UMGENI WATER

PROPOSED CONSTRUCTED WETLAND, DARVILL WASTE WATER TREATMENT WORKS, PIETERMARITZBURG, KWAZULU-NATAL

VEGETATION ASSESSMENT

FINAL REPORT

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SPECIALIST REPORT DETAILS

This report has been prepared as per the requirements of Section 32 of Government Notice No. R. 983 dated December 2014 (Environmental Impact Assessment Regulations) under sections 24(5), 24M and 44 of the National Environmental Management Act, 1998 (Act 107 of 1998).

I, declare that this report has been prepared independently of any influence or prejudice as may be specified by the Department Economic Development, Tourism and Environmental Affairs (EDTEA).

Signed: Date:

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FINAL REPORT

1. INTRODUCTION

SiVEST Environmental Division has been appointed by Umgeni Water (PTY) LTD, to conduct a vegetation assessment for the proposed construction, in terms of Regulation 13 and Appendix 6 of the Regulations compiled in terms of Chapter 3 of the Environmental Impact assessment Regulations (2014) of the National Environmental Management Act, 1998 (Act 107 of 1998) as amended December 2014. The Competent Authority (CA) for this project will be the Department of Environmental Affairs (DEA).

2. PROJECT DESCRIPTION & MOTIVATION

The Darvill Waste Water Treatment Plant (WWTP) in Pietermaritzburg, KwaZulu-Natal (Appendix 1), is currently being upgraded. However, the completed upgrade of the WWTP will still be unable to accommodate the periodic high storm water flow volumes. To alleviate the impacts associated with these storm flow events, Umgeni Water (UW) have considered the use of wetland habitat to partially treat the overflows from the storm flow storage dam. The proposed constructed wetland is 9.34 hectares in extent.

3. REGULATIONS GOVERNING THIS REPORT & LEGISLATION

Further to the Terms of Reference, the following protocol is extracted from the National Environmental Management Act, Act 108 of 1998 (NEMA) as amended in 2014. The relevant Section is included below for your ease of reference:

Specialist reports and reports on specialised processes

(1) An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.

(2) The Person referred to in sub-regulation (1) must comply with the requirements of Regulation 17.

(3) A specialist report or a report on a specialised process prepared in terms of these Regulations must contain –

(a) details of –

(i) the person who prepared the report; and

(ii) the expertise of that person to carry out the specialist study or specialised process;

(b) a declaration that the person is independent in a form as may be specified by the competent authority;

(c) an indication of the scope of, and the purpose for which, the report was prepared;

(d) a description of the methodology adopted in preparing the report or carrying out the specialised process;

(e) a description of any assumptions made and any uncertainties or gaps in knowledge;

(f) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;

(g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;

(h) a description of any consultation process that was undertaken during the course of carrying out the study;

(i) a summary and copies of any comments that were received during any consultation process; and

(j) any other information requested by the competent authority.

In addition there are various Sections of the legislation that would be applicable to the proposed development and / or the land as it currently is.

3.1 National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, *inter alia*, that:

"Development must be socially, environmentally, and economically sustainable",

"Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied."

"A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions",

NEMA also states that;

"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."

3.2 NATIONAL FORESTS ACT (ACT NO. 84 OF 1998)

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that;

"No person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister."

Any disturbance, removal, pruning or transplanting of these species would require a licence from the administrators of the National Forests Act, who are an extension of the Department of Agriculture, Forestry and Fisheries (DAFF) based in Pietermaritzburg.

3.3 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT NO. 10 OF 2004)

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).

- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.

- Limit further loss of biodiversity and conserve endangered ecosystems.

3.4 CONSERVATION OF AGRICULTURAL RESOURCES (ACT NO. 43 OF 1983) AS AMENDED IN 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

Category 1 *plants: are prohibited and must be controlled.*

Category 2 *plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.*

Category 3 *plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.*

3.5 PERMIT / LICENCE REQUIREMENTS

In terms of the National Forests Act, 1998 (Act No. 84 of 1998) and Government Notice 1339 of 6 August 1976 (promulgated under the Forest Act, 1984 (Act No. 122 of 1984) for protected tree species), the removal, relocation or pruning of any protected plants will require a license.

Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation. In KZN the relevant statute is the 1974 Provincial Nature Conservation Ordinance. In terms of this Ordinance, a permit must be obtained from *Ezemvelo KZN* Wildlife to remove or destroy any plants listed in the Ordinance. However, the list for Specially Protected Species in KwaZulu-Natal was (1974) has become very difficult to interpret and to apply to the plant species recorded during vegetation surveys. This is because of major taxonomic changes in the petalloid monocots. It must be noted that this list is in urgent need of an update. Therefore subjective decisions regarding a species protection status have to be taken which may not always be in agreement with the 1974 Ordinance.

4. SAMPLING METHODOLOGY

4.1 Vegetation Sampling

Liandra Bertolli of **SiVEST Environmental Division** undertook the ground-truthing assessment of the vegetation on the 24th November 2015 and the 6th of January 2016. A random vegetation sampling technique and "hotspot[1]" assessment technique was utilised, which focused the sampling effort on areas with natural vegetation or where the vegetation was dominated by indigenous species (i.e. not comprising a large proportion of alien invasive plant species). Individual plant species observed during the assessment were recorded to give an indication of species diversity and the overall species assemblage.

Please note that the intensity of the sampling procedure is prescribed by budgetary constraints. The sampling procedure proposed for this study is satisfactory for providing a general overview and rapid assessment of the plant diversity and assemblages that occur along the proposed road upgrade site. This methodology allows sufficient information to be gathered to make the necessary inferences as to the ecological state of the receiving environment and to assess the possible impacts that may be imparted as a result of the proposed activities.

[1] **Hotspot in this context refers to areas in the landscape, such as rocky outcrops and wetlands that supply refugia to plant species that would otherwise not exist in said landscape due to disturbance**.

4.2 Conservation Importance Assessment

Within the context of this vegetation assessment, conservation importance is broadly defined as the importance of the encountered vegetation communities (vegetation fragment) as a whole, in terms of the role these areas will fulfil in the preservation and maintenance of biodiversity in the local area. Biodiversity maintenance / importance are a function of the specific biodiversity attributes and noteworthiness of the vegetation communities in question and the biotic integrity and future viability of these features.

The biodiversity noteworthiness of the system is a function of the following:

- species richness/diversity;
- rarity of the system;
- conservation status of the system;
- habitat (real or potential) for Red Data Species; and
- presence of unique and/or special features,

The integrity and future viability of the system is a function of the following:

- Extent of buffer around the system;
- Connectivity of system to other natural areas in the landscape;
- Level of alteration to indigenous vegetation communities within the system;
- Level of invasive and pioneer species encroachment system; and
- Presence of hazardous and/or obstructive boundaries to fauna.

The scores for each function of biodiversity maintenance were determined according to the scoring system shown in **Table 1** below. The scores were totaled and averaged to determine the biodiversity maintenance services score. Thereafter, the overall scores were rated according to the rating scale in **Table 2** below.

Table 1. Biodiversity maintenance services score sheet (Template and Description)

Biodiversity Noteworthiness	**Scores**				
	0	**1**	**2**	**3**	**4**
Diversity	Low	Med-Low	Medium	Med-High	High
Rarity	Low	Med-Low	Medium	Med-High	High
Conservation Status	Least Concern	Near-Threatened	Vulnerable	Endangered	Critically Endangered
Red Data	No	-	-	-	Yes
Uniqueness / Special features	None	Med-Low	Medium	Med-High	High

Integrity & Future Viability	0	1	2	3	4
Buffer	Low	Med-Low	Medium	Med-High	High
Connectivity	Low	Med-Low	Medium	Med-High	High
Alteration	>50%	25-50%	5-25%	1-5%	<1%
Invasive/pioneers	>50%	25-50%	5-25%	1-5%	<1%
Size	<1 ha	1 – 2 ha	3 - 10 ha	10 – 15 ha	>15 ha

Table 2. Rating Scale for Biodiversity Maintenance services based on Assessment scores

Score:	0-0.8	0.9-1.6	1.7-2.4	2.5-3.2	3.3-4.0
Rating of the likely extent to which a service is being performed	Low	Moderately Low	Intermediate	Moderately High	High

5. DESKTOP ASSESSMENT

One of the major advantages that technology has provided is the access to information. As a result of this and the ongoing pursuance of environmental knowledge, databases which can be interrogated to provide general information regarding the site have been developed.

This information in turn potentially records what may occur on the site and the sites value from a regional / provincial perspective in terms of conservation and biodiversity.

The caveat here is that the majority of these databases are created at a landscape level. In addition, the factors which are often utilised to determine many of the outputs are related to abiotic characteristics, such as;

- Rainfall;
- Temperature;
- Soil types;
- Underlying geology, and;
- Elevation and aspect.

The result, therefore, is the development of a database that provides a high level assessment of the area, which requires substantial ground-truthing to illustrate the various components that comprise the landscape. The field survey may highlight areas of conservation significance and biodiversity richness as well as provide information regarding the *status quo;* and what consequences or concerns may be generated as a result of a proposed development.

A number of databases have been interrogated in the process of undertaking the Desktop Analysis. A summary of the methodology utilised for the generation of each of the databases are included below:

5.1 Ezemvelo KZN wildlife C-Plan & SEA Database

The C-Plan is a systematic conservation-planning package that runs with the GIS software ArcGIS, and which analyses biodiversity features and landscape units. C-Plan is used to identify a national reserve system that will satisfy specified conservation targets for biodiversity features (***Ezemvelo* KZN Wildlife, 2010**). Biodiversity features can be land classes or species, and targets are set within area units either for land classes, or as numbers of occurrences of species for species locality data sets (***Ezemvelo* KZN Wildlife, 2010**). These units or measurements are used as surrogates for un-sampled data. The C-Plan is an effective conservation tool when determining priority areas at a regional level and is being used in South Africa to identify areas of high conservation value. The SEA (**Goodman, 2004**) modelled the distribution of a selection of 255 red data and endemic species that have the potential to occur in the area.

5.1.1 Irreplaceability Analysis

The following is referenced from **Goodman (2004)**:

The first product of the conservation planning analysis in C-Plan is irreplaceability map of the planning area, in this case the province of KwaZulu-Natal. This map is divided into grid cells called 'Planning Units'.

Each planning unit has associated with it an 'Irreplaceability Value', which is a reflection of the planning units' importance with respect to the conservation of biodiversity. Irreplaceability reflects the planning unit's ability to meet set 'targets' for selected biodiversity 'features'. The irreplaceability value is scaled between 0 and 1.

Irreplaceability value – 0. Where a planning unit has an irreplaceability value of 0, all biodiversity features recorded here are conserved to the target amount, and there is unlikely to be a biodiversity concern with the development of the site.

Irreplaceability value – 1. These planning units are referred to as totally irreplaceable and the conservation of the features within them is critical to meet conservation targets. (EIA very definitely required and depending on the nature of the proposal unlikely to be granted).

Irreplaceability value > 0 but < 1. Some of these planning units are still required to meet biodiversity conservation targets. If the value is high (e.g. 0.9) then most units are required (few options available for alternative choices). If the value is low, then many options are available for meeting the biodiversity targets. (EIA required and depending on the nature of the proposed development, permission could be granted)."

The irreplaceability units have been optimised further to create various subcategories called *Critical Biodiversity Areas* and *Ecological Support Areas* (***Ezemvelo* KZN Wildlife, 2014).**

5.1.2 Critical Biodiversity Areas

Critical Biodiversity Areas (CBAs) can be divided into two subcategories, namely *Irreplaceable* and *Optimal*. Each of these can in turn be subdivided into additional subcategories (**Table 3**). The CBA categories are based on the optimised outputs derived using systematic conservation planning software, with the Planning Units (PU) identified representing the localities for which the conservation targets for one or more of the biodiversity features contained within can be achieved.

The distribution of the biodiversity features is not always applicable to the entire extent of the PU, but is more often than not confined to a specific niche habitat e.g. a forest or wetland reflected as a portion of the PU in question. In such cases, development could be considered within the PU if special mitigation measures are put in place to safeguard this feature(s) and if the nature of the development is commensurate with the conservation objectives. Obviously this is dependent on a site by site, case by case basis.

Using C-Plan, areas are identified through the MINSET analysis process and reflect the negotiable sites with an Irreplaceability score of less than 0.8. Within the C-Plan MINSET analysis this does not mean they are of a lower biodiversity value. It simply means more options are available for the safeguarding of sensitive or important features over and above the required conservation targets (e.g. 30% of a certain vegetation type remains and the conservation target is 25%). The determination of the spatial locality of these PU's is driven primarily by the Decision Support Layers.

Table 3. Summary of CBA Categories (from *Ezemvelo* KZN Wildlife, Biodiversity Spatial Planning Terms).

Category	C-Plan	MARXAN	Expert Input/ Desktop	Biodiversity Sector and Regional Plans
CBA: Irreplaceable (SCA)	Irreplaceability = 1	No equivalent		CBA: Irreplaceable
CBA: High Irreplaceable(SCA)	Irreplaceability Score >= 0.8 and <1.0	Selection frequency value = 80% –100%		CBA: Irreplaceable
CBA: Irreplaceable Expert Input			Expert input	CBA: Irreplaceable
CBA: Irreplaceable Linkage			Desktop and expert input	CBA: Irreplaceable
CBA: Optimal (SCA)	Irreplaceability Score > 0 and < 0.8	"Best" solution from MARXAN runs less the identified CBA High Irreplaceability areas		CBA: Optimal
CBA: Optimal, High Degradation	Irreplaceability Score > 0 and < 0.8	"Best" solution from MARXAN runs less the identified CBA High Irreplaceability areas	Field Assessment	CBA: Optimal
CBA: Optimal Low Degradation	Irreplaceability Score > 0 and < 0.8	"Best" solution from MARXAN runs less the identified CBA High Irreplaceability areas	Field Assessment	CBA: Optimal
CBA: Optimal Expert Input			Expert input	CBA: Optimal

5.1.3 Ecological Support Areas

Ecological Support Areas (ESAs) are required to support and sustain the ecological functioning of Critical Biodiversity Areas (CBAs). For terrestrial and aquatic environments, these areas are functional but are not necessarily pristine natural areas. They are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs, and contribute significantly to the maintenance of Ecological Infrastructure[2] (EI).

[2] **A term referring to areas in the landscape which provide significant Ecosystem Services which contribute positively to the economy and human welfare. Examples include 'Flood mitigation' and 'Good Water Quality' (provided both by wetlands and well maintained water catchments). Ecological infrastructure is the stock of functioning ecosystems that provides a flow of essential system services to human communities – services such as the provision of fresh water, climate regulation and soil formation. Ecological infrastructure includes features such as healthy mountain catchments, rivers, wetlands, and nodes and corridors of natural grassland habitat which together form a network of interconnected structural elements within the landscape. If this ecological infrastructure is degraded or lost, the flow of ecosystem services will diminish and ecosystems will become vulnerable to shocks and disturbances, such as the impacts of climate change, unsustainable land use change and natural disasters like floods and droughts. It is important to note that when ecological infrastructure is degraded or fails, the direct monetary cost to society and government is often very high. Ecological infrastructure is, therefore, the nature-based equivalent of hard**

5.1.4 Landscape Corridors

A series of bio-geographic corridors were created in KZN to facilitate evolutionary, ecological and climate change processes to create a linked landscape for the conservation of species in a fragmented landscape.

5.1.5 Local Corridors

Corridors were developed at a district scale to create fine scale links within the landscape that facilitate ecological processes and ensure persistence of critical biodiversity features.

5.1.6 SEA, C-Plan and CBA Biodiversity Features / Species within Project Area

In terms of the desktop analysis undertaken, the site is classified as 0.005, i.e. all biodiversity features recorded here are conserved to the target amount, and there is unlikely to be a biodiversity concern with the development of the site. The Minset analysis mirrors the C-Plan data with the irreplaceable area being deemed as not requiring protection.

There are several features present within the footprint which are considered to be of environmental significance and conservation importance. These features have been generated as a result of running the SEA data. These are included in **Table 4** below.

In terms of the Minset/ C-Plan data generated, through the physical characteristics that are present on site, the species have been identified as potentially present on the site, and these groups are wholly significant in terms of conservation significance or parts thereof. **Table 5** below identifies which species are significant

Table 4. SEA Data taken from Ezemvelo KZN Wildlife

YES	NO
Wetlands	Frogs
Birds	Medicinal Plants
Invertebrates	Forests

infrastructure, and is just as important for providing the vital services that underpin social development and economic activity.

Mammals	Grasslands
	Protected Plants
	Reptiles

Table 5. Minset / C-Plan Data taken from Ezemvelo KZN Wildlife

SPECIES NAME	TYPE
Euonyma lymneaeformis	Mollusc
Doratogonus natalensis	Millipede
Doratogonus peregrinus	Millipede

The CBA data **(Appendix 2)** indicates that the site is largely natural land.

5.2 Bio Resource Units (BRU)

A Bioresource Unit is a demarcated area in which the environmental conditions such as soil, vegetation, climate and, to a lesser degree, terrain form, are sufficiently similar to permit uniform recommendations of land use and farm practices to be made, to assess the magnitude of crop yields that can be achieved, to provide a framework in which an adaptive research programme can be carried out, and to enable land users to make correct decisions **(Camp, K.G.T. 1998)**.

The environmental factors defined in a BRU should give an indication of habitat suitability for both plant and animal species. On the other hand, knowing the habitat requirements of any particular species, it should be possible to map locations suitable for such species. There are 590 BRUs in KwaZulu-Natal, the

5.3 Bioresource Unit within the project are

5.3.1 Vb 14 – Pietermaritzburg, Dry Coast Hinterland

The vegetation pattern is comprised entirely of Grassland.

The rainfall average is 786 mm per year. The mean temperature is 18.2 ^{0}C and the climate rating is C4, which has a moderate to severe limitation on crop growing. There is a light frost hazard and the erosion rating for the site is 4.7, which translates to a high risk of erosion (**Table 6**).

There is 1 perennial river identified for this BRU. Please note there are a number of drainage lines, non-perennial streams and wetlands that are not captured at the coarse level at which this data has been defined.

Table 6 Climate Table for Dry Coast Hinterland

	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RAINFALL													
Median rainfall (mm)	756	124	113	102	42	16	7	6	19	37	81	98	111
Mean rainfall (mm)	786	145	112	99	44	23	9	11	27	48	75	87	106
TEMPERATURE													
Average (degrees C)	18.2	21.9	22.1	21.2	18.7	15.8	13.2	13.4	15.2	17.4	18.4	19.6	21.3
Minimum (degrees C)	11.8	16.8	16.9	15.7	12.5	8.5	5.3	5.4	7.4	10.5	12.4	14.3	15.8
Maximum (degrees C)	24.6	27.1	27.3	26.8	24.8	23.0	21.2	21.5	22.8	24.4	24.3	25.1	26.8
SUNSHINE													
Hours/day (Oct-Mar)	6.4												
Mean annual (hours)	6.9												

5.4 Environmental Potential Atlas

The following is referenced from the Department of Environmental Affairs and Tourism (2007): The Environmental Potential Atlas (ENPAT) developed from a single map of Gauteng to a complete spatial data set of the entire South Africa.

ENPAT was updated in July 2001 and is used by the National Department of Environmental Affairs and Tourism and various provincial environmental management departments as a decision-making tool in the process of environmental impact assessments. ENPAT includes the decision-making parameters such as: high-risk development category indications and potential impacts are linked to the 1:250 000 spatial databases on national and provincial level.

The main purpose of ENPAT is to proactively indicate potential conflicts between development proposals and critical or sensitive environments. ENPAT can also be used for development planning since it indicates the environment's potential for development.

ENPAT consists of two distinct, parallel sets of information: natural or environmental characteristics, and social-economic factors. The environmental character maps depict geology, land types, soils, vegetation, and hydrology. The socio-economic factors consist of land cover, cadastral aspects and infrastructure, land use and culture.

These two sets of information are combined and assessed in terms of their potential or latent environmental sensitivity. Sensitivity is assigned based on the ability of a resource to absorb change or

impact. A value of **0** indicates a **low sensitivity** - thus a high ability to accept change and a value of **1** indicates a **high sensitivity**, or a low ability to accept change. Areas of low sensitivity are thus available or suitable for development.

5.4.1 ENPAT Data for the project area

The ENPAT data provides the following information about the soils and geology for the site:

The geology of the site is comprised of mainly shale of the Pietermaritzburg Formation, Ecca Group with alluvium and small areas of dolerite and Tillite of the Dwyka Formation, which is not sensitive to disturbance and development. The soils are plinthic catena: dystrophic and/or mesotrophic; red soils not widespread (Department of Environmental Affairs and Tourism 2007).

5.5 Vegetation Assessment

5.5.1 Mucina and Rutherford's Vegetation Assessment

Mucina and Rutherford present an up-to-date and comprehensive overview of the vegetation of South Africa and the two small neighbouring countries of Lesotho and Swaziland. This account is based on vegetation survey using appropriate tools of contemporary vegetation mapping and vegetation description. They aimed at drawing a new vegetation map that depicts the complexity and macro-scale ecology and reflects the level of knowledge of the vegetation of the region. This is an extensive account of the vegetation of a complex and biologically intriguing part of the world, offering not only insights into structure and dynamics of the vegetation cover, but containing a wealth of base-line data for further vegetation- ecological, biogeographical, and conservation-oriented studies. The map and the descriptive account of the vegetation of South Africa, Lesotho and Swaziland offers a powerful decision-making tool for conservationists, land and resource planners, and politicians as well as the interested public at large. KwaZulu-Natal (KZN) province is rich in natural diversity. In terms of vegetation, the site falls within the Indian Ocean Coastal Belt of the Savanna Biome.

In terms of the vegetation on site, the general classification is made at a very coarse scale, i.e. low resolution and falls within the KwaZulu-Natal Ngongoni Veld (SVs 4) vegetation type.

Distribution

KwaZulu-Natal and Eastern Cape Provinces: From Melmoth in the north to near Libode in the former Transkei (including Eshowe, New Hanover, Camperdown, Eston, Richmond, Dumisa, Harding, Lusikisiki and the Libode area). Altitude 400–900 m.

Conservation

The vegetation type is considered Vulnerable, with a conservation target of 25%. Only less than 1% of the unit is statutorily in the Ophathe and Vernon Crookes Nature Reserves. Some 39% has been transformed for cultivation, plantations and urban development.

5.5.1.1 Indicative Plant Species

Small Trees: *Acacia natalitia*, *A. nilotica*, *Acacia sieberiana* var. *woodii.*
Low Shrubs: *Agathisanthemum bojeri, Euryops laxus, Gnidia anthylloides*.
Graminoids: *Aristida junciformis* subsp. *junciformis, Bothriochloa insculpta, Eragrostis curvula, Hyparrhenia hirta, Panicum maximum, Paspalum scrobiculatum, Sporobolus africanus, S. pyramidalis, Themeda triandra.*
Herb: *Chamaecrista mimosoides, Conostomium natalense, Gerbera ambigua, Helichrysum allioides, Hermannia grandistipula, Pentanisia prunelloides, Selago tarachodes, Senecio exuberans, Vernonia galpinii.*
Geophytic Herb: *Hypoxis argentea, Watsonia densiflora.*
Succulent Herb: *Aloe minima.*

5.5.2 KwaZulu – Natal Vegetation Types (KZN VT)

The KZN VT was created to provide an accurate representation of the historical extent of the vegetation types present in KZN with the most current available information. A key issue of concern is our current lack of knowledge regarding the historical extents of both our wetland and forest biomes. Almost all vegetation mapping conducted currently only displays the current extent of the feature in question. As such, no true understanding as to rates of loss and or minimum required habitat areas required to ensure persistence can be accurately determined. This issue further influences our understanding of the grassland/savannah/bushland matrix within which these features reside. The KZN VT map has undergone several changes since the publication of the Mucina and Rutherford (2006) national vegetation types.

Ezemvelo KZN Wildlife has, in association with various government departments, NGOs, Working Groups and Forums, municipalities and parastatals, refined the KZN VT to develop an accurate representation of the extent of the vegetation types present. As a result of the finer scale mapping and classification, KZN VT map has in some cases identified new vegetation types and or subtypes within the vegetation types identified at national level. These changes have been peer reviewed and adopted by the National Vegetation Committee, and have been incorporated into the revised South African Vegetation map. At this time there has been no revision of the Mucina and Rutherford (2006) national vegetation types for this area, thus the Mucina and Rutherford (2006) national vegetation type, SVs 4 stands.

5.6 National Freshwater Ecosystem Priority Areas (NFEPA)

NFEPA was a three-year partnership project between South African National Biodiversity Institute (SANBI), CSIR, Water Research Commission (WRC), Department of Environmental Affairs (DEA), Department of Water Affairs (DWA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks) **(Van Deventer *et al.* 2010)**. NFEPA map products provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs.

FEPA maps and supporting information form part of a comprehensive approach to sustainable and equitable development of South Africa's scarce water resources. They provide a single, nationally consistent information source for incorporating freshwater ecosystem and biodiversity goals into 2 planning and decision-making processes. For integrated water resource management, the maps provide guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the National Water Act (Act No. 36 of 1998; RSA, 1998a). FEPA maps are therefore directly applicable to the National Water Act, feeding into Catchment Management Strategies, classification of water resources, reserve determination, and the setting and monitoring of resource quality objectives. FEPA maps are also directly relevant to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004; RSA, 2004) (hereafter referred to as the Biodiversity Act), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act. FEPA maps support the implementation of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003; RSA, 2003) (hereafter referred to as the Protected Areas Act) by informing the expansion of the protected area network. They also inform a variety of other policies and legislation that affect the management and conservation of freshwater ecosystems, including at the municipal level.

FEPAs are strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for conserving ecosystems and associated biodiversity of rivers, wetlands and estuaries.

FEPAs are often tributaries and wetlands that support hard-working large rivers, and are an essential part of an equitable and sustainable water resource strategy. FEPAs need to stay in a good condition to manage and conserve freshwater ecosystems, and to protect water resources for human use. This does not mean that FEPAs need to be fenced off from human use, but rather that they should be supported by good planning, decision-making and management to ensure that human use does not impact on the condition of the ecosystem. The current and recommended condition for all river FEPAs is A or B ecological category. Wetland FEPAs that are currently in a condition lower than A or B should be rehabilitated to the best attainable ecological condition.

5.6.1 FEPA wetlands and / or rivers onsite

The Msunduzi River is a FEPA river which is classified as **Category D: Largely Modified (Appendix 3).**

6. VEGETATION ON SITE

6.2 General Vegetation Overview of the site

The dominant vegetation that currently occurs on site is degraded grassland (Refer to **Appendix 1** for aerial maps). It is evident from the alien species composition and indigenous pioneer herbaceous species present that the site is degraded, most notably due to a lack of environmental management (burning / mowing regimes, exclusion of fire, alien plant control), illegal dumping of waste material and some subsistence grazing. Furthermore, the presence of the sewer treatment works results in substantial leaching of nitrogen and phosphorus into the soil, both essential for plant growth. Consequently, the existing vegetation is highly productive, and in the absence of burning, results in excess moribund material. The high availability of N and P may also explain the prevalence of alien plants, which have very easily established and invaded the area.

The majority of the site is comprised of degraded grassland (16.4 ha) with a small patch of woodland (0.6 ha) at the east boundary of the site, comprised almost entirely of alien vegetation (**Appendix 1**). The woodland patch is almost exclusively comprised of Mulberry trees, *Morus alba,* which are in turn smothered by the alien invasive vine, *Cardiospermum grandiflorum* **(Figure 3)**. The Mulberries show evidence of bush clearing as there are a number of dead individuals that have been ring-barked and poisoned (**Figure 2**). There are significant patches of *Cannabis sativa* in the understorey, along with a number of other invasive alien plants. There are a few Paintbrush lilies, *Scadoxus puniceus,* (which are protected) growing in the understorey. The grassland is comprised predominantly of *Chloris gayana* and *Digitaria* spp. which make up the majority of the graminoid layer, while there are a number of alien and pioneer indigenous woody species, shrubs and herbaceous plants **(Figure 3)** scattered within the grassland, such as *Acacia* spp*., Melia azedarach, Populus* spp., *Lantana camara, Asparagus* spp*., Berkheya* spp*., Cirsium vulgare* and *Verbena aristigera* to mention a few (**Figure 4**). While species such as *Asparagus* spp. are considered protected in terms of the KZN 1974 Ordinance, it is noted that in this instance such species appear to be indigenous invaders and are of limited importance.

The riparian periphery is dominated by the cosmopolitan giant reed grass, *Phragmites australis,* while towards the water's edge are a number of sedge species and fruit-bearing Gooseberries, *Physalis viscosa*. A list of plant species recorded during this survey are given in **Appendix 4**.

Figure 1 Degraded grassland area with woody plant invasion

Figure 2 Ring-barked *Morus alba*

Figure 3 Degraded grassland area with woody plant invasion

Figure 4: Clockwise from top left - *Cirsium vulgare, Lantana camara, Berkheya erysithales* and *Verbena aristigera.*

6.3 Current Impacts

6.3.1 Alien and Indigenous Invasive vegetation

The species that occur within the site are primarily alien and indigenous pioneer forms, considered to be secondary successional communities. The indication is that most of the woody vegetation appears to have established and proliferated as a possible consequence of the exclusion of fire due to the proximity of the site to the sewage works, rubbish dump, farm lands and the communities of Sobantu and Glenwood. Increased soil fertility due to the sewage works has also lead to more favourable conditions for alien plant establishment.

6.4 Indigenous vegetation on site

Of the indigenous species that were present, the most prevalent were the *Acacia* species (Appendix 4). These species, even though indigenous, are able to establish themselves and dominate the species assemblage, hence they are similar in ecological terms to an invasive species. Several emerging individuals of *Scadoxus puniceus* **(Figure 5)** were observed around the site (protected plant species under the KZN Ordinance of 1974). This protected species will be required to be relocated out of the footprint of the proposed constructed wetland. This species is small and has underground storage

organs (bulbs). These bulbs sustain the plant and store energy reserves, so their relocation should be relatively simple. Relocation should take place early in spring.

Figure 5 *Scadoxus puniceus*

6.5 Biodiversity Assessment

When assessing the impacts of the proposed development on the receiving environment, it is important that the current state of the environment is assessed and the level at which it functions currently is considered and recorded.

Bearing this in mind that we have developed an assessment matrix which assists in determining the current biodiversity and conservation value of the various landscape (vegetation types) that were encountered during the field survey.

In addition we need to consider the biodiversity noteworthiness of the receiving environment (i.e. does the environment hold any rare species, protected species and unique landscape features) as well as the functional integrity and future sustainability of the vegetation types in the immediate vicinity of the proposed constructed wetland. The final condition score is calculated by adding the Biodiversity noteworthiness score with the Functional Integrity and Sustainability score. It must be noted that the two scores are weighted 50%:50% respectively.

6.5.1 *Biodiversity noteworthiness*

From the following vegetation classifications were identified from the aerial photography and ground-truthed on site, the following assessment was made in terms of the noteworthiness of the vegetation that occurs along the proposed development footprint.

Table 7. Biodiversity noteworthiness of the riparian and bush clump vegetation within the periphery of the site

	Scores				
Biodiversity Noteworthiness	0	1	**2**	**3**	**4**
Diversity			✓		
Rarity		✓			
Conservation Status	✓				
Red Data or Protected Species					✓
Uniqueness / Special features	✓				
OVERALL VALUE	Total Score/number of categories is 7 / 5= **1.4**				

Table 8. Biodiversity noteworthiness of the degraded grassland vegetation within the proposed site

	Scores				
Biodiversity Noteworthiness	0	1	**2**	**3**	**4**
Diversity			✓		
Rarity		✓			
Conservation Status	✓				
Red Data or Protected Species					✓
Uniqueness / Special features	✓				
OVERALL VALUE	Total Score/number of categories is 7 / 5= **1.4**				

6.5.2 *Functional Integrity and Sustainability*

The functional Integrity and sustainability speaks to the impact of the proposed activity on the receiving environment and the likelihood that it will be of significance and whether there are significant mitigation and or amelioration measures that are required to be put in place to ensure that the impacts are manageable and will not prove deleterious to the vegetation type as a whole, which falls within the current proposed area of disturbance.

Table 9. Future Integrity and viability of the riparian and bush clump vegetation within the periphery of the site

	Scores				
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer		✓			
Connectivity		✓			
Alteration	✓				
Invasive/pioneers		✓			
Size	✓				
OVERALL VALUE	Total Score/number of categories is 3 / 5= **0.6**				

Table 10. Future Integrity and viability of the degraded grassland vegetation within the proposed site

	Scores				
Integrity & Future Viability	**0**	**1**	**2**	**3**	**4**
Buffer		✓			
Connectivity			✓		
Alteration	✓				
Invasive/pioneers	✓				
Size					✓
OVERALL VALUE	Total Score/number of categories is 7 / 5= **1.4**				

The biodiversity noteworthiness of the combined vegetation has a score of **1.4,** this is deemed to be **moderately low**.

The future integrity and viability value that the combined vegetation is considered **moderately low**, with a score of **1.4**. The final condition score of this site is **1** which indicates that the site is functioning at a **moderately low** level. The alien species composition and indigenous pioneer herbaceous species present, most notably due to a lack of veld management (burning / mowing regimes, exclusion of fire), illegal dumping of waste material and some subsistence grazing, has resulted in the severe reduction of indigenous cover and loss of historical grassland.

7. SUMMARY OF FINDINGS

Having undertaken the assessment of the proposed development footprint the following findings were noted:

- The majority of the site is degraded (98% alien plant composition) due to a lack of veld management (burning / mowing regimes, exclusion of fire), illegal dumping of waste material and some subsistence grazing;
  Irrigation of plants with raw or diluted sewage stimulates the growth and productivity. Hence, excess moribund material was observed, possibly due to the interactive effects of increased soil fertility and fire exclusion. As a result, the vegetation assemblage has become dominated by alien invasive species (98% alien plant composition) and pioneer and / or ruderal indigenous plant species.
- Illegal dumping of general waste has further degraded the floristic composition and potential of this landscape.

8. RECOMMENDATIONS AND CONCLUSIONS

The study site is considered to be degraded based on the presence and abundance of alien and pioneer vegetation species, as a possible consequence of the exclusion of fire. In terms of the vegetation that was recorded, the majority of the species are common and not of conservation importance.

Historically the study site is considered Dry Coast Hinterland and thus classified as sourveld[3]. Sourveld grasses generally require frequent and regular fire that removes the unpalatable grass left behind by the grazing animals, which would otherwise inhibit grass regeneration and growth, and admit denser shrub and tree populations. Thus the typical species that occur in sourveld vegetation types are dependent on fires to maintain biodiversity where it would otherwise become dominated by woody plant species if fires were excluded. The lack of management is further exacerbated by the substantial leaching of nitrogen and phosphorus into the soil, both essential for the alien plant growth which seems to have very easily established and invaded the area.

It is important to mention, due to time constraints and the sampling methodology, additional species may have been overlooked during our field survey due to the plant life history characteristics exhibited by certain plant species. Some species may not have emerged due to the time of the year, the amount of rainfall or requisite temperature (heat units) to force emergence. However, it is our opinion that the vegetation that was recorded provides adequate information in order for the specialist to make inferences and extrapolations as to the quality, and the likely impacts associated with a development of this nature.

Possible mitigation:

- The clearing of vegetation during construction, the operation of earth moving equipment, machines and vehicles in and next to the footprint, the creation of stockpiles and increased movement and activity by people (including possibly hand digging) creates opportunities for alien plant establishment. Alien plan management should be exercised to prevent further spread.
- Checks must be carried out at regular intervals to identify areas where erosion is occurring. Appropriate remedial action, including the rehabilitation of the eroded areas should be undertaken;
- If possible, the development footprint should avoid destroying the more favourable indigenous plants such as the *Scadoxus puniceus*.
- If they are required to be removed, they should be transplanted elsewhere on site so that they may re-establish.

Furthermore, the close proximity of the proposed constructed wetland to surrounding dwellings indicates that this area will most likely be continually impacted by anthropogenic pressures. In conclusion we would support the proposed development as the Municipality in this area will benefit significantly from having a wetland area to accommodate the periodic high storm water flow volumes and alleviate the impacts associated with storm flow events.

[3] Grassland and Savanna Biomes are considered to have “Sour” grass cover, which typically occurs in high-rainfall (> 600-700 mm per year), in high-lying, and in cool areas. It is characterised by grass species, which grow very rapidly, produce coarse grazing and lose their nutritional value when they become dormant.

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APPENDIX 1:

AERIAL AND LOCALITY MAPS

APPENDIX 2:

CBA MAP

APPENDIX 3:

FEPA WETLANDS AND RIVERS MAP

APPENDIX 4:

SPECIES LIST