Environmental Consultants

DRAFT BASIC ASSESSMENT REPORT (DBAR)

in terms of the Environmental Impact Assessment Regulations, 2014, promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

File Reference Number:
1/3/1/16/1E-268

Project Title:
Proposed Remediation of the Sappi Ngodwana Dam, Ngodwana, Mpumalanga Province.

Prepared for:
Errol Von Berg
Sappi Paper and Paper Packaging
Sappi Southern Africa Ltd
Ngodwana Mill
Private Bag X1001, Ngodwana, 1209
Tel: +27 (0)13 734 6644
Fax +27 (0)86 681 7995
Email: Errol.VonBerg@sappi.com
Website: www.sappi.com

Compiled by:
Ecoleges Environmental Consultants
2 Generaal Street
eNtokozweni (Machadodorp)
P.O. Box 516, Machadodorp, 1170
Tel: +27 (0)83 644-7179
Fax: +27 (0)86 697 9316
Email: justin@ecoleges.co.za
Website: www.ecoleges.co.za

28 October 2020

Draft (Rev01)

DOCUMENT CONTROL

Table 1: Document Control.

PHASE	AUTHOR	STATUS	REVISION	DISTRIBUTED ON	SIGNATURE
Author	Philip Radford	Draft	00	04 September 2020	
Review	Justin Bowers	Draft	01	10 October 2020	
Approved	Justin Bowers	Draft	01	28 October 2020	

Table 2: General Site Information.

The following general site information is required:
Descriptions of all affected farm portions;
Farm Ngodwana 1030JT
21-digit Surveyor General codes of all affected farm portions;
The 21-digit Surveyor General Codes of each cadastral land parcel are as follows: • Farm Ngodwana 1030 JT T0JT00000000103000000
Copies of deeds of all affected farm portions;
Appendix A: Annexure C

Table 3: Checklist: Content of BAR Report in terms of Appendix 1 of the EIA Regulations, 2014, as amended.

(1) ***"A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include- "***	
(a) details of-	**Page/Appendix**
(i) the EAP who prepared the report; and	Page 16
(ii) the expertise of the EAP, including a curriculum vitae;	Page 17
(b) the location the activity, including:	
(i) the 21-digit Surveyor General code of each cadastral land parcel;	Page ii & 19
(ii) where available, the physical address and farm name;	Page ii & 19
(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	**N/A**
(c) a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale, or, if it is	**Appendix A: Annexure A**
(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	**N/A**
(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	**N/A**
(d) a description of the scope of the proposed activity, including-	Page 20 - 33
(i) all listed and specified activities triggered and being applied for; and	Page 20 - 22
(ii) a description of the activities to be undertaken including associated structures and infrastructure;	Page 32 - 33
(e) a description of the policy and legislative context within which the development is proposed including;	Page 34 - 43
(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	Page 34 - 36
(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	Page 37 - 43
(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Page 44 - 67
(g) a motivation for the preferred site, activity and technology alternative;	Page 68 - 72
(h) a full description of the process followed to reach the proposed preferred alternative within the site, including -	Page 73- 114

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat. MGSSA) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

(i) details of all the alternatives considered;	Page 74 - 114
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Page 115 - 120
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	**Appendix C**
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Page 121 - 128
(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	**Appendix D**
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with alternatives;	**Appendix D**
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	**Appendix D**
(viii) the possible mitigation measures that could be applied and level of residual risk;	**Appendix F**
(ix) the outcome of the site selection matrix;	Page 129
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	**N/A**
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity	Page 129
(i) full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including;	**Appendix D**
(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	**Appendix D**
(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	**Appendix D**
(j) an assessment of each identified potentially significant impact and risk, including-	**Appendix D**

(i) cumulative impacts;	**Appendix D**
(ii) the nature, significance and consequences of the impact and risk;	**Appendix D**
(iii) the extent and duration of the impact and risk;	**Appendix D**
(iv) the probability of the impact and risk occurring;	**Appendix D**
(v) the degree to which the impact and risk can be reversed;	**Appendix D**
(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	**Appendix D**
(vii) the degree to which the impact and risk can be avoided, managed or mitigated;	**Appendix D**
(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	Page 134 - 148
(l) an environmental impact statement which contains-	Page 148
(i) a summary of the key findings of the environmental impact assessment:	**Appendix D**
(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	**Appendix A Annexure B**
(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	**Appendix D**
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of proposed impact management outcomes and the development for inclusion in the EMPr;	**Appendix F**
(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Page 149
(o) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	**Appendix D**
(p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Page 150
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	Page 151
(r) an undertaking under oath or affirmation by the EAP in relation to-	Page 153
(i) the correctness of the information provided in the reports;	Page 153
(ii) the inclusion of comments and inputs from stakeholders and I & APs;	Page 153

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat. MGSSA) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	Page 153
(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Page 154
(s) where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	**N/A**
(t) any specific information that may be required by the competent authority; and	**N/A**
(u) any other matter required in terms of section 24(4)(a) and (b) of the Act.	**N/A**
(2) Where a government notice gazetted by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such notice will apply.	

EXECTIVE SUMMARY

The project proponent, Sappi Paper and Paper Packaging have appointed Ecoleges Environmental Consultants as the Environmental Assessment Practitioner (EAP) to undertake a Basic Assessment application for an Environmental Authorisation (EA). The proposed dam remediation will trigger activities listed in the Environmental Impact Assessment (EIA) Regulations (2014) under sections 24(5) and 44 of the National Environmental Management Act (Act 107 of 1998). The application and supporting reports will be submitted to the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) as the designated Competent Authority.

The dam remediation is to ensure the continued safe operation of this Category III dam including the stability of the main and right flank embankments and its foundations.

The scope of construction works to be included in the rehabilitation and to be authorised is:

1. Stabilizing berm on the downstream face of the main embankment to RL 941.3 m, including approximately 30 000 m3 of earthworks (predominantly rockfill that will be commercially sourced), a new internal drainage system (sand and gravel filters, rock toe and drain pipes with inspection concrete manholes) and gabion retaining walls.
2. Subsoil pipe drains above the berm of 133 m length with inspection concrete manholes.
3. Raising of the right flank embankment with earth fill to prevent overtopping and failure during large floods and to improve the stability of the embankment, including a subsoil toe drainpipe with inspection concrete manholes.
4. Improvements to the road surfaces of existing roads, including widening to provide for passing lanes and extending in length of others, sections of which fall within the extent of a watercourse, including improvements to crossings.
5. The construction of a pedestrian bridge and a low water vehicle crossing over the Ngodwana River, to allow access during construction and dam safety inspections during operation.
6. Creation of temporary site establishment, stockpile and contractor's site office areas.

This Environmental Authorisation application will be run in parallel with a registration for water uses under General Authorisation (GA) for section 21 (c) & (i) water uses for "*impeding or diverting the flow of water in a watercourse*" and "*altering the bed, banks, course or characteristics of a watercourse*", respectively.

The EA and GA processes are to take a holistic approach regarding environmental compliance at the dam site under all relevant legislation. These required authorisations will ensure that the remediation of the dam does not negatively impact the environment and surrounding water resources.

In consideration of the investigated cumulative impacts, the nature and extent of the proposed development, compliance with the relevant legal, policy and planning documentation (i.e. "need and desirability") and the findings of the specialist studies, it is anticipated that the proposed dam remediation is supported from an environmental perspective and should be considered for Environmental Authorisation, subject to the implementation of the identified recommendations.

The general objectives of public participation stipulated in both the EIA Regulations (2014), as amended and the Water Use License Regulations (2017) have been undertaken to provide interested and affected parties the opportunity to comment on the basic assessment process including all project information and associated statutory reports. The comments and responses will be recorded and form part of the Comments & Response Register and actively addressed in the Basic Assessment process.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

TABLE OF CONTENTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

TABLE OF TABLES

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

TABLE OF FIGURES

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

TABLE OF PHOTOS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

ABBREVIATIONS AND DEFINITIONS

Table 4: List of terms for abbreviations and acronyms used in this document.

Abbreviation	Term
BA	Basic Assessment
BAR	Basic Assessment Report
CA	Competent Authority
DBAR	Draft Basic Assessment Report
DEA	Department of Environmental Affairs (National)
DMRE	Department of Mineral Resources & Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIAr	Environmental Impact Assessment Report
ELU	Existing Lawful Use
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
FBAR	Final Basic Assessment Report
GA	General Authorisation
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IRP	Integrated Resource Planning
IUCMA	Inkomati-Usuthu Catchment Management Agency
IWWMP	Integrated Wastewater Management Plan
LA	Listed Activity (EIA Regulations, 2014)
LN1	Listing Notice 1: GN R. 983, 4 December 2014 amended in GN No. 327, 7 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.
LN2	Listing Notice 2: GN R. 984, 4 December 2014 amended in GN No. 325, 7 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.
LN3	Listing Notice 3: GN R. 985, 4 December 2014 amended in GN No. 324, 7 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.
MBSP	Mpumalanga Biodiversity Sector Plan
MDARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs
MPRDA	Mineral and Petroleum Resources Development Act (Act 28 of 2002)
NDP	National Development Plan
NEM: WA	National Environmental Management: Waste Act (Act 59 of 2008)
NEMA	National Environmental Management Act (Act 107 of 1998)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

NEMAQA	National Environmental Management: Air Quality Act (Act 39 of 2004)
NHRA	National Heritage Resources Act (Act 25 of 1999)
NWA	National Water Act (Act 36 of 1998)
PES	Present Ecological Status
SAHRA	South African Heritage Resources Agency
SDGs	Sustainable Development Goals
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
WML	Waste Management Licence
WUL	Water Use License

Table 5: Definitions of some terms used in this document.

Term	Source	Definition
Development	EIA Regulations, 2014 as amended	The building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or borrow pits, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint.
Development footprint	EIA Regulations, 2014 as amended	Any evidence of physical alteration as a result of the undertaking of any activity.
Environment	ISO 14001:2015	Surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans and their relationships.
Environment	National Environmental Management Act (Act 107 of 1998)	The surroundings within which humans exist and that are made up of— (i) the land, water, and atmosphere of the earth; (ii) micro-organisms, plant, and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) the physical, chemical, aesthetic, and cultural properties and conditions of the foregoing that influence human health and well-being.
Environmental aspect	ISO 14001:2015	Element of an organization's activities or products or services that interacts or can interact with the environment.
Environmental	ISO 14001: 2015	Change to the environment, whether adverse or

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

impact		beneficial, wholly, or partially resulting from an organisation's environmental aspects.
Interested party	ISO 14001: 2015	Person or organisation that can affect, be affected by, or perceive itself to be affected by a decision or activity.
Impacts	ISO 14001:2015	Any change to the environment, whether adverse or beneficial, wholly, or partially resulting from an organization's environmental aspects.
Significant impact	EIA Regulations, 2014 as amended	An impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.
Sustainable development	National Environmental Management Act (Act 107 of 1998)	The integration of social, economic, and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.
Watercourse	EIA Regulations, 2014 as amended	(a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, pan, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998); and a reference to a watercourse includes, where relevant, its bed and banks.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION A: DETAILS OF THE EAP AND APPLICANT

Details of –
(i) The EAP who prepared the report; and
(ii) The expertise of the EAP, including a curriculum vitae;

Environmental Assessment Practitioner	Ecoleges Environmental Consultants
Contact Person	Justin Bowers
Postal Address	P.O. Box 516, Machadodorp, 1170
Telephone	+27(0)82 451 5608
E-mail	justin@ecoleges.co.za

Project Applicant	Sappi Southern Africa Ltd
Trading Name (if any)	Sappi Paper and Paper Packaging
Contact Person	Errol Von Berg
Physical Address	Ngodwana Mill, Ngodwana
Postal Address	Private Bag X1001, Ngodwana
Postal Code	1209
Cell	+27(0) 82 876 7486
Fax	+27(0) 86 681 7995
Email	Errol.VonBerg@sappi.com

Abbreviated Curriculum Vitae of **Justin Bowers**

Name	Justin Bowers
Date of birth / ID No.	15 October 1972 7210155074089
Nationality	South African
Marital Status	Married with four children
Current Address	P O Box 516, Machadodorp, 1170. ● Redwing Farm, erf. Kaalbooi 368JT, Waterval Boven District, 1195, Mpumalanga, South Africa ● Cell: 082 451-5608 ● e-mail: justin@ecoleges.co.za
Languages	English, Afrikaans and Basic Zulu
Driver's Licence	Code EB, A & C1
Specialisations	Key Fields: Vegetation ecology, rehabilitation plans, environmental/ecological management plans, environmental auditing, Environmental Impact & Basic Assessment.
Qualifications & Courses Attended	**1998 – 2000** NATIONAL DIPLOMA: NATURE CONSERVATION, Technikon Pretoria **2001 – 2002** BACCALAUREUS TECHNOLOGIAE: NATURE CONSERVATION, Technikon Pretoria **2003 – 2007** MAGISTER TECHNOLOGIAE: NATURE CONSERVATION (CUM LAUDE), Tshwane University of Technology, Pretoria **2008** Environmental Law elective (MBA Programme), Rhodes University, Grahamstown. **2010 – Present** Certificate in Aquaculture, Department of Genetics & Aquaculture, University of Stellenbosch **2014** Implementing Environmental Management Systems, Centre for Environmental Management, North-West University, Potchefstroom. **2017** Transition ISO 14001 course, Centre for Environmental Management, North-West University, Pretoria locale. **2018** Lead Auditor's Course, Centre for Environmental Management, North-West University, Potchefstroom. **2020** Weed Control Course, Pest Control Industries Training Academy, Centurion, Pretoria.
Latest Publication	Sadie J. Ryan, Paul C. Cross, John Winnie, Craig Hay, Justin Bowers, Wayne M. Getz. 2012. The utility of normalized difference vegetation index for predicting African buffalo forage quality. *Journal of Wildlife Management* DOI: 10.1002/jwmg.407.
Countries worked	South Africa, United Kingdom.

Career Summary	**Jan 1995 – Jul 1997** Head Ranger (Idube Lodge, Sabi-Sands Wildtuin). **Dec 2000 – Dec 2001** Research student, Scientific Services, KNP. **Jan 2001 – Mar 2006** Senior Research Assistant, Mammal Research Institute, University of Pretoria. **Apr 2006 – current** Main Member, Ecoleges Environmental Consultants.

Full Curriculum Vitae available if required

SECTION B: THE LOCATION OF THE ACTIVITY:

Including –

(i) The 21-digit Surveyor General code of each cadastral land parcel;

(ii) where available, the physical address and farm name;

(iii) where the required information in terms (i) and (ii) is not available, the coordinates of the boundary of the property or properties;

The 21-digit Surveyor General Codes of each cadastral land parcel are as follows:

- Farm Ngodwana 1030 JT T0JT00000000103000000

SECTION C: LOCATION PLAN OF THE PROPOSED ACTIVITY AND ASSOCIATED INFRASTRUCTURES

At an appropriate scale, or if it is –

(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities to be undertaken; or

(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;

Please refer to the following Appendices for more details:

- **Appendix A**: Annexure A- SITE LAYOUT MAP
- **Appendix A**: Annexure B- SITE SENSITIVITY MAP

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION D: DESCRIPTION OF THE SCOPE OF THE PROPOSED ACTIVITY

Including -

(i) all listed and specified activities triggered and being applied for; and

(ii) a description of the activities to be undertaken including associated structures and infrastructure;

National Environmental Management Act, 1998

The proponent of the proposed development must comply with the provisions and regulations published under the terms of the EIA Regulations (2014) as amended (GG No. 40772, GN No. 324, 326 & 327, 7 April 2017 and GG No. 41766, GN No. 706, 13 July 2018) in terms of Section 24 of the National Environmental Management Act (NEMA, Act 107 of 1998), regarding the list of activities which have, or are likely to have an effect on the environment. Four listed activities are triggered by the proposed remediation of the Ngodwana Dam (Table 6).

Table 6: Potential listed activities triggered in respect of the proposed project.

Activity and Notice No.	Listed Activity	Motivation including a Description of the Activity
LA 19 (LN1) GG No. 40772, GN No. 327, 07 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.	**The infilling or depositing of any material of more than 10 cubic metres into**, **or** the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic metres **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.	More than 10 cubic metres of infill material is going to be used for the remedial works on the dam wall which includes: 1. Works Area 1: Stabilizing berm on the downstream face of the main embankment including approximately 30 000 m^3 of earthworks, a new internal drainage system (sand & gravel filters, rock toe and drainpipes with inspection concrete manholes) and gabion retaining walls; 2. Subsoil pipe drains above the berm of 133 m length with inspection concrete manholes; and 3. Works Area 2: Raising of the right flank embankment to prevent overtopping and failure during large floods and to improve the stability of the embankment. 4. Improvements to the road surfaces of existing roads, including widening to provide for passing lanes and extending in length of others, sections of

Activity and Notice No.	Listed Activity	Motivation including a Description of the Activity
		which fall within the extent of a watercourse including improvements to a crossing. 5. Construction of a pedestrian bridge and a low water vehicle crossing over the Ngodwana River to allow access during construction and dam safety inspections during operation.
LA 27 (LN1) GG No. 40772, GN No. 327, 07 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.	**The clearance of an area of 1 hectare 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.	More than 1 hectare but less than 20 hectares of indigenous vegetation is going to be cleared as part of the scope of the project. Vegetation clearance will occur as follows: 1. Establishment Area Alternative 5: Temporary rock, general fill and topsoil storage area = 10,000m^2, 2. Upgrading of existing Haul Road 2, including widening with passing lanes = 1.2km x 4m = 4,800m^2, 3. Widening/upgrading of existing access road (Haul route 2, Section 6) = 875m x 4m = 3,500m^2, 4. Link road to spillway = 200m x 5m = 1,000m^2, 5. Link road to Right Flank at Ngodwana Club entrance = 100m x 5m = 500m^2, 6. Extension of existing access road (to facilitate haulage to main embankment – portion of Haul route 2, Section 4) = 200 x 5m = 1,000m2 (total road length is 570m, 370m of which overlaps with main embankment clearance and 200m is vegetated), 7. Establishment Area Alternative 3: Right flank site establishment area = 32,150m^2 (including short access road), 8. Establishment Area Alternative 2: Main embankment site establishment area = 3,300m^2, 9. Works Area 1: Stabilising berm = 9,900m^2 plus working area of 4,200m^2, 10. Works Area 2: Raising of right flank

Activity and Notice No.	Listed Activity	Motivation including a Description of the Activity
		embankment = 6,150m^2 plus working area of 3,000m^2, 11. Establishment Area Alternative 1 = 6,000m^2, 12. Sub-soil toe drain (north) = 108m x 5m = 540m^2, 13. Sub-soil toe drain (south) = 62m x 5m = 310m^2, 14. Establishment Area Alternative 3: Contractor's site office = 5,000m^2. Therefore, the total vegetation clearance will equate to approximately 91,350m^2 or **9.14 ha.**
LA 18 (LN3) GG No. 40772, GN No. 324, 07 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.	**The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.** **f. Mpumalanga** **i. Outside urban areas:** **(aa) A protected area identified in terms of NEMPAA,** excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention; **(ee) Critical biodiversity areas** as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; or **(gg) Areas within** 10 kilometres from national parks or world heritage sites or **5 kilometres from any other protected area** identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; or ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.	Several existing roads will need to be upgraded/widened and lengthened to effectively support both construction activities and operations (including improving access for dam safety inspections), including: The existing Haul road 2 road is going to upgraded, including widening by more than 4m to allow for passing lanes and provide greater width to large plant and vehicles. Additionally, the existing central access road (Route 1, Section 6) is going to be widened & lengthened to provide for larger plant as well as creating a link of 200m to access the concrete spillway. Additionally, a 200m section of road will be extended beyond the watercourse crossing to allow for haulage of large plant to access the full length of the main embankment, and another 100m link road will be created to the Right Flank works area adjacent to the Dam Club entrance (the Dam Club entrance cannot facilitate large delivery vehicles). These activities take place outside an urban area, within a critical biodiversity area and within 5km of a protected area.
LA 23 (LN3)	**The expansion of—**	The dam wall main embankment & right

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Activity and Notice No.	Listed Activity	Motivation including a Description of the Activity
GG No. 40772, GN No. 324, 07 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.	(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or **(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;** where such expansion occurs— **(a) within a watercourse;** (b) in front of a development setback adopted in the prescribed manner; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. **f. Mpumalanga** **i. Outside urban areas:** **(aa) A protected area identified in terms of NEMPAA,** excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention; **(ee) Critical biodiversity areas** as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; (**gg) Areas within** 10 kilometres from national parks or world heritage sites or **5 kilometres from any other protected area** identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; or ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Framework.	flank (fuseplug) embankments are going to have an expanded footprint due to the introduction of large quantities of infill to increase its strength and integrity, by 10 or more square metres. Additionally, the access road upgrades will require new and improved existing watercourse crossings e.g. culverts & a low-water crossing. These activities will take place within 32m of a watercourse, outside an urban area, within a critical biodiversity area and within 5km of a protected area.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Detailed Description of the Scope of the Proposed Activity

The Ngodwana Dam is a 41 m high zoned earth fill Category III Dam. The dam is located on a tributary of the Elands River, Mpumalanga Province, directly upstream from the N4 highway and the Ngodwana Paper Mill, 40 km from Mbombela. The water surface area of the dam at the Full Supply Level of 959.8 masl is 87 ha. The catchment area of the dam is 229 km^2, which covers the entire X21H quaternary catchment. The Mean Annual Runoff (MAR) is 66.7 million m^3. The dam's gross storage capacity of 10.4 million m^3 is only 16 % of the MAR. The historical firm yield of the dam is 26.3 million m^3/a.

The purpose of the rehabilitation is to ensure the continued safe operation of this Category III dam and the stability of the main and right flank embankments and its foundations.

The scope of construction works to be included in the rehabilitation and to be authorised is:

1. Stabilizing berm on the downstream face of the main embankment to RL 941.3 m, including approximately 30 000 m3 of earthworks (predominantly rockfill that will be commercially sourced), a new internal drainage system (sand & gravel filters, rock toe and drain pipes with inspection concrete manholes) and gabion retaining walls.
2. Subsoil pipe drains above the berm of 133 m length with inspection concrete manholes.
3. Raising of the right flank embankment with earth fill to prevent overtopping and failure during large floods and to improve the stability of the embankment, including a subsoil toe drainpipe with inspection concrete manholes.
4. Improvements to the road surfaces of existing roads, including widening to provide for passing lanes and extending in length of others, sections of which fall within the extent of a watercourse.
5. Construction of a pedestrian bridge and a low water vehicle crossing over the Ngodwana River to allow access during construction and dam safety inspections during operation.
6. Creation of temporary site establishment, stockpile and contractor's site office areas.

The dam wall is going to have an expanded footprint due to the introduction of large quantities of infill to increase its strength and integrity, by 10 or more square metres. Additionally, the access roads will require upgrading, including improvements to existing and creation of new watercourse crossings e.g. culverts. The existing Haul road 1 road is going to upgraded, including widening by more than 4m to allow for passing lanes and provide greater width to large plant and vehicles. Additionally, the existing central access road is going to be widened & lengthened to provide for larger plant as well as creating a link of 200m to access the concrete spillway. There will be more than 1 hectare but less than 20 hectares of indigenous vegetation to be cleared as part of the scope of the project. These activities will take place within 32m of a watercourse, outside an urban area, within a critical biodiversity area and within 5km of a protected area. The development footprint sizes for the scope of works is given below in **Table 7**.

Table 7: Development Footprint Sizes.

Scope of Works	Development Footprint Size
Establishment Area Alternative 5: Temporary rock, fill and topsoil storage area (opposite Water	10,000m^2

Treatment Works)	
Upgrading of Haul route 2, including widening with passing lanes	1.2km x 4m = 4,800m^2
Widening/upgrading of existing access road (Haul Route 1, Section 6)	875m x 4m = 3,500m^2
Create link road to concrete spillway	200m x 5m = 1,000m^2
Create link road to main embankment	570m x 5m = 2,850m^2
Create link road to right flank embankment	100m x 5m = 500m^2
Establishment Area Alternative 3: Right flank site establishment area	32,150m^2 (including short access road)
Establishment Area Alternative 2: Main embankment site establishment area	3,300m^2
Works Area 1: Main embankment	9,900m^2 plus working area of 4,200m^2
Works Area 2: Raising of Right Flank embankment	6,150m^2 plus working area of 3,000m^2
Establishment Area Alternative 1: Alternative site establishment area	6,000m^2
Sub-soil toe drain - north	108m x 5m = 540m^2
Sub-soil toe drain - south	62m x 5m = 310m^2
Pedestrian footbridge	25m x 2m = 50m^2
Vehicle low-water crossing	8m x 6m = 48m^2
Contractor's site office	5,000m^2
Total footprint size	**93,298m^2**

The following photographs provide a view of the dam site:

Photograph 1. Works Area 1: The main dam embankment south of the spillway.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Photograph 2. The main embankment at the seepage "wet spot".

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Photograph 3. The right flank (fuseplug) embankment.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Photograph 4. The concrete spillway and main embankment.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Photograph 5. The full extent of the concrete spillway interfacing with main embankment and right flank embankment.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Project phases:

Construction Phase

The sequence of the construction phase is detailed below. The main earthworks will be carried out during the drier winter months to limit the impacts of soil erosion associated with stormwater runoff, that can occur during summer storm events.

April to June:

Start the site establishment, clearing and upgrading of haul roads, including spillway discharge channel vehicle low level crossing and footbridge.

July to September:

Complete the earthworks on main and right flank embankment.

October to November:

The completion of gabion and concrete works, manholes and rehabilitation of downstream faces and site establishment areas.

It is anticipated that the following construction equipment will be required:

Site Clearing

- 1 x Dozer DR 8

Earthworks

- 1 x Pick up 1T
- 1 x 140 H Cat Graders
- 2 x 12T Vibrating Rollers
- 2 x Water Bowsers
- 2 x 25T Komatsu Excavator
- 3 x 20T Tippers
- 1 x Varisco 6 Water Pump
- 1 x 10t Truck

Plant for Wet Trades

- 1 x 1000 litre Silla Concrete Mixer
- 1 x 450 litre Silla Mixer
- 1 x 1.5t Dumper
- 1 x set Pocket and Vibrator

Operational Phase

Appointed person from SAPPI ensures the maintenance of the dam, including implementing measures identified by the APP in required dam safety inspection reports.

Decommissioning Phase

There is no foreseeable need to decommission the dam, as security of supply is required for the operation of the Ngodwana Mill and residential use within the Ngodwana Village.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Description of Associated Structures and Infrastructure

Rezoning and land-use

The site is currently zoned *Agricultural* and would not need to be rezoned.

Access roads

There will be two main haulage routes exiting the N4 from an easterly and westerly direction to gain entry to the Dam remediation works utilising existing farm and gravel access roads.

Route 1:

Access to the N4 for the material hauled for the raised right flank (± 11000m³) will be obtained at the existing intersection at the weigh bridge (± km 3.0 W) which provides access to SAPPI's dumpsite and material stockpiles with a right turn movement onto the N4. This material will then be hauled Eastward along the N4 in 18m³ tip trucks (normal road haulers and not ADT's) up to the Kaapsehoop intersection (± km 6.2 W), where trucks will turn right onto the Kaapsehoop road (D799), travel for ± 200m along this road and turn right towards the Ngodwana Dam onto the existing fishing club access which is a surfaced access road. A material stockpile area approximately 600m along this road is the destination of this material. Trucks returning will turn left onto Kaapsehoop road (D799), left at the Kaapsehoop N4 intersection (± km 6.2 W) and left again at the dumpsite access (± km 3.0 W), at the weighbridge intersection.

Route 2:

The material for the rock toe berm (± 30000m³) will be hauled from the commercial sources situated at Alkmaar or Karino via the N4 in 18m³ tipper trucks (normal road haulers). These trucks will pass through the Kaapsehoop intersection (± km 6.2 W) and turn left opposite the existing light vehicle turn-off to SAPPI's administration area (± km 5.8 W), on an existing gravel road. This road provides access to SAPPI's Water Treatment Works (WTW). Material will be stockpiled on a stockpile area opposite the WTW. Trucks returning will turn right at the gravel access onto the N4 (± km 5.8 W), drive through the Kaapsehoop intersection (± km 6.2 W) and leave towards Nelspruit.

Buildings

Office park homes are going to be used as temporary offices during the construction period.

Visual screening

A visual buffer will not be required as the location of the dam is already visually buffered by existing vegetation on the property, and is considerable distance from public road users or adjacent residential areas.

Services:

Water supply

Three water use authorisations exist namely, the SAPPI Integrated Water Use License (File Number: 16/2/7/X205/B7, Licence No. 24001465) which includes the storage of the dam as well as water abstraction of 14 600 00036 000 m³/a, the Sappi Ngodwana Transfer Water Use Licence (Water Use

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

License No. 05/X21/A/4424) with a permitted water abstraction volume of 16 569 720 m^3/a and the Elands River abstraction permit (Reference: B191/2/2220/11), which allows for water abstraction when dam levels are low and need to be augmented from the Elands River at 3 372 000m^3/a. Water is supplied from the Ngodwana Dam for both the Ngodwana Mill as well as residential use within the Ngodwana Village. The maximum water demand to be met for the paper mill, is 40 000 m^3/day and 4 000 m^3/day for domestic purposes at the Ngodwana Village.

Electricity supply

No additional electricity supply will be required over and above the existing electricity supply. Temporary internal connections may be required for inter alia contractor's site offices.

Sewerage treatment

There are existing ablutions at the Water Treatment Works (WTW) and there will be chemical toilets provided onsite for the duration of the construction period.

Waste disposal

All non-recyclable waste will be disposed of at the Sappi Macro Dump Landfill Site, currently licensed to receive hazardous waste from the Ngodwana Mill and general waste from the Ngodwana village (License No. 12/9/11/L308/6/R1).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION E: DESCRIPTION OF THE POLICY AND LEGISLATIVE CONTEXT

(e) a description of the policy and legislative context within which the development is proposed including;

(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and

List of Applicable Legislation and Other Documents

The following legislation, guidelines, departmental policies, environmental management instruments and/or other decision-making instruments that have been developed or adopted by a competent authority in respect of activities associated with a development of this nature, were identified and considered in the preparation of this BA process, and subsequent amendments.

1. Conservation of Agricultural Resources Act (CARA, Act 43 of 1983). Government Gazette (GG) No. 8673, Government Notice (GN) No. 883, dated 27 April 1983; and subsequent regulations (including dealing with declared weeds and invader plants) under section 29 of the Act, in Government Notice R1048 in Government Gazette 9238, dated 25 May 1984, amended in Government Notice R2687 in Government Gazette 10029, dated 6 December 1985 and Government Notice R280 in Government Gazette 22166, dated 30 March 2001.
2. Constitution of the Republic of South Africa.
3. DEA. 2010. Guideline on Need and Desirability, Integrated Management Guideline Series 9, Department of Environmental Affairs (DEA), Pretoria, South Africa.
4. DEA. 2010). Public Participation, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs, Pretoria, South Africa.
5. DEA. 2011. National list of ecosystems that are threatened and in need of protection. GN 1002, GG 34809, 9 December 2011.
6. DEA&DP. 2010. Guideline on Alternatives, EIA Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning.
7. DEAT. 2002. Specialist Studies, Information Series 4, Department of Environmental Affairs and Tourism, Pretoria.
8. DWA. 2007. Guideline for Developments within a Flood line (Edition 1), Department of Water Affairs and Forestry, Pretoria, South Africa.
9. DWS. 2016. General Authorisation in GN No. 509, Government Gazette No. 40229 dated 26 August 2016.
10. DWS. 2016. General Authorisation in GN No. 538, Government Gazette No. 40243 dated 2 September 2016.
11. Ehlanzeni District Municipality. 2020/2021. Draft IDP and budget review.
12. EIA Regulations, GG No. 38282, GN No. R. 982, 983, 984, 985, 4 December 2014, amended in GN No. R. 324, R. 325, R. 326, R. 327, R. 328 in GG No. 40772, 07 April 2017, GG No. 41766, GN No. 706, 13 July 2018 and GG No. 43358, GN No. 599, 29 May 2020.

13. Electricity Regulation Act (Act 4 of 2006). Government Notice 660 in Government Gazette 28992 dated 5 July 2006. As amended by: Electricity Regulation Amendment Act 28 of 2007, Government Notice 23 in Government Gazette 30676, dated 21 January 2008.
14. Environment Conservation Act, 1989 (No 73 of 1989), including Schedules 4 and 5 of the National Regulations regarding Noise Control made under Section 25 of the Environment Conservation Act, 1989 (Act 73 of 1989) in GN No. R 154 of Government Gazette No. 13717 dated 10 January 1992. (Note that this particular section of the Environment Conservation Act is not repealed by NEMA (107 of 1998)).
15. City of Mbombela. 2017-2022. Draft integrated development plan (IDP).
16. Minerals and Petroleum Resources Development Act (Act 28 of 2002). Gazette No. 23922, Notice No. 1273 dated 10 October 2002. As amended by: Minerals and Energy Laws Amendment Act 11 of 2005, Gazette No. 27897, Notice No. 824 dated 15 August 2005. Mineral and Petroleum Resources Development Amendment Act 49 of 2008, Gazette No. 32151, No. 437 dated 21 April 2009. Mineral and Petroleum Resources Development Amendment Act 49 of 2008, Gazette No. 32151, No. 437 dated 21 April 2009.
17. MTPA. 2014. Mpumalanga Biodiversity Sector Plan Handbook. Compiled by Lotter M.C., Lechmere-Oertel R.G. and Cadman, M.J. Mpumalanga Tourism & Parks Agency, Nelspruit.
18. National Environmental Management Act (Act 107 of 1998), Gazette No. 19519, Notice No. 1540. As amended by: National Environmental Management Act 56 of 2002 - Gazette No. 24251, No. 97. Mineral and Petroleum Resources Development Act 28 of 2002 - Gazette No. 23922, No. 1273. National Environmental Management Act 8 of 2004 - Gazette No. 26570, No. 842. National Environmental Management Act 46 of 2003 - Gazette No. 26018, No. 175. National Environmental Management Act 62 of 2008 - Gazette No. 31789, No. 22. National Environment Laws Amendment Act 44 of 2008 - Gazette No. 31685, No. 1318. National Environment Laws Amendment Act 14 of 2009 - Gazette No. 32267, No. 617. National Environmental Management Laws Second Amendment Act 30 of 2013 - Gazette No. 37170, No. 1019, dated 18 December 2013. National Environmental Management Laws Amendment Act 25 of 2014 – Government Notice 448 in Government Gazette 37713, dated 2 June 2014. National Environmental Management Laws Second Amendment Act 30 of 2013 - Gazette No. 37170, No. 1019, dated 18 December 2013.
19. National Environmental Management: Air Quality Act (Act 39 of 2004). Gazette No. 27318, Notice No. 163. As amended by: National Environment Laws Amendment Act 44 of 2008 - Gazette No. 31685, Notice No. 1318. National Environment Laws Amendment Act 14 of 2009 - Gazette No. 32267, Notice No. 617. National Environmental Management Laws Amendment Act 14 of 2013 – Gazette No. 36703, No. 530 dated 24 July 2013. National Environmental Management: Air Quality Amendment Act 20 of 2014 – Gazette No. 37666, No. 390 dated 19 May 2014; including the list of activities which result in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage in Government Notice 893 in Government Gazette 37054 dated 22 November 2013. As amended by: Government Notice 551 in Government Gazette 38863 dated 12 June 2015. The National Dust Control Regulations are also relevant during the construction phase – GG No. 36974, GN No. R 827 dated 1 November 2013.
20. National Environmental Management: Biodiversity Act (Act 10 of 2004). Gazette No. 26436, Notice No. 700. As amended by: National Environment Laws Amendment Act 14 of 2009 –

Gazette No. 32267, No. 617. National Environment Laws Amendment Act 14 of 2009 – Gazette No. 32267, No. 617. National Environmental Management Laws Amendment Act 14 of 2013 – Gazette No. 36703, No. 530 dated 24 July 2013; including the alien and invasive species regulations in Government Notice R598 in Government Gazette 37885 dated 1 August 2014, and species lists in GN No.599, amended in GG No. 40166, GN No .864 dated 29 July 2016, amended in GG No. 43386, GN No. 627 dated 03 June 2020.

21. National Environmental Management: Waste Act (Act No. 59 of 2008) ("NEM: WA"). Gazette No. 32000, Notice No. 278. As amended by: National Environmental Management Laws Amendment Act 14 of 2013 – Gazette No. 36703, No. 530 dated 24 July 2013. National Environmental Management: Waste Amendment Act 26 of 2014, Government Notice 449 in Government Gazette 37714 dated 2 June 2014. National Environmental Management Laws Amendment Act 25 of 2014, Government Notice 448 in Government Gazette 37713 dated 2 June 2014.
22. National Forest Act (Act 84 of 1998). Gazette No. 19408, Notice No. 1388 dated 30 October 1998. As amended by: National Forest and Fire Laws Amendment Act 12 of 2001 – Gazette No. 22479, No. 660. Forestry Laws Amendment Act 35 of 2005 – Gazette No. 28602, No. 220.
23. National Heritage Resources Act (Act 25 of 1999).
24. National Veld and Forest Fire Act, 1998 (Act 101 of 1998). Government Gazette No. 19515 dated 27 November 1998.
25. National Water Act, 1998 (Act 36 of 1998). Gazette No. 19182, Notice No. 1091. As amended by: National Water Amendment Act 45 of 1999 – Gazette No. 20706, No. 1476. National Water Amendment Act 27 of 2014 – Government Notice 450 in Government Gazette 37715, dated 2 June 2014; including Sections 27, 28,29,30,31 and 39 (Sections dealing with General Authorisations and Water Use Licenses).
26. Sub-Division of Agricultural Land Act (Act 70 of 1970) as amended by Subdivision of Agricultural Land Amendment Act, No. 55 of 1972, Subdivision of Agricultural Land Amendment Act, No. 19 of 1974, Subdivision of Agricultural Land Amendment Act, No. 18 of 1977, Subdivision of Agricultural Land Amendment Act, No. 12 of 1979, Subdivision of Agricultural Land Amendment Act, No. 18 of 1981, Subdivision of Agricultural Land Amendment Act, No. 33 of 1984, Constitution of the Republic of South Africa Act, No 200 of 1993 (Proc. No. 100 of 31 October 1995), General Law Amendment Act, No 49 of 1996, Abolition of Racially Based Land Measures Act, No. 108 of 1991 (Proc. No. 116 of 24 June 1994).
27. Regulations regarding the safety of dams. GG No. 35062, GN No. R. 139, 24 February 2012.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Legislative Context of the Proposed Activity

(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools, frameworks, and instruments.

This BA process will run in parallel with an application for registration of Section 21 (c) & (i) water uses under General Authorisation of the National Water Act (Act 36 of 1998) for the remedial work that is required on the dam wall embankments of the Ngodwana Dam.

Constitution of the Republic of South Africa Act, 1996 including section 24.

Section 24 of the constitution provides the foundation for environmental protection, promoting ecologically sustainable development and use of natural resources.

Section 24.
Environment. -Everyone has the right-
(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(i) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Importance to the Project: It allows the environmental rights of all South African citizens to be upheld through the implementation of all types of projects, including remediating existing dams.

National Environmental Management Act (Act 107 of 1998) including amended EIA Regulations, 2014 published in Government Notice No. R. 324, R. 325, R. 327 and R. 328 in Government Gazette No. 40772 dated 07 April 2017 and Government Notice No. 599 in Government Gazette No. 43358 dated 29 May 2020.

The National Environmental Management Act (NEMA, Act 107 of 1998) states that the State must respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the needs of previously disadvantaged communities. It states further that sustainable development requires the integration of social, economic and environmental factors in the planning, evaluation and implementation of decisions to ensure that development serves present and future generations.

Importance to the Project: The project development and authorisation process will align with the processes, principles and requirements of NEMA including but not limited to a full public participation process and basic assessment process as the vehicle to environmental authorisation for the listed activities that have been triggered. Central to Basic Assessment is the Impact Assessment process which will endeavour to reduce principal impacts by ensuring suitable footprint selection to areas that have the lowest sensitivity with the lowest concomitant loss of and impact to biodiversity and

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

ecosystem function. The development of an Environmental Management Programme (EMPr) will mitigate/management activities throughout the project cycle likely to cause impacts to the receiving environment.

The project includes several listed activities (**Table 5**), in terms of the Government Notice No. R. 324, R. 326, and R. 327 published in Gazette No. 40772 of 07 April 2017.

National Environmental Management: Air Quality Act (Act 39 of 2004) including the dust control regulations

National Environmental Management: Air Quality Act (NEM:AQA, Act 39 of 2004) regulates air emissions to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and to provide for air quality monitoring and specific air quality measures.

Importance to the Project: The remedial work on the dam wall is going to include the haulage, stockpiling and installation of large quantities of infill material. These activities will likely result in dust emissions, which need to comply with thresholds stipulated in the National Dust Control Regulations (GG No. 36974, GN No. R. 827, 1 November 2013). Effective management of dust emissions will be required including dust suppression, which will be assessed and mitigated and included in the EMPr.

National Environmental Management: Biodiversity Act (Act 10 of 2004).

The National Environmental Management: Biodiversity Act (NEM:BA, Act 10 of 2004) provides for the protection of ecosystems and species that require national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources and the establishment and functions of the South African National Biodiversity Institute (SANBI).

Importance to the Project: The BA process, including the appointment of a SACNASP registered ecologist, will involve the identification, protection and management of species, ecosystems and areas of high biodiversity value. This includes the implementation of the threatened or protected species regulations and associated lists of species that are threatened or protected published in GG 36375 and GN 388 & 389, respectively. Furthermore, the alien and invasive species regulations published under NEM:BA will also be considered in the management measures stipulated in the EMPr.

National Environmental Management: Waste Act (Act 59 of 2008)

The National Environmental Management: Waste Act (NEM:WA, Act 59 of 2009) aims to reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

Importance to the Project: The project will endeavour to implement the waste hierarchy principles that the Waste Act introduces, to minimise and reduce waste created from the project, whilst encouraging the recycling and reuse of any suitable waste generated to prevent increased disposal at local landfills.

Conservation of Agricultural Resources Act (Act 43 of 1983) and the regulations dealing with declared weeds and invader plants.

The Conservation of Agricultural Resources Act (CARA, Act 43 of 1983) provides for the control of the utilization of the natural agricultural resources and to promote the conservation of the soil, the water sources and the vegetation including the combating of weeds and invader plants.

Importance to the Project: The project area contains several declared weeds and invader plants listed under the regulations promulgated under section 29 of CARA (GN R. 1048, GG 9238, 25 May 1984 as amended). Accordingly, all Category 1, 2 & 3 plants will need to be controlled in accordance relevant control measures stipulated by CARA and associated regulations, which will also be explicitly included in the project-specific Environmental Management Programme (EMPr).

National Heritage Resources Act (Act 25 of 1999).

The National Heritage Resources Act (NHRA, Act 25 of 1999) requires that the responsible heritage resource authority is notified of any new development which exceeds certain thresholds including:
"38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—
(a) ***the construction of a road****, wall, powerline, pipeline, canal or other similar form of linear development or barrier* ***exceeding 300m in length****;*
(b) the construction of a bridge or similar structure exceeding 50 m in length;
(c) any development or other activity which will change the character of a site—
(i) exceeding 5 000 m² in extent; or
(ii) involving three or more existing erven or subdivisions thereof; or
(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
(d) the re-zoning of a site exceeding 10 000 m² in extent; or
(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority."

Importance to the Project: An Archaeological and Cultural Heritage Impact Assessment was undertaken as roads will be extended beyond 300m and sites cleared exceeding 5 000m². No sites or features of heritage or archaeological significance were located or documented during the physical survey. In terms of section 34 of the National Heritage Resources Act (NHRA, 25 of 1999), no significant buildings or structures were located. In terms of section 35 of the NHRA, no archaeological

sites were located. In terms of section 36 of the NHRA, no graves or gravesites and burial grounds were located. However, awareness must still be maintained during construction where the possibility exists for heritage artefacts to be exposed/discovered, which will be catered for in the EMPr.

National Water Act, 1998 (Act No. 36 of 1998), Sections 27, 28,29,30,31 and 39 (Sections dealing with General Authorisations and Water Use Licenses).

Chapter 1 of the National Water Act (NWA, Act 36 of 1998) states that sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. It affirms that the guiding principles recognise the basic human needs of present and future generations and the need to promote social and economic development using water. Chapter 2 of the NWA states amongst others that the purpose of the Act is to ensure that everyone has equitable access to water, and that the results of past racial and gender discrimination are redressed. It aims to promote the efficient, sustainable, and beneficial use of water in the public interest, and to facilitate social and economic development. The NWA recognises that the nations' water resources are held in public trust for the people, and therefore the sustainable, equitable and beneficial use of water resources must serve the peoples' interest.

Importance to the Project: The project will require the registration of water uses under sections 21 (c) for impeding or diverting a watercourse and for S21 (i) for the altering of the beds, banks of a watercourse; under General Authorisation, for which a Risk Assessment has been undertaken by a SACNASP certified Aquatic Specialist.

Mpumalanga Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (MBSP) is a spatial tool that forms part of a broader set of national biodiversity planning tools and initiatives that are provided for in national legislation and policy. It comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines that make the most recent and best quality biodiversity information available for use in land-use and development planning, environmental assessment and regulation, and natural resource management.

The Mpumalanga Tourism and Parks Agency (MTPA) is mandated to promote and sustainably manage tourism and nature conservation, and to provide for the sustainable use of natural resources in Mpumalanga. The responsibility for conserving Mpumalanga's biodiversity, however, also lies with many other state agencies within national, provincial and local spheres of government, and organisations in the private sector and civil society - this is part of a wider responsibility for managing the environment and using natural resources sustainably to support socio-economic development.

The main purpose of a biodiversity sector plan is to ensure that the most recent and best quality spatial biodiversity information can be accessed and used to inform land-use and development planning, environmental assessments and authorisations, and natural resource management. A biodiversity sector plan achieves this by providing a map (or maps) of terrestrial and freshwater areas that are important for conserving biodiversity pattern and ecological processes – these areas are called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The maps are provided together with contextual information on biodiversity, and land-use guidelines that can be incorporated into the policies and decisions of a wide range of sectors.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Importance to the Project: The project area falls within several Critical Biodiversity Areas (CBA), 1. The dam remediation works and associated footprint falls within a Terrestrial CBA: Irreplaceable and Aquatic CBA: Rivers area, and 2. The current Macrodump stockpile areas fall within a CBA – Optimal area. The maintenance of these areas in an untransformed state is crucial to achieving provincial biodiversity conservation targets. All activities within this area thus needs to be undertaken in order to maintain and where possible improve on land use practices and management, to maintain and preferably enhance its biodiversity value.

Ehlanzeni District Municipality IDP (Draft) 2020/21.

The Integrated Development Planning (IDP) process is a process through which municipalities prepare strategic development plans for a five-year period. An IDP is a principal document for Local Government, used to guide the developmental agenda and municipal budgets, land use development, management and promotion of local economic development and institutional transformation in a consultative and systematic manner.

EDM derives its mandate and goals from Section 83 (3) of the Local Government: Municipal Structures Act of 1998 which states that a district Municipality must seek to achieve the integrated, sustainable and equitable social and economic development of its area by:

- Ensuring integrated development for the district as a whole;
- Promoting bulk infrastructural development services for the district as a whole;
- Building the capacity of local municipalities in its area to perform their functions and exercise their powers where such capacity is lacking; and
- Promoting the equitable distribution of resources between the local municipalities in its area to ensure appropriate levels of municipal services within the area.

Section 5.6.2 of the IDP entitled “Environmental Management” identifies the need for effective EM within the district. Uncoordinated and informal settlement growth has led to pollution and the degradation of the natural environment. This has been compounded by inappropriate agrarian practices resulting in soil erosion and water pollution also because of ineffective sanitation and waste removal systems. Reliance on wood as an energy source has resulted in the degradation of trees in the area. Littering and inappropriate land use management activities have further degraded the natural environment. Non-compliance with spatial development frameworks and the non-availability of Land Use Management Schemes aggravates the issue.

The partnership with the International Council for Local Environmental Initiatives (ICLEA) has afforded Ehlanzeni an opportunity to develop the Ehlanzeni Wetlands Report through the Local Action for Biodiversity Program. The purpose of this initiative is to increase awareness on the importance of wetlands as one the most vulnerable ecosystems in South Africa as well as the impact of climate change on wetlands in the district.

Importance to the Project: This project will work towards the IDP goals of improving the sustainable use of environmental resources within the District.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Mbombela Local Municipality Integrated Development Plan (IDP) Draft (2017-2022)

The IDP is required in terms of the Municipal Systems Act (Act 32 of 2000) in which municipalities must develop a five (5) year strategic planning document popularly known as an Integrated Development Plan.

An Integrated Development Plan (IDP) is a process through which the municipality conducts a comprehensive analysis of the community needs and subsequently prioritises available resources to address those needs. The process seeks to ensure vertical and horizontal integration between the municipal planned intervention and planning efforts of national and provincial spheres of government as well as within the various sectors of government.

Importance to the Project: The remediation of the dam project will work towards the IDP goals of contributing to secure and reliable water supply. Table 1.4.1 of the IDP entitled "Community priorities 2017-2022" under Ward 12 states a Need for water supply (sufficient and constant) within the entire ward. The supply of water to the SAPPI mill and associated residential area removes this burden from the municipality and allows then to assign resources elsewhere.

City of Mbombela SDF

The preparation of a spatial development framework gives effect to section 12 of the Spatial and Land Use Management Act (Act 16 of 2013). It also gives effect to section 26 of the Municipal Systems Act, 2000, which require an integrated development plan of a municipality to reflect a spatial development framework which must include the provision of basic guidelines for a land use management system for the municipality. The City of Mbombela is currently in the process reviewing its Spatial Development Framework to guide and informs land development and management within the municipal area. The SDF must give spatial effect to multi-sectoral projects identified in the IDP as well as assist the Municipality to co-ordinate the implementation of the various sector plans.

The 2018 draft SDF states the following on page 21:

2.4 DEVELOPMENT PRIORITIES

This section seeks to uncover whether there is a link between the pressing needs identified above and development priorities identified in the draft IDP 2017-2022 and the Consolidated Budget and Medium-Term Revenue and Expenditure Framework 2016/2017 – 2018/2019.

The COM has identified fourteen (14) development priorities in the IDP 2017-2022:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Diagram 5: COM fourteen (14) development priorities

Importance to the Project: Water supply has been identified as the first priority for the City of Mbombela, of which storage fulfils an important component in terms of assurance of supply. The Ngodwana Dam provides assurance of raw water supply for all SAPPI Ngodwana's operations, including both industrial and residential use.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION F: MOTIVATION FOR THE NEED AND DESIRABILITY FOR THE PROPOSED DEVELOPMENT

(f) A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;

Legislative Background and Strategic Context

National Environmental Management Principles of NEMA, 1998, which guide the interpretation, administration and implementation of NEMA, 1998 (and the EIA Regulations, 2014) specifically *inter alia* require that environmental management must place people and their needs at the forefront of its concern (Section 2(2)). The latter refers to the broader societal/community needs and interests, and is put into effect through the EIA Regulations, 2014, which require environmental impact assessments to specifically consider 'need and desirability' to ensure that the 'best practicable environmental option' is pursued and that development more equitably serves broader societal needs now and in the future. Furthermore, it ensures that the proposed actions of individuals are measured against the long-term public interest.

What is needed and desired for a specific area must be strategically and democratically determined (DEA&DP (2010) Guideline on Need and Desirability). The strategic context for informing need and desirability is best addressed and determined during the formulation of the sustainable development vision, goals and objectives of Integrated Development Plans ('IDPs') and Spatial Development Frameworks ('SDFs') during which collaborative and participative processes play an integral part, and are given effect to, in the democratic processes at local government level (DEA&DP (2010) Guideline on Need and Desirability). The need and desirability must therefore be measured against the contents of the credible IDP, SDF and EMF for the area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF (DEA&DP (2010) Guideline on Need and Desirability). Integrated Development Planning (and the SDF process) effectively maps the desired route and destination, whilst the project-level EIA decision-making finds the alternative that will achieve the desired goal (DEA&DP (2010) Guideline on Need and Desirability). However, inadequate planning or the absence of a credible IDP and SDF means that the EIA has to address the broader need and desirability considerations. Consequently, 'need and desirability' is determined by considering the broader community's needs and interests as reflected in a credible IDP, SDF and EMF for the area, and as determined in the EIA decision-making process.

Furthermore, the Constitution calls for *justifiable* economic development. The specific needs of the broader community must therefore be considered together with the opportunity costs and distributional consequences to determine whether the development is 'justified'.

The general meaning of need and desirability refers to time and place, respectively, i.e. is this the right time and is it the right place for locating the proposed activity. The need and desirability of this application was addressed separately and in detail by answering *inter alia* the following questions:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?

A terrestrial & aquatic biodiversity impact assessment was undertaken in July and September 2020, and the following impacts identified:

- Alien plants are in competition with indigenous vegetation – the spreading of alien invasive plants will impact on indigenous plant communities in the area and spread further, therefore promote the invasion of alien species into the intact indigenous vegetation.
- Alien species are already present in the valley and will colonise any area of disturbance should they not be actively controlled.
- Clearing of site establishment areas will create bare areas, channelling storm water and surface run-off, etc. which could cause erosion of sediment and resulting in the siltation of the river.
- Covering the marginal vegetation on the embankment will lead to loss of potential habitat and biodiversity.
- Damage to riparian large trees or shrubs.
- Disturbing the soil during the construction of roads, clearing areas and create bare patches, channelling storm water and road run-off, etc. will cause erosion and siltation of the river.
- Dust may affect photosynthesis, respiration, transpiration of plants along haul roads and therefore impact on the local ecology.
- Erosion of cleared areas will lead to siltation of the downstream aquatic habitat.
- Erosion of dumped soil will lead to siltation of the downstream aquatic habitat.
- Fragmenting the riparian corridor by removing riparian bushes or river bank vegetation and thus compromise the function of riparian connectivity.
- Impacting the flow and water quality of this near-pristine mountain stream due to construction activities.
- Loss of riparian habitat and potential habitat for local biota, including corridors and buffers.
- Removal of indigenous riparian vegetation, considering coves of White Stinkwood along the western haul route.
- The covering of indigenous riverine vegetation will be associated with the construction of the berm and toe drain.
- Vehicle and human movement and sounds will disturb riparian fauna in the vicinity of the construction activities.

All the risk ratings after mitigation have been classified as “Low”. This rating indicates that the impacts of the proposed project on the ecology of both the project site drainage lines, will not be significant. The identified risk will thus not alter the Present Ecological Status (PES) of these reaches or the downstream ecology in any way should the prescribed control measures be adhered to.

Please see the full reports attached as Appendix E: Annexure A & Appendix E: Annexure B.

1.1. How were the following ecological integrity considerations taken into account?

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

1.1.1. Threatened Ecosystems

The project area falls within the Legogote Sour Bushveld, classified as "Vulnerable" in the National Biodiversity Assessment (NBA, 2018). This required that footprints be identified and constrained as far as possible to the least sensitive footprints, including prioritising the use existing services (e.g. roads) and previously disturbed/degraded areas.

A sensitivity map Appendix A: Annexure B was done in order to demonstrate areas that need to be taken into account, namely the threatened ecosystems, critical biodiversity areas, ecological support areas, etc.

In addition, the potential impacts and quantification of cumulative impacts were assessed by the following appointed specialists in relation to threatened ecosystems:
• Terrestrial biodiversity impact assessment, specifically the impacts on the existing riparian zone condition and associated fauna and flora; and
• Aquatic Biodiversity Assessment.

1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure

No known wetlands were identified within the project area. The sensitive riparian zone was delineated, including a buffer zone, and activities restricted from this area as far as possible especially potentially hazardous activities often associated with laydown and site establishment areas. The main works areas are however within this zone, as the dam wall sections requiring remediation are an instream impoundment to the Ngodwana River. The re-directed Ngodwana River is also a sensitive environment, with high a standard of water quality and viable aquatic biota.

The potential impacts and quantification of cumulative impacts were assessed by the following appointed specialists in relation to sensitive, vulnerable, highly dynamic or stressed ecosystems such as wetlands:
• Terrestrial Biodiversity Impact Assessment; and
• Aquatic Biodiversity Assessment.

The summary of the key findings relating to the sensitive environments are provided below.
A terrestrial & aquatic biodiversity impact assessment was undertaken in July and September 2020, and the following impacts identified:

- Covering the marginal vegetation on the embankment will lead to loss of potential habitat and biodiversity.
- Damage to riparian large trees or shrubs.
- Erosion of stockpiled soil will lead to siltation of the downstream aquatic habitat.
- Fragmenting the riparian corridor by removing riparian bushes or river bank vegetation and thus compromise the function of riparian connectivity.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Impacting on indigenous riparian vegetation, fragmenting the riparian corridor.
- Impacting the flow and water quality of this near-pristine mountain stream due to construction activities.
- Loss of riparian habitat and potential habitat for local biota, including corridors and buffers.
- Removal of indigenous riparian vegetation, considering coves of White Stinkwood along the western haul route.
- The covering of indigenous riverine vegetation will be associated with the construction of the berm and toe drain.

All the risk ratings after mitigation have been classified as "Low". This rating indicates that the impacts of the proposed project on the ecology of the project area sensitive areas, will not be significant.

Please see the full reports attached as Appendix E: Annexure A & Appendix E: Annexure B.

1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs")

According to the Mpumalanga Biodiversity Sector Plan (MBSP), the project area falls within two CBAs namely, 1. an "Irreplaceable" terrestrial CBA, and 2. A "River" CBA. Furthermore, the material stockpiles at the SAPPI Macrodump, which will be used for a small percentage of the infill material falls within a CBA: "Optimal" area. Additionally, the project area falls within the ESA: "Protected Area Buffer", associated with an upstream Coetzeerstroom Conservation Area. Finally, the area around the Water Treatment Works (WTW) is classified as "Heavily Modified". The specified landuse objectives for each MBSP category were considered in the placement of construction and operational footprints. Table 8 below indicates the land use objectives for each MBSP category relevant to this project.

Table 8: Land use objective for each MBSP category.

MBSP Category			**Landuse objective as per Mpumlanga landuse zones (2008) & landuse groups per landuse zone (2007)**
Level 1	**Level 2**	**Details of what is included (ecosystems, species, processes)**	
CBA: Terrestrial Irreplaceable		Areas that are 100% irreplaceable for meeting biodiversity conservation targets.	Maintain in a natural state with no loss of ecosystems, functionality or species
CBA: Terrestrial Optimal		Areas that are optimally located as part of the most efficient solution to meet both all the biodiversity targets and the criteria defined in the analysis.	Maintain in a natural state with no loss of ecosystems, functionality or species

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

CBA Aquatic	CBA Rivers	Flagship, Free-flowing & FEPA rivers (with a 100m buffer)	Maintain in a natural state with no loss of ecosystems, functionality or species
ESA Terrestrial	ESA: Protected Area buffer	Either the formally delineated buffer recognised in the PA Mgmt plan, or a buffer distance of either 10km for National Parks or 5km for all other PAs.	Maintain or improve ecological and tourism functionality of a PA, ensuring none of the PA objectives are compromised by activities or landuse changes in the buffer zone.
Modified	Modified - not specified	Transformed areas, where biodiversity and ecological function have been lost to the point that they are not worth considering for conservation at all.	Manage the landuse in a biodiversity-friendly manner aiming to maximise ecological functionality.

A sensitivity map Appendix A: Annexure B was done in order to demonstrate areas that need to be taken into account, namely the critical biodiversity areas and ecological support areas, etc.

In addition, the potential impacts and quantification of cumulative impacts were assessed by the following appointed specialists in relation to threatened ecosystems:
• Terrestrial biodiversity impact assessment, specifically the impacts on the existing riparian zone condition and associated fauna and flora; and
• Aquatic Biodiversity Assessment.

1.1.4. Conservation targets

According to Mucina & Rutherford (2006) the conservation target for this vegetation unit is 19% of which about 2% is currently conserved mainly in Bosbokrand and Barberton Nature Reserves; with at least another 2% conserved in private reserves including the Mbesan and Kaapsehoop Reserves and Mondi Cycad Reserve. This vegetation unit has been greatly transformed (50%), mainly by plantations and also by cultivated areas and urban development. Alien plants are also a threat, especially *Lantana camara*, *Tecoma stans* and *Solanum mauritianum* of which there is a heavy infestation across the project area. Effective control of these plants will provide the opportunity for indigenous and endemic vegetation to again dominate the area and improve ecological function and habitat restoration and contributing albeit informally to attainment of the conservation target.

1.1.5. Ecological drivers of the ecosystem

A driver is any natural or human-induced factor that directly or indirectly causes a change in an ecosystem. A direct driver unequivocally influences ecosystem processes. An indirect driver operates more diffusely, by altering one or more direct drivers.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

The dam wall impoundment is probably the largest driver of the downstream system as it restricts natural hydrological flows and attenuates flood events. The ubiquitous presence of alien invasive plants is also a driver of both ecological function as well as floral and associated faunal species diversity. So while the remedial works of the dam wall is unlikely to make any changes to the existing suite of ecological drivers as the spillway capacity will remain unchanged (the initial changes took place at the time of the original dam wall construction in the early 1980's), the effective control of Alien Invasive plants will greatly improve the ecological integrity of the area.

1.1.6. Environmental Management Framework

The municipality does not have an EMF in place.

1.1.7. Spatial Development Framework

The City of Mbombela (COM) Draft SDF 2018, on page 21, states that the COM has identified fourteen (14) development priorities in the IDP 2017-2022, which are as follows:

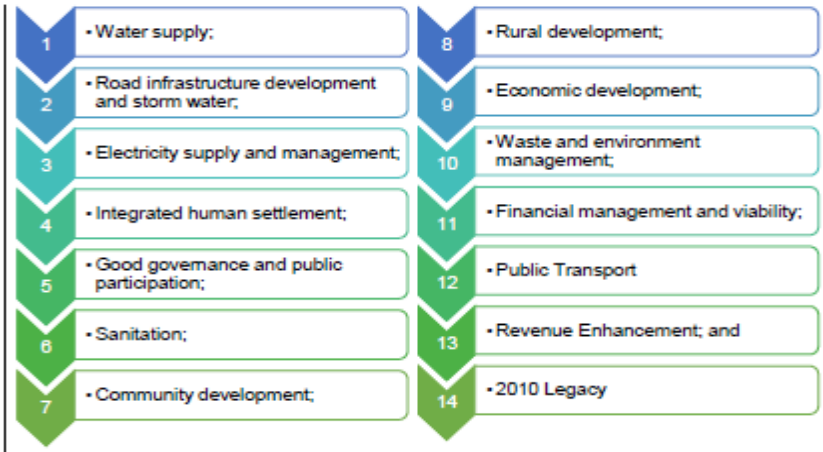


Diagram 5: COM fourteen (14) development priorities

Water supply is number 1 on the list of development priorities, although the dam already exists, remediating it will ensure continuous water supply for generations to come.

1.1.8. Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.)

The Ngodwana Dam is not a RAMSAR site.

1.2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?

The following specialist studies were undertaken, which identified all the potential impacts and how they could be managed (please refer to Appendix E: Annexure A for the full report) and the findings of

the assessment have been assessed in the Impact Assessment and included in the Environmental Management Programme (refer to Appendix D & Appendix F, respectively).

• Terrestrial Biodiversity Impact Assessment; and
• Aquatic Biodiversity Assessment.

A summary of the findings is provided below:

- Alien plants are in competition with indigenous vegetation – the spreading of alien invasive plants will impact on indigenous plant communities in the area and spread further, therefore promote the invasion of alien species into the intact indigenous vegetation.
- Alien species are already present in the valley and will colonise any area of disturbance should they not be actively controlled.
- Clearing of site establishment areas will create bare areas, channelling storm water and surface run-off, etc. which could cause erosion of sediment and resulting in the siltation of the river.
- Covering the marginal vegetation on the embankment will lead to loss of potential habitat and biodiversity.
- Damage to large trees or shrubs.
- Damage to riparian large trees or shrubs.
- Disturbing the soil during the construction of roads, clearing areas and create bare patches, channelling storm water and road run-off, etc. will cause erosion and siltation of the river.
- Dust may affect photosynthesis, respiration, transpiration of plants along haul roads and therefore impact on the local ecology.
- Erosion of cleared areas will lead to siltation of the downstream aquatic habitat.
- Erosion of dumped soil will lead to siltation of the downstream aquatic habitat.
- Fragmenting the riparian corridor by removing riparian bushes or river bank vegetation and thus compromise the function of riparian connectivity.
- Impacting on indigenous riparian vegetation, fragmenting the riparian corridor.
- Impacting the flow and water quality of this near-pristine mountain stream due to construction activities.
- Loss of riparian habitat and potential habitat for local biota, including corridors and buffers.
- Removal of indigenous riparian vegetation, considering coves of White Stinkwood along the western haul route.
- The covering of indigenous riverine vegetation will be associated with the construction of the berm and toe drain.
- Vehicle and human movement and sounds will disturb riparian fauna in the vicinity of the construction activities.

All the risk ratings after mitigation have been classified as “Low”. This rating indicates that the impacts of the proposed project on the ecology, will not be significant including the downstream ecology, should the prescribed control measures be adhered to. A possibly more significant risk to the ecology remains if the remedial works are not undertaken, and the integrity of the dam wall continues to regress to the

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

point of failure. This failure and high flows and sediment would be devastating to downstream ecosystems, especially aquatic ones.

Please see the full reports attached as Appendix E: Annexure A & Appendix E: Annexure B.

1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?

An Impact Assessment, considering all specialist studies was completed and an EMPr has been formulated as part of the environmental impact assessment within the draft BAR (refer to Appendix D for the full findings and management thereof).
The direct impact of hazardous substances is one of the largest anthropogenic sources of pollution, including ineffective containment and/or treatment of wastewater, storage and use of petroleum hydrocarbons and other construction chemicals, spillages from plant and vehicles.

Indirect impacts could result predominantly from erosion and associated erosion, which will likely result in siltation of the watercourse and increases in Total Suspended Solids (TSS) in the river. These impacts have been assessed and mitigated in two of the specialist studies and reports namely;
• Terrestrial Biodiversity Impact Assessment; and
• Aquatic Biodiversity Assessment.

A summary of the findings is provided below:

- Erosion of cleared areas will lead to siltation of the downstream aquatic habitat.
- Impacting the flow and water quality of this near-pristine mountain stream due to construction activities.
- Erosion of dumped soil will lead to siltation of the downstream aquatic habitat.
- Disturbing the soil during the construction of roads, clearing areas and create bare patches, channelling storm water and road run-off, etc. will cause erosion and siltation of the river.
- Clearing of site establishment areas will create bare areas, channelling storm water and surface run-off, etc. which could cause erosion of sediment and resulting in the siltation of the river.

No off-setting was considered, as the post-construction rehabilitation, including the deliberate large-scale control of alien invasive vegetation within the broader project area, will improve the overall ecological state of this system.

1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

General waste and construction waste are going to be generated by this development. The implementation of the waste hierarchy will ensure the effective management of all waste generated during construction, which is a condition of the EMPr, This includes recyclable waste being separated and promoted for recycling at a suitable recycling centre, while the unrecyclable waste will be disposed of at the SAPPI Ngodwana Macrodump Disposal site (waste management license no. 12/9/11/L308/6/R1).

1.5. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?

An Archaeological and Cultural Heritage Impact Assessment was undertaken by Kudzala Antiquity CC and a report (please refer to Appendix E: Annexure C for the full report) thereof compiled on the 21st of July 2020. A Paleontological Impact Assessment was undertaken Professor Marion Bamford of WITS University and the findings of these assessments have been incorporated into the Draft Basic Assessment Report and all mitigations accounted for within the EMPr.

1.6. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?

Please refer to the Impact Assessment in Appendix D.

1.7. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?

Please refer to the Impact Assessment in Appendix D.

1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life).

It is considered that the ensured water storage will provide a more sustainable and reliable source for the supply of water. This would mean that there will be no need to use other sources to supply water in

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

the near future and for generations to come as this is the first remediation for the dam since its construction in 1983.

There is an existing Eskom connection on site. The proposed dam remediation purpose is to ensure that there is enough water supply, therefore maintaining existing jobs and a possibility of creating more job opportunities.

The recycling waste will be separated, and the unrecyclable waste will be disposed of at the SAPPI Ngodwana Macrodump Disposal site (waste management license no. 12/9/11/L308/6/R1).

1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)

The natural environment cannot be considered in isolation. Development must also be socially and economically sustainable (Section 2 (3) NEMA, 1998). The government decision-makers and environmental assessment practitioners must serve the public's social, economic and ecological needs equitably. Sustainable development requires the simultaneous achievement of the triple bottom-line. Consequently, one must determine whether the nature and extent of the negative environmental impacts occur at a cost acceptable to society and the economy. This can be determined by considering the opportunity costs. Considering an investigation of potential alternatives (Section G), the next best alternative for establishing the opportunity cost is the no-go option.

Consequently, the opportunity cost is the foregone benefit of losing the no-go option. As mentioned above, a comparative assessment of the proposed activity with the no-go option must consider the social, economic and environmental benefits and/or disadvantages associated with/yielded by each alternative. Land is an environmental resource. Considering "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage," (Section 2 (4) NEMA, 1998) it is useful to consider if and how the public benefits from the use of environmental resources in the case of implementing the no-go option/alternative. In this case, the public will not benefit from the no-go option. The opportunity cost or forgone social and economic benefit for not constructing the dam will be increased agricultural production and associated job creation. Consequently, the proposed activity will better benefit and serve the public interest.

The proposed activity will not provide the most benefit and cause the least damage to the existing natural environment if compared with the no-go option. It will result in the disturbance and/or loss of riparian habitat. However, the terrestrial and aquatic ecosystems will be replaced by even better ecosystems that support water birds and other aquatic flora and fauna. The aquatic habitat is 'Irreplaceable,' but the proposed dam remediation including prescribed mitigations, should not have a detrimental effect on the surface water hydrology.
In conclusion, the negative natural environmental impacts occur at a cost acceptable to society and the economy.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?

Yes. The proposed dam remediation will provide and ensure continual water supply for even more generations to come, additional to the 36 years that the dam, has already been supplying water.

1.8. How were a risk-averse and cautious approach applied in terms of ecological impacts?

A terrestrial biodiversity impact assessment and an aquatic biodiversity assessment was undertaken to assess how the area is going to be affected and mitigations on how to avoid, minimise and mitigate the impacts. Please refer to Appendix E: Annexure A and Annexure B for the full reports of the findings and Appendix D for the Impact Assessment.

1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?

The magnitude of the following impacts is not known:

- the extent of ground and surface water contamination during construction;
- the extent and intensity of the visual transformation;
- the amount of energy/power/electricity required for construction and the amount likely to be wasted;
- the quantities of water required for construction activities and likely to be wasted;
- the amount of soil that will be lost;
- the extent and severity of the soil and water pollution;
- the extent and severity of the loss of terrestrial and avi-fauna and vegetation;
- the applicant and professional team are not aware of the relevant environmental legislation and how it affects certain activities associated with the proposed development.
- the magnitude of the impact, specifically the extent of non-compliance

The following assumptions are made:

- the dam design engineer will remain involved in and take cognisance of the environmental and water use authorisaton processes and content, specifically on flora and water quality, to help ensure appropriate layout and design.
- the contractor and his/her labourers will need to be made aware of the actual and potential impacts resulting from their activities, to ensure the effective implementation of the EMPr. Over and above inductions and awareness training, the EMPr must be made a contractually binding document and be included in the tender documents for accurate costing.
- none of the activities require an atmospheric emissions or waste management license.
- erosion is a natural phenomenon and cannot be prevented. It can, however, be controlled /reduced.
- dust is unlikely to impact plants, if dust suppressants are actively used on haul routes.

1.8.2. What is the level of risk associated with the limits of current knowledge?

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

The risk of the limits of current knowledge highlighted above is low, the specialist findings have been incorporated into the Basic Assessment Report and addressed in the impact assessment and mitigations in the EMPr.
The level of risk is low and can be minimised or avoided, through the monitoring and/or adherence of the EMPr. The appointment of a suitably qualified Site Environmental Officer (SEO) during construction will further limit risks by helping implement the conditions of both the environmental and water use authorisations.

1.8.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?

An environmental impact assessment was done as part of the Basic Assessment process and all the findings, recommendations and mitigations of all the specialists' reports will be included in Impact assessment. Please refer to Appendix D for the Impact Assessment.

1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following:

1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?

The natural environment cannot be considered in isolation. Development must also be socially and economically sustainable (Section 2 (3) NEMA, 1998). The government decision-makers and environmental assessment practitioners must serve the public's social, economic and ecological needs equitably. Sustainable development requires the simultaneous achievement of the triple bottom-line. Consequently, one must determine whether the nature and extent of the negative environmental impacts occur at a cost acceptable to society and the economy. This can be determined by considering the opportunity costs. Considering an investigation of potential alternatives (Section G), the next best alternative for establishing the opportunity cost is the no-go option.

Consequently, the opportunity cost is the foregone benefit of losing the no-go option. As mentioned above, a comparative assessment of the proposed activity with the no-go option must consider the social, economic and environmental benefits and/or disadvantages associated with/yielded by each alternative. Land is an environmental resource. Considering "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage," (Section 2 (4) NEMA, 1998) it is useful to consider if and how the public benefits from the use of environmental resources in the case of implementing the no-go option/alternative. In this case, the public will not benefit from the no-go option. The opportunity cost or forgone social and economic benefit for not constructing the dam will be increased agricultural production and associated job creation. Consequently, the proposed activity will better benefit and serve the public interest.

The proposed activity will not provide the most benefit and cause the least damage to the existing natural environment if compared with the no-go option. It will result in the disturbance and/or loss of

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

riparian habitat. However, the terrestrial and aquatic ecosystems will be replaced by even better ecosystems that support water birds and other aquatic flora and fauna. The aquatic habitat is 'Irreplaceable,' but the proposed dam remediation including prescribed mitigations, should not have a detrimental effect on the surface water hydrology.
In conclusion, the negative natural environmental impacts occur at a cost acceptable to society and the economy.

1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?

Positive impacts include, but are not limited to:
• Creation of job opportunities;
• Increase in- / enhancement of the diversity of aquatic species and plants (through the active control of alien invasive species which currently dominate the area); and
• Improved dam integrity and safety.

1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?

The community/area is dependent on the Ngodwana Dam to supply water, and job creation is a societal priority. Consequently, there is a need for the improvement and/or upgrading of the current dam condition that will enable increased water supply and more jobs for the neighbouring Agricultural Farms that depend on the Ngodwana Dam to supply water. Any negative natural environmental impacts occur at a cost acceptable to society and the economy. Terrestrial habitat occurring within the dam banks might be affected, however cultural areas will not be impacted.

1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?

A terrestrial biodiversity impact assessment was undertaken to investigate how this dam remediation will positively or negatively impact on ecological integrity objectives/targets/considerations of the area. Please refer to the full report at Appendix D Annexure A.

1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?

Refer to Alternatives Section H (i).

1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?

Refer to Impact Assessment (Appendix D) and Alternatives in Section H (i).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations:

2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area

Page 20 of the Ehlanzeni District Muncipality's Draft IDP and Budget Review 2020/2021, states the following:

THE OUTCOME BASED PLANNING APPROACH

In its effort to speed up service delivery to the general public, cabinet adopted a much smarter planning approach called the OUTCOME BASED APPROACH on 27 May 2010. It is a systems approach which seeks to ensure a structured manner to respond to the community needs on the ground. This planning approach is aimed at being a management, co-ordination and learning tool than a punitive measure to failing institutions. The twelve delivery outcomes have each been given clear targets for proper reporting, monitoring and support by all institutions of government. These Outcomes are summarized as follows:

- Improve quality of basic education
- A long and healthy life for all South Africans
- All people in South Africa are free and feel safe
- Decent employment through inclusive economic growth
- A skilled and capable workforce to support an inclusive growth path
- An efficient, competitive and responsive economic infrastructure network
- Vibrant equitable and sustainable rural communities with food security for all
- Sustainable human settlements and improved quality of household life
- A responsive accountable, effective and efficient Local Government System
- **Environmental assets and natural resources that are well protected and continually enhanced**
- Create a better South Africa and contribute to a safer Africa and the World
- An efficient, effective and development oriented public service and an empowered, fair and inclusive citizenship.

Ngodwana Dam in this regard is an environmental asset that will be enhanced by this proposed remediation.

2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.)

This development is not provided for in the infrastructure planning of the municipality but will not have an impact on the infrastructure planning because it is isolated from urban developments. The purpose of the proposed activity is to maintain and enhance water supply.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

However, according to the COM SDF (2018), on page 21, states that the COM has identified fourteen (14) development priorities in the IDP 2017-2022, which are as follows:

Diagram 5: COM fourteen (14) development priorities

Water supply is number 1 on the list of development priorities, although the dam already exists, remediating it will ensure continuous water supply for generations to come.

2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.)

The land is currently zoned as agriculture and other than the dam footprint is used primarily as a wildlife area and for recreational purposes. The dam is not within visible range of any neighbours.

An Archaeological and Cultural Heritage Impact Assessment was completed to address the cultural landscapes of the project area and the findings have been incorporated into the draft BAR. No sites of heritage or archaeological significance were identified in the proposed project areas.

2.1.4. Municipal Economic Development Strategy ("LED Strategy").

The projects approval and success will help create more job opportunities for the surrounding community, hence strengthening the economic state of the municipality.

2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?

The community and local area is dependent on the agriculture sector, and job creation is a societal priority. Consequently, there is a need for the dam remediation to ensure continuous water supply that will enable increased agricultural production and more permanent jobs.

2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?

The projects approval and success will help create more job opportunities for the surrounding community, hence strengthening the economic state of the municipality.

2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?

The community and local area is dependent on the agriculture sector, and job creation is a societal priority. Consequently, there is a need for the dam remediation to ensure continuous water supply that will enable increased agricultural production and more permanent jobs.

2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?

Yes, the development will result in equitable (intra- and inter-generational) impact distribution, as well as socially and economically sustainable in the short- and long-term because of the job creation and ensured sustainability in the supply of water.

2.5. In terms of location, describe how the placement of the proposed development will:

2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other

The approval of this dam remediation will result in ensured water supply for generations to come, not so much residential opportunities.

2.5.2. reduce the need for transport of people and goods

The proposed project will have no impact on the need for transport of people and goods, the dam remediation will be on private land.

2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport)

A Traffic Study was undertaken, please see Appendix E Annexure E & F for the full report with impacts thereof.

2.5.4. compliment other uses in the area

The proposed dam remediation will complement the agricultural uses in the area, as it will ensure that sufficient water is always available (water doesn't run completely dry or out) for irrigation of more produce that can be grown around the area.

2.5.5. be in line with the planning for the area

A reliable supply of suitable quality water for the Ngodwana Mill (especially the water quality parameters for paper making), Ngodwana nurseries, Ngodwana Residential area, and other operational areas associated with the Mill depend on assured water supply. The planned remediation of the dam wall to ensure its continued integrity is key to the long-term sustainability of the aforementioned business units.

2.5.6. for urban related development, make use of underutilised land available with the urban edge

This is a rural development where the urban edge is not applicable.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.5.7. optimise the use of existing resources and infrastructure

The remediation will optimise the supply of water, not the use of existing resources and infrastructure.

2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement)

This development is not provided for in the infrastructure planning of the municipality but will not have an impact on the infrastructure planning because it is isolated from urban developments. The purpose of the proposed activity is to ensure endless water supply.

2.5.9. discourage "urban sprawl" and contribute to compaction/densification

The project is for the benefit of the applicant, therefore will not discourage "urban sprawl" nor contribute to compaction/densification.

2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs

The project is solely for the benefit of the applicant and his workers (in terms of jobs and economic sustainability) and will have no effect on historically distorted special patterns as the area will remain an agricultural dominated area.

2.5.11. encourage environmentally sustainable land development practices and processes

The proposed dam remediation will be to ensure endless water supply which will help increase the availability of water for agricultural growth (plants give off oxygen).

2.5.12. take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.)

The dam already exists, therefore no special locational factors were taken into account.

2.5.13. the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential)

The proposed project will ensure that temporary job opportunities are created for the duration of the remediation.

2.5.14. impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area

An Archaeological and Cultural Heritage Impact Assessment was completed to address the cultural landscapes of the project area and the findings have been incorporated into the draft BAR. No sites of heritage or archaeological significance were identified in the proposed project areas.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.5.15. in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?

The project is solely for the benefit of the applicant and the people that depend on Ngodwana Dam for water supply and will not create a more integrated settlement.

2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts?

The project is solely for the benefit of the applicant and the people that depend on Ngodwana Dam for water supply and will not create a more integrated settlement and is unlikely to pose or have a risk-averse and cautious approach applied in terms of socio-economic impacts.

2.6.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?

The magnitude of the following impacts is not known:

- the extent of ground and surface water contamination during construction;
- the extent and intensity of the visual transformation;
- the amount of energy/power/electricity required for construction and the amount likely to be wasted;
- the quantities of water required for construction activities and likely to be wasted;
- the amount of soil that will be lost;
- the extent and severity of the soil and water pollution;
- the extent and severity of the loss of terrestrial and avi-fauna and vegetation;
- the applicant and professional team are not aware of the relevant environmental legislation and how it affects certain activities associated with the proposed development.
- the magnitude of the impact, specifically the extent of non-compliance

The following assumptions are made:

- the dam design engineer will remain involved in and take cognisance of the environmental and water use authorisaton processes and content, specifically on flora and water quality, to help ensure appropriate layout and design.
- the contractor and his/her labourers will need to be made aware of the actual and potential impacts resulting from their activities, to ensure the effective implementation of the EMPr. Over and above inductions and awareness training, the EMPr must be made a contractually binding document and be included in the tender documents for accurate costing.
- none of the activities require an atmospheric emissions or waste management license.
- erosion is a natural phenomenon and cannot be prevented. It can, however, be controlled /reduced.
- dust is unlikely to impact plants, if dust suppressants are actively used on haul routes.

Refer to Impact Assessment (Appendix D), where each aspect of the proposed project lists the gaps, uncertainties and assumptions associated with the project.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.6.2. What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?

The risk of the limits of current knowledge highlighted above is low, the specialist findings have been incorporated into the BAR and addressed in the impact assessment and mitigations in the EMPr.

The level of risk is low and can be minimised or avoided, through the monitoring and/or adherence of the EMPr. As minimal as the risks are, mitigations were sought and tailored to counteract the project-specific impacts and achieve goals and objectives in line with environmental best practices.

2.6.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?

The activities associated with the project were identified, assessed and impacts predicted and including additional safety nets. Finally, mitigations were sought and tailored to counteract the project-specific impacts and achieve goals and objectives in line with environmental best practices and regulatory requirements. Finally, an Environmental Management Programme (Appendix F) was formulated to help minimise and/or avoid any risks that might occur.

2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:

2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?

The applicant is likely to keep his existing workforce and a similar situation for the contractor who is likely to be on site for no longer than nine (9) months. During which the daily/weekly toolbox talks will include but will not be limited to health, safety, environment and social.

2.7.2. Positive impacts. What measures were taken to enhance positive impacts?

The project is solely for the benefit of the applicant and the people that depend on Ngodwana Dam for water supply and will only impact on people's environmental right in the sense that water will always be supplied.

2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?

The project is solely for the benefit of the applicant and the people that depend on Ngodwana Dam for water supply and will not result in the over utilisation of natural resources.

2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Please refer to Public the Participation Process in Section H.

2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?

Refer to the Alternatives Section G.

2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?

Please refer to Public the Participation Process in Section H.

2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?

Please refer to the Impact Assessment and Environmental Management Programme in Appendix D & Appendix F, respectively.

2.13. What measures were taken to:

2.13.1. ensure the participation of all interested and affected parties

The public participation process has identified all relevant interested and effected parties to ensure all aspects and potential concerns will be received and addressed in the final BAR.
Please refer to Public the Participation Process in Section H (ii) and Appendix C.

2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation

The public participation process has identified all relevant interested and effected parties to ensure all aspects and potential concerns will be received and addressed in the final BAR.
Please refer to Public the Participation Process in Section H (ii) and Appendix C.

2.13.3. ensure participation by vulnerable and disadvantaged persons

The public participation process has identified all relevant interested and effected parties to ensure all aspects and potential concerns will be received and addressed in the final BAR.
Please refer to Public the Participation Process in Section H (ii) and Appendix C.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.13.4. promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.

All registered I&AP's will receive copies of the Draft BAR and draft EMPr that will share the knowledge of the environmental aspects and impacts of the project and how they will be addressed and mitigated.

The public participation process has provided the opportunity to raise environmental awareness and environmental education within the Background Information Documents (BID) and the Draft report that is to be disseminated.

Please refer to Public the Participation Process in Section H (ii) and Appendix C.

2.13.5. ensure openness and transparency, and access to information in terms of the process

The public participation process has identified all relevant interested and effected parties to ensure all aspects and potential concerns will be received and addressed in the final BAR.

Please refer to Public the Participation Process in Section H (ii) and Appendix C.

2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge

The public participation process has identified all relevant interested and effected parties to ensure all aspects and potential concerns will be received and addressed in the final BAR.

Please refer to Public the Participation Process in Section H (ii) and Appendix C.

2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein were be promoted?

Please refer to the Public Participation Process Section H, for the details of the interested and affected parties were brought into consideration, what issues & concern they raised and how they are going to be addressed.

2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?

The project is to ensure continual and longest-term water supply and will not be providing any opportunities for community housing.

2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?

A section on social, health and safety has been incorporated into the Impact Assessment (Appendix D) as well as the Environmental Management Plan (Appendix F). The workforce will have relevant toolbox talks daily and everyone will be required to attend an induction before commencing work on the project.

2.16. Describe how the development will impact on job creation in terms of, amongst other aspects:

2.16.1. the number of temporary versus permanent jobs that will be created

Temporary construction-related job opportunities will be predominantly created with traffic control, gabions etc. estimated at 25-30 positions. The larger-scale work related to earthworks is less labour intensive and highly mechanised. Currently, the management of the dam is undertaken by one full-time person.

2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area)

The contractor is likely to come with his own skilled team, but SAPPI does have a "job-seekers" database from which local labour can be sourced.

2.16.3. the distance from where labourers will have to travel

The distance that labourers must travel will not be a significant concern, as the appointed contractor will provide transport to the project site for any job opportunities not sourced from the local community.

2.16.4. the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits)

The proposed project will increase the water supply benefit to the local community however, the costs of the remediation will be the applicant's responsibility.

2.16.5. the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.)

The contractor who is likely to be on site for no longer than nine (9) months will bring his own workforce and should the need to have more people arise, she/he will be requested to hire within the local communities.

2.17. What measures were taken to ensure:

2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment

Please refer to Section E for the list of environmental legislation and policies that was considered and used for the formulation of the main report and the appendices. The EAP also had a pre-application brief discussion with MDARDLEA to discuss the project and relevant legislation.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.17.2. that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?

Please refer to the Public Participation Process in Section H (ii) and Appendix C, for the details.

2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?

An impact assessment that shows that almost all identified impacts can be affectively mitigated was undertaken, indicating that the cumulative impact effect will also be mitigated, was undertaken. Additional impacts and quantification of cumulative impacts were assessed by the following appointed specialists:

- Terrestrial Biodiversity Impact Assessment (Fauna & Flora)
- Aquatic Biodiversity Assessment
- Archaeological and Cultural Heritage Impact Assessment
- Palaeontology Impact Assessment
- Geotechnical Assessment.

Please refer to the specialist reports in Appendix E and the impact assessment in Appendix D.

2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?

The mitigation measures proposed are realistic, ensures proper rehabilitation will leave no environmental legacy and managed burden, besides the loss of jobs to those that will have secured any temporal employment (if available).

2.20. What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?

The Impact Assessment and Environmental Management Programme were formulated to cover ways and means of ensuring that all the stakeholders (applicant, contractor & ECO) have roles to play in combating pollution during all the phases (from planning through to decommissioning).

2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?

Please refer to the alternative types within Section H (i).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?

Please refer to the social section of the Impact Assessment in Appendix D.

Conclusion:

The level of risk for this proposed dam remediation is low and can be minimised or avoided, through the monitoring and/or adherence of the EMPr. People will not be negatively affected by the proposed remediation; in-fact temporary job opportunities will be created. The dam must be remediated to ensure continual water supply without compromising environmental sustainability.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION G: THE PREFERRED SITE, ACTIVITY AND TECHNOLOGY ALTERNATIVES

(g) A motivation for the preferred site, activity and technology alternative;

In relation to the motivation of the preferred site, no alternative exists, as the dam is an existing structure and requires remedial work to ensure continued structural integrity and safe operation. The entire works area falls within a Terrestrial CBA – Irreplaceable and an Aquatic CBA – Rivers, necessitating the selection of the least sensitive footprints in which to locate site establishment areas, haul roads and site offices so as not to lose any biodiversity in this sensitive landscape. Existing services and already transformed areas were therefore selected as far as possible from the onset, to limit impact to untransformed landscapes, including locating activities outside of watercourses and delineated riparian zone, as far as possible (other than watercourse crossings and the actual dam wall remedial works).

Table 9 Below indicates the various footprint alternatives identified and reasons for assignment as preferred alternative/s (see Legend below) indicated with relevant with motivation.

Legend for Table 9.

	Preferred option
	Second priority option
	Flawed alternative

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Table 9: Site activities, footprint alternatives and identification of preferred options supported with motivation.

DAM REMEDIATION WORKS AREA FOOTPRINTS	**WORKS AREA 1** (Main Embankment) 	**Location** The main embankment is an existing structure that only supports a grass cover, as tree roots jeopardise the integrity of the wall structure. This is the footprint on which the majority of the remedial works will be undertaken and hence, there is no locational alternative to this footprint. **Technology** Vegetation cover and associated topsoil and sub-soil layers of the section of the main embankment that will be remediated, will be removed and used as fill material for the raising of the right flank embankment. The main embankment fill material will be largely rock-fill due to its intrinsic strength, which will remain as the finishing layer in order to eliminate vegetation regrowth and minimise maintenance. From an aesthetic & ecosystem function perspective, re-vegetating the remediated section would be preferable, but as the remedial works is on the lower section of the dam wall it will not be visible at a distance. While the ecological function of this section of the dam wall will be affected, it may in fact provide habitat to smaller fauna and may be mitigated and compensated for by the clearance of the prolific amount of alien invasive vegetation beneath the dam wall to be conducted as part of construction and operational requirements.
	WORKS AREA 2 (Right Flank) 	**Location** The right flank embankment is also an existing structure that only supports a grass cover, as tree roots jeopardise the integrity of the wall structure. This footprint will not be disturbed to the extent of the main embankment, as the works will be largely constrained to adding soil-based infill, derived from the main embankment. The remedial works are not deemed as critical as the main embankment but rather motivated as an additional safety measure, to ensure excessive flows never overtop the right flank resulting in wash away and failure. **Technology** Imported topsoil and sub-soil from the main embankment, with associated re-vegetation, will provide a preferable visual impact and partial restoration of ecological function (only grass, no trees are permitted to grow on this embankment).
SITE ESTABLISHMENT AREA FOOTPRINTS	**ESTABLISHMENT AREA ALTERNATIVE 1** (Proposed) 	**Location** This site establishment area is located strategically well, as the remedial works will be clearly visible, facilitating oversight and supervision. **Technology** Access to the site is difficult and necessitates driving up a very steep section of the main embankment, which poses unacceptably high Health & Safety risks. The only other access

	alternative to the site is via an existing road from the Macrodump site, which is impractical both in terms of time and cost implications.
ESTABLISHMENT AREA ALTERNATIVE 2 (Main Embankment) 	**Location** This site establishment area is located strategically to be able to access both sides of the works areas, connected by way of a pedestrial bridge, facilitating access by site staff to both work fronts. **Technology** The southern side of this area (southern side of spillway channel) will likely serve as a laydown area and plant/equipment storage area, limiting unnecessary and costly movement of equipment at the close of every work day. However, due to it being positioned within the riparian zone, no servicing of plant or storage of hazardous substances shall be permitted, and effective preventative and containment measures must be in place for all potential accidental leakages and spills from plant.
ESTABLISHMENT AREA ALTERNATIVE 3 (Right Flank) 	**Location** This site establishment area is the largest area, and will likely act as the primary laydown, stockpile, storage and office area. It's location off the main tarred access road to the Ngodwana Club also allows for all-weather access, including deliveries of commercial fill material. **Technology** The area has previously been disturbed and is largely covered in exotic Kikuyu grass *(Pennisetum clandestinum)*. The larger trees are widely spaced and should not need to be removed. Rehabilitation with indigenous grass seeds and restoration with suitable tree species can improve upon the baseline biodiversity value of this site.
ESTABLISHMENT AREA ALTERNATIVE 4 (Contractors Offices) 	**Location** This site establishment area is located in a flat area beneath large established trees, at the intersection with the link road to the spillway channel, shortly before the low-water watercourse crossing. This area has specifically been identified for offices only, which is why the "preferred option" indicator is surrounded in amber colour, as it would be a secondary priority site. **Technology** This site should only be used if the existing established trees will not be affected, and then only for site offices. No potentially hazardous activities must be allowed due to its proximity to the riparian and associated buffer zone boundary and associated alluvial soils.
ESTABLISHMENT AREA ALTERNATIVE 5 (Stockpile) 	**Location** This site establishment area is located adjacent to the Water Treatment Works (WTW), on a previously disturbed footprint. The site is located beneath internal SAPPI powerlines, which would nonetheless require careful management not to cause damage to the electricity supply to the WTW.

		It is well positioned in close proximity and access to the N4 to facilitate delivery of materials. **Technology** A proviso to the use of this site by Trans African Concessions (TRAC), the concessionaire on behalf of the South African Roads Agency Limited (SANRAL), is that at least 100m of additional queuing lanes be added to the N4 for west bound traffic on the approach of the WTW entrance. This will have significant cost implications but limited environmental impacts.
HAULAGE ROUTE FOOTPRINTS	**Route 1- SECTION 6** (East-Fishing Club) 	**Location** This access route is an existing tarred road, well suited to all weather conditions. **Technology** The specification of the tarred surface has not been determined and may require upgrades both during and post construction due to the large vehicles that will be used for delivery and internal haulage.
	Route 1- SECTION 7 (New Access to Spillway) 	**Location** This access route will provide access to the northern side of the concrete spillway, where repairs will be undertaken to joints and the retaining wall. **Technology** Vegetation clearance and earthworks will be required for the creation of this link road, which will remain in place during operational phase of the dam to facilitate maintenance activities and dam safety inspections. A no nett loss principle must be applied to the clearance of all indigenous vegetation, whereby all plants cleared must be recorded by species and location and replaced outside the road footprint, or replaced in situ if the road is decommissioned after the construction phase.
	Route 1- SECTION 5 (New Access to Right Flank) 	**Location** This access route will provide access to the right flank embankment from the tar road shortly before the Ngodwana Club entrance. This link road is required as the current entrance structure of the Dam Club cannot facilitate large vehicle access. **Technology** Vegetation clearance and earthworks will be required for the creation of this link road, which will remain in place during operational phase of the dam to facilitate maintenance activities and dam safety inspections. A no nett loss principle must be applied to the clearance of all indigenous vegetation, whereby all plants cleared must be recorded by species and location and replaced outside the road footprint, or replaced in situ if the road is decommissioned after the construction phase.

	Route 2- SECTION 2&3 (From WTW) 	**Location** This existing access route runs along the raw water supply pipeline from the dam to the WTW. The road is narrow and crosses a seepage area close to the dam main embankment. **Technology** The road will require upgrades to the surface, passing lanes, potential upgrade for crossing the seepage area and protection of the raw water supply pipeline. Passing lanes must be installed where additional width is available without having to infill sections of the bench of the adjacent watercourse. Passing lanes must also ensure the protection of large established in situ vegetation and rocky outcrops.
	Route 2- SECTION 4 (New bridge over watercourse) 	**Location** This crossing will create access across the spillway discharge channel, which is a man-made watercourse following the construction of the dam and the diversion of the original Ngodwana River channel. **Technology** A low-water concrete causeway will be installed that will provide access only during low water flows and will not impede or divert water within this channel, nor the free movement of aquatic organisms. Clearance of aquatic vegetation (mostly reeds) and limited riparian vegetation will be required.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION H: DESCRIPTION OF PROCESS TO REACH THE PROPOSED ALTERNATIVE WITHIN THE SITE;

(h) a full description of the process followed to reach the proposed preferred alternative within the site; including;

Details of the Alternatives Considered

(i) Details of all the alternatives considered;

Legislative background

The very consideration of a development in terms of EIA is about the consideration of alternatives related to the development. The NEMA prescribes that all environmental impact assessments, which are to be utilised in informing an application for environmental authorisation, must identify and investigate the alternatives to the activity on the environment and include a description and comparative assessment of the advantages and disadvantages that the proposed activity and feasible and reasonable alternatives will have on the environment and on the community, that may be affected by the activity. If, however, after having identified and investigated alternatives, no feasible and reasonable alternatives exist, no comparative assessment of alternatives, beyond the comparative assessment of the preferred alternative and the option of not implementing the proposed project, is required during the assessment phase. In this instance, the EAP managing the application must provide the competent authority/DEA with detailed, written proof of the investigation(s) undertaken and motivation indicating that no reasonable or feasible alternatives, other than the preferred alternative and the no-go option, exist.

Definition of Alternatives

"Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include the following types of alternatives:

- The property on which, or location where, it is proposed to undertake the activity;
  - Refers to both alternative properties (locations) as well as alternative sites on the same property.
- The type of activity to be undertaken;
  - Provision of public transport rather than increasing the capacity of roads.
- The design or layout of the activity;
  - Different architectural and or engineering designs.
  - Consideration of different spatial configurations of an activity on a particular site (Site Layout).
- The technology to be used in the activity;
  - Option of achieving the same goal by using a different method or process.
- The operational aspects of the activity;
- Demand;

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

  - When a demand for a certain product or service can be met by some alternative means, i.e. the demand for electricity/storm water controls could be met by supplying more energy or using energy more efficiently by managing demand.
- Input;
  - Input alternatives for projects that may use different raw materials or energy sources in their processes.
- Routing;
  - Alternative routes generally apply to linear developments (pipeline routes).
- Scheduling and Timing;
  - Where several measures might play a part in an overall programme, but the order in which they are scheduled will contribute to the overall effectiveness of the end result.
- Scale and Magnitude;
  - Activities that can be broken down into smaller units and can be undertaken on different scales, i.e. for a housing development there could be the option 10, 15 or 20 housing units.
- The option of not implementing the activity (no-go option).
  - The no-go option is taken to be the existing rights on the property and this includes all the duty of care and other legal responsibilities that apply to the owner of the property. All the applicable permits must be in place for a land use to be an existing right.

The key criteria when identifying and investigating alternatives are that they should be "feasible" and "reasonable". The "feasibility" and "reasonability" of and the need for alternatives must be determined by considering, *inter alia*, (a) the general purpose and requirements of the activity, (b) need and desirability, (c) opportunity costs, (d) the need to avoid negative impact altogether, (e) the need to minimise unavoidable negative impacts, (f) the need to maximise benefits, and (g) the need for equitable distributional consequences. The (development) alternatives must be socially, environmentally and economically sustainable. They must also aim to address the key significant impacts of the proposed development by maximising benefits and avoiding or minimising the negative impacts.

Given the definition and description of alternatives, alternatives for investigation in this assessment were first identified by considering whether the different types of alternatives could meet the general purposes and requirements of waste treatment facility for non-infectious carcasses, and subsequently constitute a comparable activity. Thereafter, the need for an alternative was assessed to determine whether it warranted further investigation.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Purpose and requirements of the dam remediation

The Ngodwana Dam was built in 1987, undergoes 7 yearly Dam Safety Evaluations (DSE's). The previous one conducted in 2016 September recommended that further analysis and monitoring be done because of the slope stability of the dam.

In 2017/2018 seepage and slope stability analyses of two sections of the embankment were undertaken. Material properties were obtained from extensive laboratory testing done on samples retrieved from the piezometer boreholes. Noticeable was the high clay content of average 27% and very low gravel content of 4% average. The material was clearly of low strength for a "shell" zone where normally coarser material is placed.

Seepage and slope stability analyses showed to be lower than normally accepted safety factors against slope failures of the embankment downstream face. The material in the large downstream shell zone of the embankment were of low strength and erodible. The standpipe piezometers showed a high phreatic surface within the embankment at its highest section where a wet area on the lower downstream face had also been observed. The portion of the embankment between the riverbed and the left flank foundation contact showed significant erratic movements. The effectiveness of the embankment internal drainage system and toe drain was suspect.

A dam break analysis conducted in 1987 indicated that the dam break flood peak could be as much as 11 000 m3/s compared to the 1 in 200 year flood of the catchment of the dam of 832 m3/s. A dam failure will cause significant damage to the N4 and SAPPI Mill immediately downstream of the dam, and also further downstream of the dam. Hence the need for the remediation.

Please see Appendix B for the full reports.

The proposed dam remediation will improve the current state of the banks.

Identification and investigation of alternatives including motivations

Alternative Type No. 1: Site and Location

- Purpose and Requirements

The SAPPI Ngodwana Dam was built between 1982 and 1983. The dam wall was designed as a 41.2m embankment dam with a sloping clay core and an un-zoned sloping chimney filter, connected to horizontal strip drains that terminates in collection toe-drains fitted with V-notch flow gauges. The upstream slope is 1:2,5 and the downstream slope is 1:2,0 and it has two equidistant berms. The dam is classified with the Department of Water Affairs [DWA] Dam Safety Office as a Category III High Risk dam, in terms of the Dam Safety Regulations, Chapter 12 of the National Water Act 1998 (Act 36 of 1998) (de Beer, 2019).

Following the 2019 Annual Dam Safety Inspection & Report the following maintenance matters were identified:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

1. Promptly undertaking measures to improve the stability of the downstream slope of the embankment.
2. These measures should commence with a study to determine the most feasible and cost-effective way to achieve the desired slope stability. The desired slope stability can be achieved by adding a stabilizing berm at the toe of the dam with a filter between the berm and the existing embankment (de Beer, 2019).

Additionally, it has been recommended by the newly appointed Dam Design Engineer or APP (Approved Professional Person), that the Fuseplug (right flank) embankment, located to the North of the concrete spillway, be remediated as well as increased in height, to improve its safety in the event of significant flood events.

This project intends to remediate the dam wall safety concerns therefore, there are no other site alternatives.

No sites or features of heritage or archaeological significance were located or documented during the physical survey. In terms of section 34 of the National Heritage Resources Act (NHRA, 25 of 1999), no significant buildings or structures were located. In terms of section 35 of the NHRA, no archaeological sites were located. In terms of section 36 of the NHRA, no graves or gravesites and burial grounds were located.

The selection of feasible footprints was premised on the principle of minimising impact on the terrestrial and aquatic biodiversity of the receiving environment by, as far as possible, placing the footprints on the least sensitive locations. These footprints include haul roads, stockpile and site establishment areas, while the principle remedial works to the dam wall itself, have no footprints alternatives.

Material requirements for the dam wall repairs will be sourced from commercial sources as well as existing stockpiles which originated from the construction of the SAPPI Macrodump, so no on-site quarries will be used for material sourcing.

- Methodology

The site selection is constrained by the location of the existing dam wall, but several footprint alternatives exist, including internal haul routes and site establishment areas (including laydown and temporary stockpile areas). As far as practicable, these footprints have been overlaid on top of current and/or previously disturbed and degraded areas, as the entire project area falls within Critical Biodiversity Areas (CBAs, partly “Irreplaceable” and partly “Optimal” (topsoil & general fill stockpiles)) according to the Mpumalanga Biodiversity Sector Plan (MBSP, Lotter *et al*, 2014). Furthermore, a Terrestrial & Aquatic (including Riparian delineation) Ecology Assessment was undertaken to assess and augment the high-level spatial information and ensure optimal placement of footprints.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Criteria used to investigate and assess alternatives

Certain site-level criteria were assessed to help ensure appropriateness of site & footprint selection presented in the table 10 below. The table shows that the project area is within several sensitive areas.

Table 10: Sensitivity indicators used to assess suitability of site selection.

Watercourse	Protected area 5 km buffer	Provincial Terrestrial CBA (MBCP)	Provincial Aquatic CBA (MBCP)	Provincial Terrestrial CBA (MBSP 2013)	Provincial Aquatic CBA (MBSP 2013)	National Vegetation Type	National List of Threatened Ecosystems
Yes	Yes	MBCP: "Highly Significant"	Irreplaceable	1. CBA Irreplaceable 2. ESA Protected Area buffer 3. CBA Optimal	1. CBA: Rivers 2. ESA: Important subcatchments	Legogote Sour Bushveld	Vulnerable

Finer scale criteria from the MBSP were used that classifies terrestrial and aquatic areas into several sensitivity classes. The sensitivity classes identify not only which Listed Activities will be triggered according to the EIA Regulations (2014) as amended, but also the desired management of those areas to help ensure the biodiversity targets for the province are achieved. The category and associated management criteria, as well as endeavouring to keep footprints outside of the DWS "Regulated Area", formed the criteria governing footprint location (Table 11). Due to the importance of the Regulated Area for both biodiversity and water resource management, this remained an important component of footprint location (Figure 1).

Table 11. Sensitivity category with definition and desired management objectives.

Map Category	Definition	Desired management objectives
Protected Areas	Areas that are proclaimed as protected areas under national or provincial legislation, including gazetted Protected Environments.	Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.
Critical Biodiversity	Areas that are required to meet biodiversity targets, for species, ecosystems or ecological processes.	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Areas (CBAs)		
Ecological Support Areas (ESAs)	Areas that are not essential from meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services.	Maintain in a functional, near-natural state, but some habitat loss is acceptable. A greater range of land-uses over wider areas is appropriate, subject to an authorisation process that ensures the underlying biodiversity objectives are not compromised.
Other Natural Areas (ONAs)	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.	An overall management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. These areas offer the greatest flexibility in terms of management objectives and permissible land-uses, but some authorisation may still be required for high-impact land-uses.
Heavily or Moderately Modified Areas	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructural functions, even if they are never prioritised for conservation action.	Such areas offer the most flexibility regarding potential land-uses, but these should be managed in a biodiversity-sensitive manner, aiming to maximise ecological functionality and authorisation is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilised and restored where possible, especially for soil carbon and water-related functionality.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

The dam wall location is fixed as an embankment impoundment and locational alternatives are not possible. The roads and site establishment areas were selected based on the lowest possible impacts as the project area falls within several biodiversity sensitive area. The narrative below provides explanation as to which road and establishment area alternatives were found to be most reasonable and feasible, which have also been assessed in the Impact Assessment section.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

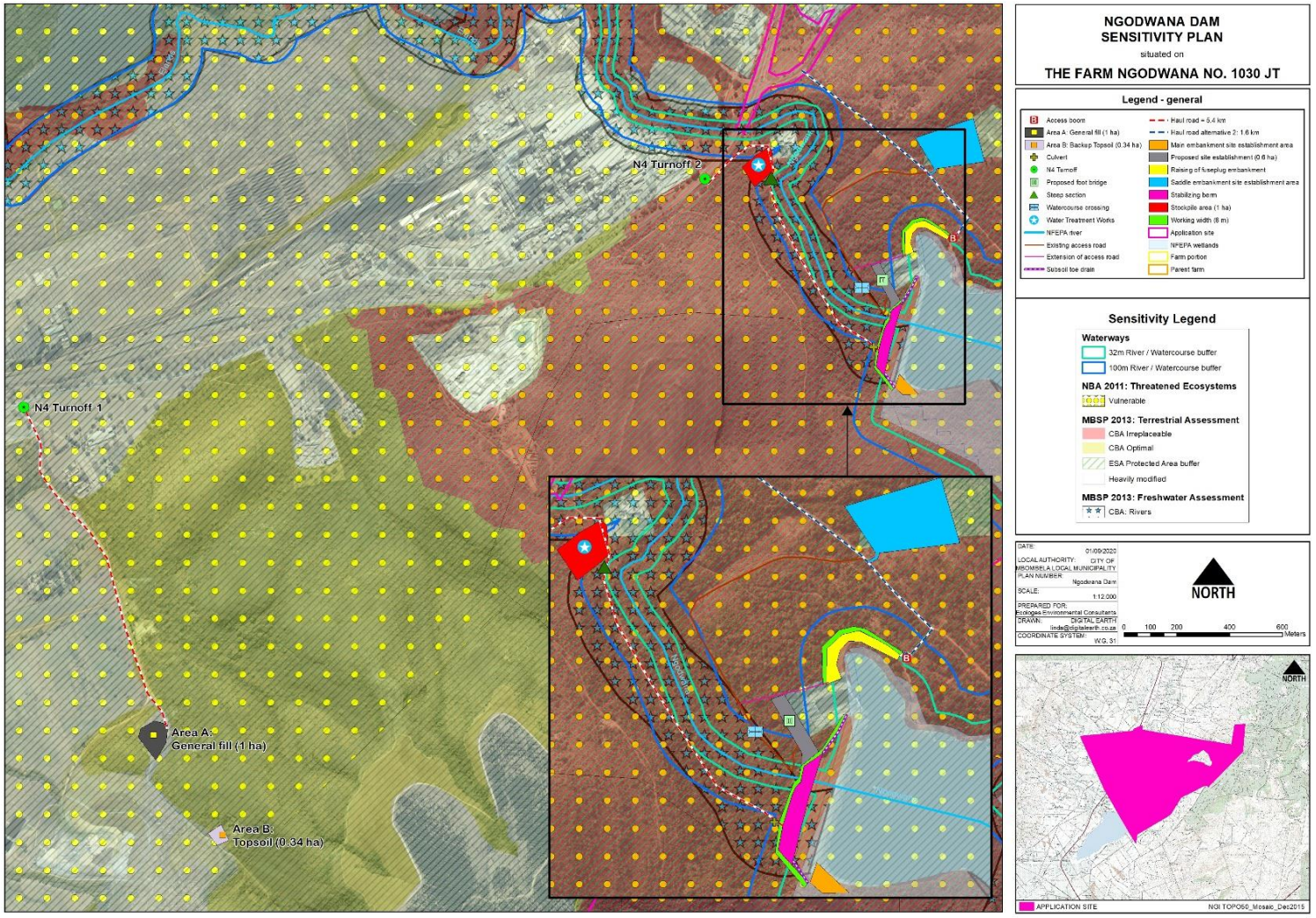


Figure 1. Location of the dam wall remedial works and associated haul routes and site establishment areas with associated sensitivity layers.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Site establishment areas (as per Figure 3)

1. **Establishment Area Alternative 1**: Proposed site establishment area (located beneath the spillway, straddling both sides of the Ngodwana River and connected by a footbridge). This area is heavily infested with alien invasive vegetation, as well as limited indigenous vegetation. This site establishment area will require clearance of the alien invasive vegetation as well as limited clearance of indigenous vegetation, with larger indigenous trees being retained as far as possible. This must be done in a way to conserve the area and to serve as an eco-recreation area after construction, which includes the pedestrian footbridge which will link the establishment area both sides of the Ngodwana River. Table 12 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 12: Impact Assessment table for proposed Establishment Area 1 footprint for which sensitive receptors show the highest risk as the footprint occurs within a Critical Biodiversity Area with associated impacts to flora and fauna due to indigenous vegetation clearance.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
ESTABLISHMENT AREA ALTERNATIVE 1 (Proposed)	Topography	Local	Low	Short-Term	Very Low	Improbable
	Sensitive Receptors	Local	Medium	Short-Term	Low	Probable
	Human health/nuisance effects	Local	Low	Long Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	No Impact
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

2. **Establishment Area Alternative 2:** Main embankment site establishment area (located on the southern side of the dam wall). This area provides a suitable location strategically for a contractor's site office (good visibility of the works), but access to this site from beneath (Route 2) is very steep and hazardous. Existing road access to this site is impractical to use due to its condition and distance to travel. Table 13 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 13: Impact Assessment table for proposed Establishment Area 2 footprint with topography and sensitive receptors showing the highest risks due to steep slopes and working within the watercourse of a CBA.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
ESTABLISHMENT AREA ALTERNATIVE 2 (Main Embankment)	Topography	Local	High	Short-Term	Low	Improbable
	Sensitive Receptors	Local	High	Short-Term	Low	Probable
	Human health/nuisance	Local	Low	Long Term	Low	Probable

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	effects					
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

3. **Establishment Area Alternative 3**: Right flank/Saddle embankment site establishment area (located adjacent to the Ngodwana Club access road on the northern side of the project area) (Figure 2). This site establishment area is in excess of 3 hectares in extent and is located in an area inundated with alien invasive vegetation, especially Kikuyu grass (*Pennisetum clandestinum*). The all-weather Ngodwana Club access road provides for suitable haulage. One limitation of this site is the presence of an existing pipeline crossing at the entrance to the establishment areas, which will require upgrades to ensure its safety. Table 14 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 14: Impact Assessment table for proposed Establishment Area 3 footprint with all aspects computing low risk, but care is required due to its occurrence within a CBA.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
ESTABLISHMENT AREA 3 (Right Flank & Stockpile)	Topography	Local	Low	Short-Term	Very Low	Improbable
	Sensitive Receptors	Local	Low	Short-Term	Very Low	Probable
	Human health/nuisance effects	Local	Low	Short-Term	Very Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 2. Right flank (saddle embankment) site establishment area dominated by Kikuyu grass and crossed by existing water pipeline that will require protection.

4. **Establishment Area Alternative 4:** Contractor's offices. This area is located on a flat area and preparation of the site office area will require some clearing of vegetation around and under the indigenous trees in order to erect temporary structures to maintain this area in a proper manner and to facilitate overland/drainage. Table 15 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 15: Impact Assessment table for proposed Establishment Area 4 footprint with the highest risks associated with clearance of indigenous vegetation within a CBA and risk of stormwater erosion and associated siltation of the receiving watercourse.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
ESTABLISHMENT AREA 4 (Contractors Offices)	Topography	Local	Low	Short-Term	Very Low	Improbable
	Sensitive Receptors	Local	Medium	Short-Term	Low	Probable
	Human health/nuisance effects	Local	Medium	Short-Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

5. **Establishment Area Alternative 5**: Stockpile area (located adjacent to the Water Treatment Works – WTW). This area was historically disturbed but has fully recovered albeit dominated by

Kikuyu grass (*Pennisetum clandestinum*). The area is approximately 1 hectare in extent and also has existing overhead powerlines in place, which is a local distribution line belonging to SAPPI. Table 16 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 16: Impact Assessment table for proposed Establishment Area 5 footprint with the highest risk of activities within a CBA and possible damage to existing services and operation of the WTW.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
ESTABLISHMENT AREA 5 (Stockpile, WTW)	Topography	Local	Low	Short-Term	Very Low	Improbable
	Sensitive Receptors	Local	Medium	Short-Term	Low	Probable
	Human health/nuisance effects	Local	Medium	Short-Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

Haulage routes

Route 1 (includes seven sub-sections)

This route (indicated in green arrows on Figure 18) starts at the SAPPI Macrodump general fill stockpile area (Figure 3), which is an existing haul road for the haulage of waste at the dumpsite, and accesses the N4 at the weigh bridge (Section 1) (Figure 4). This road has a surfaced section of approximately 150m and a gravel section of approximately 1150m. It is generally in a good condition and is a well-maintained road which is regularly sprayed with lignosulphate for dust control purposes and will require limited upgrading to serve as a haul road. The gravel section of this road will require normal gravel road maintenance in order to achieve a level 5 serviceability with maximum roughness of 80, dustiness of less than 3 and exclusive possibility as defined in TRH 20 technical guidelines.
The required maintenance will include:

- Roadside maintenance which is mainly restricted to vegetation control;
- Drainage maintenance;
- Surface maintenance;
- Safety aspects;

It is however a fact that this section will require some rehabilitation after the haulage due to the expected deterioration of the wearing course during the haul process.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 3. SAPPI Macrodump general fill stockpile.

Figure 4. Weighbridge turnoff from the N4 toward the Macrodump general fill stockpile area.

Haul trucks will then turn right onto the N4 to be hauled Eastward along the N4 up to the Kaapsehoop intersection (Section 2). This second section of the route is the N4 section which is serviced by an at-grade intersection of a high standard which provides safe access to and from the dump site access. This 3.2km section stretches to the Kaapsehoop intersection which is also an at-grade intersection of a high standard which provides access to the Kaapsehoop section of this route. where trucks will turn right onto the Kaapsehoop road (D799), travel for ± 200m along this road (Section 3), which is also a high standard surfaced road and turn right towards the Ngodwana Dam, at an existing intersection which requires no upgrading, onto the existing Ngodwana Club (Figure 5) access which is a surfaced access road (section 4). The Club access road is surfaced and provides an all-weather access to the dam.

Sections 2 and 3 falls under the control of the National and Provincial Roads Authorities and is maintained regularly to a high standard. The horizontal and vertical alignment of the N4 allows acceptable sight distances at the proposed location of access onto the N4 (i.e. in excess of 300m). Good lighting exists along this section of road, which enhances safety during night-time hauling. Liaison with the authorities before expected peak traffic conditions occur, for instance, long weekends and the start and end of school holidays will ensure optimal and safe utilisation of these facilities. Coordinated planning and temporary suspension of haulage on these routes during these periods will provide a productive and safe environment for all road users.

Section 4 will in all probability suffer some damage during the haul operations. Although no as-built information is available, this road was never designed for heavy construction traffic and as such the following damage can be expected: -

- Damage to surfacing where turning movement onto and off this section occurs;
- Development of potholes due to the structural design of the road, aged condition of the existing surfacing and the effect of surface water during the haul process.

It is proposed that maintenance be done on this section of road during the construction period by repairing defects in order to maintain trafficability and then to reassess the condition after the dam rehabilitation is completed. Final repairs can then be affected and re-surfacing of the road can be done to reinstate it to its former condition.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 5. Surfaced access road approaching the Ngodwana Club entrance.

A material stockpile area located approximately 600m along this road is the destination of this material (saddle embankment site establishment area) (Figure 6). Trucks returning from the stockpile area, will use the club access road and turn left onto Kaapsehoop road (D799), left at the Kaapsehoop N4 intersection and left again at the Macrodump access, at the weighbridge intersection (Route 1, Road 1 indicated in red on Figure 18).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 6. Saddle embankment site establishment area.

Material from this stockpile will be hauled to the point of placement on the North flank (fuseplug embankment) accessed from the Ngodwana Club road onto a newly created gravel access road (section 5) which is to be constructed North-East of the Club entrance (road indicated in black on Figure 18), as haul trucks will be too large to fit underneath the current access gate structure (Figures 5, 7, 8 & 9). This section 5 will be a temporary 3.9m wide access to the right flank of the construction area, with passing bays and a turnaround area. This section will require a new geometric design, structural design, and drainage design with alignment through indigenous vegetation and away from the section of steel pipeline which is located above ground in this area. Once alignment and clearing and grubbing of vegetation and topsoil have been completed, this section will require drainage features like mitre banks and possibly a pipe culvert. Subgrade preparation will include ripping and re-compaction within these alignment parameters. A gravel wearing course of 150mm thickness, which meets the requirements of TRH 20, will be imported from a suitable source and placed on top of the subgrade to abovementioned width and processed to the required geometric standards before being compacted to the density required to provide adequate bearing capacity for the anticipated traffic. It is recommended that the same material from the dumpsite stockpile be blended with ash plant material to be used as wearing course material.

The boiler ash emanating from the SAPPI Ngodwana Mill has been excluded as a waste in terms of Regulations 5 and 6 of the Waste Exclusion Regulations, 2018 published in Government Notice No. 715 in Government Gazette 41777 of 18 July 2018; when used for road construction material, brick making, block making, cement production, soil amelioration and land capping. This exclusion was confirmed by the Department on 28/01/2020 with notification reference: EDMS190424.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Table 17 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 17: Impact Assessment table for proposed Haul Route 1, Section 5 with the highest risks associated with steeper slopes, stormwater drainage and risk of associated erosion and impacts on fauna & flora within a CBA as well as the financial implications to the road surface upgrades.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
Haulage Route 1- SECTION 5 (New access to Right Flank) & Route 2 - SECTION 4 (Main Embankment)	Topography	Local	Medium	Short-Term	Low	Probable
	Sensitive Receptors	Local	Medium	Medium Term	Medium	Probable
	Human health/nuisance effects	Local	Low	Long Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Medium Term	Low	Improbable

Figure 7. Current access road to the Ngodwana Club, for which an alternative road to the right will be required to allow for large haulage.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 8. Current access gate to the right flank of the Ngodwana Club entrance.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 9. Current access gate to the right flank of the Ngodwana Club entrance leading onto the fuseplug embankment.

Opposite the saddle embankment site establishment area, an existing road (section 6) provides an access route to the contractors site office *en route* to the watercourse crossing below the concrete spillway (road indicated in yellow on Figure 18). This route crosses the river pipeline at an existing structure which may require a safety upgrade. This existing access route, will also serve as a haul road for the ± 7,500m³ material from the Macrodump general fill stockpiles required for the main section of the embankment, as well as the ± 10,200m³ material required for the upgrading of haul roads.
Table 18 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 18: Impact Assessment table for proposed Haul Route 1, Section 6 with the highest risks associated with upgrades required to the road in close proximity to a watercourse with vegetation

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

clearance within a CBA, as well as the financial expense associated with the necessary upgrades to the road.

Footprint	Aspect	Extent	Magnitude	Duration	Significance	Probability of impacts
Haulage Route 1- SECTION 6 (East-Fishing Club)	Topography	Local	Low	Short-Term	Very Low	Improbable
	Sensitive Receptors	Local	Medium	Medium Term	Medium	Probable
	Human health/nuisance effects	Local	Medium	Short-Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

This section will require upgrades in terms of a widened pipe crossing as well as minor fills around these areas. Some blading of this 3.9m wide route with subgrade preparation along the existing alignment with a new 150mm thick gravel wearing course will be adequate to create an all-weather route for vehicles to reach the parking areas, offices and other temporary facilities required by the contractor and to link up with Route 2, Section 4 (Figures 10 & 11).

A link from this road to the northern spillway retaining wall will be required to clear the trees whose roots are affecting the stability of this retaining wall (section 7). This access will require bush clearing, a 3.9m wide route with subgrade preparation along the new alignment.

Table 19 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 19: Impact Assessment table for proposed Haul Route 1, Section 7 with the highest risks associated with the extension of an existing road linking to the spillway on a steep slope with associated erosion risks within a CBA, as well as the financial expense associated with the necessary upgrades to the road.

Haulage Route 1 - SECTION 7 (New Spillway Access)	Topography	Local	Low	Short-Term	Very Low	Probable
	Sensitive Receptors	Local	Medium	Medium Term	Medium	Probable
	Human health/nuisance effects	Local	Medium	Short-Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 10. Proposed location for Contractor's Site Offices.

Figure 11. Terrain over which the link road will be constructed to northern side of the spillway.

Route 2 (includes four sub-sections)

The material for the rock toe berm (± 22,500m³) will be hauled from commercial sources situated at Alkmaar or Karino via the N4 in tipper trucks (normal road haulers) (Section 1). These trucks will pass through the Kaapsehoop intersection and turn left opposite the existing light vehicle turn-off to SAPPI's administration area, on an existing gravel road (Section 2) (Figure 12). This road provides access to SAPPI's Water Treatment Works (WTW) (Figure 13). The access from the N4 to this section will require some upgrading to ensure capacity for queuing of vehicles turning East onto the N4.

Access from the N4 requires upgrading of this access from the N4. A proper designed access which meets the requirements of SANRAL as roads authority and TRAC as its concessionaire will be required here. Such access will have to meet the following standards: -

- A T-type junction with maximum of 30° deflection and N4 through alignment;
- Surfaced 7m wide roadway 100m long for queuing and paint markings with kerbing to guide vehicles and a 1.8m gravel shoulder;
- Stop control at point of entrance at 6.25m from N4 edge of road;
- A line of sight from 5m back from the edge of the N4 of at least 300m in both directions;
- A right turn radius of at least 15m;
- Lane width of at least 6.5m at bell mouth;
- Kerb radii of 15m;
- Tapers of 60m to a full lane width of 3.7m wide;
- Drainage by culverts of N4 side drains.

Figure 12. Access point off the N4 opposite SAPPI's administration turnoff.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

This section up to the Water Treatment Works stockpile area will require re-alignment of horizontal and vertical geometry to meet the abovementioned standards. Clearing and grubbing of this re-aligned section will be required with drainage features such as like side drains and stormwater crossings. The sub-grade preparation of the re-aligned roadway will require ripping and re-compaction. A gravel wearing course of 3.9m width, with gravel shoulders will be constructed with imported gravel material.

Figure 13. Gravel access road leading to SAPPI's Water Treatment Works (WTW).

Material will be stockpiled at a temporary stockpile area opposite the WTW (Figure 14).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 14. Temporary stockpile area opposite the Water Treatment Works (WTW).

Trucks returning will turn right at the gravel access onto the N4, drive through the Kaapsehoop intersection and leave towards Nelspruit.

An alternative to this return route, is the upgrading of a historic stream crossing (Figure 15) which will allow trucks to cross the Ngodwana River and access the N4 by way of Route 1 and Road D799 (Kaapsehoop) and back to Nelspruit on the N4.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 15. Stream crossing that will link road sections both sides of the Ngodwana River.

Material will be hauled from the WTW stockpile area to the rock toe berm on the main section of the dam on an existing route (Section 3). It runs along the SAPPI bulk water supply line to the West of the Ngodwana River to the embankment of the central section (road indicated in green on Figure 18). This existing section is very narrow with poor horizontal and vertical alignment. It will require some adjustment in this regard and passing bays will have to be established along the route to facilitate passing of construction traffic and to protect the pipeline from construction traffic.

The existing route from the Water Treatment Works (Figure 16) has a limited geometrical alignment which falls outside the safety and geometrical design standards required for a haul road. Although it is not economical to construct deep cuts, high fills or large horizontal curves and obstructions such as the water pipeline and its protection as well as the streambeds are limiting factors it is still recommended that, where possible, 7m wide sections be contemplated for passing purposes and 3.9m wide sections elsewhere. Spacing will be determined by sight distance. It is proposed that a 30km/h geometric design standard be followed and that the construction vehicles expected on this route determine the horizontal alignment minimum standards. In this regard a 25m curve in the roadway should be achieved with 15m as the absolute minimum for low-bed equipment delivery. On the vertical alignment the crest and sag k-values 2 and 5 respectively should be maintained.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Protection of services such as the pipeline will be facilitated with extended culverts at pipeline crossings, berms, barriers and bollards. Drainage will consist of extended culverts and concrete causeways with roadway crossfall as well as mitre banks and berms. Sub-soil drainage may be required on wet sections. This section will require cut to fill operations, rockfill in some areas, sub-grade preparation of re-aligned sections. Imported gravel material of 150mm thickness will be processed into a wearing course along the route. Dump truck manoeuvring areas will be accommodated in the bypass areas.

Figure 16. Existing gravel access road running from the WTW along the raw water pipeline to the main dam embankment.

Table 20 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 20: Impact Assessment table for proposed Haul Route 2, Section 2 & 3 with the highest risks associated with the upgrades to the road in close proximity to a watercourse, including the potential upgrade of an existing seepage area crossing, within a CBA, as well as the financial expense associated with the necessary upgrades to the road.

Haulage Route 2-SECTION 2&3 (West-WTW)	Topography	Local	Low	Short-Term	Very Low	Improbable
	Sensitive Receptors	Local	Medium	Medium Term	Medium	Probable
	Human health/nuisance	Local	Low	Short-Term	Very Low	Probable

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	effects					
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Short-Term	Very Low	Improbable

A new route (road indicated in blue on Figure 18) up the embankment up to the point of placement of the rock toe berm on the main section of the dam will be required due to material delivery requirements and restricted space between the toe and the bulk water pipeline (Section 4). This section will require a 3.9m wide section with a completely new alignment in order to reach the points of placement of the material along the rock toe berm. Restricted space at the bottom of this structure between the pipeline and the toe limits the space available to less than 2m, which is not wide enough for trucks to pass. The final level of material placement is also much higher up the embankment and a new road is required to this point. This new haul road is indicated in blue as Route 2, Section 4 on the layout on Figure 18. It follows the route up the groin of the dam and turns onto the embankment at the existing berm, runs along this berm line along the face of the embankment and then drops down to the plant and equipment laydown area. This route will cross the pipeline at the newly constructed culvert before running uphill to the groin area. Fills will be used to create this route. Once past the equipment laydown area this road will cross the Ngodwana river below the spillway area at a stream crossing before linking with Route 1, Section 6.

A foot bridge below the spillway will link the site office area with the contractor's laydown area (Figure 17).

Figure 17. Location of footbridge over the Ngodwana River beneath the spillway, which will create pedestrian access to both sides of the dam wall.

Table 21 indicates the extent of the potential pre-mitigation risks to this footprint, which is dealt with in greater detail in the Impact Assessment section with mitigations provided.

Table 21: Impact Assessment table for proposed Haul Route 2, Section 4 with the highest risks associated with the upgrades to the road, including the installation of a low-water crossing of the spillway channel with associated risk to water quality, riparian vegetation and soil erosion, within a CBA, as well as the financial expense associated with the necessary upgrades to the road.

Haulage Route 2- SECTION 4 New River Bridge Route	Topography	Local	Low	Short-Term	Very Low	Probable
	Sensitive Receptors	Local	High	Medium Term	Medium	Probable
	Human health/nuisance effects	Local	Low	Long Term	Low	Probable
	Existing Infrastructure	Local	Low	Short-Term	Very Low	Improbable
	Land Use Compatibility	Local	Low	Medium Term	Low	Improbable

From the haul route description for both routes, sections of the N4 are to be used as haul routes. A traffic assessment was done for the affected sections of the N4 and was discussed in a separate report to investigate the traffic conditions of this facility. The N4 falls under the jurisdiction of SANRAL as roads authority and TRAC, the concessionaire operating this route as a toll road concession.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

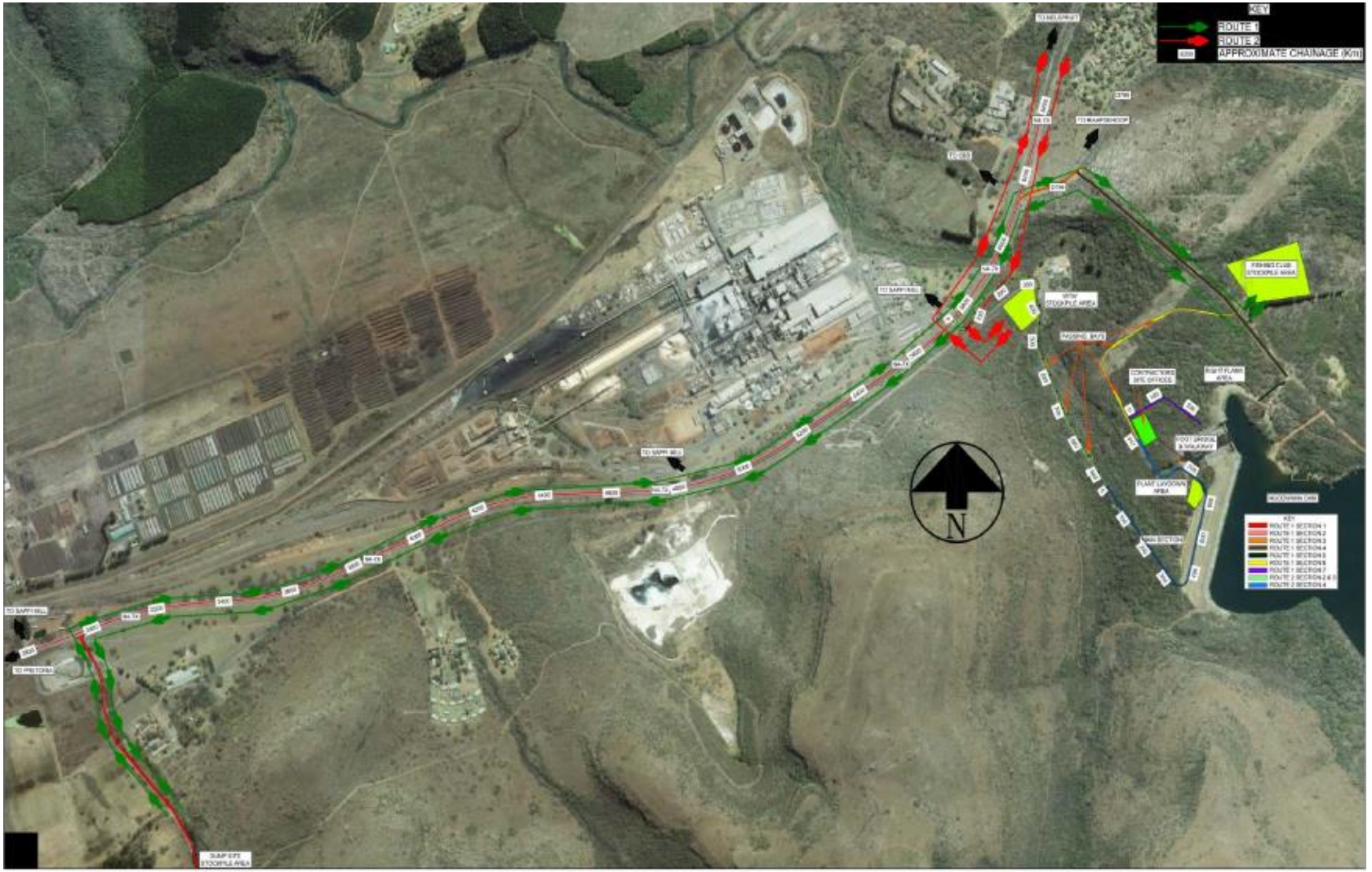


Figure 18. Proposed haul routes alternatives.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Type No. 2: Type of Activity

- Purpose and Requirements

Previous 5-yearly compulsory dam safety inspections and reports were undertaken during 1987 June, 1993 August, 1998 July, 2003 August, 2009 August as well the latest 7-yearly compulsory report compiled in 2016. Additionally, annual interim dam safety inspections are undertaken with the latest safety report compiled in 2019. All these dam safety reports assessed various parameters of the dam and identified requisite maintenance interventions required to ensure the ongoing integrity and safety of the dam. The following key recommendations were made in the 2019 report:

1. Promptly undertaking measures to improve the stability of the downstream slope of the embankment.
2. These measures should commence with a study to determine the most feasible and cost-effective way to achieve the desired slope stability. The desired slope stability can be achieved by adding a stabilizing berm at the toe of the dam with a filter between the berm and the existing embankment. The study would be required to procure materials and size the berm.
3. With regards to other dam safety issues, it should be mentioned that the Owner generally maintains Ngodwana Dam in a good condition. The responsible person, Mr Carel van der Merwe, diligently kept records and ensured the proper maintenance of the dam.
4. Ongoing monitoring and maintenance activities should be continued, namely:

i. monthly reading of the water table in the standpipe piezometers;
ii. weekly gauging of seepage flow through V notches;
iii. annual monitoring of dam wall deflections through precision survey of deflection beacons;
iv. the embankment material leakage as well as the water seepage through the construction joints of the outlet conduit should be carefully monitored;
v. termite nests seems to have been effectively poisoned but they should be regularly monitored for any further activity;
vi. the Warning & Evacuation Plan should contain all the necessary warning and evacuation procedures as well as updated contact numbers of all affected people and organisations. The Plan is to be kept in an accessible location, which should be known to all key safety operational staff at SAPPI;
vii. the SAPPI safety operational staff should, at least once per year, check whether they are able to contact all relevant affected individuals in a timely manner to take appropriate action in the event of a "dam break flood" event; and
viii. the early warning and evacuation plan should be maintained and practised, in the event that a dam failure risk is detected or experienced.

- Methodology

The type & nature of remedial activities have been informed by the Dam Safety Inspection and Reports, which has in turn informed remedial design interventions. The technical alternatives considered are dealt with in the next Alternatives section.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Criteria used to investigate and assess alternatives

The only Alternatives considered as those proposed by the Design Engineer to ensure the ongoing safety of the dam.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

Outcomes of the dam safety inspections has identified several key safety risks, which are summarised as being:

(i) the precarious stability of the downstream slope of the embankment, as demonstrated by the slope stability analysis conducted as part of the 2018 dam safety report;

(ii) further impairment of the downstream slope stability, caused by a rising downstream phreatic surface;

(iii) sliding failure through the foundations on the left bank. Of particular concern in this regard, was the development of a "wet spot" on the embankment, near the downstream toe of the embankment, on the left flank and the generally poor foundation conditions at the left flank foundation interface, as well as the recent significant measured movements of the embankment at the left bank interface;

(iv) the potential for uncontrolled piping (through either the dam wall or foundations), caused or initiated by the combined effect of the sloping, un-zoned filter, high phreatic surface, erodible material in the downstream embankment and unsatisfactory foundation conditions on the left bank foundation contact;

(v) leaching of embankment material into the outlet conduit, possibly caused by movement of the conduit that lead to tearing of water stops at construction joints;

(vi) undercutting and / or lifting of the reinforced concrete slabs forming the spillway return channel bottom, caused by water ingress through failed joint sealers; and

(vii) loss of life caused by dam break flood and inadequate advanced warning and poorly executed evacuation plan and procedures. During 1987 a dam break flood analysis was undertaken by the firm Stewart, Sviridov & Oliver that indicated a dam break flood peak of 11,000 cubic meters per second, which would, although much dissipated, travel well past Nelspruit. The dam break flood analysis showed that, in the event of a dam break failure of Ngodwana Dam, the following damage is likely to be caused:

1. Washing away of a section of the N4 highway to Nelspruit,
2. Washing away of a large portion of the Ngodwana Paper Mill, and
3. Inundation of the Mataffin village on the banks of the Crocodile River.

In summary, no other alternatives other than those proposed by the Dam Engineer are considered feasible.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Type No. 3: Design and Layout

- Purpose and Requirements

Various remedial designs have been considered by the Dam Engineer to address the concerns raised in the dam safety reports.

- Methodology

Dam Preliminary Remedial Designs inputs.

- Criteria used to investigate and assess alternatives

1. Improving the stability of the downstream slope of the main embankment

The alternatives considered for stabilizing the 41 m high embankment downstream slope are discussed below with the preferred option discussed last.

a) Mechanical stabilised earthfill (MSE) or rockfill

A typical MSE embankment is shown in Figure 19 below. In this case the design was used for embankment protection during construction. It could have precast concrete facing panels (refer to Figure 21) or rock mattresses. This design will require excavating into the existing embankment to install soil reinforcement. As the existing slope stability was already found precarious, the associated risk is not considered acceptable. The solution is also considered more expensive and not considered aesthetically pleasing.

Figure 19. Reinforced rockfill used at Impofu Dam.

b) Soil improvement

Soil improvement of the existing downstream embankment fill will also require excavating into the embankment fill and mixing a product like lime into the fill to improve the soil properties. The same risk as option a) exists.

c) Reinforced concrete or gabion retaining wall

Such retaining wall will be required at the existing outlet conduit where there is no space for a berm. It has the disadvantage that it does not blend in aesthetically with the rest of the embankment downstream face and will be more expensive. Gabion retaining walls (refer to Figure 20 below) also require maintenance and are prone to vandalism.

Figure 20: Gabion retaining wall.

d) Earthfill/rockfill berm

A combination of an earthfill/rockfill berm is preferred as it will be the most economical and can be rehabilitated to perfectly aesthetically blend into the existing downstream face. It is robust and will require little maintenance. The crest of the berm will provide an 8 m wide access road between the abutments of the embankment.

2. Raising of the right flank embankment

The alternatives considered for raising the 222 m long embankment are discussed below with the preferred option discussed last.

a) Mechanical stabilised earthfill

Mechanical stabilised earthfill (MSE) was used successfully for many dam raisings, including Rietvlei Dam in South Africa (refer to Figure 21 below). In the case of the Ngodwana Dam right flank embankment it will be more expensive and is not preferred due to safety considerations in the fishing club environment with its vertical slopes and due to aesthetical impacts.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Figure 21: MSE raising of Rietvlei Dam.

b) Rockfill

A rockfill raising of the right flank embankment will allow steeper slopes, but is more difficult to rehabilitate and vegetate on the new downstream face. Rockfill is not available from the SAPPI stockpiles and will have to be imported from commercial sources which will be expensive.

c) Earthfill

An earthfill raising will match the existing material in the embankment. Such material is available from the SAPPI stockpile and the solution is therefore considered to be the most economical option. The earthfill slopes can also be easily topsoiled and vegetated to blend in with the existing environment.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

The combination earthfill and rockfill will meet the dual technical and environmental requirements, by providing the necessary structural integrity as well as providing a natural finish on the embankments that will support a vegetative cover and provide the most natural aesthetics.

Alternative Type No. 4: Technology

- Purpose and Requirements

The technological alternatives have been included in the design section above. As this dam wall is an existing structure that is undergoing remediation, limited technological alternatives exist. However, several mechanisms are already installed to be able to monitor the dam and its stability which would require ongoing maintenance and possible replacement in years to come should better alternatives become available:

- Methodology

Dam safety reports.

- Criteria used to investigate and assess alternatives

Review of dam Safety annual and 7-yearly reports.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

Most dam safety monitoring instrumentation and observations are geared at detecting any possible problems associated with the performance of filters and drains and with slope stability. Ngodwana Dam is fitted with V-notch gauges for monitoring seepage and with standpipe and pneumatic piezometers for monitoring the phreatic surface and pore pressures in the embankment. Ngodwana Dam is fitted with settlement beacons on the crest of the wall as well as at some strategic locations on the downstream face of the embankment, with which to monitor movements of the dam wall, i.e. slope stability. The continued operation and maintenance of the above-mentioned instrumentation and monitoring will allow for safe operation of the dam.

Alternative Type No. 5: Operational Aspects

- Purpose and Requirements

Effective operational management of the Ngodwana Dam is critical for dam safety requirements, which in the case of a dam wall breach would have disastrous impacts on the downstream receiving environment as well as the livelihoods of people living and working, not the least of which is the SAPPI Mill. A dam break flood analysis showed that, in the event of a dam break failure of Ngodwana Dam, the following damage is likely to be caused:

- Washing away of a section of the N4 highway to Nelspruit
- Washing away of a large portion of the Ngodwana Paper Mill
- Inundation of the Mataffin village on the banks of the Crocodile River

- Methodology

Reviewing Dam Safety Reports.

- Criteria used to investigate and assess alternatives

Requirements for safe dam operations elucidated in the dam safety report.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

The Ngodwana Dam is well currently maintained and operated as demonstrated by the following measures (de Beer, 2019):

- The owner, SAPPI, has always assigned a dedicated “responsible person” to look after the dam.
- The Owner sets aside a budget to operate and maintain the dam in good order.
- The Owner maintains in good order all relevant documentation with respect to the dam, including emergency procedures and contact details.
- The Owner implements an annual inspection by the APP.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- All settlement survey beacons and stand-pipe piezometers are surveyed by professionals on an annual basis.
- All seepage is measured through V-notches on a weekly basis by the Owner's personnel.
- Downstream control valves are operated daily and other valves tested at least quarterly.
- A lubrication and stroking maintenance schedule is in place for the valves.
- All trees and shrubs within 5 meters of the toe of the dam wall are removed. Grass on the downstream embankment is regularly mown.
- Any damage to the spillway joint sealants are promptly repaired.
- Rust-proofing paint is regularly applied to the mechanical installations.

No additional dam operational alternatives have been deemed necessary and the receiving environment is stable, with the exception of high levels of alien invasive vegetation growing beneath the dam wall, which needs to be controlled by means of a adequately resourced control strategy.

Alternative No. 6: Demand

- Purpose and Requirements

The maximum water demand to be met for the paper mill, is 40 000 cubic meters per day which is derived from the Ngodwana Dam which acts an impoundment to the Ngodwana River. The current Water Use License permits 36 000 cubic meters per day which is augmented by additional water from the Sappi Ngodwana Transfer Water Use Licence, with an allocation in excess of 45 000 cubic meters per day. The Ngodwana River was chosen in preference to the Elands River, as it provides high quality water with a TDS of only 40 mg/l – which a very desirable factor in papermaking. However, with very infrequent occurrence, water is pumped from the Elands River (on portion 10 of Farm Groot Geluk 477 JT and remaining extent of farm Roodewal 470 JT) to augment storage volumes in the Ngodwana Dam. The volume of water that is permitted to be pumped is limited especially during low river flow periods, and the abstraction from the Elands may not exceed 2 litres per second at the Lindennau weir (X2H015).

- Methodology

Water Use authorisation documents provided by SAPPI.

- Criteria used to investigate and assess alternatives

The conditions and stipulations of the SAPPI Water Use License (File Number: 16/2/7/X205/B7, Licence No. 24001465), Elands River abstraction permit (Reference: B191/2/2220/11) and Sappi Ngodwana Transfer Water Use Licence (Water Use License No. 05/X21/A/4424).

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

One of the original intentions of construction of the Ngodwana Dam was to improve water quantity assurance, but also ensure an improved water quality essential for paper processing, for which the Water Treatment Works has been calibrated. So, while the Elands River provides very occasional

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

supplementary water to the dam, it poses challenges to the WTW as the water quality from the Elands River does not match that of the Ngodwana River. Hence, the current principle supply of water from the Ngodwana River remains the preferred operational alternative, which further supports the need to upgrade and remediate the dam wall to ensure the ongoing safety and long-term integrity of this facility.

Alternative No. 7: Input

- Purpose and Requirements

The principle raw material inputs required for the project relate to both the required upgrades to the identified haul roads as well as fill material for the dam wall remediation; including general and rock fill material for the toe of the main embankment and general fill for the raising of the fuseplug embankment. Figure 22 below gives a basic overview of the various areas requiring interventions on the dam wall.

Figure22. Areas of concern on the Ngodwana Dam wall, for which remedial work will be required.

- Methodology

Preliminary assessment of haul roads for SAPPI, Ngodwana dam rehabilitation project 20828, August 2020 compiled by DMV Incorporated and Review of dam safety risk and proposed remedial work associated with category 3 Ngodwana dam, Mbombela compiled by DJ Hagen & Associates dated 3 December 2019.

- Criteria used to investigate and assess alternatives

Review of technical requirements in DMV & DJ Hagen technical reports.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

The proposed rehabilitation process will require approximately 41,000m³ of material, excluding the upgrading of haul roads. It will be upgraded with a raised right flank to the North of the dam spillway and a rock toe berm on the main section South of the spillway, which includes the left flank of the dam. Several alternatives exist for the quantities of each type of material required, which will vary based on the findings and recommendations emanating from geotechnical investigations as well as cost considerations.

Alternative 1:

- 30,000m³ of material for the rock toe berm on the main embankment will be sourced commercially from suppliers in the Nelspruit area that can meet the specification.
- 11,000m³ of material for the right flank area where the embankment will be raised with material from the SAPPI Macrodump stockpiles.

Alternative 2:

- The material for the haul road upgrading and right flank (± 29,000m³) will be hauled from the general fill stockpiles at the SAPPI Macrodump area, and
- The rock toe material (22,500m³) will come from commercial sources in the Nelspruit area. The balance of material (7,500m³) for this section will also come from SAPPI Macrodump stockpiles. Figure 23 below indicates the footprint of the rock toe fill to the main embankment.

Figure 23. Ngodwana Dam wall with red area indicating the extent of the fill required on the main embankment to provide the necessary slope stability.

-Alternative No. 9: Scheduling and Timing

- Purpose and Requirements

The total construction period is expected to be eight (8) months, with four to six months required for the dam wall construction process and at least two months required for the requisite upgrading of the haul

roads. Preceding the construction activities, both the environmental and water use authorisations need to be approved.

- Methodology

Review of authorisation programme and estimated construction duration.

- Criteria used to investigate and assess alternatives

Ecoleges Authorisation programme informed by timeframes set in the EIA Regulations (2014) and general authorisation timeframes for section 21(a) water uses in GN 538 of 2016.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

Table 22 below captures the key deliverables in the environmental authorisation process, which includes time provision for the general authorisation registration process. The authorisation programme includes an extension of time approved by the Competent Authority in terms of Regulation 19(1)(b) of the EIA Regulations (2014), as amended. The dam wall construction will be largely constrained to the dry winter months, while the road upgrades will need to precede the dam wall construction phase and will take place during the rainy season. Construction is expected to commence in 2022.

Table 22. Key deliverables and associated timeframes in the environmental authorisation process.

No.	Phase	Revised/actual dates		Responsibility
		Start date	End date	
1	Project Inception and signing of contract:			JB
2	Pre-application consultation with CA			JB
3	Compile PPP documentation			HM, PR, JB
4	Distribute BID, Notification Letter, Advert & Site Notices			JB, HM, PR
5	Registration of I&APs (minimum of 30-days to register)			HM
6	Specialist ToR and quotes	19-May-20	19-May-20	JB
7	Specialist appointments			JB
8	Specialist studies	20-Jun-20	03-Oct-20	Specialists
9	Review of Specialist Studies	04-Oct-20	14-Oct-20	JB, PR, HM
10	Preparation of Draft Basic Assessment Report (DBAR) & EMPr	02-May-20	28-Oct-20	HM (DBAR & N&D), PR (IA & EMPr), JB (Alternatives)
11	Print Draft BAR	29-Oct-20	01-Nov-20	HM
12	Preparation of application	02-May-20	31-Jul-20	HM, PR, JB
13	Submit application for signature	02-Aug-20	09-Aug-20	PR

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

14	Submit application for EA	20-Aug-20	20-Aug-20	PR
15	Acknowledge receipt of application by DEA (within 10 days)	21-Aug-20	30-Aug-20	MDARDLEA
16	Submit DBAR to CA (Hard Copy) (30-days PPP)	02-Nov-20	02-Dec-20	HM & MDARDLEA
17	Distribute DBAR to I&APs (30-days PPP)	02-Nov-20	02-Dec-20	HM
18	Public Meeting	16-Nov-20	16-Nov-20	HM, PR, JB
19	Include comments from CA and I&APs into Final BAR	03-Dec-20	07-Dec-20	HM, PR, JB
20	Printing Final BAR	08-Dec-20	10-Dec-20	HM, PR, JB
21	Submission of FBAR to DEA (Hard copy) - within 90 days of **receipt** of application, including 30-days PPP	11-Dec-20	11-Dec-20	PR
22	Distribute FBAR to I&APs	30-Jan-21	11-Dec-20	HM
23	Acknowledgement of receipt of FBAR by DEA (within 10 days)	12-Dec-20	06-Jan-21	MDARDLEA
24	DEA decide to grant / refuse EA (within 107 days of receipt of FBAR)	12-Dec-20	26-Apr-21	MDARDLEA
25	DEA notify applicant of EA (within 5 days)	27-Apr-21	03-May-21	MDARDLEA
26	Notify I&APs of the decision (within 14 days)	27-Apr-21	11-May-21	HM
27	"Cool down" period & project handover	27-Apr-21	17-May-21	SAPPI

-Alternative No. 10: Scale and Magnitude

- Purpose and Requirements

Scale and magnitude have already been largely discussed in the Scheduling and Timing section. However, dependent on the availability of Capex, the upgrades may be undertaken in a phased approach.

- Methodology

Discussions with SAPPI & Design Engineer.

- Criteria used to investigate and assess alternatives

Outcomes of virtual meeting discussions with relevant parties.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

The original cost estimate for the dam remedial works was in the region of R20m. However, following the Traffic Impact Study, and the assessed upgrade requirements to the haul roads to be able to sustain heavy loads during the construction phase, the budget has increased significantly, with the road budget alone exceeding R13m.

A detailed cost estimate was prepared for the various roads sections and this estimate is summarised in Table 23 below.

Table 23: Cost estimate for the various road sections.

Route	Cost (ZAR)
Route 1 Section 1	153,986.86
Route 1 Section 4	466,619.38
Route 1 Section 5	305,629.34
Route 1 Section 6	1,473,962.44
Route 1 Section 7	401,144.10
Footbridge	689,865.00
Route 2 Section 2	2,235,078.82
Route 2 Section 3	2,183,983.24
Route 2 Section 4	5,115,158.14
Stockpile & Laydown Areas	565,123.61
Sub Total	**13,590,550.92**
Vat (15%)	2,038,582.24
TOTAL	**15,629,133.56**

This cost estimate is based on cost of construction of similar activities and may vary due to escalation and detail design requirements. This estimate includes preliminary and general costs as well as professional fees and disbursements.

The final selection of haul route options and associated upgrade requirements will have an influence on the total project capex requirements, which in turn will determine if all remedial works are undertaken concurrently, or in a phased approach over several years, with the highest priority items being addressed first.

The priority proposed remedial work to construct a downstream stabilizing berm with an adequate internal drainage filter system and toe drain is supported. Additional remedial works to be undertaken concurrently or in a phased approach includes:

1. A new toe drain for the embankment flanks above the berm should also be considered. The berm toe drain should have manholes at regular intervals for maintenance and monitoring.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

2. Remedial work to the breaching section downstream face local slip and possible raising of the breaching section as it is no longer considered a necessary emergency spillway.
3. Repair of outlet conduit joints where water with muddy material is leaking out.
4. Spillway joint sealant replacement.
5. Removal of trees along spillway discharge channel training walls and repair of joint; and
6. Provide safety handrails alongside the spillway retaining walls.

-Alternative No. 11: No-go Option

- Purpose and Requirements

The principal safety risk for Ngodwana Dam is the precarious stability conditions of the downstream slope, as was determined as part and parcel of the 2018 dam safety report. This report also concluded that a downstream slope failure of the dam is a very likely potential failure mode, but that internal erosion of the poorly protected embankment core, internal erosion of the complex embankment foundation, specifically the embankment left flank, or internal erosion along the outlet conduit are other potential failure modes to be considered.

- Methodology

Review of dam safety risk and proposed remedial work associated with category 3 Ngodwana dam, Mbombela compiled by DJ Hagen & Associates dated 3 December 2019.

- Criteria used to investigate and assess alternatives

Scope of remedial work proposed by DJ Hagen.

- Reasoned explanation why an alternative was or was not found to be reasonable or feasible

According to the independent dam safety reports, the no-go option poses an unsatisfactory risk to the ongoing stability of the dam wall. The following items summarise the various dam safety concerns:

- Seepage and slope stability analyses show lower than normally accepted safety factors against slope failures of the embankment downstream face.
- The material in the large downstream shell zone of the embankment is of low strength and erodible.
- The standpipe piezometers show a high phreatic surface within the embankment at its highest section where a wet area on the lower downstream face had also been observed.
- The portion of the embankment between the riverbed and the left flank foundation contact showed significant erratic movements.
- The effectiveness of the embankment internal drainage system and toe drain is suspect.

A dam break analysis conducted in 1987 indicated that the dam break flood peak could be as much as 11 000 m3/s compared to the 1 in 200 year flood of the catchment of the dam of 832 m3/s. A dam failure will cause significant damage to the N4 and SAPPI Mill immediately downstream of the dam, and also further downstream of the dam.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Observations, analyses, original design shortfalls and instrumentation monitoring have identified likely potential failure modes of Ngodwana Dam. The present probability of failure of this Category III is considered too high. As such, there remains no responsible option but to undertake remedial work before the situation regresses further.

References

Bamford, M (Prof). 1 June 2020. *Palaeontological Impact Assessment for the proposed remediation project for Ngodwana Dam, Mpumalanga Province - Desktop Study (Phase 1)*. Johannesburg, South Africa.

de Beer, A. 9 September 2016. *Ngodwana Dam 6'th Compulsory Dam Safety Report, Compulsory 7-yearly dam safety report.* Altus de Beer Consulting Engineer. Sandton, South Africa.

de Beer, A. 30 September 2019. *Ngodwana Dam annual dam safety report.* Altus de Beer Consulting Engineer. Sandton, South Africa.

Department of Environmental Affairs. 18 July 2018. *Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste*. Government Gazette 41777, Government Notice No. 715. Pretoria, South Africa.

Department of Water Affairs. 24 February 2012. *Regulations regarding the safety of dams in terms of section 123(1) of the National Water Act, 1998.* Government Gazette No. 35062, Government Notice No. R. 139. Pretoria, South Africa.

Department of Water Affairs & Forestry. 9 December 1994. *Elandsrivier: Aansoek om 'n Artikel 9B(1) – Permit on water uit die Elandrivier te onttrek*. Pretoria, South Africa.

Department of Water Affairs & Forestry. 1 June 2007. *Licence in terms of Chapter 4 of the National Water Act (Act 36 of 1998). Licence No. 24001465*. Pretoria, South Africa.

Department of Water Affairs and Forestry. 8 February 1995. Sappi Ngodwana Transfer Water Use Licence. Water Use License No. 05/X21/A/4424. Pretoria, South Africa.

Department of Water & Sanitation. 2 September 2016. *Revision of general authorisation for the taking and storing of water.* Government Gazette No. 40243, Government Notice 538. South Africa.

DJ Hagen & Associates. December 2019. *Review of dam safety risk and proposed remedial work associated with category 3 Ngodwana dam, Mbombela Reference No: DJH059-R01*. Western Cape.

DMV Incorporated. August 2020. *Preliminary assessment of haul roads for SAPPI, Ngodwana Dam rehabilitation, project 20828.* Nelspruit, Mpumalanga.

Celliers, JP. 10 July 2020. *Phase 1 Archaeological and Heritage Impact Assessment on the farm Ngodwana 1030 JT in respect of proposed Remediation work to the Ngodwana Dam, Mpumalanga Province.* Kudzala Antiquity cc. Lydenburg, Mpumalanga Province.

Minister Environment, Forestry and Fisheries. 28 January 2020. Application in terms of Regulations 5 and 6 of the Waste Exclusion Regulations, 2018, for the exclusion of a waste stream or portion of a

waste stream from the definition of waste as contained in the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008) for SAPPI Southern Africa Ltd: Ngodwana Mill Boiler Ash, Mpumalanga Province. Reference: EDMS 190424. Pretoria, South Africa.

MTPA. 2014. Mpumalanga Biodiversity Sector Plan Handbook. Compiled by Lotter M.C., Lechmere-Oertel R.G. and Cadman, M.J. Mpumalanga Tourism & Parks Agency, Nelspruit.

National Environmental Management Act (Act 107 of 1998) and EIA Regulations, Government Notices R.982, 983, 984, 985 in Government Gazette 38282 of 4 December 2014, as amended in GG 40772, GN No. 324, 325, 326, 327 of 7 April 2017 and GG 41766, GN No. 706 of 13 July 2018.

National Environmental Management: Waste Act (Act 59 of 2008), as amended.

National Heritage Resources Act (Act 25 of 1999).

National Water Act (Act 36 of 1998) as amended.

Details of the Public Participation Process

(ii) details of the public participation process undertaken in terms of regulation 14 of the Regulations, including copies of the supporting documents and inputs;

(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;

1. Introduction

The Public Participation Process (PPP) was undertaken according to Chapter 6 of the EIA Regulations, 2014, as amended, and took into consideration the Public Participation 2017 Guideline Document (DEA, 2017).

2. Objectives of the public participation

The level of public participation (Appendix C, Annexure A) was determined by taking into account the scale of the anticipated impacts of the proposed project, the sensitivity of the affected environment and the degree of controversy of the project, and the characteristics of the potentially affected parties. Based on the findings of the above considerations, including cognisance of the Covid-19 pandemic, the PPP elaborates on the minimum requirements of the public participation process outlined in the EIA Regulations, 2014 by way of a number of reasonable alternative methods, including consideration for people desiring of but unable to participate in the process due to illiteracy, disability or any other disadvantage.

3. Identification of interested and affected parties

Over and above the placement of site notices on site and an advert in the local newspaper inviting I&APs to participate in the application process, certain stakeholders were specifically approached (organs of state, the owner or person in control of the land etc. are automatically regarded as I&AP's).

The following means of identifying stakeholders were used:

- Established lists and databases on Ecoleges' old projects in the surrounding area or jurisdiction,
- Network or chain referral systems according to which key stakeholders were asked to assist in identifying other stakeholders,
- SAPPI Environmental Liaison & Monitoring Committee (ELMC) members,
- Search of title deed and servitude holders directly adjacent to the affected propert/ies,
- Relevant ward councillors for the local municipal,
- Relevant Non-Governmental Organisations (NGOs), and
- Relevant government departments as commenting authorities.

4. Notification of interested and affected parties

All potential and registered I&APs (Appendix C, Annexure H) have a right to be informed early and in an informative and proactive way regarding proposals that may affect their lives or livelihoods. Early communication can aim to build trust among participants, allow more time for public participation, and

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

improve community analysis and increases opportunities to modify the proposal in regard to the comments and information gathered during the PPP.

4.1 Method of notification

Notification of a proposal to all I&APs may be given through a number of methods including fixing of notice boards, providing written notice, placing advertisements etc. Potentially interested and affected parties were notified of the site meeting and proposed application by –

a. fixing a notice board at a place conspicuous to the public at the boundary or on the fence of –
    i. the site where the activity to which the application relates is or is to be undertaken; and
    ii. any alternative site mentioned in the application;

Three notice boards were fixed at places conspicuous to the public, on the 18th of June, 2020, including two on the boundary of the affected property at highly visible sites on high-traffic roads as well as a third on a public notice board at the Ngodwana Shopping Centre.

b. giving written notice to –

- Giving written notice (Background Information Document – BID - Appendix C, Annexure D) to owners and occupiers of land adjacent to Farm Ngodwana 1030JT and organs of state having jurisdiction in respect of the proposed activity. The applicant is the owner of the land where the activity is to be undertaken. The BID was prepared and distributed via email, hand and registered mail (Appendix C, Annexure E) to:

The owner, whom is the applicant and person in control of the land: • Errol Von Berg, 082 876 7486, Errol.VonBerg@sappi.com
The occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken: • Renee Van Hoeve, Renee.VanHoeve@sappi.com • Hennie Viviers, Hennie.Viviers@sappi.com • Andile Mbatha, Andile.Mbatha@sappi.com • Carel van der Merwe, Carel.VanDerMerwe@sappi.com • DJ Hagen, dj@djha.co.za • Pfuluwani Magau, Pfuluwani.Magau@sappi.com • Cor Steyn, Cor.Steyn@sappi.com
Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken: • Lereko Properties, 0112680755, mpumelelo@lereko.co.za • Gumpro Pty Ltd, 079 512 7639, hermien@gumpro.co.za or gumpro@lantic.net • Chilidzi Mavhulwane, 083 797 1392, tshilidzi.mavulwana@transnet.net • Carla Davis, 082 887 4941, cdavis@tracn4.co.za • Ismael Essai, 012 426 6200, essai@nra.co.za • Shilla Promise Mamba, 076 425 9178, kgotsoletlalo@gmail.com

- David Moffett, 084 602 8891, david.moffett@drdlr.gov.za
- Craig Todd, 0832724634, craig@gmtoddirrigation.co.za

The municipality which has jurisdiction in the area:

Mbombela Local Municipality:

- Mr Wiseman Khumalo (Municipal Manager); 013 759 2070, municipalmanager@mbombela.gov.za;
- Mr Maarten Coetzee (Town Planner), 013 759 9173; Maarten.Coetzee@mbombela.gov.za
- Mr Ben Steyn (Snr Man - Land Use Development), 013 759 2196, ben.steyn@mbombela.gov.za
- Mini Giwueze (Town Planner), 0745619387, mini.giwueze@mbombela.gov.za;
- Sihle Mthembu (Environmental Officer), 076 991 1195, Sihle.Mthembu@mbombela.gov.za;
- Philllip Nkhoma (Ward 12 Councillor), 082 964 8340, phillip.nkhoma@gmail.com.
- KM Mkhonto (Ward 14 Councillor), 082 078 3151, mk.wezizwe@gmail.com

Ehlanzeni District Municipality:

- Mr FS Siboza (Municipal Manager) & Noma Fakude (PA),013 759 8531, nfakude@ehlanzeni.gov.za;
- Johan Bothma (Planning & Development), 082 460 4498, jbothma@ehlanzeni.gov.za;
- Johan Burger (Planning & Development), 082 460 4228, jburger@ehlanzeni.gov.za
- Randzu Ntusi (Env Officer), 013 759 8545, rntusi@ehlanzeni.gov.za
- Zamanguni Mdluli (Env Officer), 013 759 8500, Zmdluli@ehlanzeni.gov.za.
- ES Mashiyane (Env Officer), 0829319666, mashianees@gmail.com

Any organ of state having jurisdiction in respect of any aspect of the activity:

DWS (IUCMA):

- Tanganedzani Makhanthisa, 061 824 6608 / 076 518 7761, makhanthisat@iucma.co.za;
- Sampie Shabangu, 062 907 9061, shabangus@iucma.co.za;
- Sandile Dlamini, 062 189 5050, dlaminis@iucma.co.za.

DARDLEA:

- Robyn Luyt, 082 672 7868, rluyt@mpg.gov.za.
- Xolani Nkosi, 072 157 0587, nkosixe@mpg.gov.za,

DAFF:

- Zinzile Mthotywa, 082 317 7581, ZinzileM@daff.gov.za.

Any other party as required by the competent authority/EAP:

Elands Irrigation Board (Ngodwana)

- Izak Boozaaier; 013 734 4706, izak@groenkloof.co.za

Elands Valley Conservancy

- Sheena Cooper (chairperson), baileysbest@telkomsa.net

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- ED Tilborn, 0827035534, edtilborn@gmail.com

MTPA:

- Frans Krige (EIA Scientist), 084 232 2902, franskrige@telkomsa.net/frans@mtpa.co.za
- Francois Roux (aquatic specialist), 082 366 7708, hydrocynus@mweb.co.za

SAHRA:

- Load onto SAHRIS website.

EWT:

- Ursula Franke; 017 811 2817; ursulaf@ewt.org.za

ESKOM:

- Josia Zungu (Nelspruit), 013 755 9655, zunguj@eskom.co.za.
- Siebert Labuschagne, 013 755 9614, siebert.labuschagne@eskom.co.za

TELKOM SA Ltd:

- Gerrit Nieman, 081 390 1445, niemang@telkom.co.za

SAPPI ELMC:

- Aneesa Haroon, Aneesa.Haroon@sembcorp.com;
- Annamarie van Brakel, annamariea@mpuhealth.gov.za;
- Apollo Sambo, aesambo@mpg.gov.za;
- Avhatakali Mamatsharaga, a.mamatsharaga@sanbi.org.za;
- Chris Foster, cfoster@klf.co.za;
- DT Mahlaku, dmahlaku@ehlanzeni.gov.za
- E Fry, efry.dombeya@gmail.com
- Eddie Riddell, Eddie.Riddell@sanparks.org;
- Enny Tsebe, Enny.Tsebe@weathersa.co.za / ennytsebe13@gmail.com
- Francois Roux, hydrocynus@mweb.co.za;
- Gugu Motha, mothag@iucma.co.za
- Heinrich Kammeyer, heinrich@enpact.co.za;
- Hermien Oliver, gumpro@lantic.net
- Lerato Phahlane, LPhahlane@environment.gov.za
- Louw Pretorius, luilekker@netactive.co.za;
- Louw Winterbach, lwinterbach@ledc.co.za;
- Lucas Mahlangu, Lmahlangu@environment.gov.za
- Manty Mashaba, mashabam@iucma.co.za;
- Marius Van Rooyen, mvanrooyen.agric@gmail.com;
- Mduduzi Nkuna, nkunam@iucma.co.za;
- Moolman Wilna, MoolmanW@dws.gov.za;
- Naidoo Mershan, NaidooM@dws.gov.za
- Nocawe Nkosi, nocawe@mpg.gov.za;
- Patrick Khoza, patrickk@mbombela.gov.za;
- Rendani Ndou, ndour@dwa.gov.za;

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Rofhiwa Ramunenyiwa, ramunenyiwar@iucma.co.za;
- Sumaya Nassiep, sumaya.nassiep@eskom.co.za;
- Thabo Rasiuba, rasiubat@iucma.co.za;
- Thandiwe Makhubela, thandiwemA@mpuhealth.gov.za;
- Thapelo Nhlapho, thapelon@mpuhealth.gov.za;
- Thomas Gyedu-Ababbio, thomasga@iucma.co.za;
- Tracy Petersen, tracy.petersen@sanparks.org;
- Tshikhovhokhovhom@dws.gov.za;
- victor@victormunnik.co.za;
- Zmbili@environment.gov.za
- nqelensal@DWS.gov.za;
- owen@soft.co.za;
- patandgeorgemac@gmail.com;

c. placing an advertisement in –
   i. one local newspaper; or
   ii. any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations
   iii. one provincial newspaper or national newspaper if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it is or will be undertaken

An advertisement (Appendix C, Annexure F) was placed in a local newspaper, the Laevelder Newspaper, on the 19th of June 2020 (Appendix C, Annexure G). No official Gazette existed at the time of the application. The proposed activity shall not have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it will be undertaken.

d. using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person desires of but unable to participate in the process due to illiteracy, disability or any other disadvantage.

Two alternatives have been identified
1. Translating the BID/Notification into isiZulu which was distributed by hand to residents of the informal settlement opposite the Ngodwana Mill, and
2. Scheduling an online virtual public meeting with the SAPPI ELC via Zoom as an alternative to the normal Public Meeting.

In terms of regulation 55(1), all organs of state which have jurisdiction in respect of the proposed activity and all persons who submitted written comments, attended the site meeting or requested, in writing, to be registered were placed on the register.

4.2 Proof of notification

Please see (refer to Appendix C, Annexure E) for Proof of Notification via email & registered mail.

5. Notification of interested and affected parties of reports and other studies

Please refer to Appendix C, Annexure K.

6. Interested and affected parties

Refer to Appendix C, Annexure H for the list of Interested and Affected Parties.

6.1 Access and opportunity to comment on all written submissions

All communication, including but not limited to reports is disseminated to registered interested and affected parties for a 30-day commenting period.

6.2 Response to comments received: feedback to interested and affected parties

Please refer to Appendix C, Annexure I for the Comments and Response sheet.

6.3 Disclosure of interested and affected parties' interests

Please refer to Appendix C, Annexure I for the Comments and Response sheet.

6.4 Notifying interested and affected parties of the decision

Once a decision has been made, all registered interested and affected parties will be notified.

7. Record of issues raised

Please refer to Appendix C, Annexure J for the Copies of received comments.

8. Addressing the comments and concerns raised by the interested and affected parties

Please refer to Appendix C, Annexure I for the Comments and Response sheet.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

The Environmental Attributes Associated with the Alternatives

(iv) The environmental attributes associated with the alternatives focusing on geographical, physical, biological, social, economic, heritage and cultural aspects;

Geographical Aspects

The Mbombela Local Municipality is in the Ehlanzeni District Municipality and is one of four local municipalities located in the District. It is bordered by Emakhazeni Local Municipality to the west in the Nkangala District Municipality, Albert Luthuli Municipality to the south in Gert Sibande District Municipality and Nkomazi Local Municipality to the west and Thaba Chweu Local Municipality to the north (both in the same District Municipality - Ehlanzeni).

The first order urban area around Ngodwana is City of Mbombela. City of Mbombela is located on the N4, towards Malelane, Komatipoort and Maputo. The Ngodwana Dam is an existing dam located on Portion 0 of Farm Ngodwana 1030JT, off the N4, 40km before City of Mbombela, Mpumalanga Province (GPS coordinates 25° 34'58.92"S, 30°40'21.09"E).

Physical Aspects

Climate

The City of Mbombela is characterised by a humid subtropical climate with mild winters and warm summers. The average daily temperature fluctuates from 6 ºC in winter (June and July) to 29 ºC in summer (January, February). Barberton's climate is subtropical and the average day time temperature ranges from 18 degrees centigrade from June to August to the mid 30's from October to February. The average rainfall varies from 10mm during the winter (June, July and August) to 120mm during summer (November, December, January and February). The highest average rainfall is recorded in December and January. The geographic distribution of rainfall is as follows:

- The highest rainfall (800-1500mm) is recorded in the areas surrounding Ngodwana, Kaapsehoop, and Elandshoek to the west and in the area north-west of White River town.
- The Crocodile River catchment area and a north-south belt, including White River, Sabie River, Longmere Dam, Klipkoppie Dam and Da Gama Dam fall within a 700–800mm rainfall zone.
- The eastern areas receive the lowest annual rainfall between 400–700mm.
- The average mean annual precipitation for the Umjindi area varies from approximately 500 to 1700mm with average varying from approximately 450 to 550mm on the eastern areas to 1500mm at the escarpment and higher lying areas (DWAF 2000). (MLM Draft IDP 2017 – 2022).

Summer rainfall with dry winters. MAP from about 700 mm on the footslopes of the escarpment in the east to about 1 150 mm where it borders on grassland at higher altitude to the west. Frost infrequent to occasional at higher altitudes. Mean monthly maximum and minimum temperatures for Nelspruit 35.7°C and 1.6°C for October and July, respectively. Corresponding values for Barberton 36.0°C and 0.8°C for October and June, respectively. Both weather stations lie at the eastern edge of the unit at lower altitude (Deacon, 2020 extracted from Mucina & Rutherford, 2006).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Topography

The City of Mbombela lies on the eastern edge of the Drakensberg mountain range. The area can be divided into three distinct physiographic regions based on the north-south orientation of the Drakensberg mountain range, namely, Highveld, escarpment and Lowveld. Umjindi area is situated on the Lowveld escarpment with an average elevation of 877m above sea level and altitudes varying from 600 to 2100m. The escarpment and the beautiful Makhonjwa Mountain provide an attractive variety to the landscape promoting scenic tourism.

The topography ranges from mountainous areas in the western parts to gently sloping areas in the eastern parts. The area falls from a height of approximately 1200m above sea level in the southern-western part to 350m in the north-eastern parts. A slope analysis, based on slope data received from the National Department of Agriculture, Forestry and Fisheries, presents areas with slopes that vary between ≤2% (level to very gently slope) and ≥20 % (steep slopes). Accordingly, most of the municipality consists of steep slopes.

The Umjindi area is dominated by high mountains representing 57.34% while low mountains constitute 42.66% of the area. The majority of the area is level (68.44%) with moderate slopes (23.55%) and, thus, potentially fit for urbanisation and agriculture. Steep and very steep slopes occur in only 7.99% of the area (MLM Draft IDP 2017 – 2022).

Natural vegetation and plant life

The most dominant vegetation type is the Legogote Sour Bushveld, covering most of the western, central and northern parts. The Highveld regions in the west is characterised by grassland vegetation. Typical plants include Red-hot pokers, Pineapple lilies, Scillas, Gladioli, Watsonias, Brunsvigias and numerous terrestrial orchards and summer rainfall proteas. The Lowveld region is characterised by the Croc Gorge Mountain Bushveld, Malalane Mountain Bushveld and Pretoriuskop Sour Bushveld. The Escarpment is characterised by the Northern Escarpment Dolomite Grasslands, Steenkamsberg Montane Grassland, Northern Escarpment Dolomite Grassland and Long Tom Pass Montane (MLM Draft IDP 2017 - 2022).

Gentle to moderate vegetation and landscape features. Sloping upper pediment slopes with dense woodland including many medium to large shrubs often dominated by *Parinari curatellifolia* and *Bauhinia galpinii* with *Hyperthelia dissoluta* and *Panicum maximum* in the undergrowth. Short thicket dominated by *Vachellia ataxacantha* occurs on less rocky sites. Exposed granite outcrops have low vegetation cover (Deacon, 2020).

Sensitive landscapes

Mpumalanga Tourism and Parks Agency (MTPA), as the authority mandated to conserve biodiversity in Mpumalanga, have developed the Mpumalanga Biodiversity Sector Plan (MBSP). All site perspective biodiversity assessments therefore need to be contextualised within this provincial biodiversity plan including mapping of the Terrestrial and Aquatic Biodiversity classes and vegetation units.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

The project area falls within several sensitive terrestrial areas including CBA: Irreplaceable, Threatened Ecosystem (Vulnerable), ESA: Protected Area Buffer and CBA: Optimal for the Macrodump stockpiles. The aquatic sensitivity is also high with the river classified as a CBA. See Appendix A Annexure B for the Site Sensitivity Plan.

Geology

The site geology is extremely complex due to the occurrence of a variety of sedimentary, volcanic and metamorphic rocks, unconformities in the sedimentary succession, faulting, variable weathering, thick alluvium in the river section, colluvium on the left flank and large dislodged quartzite blocks on the right flank (De Beer, 2019).

Most of the area is underlain by gneiss and migmatite of the Nelspruit Suite, but the southern part occurs on the potassium-poor rocks of the Kaap Valley Tonalite (both Swazian Erathem). The westernmost parts of the distribution are found in Pretoria Group shale and quartzite (Vaalian). Archaean granite plains with granite inselbergs and large granite boulders also occur (Deacon, 2020).

Geo- and Hydrology

The City of Mbombela is situated within two sub-catchments that constitute the main Nkomati River catchment area. The two sub-catchments are the Crocodile River catchment area and the Sabie-Sand catchment area. The Crocodile River runs in a west-east direction across the middle of the municipality and the Sabie River runs in a west-east direction along the northern boundary of the municipality. The Elands River, running south-east to north-west, is the main tributary flowing into the Crocodile River.

The North Sand River, running north-south, is the main tributary flowing into the Sabie River. Other rivers of note include Ngodwana River, Nels River, White River, White Waters River, Gutshwa River, Nsikazi River, Houtbosloop River, Lupelule River, Rietspruit River and Blinkwater River. Umjindi disposes of the Noordkaap River, the Suidkaap River, Queen's and Fig Tree Creek feeding the Kaap River, the Mtsoli River and Mlumati River, flowing towards the Indian Ocean. The catchments of the rivers determine the respective landscapes for tourism, timber growing and agriculture.

The main dams in the City of Mbombela are Longmere, Ngodwana, Da Gama, Klipkopje, Primkop, Nsikazana, Friedenheim, Kwena (situated outside Mbombela in Thaba Chweu), Witklip (situated outside Mbombela in Thaba Chweu) and Inyaka (situated outside Mbombela in Bushbuckridge). The major dams in the Umjindi area include Shelangubo Dam and Lomati Dam.

The area to the north of the City of Mbombela is typically underlain by un-oxidised residual dolomite soils however some of the areas appear to be oxidised and as a consequence are likely to be very permeable. Other areas may have sinkholes forming as a result of the poor drainage and where the dolomite rock is less than 6 meter deep.
(MLM Draft IDP 2017 – 2022).

Soil

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Soils are of Mispah, Glenrosa and Hutton forms, shallow to deep, sandy or gravelly and well drained. Diabase intrusions are common, giving rise to Hutton soils (Deacon, 2020). See Table 24 for detailed soil property analysis of the dam wall.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Table 24: Soil Properties used in additional Seepage and Slope Stability Analyses (De Beer, 2019).

NGODWANA DAM SEEPAGE & SLOPE STABILITY ANALYSIS SOIL PROPERTIES AND ANALYSIS CASES - OCTOBER 2018								
SOIL PROPERTY	**LAYER 1 - FOUNDATION**	**LAYER 2 - DOWNSTREAM SHELL**			**LAYER 3 - SLOPING FILTER**	**LAYER 4 - IMPERVIOUS UPSTREAM ZONE**	**LAYER 5 - HORISONTAL STRIP FILTERS**	**Filter Case**
k	$6.5x10^{-7}$	$6.5x10^{-7}$	Maximum Seepage Coefficient		$1.0x10^{-4}$	$1.0x10^{-8}$	$1.0x10^{-4}$	Filters fully functional
		$3.1x10^{-8}$	Minimum Seepage Coefficient		$6.5x10^{-7}$		$6.5x10^{-7}$	Filters clogged
		$2.6x10^{-7}$	Average Seepage Coefficient					
γ	1700 kg/m3	2044 kg/m3	γ	Material properties for slope stability analysis case 1 - Average γ and c' and high Φ'	1650 kg/m3	1700 kg/m3	1650 kg/m3	
c'	50 kPa	27.8 kPa	c'		0 kPa	35 kPa	0 kPa	
Φ'	35 degrees	25.7 degrees	Φ'		35 degrees	15 degrees	35 degrees	
γ	1700 kg/m3	2044 kg/m3	γ	Material properties for slope stability analysis case 2 - Average γ and c' and low Φ'	1650 kg/m3	1700 kg/m3	1650 kg/m3	
c'	50 kPa	27.8 kPa	c'		0 kPa	35 kPa	0 kPa	
Φ'	35 degrees	18.3 degrees	Φ'		35 degrees	15 degrees	35 degrees	
γ	1700 kg/m3	2044 kg/m3	γ	Material properties for slope stability analysis case 3 - Average γ and Φ' and high c'	1650 kg/m3	1700 kg/m3	1650 kg/m3	
c'	50 kPa	39.6 kPa	c'		0 kPa	35 kPa	0 kPa	
Φ'	35 degrees	20.8 degrees	Φ'		35 degrees	15 degrees	35 degrees	
γ	1700 kg/m3	2044 kg/m3	γ	Material properties for slope stability analysis case 4 - Average γ and Φ' and low c'	1650 kg/m3	1700 kg/m3	1650 kg/m3	
c'	50 kPa	13.4 kPa	c'		0 kPa	35 kPa	0 kPa	
Φ'	35 degrees	20.8 degrees	Φ'		35 degrees	15 degrees	35 degrees	

Surface water

- *name of nearest watercourse, water quality - pH, conductivity etc.*
- *surface water use (domestic, industrial, agricultural, recreational or natural environment)*
- *water authority*
- *presence of wetlands*

The drainage line in the study area is in the Ngodwana River catchment within the X21H quaternary catchment and part of the Inkomati-Usuthu Catchment Management Agency (IUCMA). The water courses implicated in the project area are the wetlands (natural and created by the dam environment), which end up joining the Ngodwana River.

Please see the attached Present Ecological State Report within Appendix E Annexure B.

Sites of archaeological interest

In terms of Section 38 of the National Heritage Resources Act, 1999, SAHRA must be notified of developments on areas that are larger than 5000m². SAHRA has been informed of the proposed development during the notification process, which formed part of the public participation process. No sites of archaeological or heritage significance were located during the field survey. A total of fourteen survey orientation locations were documented (SO 1-14) which includes a GPS location and photographs of the landscape at that location. Surface visibility and access in certain areas was reduced due to very dense bush and undergrowth which included Lantana and sickle bush and dense thick grass cover. In terms of the archaeological component of the Act (25 of 1999, section 35) no sites were located or recorded in the study area. In terms of the built environment in the project area (section 34 of the Act) no sites were located or recorded in the study area. In terms of burial grounds and graves (section 36 of the Act) no graves or gravesites were identified in the study area. The bulk of archaeological remains are normally located beneath the soil surface. It is therefore possible that some significant cultural material or remains were not located during this survey and will only be revealed when the soil is disturbed. Should excavation or large-scale earth moving activities reveal any human skeletal remains, broken pieces of ceramic pottery, large quantities of sub-surface charcoal or any material that can be associated with previous occupation, a qualified archaeologist should be notified immediately.

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the arenites, quartzites, sandstones and conglomerates are typical for the country and do not contain fossil plant, insect, invertebrate and vertebrate material. The surface soils of the Quaternary period would not preserve fossils.
Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the Black Reef Formation (basal Transvaal Supergroup). Based on the literature survey and more recent publications, the SAHRIS map needs to be updated to reflect this. However, in the interim and to satisfy SAHRA regulations a Fossil Chance Find Protocol should be added to the EMPr: if fossils of stromatolites are found once excavations for the remedial project have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Visual aspects

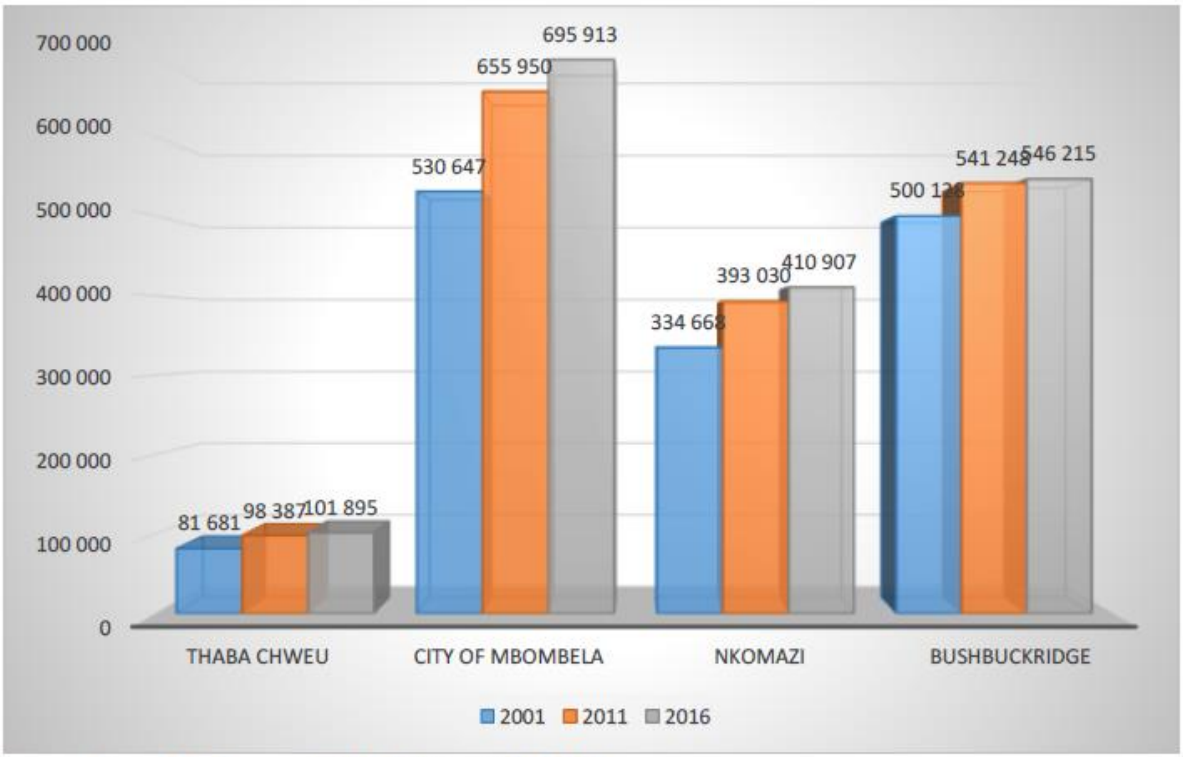
A visual buffer or screening will not be required for the preferred location of the works as it within the existing footprint of the Ngodwana Dam and will have limited or no visual impact to adjacent properties, due to the visual buffering of existing buildings and vegetation on the property.

Regional socio-economic structure

Population, economic activities, unemployment rate, housing demand, social infrastructure, water supply and sanitation, power supply

Population

According to Community Survey 2016 results which is based on the 2016 municipal boundaries, the Mbombela municipal area had a total population of 695 913. This population constitutes 39.6% of the entire population of Ehlanzeni District. Hence, the municipal area of Mbombela is the most populous within the Ehlanzeni District (Community Survey, 2016). With regards to the municipal area's population trends over the past 15 years, the Municipality has been one of the fastest growing municipalities in the district (Figure 24).



Source: **Stats SA, Census, 2001, 2011 and CS 2016**

Figure 24. The population distribution in Ehlanzeni district area (2001 – 2016) (MLM IDP 2017 - 2022).

The Mbombela municipal area has recorded annual population growth rate 2.3% per annum between 2001 and 2011 (Stats SA, 2011). Between 2011 and 2016, however, an annual population growth rate of 1.2% was observed within the municipal area. These trends can be attributed to the municipality's economic potential to attract people from other countries, provinces and municipalities.

According to Community Survey 2016, the municipal area of Mbombela is a destination for about 35.6% of all immigrants (both from other provinces and other countries) coming into Ehlanzeni District. The City of Mbombela is currently in a process of developing a strategy to manage the challenges of migration.

Unemployment

Currently, there are no official statistics on labour indicators for the newly formed City of Mbombela which is made up of the former Umjindi Local Municipality (MP323) and Mbombela Local Municipality (MP322). The implementation of the Local Economic Development (LED) programmes, Extended Public Works Programme (EPWP) and Community Works Programme (CWP) helped in creating job opportunities to the communities including women, youth and people with disability. Moreover, it is anticipated that the LED strategy, Spatial Development Framework (SDF), and the Vision 2030 Strategy will also assist in identifying key areas that the City of Mbombela can invest in to create more job opportunities.

Table 25: Economic Activities (Economic contribution and growth).

Local municipal area	% contribution to Mpumalanga economy 2015	Average annual economic growth 1996-2015	Average annual economic growth 2015-2020
Emalahleni	20.9%	2.4%	1.9%
Mbombela	15.4%	2.9%	1.2%
Govan Mbeki	14.8%	1.5%	1.9%
Steve Tshwete	13.4%	2.7%	2.1%
Bushbuckridge	4.3%	0.7%	1.7%
Msukaligwa	4.2%	2.5%	1.0%
Lekwa	3.7%	1.7%	2.3%
Victor Khanye	3.2%	5.2%	2.5%
Thaba Chweu	3.1%	2.7%	1.2%
Nkomazi	3.1%	1.6%	1.5%
Mkhondo	2.7%	3.6%	1.8%
Thembisile Hani	2.7%	3.1%	2.0%
Umjindi	2.5%	2.4%	1.2%
Chief Albert Luthuli	2.4%	2.8%	1.0%
Emakhazeni	1.0%	2.0%	1.1%
Dr Pixley Ka Isaka Seme	1.0%	1.9%	1.3%
Dr JS Moroka	0.7%	-4.7%	0.9%
Dipaleseng	0.7%	1.9%	0.4%

Source: **Socio-Economic Review and Outlook (SERO) Report 2016**

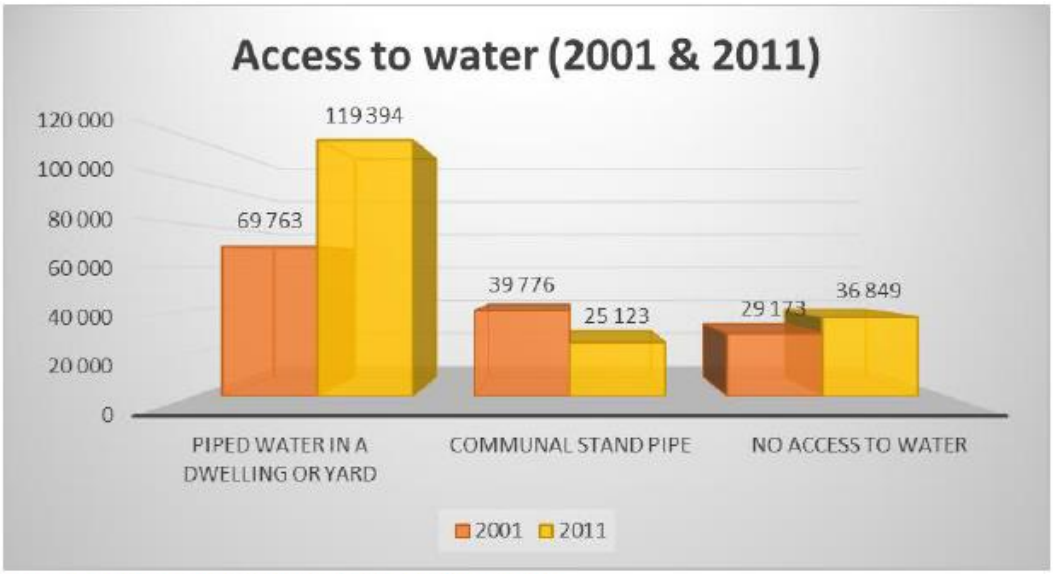
From the above table, it is clear that the former Mbombela municipal area was the second highest contributor to the Province's economy on 15.4% during 2015. Mbombela, as the capital city of the Province, has the ability to attract huge investments and has major economic activities ranging from trade, agriculture, mining and tourism. From 1996 until 2015, the economy of the former Mbombela municipal area has been growing by 2.9% annually. It is anticipated that in the next five years (2015 - 2020), its annual economic growth rate will average 1.2% according to the Mpumalanga Provincial Department of Finance, Economic Development and Tourism.

Water supply

Whilst the Municipality has shown improvement in the provision of water to its households, it must be borne in mind however that the backlog (households without access to water) in the water service

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

provision has been increasing. This is depicted by the 36 849 in 2011 from 29 173 in 2001, thereby implying a 26.3% increase. The increase in the backlog is closely linked to the sharp increase in the number of households within the municipal area. (*NB: The 2001 and 2011 results are based on a combined 2001 and 2011 municipal boundaries for the former Umjindi and Mbombela Municipalities respectively*).



Source: **Stats SA Census Surveys 1996, 2001 & 2011**

Figure 25. Access to Water (2001 & 2011).

Power supply

Provision of electricity within the municipal area is one area where the Municipality has made considerable progress. Throughout the years, the Municipality together with Eskom and the National Department of Energy have rigorously implemented electrification projects to benefit communities in all the affected area. However, it should be noted that the backlog that is still existing is as a result of the additional households within the municipal area thereby causing additional demand.

The municipality in partnership with Eskom is in the process of upgrading existing power stations in order to cater for all the areas within the municipal area.

The Impacts and Risks Identified for each Alternative.

(v) The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts-

(aa) can be reversed;
(bb) may cause irreplaceable loss of resources; and
(cc) can be avoided, managed or mitigated;

Please refer to the Impact Assessment in Appendix D**.**

The Methodology used in Determining and Ranking the Impacts and Risks associated with the Development Footprint.

(vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks with the alternatives;

Please refer to the Impact Assessment in Appendix D**.**

The Positive and Negative Impacts that the Proposed Activity and Alternatives on the Environment and Community.

(vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community, that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.

Please refer to the Impact Assessment in Appendix D.

The Possible Mitigation Measures application and level of Residual Risk.

(viii) The possible mitigation measures that could be applied and the level of residual risk;

Please refer to the Impact Assessment in Appendix D.

The site selection Matrix

(ix) The outcome of the site selection matrix;

Please see section G and consideration of alternatives.

No Alternatives:

(x) If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such: and

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Not applicable.

The Concluding Statement.

(xi) A concluding statement indicating the preferred alternatives, including preferred location of the activity;

The two works areas (main embankment and right flank embankment) are already transformed footprints, for which key remedial works are required, including appurtenant works (e.g. side drains) to improve identified failures in the dam wall and improve the long-term integrity and safety of these structures, for which there is no other alternative. Failure to undertake this work jeopardises downstream human safety, economic activity (e.g. Ngodwana Mill) and ecological integrity. The infill material for the main embankment will be rockfill which has the highest technical specification fit for purpose, and although it poses a higher visual impact than a general/soil fill, it will assist in the ongoing maintenance of the embankment without an undue visual impact.

The site establishment areas should all be considered as alternatives for use during construction, with the exception of Alternative 2 (main embankment), which has the critical flaw of excessively steep slopes and poor access. Site establishment areas must be prioritised according to the nature of the activities proposed for that site, to ensure suitable activities are undertaken on suitable sites to minimise the risk to the receiving environment. Established indigenous vegetation, especially large trees, must remain in situ as far as possible, with the principle of no nett loss implemented (including translocation outside the works footprint) where there is no alternative but to remove these trees.

All identified haul routes will be necessary to effectively access the site and allow for delivery of materials to the work fronts. The majority of the haul routes already occur on existing roads and where extensions/upgrades are required, the impact on the receiving environment must be reduced as far as possible as the entire project footprint falls within multiple sensitive areas.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION I: DESCRIPTION OF PROCESS TO IDENTIFY, ASSESS AND RANK THE IMPACTS THE ACTIVITY WILL IMPOSE THROUGH THE LIFE OF THE ACTIVITY.

(i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including-

Description of Environmental risks and mitigation measures.

(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process: and

(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures:

Please refer to the Impact Assessment in Appendix D.

SECTION J: ASSESSMENT OF IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK.

(j) an assessment of each identified potentially significant impact and risk; including-

- *(i)* ***cumulative impacts****;*
- *(ii) the nature, significance and consequence of the impact and risk;*
- *(iii) the extent and duration of the impact and risk;*
- *(iv) the probability of the impact and risk occurring;*
- *(v) the degree to which the impact and risk may cause irreplaceable loss of resources*
- *(vi) the degree to which the impact and risk can be avoided, managed or mitigated;*

Please refer to the Impact Assessment in Appendix D.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Cumulative Effects

A guide prepared for the Canadian Environmental Assessment Agency (CEAA) (Hegmann et al. 1999) defined cumulative effects as: *"…changes to the environment that are caused by an action in combination with other past, present and future human actions."*

Cumulative effects are commonly understood as the impacts which combine from different projects and which result in significant change, which is larger than the sum of all the impacts. (DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria)

Cumulative effects can then occur when impacts are:
(1) additive (incremental);
(2) interactive;
(3) sequential; or
(4) synergistic.

Eccles et al. (1994) summarises the essence of cumulative environmental change as follows:

"Where the intensity of development remains low, the impacts can be assimilated by the environment over time, and cumulative effects do not become a significant issue. However, when development reaches a high level of intensity, impacts cannot be assimilated rapidly enough by the environment to prevent an incremental build-up of these impacts over time. Changes over time and space accumulate and compound so that in aggregate the effect exceeds the simple sum of previous changes. This temporal and spatial accumulation gradually alters the structure and functioning of environmental systems, and subsequently affects human activities."

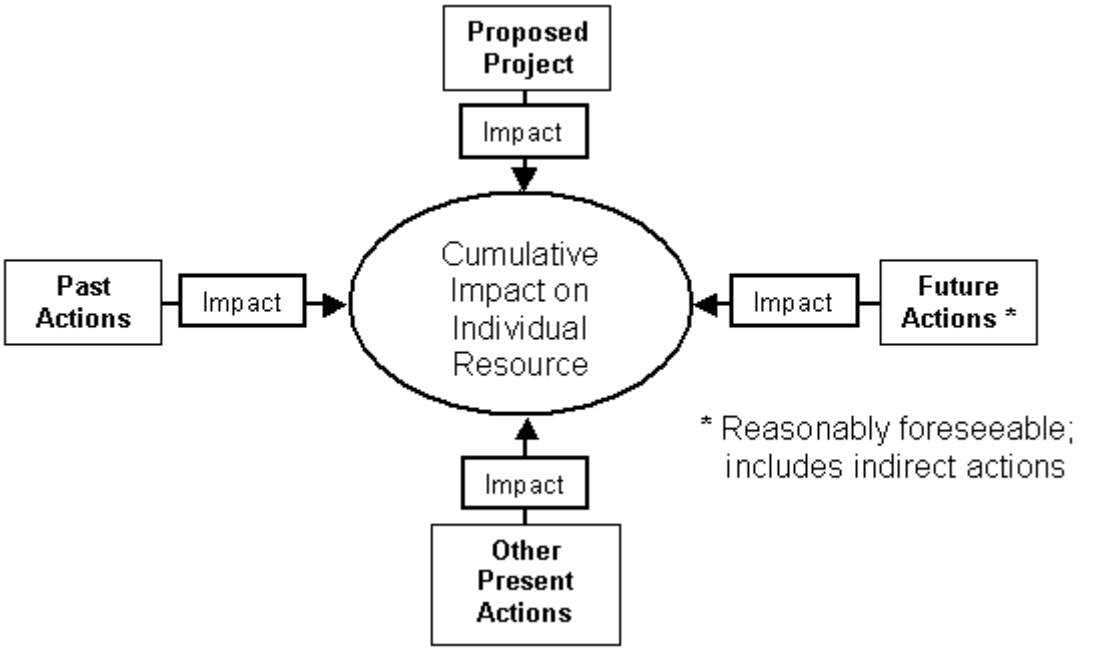


Figure 26. A flow diagram showing the compounding effects of cumulative impacts on a resource.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

The BA would need to identify and investigate the potential cumulative effects of the proposed development taking into consideration the types and characteristics of aggregate effects. These can be fragmentation, compounding effects, indirect effects, triggers and thresholds.

Planning to address cumulative effects involves delineating spatial and temporal boundaries, determining future development and determining the significance of cumulative impacts. The selected method to identify and assess cumulative effects for this BA was primarily based on Geographic Information Systems (GIS). This computer tool uses powerful mapping and spatial information for capturing, displaying and analysing digital data. Map overlays have been used to identify areas where effects are likely to be greatest.

The assessment of sensitive receptor information can be used to form a consolidated “no-go” area map from a geographical, physical, biological, social, economic, heritage and cultural aspects. The project property is already heavily modified and there are no threatened or protected areas to be avoided. The main sensitive receptor is the riparian zone within the drainage line that runs through the farm property. This exercise used the method of bio-geographical analysis, including landscape analysis looking at patterns, structure and ecological process within a spatial unit (i.e. the project development footprint alternatives within the approved site). There was also the carrying capacity analysis which identifies thresholds as constraints to development, in the ecological context, carrying capacity is defined as the threshold below which ecosystem functions can be sustained.

The additional method to identify the potential cumulative impacts included the checklist technique in which potential cumulative impacts can be identified by using a list of common or likely effects. This was undertaken within the development footprint selection process and the completion of the impact assessment within Appendix D.

The consideration of different spatial configurations of the proposed development footprint alternatives were directed by the sensitivity map (Appendix A: Annexure B) and the findings of the impact assessment process and development footprint selection process. These guided the EAP to establish the preferred development footprint that that would avoid areas that have a higher cumulative impact if they were to be developed.

The other pathway within cumulative impacts of a proposed development could be the compounding effect from one or more processes. The method of interactive matrices involves analysis of the additive and interactive effects of various configurations of multiple similar projects in the same geographic area. Due to the large number of developments in the broader area, there is potential for cumulative impact to generate additional impacts on broad-scale ecological processes and the countries’ ability to meet conservation targets. The cumulative impacts are considered low for this project as it’s there are no more similar developments proposed in the local area.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION K: SUMMARY OF SPECIALIST REPORT FINDINGS AND RECOMMENDATIONS.

(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these regulations and an indication as to how these findings and recommendations have been included in the final report;

Table 26: Summary of Specialist Findings and impact management measures.

Appendix E-B: Aquatic Impact Assessment

Riparian- and In-stream Habitat

The outcome of the in-stream and riparian IHI evaluated for the Ngodwana River in the study area, resulted in an in-stream IHI of 69.2% (C) which classifies as "Moderately modified" according to the Habitat Integrity Categories. The riparian IHI of 61.6 (C/D) falls in the "Moderate change" category. The finer scale rating (C/D) of the riparian IHI relates to the EC rating table where C/D matches a score of >57.4 and <62.01, which puts it in the "Fair" category.

Vegetation communities

The final vegetation integrity score of the VEGRAI assessment, which is incorporating the riparian and marginal zone integrity of the Ngodwana River in the project area, is 64.1% which represents an Ecological Class C (60-79). This score reflects a "Moderately modified" status.

Riparian delineation

During the study the Ngondwana River and its associated riparian zone was delineated. Most of the area below the Ngodwana dam wall (314m wide) consists of wetlands, both natural and created by the dam environment. According to the National Wetland Classification System, the source zone at the upper end of a river would typically be classified as one of the wetland types (e.g. a seep, an unchanneled valley bottom wetland, depression or wetland flat) and not as part of a river. In the project area, two wetland seeps originates on the slope of the mountain and drain down into the area below, one becomes a valley bottom wetland which joins the Ngodwana River just before the Ngodwana Water Works, while the other shorter seepage joins the original drainage line of the Ngodwana River below the dam.

Buffer Zone

Buffer zones have been used in land-use planning to protect natural resources and limit the impact of one land-use on another. Buffer zones will serve as a mitigating measure for impacts created by the construction and operational phases of the proposed Ngodwana Dam project. Final aquatic impact buffer requirements (including practical management considerations) for all the identified systems, are:

Wetland system	Construction Phase	Operational Phase	Final aquatic impact buffer requirement
Ngodwana River	18 m	19 m	19 m
Ngodwana catchment	21 m	22 m	19 m

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

valley bottom wetland			
Ngodwana catchment seep wetland	24 m	24 m	24 m

Aquatic Invertebrates and Fish

Aquatic habitat assessment

During the July 2020 survey, the IHAS (Integrated Habitat Assessment System) and HQI (Habitat Quality Index) scores were "Fair" to "Good" at Site 1, while at Site 2, all habitat scores are "Fair". The lack of running water habitats, such as riffles and rapids, reflected in the macro-invertebrate scores at Site 2, resulting in the "Fair" SASS scores, while the favourable stones-in-current habitats at Site 1, resulted in HQI score of 80% ("Good").

Aquatic invertebrate assessment

The better habitat quality at Site 1 also reflected in the macro-invertebrate scores, where the ASPT score at Site 1 is 6.9 ("Good" very close to "Excellent"), while the ASPT score at Site 2 is 5.0 (borderline between "Fair" and "Good"). Although Site 1 had a lower number of Families, these were mostly more sensitive taxa.

During the current assessment, the relative MIRAI score of the Ngodwana River in the project area was placed within the limits of an ecological state category Class C (68.9%), which means this reach is "Moderately modified". The fact that the status is "Moderately modified" can mainly be attributed to the presence of the Ngodwana Dam upstream of the survey sites, which intercept most flow events and seriously affects the natural hydrology of the river.

Fish Response Assessment Index (FRAI)

The relative FRAI score at this reach in the Ngodwana River was placed within the limits of an ecological state category Class D (54.9%), which means this reach is "Largely modified".

According to the FRAI model, the "Flow Modification" metric carries the most weight due to the impact of the Ngodwana Dam wall on the system. This is followed by "Velocity-depth" and "Cover" metrics, caused by lack of surface flows certain times of the year due to the presence of the dam. Stagnant pools during no-flow situations and poor water quality in the Elands River explain the Physico-chemical metric, while both the dam wall and poor water quality obstacles impact on fish migration. The Rainbow trout in the upper Ngodwana River flags the "Impact of Introduced" metric.

Eco Classification

PES of the Project Area:

The table below provides the available parameters that were instrumental to establish the PES of the Project Area:

Parameter	Score %	Category	Description
In-stream IHI	69.2	C	Moderately modified
Riparian IHI	61.6	C/D	Moderate change.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

VEGRAI	64.1	C	Moderately modified
MIRAI	68.9	C	Moderately modified
FRAI	54.9	D	Largely modified
Mean EI Class			Moderate
Ecological Sensitivity			Very high
EcoStatus		C	Moderately modified
PES		C	Moderately modified

The table lists the parameters that were instrumental in providing the project area with a very favourable PES Category of a "C", which equates to a "Moderately modified" status.

The use of CBA maps:

A CBA map of the study area was compiled by using the Biodiversity Geographic Information System (BGIS) maps. The key results of the Biodiversity Geographic Information System (BGIS) maps and LUDS Report are summarised below:

National terrestrial information: Ngodwana 638 and 1030 (Mpumalanga).

- Savanna Biome (Lowveld): SVI 9 Legogote Sour Bushveld- Threatened ecosystem status: Vulnerable

Aquatic Critical Biodiversity Areas

- Water Management Area (WMA): Inkomati WMA - Freshwater Ecosystem Priority Areas (FEPA) WMA;
- Ecological Support Areas: Ecological Support Area (ESA): Important sub catchments and ESA: FEPA sub catchments;
- Freshwater **Critical Biodiversity Areas (**CBA) and Ecological Support Area (ESA): FEPA rivers; Fish support area.

The Ngodwana River is a river FEPA, which means it is a river reach that is required for meeting biodiversity targets for river ecosystems and threatened fish species. The Desired Management Objectives of a river in the Critical Biodiversity Area category, are to maintain the river in a natural state with no loss of ecosystems, functionality or species; no flexibility in land-use options.

Since the river is also situated in a Ecological Support Area, the Desired Management Objectives are to minimise habitat and species loss through judicious planning and maintain basic ecosystem functionality

Risk Assessment

The risks associated with the water use/s and related activities.

The Risk Assessment for this project was done in accordance with the Risk Matrix (Based on DWS 2015 publication: Section 21 (c) and (I) water use Risk Assessment Protocol and as contained in Appendix A in GN509 of 26 August 2016) and was carried out considering the risk rating of the project.

Following is an abstract from the Risk Assessment Matrix for the Ngodwana Dam project area

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

relating to all current and expected impacts that the development will have on the system and the significance of these impacts.

PHASE: CONSTRUCTION

Activity 1. Stabilizing the berm and toe drain.

Aspect 1.1 Vegetation clearing.

Impact 1. Loss of riparian habitat and potential habitat for local biota, including corridors and buffers.

Impact 2. Damage to riparian large trees or shrubs.

Impact 3. Fragmenting the riparian corridor by removing riparian bushes or riverbank vegetation and compromise the function of riparian continuity.

Activity 2. Raising of the right flank embankment

Aspect 2.2: Topping soil on the embankment

Impact 4. The covering of indigenous riverine vegetation will be associated with the construction of the berm and toe drain.

Impact 5. Covering the marginal vegetation on the embankment will lead to loss of potential habitat and biodiversity.

Impact **6.** Erosion of cleared areas will lead to siltation of the downstream aquatic habitat.

Aspect 1.3: Disturbance - Noise and movement

Impact **7.** Vehicle and human movement and sounds will disturb riparian fauna in the vicinity of the construction activities.

Aspect 1.4: Impacting the Ngodwana catchment seep on the western slope.

Impact 8. Impacting the flow and water quality of this near-pristine mountain stream due to construction activities.

Activity 2. Raising of the right flank embankment

Aspect 2.1: Vegetation clearing

Impact 9. Loss of riparian habitat and potential habitat for local biota, including corridors and buffers.

Impact 10. Erosion of dumped soil will lead to siltation of the downstream aquatic habitat.

Activity 3. Haul route – both sides of the river

Aspect 3.1: Vegetation clearing.

Impact 11. Removal of indigenous riparian vegetation, considering coves of White

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Stinkwood along the western haul route.

Aspect 3.2: Fragmentation or riparian corridor

Impact 12. Removal of indigenous riparian vegetation, considering coves of White Stinkwood along the western haul route.

Aspect 3.3: Impacting stream flow of the Ngodwana catchment seep on the western slope.

Impact 13: Impacting the flow and water quality of this near-pristine mountain stream due to construction activities.

Aspect 3.4: Erosion and siltation.

Impact 14**:** Disturbing the soil during the construction of roads, clearing areas and create bare patches, channelling storm water and road run-off, etc. will cause erosion and siltation of the river.

Activity 4. Site establishment area and footbridge.

Aspect 4.1: Vegetation clearing.

Impact 15: Loss of riparian habitat and potential habitat for local biota, including corridors and buffers.

Impact 16: Damage to large trees or shrubs.

Impact 17: Fragmenting the riparian corridor by removing riparian bushes or riverbank vegetation and compromise the function of riparian continuity.

Aspect 4.2: Erosion and siltation

Impact 18: Clearing of site establishment areas will create bare areas, channelling storm water and surface run-off, etc. which will cause erosion of sediment and resulting in the siltation of the river.

Activity 5. Alien invading vegetation

Aspect 5.1: Introduction of alien vegetation

Impact 19: Competition with indigenous vegetation - would impact adjacent plant communities and promote the invasion of alien species into the intact vegetation.

PHASE: OPERATION

Activity 6: Haul route – both sides of the river

Aspect 6.1: Dust

Impact 20: Dust may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants.

Activity 7: Alien invading vegetation.

Aspect 7.1: Spreading of alien vegetation

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact 21: Alien species are already present in the valley and will colonise any area of disturbance should they not be actively controlled.

Risk rating after mitigation: Impact 1 to 21 - all "Low" (4 confidence).

Summary

All the risk ratings have been classified as "Low". This rating indicates that the impacts of the proposed project on the ecology of all the project area drainage lines, will not be significant. The identified risk will thus not alter the PES of these reaches or the downstream ecology in any way should the prescribed control measures be adhered to.

Appendix E-A: Terrestrial Impact Assessment

The Environmental Evaluation concerns the riverine aspects of the delineated footprint (Regulated Zone) and the positioning of site camps in the terrestrial zone.
During the field study in the project area, a total of four units comprising untransformed vegetation/habitat and five units comprising transformed vegetation/habitat were identified. These nine units are listed below.

Vegetation units and land cover type:
- Untransformed vegetation/habitat

1. Legogote Sour Bushveld
2. Ngodwana River
3. Ngodwana Catchment Valley Bottom Wetland
4. Ngodwana Catchment Valley Seeps

- Transformed vegetation/habitat

Vegetation communities

The vegetation communities of the Ngodwana Dam study area are classified as the Legogote Sour Bushveld**, which has a conservation status of "Vulnerable" (**NSBA)**.** This vegetation type consists of open woodland of the hilly areas and valleys of the project area. A total of 48 indigenous plant species were recorded during fieldwork; as well as 8 exotic species, some declared alien invaders.

Conservation-important plant species listed for the quarter-degree grid 2530DA in the Mpumalanga Tourism & Parks Agency's (MTPA) threatened species database and the Environmental Screening Tool, listed 17 threatened species for the study- and surrounding area. None were encountered during the survey. Four riparian indicator plant species were observed in the riparian zone along the Ngodwana River during the survey.

Frog surveys

According to the 2004 Frog Atlas, the Ngodwana Dam project area is situated in the Sour Grassland Assemblage. The associated frog distribution maps confirms 18 frog species are expected to be present in the study area. Of these frog species it is anticipated that 17 species may reside in the project area, accommodated by potential habitat in the area.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Using distribution maps and habitat quality, two endemic species are expected to occur in the Ngodwana Dam project area:

- Raucous toad *(Sclerophrys capensis)*
- Gray's stream frog (*Strongylopus grayii*)

No threatened frog species are expected to occur in the area.

Reptiles

According to the distribution of reptiles in South Africa, 49 species have distribution ranges extending into the region. Of the 38 of these species that are expected to occur in the area, 37 species has adequate habitat available.

During surveys in July 2020, four of the expected reptile species were encountered in the Ngodwana Dam project area. Due to the fact that reptiles aestivates during the dry and cold winter months, the time of the year plays an important role regarding surveying reptiles. Therefore, the cold and dry winter weather during the survey explains their low numbers observed:

- Common dwarf gecko *(Lygodactylus capensis capensis)*
- Variable skink (*Trachylepis varia)*
- Rainbow rock skink (*Trachylepis margaritifer*)
- Striped skink (*Trachylepis striata*)

According to the South African Reptile Atlas, there are 10 endemic reptile species that have distribution ranges overlapping the study area, nine of these have the potential to occur here:

- Spotted dwarf gecko (*Lygodactylus ocellatus ocellatus*)
- Transvaal gecko (*Pachydactylus affinis*)
- Jacobsen's Thread Snake (*Leptotyphlops jacobseni*)
- Swazi rock snake (*Inyoka swazicus*)
- Western Natal green snake (*Philothamnus natalensis occidentalis*)
- Montane dwarf burrowing skink (*Scelotes mirus*)
- Large-scaled grass lizard *(Chamaesaura macrolepis)*
- Wilhelm's flat lizard (*Platysaurus intermedius wilhelmi*)
- Distant's ground agama (*Agama aculeata distanti*).

There are two threatened reptile species expected to occur in the area:

- Wilhelm's flat lizard (*Platysaurus intermedius wilhelmi*) - Conservation status for South Africa – Least concern; Conservation status for Mpumalanga – Near-threatened; Endemic – Mpumalanga.
- Large-scaled grass lizard *(Chamaesaura macrolepis)* - IUCN 2015: Near-threatened; SARCA 2015: Near-threatened.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

There is also one South African Threatened or Protected Species (TOPS) expected to be present in the region:

- Southern African python (*Python natalensis*).

Birds

During the July 2020 survey, a variety of biotopes and sites were surveyed for bird species, including both transformed and untransformed habitats. A total of 283 bird species were observed in this region during the Bird Atlas project. If bird distribution and local habitat are evaluated, it is clear that all the species of birds that are likely to utilise the different biotopes of the study area, can be present in the Ngodwana Dam and surrounding area. The July 2020 surveys produced a total of 44 bird species across all transects in the Ngodwana Dam project area.

Through comparisons with expected bird lists, a total of 23 bird species expected to be found in the area are listed as "Species of Special Concern". If bird distribution and local habitat are evaluated, all the Species of Special Concern birds are likely to utilise the different biotopes of the study area. Currently thirteen endemic bird species are expected to occur in the area:

- Southern Bald Ibis *(Geronticus calvus)*
- Forest Buzzard (*Buteo trizonatus*)
- Blue korhaan *(Eupodotis caerulescens)*
- Knysna Turaco (*Tauraco corythaix*)
- Ground Woodpecker (*Geocolaptes olivaceus*)
- Eastern Long-billed Lark (*Certhilauda semitorquata*)
- Cape Rock Thrush (*Monticola rupestris*)
- Sentinel Rock Thrush (*Monticola explorator*)
- Buff-streaked Chat (*Oenanthe bifasciata*)
- Chorister Robin-Chat (*Cossypha dichroa*)
- Yellow-breasted Pipit (*Anthus chloris*)
- Pied Starling *(Lamprotornis bicolor)*
- Greater Double-collared Sunbird (*Cinnyris afer*)

The following 15 threatened bird species have distribution ranges that correspond with the study area (IUCN, 2014; NEMBA, 2014; Red Data Book, 2015):

- African Crowned Eagle *(Stephanoaetus coronatus)* - IUCN 2015 Status: Near-threatened. SA Red Data (Taylor 2015): Vulnerable. NEMBA (TOPS 2007): Vulnerable species. Mpumalanga: Vulnerable.
- African Grass-owl *(Tyto capensis)* - SA Red Data (Taylor 2015): Vulnerable.
- Black-bellied Bustard (*Lissotis melanogaster*) - SA Red Data (Barnes 2000): Near-threatened.
- Black-winged Pratincole *(Glareola nordmanni)* - IUCN 2017 NT: Near-threatened; SA Red Data (Taylor 2015): Near-threatened. Conservation status for Mpumalanga – Near-

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

threatened.

- Blue korhaan *(Eupodotis caerulescens)* – IUCN (2018) Near-threatened.
- Cape Vulture *(Gyps coprotheres)* - IUCN 2015: EN Endangered; SA Red Data (Taylor 2015): Endangered. NEMBA TOPS (2015): Endangered species.
- Denham's Bustard *(Neotis denhami)* - IUCN 2017 NT: Near-threatened. NEMBA TOPS (2015): Vulnerable species; SA Red Data (Taylor 2015): Vulnerable.
- European Roller (*Coracias garrulus*) - SA Red Data (Taylor 2015): Near-threatened; IUCN 2018 Least concern.
- Gurney's Sugarbird (*Promerops gurneyi*) - IUCN (2018): Near-threatened.
- Lanner Falcon *(Falco biarmicus)* - SA Red Data (Taylor 2015): Vulnerable. IUCN 2017 Status: Least concern.
- Secretary bird (*Sagittarius serpentarius*) - IUCN 2017 VU Vulnerable; SA Red Data (Taylor 2015): Vulnerable. NEMBA (TOPS 2007): Vulnerable species.
- Southern Bald Ibis *(Geronticus calvus)* – IUCN 2017 VU: Vulnerable; SA Red Data (Taylor 2015): Vulnerable; NEMBA TOPS (2015): Vulnerable species; SA endemic.
- White-bellied korhaan (*Eupodotis caffra*) – SA Red Data (Taylor 2015): Vulnerable.
- Yellow-breasted Pipit (*Anthus chloris*) - IUCN 2017 Vulnerable. SA Red Data (Taylor 2015): Vulnerable.

Mammals

Of all the mammal species that have distribution ranges in the region, 109 coincide with the Ngodwana Dam project area. If local habitat are evaluated, it is clear that a total of all 109 species of mammals are likely to utilise the different biotopes of the study area. The larger species will be accommodated in the adjacent game reserve.

During the July 2020 survey, signs and/or sightings of 7 mammal species were recorded or reported by the staff in the area:

- Chacma baboon (*Papio ursinus*)
- Vervet monkey (*Cercopithecus aethiops*)
- Leopard (*Panthera pardus*)
- Black-backed jackal (*Canis mesomelas*)
- Bushpig *(Potamochoerus larvatus)*
- Nyala *(Tragelaphus angasii)*
- Greater Canerat *(Thryonomys swinderianus)*

After analysing the fauna distribution data and habitat availability, 17 frog species, 37 reptile species, 283 bird species and 109 mammal species are expected to occur in the project area, a total of 446 animal species. The presence of these different faunal groups is however dependent on availability of potential habitat types in each distinct biotope.

It is expected that 45 faunal Species of Special Concern that have a Medium to Optimal probability of occurring in the region, will frequent the Ngodwana Dam project area, periodically as nomads, or

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

permanent as inhabitants. If any threatened or near-threatened animal species are recorded within the study area in future, appropriate conservation measures should be developed in consultation with the relevant conservation authorities.

Screening Report

The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity. Following is an abstract from the Screening Tool application:

Sensitivity features of the project area.

Theme	Sensitivity	Feature
Agriculture Theme	Very High	Land capability; 12. High-Very high
Animal species theme	Medium	Mammalia - *Cercopithecus albogularis schwarzi* Mammalia - *Ourebia ourebi ourebi* Insecta - *Lepidochrysops irvingi* Insecta - *Serradinga clarki amissivallis* Insecta - *Lepidochrysops swanepoeli* Insecta - *Orachrysops violescens*
Aquatic biodiversity	Very High	Aquatic CBAs Strategic water source area Freshwater ecosystem priority area quinary catchments
Archaeological and Cultural Heritage Theme	High	Within 500 m of an important river
Plant Species Theme	Medium	Sensitive species 330
Terrestrial Biodiversity Theme	Very High	Vulnerable ecosystem Critical Biodiversity Area 1 Focus Areas for land-based protected areas expansion Freshwater ecosystem priority area quinary catchments Strategic Water Source Area

Sensitivity mapping

Sensitivity assessments identify those sections of the study area that have high conservation value or that may be sensitive to disturbance. The overall ecological value and sensitivity of the different vegetation and land cover types of the project area, are rated as follow:

Vegetation units and land cover type:

Untransformed vegetation/habitat

1. Legogote Sour Bushveld - **Very high**
2. Ngodwana River - **Very high**
3. Ngodwana Catchment Valley Bottom Wetland - **Very high**
4. Ngodwana Catchment Valley Seeps - **Very high**

Transformed vegetation/habitat

5. Old Mining - **Negligible**
6. Power Line Servitude - **Negligible**
7. Ngodwana Dam Wall - **Negligible**
8. Habitat impacted by Dam Wall Construction early 1980s - **Low**
9. Roads and pipelines - **Negligible**

The use of CBA maps in Environmental Impact Assessments

A CBA map of the study area was compiled by using the Biodiversity Geographic Information System (BGIS) maps. The key results of the Biodiversity Geographic Information System (BGIS) maps and LUDS Report are summarised below:

National terrestrial information: Ngodwana 638 and 1030 (Mpumalanga)

- Savanna Biome (Lowveld): SVI 9 Legogote Sour Bushveld - Threatened ecosystem status: Vulnerable
- Terrestrial CBA: Irreplaceable

Assessment of impacts and proposed mitigation

The potential impacts of the project on biodiversity of the study area are assessed under five broad impacts. The following list provides a summary of the impact assessment, indicating the changes from pre-mitigation to post mitigation.

Main Impact 1: The clearing of vegetation or covering of habitat in the project footprint area for construction purposes.

Many different areas will be cleared and covered during the proposed project construction period. By adhering to the main mitigation aspects, a “Medium” significance can be mitigated to a “Low” significance:

- Care must be taken not to impact on areas outside the demarcated route and unnecessary clearing of areas should also be avoided.
- Removing large trees should be avoided as far as possible.
- Whenever tall trees are removed on haul roads, these trees must be replaced in order to mimic the natural habitat impacted on.
- During site clearing, large trees should be left intact as they can become incorporated as shade and garden features in the site establishment areas.
- Refrain from fragmenting the riparian corridor by respecting the buffer zones.
- No indigenous plants of Special Concern must be impacted on.
- Indigenous vegetation should be planted during rehabilitation.
- Corridors and buffers must be respected and the riparian zone must not be disturbed at all.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Main Impact 2: Altering bed, banks or course of a watercourse.

The Ngodwana Dam project area surrounds a network of riverine wetland areas which could be impacted adversely by the proposed project activities. By adhering to the main mitigation aspects, a "Medium" significance can be mitigated to a "Low" significance:

- All riverine wetlands should be treated with care throughout the construction phase.
- Respect buffer zones.
- No covering of material or dumping of any rubble will be allowed into the wetland system.
- Water flow in drainage lines and wetland systems must not be obstructed.
- Construction activities inside the riparian buffer zone must proceed with special care.

Main Impact 3: Erosion and siltation.

Due to the proximity of the Ngodwana River and associated network of riverine wetland areas, erosion and siltation originating from construction activities could be impacted adversely by the proposed project activities. By adhering to the main mitigation aspects, a "Medium" significance can be mitigated to a "Low" significance:

- Best Practice measures should be implemented during construction and rehabilitation. Mitigation and management measures are to be specified in order to ensure that areas susceptible to potential erosion are protected both during the construction and operational phase of the development.
- Stringent mitigation measures must be imposed during construction to minimize runoff and stop possible silt run-off.
- The contamination of water leaving the site could be controlled by the use of silt-fencing, rows of hessian bags, mulch, brushwood and deflection berms.
- All areas susceptible to erosion must be identified and protection measures be implemented.
- In any areas where the risk of erosion is evident, appropriate temporary or permanent works and water energy dispersion structures must be installed.
- Cleared or bare areas prone to erosion should be monitored and rehabilitation should be implemented wherever indications of potential erosion become evident.

Main Impact 4: Noise, movement and dust.

Proposed construction activities over a period of time will result in noise, movement and dust which will impact negatively on local fauna and flora. By adhering to the main mitigation aspects, a "Medium" significance can be mitigated to a "Low" significance:

- The disturbance will be for a relative short period, no major activities other than routine maintenance should be allowed during the Operational Phase.
- All activities will be contained to the dam wall and roads leading tot the construction site.
- Workers should be restricted to the construction site.
- Dust incidences can be treated by either watering, alternative material choices or using dust binders.
- Alternatives include re-vegetation of temporarily exposed surfaces on which infrastructure will not be constructed.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Main Impact 5: Introduction of alien vegetation.

Proposed construction activities and transport of material into the project area have the potential to spread further and impact on indigenous plant communities in the area. By adhering to the main mitigation aspects, a "Medium" significance can be mitigated to a "Low" significance:

- All aggressive alien species should be removed.
- Footprint areas should be kept as small as possible when removing alien plant species.
- 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.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge.
- Implement an invasive alien plant management plan. The broad objectives of the plan include the following:
    - Ensure alien plants do not become dominant in parts of the site, or the whole site, through the control and management of alien and invasive species presence, dispersal and encroachment.
    - Develop and implement a monitoring and eradication programme for alien and invasive plant species.
    - Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

Appendix E-E & F: Traffic Route Assessments

N4 Traffic Study Findings

The following conclusions and recommendations are made from this study:

- It is proposed to rehabilitate Ngodwana Dam on Farms Roodewal 470 JT and Grootgeluk 477 JT, located along the N4, section 7X.
- The proposed rehabilitation process will require haulage of material along the N4.
- The proposed position of access at existing intersections will allow acceptable site distances (in excess of 300m).
- The existing peak hour traffic volumes along the N4 are low i.e. less than 500 veh/hr in both directions.
- The proposed haulage of material is expected to generate low peak hour trips (less than 10 trips/hr) and will have a negligible impact on the operating conditions along the surrounding road network.
- The proposed rock toe access should be controlled by means of a 1-way stop.
- Access to the site will be controlled (1 lane per direction) and it is recommended that a minimum of 30m queue storage space be provided.
- Dust control will be implemented on gravel haul roads.
- Haul of material be planned for the dry season.
- Haul of material be suspended in wet weather.
- Haul of material be suspended with notification from TRAC during peak seasonal traffic periods like Easter and start of school holidays, etc.

Considering the above, the proposed new haul route is supported from a traffic engineering point of view. Please do not hesitate to contact me should you wish to discuss any aspects of the

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

assessment or need any additional information.

Appendix E-C: Archaeological and Heritage Resources Impact Assessment

No sites of archaeological or heritage significance were located during the field survey. A total of fourteen survey orientation locations were documented (SO 1-14) which includes a GPS location and photographs of the landscape at that location. Surface visibility and access in certain areas was reduced due to very dense bush and undergrowth which included Lantana and sickle bush and dense thick grass cover. In terms of the archaeological component of the Act (25 of 1999, section 35) no sites were located or recorded in the study area. In terms of the built environment in the project area (section 34 of the Act) no sites were located or recorded in the study area.

In terms of burial grounds and graves (section 36 of the Act) no graves or gravesites were identified in the study area. It is not within the expertise of this report or the surveyor to comment on possible palaeontological remains which may be in the study area.

The bulk of archaeological remains are normally located beneath the soil surface. It is therefore possible that some significant cultural material or remains were not located during this survey and will only be revealed when the soil is disturbed. Should excavation or large-scale earth moving activities reveal any human skeletal remains, broken pieces of ceramic pottery, large quantities of sub-surface charcoal or any material that can be associated with previous occupation, a qualified archaeologist should be notified immediately. This will also temporarily halt such activities until an archaeologist has assessed the situation. It should be noted that if such a situation occurs it may have further financial implications.

Recommended management measures

Management objectives include not to impact on sites of heritage significance. Monitoring programmes which should be followed when a "chance find" of a heritage object or human remains occur, include the following:

- The contractors and workers should be notified that archaeological sites might be exposed during the construction work.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a museum, preferably one at which an archaeologist is available, so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;
- Under no circumstances shall any artefacts be removed, destroyed, or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological, or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999).

Appendix E-D: Palaeontological Impact Assessment

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the arenites, quartzites, sandstones and conglomerates are typical for the country and do not contain fossil plant, insect, invertebrate and vertebrate material. The

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

surface soils of the Quaternary period would not preserve fossils.

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the Black Reef Formation (basal Transvaal Supergroup). Based on the literature survey and more recent publications, the SAHRIS map needs to be updated to reflect this. However, in the interim and to satisfy SAHRA regulations a Fossil Chance Find Protocol should be added to the EMPr: if fossils of stromatolites are found once excavations for the remedial project have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

SECTION I: ENVIRONMENTAL IMPACT STATEMENT.

(I) an environmental impact statement which contains-

(i) a summary of the key findings of the environmental impact assessment:

Please refer to the Impact Assessment in Appendix D.

(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and

Please see Appendix A: Annexure A (Layout Map) & B (Site Sensitivity Map).

(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;

Please refer to the Impact Assessment in Appendix D.

SECTION M: IMPACT MANAGEMENT OBJECTIVES AND IMPACT MANAGEMENT OUTCOMES (EMPR).

(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr;

Please refer to the Impact Assessment and EMPr in Appendix D & F.

SECTION N: CONDITIONAL FINDINGS OF EAP AND SPECIALISTS.

(n) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

1. The holder of the authorisation must appoint an experienced independent Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation/rehabilitation measures and recommendations referred to in this environmental authorisation are implemented and to ensure compliance with the provisions of the approved EMPr.

2. An integrated waste management approach must be implemented that is based on waste minimisation and must incorporate reduction, recycling, re-use, and disposal where appropriate. Any solid waste, which will not be recycled, must be disposed of at a landfill licensed in terms of section 20 (b) of the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008).

3. A permit must be obtained from the relevant nature conservation agency for the removal or destruction of indigenous, protected or endangered plant or animal species and a copy of such permit/s must be submitted to the Department for record keeping.

5. A licence must be obtained from the Department of Water and Sanitation for any proposed decommissioning of a dam with safety risk under section 38 of the Regulations Regarding the Safety of Dams in terms of Section 123 (1) of the NWA.

6. Vegetation clearing must be kept to an absolute minimum. The proposed clearing of areas should not impact on any CBA or ESA features.

7. Mitigation measures must be implemented to reduce the risk of erosion and the invasion of alien species, in accordance with the approved EMPr.

8. The construction activities must be limited to approved footprints and vegetation clearing must be limited to these construction footprints.

9. Areas outside the approved construction footprints, including sensitive CBAs, ESAs, and buffer zones, must be clearly demarcated (using fencing and signage) before construction commences and must be regarded as 'no-go' areas. Contractors and construction workers must be clearly informed of the no-go areas.

10. To remedy degradation and fragmentation through rehabilitation and promote long-term persistence of taxa of special concern, rehabilitation must be done in accordance with the approved EMPr.

11. Integrating in situ biodiversity-sensitive management into the overall design and operation of the proposed land-use development.

12. Secure priority biodiversity in CBAs and ESAs through biodiversity stewardship.

Recommendations from Aquatic & Terrestrial Specialist

Conditions for inclusion in the environmental authorisation:

These conditions are based on the identification of mitigation measures and solutions that minimise impacts on biodiversity and conflicts in land-use by making use of use of CBA maps in the Environmental Impact Assessment. The steps used in this section correspond with the steps which are obtained from the Mpumalanga Biodiversity Sector Plan (2014).

a) Retain natural habitat and connectivity in CBAs and ESAs: Retain natural habitat and connectivity in CBAs and ESAs: The avoidance of environmentally sensitive areas identified during the Sensitivity

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Mapping exercise is regarded as the single most effective possible mitigation measure for mitigating impacts on the ecology of the project area.

(i) The proposed clearing of areas should not impact on any CBA or ESA features:

- The entire project footprint of the proposed project is situated in a Critical Biodiversity Area: CBA Irreplaceable (Terrestrial CBA). According to the categories in terms of management objectives and permissible land-uses (MBSP Handbook 2014), the establishment of roads and other linear structures are land-uses that will compromise the biodiversity objective and are not permissible.
- However, since most of the routes are planned on existing roads and tracks, these activities will probably not impact significantly on the ecology of the project area. If any of this CBA in the project footprint is earmarked for development (laydown areas, material stockpile, dam wall rehabilitation), it is suggested that the areas with some alien trees and areas cleared in the past should be utilised first.
- Implementing riverine buffer zones emphasize the importance of the drainage line and wetlands (important FEPA sub-catchment and Fish Support Area) will certainly augment the importance of the ecology in the project area.

(ii) Avoid environmentally sensitive areas identified on the Sensitivity Mapping exercise:

- With its "Very High" ecological value and sensitivity, the valley drainage lines, and its associated riparian zone should be protected against impacts emanating from the project area. By adding an 18-24m buffer around the entire riverine area in the vicinity and adhere to strict rules not to impact on the area inside the buffer, this sensitive area will be safe from further development and local impacts.
- None of the construction activities are planned in the riparian area and even roads to the project areas should be outside the riparian corridor, as the example in Figure 58 illustrates.

(iii) Wherever possible, sites must be chosen that have already been cleared or altered (old mining area, servitudes, existing tracks and roads, areas with invading alien trees and areas cleared in the past for construction).

- Avoid environmentally sensitive areas identified on the Sensitivity Mapping exercise. Wherever possible, choose sites that already have been cleared or altered (Heavily modified portions). Limit the removal of vegetation to the development footprint only.

(iv) Maximise connectivity in CBAs and ESAs, the retention of intact natural habitat and avoid fragmentation:

- The buffer around the valley drainage line will protect the connectivity of the riparian corridor. No new structures or development are planned that will compromise connectivity in CBAs and ESAs.

b. Apply the mitigation hierarchy:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

(i) Identify the best practicable environmental options by avoiding loss of biodiversity and disturbance to ecosystems, especially in CBAs, by applying the mitigation hierarchy and the land-use guidelines. In particular:

- Maximise connectivity in CBAs and ESAs, the retention of intact natural habitat and avoid fragmentation: No new structures or development are planned that will compromise connectivity in CBAs and ESAs. The project area will be connected to the game reserve around the dam area and fauna will be able to move into that extensive area to the west and the east during the height of the construction phase.
- Minimise unavoidable impacts: It is proposed that, when the footprint areas are cleared for construction, the clearing activities should be restricted to the designated areas, and that cleared vegetation should not be dumped on adjacent habitats or burned in areas not earmarked for clearing.
- Take opportunities to conserve biodiversity: At this stage of the development, none of the remaining project footprint is assigned to further development, and the valley with its buffered drainage line will match up with the Ngodwana Dam Nature Reserve without jeopardising the integrity of the reserve.
- Remedy habitat degradation and fragmentation through rehabilitation: After completion of the project, rehabilitation of the area presents opportunities to restore degraded areas (old mining and laydown areas). The current poor state the old mining area could be reversed when some topsoil will be left on the temporary stockpile area and planted with indigenous vegetation. The laydown areas can be converted into parks and picnic sites.
- Promote long-term persistence of taxa of special concern: By safeguarding the area not developed, the taxa of special concern will also be conserved, especially those species expected to be present.

c) Secure priority biodiversity in CBAs and ESAs through biodiversity stewardship:

(i) Set aside land of high biodiversity importance for conservation through biodiversity stewardship options. Where biodiversity losses are unavoidable, set aside another piece of land of equivalent or greater biodiversity importance for conservation:

- At this stage of the development, none of the remaining Ngodwana Dam project area is assigned to further development, and the near-natural Legogote Sour Bushveld and buffered drainage lines will match up with the Ngodwana Dam Nature Reserve without jeopardising the integrity of the reserve. By safeguarding the area not developed, the taxa of special concern will also be conserved, especially those species expected to be present.

d) Remedy degradation and fragmentation through rehabilitation:

(i) It is important that flows from the seepage wetlands are not interrupted and be allowed to connect with the mainstream without any obstructions.

e) Promote long-term persistence of taxa of special concern:

(i) By safeguarding the area not developed, the taxa of special concern will also be conserved, especially those species expected to be present. It is possible that species of special concern or species protected in terms of the Nature & Environmental Conservation Ordinance (19 of

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

1974) or the National Forest Act (Act 84 of 1998) occur within the work areas. Should there be any doubt regarding whether such a species exists, then no clearing of that species should take place without verification from the ECO.

f) Integrating *in situ* biodiversity-sensitive management into the overall design and operation of the proposed land-use development:

(i) To avoid unnecessary disturbance, vegetation clearing must be strictly contained to orchard areas and defined work areas. Cleared bush should be stockpiled and used for firewood. Only the excess must be stockpiled and burnt within the cleared area.
(ii) Retain as much native vegetation as possible. View the un-cleared areas as a resource to be conserved.

SECTION O: ASSUMPTIONS AND UNCERTAINTIES.

(o) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;

Addressed in the Impact Assessment.

SECTION P: REASONED OPINION

(p) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;

In consideration of the investigated cumulative impacts, the nature and extent of the proposed development, compliance with the relevant legal, policy and planning documentation (i.e. "need and desirability") and the findings of the specialist studies, it is the opinion of Ecoleges that the proposed remedial repairs to the SAPPI Ngodwana Dam is supported from an environmental perspective and should be considered for Environmental Authorisation, subject to the implementation of the identified recommendations.

SECTION Q: OPERATIONAL ASPECTS AND POST CONSTRUCTION MONITORING.

(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;

The EA must be valid for five (5) years which will allow adequate time for the conclusion of all remedial works which may run over several financial years to ensure adequate budget is available. Post-construction monitoring requirements are captured in the EMPr.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION R: APPOINTED INDEPENDENT EAP

(r) An undertaking under oath or affirmation by the EAP in relation to-

Report Information Accuracy.

(i) the correctness of the information provided in the report;

EAP AFFIRMATION.

Appendix 2 Section 3 (s) of the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of the National Environmental Management Act 107 of 1998, as amended - NEMA), require an undertaking under oath or affirmation by the Environmental Assessment Practitioner (EAP) in relation to;
(i) the correctness of the information provided in the reports;
(ii) the inclusion of comments and inputs from stakeholders and I&APs;
(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and
(iv) any information provided by the EAP to interested and affected parties and any

I, **Justin A. Bowers**, on behalf of Ecoleges, hereby affirm that all comments and inputs received from stakeholders, specialists, interested and affected parties have been accurately recorded herein and, insofar as comments and recommendations are relevant and practicable, accommodated in the final Environmental Impact Assessment Report submitted to the Competent Authority, thereby attaining a desirable level of agreement for undertaking the environmental impact assessment.

_____
Signature of the EAP

DATE: 28 October 2020

Stakeholder and Interested and Affected Parties Feedback.

(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and

Please refer to the Public Participation Process in Appendix C.

Specialist Report findings and recommendations.

(iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and

Please refer to the Public Participation Process in Appendix C.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Comments and Response between EAP and Interested and Affected Parties.

(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;

Please refer to the Public Participation Process in Appendix C.

SECTION S: FINANCIAL PROVISION[S] FOR REHABILITAION, CLOSURE AND DECOMMISSIONING.

(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;

N/A, any decommissioning activity will require both a new environmental and water use authorisation process.

SECTION T: COMPETENT AUTHORITY SPECIFIC INFORMATION

(t) any specific information required by the competent authority; and

Specific Information:
Any requirements received from the Competent Authority will have been addressed in the Final BAR.

SECTION U: OTHER INFORMATION REQUIRED BY REGULATIONS

(u) any other matter required in terms of section 24(4)(a) and (b) of the Act.

Other Information:

N/A.

(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to an environmental impact assessment report the requirements as indicated in such notice will apply.

Noted.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

BIBLIOGRAPHY

Bamford, M. 2020. Desk Top Study (Phase 1) Palaeontological Impact Assessment for the proposed remediation project for Ngodwana Dam, Mpumalanga Province dated 1st June 2020.

DEA .2011. National list of ecosystems that are threatened and in need of protection. GN 1002, GG 34809, 9 December 2011.

DEA. 2010. Guideline on Need and Desirability, Integrated Management Guideline Series 9, Department of Environmental Affairs (DEA), Pretoria, South Africa.

DEA. 2010. Public Participation 2010, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs, Pretoria, South Africa.

Deacon, A. August 2020. An ecological assessment regarding the Environmental and Water Use Authorisation for remedial work required on the SAPPI Ngodwana Dam. Mpumalanga.

Deacon, A. August 2020. The Present Ecological State of the water courses in the proposed project area: Ecological Risk Assessment Process. Mpumalanga.

DEA&DP. 2010. Guideline on Alternatives, EIA Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP).

DEAT. 2002. Specialist Studies, Information Series 4, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT. 2004. Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria).

DWA. 2007. Guideline for Developments within a Flood line (Edition 1), Department of Water Affairs and Forestry, Pretoria, South Africa.

DMV Nelspruit Incorporated. 2020. SAPPI Ngodwana Dam Rehabilitation: Request for Approval of a Haul Route along Eland Valley Section 7X of N4 dated 11th August 2020. Nelspruit, Mpumalanga.

DMV Nelspruit Incorporated. 2020. Preliminary Assessment of Haul Roads for SAPPI, Ngodwana Dam Rehabilitation. Nelspruit, Mpumalanga.

Kudzala Antiquity CC, (2020) Phase 1 Archaeological and Heritage Impact Assessment on the farm Ngodwana 1030 JT in respect of proposed Remediation work to the Ngodwana Dam, Mpumalanga Province dated 10th July 2020. Lydenburg, Mpumalanga.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

SECTION N: APPENDICES

APPENDIX A: SITE PLAN(S)

Annexure A Site Layout Map
Annexure B Site Sensitivity Map
Annexure C Title Deed

APPENDIX B: TECHNICAL REPORT

Annexure A: Ngodwana Dam Remediation Design Report
Annexure B: Annual Dam Safety Report 2019
Annexure C: Compulsory 7-Yearly Dam Safety Report

APPENDIX C: PUBLIC PARTICIPATION PROCESS

Annexure A: Level of public participation
Annexure B: Site notice text
Annexure C: Proof of displayed notice boards
Annexure D: Background Information Document (BID) text
Annexure E: Proof of distributed Background Information Document (BID)
Annexure F: Advertisement text
Annexure G: Proof of placed advertisement
Annexure H: List of Registered Interested and Affected Parties
Annexure I: Comment and Response Sheet
Annexure J: Copies of Comments Received

APPENDIX D: IMPACT ASSESSMENT

Annexure A: Impact Assessment
Annexure B: Impact Score Sheet

APPENDIX E: SPECIALIST REPORTS

Annexure A: Terrestrial Impact Assessment Report
Annexure B: Aquatic Impact Assessment Report
Annexure C: Archaeological and Heritage Resources Impact Assessment Report
Annexure D: Palaeontological Impact Assessment Report
Annexure E: N4 Traffic Impact Study Report
Annexure F: Haulage Route Assessment Report

APPENDIX F: ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT (EMPR)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

APPENDIX A: SITE PLAN(S)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure A: Site Layout Map

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure B: Site Sensitivity Map

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure C: Title Deed

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

APPENDIX B: TECHNICAL REPORTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure A: Preliminary Dam Remediation Design Report

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure B: Annual Dam Safety Report 2019

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure C: Compulsory 7-yearly Dam Safety Report

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

APPENDIX C: PUBLIC PARTICIPATION PROCESS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure A: Level of public participation

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure B: Site notice text

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure C: Proof of displayed notice boards

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure D: Background Information Document (BID) text

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure E: Proof of given Background Information Document (BID)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure F: Advertisement text

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure G: Proof of placed advertisement

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure H: List of Registered Interested and Affected Parties

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure I: Comment and Response Sheet

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure J: Copies of Comments Received

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

APPENDIX D: IMPACT ASSESSMENT

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure A: Impact Assessment

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure B: Leipoldt Matrix

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

APPENDIX E: SPECIALIST REPORTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure A: Terrestrial Ecology Assessment

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure B: Aquatic Ecology Assessment

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure C: Heritage & Archaeological Assessment

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure D: Paleontological Assessment

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure E: Traffic Study on N4

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Annexure F: Haul Road Assessment

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23

APPENDIX G: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat., MGSSA) & S.D. MacGregor (MSc., Pr.Sci.Nat.)
Reg: 2006/023163/23