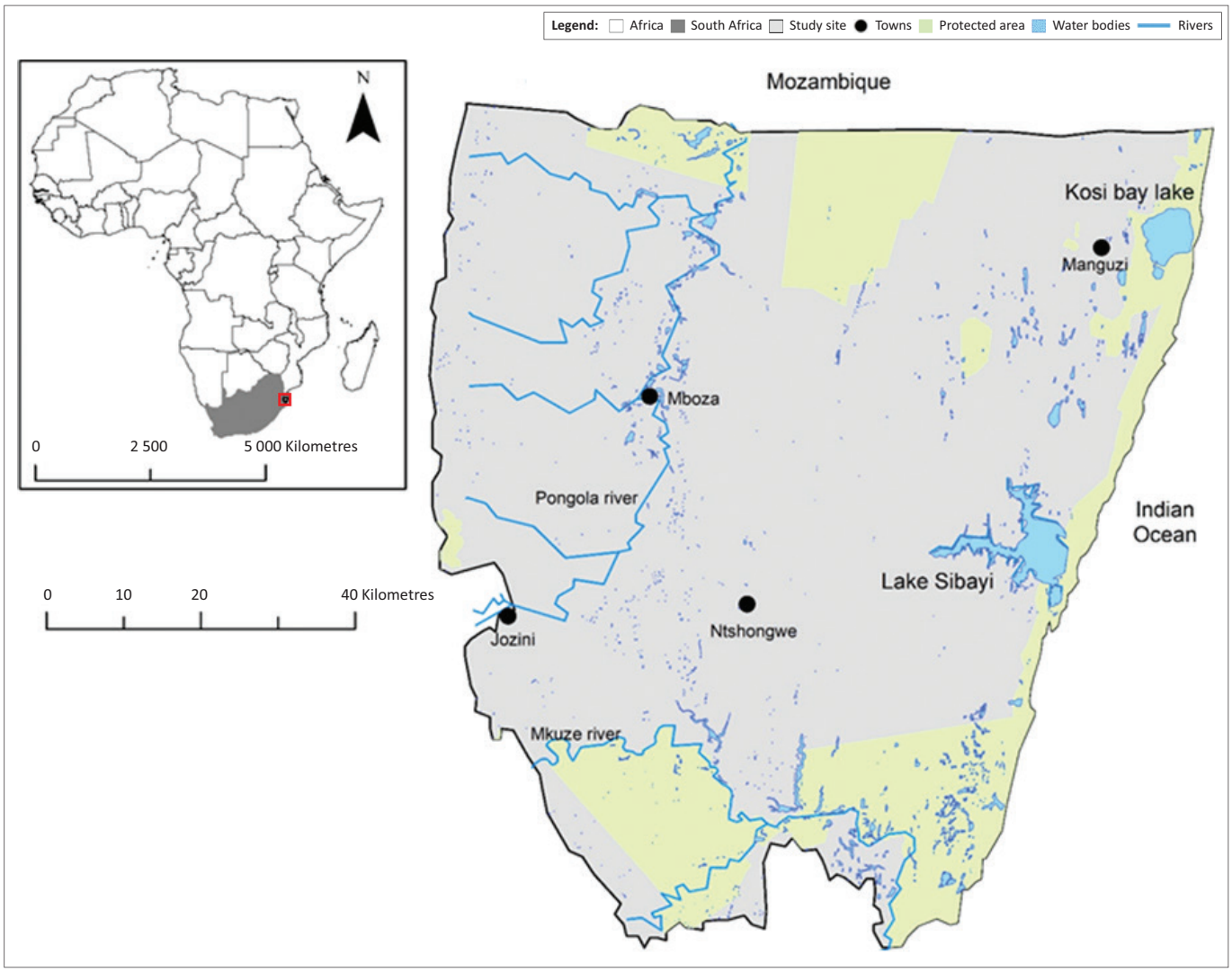

FIGURE 1: Location map of the study area in north-eastern South Africa.

and Southern Lebombo Bushveld, which cover the entire Lebombo mountain range (Mucina & Rutherford 2006:573). The Sand Forest, the Lowveld Riverine Forest and the Northern Coastal Forest are distributed throughout the study area (Mucina & Rutherford 2006:571). Adjacent to St. Lucia, the wetland type vegetation is evident through the azonal vegetation identified in SANBI (2018). Large areas of the IOCB and savanna biomes have been replaced by plantations and commercial agriculture, with homesteads distributed throughout the biome regions.

Methods and material

Earth observation data and data processing

The multi-year land-use maps reported in this study were produced using JavaScript in GEE Application Programming Interface. Google Earth Engine (GEE) is a cloud-based platform for earth science and data analyses (Google Earth Engine 2018). Google Earth Engine (GEE) contains a multi-petabyte catalogue of over 40 years of satellite imagery and geospatial data sets with massive computational abilities available for users to perform studies relating to change detection, trend mapping and quantify changes on the Earth's surface (Google Earth Engine 2018).

Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+) and Landsat 8 Operational Land Imager (OLI) surface reflectance data were used. As the operational period for each satellite is different, a combination of three satellites was used. Landsat 5 TM was launched in March 1984 and decommissioned in June 2013. Landsat 7 ETM+ and Landsat 8 OLI were launched in April 1999 and February 2013, respectively, and are still operational (USGS 2018). All have the same 30-m spatial resolution. The flow diagram (Figure 2) describes the process undertaken in GEE to classify the Landsat images. The Landsat collection was filtered to acquire one cloud-free image every 5 years from 1986 to the most recent 2019 cloud-free images. Moreover, a cloud-free Landsat image for 2018 was obtained and used to validate against the 2018 South African National Land-Cover (SANLC) map. All but one of the cloud-free images were available during the winter months. The aim of this study was to determine long-term trends in land use and land cover, not the seasonal variability. Thus, although it is

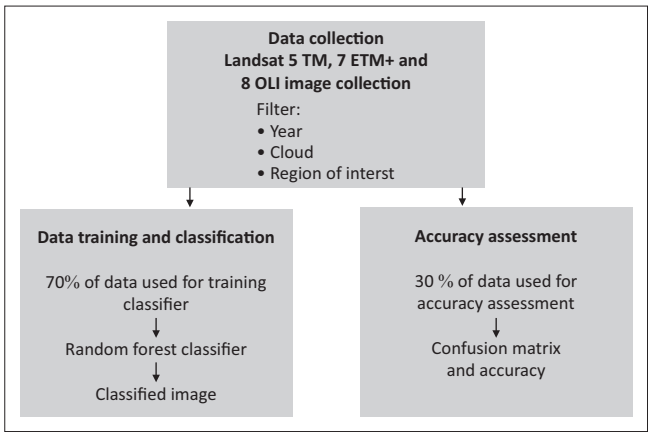

FIGURE 2: Flow chart summarising the methods followed.

acknowledged that in the wetland, lake levels will be lower in the dry, winter season, the consistency of using only winter images will allow the long-term changes to be identified. The images used in this study were for 04 November 1986, 23 July 1991, 18 June 1996, 16 June 2001, 14 June 2006, 23 August 2011, 12 August 2016, 15 June 2018 and 04 July 2019. The availability of images was limited because of cloud cover.

Supervised classification

Supervised classification is based on the premise that prior knowledge of the land classes in the study area is known (Richards & Jia 2006:78). The users determine the land cover types to be investigated, and representative pixels for each type are identified. This is known as training, and the information is obtained either from field surveys, aerial photographs, maps, satellite imagery or a combination of these (Richards & Jia 2006:80). Once the pixels are trained, a classifier is used to classify the rest of the image (Richards & Jia 2006:298). Several classifiers are available, including the maximum likelihood, minimum likelihood, support vector machine and random forest.

Training data

Training data were obtained by visual inspection of TerraMetrics 15-m spatial resolution satellite imagery, the EKZNW land cover map and field data. Ezemvelo KwaZulu-Natal Wildlife land cover map is a free data set available on request for 2005, 2008, 2011 and 2017. The EKZNW data sets were selected as they are well-recognised published maps for KwaZulu-Natal that have relatively high overall accuracies (Thompson 2018:21). The EKZNW land cover maps were produced using Sentinel 2 satellite imagery based on a 20-m spatial resolution (Thompson 2018:5). In addition to the use of the EKZNW maps, a field survey was conducted between 24 June 2019 and 28 June 2019, where a total of 65 *in situ* land-use data points were collected. The location of the data points was generated using a random point generator tool. The data points were collected around the study site and consist of 18 grasslands, 16 plantations, 14 indigenous vegetation, 7 wetlands, 5 urban, 4 bare ground and 1 agriculture data point. These data were used to assist in identifying land uses in the study area for training purposes.

Overall, 35 water body, 25 urban, 25 bare soil, 25 agriculture, 35 plantations, 50 grasslands, 50 natural vegetation, 30 wetlands and 30 degraded land reference polygons, accounting for over 70 000 pixels, formed the reference data set, which was used to identify Landsat pixels that made up one of the nine land-use classes. The nine land-use classes were chosen as these were identified as the dominant land covers, which could be clearly distinguished for the study area. The nine land-use classes are water bodies, urban, bare ground, agriculture, plantations, grasslands, indigenous vegetation, wetlands and degraded land. Bare ground is described as a sand cover found typically on the coastline, whereas degraded land consisted of partial vegetation cover. From the reference data set, 70% of the sample data were randomly selected for training, and the remaining 30% was used to validate the data set. The training data was used for the supervised classification algorithm, and the validation data were used in the accuracy assessment of the classified land-use maps.

Image classification

The random forest classification algorithm has become a popular model for land-use and land cover classification as it has produced more accurate results in comparison to other classification algorithms (Li et al. 2014:21; Reynolds et al. 2016:2). The random forest classification is easier to operate, more efficient and robust to outliers and can handle a large amount of training data (Rodriguez-Galiano & Chica-Rivas 2012:13). The random forest classifier has been used in several studies to map forests (Mellor et al. 2012; Senf, Hostert & van der Linden 2012), wetlands (Berhane et al. 2018; Chignell et al. 2018), agriculture (Lebourgeois et al. 2017; Ok, Akar & Gungor 2012) and land cover (Jin et al. 2018; Na et al. 2010). The random forest classifier consists of many decision trees that operate as an ensemble and requires two parameters to be identified to make accurate class predictions, namely, the number of predictor variables and the number of classification trees (Yiu 2019:1; Zurqania et al. 2018:178). Consequently, the random forest classification algorithm was adopted and used in GEE for this study.

Accuracy assessment

Accuracy assessment techniques are used to determine how well an image has been classified (NASA 2018:2). The validation data set was used to produce an error matrix for each of the classified images. The error matrix was used to determine the overall accuracy, kappa coefficient, user's accuracy and producer's accuracy using Equations 1, 2, 3 and 4, respectively. The user's accuracy (error of commission) occurs when a pixel is incorrectly included in a category being evaluated, whereas the producer's accuracy (error of omission) occurs when a pixel is left out of the category being evaluated (NASA 2018:17). The kappa coefficient is a measure of inter-rater reliability and is used to determine the

agreement between two data sets. The user's and producer's accuracies were generated for all nine classes for each image:

$$\text{Overall accuracy} = \frac{\text{Sum of diagonal elements}}{\text{Total number of accurate pixels}} \quad \text{[Eqn1]}$$

$$\text{Kappa coefficient } (K) = \frac{P_{agree-}\ P_{chance}}{1 - P_{chance}} \quad \text{[Eqn2]}$$

where P_{agree} is the agreement observed and P_{chance} is the agreement expected by chance.

$$\text{User's accuracy} = \frac{\text{Total number of correct pixels in a category}}{\text{Total number of pixels of that category derived from the reference data (column total)}} \quad \text{[Eqn3]}$$

$$\text{Producer's accuracy} = \frac{\text{Total number of correct pixels in a category}}{\text{Total number of pixels of that category derived from the reference data (row total)}} \quad \text{[Eqn4]}$$

In addition to the error matrix, a land-use map was produced for 2018 and compared with the SANLC (2018) map. The SANLC map was chosen as it is a well-recognised published map for South Africa with an overall accuracy of 90.1%. Classes from the SANLC (2018) map had to be merged to form classes that were comparable to the nine classes defined for this study. Open water bodies, such as rivers, estuaries, lakes, dams and natural pans, were merged to form the 'water' land cover. Residential areas including informal settlements, scattered and dense villages, commercial, industrial and roads were merged to form the 'urban' land cover. Natural rock, dry pans, coastal dunes and dry riverbeds were merged to form 'bare ground'. Cultivated commercial permanent orchards, cultivated commercial sugarcane (pivot and non-pivot), emerging farmer sugarcane non-pivot, commercial annual crops (irrigated and drylands) and subsistence farms were merged to form the 'agriculture' land cover. Contiguous and dense plantation forests, open and sparse plantation forests and temporary unplanted (clear-felled) plantation forests were merged to form 'plantations'. Natural grasslands were merged to form 'grasslands'. Contiguous (indigenous) forests, contiguous low forests and thicket, dense forests and woodland, open woodland and low shrubland were merged to form 'indigenous vegetation'. Herbaceous wetlands and mangrove wetlands were merged to form 'wetlands'.

Ethical consideration

The authors confirm that ethical clearance was not required for the study.

Results

The results obtained from the accuracy assessment, the comparison between the 2018 classified Landsat image and the SANLC (2018) map as well as the spatiotemporal changes for plantations, water bodies and wetlands from 1986 to 2019 are presented in this section.

Accuracy assessment

The overall accuracies achieved are all greater than 92% with the highest accuracy of 96.3% for the 1996 image (Table 1). The highest and lowest kappa coefficients are 0.95 (1996) and 0.89 (2011) (Table 1). The 2011 image was the only image based on the Landsat 7 ETM+ satellite data and has the lowest overall accuracies and kappa coefficient. This could be a result of scan lines present on the Landsat 7 ETM+ images.

The user's accuracy and producer's accuracy range from 60.2% to 99.9% and from 64.8% to 100%, respectively (Table 1). Water bodies proved to be the most accurately predicted land-use class across all images with user's and producer's accuracies ranging between 99.7% and 99.9% and 99.7% and 100%, respectively. The least accurately predicted class was the urban areas with a maximum user and producer accuracy of 72.3% and 76.5%, respectively. A majority of the settlements in the study area are located within grasslands; as a result, some settlement areas, which should have been classed as urban land use, are classed as grasslands in the majority of the images classified. The plantation land-use class produced user's and producer's accuracies ranging from 71.6% to 92% and 72.0% to 91%, respectively.

TABLE 1: The user's accuracy, producer's accuracy, overall accuracies and kappa coefficients for the classified Landsat images.

Landuse class	1986		1991		1996		2001		2006		2011		2016		2019	
	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)
Water	99.7	99.9	99.9	99.9	99.8	99.7	99.8	99.8	99.7	99.9	99.8	99.7	99.9	99.9	99.9	100.0
Urban	71.8	73.1	71.6	69.7	65.6	69.8	70.2	69.1	72.3	76.5	64.0	64.9	66.8	70.9	60.2	64.8
Bare ground	99.8	98.4	98.8	96.6	98.1	96.2	98.9	98.9	96.7	96.5	97.4	97.8	96.4	97.3	95.4	98.0
Agric	93.1	91.0	89.4	89.9	74.5	80.1	84.2	83.5	86.3	87.7	82.2	83.7	83.4	86.2	85.5	85.7
Plantations	88.5	90.0	90.3	91.0	92.0	89.4	86.5	85.5	86.7	87.5	71.6	72.0	83.9	83.7	81.5	82.4
Grasslands	87.7	88.1	90.8	89.7	90.9	91.0	88.1	87.7	91.1	89.6	83.0	83.1	85.1	84.8	84.2	83.4
Indigenous veg	97.9	98.0	98.2	98.3	98.5	98.4	98.5	98.7	98.1	98.1	95.9	96.1	97.1	97.1	97.1	97.1
Wetlands	94.0	93.2	95.3	95.5	96.2	96.9	96.9	96.5	96.0	96.6	88.3	87.8	93.2	92.2	92.2	92.6
Degraded land	92.4	92.0	92.0	92.5	93.5	93.1	88.9	89.2	93.2	93.4	88.9	88.2	90.6	90.3	87.9	87.5
Overall accuracy (%)	-	95.5	-	96.0	-	96.3	-	95.4	-	96.0	-	92.3	-	94.0	-	93.5
Kappa coefficient	-	0.9	-	0.9	-	0.9	-	0.9	-	0.9	-	0.9	-	0.9	-	0.9

UA, user's accuracy; PA, producer's accuracy.

Validation of the 2018 Landsat classified map

The 2018 Landsat classified land-use map was compared with the 2018 SANLC map (2018) as part of the validation study. The water bodies, wetlands and plantations land-use classes were compared.

The regression indicates a good correlation between the two data sets with a coefficient of determination (R^2) of 0.92. Water bodies have the least difference in area between the two maps followed by wetlands and plantations. Water bodies covered a total area of 10 303 ha according to the SANLC (2018) map, whereas the Landsat classified map had a total area of 11 260 ha (Table 2). The Landsat classified map overestimated water bodies, wetlands and plantations by approximately 9.3%, 4.4% and 29.3%, respectively. These small discrepancies may be attributed to the fact that the SANLC (2018) map was produced at a 20-m spatial resolution compared with the Landsat image, which has a 30-m spatial resolution.

Land-use changes in the Maputaland Coastal Plain from 1986 to 2019

Plantations, water bodies and wetland land-use classes from 1986 to 2019 were selected and assessed. Most of the plantations are located along the coastline, just north and south of Lake Sibayi (Figure 3). Plantations increased at an average rate of 235 ha year^{-1} between 1986 and 1991, which increased to approximately 2372 ha year^{-1} by 2019 (Table 3). This indicates that the rate of change increased 10-fold between 1986 and 2019. The plantation coverage increased by about 22 549 ha between 1986 and 2019. Initially, the plantation was concentrated around Lake Sibayi. Between 1986 and 2001, a 5936-ha increase in plantations was observed. This expansion of plantation occurred in the region north of Lake Sibayi with smaller plantations developing west of Lake Kosi Bay. In 2006, there was a decrease in forestry, possibly because of felling. Following this, a 35.4% (11 193 ha) increase in plantations occurred between 2006 and 2019. The classified images between 2006 and 2019 (Figure 3) indicate that the expansion of commercial plantations was concentrated in the area west of Kosi Bay and to a smaller extent west of Lake Sibayi.

Surface water bodies and wetlands have experienced a decline since 1986. The largest rate of change was experienced during the 2001–2006 period for surface water bodies with an average decrease of 444 ha year^{-1}. During the same period, wetlands experienced the largest rate of decline of 1383 ha year^{-1} (Table 3). Open water bodies decreased by 17.5% between 1986 and 1996 (Figure 4). However, water bodies increased by 0.5% between 1996 and 2001. From 2001 to 2019, a more significant decrease by 22.9% was observed. An overall decrease of 36.1% occurred between 1986 and 2019. The largest rate of change was experienced during the 2001–2006 period with an average decrease of 444 ha year^{-1} (Table 3). The extent of Lake Sibayi and water bodies located in the middle of the study area visibly declined in the images from 1986 to 2019 (Figure 3). Between 2001 and 2006, the southern basin of Lake Sibayi became noticeably smaller (Figure 3). By 2016, the southern portion of the lake was disconnected from the main lake and continued to decrease, as can be seen in the 2019 image (Figure 3). The water bodies located near the middle of the study area have also decreased between 1986 and 2019 and, in some instances, disappeared. The water bodies in the Kosi Bay area do not seem to have been affected that much. Within the conservation area, water bodies decreased by 17.5% between 1986 and 2019.

The distribution of wetlands located in the study area is shown in the classified images of Figure 3, where the most extensive one is located in the southern section of the study area. The extent of wetlands is visibly smaller in the 1986 image as a result of below-average rainfall received in 1985 (DWS 2018). Between 1986 and 1991, a 16.7% increase in wetlands occurred (Figure 4), particularly along and around water bodies in the northern region of the study area and in the south-west section of the study area (Figure 3).

The extent of wetlands remained relatively constant with a 705.7-ha difference between 1996 and 2001. The extent began to decrease significantly from 2001 onwards (Figure 4). Between 2001 and 2019, wetlands decreased by 47.9%. The highest rate of wetland decline was experienced during the 2001 and 2006 period at a rate of 1383 ha year^{-1} (Table 3). A decrease in the extent of the iSimangaliso wetland in the south and wetlands located on the northern boundary of the study area is noticeable in the classified maps. Generally, wetlands experienced an overall decrease of 15 862.6 ha (49.1%) during the study period. Wetlands within the conservation area increased between 1986 and 1996, and after which, their extent decreased by an overall 18%.

Urban areas increased by 36.5% between 1986 and 1996 (Figure 4). This was followed by a decrease of 4.8% between 1996 and 2001. Overall, the urban land class increased by 38% between 1986 and 2019.

Discussion

Image processing, classification and validation

The random forest classification algorithm was used within the GEE platform to produce land-use maps for the northern

TABLE 2: Area comparison between South African National Land-Cover map (2018) land cover and the Landsat 2018 classified map.

Land use class	SANLC 2018 (ha)	Landsat classified map for 2018 (ha)	Area difference (ha)	Percentage difference (%)
Water bodies	10 303	11 260	957	9.3
Wetlands	27 918	29 139	1 221	4.4
Plantations	26 106	33 751	7 645	29.3

SANLC, South African National Land-Cover.

MCP for the years 1986, 1991, 1996, 2001, 2006, 2016 and 2019 to assess long-term trends and changes. The results of the validation study indicate a good overall goodness of fit (R^2 = 0.92). The overall accuracy ranged between 92.3% and 96.3%. The 2011 image had the lowest overall accuracy (92.3%) because of the gap-filled scan lines present in the Landsat 7 ETM+ image, which may have affected the accuracy of the classification. The Landsat 7 ETM+ 2011 image was used as there was no cloud-free image available from Landsat 5. The overall accuracy decreased from 1986 to 2019. This could be zattributed to the change in land cover over time. As land cover heterogeneity increases, the probability of misclassifying pixels increases, which influences the overall accuracy (Smith et al. 2002:69).

The error matrix for all eight images indicated that urban areas were the least accurate land cover class predicted. The reason for the poor estimation of the urban land cover class could be attributed to the 30-m spatial resolution of the Landsat satellite data, which failed to capture the homesteads in the MCP, as many of them are smaller than the satellite resolution. Furthermore, the yards are not tarred or paved and are covered by grass or shrub vegetation and small subsistence vegetable plots, which may have been incorrectly

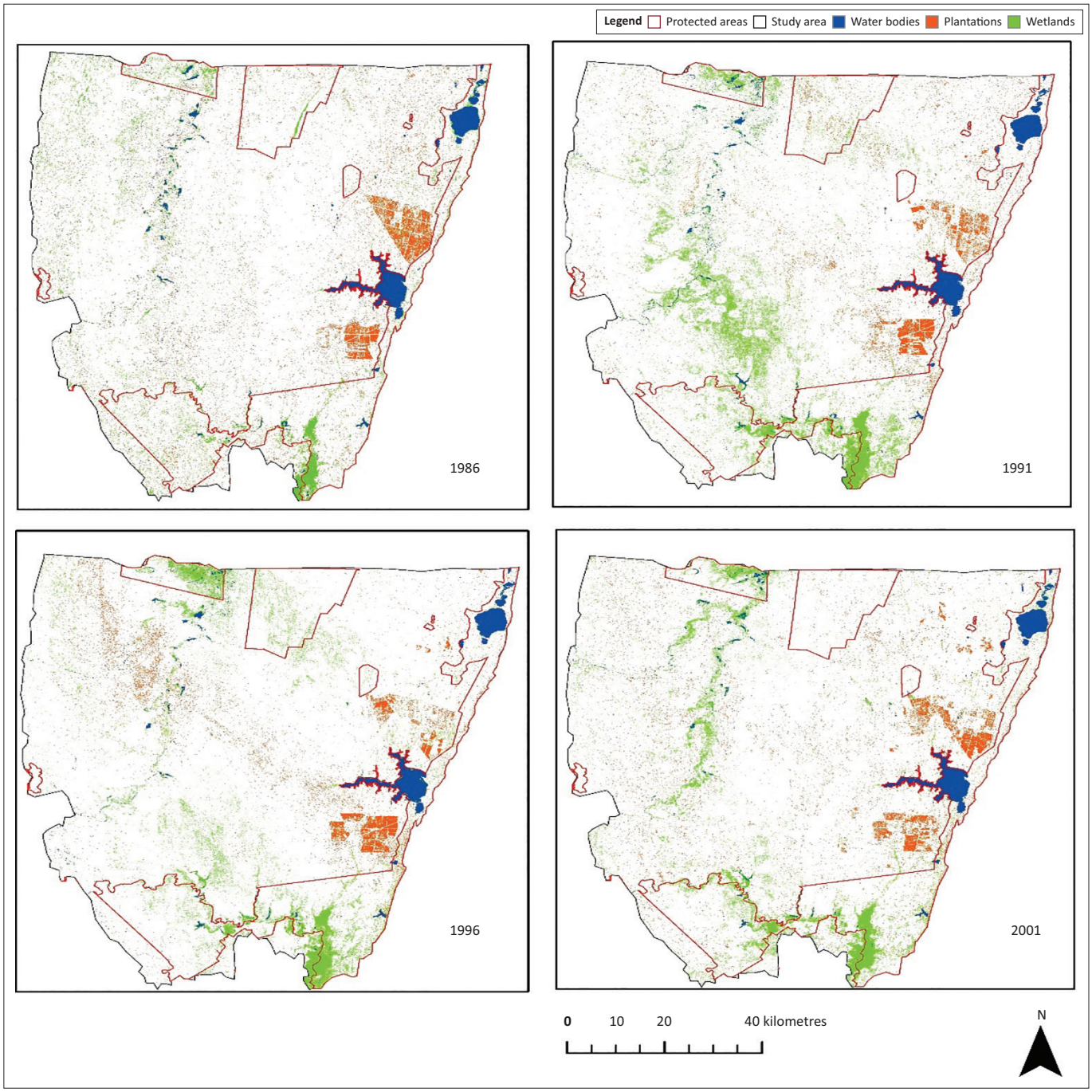

FIGURE 3: Spatial distribution of forests, water bodies and wetlands for the Maputaland Coastal Plain between 1986 and 2019.

Figure 3 continues on the next page →

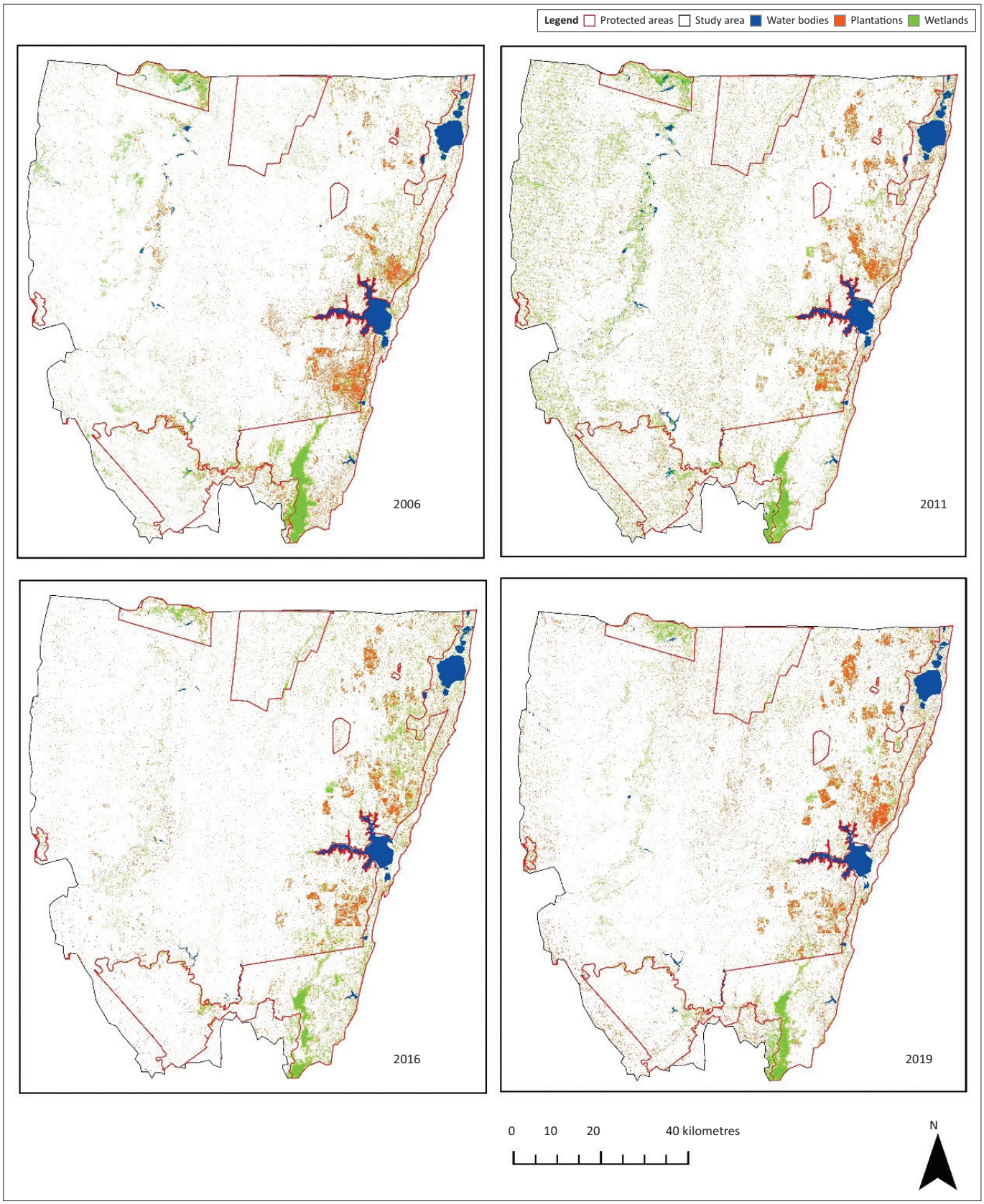

FIGURE 3 (Continues...): Spatial distribution of forests, water bodies and wetlands for the Maputaland Coastal Plain between 1986 and 2019.

mapped as grassland land cover. Improved classification of urban areas can be achieved using a finer resolution satellite such as Sentinel (10 m resolution); however, imagery is not available for long-term studies. The lower accuracies achieved for the grasslands, plantation and agricultural classes may be attributed to the random forest classification algorithm. Jin et al. (2018:17) identified Normalized Difference Vegetation Index (NDVI) as the most important

TABLE 3: Net area change (ha year^{-1}) between measurement periods for plantations, surface water bodies and wetlands.

Land use class	1986–1991	1991–1996	1996–2001	2001–2006	2006–2011	2011–2016	2016–2019	1986–2019
Plantations	235	151	801	1 084	-1 231	1 098	2 372	683.2909
Surface water bodies	-242	-316	12	-444	-56	32	-135	-174.325
Wetlands	1 078	-1 085	-141	-1 383	-623	-497	-523	-480.684

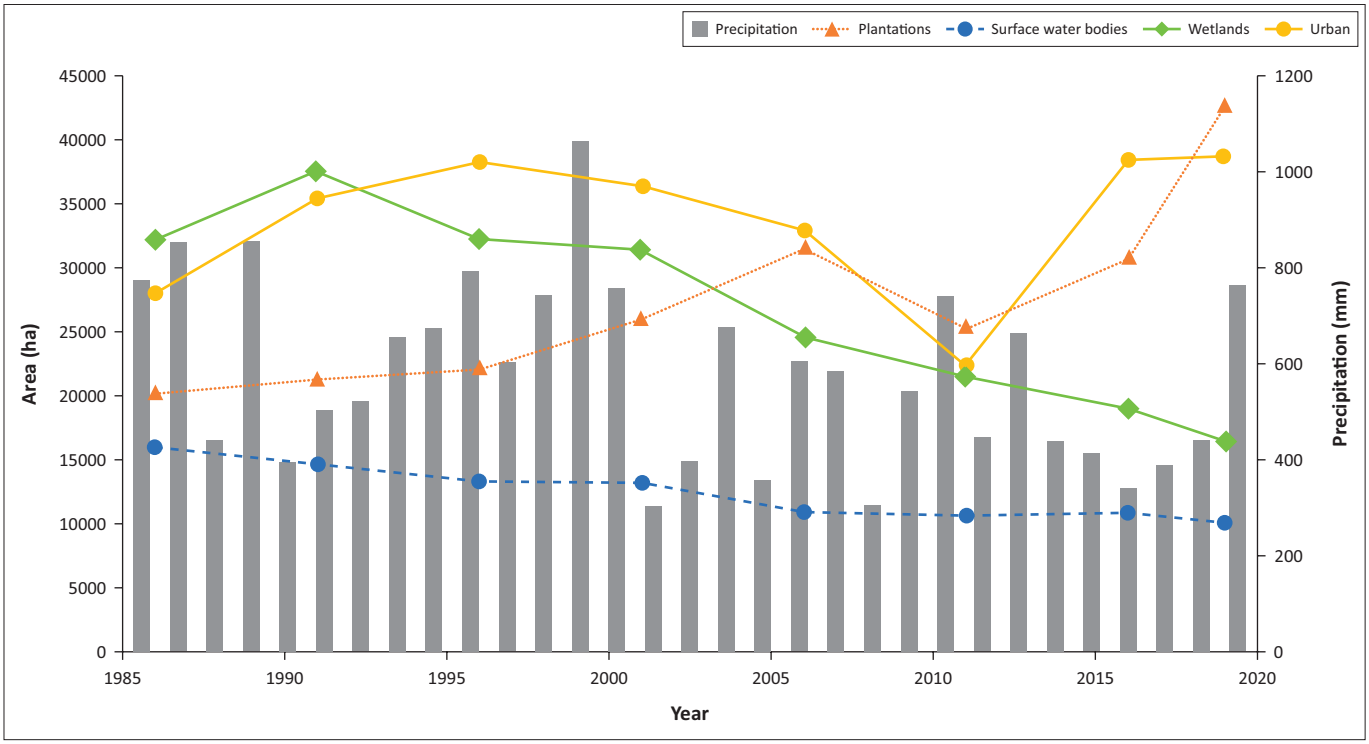

FIGURE 4: Change in area covered by plantations, water bodies and wetlands, as well as annual precipitation for the study area, for the period from 1986 to 2019.

variable that influenced the random forest classifier. The limited availability of water, particularly in recent years, may have influenced the NDVI of grasslands, plantations and rainfed agriculture lands during the winter season and hence affected the results achieved. The 30-m spatial resolution appeared to be suitable for water bodies and wetlands as the overall accuracies for these classes were relatively high.

Land-use/land cover change

The Landsat classified maps from 1986 to 2019 indicated an overall increase in size and number of plantations, wherein it more than doubled during the last three decades. The Manzengwenya and Mbazwana plantations have expanded but most notable was the development of new plantations near the Kosi Bay area and west of Lake Sibayi. These findings were in line with earlier reports by Weitz and Demlie (2014:1) and Everson et al. (2019:69), who expressed concern that plantations in the MCP were increasing. The new plantation developments are visibly smaller than the Manzengwenya and Mbazwana plantations and are likely related to small-scale woodlots grown by subsistence farmers. SA Forestry (2012:1) reported that Mondi, a timber production company, has been assisting the local communities that are located from Sodwana Bay to the Mozambique border in establishing small-scale commercial plantations as means of livelihoods. Another timber production company, Sappi, has established a programme that provided small-scale growers with a minimum of 5 ha (SA Forestry 2012:1). One such site is established near Manguzi, near Lake Kosi Bay (Sappi 2020:1). Many studies highlighted the high water use of plantations compared with the natural vegetation it replaces (Dye 1996:33; Dye & Versfeld 2007:122; Everson et al. 2019:6). The evergreen canopies, high leaf area index and deep roots coupled with favourable climatic conditions are the drivers behind the high water use of plantations (Dye & Versfeld 2007:122; Everson et al. 2019:138). The deep root systems of plantations allow the trees to access groundwater, which is not accessible by shallow-rooted grasslands and poses a threat to groundwater systems. Water use of *Pinus* plantations from three summer-rainfall catchments in South Africa, namely, Cathedral Peak, Mokobulaan A and Mokobulaan B, ranged between 750 and 900 mm year^{-1} (Dye 1996:32). Recently, Everson et al. (2019:5) estimated the average daily water use of individual trees in the MCP. Small *Eucalyptus* trees had an average daily water use of 19.2 L day^{-1}, whereas the average daily water use of mature trees was 8.0 and 11.41 L day^{-1} for *Pinus* and *Eucalyptus*, respectively. In Nebraska Sand Hill, United States, Adane et al. (2018:180) reported that annual average groundwater recharge rates decreased from 9.65 to 0.07 cm year^{-1} when natural grasslands were replaced with *Pinus* plantations. Ndlovu and Demlie (2018:1) reported that groundwater level around the Tembe and Mbazwana areas in MCP decreased by 0.7 m and 2.7 m, respectively.

The Landsat classified maps revealed a decrease in water bodies and wetlands in the study area during the same period. The main drivers for the reduction in the extent of open water bodies and wetland systems are the expansion of plantations and the change in climate. The results of this study are consistent with the findings of Rawlins (1991:30) and Smithers et al. (2017:490), where plantations are reported to have induced a reduction in the extent of surface water and wetland systems. Since the early 1990s, studies have indicated that plantations have reduced the size and number of wetlands in the MCP (Rawlins 1991:30). Rawlins (1991:30), Everson et al. (2019:24) and Orimoloye et al. (2019:1) noted the reduction in wetlands linked to plantations, with Orimoloye et al. (2019:1) finding a 38% decrease in wetlands in the iSimangaliso Wetland Park between 1987 and 2017. Moreover, Grundling, Van Den Beg & Price (2013:135) reported that wetlands in the MCP decreased as a result of land-use change and drought.

The present study found an overall decrease of 49.1% in wetlands that is far more than that reported by Orimoloye et al. (2019), which is related to the difference in the size of the study area investigated and the length of time considered. Smithers et al. (2017:490) indicated that plantations were the cause of a 35% drop in the water level of Lake Sibayi and that removal of the forest from the catchment area would increase water yield substantially. Elsewhere in the world, D'Amato et al. (2017:270) stated that plantations in southern China had negative impacts on water quantity and suggested the removal of plantations to improve water availability. Immediate increase in water yield following the removal of plantations has been reported in many countries, including south-eastern Australia (Bren & Hopmans 2007:1), India (Sikka et al. 2003:1) and several Andean countries (Bonnesoeur et al. 2019:575). Similarly, Woodward et al. (2014:1) reported that the removal of forests has increased the water available to wetlands and, in some instances, created new wetlands, particularly in Australia and New Zealand.

Climate has a major impact on water resources in the MCP. Pitman and Hutchison (1975) highlighted that Lake Sibayi was highly sensitive to changes in local climate. In addition to forestry, the decrease in the extent of water bodies reported in this study for the period between 1991 and 1996 may be attributed to a severe drought that occurred between 1992 and 1995 (Kelbe & Germishuyse 2010:183; Ndlovu & Demlie 2020:8). Rainfall data from the Makatini Research Centre (Figure 4) recorded an average annual precipitation of 471 mm between 1992 and 1994. This was lower than the 30-year average annual precipitation of 580 mm between 1988 and 2018. The increase in water bodies found between 1996 and 2001 is attributed to the higher rainfall the area received during the same period, where surface water bodies increased in area by approximately 12 ha year^{-1}. However, the following decade recorded lower-than-average rainfall, which was a major contributor to the shrinkage of wetlands and lake level reduction reported for the study area (Nsubuga, Mearns & Adeola 2018:1; Smithers et al. 2017:490). Climatic patterns investigated over the study period found that below-average rainfall has been experienced in the study area since 2001 (Blamey et al. 2018:6). Nsubuga et al. (2018) analysed rainfall data from eight stations in the MCP and reported a strong correlation (0.88) between precipitation and surface water levels. The study reported in this article shows that, the extent of surface water bodies decreased by about 444 ha year^{-1} between 2001 and 2006; this decrease was consistent with that reported in Smithers et al. (2017:490) and Nsubuga et al. (2018:1).

Implications on conservation areas

This study showed that expansion of plantations and decrease in rainfall in the MCP have resulted in a decrease in the extent of surface water bodies and wetlands. The expansion of plantations is concentrated around the south–north axis of the recharge area of the iSimangaliso Wetland Park. Consequently, the extent of water bodies and wetlands in the conservation areas of the MCP decreased by 17% and 24%, respectively. Because of the interconnected nature of the hydrologic system of the MCP, any stress on the groundwater systems will transmit automatically into surface water bodies and wetlands, including the conservation areas. This suggests that land-use planning and decisions outside of conservation areas and their impact on water resources disregard boundaries and may transgress on conservation areas.

Conclusion

The north-eastern MCP has undergone significant change in land use over the last five decades, including afforestation, agriculture and rural settlements. To understand and map these land-use changes, the cloud-based GEE platform was used to process and classify satellite data for the period from 1986 to 2019. The random forest classifier was used to classify a total of eight images for the study period. The overall accuracies of the classification achieved range from a minimum of 92.3% (2011) to a maximum of 96.3% (1996). The spatial expansion of plantations is clearly indicated, and an inverse relationship with surface water bodies and wetlands is noticed over the study period.

The development of plantations was tracked between 1986 and 2019, which indicated that during the last decade, the rate of development has increased. The Landsat classified images indicated that the expansion of plantation was concentrated in the area west of Lake Kosi Bay and Lake Sibayi. Over the same period, surface water bodies and wetlands decreased by 36.1% and 49.1%, respectively. As a result of the shrinkage in the areal extent of the lakes, the southern basin of Lake Sibayi was disconnected from the main basin of the lake in 2016, and the lake area continued to decrease. Water bodies located around the middle of the study area have also been negatively affected, and some of them have disappeared in the 2019 classified map. Similarly, the extent of wetlands decreased significantly, and a 47.9% reduction in area was noted between 2001 and 2019. The decrease in the extent of surface water systems, including lakes and wetlands, is not only attributed to land-use changes

such as the expansion of plantation but also to climate changes in the form of below-average rainfall.

This study confirms that the GEE platform is an ideal tool for processing earth observation data at large spatial and long-time scales as it contains a multi-petabyte catalogue of satellite imagery and geospatial data sets with massive computational abilities, which allow users to efficiently determine long-term land-use changes for large areas. The results of the multi-temporal land-use and land cover information reported in this article will undoubtedly inform policy- and decision-making related to the impacts of land-use change, including critical evaluation of water use license issues related to various scales of plantations and undertaking consistent compliance monitoring.

Acknowledgements

The South African Weather Service is acknowledged for the meteorological data; Dr. Gokool of the University of KwaZulu-Natal, for assisting in the use of Google Earth Engine; Ezemvelo KwaZulu-Natal Wildlife, for providing the land-use maps, and the South African National Biodiversity Institute, for providing the South African National Land-Cover map.

Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

M.R., M.D., M.L.T. and S.J.v.R. contributed to the design and implementation of the research, analysis of the results and writing of the manuscript.

Funding information

The financial assistance of the Expanded Freshwater and Terrestrial Environmental Observation Network, hosted by the National Research Foundation's South African Environmental Observation Network business unit, and the South African Department of Science and Innovation towards this research is acknowledged.

Data availability statement

The data that support the findings of this study are available from the corresponding author (M.R.) upon reasonable request.

Disclaimer

Opinions expressed and conclusions arrived at in this article are those of the authors and are not necessarily to be attributed to the National Research Foundation or the South African Environmental Observation Network.

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