water and sanitation

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Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments

WETLAND REPORT

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Department of Water and Sanitation

Chief Directorate: Water Ecosystems Management

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Wetland Report

CLASSIFICATION OF SIGNIFICANT WATER RESOURCES AND DETERMINATION OF RESOURCE QUALITY OBJECTIVES FOR WATER RESOURCES IN THE USUTU TO MHLATHUZE CATCHMENTS

DECEMBER 2022

REFERENCE

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3	WEM/WMA3/4/00/CON/CLA/0322	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Units Delineation and Prioritisation Report**
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8	WEM/WMA3/4/00/CON/CLA/0822	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Groundwater Report**
9	WEM/WMA3/4/00/CON/CLA/0922	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River specialist meeting Report**
10	WEM/WMA3/4/00/CON/CLA/1022	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Estuary Survey Report**
11	WEM/WMA3/4/00/CON/CLA/1122	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Wetland Report**
12	WEM/WMA3/4/00/CON/CLA/1222	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecological Water Requirements Report**
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	WEM/WMA3/4/00/CON/CLA/0123, volume 2	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecological Consequences Report, Volume 2: Estuaries**
15	WEM/WMA3/4/00/CON/CLA/0323	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecosystem Services Consequences Report**
16	WEM/WMA3/4/00/CON/CLA/0423	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Economic & User water quality Consequences Report**
17	WEM/WMA3/4/00/CON/CLA/0523	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Water Resource Classes Report**
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	WEM/WMA3/4/00/CON/CLA/0623, volume 2	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Quality Objectives Report, Volume 2: Estuaries**
	WEM/WMA3/4/00/CON/CLA/0623, volume 3	Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Quality Objectives Report, Volume 3: Wetlands and Groundwater**
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Shaded Grey refers to this report.

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Approved for the PSP by:

.....

CJ Seago

Study Leader

Approved for the Department of Water and Sanitation by:

..... 08/12/2022

Ms Mohlapa Sekoele

Project Manager

..... 9/12/2022

Ms Lebogang Matlala

Director: Water Resource Classification of

CD: Water Ecosystems Management

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The following persons are acknowledged for their contribution to this report:

Project Management Team:

Sekoele, M	DWS: Water Resource Classification
Pillay, R	DWS: Regional Office, Water Quality Planning

AUTHORS

The following persons contributed to this report:

Author	Company
MacKenzie, James	MacKenzie Ecological & Development Services CC

EXECUTIVE SUMMARY

BACKGROUND

Chapter 3 of the National Water Act, 1998 (NWA) (Act 36 of 1998), deals with the protection of water resources. Section 12 of the NWA requires the Minister to develop a system to classify water resources. In response to this, the Water Resource Classification System (WRCS) was gazetted on 17 September 2010 and published in Government Gazette 33541 as Regulation 810. The WRCS is a stepwise process whereby water resources are categorised according to specific classes that represent a management vision of a particular catchment. This vision takes into account the current state of the water resource, the ecological, social and economic aspects that are dependent on the resource. Once significant water resources have been classified following the WRCS, Resource Quality Objectives (RQOs) must be determined to give effect to the class. The implementation of the WRCS therefore assesses the costs and benefits associated with utilisation versus protection of a water resource. Section 13 of the NWA requires that Water Resource Classes and RQOs be determined for all significant water resources.

Thus, the Chief Directorate: Water Ecosystems Management (CD: WEM) of the Department of Water and Sanitation (DWS) initiated a study for determining the Water Resource Classes and RQOs for all significant water resources in the Usutu to Mhlathuze Catchment. The Usutu to Mhlathuze Catchments are amongst many water-stressed catchments in South Africa. These catchment areas are important for conservation and contain a number of protected areas, natural heritage sites, cultural and historic sites as well as other conservation areas that need protection. There are five RAMSAR[1] sites within the catchment, which includes the world heritage site and St Lucia. The others are Sibaya, Kosi Bay, Ndumo Game Reserve and Turtle Beaches.

According to the latest national wetland map (National Biodiversity Assessment (NBA); van Deventer *et al.*, 2018) there are almost 371 603 Ha of wetlands (excluding estuaries) in the study. This includes five RAMSAR sites, the St Lucia System, Lake Sibaya, Kosi Bay, Ndumo Game Reserve and the Turtle Beaches / Coral Reefs of Tongaland. The Pongola (W4) secondary catchment is the highest representing 30% of wetland hectarage, and the Mhlatuze (W1) and Mkuzu (W3) the lowest. The study area is also diverse in terms of wetland types and while riverine wetlands dominate with 104038 Ha (excluding estuaries), all other HGMs are well represented.

STUDY AREA

The study area is the Usutu to Mhlathuze Catchment, which has been divided into six drainage areas, as well as secondary catchment areas:

- W1 catchment (main river: Mhlathuze).
- W2 catchment (main river: Umfolozi).
- W3 catchment (main river: Mkuze).
- W4 catchment (main river: Pongola) - part of this catchment area falls within Eswatini.
- W5 catchment (main river: Usutu) - much of this catchment falls within Eswatini.
- W7 catchment (Kosi Bay and Lake Sibaya).

[1] A Ramsar site is a wetland site designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an intergovernmental environmental treaty established in 1971 by UNESCO in the Iranian city of Ramsar, which came into force in 1975.

PURPOSE OF THIS REPORT

The purpose of this report is to provide a desktop assessment of the EcoClassification for very high priority wetlands, and establish EWRs for very high priority wetlands as a key component of the Usutu-Mhlathuze Classification study

QUANTIFICATION OF THE WETLAND EWR

The results of desktop EcoClassification and prioritisation of wetlands is summarised at the SQ level in **Chapter 3** per secondary catchment and outlined in **Figures 3.1** to **3.6** and **Tables 3.1** to **3.6**. The outcomes of the prioritisation process resulted in smaller subsets of wetlands with very high or high priority, within each secondary catchment, that were again assessed for PES at a more detailed level, using additional and more current / updated data. The resultant PES scores / categories and dominant impacts are presented in **Chapter 4** from **Table 4.1** to **Table 4.25**, and summarised as follows:

1) W1 (Mhlathuze) – Four groups of wetlands including riverine wetlands along the Mhlathuze River leading into the Mhlathuze swamp system, lower reaches of Nseleni, including Nsezi and portions of the Mhlathuze floodplain, Nundwane, mainly Mzingazi, extensive channelled valley bottom wetlands leading into Richard's Bay Estuary, and depressions and seeps near the Nlabane estuary.
2) W2 (Umfolozi) – Four groups of wetlands including riparian wetlands along the White Mfolozi River, Aloeboom vlei, Mvamanzi pan and the Mfolozi swamp.
3) W3 (Mkuze) – Five groups of wetlands including Mkuze and Nhlonhlela rivers including Nhlonhlela Pan, Hluhluwe, Nyalazi and Mpate, including Nyalazi, and the Mkuze River with swamps and floodplain before entering the estuary.
4) W4 (Pongola) – Two groups of wetlands including riparian wetlands along the Bivane River and the Pongola floodplain.
5) W5 (Usutu) – Six groups of wetlands including Boesmanspruit and Assegaai River, Sandspruit and Seganagana, Mpumalanga pan district around Chrissiesmeer, lower Usutu River including Banzi Pan and Ndumo.
6) W7 (Kosi & Sibaya) – Two groups of wetlands including Lake Sibaya and the Muzi swamps.

Besides Lake Sibaya and the Pongola floodplain which have quantitative flow requirements expressed as Lake levels and dam releases respectively (DWS, 2015a,b), the Ecological Water Requirement (EWR) of very high priority floodplains, channelled and unchannelled valley-bottom, and seep wetlands is expressed through ecological specifications that protect the habitat. To provide these specifications, the EWRs are expressed in terms of a Recommended Ecological Category (REC), which is dependent on the Present Ecological State (PES) and the ecological importance, which denotes whether the REC is the same as the PES or an improvement, if at all possible. Where the REC is an improvement of the PES, this will involve management of land use. The most common method to achieve the REC where it is higher than the PES is to remove alien vegetation, reduce agricultural / forestry encroachment of wetlands and manage (usually reduce) grazing pressures which can promote erosion. A summary of high priority wetlands is shown in **Table 4.27** with some indication of a proposed REC and strategies to achieve said.

Validated PES, trajectory and REC for wetlands with High or Very High priority

Name	Includes SQs	Size (Ha)	PES	Trajectory	REC	How to achieve the REC
W1 Mhlatuze						
Mhlathuze Riverine Wetlands	W12E-03475	N/A	C	N/A	C	Maintain PES.
Mhlathuze Floodplain	W12H-03459	4809.0	E	↓	D	Reduce / control sugarcane cultivation.
Nlabane Wetlands	W12J-03411	546.9	D	↓	C/D	Reduce / control forestry.
Mzingazi	W12J-03392 W12J-03403 W12J-03450	1689.0	B/C	→	B/C	Control expansion of forestry and residential development.
W2 Umfolozi						
White Mfolozi Riverine Wetlands	W21G-02885 W21H-02897 W21H-03004	N/A	B	N/A	B	Maintain PES.
Aloeboom Vlei	W22A-02586 W22A-02591 W22A-02596	343.8	C	↓	B/C	Reduce / control forestry, control formal residential expansion.
Mvamanzi Pan	W23A-03160	485.1	B/C	→	B/C	Control expansion of subsistence / small-scale crops and formal residential areas.
Mfolozi Swamps	W23C-03180 W23D-03108	11911.1	D	→	D	Reduce / control sugarcane cultivation.
W3 Mkuze						
Nhlonhlela Pan	W31J-02469 W31J-02501	8.2	A	→	A	Preventative conservation: prevent expansion of surrounding forestry.
Hluhluwe Floodplain	W32F-02835	2310.1	C/D	↓	C	Reduce / control cultivation of commercial and emerging farmer sugarcane.
Nyalazi Pan	W32H-02854	43.2	C	→	C	Control existing forestry extent
Mpate Wetlands	W32H-02998	236.9	A	→	A	Preventative conservation: prevent expansion of forestry and small-scale subsistence farming.
Mkuze Floodplain	W32B-02535	11222.9	B	→	B	Control extent of subsistence / small-scale annual crops.
W4 Pongola						
Bivane Riverine Wetlands	W41B-02431	N/A	B	N/A	B	Maintain PES
Pongola Floodplain	W45A-02216 W45A-02245 W45A-02246 W45A-02256 W45A-02275 W45A-02282 W45A-02285 W45A-02310 W45A-02316 W45A-02356 W45A-02367	11802.6	D	↓	C	Reduce / control subsistence and small-scale annual crops, continued implementation of EWR determined in 2015 (DWS, 2015b).

Name	Includes SQs	Size (Ha)	PES	Trajectory	REC	How to achieve the REC
	W45A-02368					
	W45B-02029					
	W45B-02105					
W5 Usutu						
Assegaai Floodplain	W51C-01981	886.4	C	→	C	Control expansion of forestry and informal farming.
	W51C-02011					
	W51C-02022					
	W51C-02067					
	W51C-02074					
	W51C-02109					
	W51D-02044					
	W51D-02151					
	W51D-02160					
	W51D-02171					
	W51D-02177					
	W51D-02193					
Sandspruit Wetlands	W53A-01757	1676.8	C	→	C	Control expansion of commercial annual crops and dry-land agriculture.
	W53A-01804					
	W53A-01853					
Upper Usutu Wetlands	W54A-01534	767.2	B/C	→	B/C	Control expansion of commercial annual crops and dry-land agriculture.
	W54A-01630					
Seganagana Wetlands	W54B-01569	1264.7	A	→	A	Preventative conservation: Control expansion of forestry and dry-land agriculture.
	W54B-01623					
Pans District	W55A-01375	21348.2	A/B	→	A/B	Preventative conservation: Control expansion of forestry and commercial annual crops, rain-fed.
	W55A-01423					
	W55C-01395					
Lower Usutu (Ndumo)	W57J-01923	1310.0	A	→	A	Preventative conservation: prevent expansion of nearby slash and burn agricultural activities.
	W57K-01929					
	W57K-02025					
W7 Kosi & Sibaya						
Lake Sibaya	W70A-02278	10168.0	B	→	B	Prevent expansion of surrounding forestry, residence and dry-land agriculture. Continued implementation of EWR determined in 2015 (DWS, 2015a).
	W70A-02301					
	W70A-02381					
Muzi Swamps	None	25409.9	C	↓	C	Control forestry and subsistence and small-scale annual crops, address erosion.

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TERMINOLOGY AND ACRONYMS

CD: WEM	Chief Directorate: Water Ecosystems Management
DRIFT	Downstream Response to Imposed Flow Transformations
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EcoSpecs	Ecological Specifications
EI	Ecological Importance
EMC	Ecological Management Class
ES	Ecological Sensitivity
EWR	Ecological Water Requirement
HGM	Hydrogeomorphic
IEI	Integrated Environmental Importance
masl	Metres above sea level
NBA	National Biodiversity Assessment
NFEPA	National Freshwater Ecosystem Priority Area
NSBA	National Spatial Biodiversity Assessment
NWA	National Water Act
NWM5	National Wetland Map version 5
PES	Present Ecological State
PES/EI/ES	Present Ecological State, Ecological Importance and Ecological Sensitivity
REC	Recommended Ecological Category
RQO	Resource Quality Objectives
SANBI	South African National Biodiversity Institute
SANLC	South African National Land Cover
SQ	Sub-quaternary
SQR	Sub-quaternary reach
WRCS	Water Resource Classification System
WRUI	Water Resource Use Importance

SPELLING

There are multiple references to the spelling of various Rivers, Lakes, Dams and Estuaries, depending on the source of information. For the purposes of this report, the following Table presents the selected spelling of indicated water resources and places.

Selected Spelling for this Study	Alternate spellings
Usutu River	Usuthu River
Mhlathuze River	Mhlatuze, uMhlatuze River
Pongola (river, Town & Pongolapoort Dam)	Phongola, Phongolo
Lake Sibaya	Lake Sibiya, Lake Sibhayi, Lake Sibhaya
Eswatini	eSwatini
Umfolozi River	Mfolozi River
Amatigulu River	Amatikulu, Matigulu River
Goedertrouw Dam	Lake Phobane
Mfuli River	Mefule River

Selected Spelling for this Study	Alternate spellings
aMatigulu/iNyoni Estuary	
Sibiya Estuary	
Mlalazi Estuary	
uMhlathuze /Richards Bay Estuary	
iNhlabane Estuary	
uMfolozi/uMsunduze Estuary	
St Lucia Estuary	
uMgobezeleni Estuary	
Kosi Estuary	
Hluhluwe Game Reserve	
iMfolozi Game Reserve	
Ithala Game Reserve	
Ndumo Game Reserve	
Tembe Elephant Reserve	
iSimangaliso Wetland Park	
Kosi Bay and Coastal Forest Area	
uMkhuze Game Reserve	

GLOSSARY

Basic Human Needs	Water needs to be set aside for basic human needs such as drinking, food preparation, and health and hygiene purposes. This is referred to as the Basic Human Needs Reserve (BHNR).
Ecological Water Requirements (EWR)	The flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components.
Ecosystem services	The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth.
EcoClassification	The term used for the Ecological Classification process - refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative the natural or close to the natural reference condition. The purpose of the EcoClassification process is to gain insights and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the river.
Integrated Unit of Analysis (IUAs)	An IUA is a homogeneous area that can be managed as an entity. It is the basic unit of assessment for the Classification of water resources, and is defined by areas that can be managed together in terms of water resource operations, quality, socio-economics and ecosystem services.
Resource Quality Objectives (RQOs)	RQOs are numeric or descriptive goals or objectives that can be monitored for compliance to the Water Resource Classification, for each part of each water resource. “The purpose of setting RQOs is to establish clear goals

	relating to the quality of the relevant water resources" (NWA, 1998).
Sub-quaternary reaches (SQR)	A finer subdivision of the quaternary catchments (the catchment areas of tributaries of main stem rivers in quaternary catchments), to a sub-quaternary reach or quinary level.
Target Ecological Category (TEC)	This is the ecological category toward which a water resource will be managed once the Classification process has been completed and the Reserve has been finalised. The draft TECs are therefore related to the draft Classes and selected scenario.
Water Resource Class	The Water Resource Class (hereafter referred to as Class) defines three management classes, Class I, II, and III, based on extent of use and alteration of ecological condition from the predevelopment condition.
Channel	An open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies.
Channelled valley-bottom wetland	A mostly flat valley-bottom wetland dissected by and typically elevated above a channel (see channel). Dominant water inputs to these areas are typically from the channel, either as surface flow resulting from overtopping of the channel bank/s or as interflow, or from adjacent valley-side slopes (as overland flow or interflow). Water generally moves through the wetland as diffuse surface flow, although occasional, short-lived concentrated flows are possible during flooding events (SANBI, 2009).
Erosion	The weathering, transportation and deposition of the earth's surface by wind, water and other natural forces.
Flat	A near-level wetland area (i.e. with little or no relief) with little or no gradient, situated on a plain or a bench in terms of landscape setting. The primary source of water is precipitation, with the exception of flats along the coast (usually in a plain setting) where the water table (i.e. groundwater) may rise to the surface or near to the surface in areas of little or no relief because of the location near to the base level of the land surface represented by the presence of the ocean (SANBI, 2009).
Floodplain wetland	The mostly flat or gently sloping wetland area adjacent to and formed by a lowland or upland floodplain river, and subject to periodic inundation by overtopping of the channel bank (SANBI, 2009).
Hillslope seep	A wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Water inputs are primarily from groundwater or precipitation that enters the wetland from an up-slope direction in the form of subsurface flow. Water movement through the wetland is mainly in the form of interflow, with diffuse overland flow ('sheetwash') often being significant during and after rainfall events (SANBI, 2009).
Unchannelled valley-bottom wetland	A mostly flat valley-bottom wetland area without a major channel running through it, characterised by an absence of distinct channel banks and the prevalence of diffuse flows, even during and after high rainfall events. Water inputs are typically from an upstream channel, as the flow becomes dispersed, and from adjacent slopes (if present) or groundwater. Water generally moves through the wetland in the form of diffuse surface flow and/or interflow (with some temporary containment of water in depressional

areas), but the outflow can be in the form of diffuse or concentrated surface flow (SANBI, 2009).

Valleyhead seep A gently-sloping, typically concave wetland area located on a valley floor at the head of a drainage line, with water inputs mainly from subsurface flow (although there is usually also a convergence of diffuse overland water flow in these areas during and after rainfall events). Horizontal, unidirectional (down-slope) movement of water in the form of interflow and diffuse surface flow dominates within a valleyhead seep, while water exits at the downstream end as concentrated surface flow where the valleyhead seep becomes a channel (SANBI, 2009).

Wetland Any ecosystem that has an aquatic base or hydrological driving force and possesses both upland and aquatic characteristics.

National Water Act (1998): A wetland is land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

1 INTRODUCTION

1.1 BACKGROUND

Chapter 3 of the National Water Act, 1998 (NWA) (Act 36 of 1998), deals with the protection of water resources. Section 12 of the NWA requires the Minister to develop a system to classify water resources. In response to this, the Water Resource Classification System (WRCS) was gazetted on 17 September 2010 and published in Government Gazette 33541 as Regulation 810. The WRCS is a stepwise process whereby water resources are categorised according to specific classes that represent a management vision of a particular catchment. This vision takes into account the current state of the water resource, the ecological, social and economic aspects that are dependent on the resource. Once significant water resources have been classified following the WRCS, Resource Quality Objectives (RQOs) must be determined to give effect to the class. The implementation of the WRCS therefore assesses the costs and benefits associated with utilisation versus protection of a water resource. Section 13 of the NWA requires that Water Resource Classes and RQOs be determined for all significant water resources.

Thus, the Chief Directorate: Water Ecosystems Management (CD: WEM) of the Department of Water and Sanitation (DWS) initiated a study for determining the Water Resource Classes and RQOs for all significant water resources in the Usutu to Mhlathuze Catchment. The Usutu to Mhlathuze Catchments are amongst many water-stressed catchments in South Africa. These catchment areas are important for conservation and contain a number of protected areas, natural heritage sites, cultural and historic sites as well as other conservation areas that need protection. There are five RAMSAR[2] sites within the catchment, which includes the world heritage site and St Lucia. The others are Sibaya, Kosi Bay, Ndumo Game Reserve and Turtle Beaches.

South Africa' wetlands were defined into 26 different wetland regions by Cowan (1995). The basis of the distinction between types is topography, hydrology and nutrient regimes. Based on geomorphology and climate the 26 different wetland regions can broadly be classified into the following four groups:

- Plateau wetlands.
- Mountain wetlands.
- Coastal slopes and rimland wetlands; and
- Coastal plains.

Within each of these groups are various subdivisions based on differences in geology. Each wetland group has characteristic wetland types. A total of five EcoRegions within two of the main groupings (Coastal slopes and Coastal Plain), fall within the study area (**Table 1.1**).

[2] A Ramsar site is a wetland site designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an intergovernmental environmental treaty established in 1971 by UNESCO in the Iranian city of Ramsar, which came into force in 1975.

Table 1.1 Wetland regions described by Cowan (1995), typical wetlands found in the regions and well known wetlands in some of the regions (taken from DWS, 2014)

Region	Typical wetlands	Examples within the Study Area
Coastal slopes and rimland		
East coastal slope, Drakensberg region	Grass and restio marshes and reed swamps	Stilwater Vlei (Vryheid)
East coast, subtropical region	Lagoons, reeds marshes, swamp forest and mangrove swamps	Mhlathuze and Mfolozi floodplain
Northern Escarpment Lowveld region	Diverse, pans and grassland Vleis	Lake Chrissie (Mpumalanga Province)
Lowveld., Lowveld region	Rivers with distinctive riparian communities	Usutu floodplain just before Phongola floodplain confluence
Coastal Plain		
Coastal plain, subtropical	Floodplains, swam forest, coastal lakes and coral reefs	Lake St. Lucia, Lake Sibaya and Kosi system

According to the latest national wetland map (National biodiversity assessment; van Deventer *et al.*, 2018) there are almost 1.5 million Ha of wetlands in the study area if estuaries are included in the analysis and 371 603 Ha if they are excluded. The distribution of different wetland types (HGMs – hydro-geomorphic units, Level 4 classification from Ollis *et al.*, 2013) is shown **in Figure 1.1**. This includes five RAMSAR sites, the St Lucia System, Lake Sibaya, Kosi Bay, Ndumo Game Reserve and the Turtle Beaches / Coral Reefs of Tongaland.

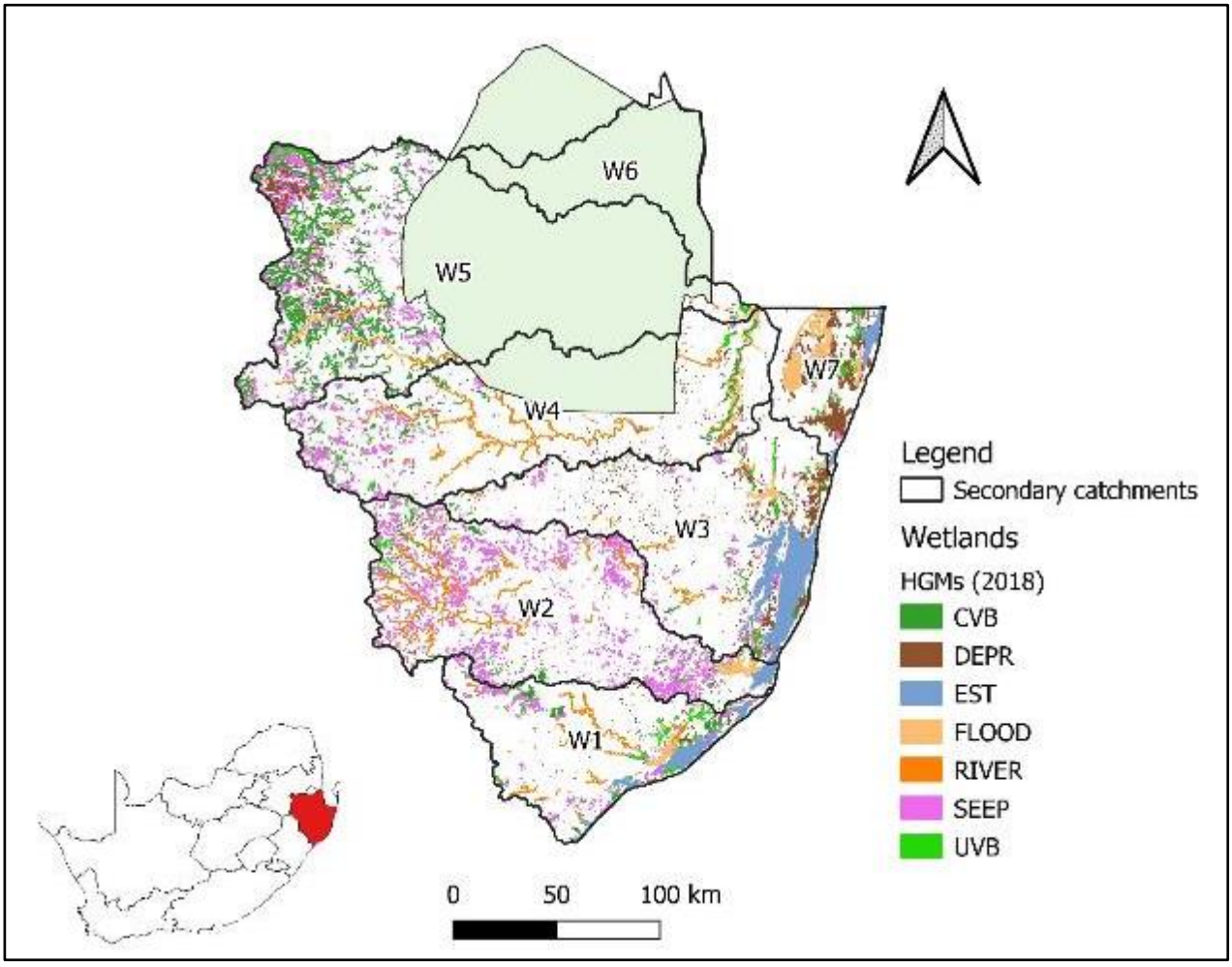

Figure 1.1 Wetlands within the study area showing distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) and secondary catchments

1.2 STUDY AREA

The study area is the Usutu to Mhlathuze Catchment that has been divided into six drainage areas and secondary catchment areas as follows (refer to the locality map provided as **Figure 1.2**):

- W1 catchment (main river: Mhlathuze).
- W2 catchment (main river: Umfolozi).
- W3 catchment (main river: Mkuze).
- W4 catchment (main river: Pongola) - part of this catchment area falls within Eswatini.
- W5 catchment (main river: Usutu) - much of this catchment falls within Eswatini.
- W7 catchment (Kosi Bay estuary and Lake Sibaya).

Note that all assessments within Eswatini are excluded apart from the hydrological modelling required to assess any downstream rivers in South Africa that either run through Eswatini or originate (source) in Eswatini.

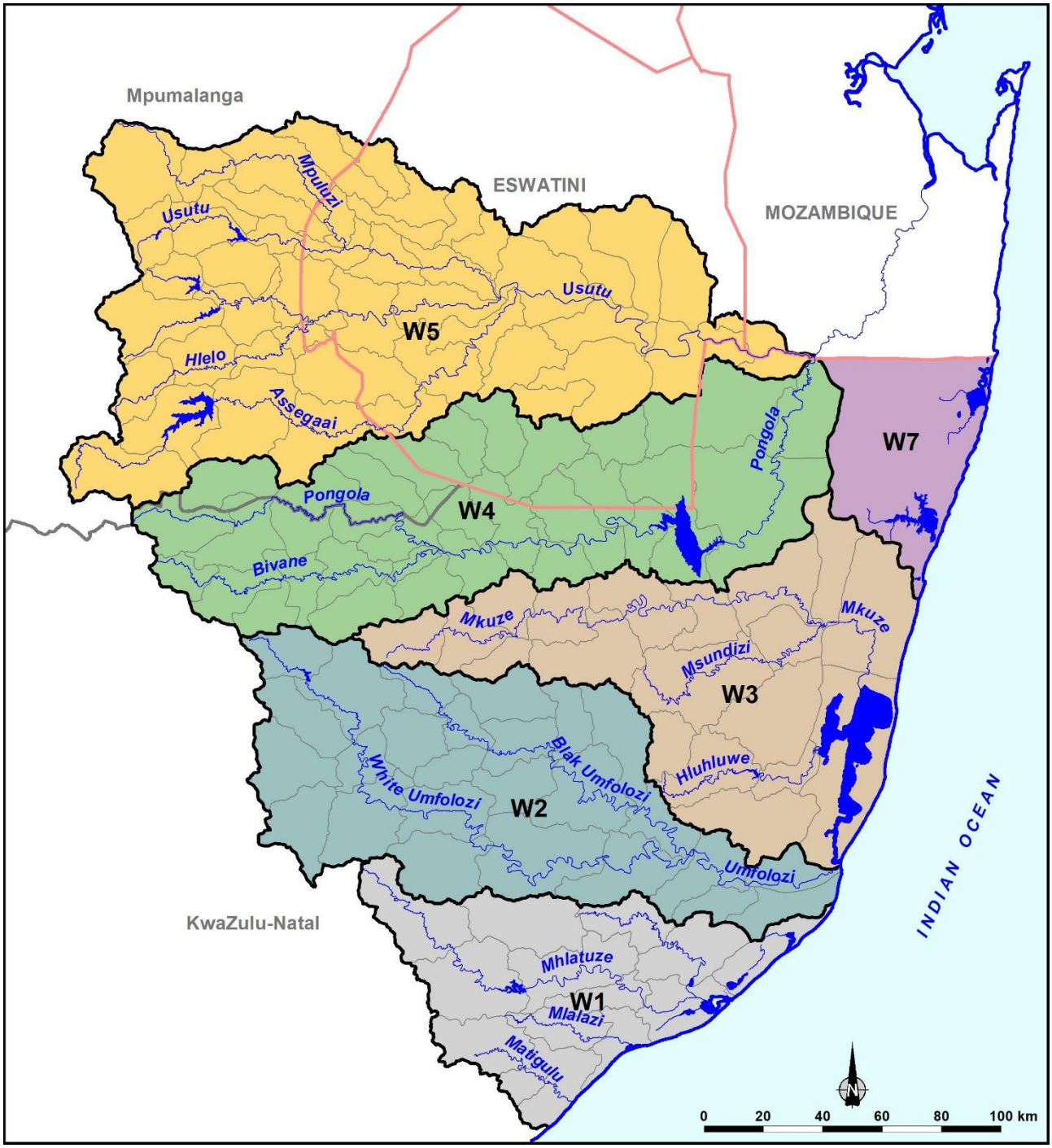

Figure 1.2 Locality Map of the Study Area

1.3 PURPOSE OF THE REPORT

The purpose of this report is to provide a desktop assessment of the EcoClassification for very high priority wetlands, and establish EWRs for very high priority wetlands as a key component of the Usutu-Mhlathuze Classification study and as per the Project Plan in **Figure 1.3**.

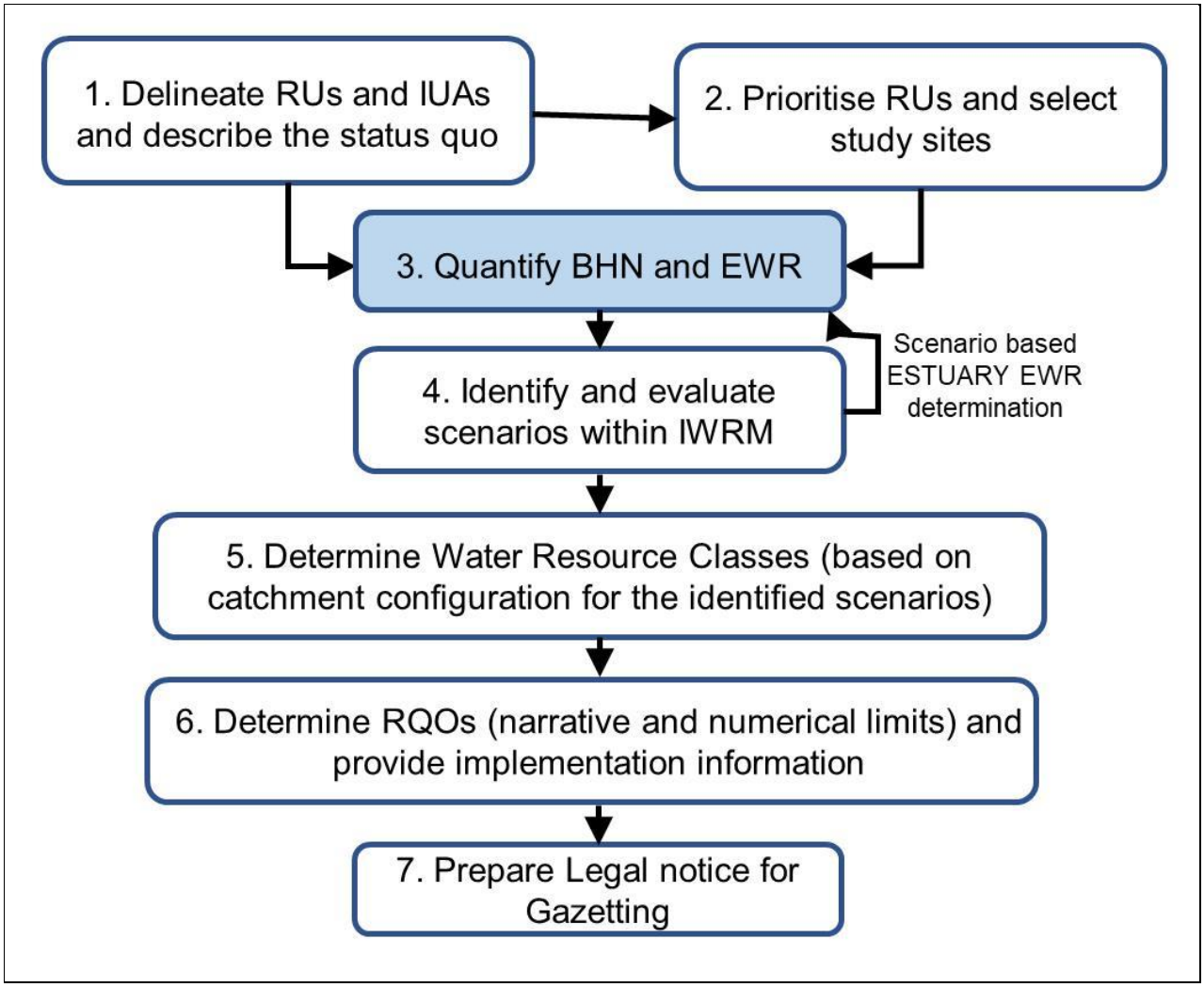

Figure 1.3 Project Plan for the Usutu-Mhlathuze Classification study

1.4 OUTLINE OF THIS REPORT

The report outline is provided below.

Chapter 1: Introduction
This chapter provides general background to the project, study area and purpose of the report.

Chapter 2: Methods and approach
This chapter outlines the methods used and approaches taken to achieve the objective.

Chapter 3: Desktop EcoClassification and summary of wetland priority
This chapter outlines a desktop assessment of the EcoClassification for high priority wetlands using updated information at the sub-quaternary (SQ) scale and summarises the outcomes of the wetland prioritisation process, but at the SQ-scale rather than the RU-scale.

Chapter 4: Quantification of the wetland EWR
This chapter outlines the EWR for very high priority wetlands. In most cases, these EWRs consist of wetland-specific EcoClassification using more detailed tools such as WET-Health to provide ecological specifications were possible.

Chapter 5: Conclusion

This chapter outlines the main conclusions of the work.

Chapter 6: References

This chapter outlines references cited in the text.

2 METHODS AND APPROACH

2.1 PRESENT ECOLOGICAL STATE

The assessment of wetland Present Ecological State (PES) relied on best available data from mainly 3 sources:

- The riparian and wetland metrics within the Present Ecological State, Ecological Importance and Ecological Sensitivity (PES/EI/ES) database (DWS, 2014), and updates from this project.
- The wetland condition metric (WETCON) within the new wetland map (NWM) metadata from the 2018 national biodiversity assessment (van Deventer *et al*., 2018).
- The wetland condition metric (WETCON) within the National Freshwater Ecosystem Priority Area (NFEPA) map metadata (Nel *et al.*, 2011).

Both of the riparian / wetland metrics rated in the PES/EI/ES database (DWS, 2014; current updates) were used as surrogate measures of wetland condition by taking an average of the following two metric scores.

- Riparian / wetland zone modification relates to “modifications that indicate the potential that wetland zones may have been changed from reference [condition] in terms of structure and composition that may influence these zones regarding functioning and processes occurring within these zones”, and also refers to these zones as habitats for biota.
- Riparian / wetland zone continuity modification relates to “modifications that indicate the potential that riparian/wetland connectivity may have changed from the reference [condition]”. Physical fragmentation (both longitudinal and lateral) is the indicator used for wetland continuity and includes for example inundation by weirs and dams, physical removal for farming, mining, overgrazing etc. and the presence of roads or other human structure, e.g. urban areas.

The underlying assumption is that these two metrics incorporate wetlands within each Sub-quaternary reach (SQR), and as such should provide a useful measure of a more detailed investigation (visual assessment by specialist using satellite imagery) of overall ecological state.

Both the NFEPA project and the National Biodiversity Assessment produced an estimation of wetland condition and the final ecological condition of inland wetlands modelled from ancillary data (using mainly land use within variously defined buffer zones around wetlands) has been used here as a measure of present ecological state. The possible ratings in the NFEPA data are either A/B (natural or good - % natural land cover ≥ 75%), C (moderately modified - % natural land cover 25-75%), D/E/F (heavily to critically modified), Z1 (artificial wetland and excluded from this assessment), Z2 (majority of the wetland classified as artificial and excluded from this assessment) or Z3 (heavily to critically modified - % natural land cover < 25%). Similarly, the possible ratings in the new wetland map (2018) data are either A/B (natural or good - % natural land cover ≥ 75%), C (moderately modified - % natural land cover 25 - 75%), D/E/F (heavily to critically modified), or not assessed. In order to integrate the WETCON categories with the PES/EI/ES ratings, each was assigned a score as follows: A/B a score of 1, C a score of 2, D/E/F a score of 3.5 and Z3 a score of 5. The average of the PES/EI/ES, NFEPA and NWM scores was taken to represent an integrated PES score presented herein under as the wetland PES for use within prioritisation. Note that wetlands that emerge from the prioritisation process with very high and in some cases

high priority receive additional and more detailed assessment of the PES, which may then change due to improved assessment methodology.

2.2 WETLAND EWR

The approach is in keeping with outlined techniques for the rapid ecological Reserve determination of inland wetlands (Rountree *et al*., 2013), and is to provide conditions that support the hydrological functioning of wetlands for the maintenance of a desired ecological state. These conditions will vary depending on wetland type from quantified flow volumes and distribution or inundation regimes (i.e. quantification of the Reserve) to setting of criteria for the protection of wetland condition where the hydrological requirements cannot be quantified.

For each Very High priority wetland, the EWR is determined according to the following steps:

1) Determine dominant wetland HGM type.
2) Determine appropriate level of Resource Directed Measures (RDM) study for wetlands according to HGM type.
3) Assess / validate EcoStatus of these priority wetlands.
4) Determine Ecological Water Requirement (EWR), or other RDM to achieve the Recommended Ecological Category (REC).

2.2.1 Determine dominant wetland HGM type

The HGM wetland type dictates the method of RDM study, as there are different types of assessment methods and EWR determination approaches for different types of wetlands. For the Rapid Reserve methods for wetlands, HGM types were taken from the NWM metadata from the 2018 national biodiversity assessment (van Deventer *et al*., 2018), but were updated / changed in some cases when viewed with Google or Bing satellite imagery.

2.2.2 Determine appropriate level of RDM study for wetlands

Rountree *et al*. (DWA, 2012) provide a framework for selecting the appropriate level of RDM study for wetlands. This approach uses the type of wetland and main impact or threat categorized into Disturbance Classes to identify an appropriate level of RDM assessment. The extent of impact is measured as the proportion of a wetland and/or its catchment that is affected by an activity. Extent is expressed as a percentage.

The RDM assessment may be either a quantitative EWR determination, a qualitative EWR determination or, in the most simple (low risk) situations, the determination of simple conditions to achieve the REC.

2.2.3 Assess / validate EcoStatus of very high priority wetlands

This was achieved by the validation / update of the PES and the determination of the REC. South African National Land Cover (SANLC, 2020), Google Earth © and WET-Health (Level 1, vegetation module; MacFarlane *et al.*, 2007) were used to determine the PES of very high, and at times, high priority wetlands. The SANLC data was used to design a front-end data provider for the WET-Health, as well as assigned internal ecological integrity scores to calculate the PES value/s (refer to **Appendix A** for land cover class integrity scores). Where the wetland HGM was not entirely applicable to WET-Health (e.g. riverine wetlands), PESEIS (DWS, 2014) metrics for the riparian/wetland assessments were additionally used as a starting point and were verified for each SQ / wetland polygon using Google Earth © and SANLC data.

2.2.4 Determine EWR (or other RDM) to achieve REC

The methods for determining wetland EWR vary according to the HGM type of wetland and level of study. It may not be necessary to quantify the Reserve in the same sense that it is determined for rivers, and in some cases, may only require the setting of conditions for the maintenance of the hydrological functioning of a specific wetland.

The EWR of high priority channelled valley bottom and floodplain wetlands are aligned to river processes since these wetlands are an integral component of the channel. The EWR of high priority seeps (includes hillslope and valleyhead) and unchannelled valley-bottom wetlands are expressed through Ecological Specifications (or EcoSpecs) that protect the habitat. To provide these specifications, the EWRs are expressed in terms of a REC, which is dependent on the PES, and the ecological importance denotes whether the REC is the same as the PES or an improvement, if at all possible.

3 DESKTOP ECOCLASSIFICATION AND SUMMARY OF WETLAND PRIORITY

The desktop EcoClassification for wetlands was conducted for the Delineation and Status Quo Report, and a summary of the prioritisation (including PES) is included here as a base for the next step: Quantifying the EWR. Summary results of the PES assessment and wetland prioritisation are shown in Tables in sections below for each secondary catchment where Table headings are as follows:

- **SQ:** The SQ number from the PESEIS study (DWS, 2014) representing the sub-quaternary catchment.
- **Name:** Name of the River in the SQ if it exists.
- **Wetland PES:** The dominant PES Category of the wetlands within the sub-quaternary catchment.
- **Wetland Ecological Importance (EI):** Obtained from an integration of RAMSAR status, wetland FEPA status, provision of habitats for rare and endangered species (birds, frogs, plants), critical biodiversity areas (Berliner & Desmet, 2007), and wetland extent (area).
- **Wetland Ecological Sensitivity (ES):** Based on natural land cover data within wetlands and within a 100m buffer around wetlands (data from NFEPA; Nel *et al*., 2011 and NBA; Van Deventer *et al.*, 2018).
- **Integrated Environmental Importance (IEI):** Based on a rating from 1 – 5 where 1 is Very Low and 5 is Very High. The IEI considers both the ES and the PES.
- **Water Resource Use Importance (WRUI):** Based on a rating from 0 – 4 where 0 is Very Low and 4 is Very High.
- **Wetland Priority:** This is based on a rating from 1 – 4 where 1 is Low, 2 is Moderate, 3 is High and 4 is Very High, and considers both the IEI and the WRUI. At the SQR level, the wetland priority represents the combined priority of all wetlands in the quinary catchment.

The following Wetland HGM abbreviations are applicable to maps in this Chapter:

- CVB - Channeled valley bottoms.
- DEPR – Depressions.
- FLOOD – Floodplains.
- RIVER – Riverine.
- SEEP – Seeps.
- UVB - Unchanneled valley bottoms.
- EST – Estuary.

3.1.1 W1 Catchment (Main River: Mhlathuze)

The Mhlathuze catchment has roughly 124 000 Ha of wetlands including estuaries and nearly 20 000 Ha if estuaries are excluded. **Figure 3.1** shows the spatial distribution of different wetland HGMs within the catchment. Floodplain wetlands dominate the catchment with a combined area of over 6700 Ha, but unchanneled valley bottoms and riverine and seepage wetlands are also notable in extent covering 3078, 3882 and 4490 Ha respectively. Wetlands named in the National Spatial Biodiversity Assessment (NSBA) within this catchment include the floodplain and swamp system, Umlalazi, Cubhu, Nsezi, Thulazihleka and Mzingazi. Mzingazi was historically part of the Richard's Bay estuary, but a weir was built between the lake and the connection to the ocean which results in the lake being a freshwater system.

The priority of wetlands within the Mhlathuze Catchment, as well as the data which are considered in its determination, are summarised at the sub-quaternary catchment scales in **Table 3.1**. The SQs that have a Very High wetland priority include W12E-03475 (Mhlathuze leading into the Mhlathuze swamp system), W12H-03459 (mostly lower reaches of Nseleni, including Nsezi and portions of the Mhlathuze floodplain), W12J-03450 (Nundwane, mainly Mzingazi), W12J-03392 (Mpisini) and W12J-03403 (extensive channelled valley bottom wetlands leading into Richard's Bay Estuary, and W12J-03411 (Depressions and seeps near the Nlabane estuary).

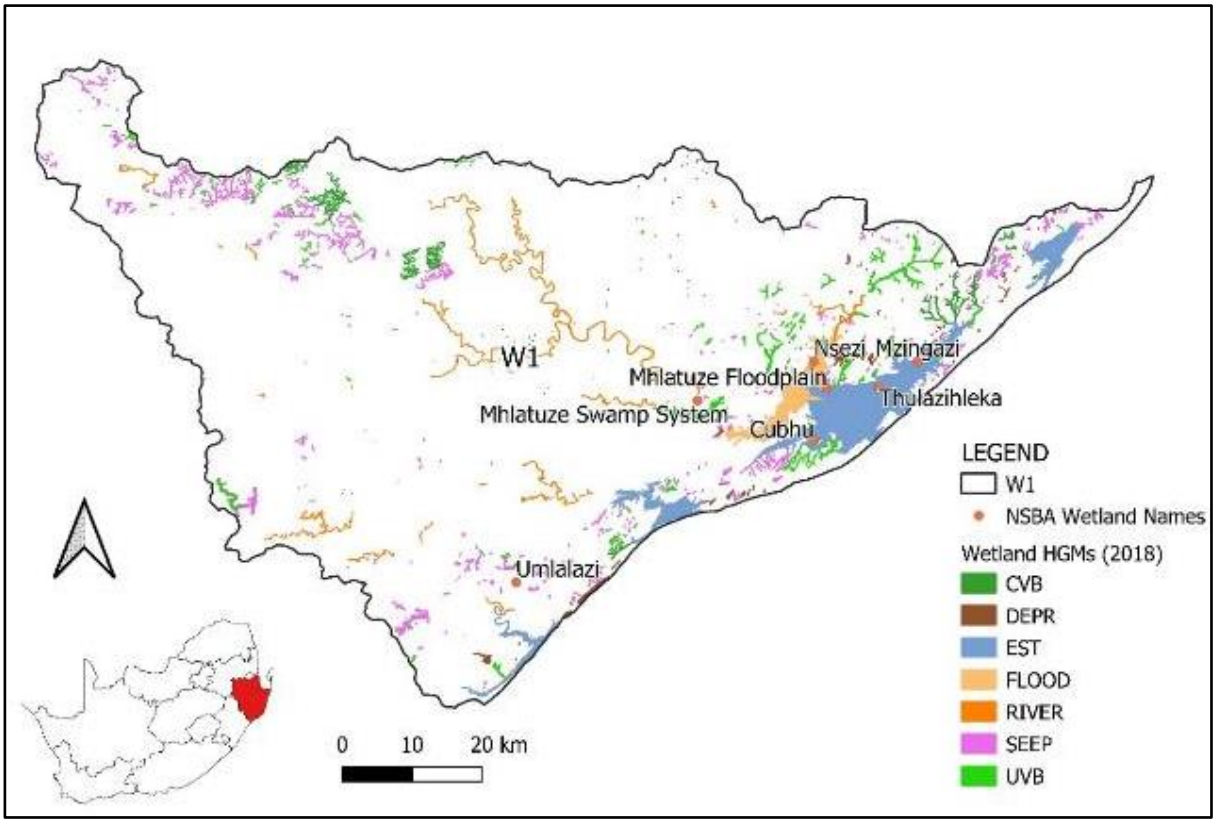

Figure 3.1 The spatial distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) in the Mhlathuze Catchment (W1) and NSBA named wetlands (data from the NSBA, Driver *et al.*, 2005)

Table 3.1 Summary of wetland PES, EI, ES and IEI, along with WRUI and wetland priority per SQ in the Mhlathuze catchment

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W11A-03597	Matigulu	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W11A-03748	uMngwenya	C	MODERATE	MODERATE	MODERATE	1	1
W11A-03776	kuMnyameni	C	MODERATE	MODERATE	MODERATE	1	1
W11A-03599	Ngoje	D/E	HIGH	VERY HIGH	MODERATE	2	2
W11A-03612	Matigulu	C	VERY HIGH	HIGH	MODERATE	2	2
W11C-03713	Nyezane	D	VERY HIGH	HIGH	MODERATE	2	3
W11C-03917	Nyoni	D/E	VERY HIGH	LOW	MODERATE	2	3
W12A-03086	Gologodo	C	VERY HIGH	VERY HIGH	HIGH	2	2
W12A-03104	Mhlatuze	D	VERY HIGH	VERY HIGH	MODERATE	2	2

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W12A-03153	Mhlatuze	C/D	VERY HIGH	VERY HIGH	MODERATE	2	2
W12A-03226		D	VERY HIGH	VERY HIGH	MODERATE	2	2
W12B-03334	Mhlatuze	C	VERY HIGH	VERY HIGH	HIGH	1	2
W12B-03356	Mhlatuze	B/C	VERY HIGH	VERY HIGH	VERY HIGH	1	2
W12B-03398	Mavungwini	B/C	VERY HIGH	VERY HIGH	VERY HIGH	1	2
W12B-03471	Nyawushane	B/C	VERY HIGH	VERY HIGH	VERY HIGH		3
W12B-03479	Mhlatuze	D/E	VERY HIGH	VERY HIGH	MODERATE	4	3
W12B-03336	KwaMazula	D/E	VERY HIGH	VERY HIGH	MODERATE	1	1
W12C-03189	Mfule	D	VERY HIGH	HIGH	MODERATE	2	2
W12C-03225	Mfule	C	VERY HIGH	VERY HIGH	HIGH	2	2
W12C-03232	Nhlozane	B	VERY HIGH	LOW	HIGH	2	2
W12C-03263	Mfulazane	C/D	VERY HIGH	VERY HIGH	MODERATE	2	2
W12C-03303	Mfule	B/C	VERY HIGH	LOW	MODERATE	2	2
W12D-03346	Ntambanana	C	VERY HIGH	VERY HIGH	HIGH		3
W12D-03375	Mhlatuze	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12D-03388	Mhlatuze	E	VERY HIGH	VERY HIGH	MODERATE	4	3
W12E-03475	Mhlatuze	C	VERY HIGH	VERY HIGH	HIGH	4	4
W12E-03526	Mhtatuzana	C	VERY HIGH	VERY HIGH	HIGH		1
W12E-03530	Mateku	D	VERY HIGH	VERY HIGH	MODERATE		1
W12E-03558	Mhlatuzana	B	VERY HIGH	VERY HIGH	VERY HIGH		2
W12G-03229	Nseleni	D	HIGH	VERY HIGH	MODERATE	4	3
W12H-03289	Mbabe	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12H-03316	Mposa	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12H-03401	Okula	E	VERY HIGH	VERY HIGH	MODERATE	4	3
W12H-03418	Nseleni	C	VERY HIGH	VERY HIGH	HIGH	4	3
W12H-03428	Mbabe	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12H-03459	Nseleni	C	VERY HIGH	VERY HIGH	HIGH	4	4
W12F-03611	Mzingwenya	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12J-03290	Nhlabane	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12J-03411		C	VERY HIGH	VERY HIGH	HIGH	4	4
W12J-03493		C	VERY HIGH	VERY HIGH	HIGH	4	3
W12J-03501	Kondweni	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W12J-03392	Mpisini	C	VERY HIGH	VERY HIGH	HIGH	4	4
W12J-03403		C	VERY HIGH	VERY HIGH	HIGH	4	4
W12J-03450	Nundwane	C	VERY HIGH	VERY HIGH	HIGH	4	4
W13A-03583	Mlalazi	C	HIGH	VERY HIGH	MODERATE	2	2
W13A-03609	Mlalazi	C/D	VERY HIGH	VERY HIGH	MODERATE	2	3
W13A-03641	Mkukuze	C	VERY HIGH	VERY HIGH	HIGH	2	2
W13B-03593	KwaGugushe	C	VERY HIGH	VERY HIGH	HIGH	2	3
W13B-03774	Manzamnyama	B	VERY HIGH	VERY HIGH	VERY HIGH	1	2
W12F-03494	Mhlatuze	D/E	VERY HIGH	VERY HIGH	MODERATE		1

3.1.2 W2 Catchment (Main River: Umfolozi)

The Umfolozi catchment has roughly 90 000 Ha of wetlands including estuaries and just over 66 100 Ha if estuaries are excluded. **Figure 3.2** shows the spatial distribution of different wetland HGMs within the catchment. Riverine and seepage wetlands dominate the catchment with a total area each of nearly 32300 Ha and 26072 Ha respectively. Wetlands named in the NSBA within this catchment include the Bloemveld Vlei, Stilwater Vlei, Grootgewaagd Vlei, Lenjani Vlei,

Aloeboom Vlei, the Fuyeni Reedbed, Mvamazi Pan, Umfolozi, Lake Teza, Collin's Lake, Mavuya Pan, Mfuthululu and the Umfolozi Swamp. The SQs that have a Very High wetland priority include W21G-02885, W21H-02897 and W21H-03004 (mainly the White Mfolozi, and mainly because PES is B and WRUI is high) (**Table 3.2**).

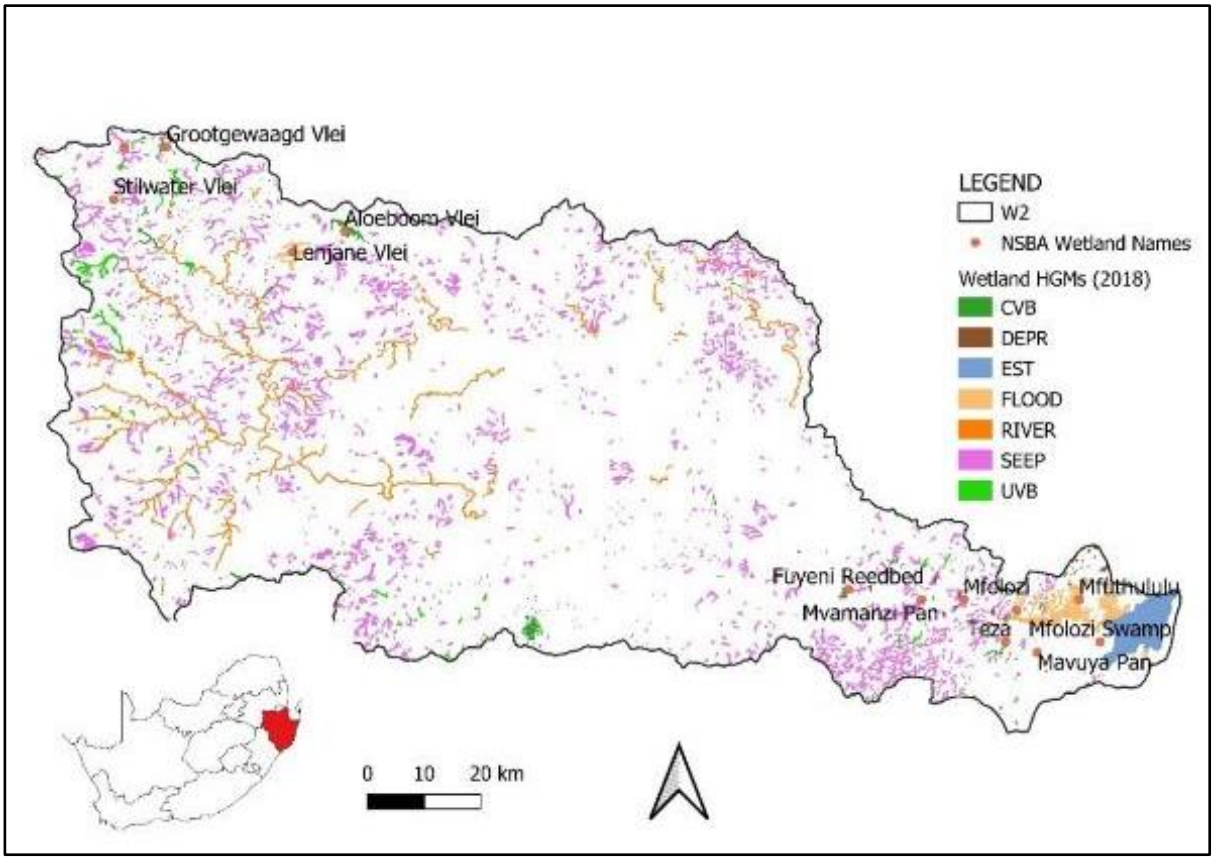

Figure 3.2 The spatial distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) in the Umfolozi Catchment (W2) and NSBA named wetlands (data from the NSBA, Driver *et al.*, 2005)

Table 3.2 Summary of wetland PES, EI, ES and IEI, along with WRUI and wetland priority per SQ in the Umfolozi catchment

SQ / RU	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W21A-02512	aMagoda	C/D	VERY HIGH	VERY HIGH	MODERATE	2	3
W21A-02527	White Mfolozi	C/D	VERY HIGH	HIGH	MODERATE	2	3
W21B-02539	iShoba	C	VERY HIGH	HIGH	MODERATE	2	3
W21B-02546	White Mfolozi	B/C	VERY HIGH	MODERATE	MODERATE	2	3
W21B-02603	Lenjane	B/C	VERY HIGH	HIGH	HIGH	2	3
W21B-02652	White Mfolozi	B	VERY HIGH	HIGH	VERY HIGH	2	3
W21B-02670	White Mfolozi	B	VERY HIGH	HIGH	VERY HIGH	2	3
W21C-02599	Sandspruit	B	VERY HIGH	VERY HIGH	VERY HIGH	1	3
W21F-02727	White Mfolozi	B/C	VERY HIGH	HIGH	HIGH	1	2
W21D-02676	Mvunyane	C/D	VERY HIGH	HIGH	MODERATE	1	1
W21D-02788	Vumankala	C/D	VERY HIGH	HIGH	MODERATE	1	1
W21D-02815	Mvunyane	B/C	VERY HIGH	HIGH	HIGH	1	2

SQ / RU	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W21D-02832	Jojosi	C/D	VERY HIGH	HIGH	MODERATE	1	1
W21D-02848	Jojosi	C/D	VERY HIGH	HIGH	MODERATE	1	1
W21E-02873	Nondweni	B/C	VERY HIGH	HIGH	HIGH	1	2
W21E-02912	Nondweni	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W21E-02934	Vuwankala	C	VERY HIGH	MODERATE	MODERATE	1	1
W21E-02953	Ngwebini	D	VERY HIGH	VERY HIGH	MODERATE	1	1
W21E-02963	Nondweni	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W21F-02840	Mvunyane	B/C	VERY HIGH	HIGH	HIGH	3	3
W21G-02851	White Mfolozi	B/C	VERY HIGH	HIGH	HIGH	3	3
W21G-02885	White Mfolozi	B	VERY HIGH	HIGH	VERY HIGH	3	4
W21G-02914	Ntinini	B/C	VERY HIGH	MODERATE	HIGH	3	3
W21G-02929	Nsubeni	B/C	VERY HIGH	MODERATE	HIGH	3	3
W21G-03067		E	VERY HIGH	HIGH	MODERATE	3	3
W21G-03085	Ntinini	D	VERY HIGH	HIGH	MODERATE	3	3
W21H-02889	Mhlahlane	C	VERY HIGH	HIGH	MODERATE	3	3
W21H-02897	White Mfolozi	B	VERY HIGH	MODERATE	VERY HIGH	3	4
W21H-03004	White Mfolozi	B	VERY HIGH	MODERATE	VERY HIGH	3	4
W21J-03018	Maphophoma	D	VERY HIGH	MODERATE	LOW	1	1
W21J-03030	White Mfolozi	C	VERY HIGH	MODERATE	MODERATE	1	1
W21J-03036	Mpembeni	B	VERY HIGH	MODERATE	HIGH	1	2
W21J-03050	Mpembeni	B	VERY HIGH	LOW	HIGH	1	2
W21J-03066	Mpembeni	B/C	VERY HIGH	MODERATE	MODERATE	1	1
W21J-03075	Mkumbane	B	VERY HIGH	HIGH	VERY HIGH	1	2
W21J-03112	Mzinhlanga	C	VERY HIGH	MODERATE	MODERATE	1	1
W21K-02976	Mbilane	C/D	VERY HIGH	MODERATE	MODERATE	1	1
W21K-02981	White Mfolozi	C	VERY HIGH	MODERATE	MODERATE	1	1
W21K-03019	Nhlungwane	B	VERY HIGH	MODERATE	VERY HIGH	1	2
W21K-03080	White Mfolozi	C	VERY HIGH	HIGH	MODERATE	1	1
W21L-03041	White Mfolozi	B	VERY HIGH	MODERATE	HIGH	1	2
W21L-03059	White Mfolozi	B	HIGH	MODERATE	HIGH	1	2
W21L-03161	Munywana	B/C	HIGH	MODERATE	MODERATE	1	1
W21L-03163	Munywana	B	HIGH	LOW	HIGH	1	2
W21L-03176	Mayayeni	B	VERY HIGH	MODERATE	HIGH	1	2
W22A-02586	Black Mfolozi	C	VERY HIGH	VERY HIGH	HIGH	2	3
W22A-02587	Mgobhozi	C	VERY HIGH	VERY HIGH	HIGH	2	3
W22A-02591		C/D	VERY HIGH	VERY HIGH	MODERATE	2	3
W22A-02596	Black Mfolozi	C	VERY HIGH	VERY HIGH	HIGH	2	3
W22A-02610	Black Mfolozi	C	VERY HIGH	HIGH	MODERATE	2	2
W22B-02661	Hlonyana	C	VERY HIGH	HIGH	MODERATE	2	2
W22B-02662	KwaMbizankulu	C	VERY HIGH	HIGH	MODERATE	2	2
W22B-02706	Hlonyane	B/C	VERY HIGH	MODERATE	MODERATE	2	2
W22B-02728	Hlonyane	B	VERY HIGH	MODERATE	HIGH	2	2
W22B-02773	Hlangabende	C	VERY HIGH	VERY HIGH	HIGH	2	2
W22C-02688	Black Mfolozi	C	VERY HIGH	HIGH	MODERATE	1	1
W22D-02795	iThaka	C	VERY HIGH	HIGH	MODERATE	1	1
W22F-02722	Black Mfolozi	C/D	VERY HIGH	HIGH	MODERATE	0	1
W22E-02595		C	VERY HIGH	HIGH	MODERATE	2	2
W22E-02601	Bululwana	C/D	VERY HIGH	HIGH	MODERATE	2	2
W22E-02605	Sikwebezi	C	VERY HIGH	HIGH	MODERATE	2	2

SQ / RU	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W22E-02702	Sikwebezi	C/D	VERY HIGH	HIGH	MODERATE	2	2
W22F-02726	Sikwebezi	C	VERY HIGH	HIGH	MODERATE	2	2
W22F-02748	Black Mfolozi	C	VERY HIGH	MODERATE	MODERATE	2	2
W22G-02624	Vuna	B/C	VERY HIGH	MODERATE	HIGH	2	2
W22H-02846	Black Mfolozi	B/C	VERY HIGH	LOW	HIGH	2	2
W22H-02844	Mbhekamuzi	C	VERY HIGH	MODERATE	MODERATE	1	1
W22J-02807	Black Mfolozi	C/D	VERY HIGH	MODERATE	MODERATE	1	1
W22J-02817	Black Mfolozi	B/C	VERY HIGH	MODERATE	HIGH	1	2
W22J-02910	Black Mfolozi	B/C	VERY HIGH	MODERATE	HIGH	1	2
W22J-02918	Wela	C	VERY HIGH	MODERATE	MODERATE	1	1
W22J-02942	Mvalo	C/D	VERY HIGH	MODERATE	MODERATE	1	1
W22K-02622		C	VERY HIGH	MODERATE	MODERATE		1
W22K-02629	Mona	C	VERY HIGH	MODERATE	MODERATE	1	1
W22K-02636	Manzimakulu	C	VERY HIGH	MODERATE	MODERATE	1	1
W22K-02761	Mapopoma	B	VERY HIGH	MODERATE	VERY HIGH	1	2
W22K-02783	Mona	B	VERY HIGH	LOW	VERY HIGH	1	2
W22L-02916	Black Mfolozi	B	VERY HIGH	HIGH	VERY HIGH	1	2
W23A-03058	Mbukwini	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W23A-03083	Mfolozi	C	VERY HIGH	VERY HIGH	HIGH	1	2
W23A-03098	Nkatha	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W23A-03113	Mfolozi	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W23A-03149	Mfolozi	B/C	MODERATE	VERY HIGH	MODERATE	1	1
W23A-03160	Mvamanzi	C/D	VERY HIGH	VERY HIGH	MODERATE	1	3
W23B-03222	Msunduzi	C	VERY HIGH	VERY HIGH	HIGH	0	1
W23B-03250	Ntobozi	D	VERY HIGH	VERY HIGH	MODERATE	0	1
W23B-03231	Msunduzi	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W23C-03180	Msunduzi	E	VERY HIGH	VERY HIGH	MODERATE	4	3
W23C-03254	Mavuya	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W23C-03272	Ntenja	E	VERY HIGH	VERY HIGH	MODERATE	4	3
W23C-03287	Mavuya	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W23D-03108	Mfolozi	E	VERY HIGH	VERY HIGH	MODERATE	4	3

3.1.3 W3 Catchment (Main River: Mkuze)

The Mkuze catchment has over 1 000 000 Ha of wetlands including estuaries but almost 33 000 Ha if estuaries are excluded. **Figure 3.2** shows the spatial distribution of different wetland HGMs within the catchment. Floodplains and depressional wetlands dominate the catchment with a total area each of 11844 Ha and 9484 Ha respectively. Wetlands named in the NSBA within this catchment include Enseleni, Nyalazi, the Makhakathana Flats, Hluhluwe River Vlei, Bushlands Pan, the Hluhluwe Floodplain, the Mkuze Floodplain and Swamp System, Ku Ndlebeni, Nhlonhlela Pan, Hlonhlela, Mkuze Airstrip Pans, Nsumo Pan, Neshe, Muzi (South), Tshanetshe, Ntshangwe Lake, Mpanze Pan, Yengweni, Mdlaze Pan, StLucia-Manzibomvu, Mhlazi Pan, St Lucia-Siphudwini, Siphudwini, Mfula Pan and St Lucia-Mbazwana. The RUs that have a Very High wetland priority include W31-1 (Mkuze), W31-4 (Mkuze including Nhlnhlela Pan), W31-5 (Mkuze), W31-6 (Nsumu), W32-1 (Mkuze), W33-7 (Hluhluwe, Nyalazi and Mpate, including Nyalazi, Bushlands Pan and Hluhluwe River Vlei) and the St Lucia RU (**Table 3.3**).

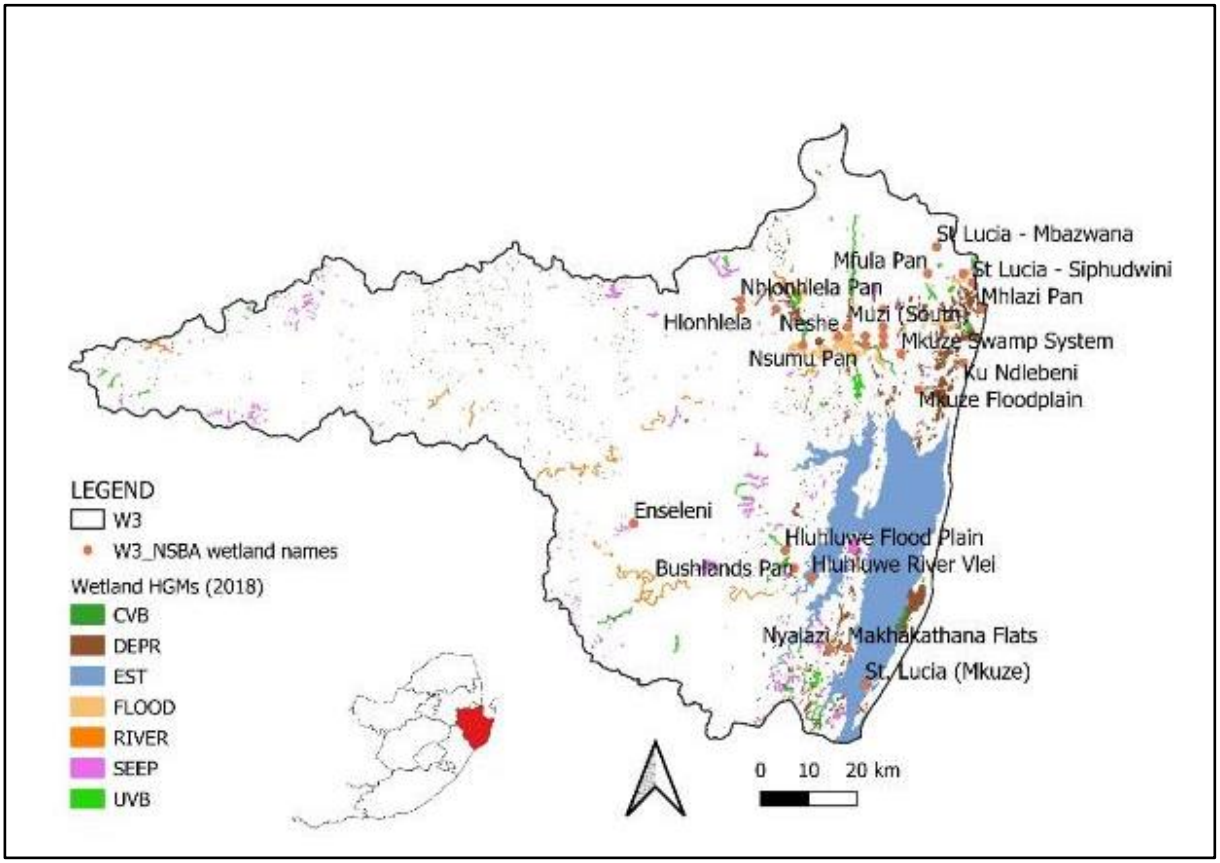

Figure 3.3 The spatial distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) in the Mkuze Catchment (W3) and NSBA named wetlands (data from the NSBA, Driver *et al.*, 2005)

Table 3.3 Summary of wetland PES, EI, ES and IEI, along with WRUI and wetland priority per SQ in the Mkuze catchment

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W31A-02494	Nkongolwana	E	VERY HIGH	VERY HIGH	MODERATE	2	2
W31A-02534	Mkuze	B/C	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W31B-02477	Mkuze	C	VERY HIGH	HIGH	MODERATE	2	2
W31C-02556	Sihlengeni	C	VERY HIGH	VERY HIGH	HIGH	2	2
W31D-02436	Manzimhlope	C/D	VERY HIGH	HIGH	MODERATE	2	2
W31D-02450	Ntutshe	C/D	VERY HIGH	HIGH	MODERATE	2	2
W31D-02495	Mkuze	C/D	VERY HIGH	LOW	LOW	2	1
W31D-02500	Mkuze	B	VERY HIGH	LOW	HIGH	2	2
W31E-02456	Mkuze	C/D	VERY HIGH	LOW	LOW	3	2
W31F-02530	Nkunzana	C/D	VERY HIGH	LOW	LOW	3	2
W31F-02555	Nkunzana	D/E	VERY HIGH	HIGH	MODERATE	3	3
W31F-02573	Mpuphisi	B	VERY HIGH	LOW	HIGH	3	3
W31G-02455	Mtiki	C/D	MODERATE	LOW	LOW	3	2
W31G-02506	Mkuze	C/D	MODERATE	LOW	LOW	3	2
W31G-02425	Mkuze	C	VERY HIGH	MODERATE	MODERATE	3	3
W31H-02514	KwaSekane	B/C	MODERATE	HIGH	MODERATE	3	3
W31J-02469	Mkuze	B	HIGH	HIGH	VERY HIGH	3	4
W31J-02501	Nhlohlela	B	HIGH	LOW	HIGH	3	3

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W31J-02343	Mthambalala	C	VERY HIGH	MODERATE	MODERATE	0	1
W31J-02406	Ndlamyane	C/D	VERY HIGH	HIGH	MODERATE	0	1
W31J-02480	Mkuze	B/C	VERY HIGH	MODERATE	HIGH	0	1
W31J-02509	Mkuze	B	VERY HIGH	HIGH	VERY HIGH	0	2
W31K-02568	Msunduzi	C	VERY HIGH	MODERATE	MODERATE	0	1
W31K-02582	Ntweni	C/D	VERY HIGH	LOW	MODERATE	0	1
W31K-02611	Msebe	B	VERY HIGH	LOW	VERY HIGH	0	2
W31K-02617	Mduna	D	VERY HIGH	LOW	MODERATE	0	1
W31L-02525		B	VERY HIGH	HIGH	VERY HIGH	0	2
W31L-02528	Masundwini	B	VERY HIGH	MODERATE	VERY HIGH	0	2
W31L-02551	Nsumu	B	VERY HIGH	HIGH	VERY HIGH	0	2
W31L-02553	Nsumu	D	VERY HIGH	MODERATE	MODERATE	0	1
W31L-02563	Nsumu	B	VERY HIGH	HIGH	VERY HIGH	0	2
W31L-02569	Msunduzi	B	VERY HIGH	HIGH	VERY HIGH	0	2
W32A-02345	Neshe	C	VERY HIGH	HIGH	MODERATE	0	1
W32A-02557	Mkuze	B/C	VERY HIGH	HIGH	HIGH	0	1
W32B-02476	Khobeyane	B	VERY HIGH	HIGH	VERY HIGH	0	2
W32B-02535	Mkuze	C	VERY HIGH	MODERATE	MODERATE	0	3
W32D-02720	Wela	B/C	VERY HIGH	LOW	HIGH	1	2
W32D-02811	Nzimane	C	VERY HIGH	MODERATE	MODERATE	1	1
W32E-02765	Mansiya	C	VERY HIGH	LOW	MODERATE	1	1
W32E-02779	Nzimane	B/C	VERY HIGH	LOW	HIGH	1	2
W32E-02797	Manzabomvu	D	VERY HIGH	MODERATE	MODERATE	1	1
W32E-02859	Nzimane	B	VERY HIGH	LOW	VERY HIGH	1	2
W32E-02865	Hluhluwe	B	VERY HIGH	LOW	VERY HIGH	1	2
W32E-02887	Hluhluwe	B/C	VERY HIGH	LOW	HIGH	1	2
W32G-02946	Sikhathula	C/D	VERY HIGH	VERY HIGH	MODERATE	0	1
W32G-02973	Nyalazi	B	VERY HIGH	VERY HIGH	VERY HIGH	0	2
W32G-02943	Hlazane	C	VERY HIGH	VERY HIGH	HIGH	2	2
W32G-02980	Mnyaba	D	VERY HIGH	VERY HIGH	MODERATE	2	2
W32G-02986	Hlazane	D	VERY HIGH	VERY HIGH	MODERATE	2	2
W32G-03006	Nyalazi	D/E	VERY HIGH	VERY HIGH	MODERATE	2	2
W32G-03055	Nyalazi	C	VERY HIGH	VERY HIGH	HIGH	2	2
W32G-03102	Nsane	D	VERY HIGH	VERY HIGH	MODERATE	2	2
W32C-02671	Mzinene	B	VERY HIGH	MODERATE	HIGH	2	3
W32C-02684	Ngweni	C/D	VERY HIGH	HIGH	MODERATE	2	2
W32C-02721	Mzinene	C	VERY HIGH	MODERATE	MODERATE	2	2
W32C-02749	Mzinene	C	VERY HIGH	HIGH	MODERATE	2	3
W32C-02612	Munywana	B	VERY HIGH	MODERATE	HIGH	0	1
W32C-02634	Mhlosinga	C	VERY HIGH	MODERATE	MODERATE	0	1
W32F-02835	Hluhluwe	D/E	VERY HIGH	VERY HIGH	MODERATE	3	3
W32H-02854	Nyalazi	C/D	VERY HIGH	VERY HIGH	MODERATE	3	3
W32H-02998	Mpate	B	VERY HIGH	VERY HIGH	VERY HIGH	3	4
W31J-02497	Ndlamyane	B	VERY HIGH	MODERATE	VERY HIGH		2
W32B-02429	Mbazwana	C	VERY HIGH	HIGH	MODERATE		1
W32B-02462	Siphudwini	C	VERY HIGH	HIGH	MODERATE		3
W32B-02467	Mbazwana	B	VERY HIGH	HIGH	VERY HIGH		2
W32B-02489		B/C	VERY HIGH	HIGH	HIGH		1

3.1.4 W4 Catchment (Main River: Pongola - excluding Eswatini)

The Pongola catchment has over 113 000 Ha of wetlands. **Figure 3.4** shows the spatial distribution of different wetland HGMs within the catchment. Riverine wetlands dominate the catchment with a total area of 61752 Ha, but channelled valley bottoms and floodplains are also high with 20759 Ha and 17660 Ha respectively. Wetlands named in the NSBA within this catchment include Balamhlanga, the Pongola Floodplain, Msenyeni Pan, Mtoti Pan, Tete Pan, Khanganzeni Pan, Shalala Pans, Nhlole Pan, Bumbe Pan, Mandlankunzi Pan and the Ndumo Game Reserve wetlands (a Ramsar site). The Pongola catchment also contains two thermal springs, Natal Spa and Swaelfontein, a sulphur spring. The RUs that have a Very High wetland priority include W41-1 (Bivane) and W43-1 (Ngwavuma [Ndumo]). An unexpected outcome of the process is that the Pongola floodplain has a High priority and not Very High. This is mainly due to poor ecological state (PES is mainly C/D, D or worse) even though ecological importance and WRUI are high (**Table 3.4**).

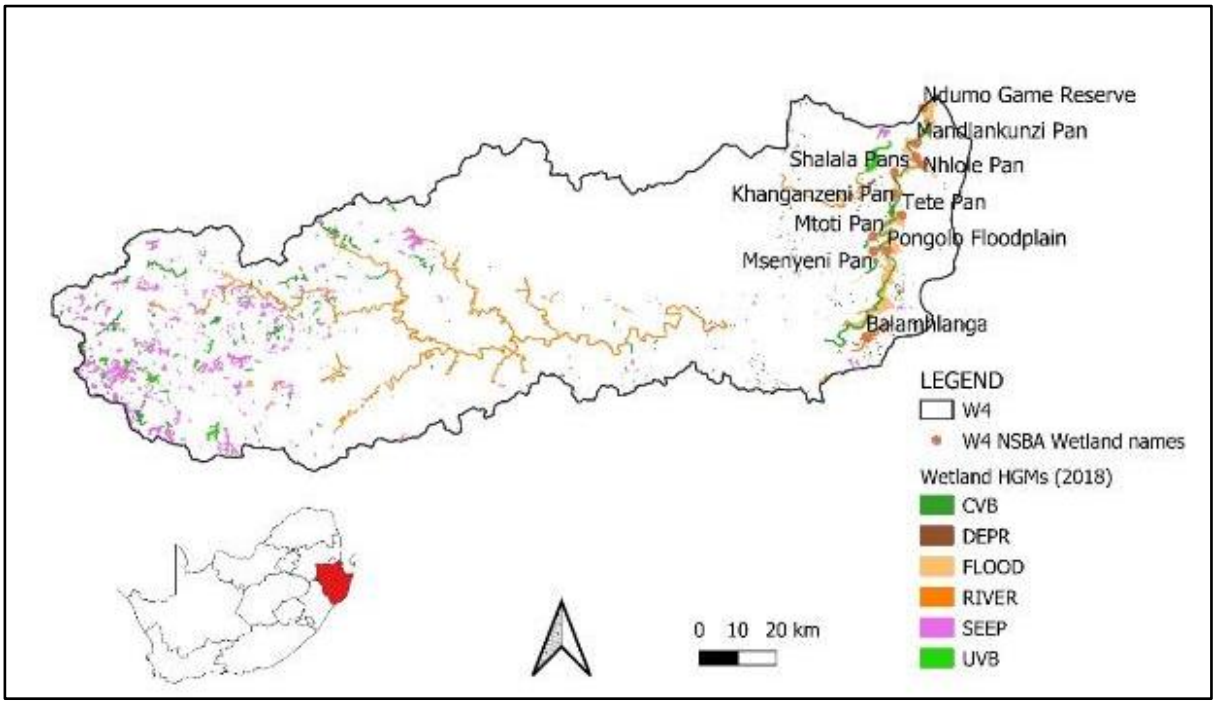

Figure 3.4 The spatial distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) in the Pongola Catchment (W4) and NSBA named wetlands (data from the NSBA, Driver *et al.*, 2005)

Table 3.4 Summary of wetland PES, EI, ES and IEI, along with WRUI and wetland priority per SQ in the Pongola catchment

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W41A-02372	Bivane	B/C	VERY HIGH	HIGH	HIGH	3	3
W41B-02401	uBivanyana	C/D	HIGH	HIGH	MODERATE	3	3
W41B-02427	Bivane	D	VERY HIGH	HIGH	MODERATE	3	3
W41B-02431	Bivane	B	MODERATE	HIGH	VERY HIGH	3	4
W41B-02434	Soetmelks	C/D	VERY HIGH	HIGH	MODERATE	3	3
W41C-02437	Mpemvana	C/D	VERY HIGH	VERY HIGH	MODERATE	3	3

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W41D-02373	Bivane	D/E	VERY HIGH	HIGH	MODERATE	3	3
W41D-02435	iNxwayi	C	HIGH	HIGH	MODERATE	3	3
W41E-02359	Bivane	D/E	VERY HIGH	MODERATE	MODERATE	3	3
W41F-02433	Manzana	D	HIGH	MODERATE	LOW	1	1
W41F-02454	Manzana	D	VERY HIGH	HIGH	MODERATE	1	1
W41F-02461	KwaCeba	C	HIGH	HIGH	MODERATE	1	1
W41F-02481	Manzana	C/D	MODERATE	HIGH	LOW	1	1
W41F-02502		D	MODERATE	HIGH	LOW	1	1
W42A-02261	Phongolo	B/C	VERY HIGH	HIGH	HIGH	3	3
W42A-02328	Pandana	C/D	VERY HIGH	HIGH	MODERATE	3	3
W42B-02268	Phongolo	C/D	VERY HIGH	HIGH	MODERATE	3	3
W42B-02271	Phongolo	C/D	VERY HIGH	VERY HIGH	MODERATE	3	3
W42B-02315	Tsakwe	C	HIGH	HIGH	MODERATE	3	3
W42B-02325	Tsakwe	D	VERY HIGH	HIGH	MODERATE	3	3
W42B-02331	Bazangoma	D	VERY HIGH	HIGH	MODERATE	3	3
W42C-02205	Ntombe	C/D	VERY HIGH	HIGH	MODERATE	3	3
W42D-02251	Phongolo	C/D	VERY HIGH	HIGH	MODERATE	2	2
W42D-02327		C	VERY HIGH	HIGH	MODERATE	2	2
W42E-02221	Phongolo	C	VERY HIGH	HIGH	MODERATE	2	2
W42F-02185	Wit	D	VERY HIGH	HIGH	MODERATE	2	2
W42G-02317	Phongolo	B	VERY HIGH	HIGH	VERY HIGH	2	3
W41G-02379	Bivane	D	VERY HIGH	MODERATE	LOW	2	1
W42H-02382	Phongolo	B	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42H-02394	iThalu	B	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42H-02411	iThalu	B/C	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42H-02428	Mbizane	B	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42J-02353	Phongolo	B	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42J-02378	Phongolo	B	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42J-02397	Mhulumbela	B/C	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W42K-02148	Mozana	C	VERY HIGH	HIGH	MODERATE	2	2
W42K-02242		B/C	VERY HIGH	HIGH	HIGH	2	2
W42K-02272	Mozana	B	HIGH	LOW	HIGH	2	2
W42L-02270	Mozana	B	VERY HIGH	MODERATE	HIGH	2	2
W42M-02269	Mtokotshwala	D/E	VERY HIGH	MODERATE	LOW	2	1
W42M-02294	Spekboom	D	VERY HIGH	MODERATE	LOW	2	1
W42M-02352	Phongolo	B	VERY HIGH	MODERATE	HIGH	2	2
W43F-02013	uMsunduzi	D	VERY HIGH	HIGH	MODERATE	0	1
W43F-02053		D/E	VERY HIGH	HIGH	MODERATE	0	3
W43F-02072	Ngwavuma	C/D	VERY HIGH	HIGH	MODERATE	0	1
W43F-02076	Msunduzi	E/F	VERY HIGH	HIGH	MODERATE	0	1
W43F-02089	Ngwavuma	D	VERY HIGH	HIGH	MODERATE	0	1
W43F-02099	Ngwavuma	C	VERY HIGH	HIGH	MODERATE	0	1
W43F-02104	Mnvoni	B/C	VERY HIGH	HIGH	HIGH	0	1
W43F-02107		C/D	VERY HIGH	HIGH	MODERATE	0	1
W43F-02113	Ngwavuma	D	VERY HIGH	HIGH	MODERATE	0	1
W43F-02142		B	VERY HIGH	HIGH	VERY HIGH	0	2
W43F-02159	Ngwavuma	C	VERY HIGH	HIGH	MODERATE	0	1
W44A-02332	Phongolo	C	VERY HIGH	MODERATE	MODERATE	4	3
W44A-02386	Phongolo	D/E	VERY HIGH	MODERATE	LOW	4	3
W44A-02389	Voyizana	E	VERY HIGH	HIGH	MODERATE	4	3

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W44A-02410	Mdlavenga	D	VERY HIGH	MODERATE	LOW	4	3
W44B-02248	Manzawakho	E	VERY HIGH	MODERATE	LOW	4	3
W44B-02351	Phongolo	E	VERY HIGH	MODERATE	LOW	4	3
W44C-02338	Phongolo	E	VERY HIGH	MODERATE	LOW	4	3
W44D-02304	Phongolo	D	VERY HIGH	MODERATE	LOW	4	3
W45A-02216	Zibayeni	C/D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02245	Zibayeni	D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02246	Phongolo	D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02256	Lubambo	C/D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02275	Mpontshane	D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02282	Phongolo	D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02285	Mpontshane	C/D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02310	Mangqwashi	D/E	VERY HIGH	HIGH	MODERATE	4	3
W45A-02316	Mfongosi	C	VERY HIGH	HIGH	MODERATE	4	3
W45A-02356	Mlambo	C	VERY HIGH	HIGH	MODERATE	4	3
W45A-02367	Phongolo	C/D	VERY HIGH	HIGH	MODERATE	4	3
W45A-02368	Phongolo	D/E	VERY HIGH	HIGH	MODERATE	4	3
W45B-02029	Phongolo	D	VERY HIGH	HIGH	MODERATE	4	3
W45B-02105	Phongolo	D	VERY HIGH	HIGH	MODERATE	4	3

3.1.5 W5 Catchment (Main River: Usutu - excluding Eswatini)

The Usutu catchment has roughly 80 100 Ha of wetlands. **Figure 3.5** shows the spatial distribution of different wetland HGMs within the catchment. Channelled valley bottoms dominate the catchment with a total area of over 33081 Ha, but seepage wetlands, depressions and floodplains are also notable in extent covering 16814, 11266 and 12934 Ha respectively. Wetlands named in the NSBA within this catchment include Banzi Pan, Shokwe Pan, Upper Black Umfolozi, Langfontein Pan 3, Coalbank, Liefgekozen, Lake Chrissie and several other Lake Chrissie pans, Tweelingpan, Wets Tweelingpan, Lake Banagher and several other Lake Banagher pans, Van Aardt Kaalpan, Blinkpan, Hamilton, Neethlingpan, Grasdal, Florence, Blaauwater, Lusthop Pan 18, Tevreden and Tevrede se pan 16. The RUs that have a Very High wetland priority include W51-2 (Boesmanspruit and Assegaai), W51-3 (Swartwater and Mhkondvo), W53-1 (Sandspruit and Ngwempisi), W54-1 (uSuthu, including Coalbank and Liefgekozen, and Seganagana) and W55-1 (Mpumalanga pan district around Chrissiesmeer, Majosie se Vlei and Mpuluzi) and W57-1 (uSuthu, Banzi Pan Ndumo, Shokwe Pan) (**Table 3.5**).

From a regional perspective, Chrissiesmeer (Mpumalanga Lake District) has been classified as being an irreplaceable Critical Biodiversity Area in the Mpumalanga Biodiversity Sector Plan 2013. The majority of this ecosystem falls within the Chrissiesmeer Panveld Ecosystem which has been listed as Endangered in the National List of Ecosystems that are Threatened and in Need of Protection (GN1002 of 9 December 2011). In terms of the Mpumalanga Provincial Gazette Extraordinary (Notice 19 of 2014) the Mpumalanga Lake District forms part of the Chrissiesmeer Protected Environment (CPE). This area is unique due to the high density of pans, several of which are permanently saturated (DWA, 2014a). The pans range in size from less than a hectare to over a thousand hectares (Lake Chrissie). According to McCarthy *et al*. (2007), Tevreden Pan, along with other pans in the Mpumalanga Lakes District should be nominated/proposed for Listing as Wetlands of International Importance in terms of the Ramsar Convention, given the uniqueness

of the area, which includes its status as an important bird area (Global IBA: SA019 Chrissie Pans of approximately 62500 Ha), as well as its geomorphological and hydrological uniqueness.

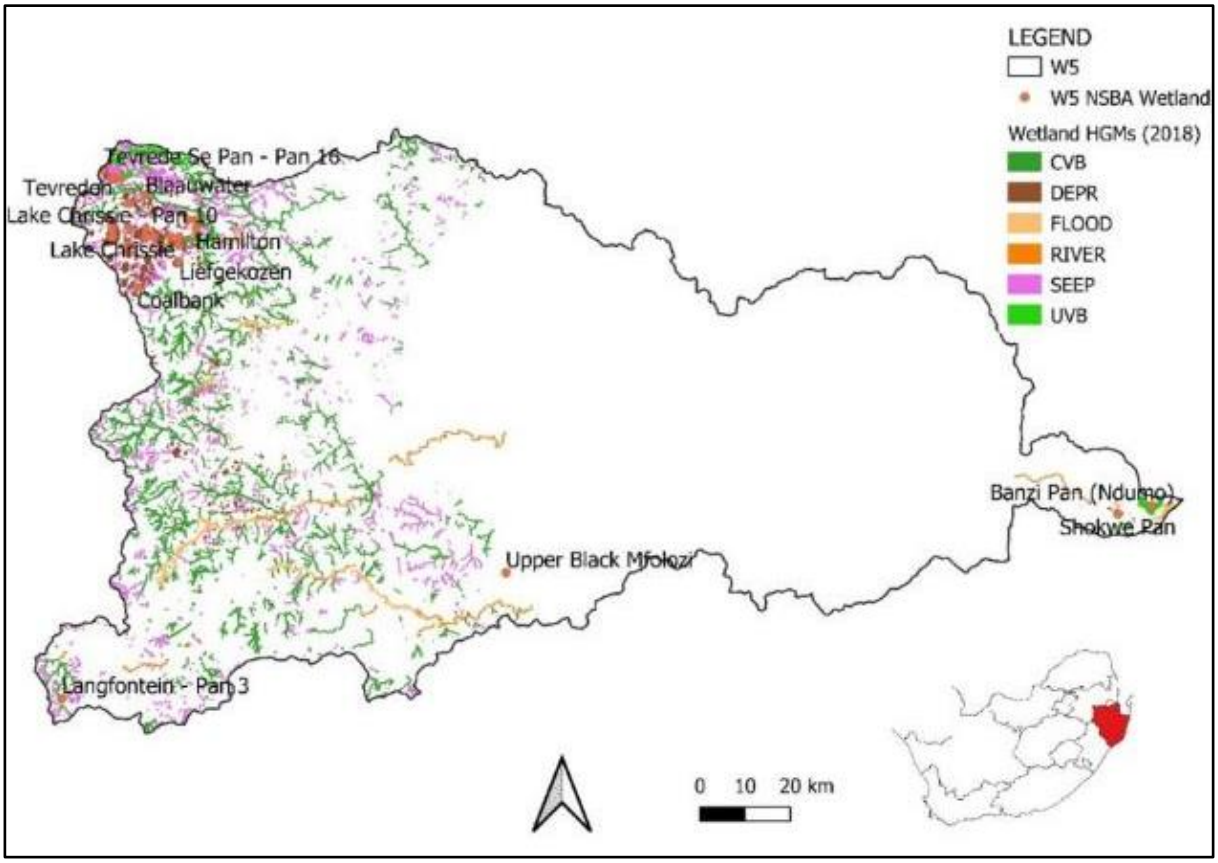

Figure 3.5 The spatial distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) in the Usutu Catchment (W5) and NSBA named wetlands (data from the NSBA, Driver *et al.*, 2005)

Table 3.5 Summary of wetland PES, EI, ES and IEI, along with WRUI and wetland priority per SQ in the Usutu catchment

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W51A-02082	Assegaai	D/E	VERY HIGH	HIGH	MODERATE	1	3
W51B-02101	Ngulane	E	VERY HIGH	VERY HIGH	MODERATE	1	3
W51C-01981	Assegaai	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W51C-02011		C	VERY HIGH	VERY HIGH	HIGH	4	4
W51C-02022	Assegaai	E	VERY HIGH	VERY HIGH	MODERATE	4	3
W51C-02067	Assegaai	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W51C-02074	Anysspruit	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W51C-02109	Boesmanspruit	C	VERY HIGH	VERY HIGH	HIGH	4	4
W51D-02044	Assegaai	C/D	VERY HIGH	VERY HIGH	MODERATE	4	3
W51D-02151	Swartwater	D	VERY HIGH	MODERATE	LOW	4	3
W51D-02160		C	HIGH	VERY HIGH	MODERATE	4	3
W51D-02171	Klein-Assegaai	D	HIGH	VERY HIGH	MODERATE	4	3
W51D-02177	Klein-Assegaai	C	HIGH	VERY HIGH	MODERATE	4	3
W51D-02193	Swartwater	C	VERY HIGH	VERY HIGH	HIGH	4	4

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W51E-02049	Mhkondvo	B	VERY HIGH	VERY HIGH	VERY HIGH	4	4
W51F-01919	Ndlozane	D	MODERATE	VERY HIGH	LOW	1	1
W51F-01951		D	VERY HIGH	HIGH	MODERATE	1	1
W51F-01986	Blesbokspruit	D	HIGH	VERY HIGH	MODERATE	1	1
W51F-02019	Blesbokspruit	D	VERY HIGH	VERY HIGH	MODERATE	1	1
W52A-01934		C/D	VERY HIGH	VERY HIGH	MODERATE	2	3
W52A-01983	Hlelo	C/D	VERY HIGH	VERY HIGH	MODERATE	2	3
W52B-01890		D	VERY HIGH	VERY HIGH	MODERATE	2	2
W52B-01964	Hlelo	D	VERY HIGH	VERY HIGH	MODERATE	2	2
W52C-01867	Hlelo	C/D	VERY HIGH	VERY HIGH	MODERATE	2	2
W52C-01888	Tweelingspruit	C	VERY HIGH	VERY HIGH	HIGH	2	2
W52D-01862	Hlelo	C/D	VERY HIGH	VERY HIGH	MODERATE	2	2
W53A-01757	Sandspruit	C	VERY HIGH	VERY HIGH	HIGH	4	4
W53A-01804	Ngwempisi	E	VERY HIGH	VERY HIGH	MODERATE	4	3
W53A-01853	Ngwempisi	C/D	VERY HIGH	HIGH	MODERATE	4	3
W53B-01694		D/E	VERY HIGH	VERY HIGH	MODERATE	4	3
W53B-01710	Mpama	D/E	VERY HIGH	VERY HIGH	MODERATE	4	3
W53C-01679	Thole	B/C	VERY HIGH	VERY HIGH	VERY HIGH	2	3
W53D-01751		B/C	HIGH	HIGH	HIGH	2	2
W53D-01764	Mpama	D/E	VERY HIGH	VERY HIGH	MODERATE	2	2
W53D-01773	Ngwempisi	D/E	VERY HIGH	VERY HIGH	MODERATE	2	2
W53D-01801	Ngwempisi	D	VERY LOW	LOW	VERY LOW	2	1
W53D-01809	Ngwempisi	C	VERY HIGH	VERY HIGH	HIGH	2	2
W53D-01814	Swartwaterspruit	C/D	VERY HIGH	VERY HIGH	MODERATE	2	2
W53E-01790	Ngwempisi	D/E	VERY HIGH	MODERATE	LOW	2	1
W54A-01534	uSuthu	C	VERY HIGH	VERY HIGH	HIGH	4	4
W54A-01630		C	VERY HIGH	VERY HIGH	HIGH	4	4
W54B-01569	uSuthu	D	VERY HIGH	VERY HIGH	MODERATE	4	3
W54B-01623	Seganagana	C	VERY HIGH	VERY HIGH	HIGH	4	4
W54C-01512	Bonnie Brook	B/C	VERY HIGH	VERY HIGH	VERY HIGH	1	2
W54C-01552	Bonnie Brook	C	VERY HIGH	VERY HIGH	HIGH	1	2
W54C-01556	Bonnie Brook	C	VERY HIGH	VERY HIGH	HIGH	1	2
W54D-01593	uSuthu	C/D	VERY HIGH	HIGH	MODERATE	1	1
W55A-01375	Mpuluzi	C	VERY HIGH	VERY HIGH	HIGH	2	4
W55A-01423	Majosie se Vlei	C	VERY HIGH	HIGH	MODERATE	2	4
W55C-01395	Mpuluzi	C/D	VERY HIGH	HIGH	MODERATE	2	4
W55C-01489	Swartwater	C/D	VERY HIGH	VERY HIGH	MODERATE	2	2
W55E-01477	Mpuluzi	C	VERY HIGH	VERY HIGH	HIGH	2	2
W55D-01506	Metula	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W56A-01372	Lusushwana	C/D	VERY HIGH	VERY HIGH	MODERATE	1	1
W57J-01923	uSuthu	A/B	VERY HIGH	MODERATE	VERY HIGH	0	2
W57K-01929	uSuthu	B	VERY HIGH	HIGH	VERY HIGH	0	2
W57K-02025		B/C	VERY HIGH	HIGH	HIGH	0	1

3.1.6 W7 Catchment (Kosi Estuary and Sibaya Lake)

The Lake Sibaya and Kosi catchment has roughly 82 200 Ha of wetlands including estuaries and 59 500 Ha of wetlands excluding estuaries. **Figure 3.6** shows the spatial distribution of different wetland HGMs within the catchment. Depressions and floodplains dominate the catchment with a

total area each of 33191 Ha and 21991 Ha respectively. Wetlands named in the National Spatial Biodiversity Assessment within this catchment include Mgobozeleni – Shazibe, KuMzingwane, KuMzinganwane, Siyadla, Mvelabusha, Muzi Swamps, Sileza Vlei, Nlangu mire complex, Kosi – Siyadla, KuShengeza, Kozi – aManzamnyama, Sihadla, Enkathweni, Kosi – Swamanzi, KuNkanini, Matitimane, Apiesdraai, Mtando, Kosi – Ngweve, KuZilonde, Kukalwe, Cele, Nlovu, Gazini and Mloli. The Vazi Pan peatlands near the town of Manguzi is also within this catchment. The Resource Units (RUs) that have a Very High wetland priority include W70-1 (Swamanzi) and W70-3 (Lake Sibaya, Muzi swamps) (**Table 3.6**).

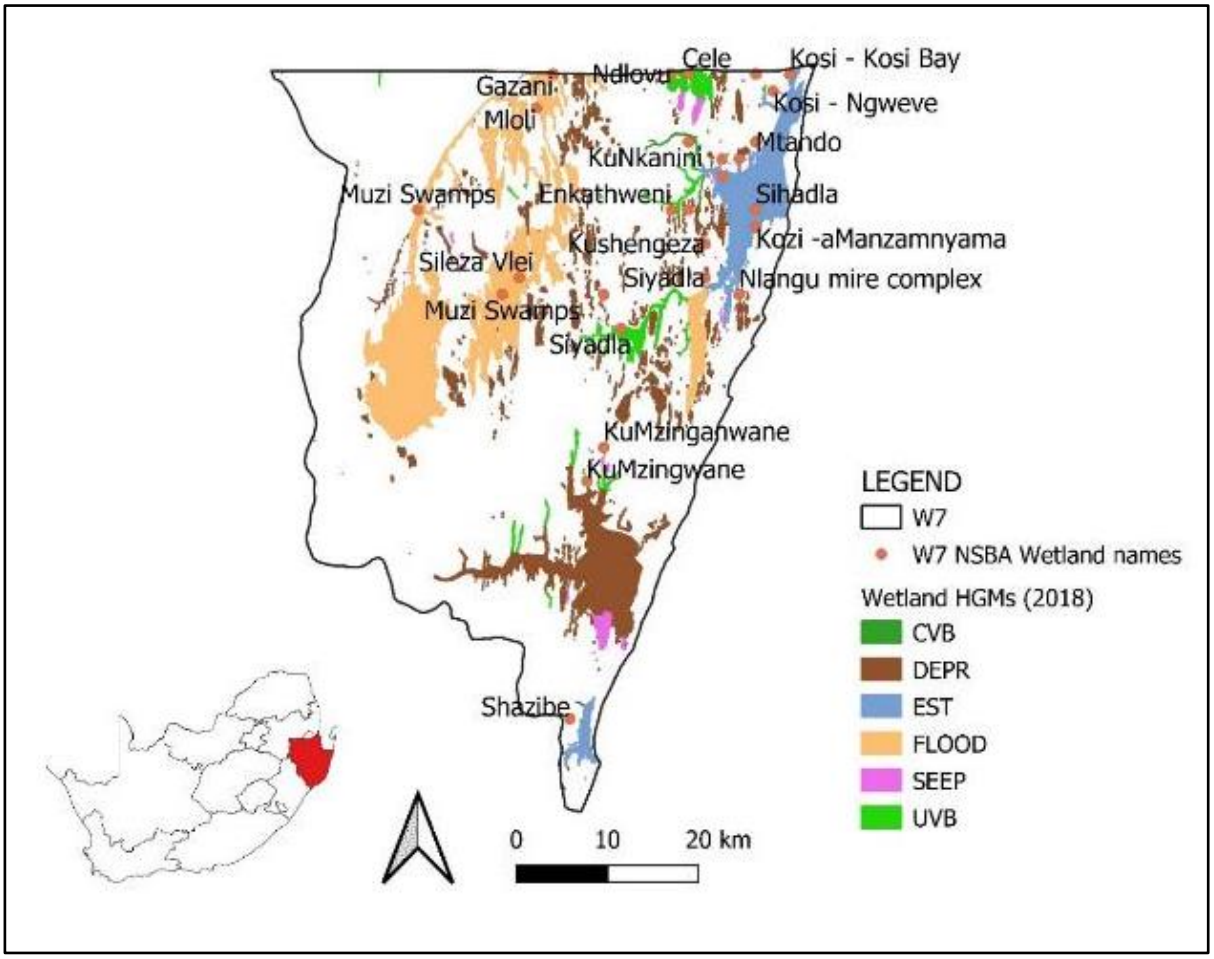

Figure 3.6 The spatial distribution of different HGMs (2018 updated wetland map 5; van Deventer *et al.*, 2018) in the Lake Sibaya and Kosi Catchment (W7) and NSBA named wetlands (data from the NSBA, Driver *et al.*, 2005)

Table 3.6 Summary of wetland PES, EI, ES and IEI, along with WRUI and wetland priority per SQ in the Kosi and Lake Sibaya catchment

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W70A-02046	Kosi Lakes	**Estuary**					2
W70A-02079	Swamanzi	**E**	VERY HIGH	HIGH	MODERATE	0	1
W70A-02112	Malangeni	**B/C**	VERY HIGH	HIGH	HIGH	0	1
W70A-02030	Muzi Swamps	**N/A**	VERY HIGH	HIGH	VERY HIGH		4
W70A-02278	Lake Sibaya	**B/C***	VERY HIGH	HIGH	VERY HIGH		4

SQ	Name	Wetland PES	Wetland EI	Wetland ES	Wetland IEI	WRUI	Priority
W70A-02301		D	VERY HIGH	VERY HIGH	MODERATE	2	2
W70A-02381		C	VERY HIGH	HIGH	MODERATE		1

* DWS, 2015a.

4 QUANTIFICATION OF THE WETLAND EWR

It is important to note that wetland EWRs are only considered for those wetlands with a very high and at times, high priority. As the calculation of priority includes ecological aspects only as a *contribution* to the calculation, many ecologically important wetlands do not necessarily score very high for priority since water resource demand / use may not also be high.

For each very high priority wetland, the EWR is determined according to the following steps:

1) Determine dominant wetland HGM type.
2) Determine appropriate level of RDM study for wetlands according to HGM type.
3) Assess / validate EcoStatus of these priority wetlands, including the REC.
4) Determine EWR (or other RDM) to achieve the REC.

4.1 DETERMINATION OF THE DOMINANT HGM TYPE

The HGM types of wetlands with High or Very High priority are shown in **Figure 4.1** and although the estuaries are also shown, these do not form any further part of this assessment. HGM types were taken from NBA spatial dataset (van Deventer *et al*., 2018), but were updated / changed in some cases when viewed with Google or Bing satellite imagery.

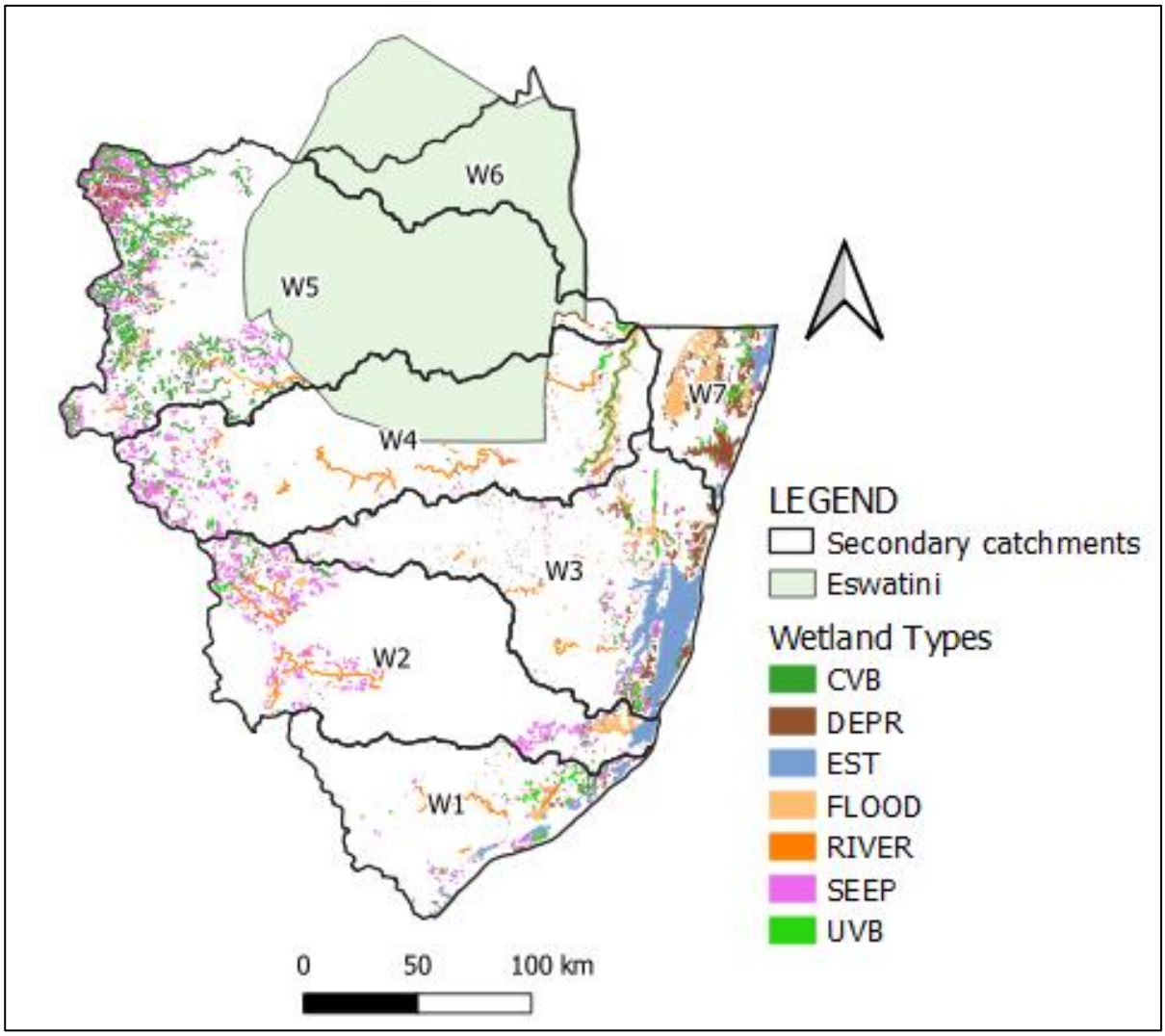

Figure 4.1 Wetland HGM types of high and very high priority wetlands only

4.2 DETERMINE APPROPRIATE LEVEL OF RDM

The characteristics of the various levels of RDM assessments (according to published methods) associated with wetland type and level of Reserve study are shown in **Figure 4.2**. These procedures (outlined in DWA, 2012; **Figure 4.2**) for the desktop Reserve of floodplains involve the traditional river-based hydrology and hydraulic approaches, "with some adaptation", since floodplains would (hydraulically) function similarly to rivers, although the overbank features are unique and this makes these wetland types more complex than river studies. There is no prescribed method for intermediate and comprehensive Reserve studies, while a desktop Reserve would utilise the current desktop (hydrological) model. Since river EWR sites could not be used to infer flow requirements for these floodplains, it was decided to take the EcoStatus approach whereby the vegetation component of WET-Health (MacFarlane et al., 2007) and the SANLC data (2020) was used to score the PES and REC. Conservation and maintenance of the REC would then be a compromise of flow requirements, and as such the aim of the EWR would then be to maintain the REC, and quantification of land-use cover within each wetland system would lend itself to the quantification of ecological specifications for this purpose.

	RQO's only		Reserve Study			
	Generic RQO's/conditions	*EcoStatus and specific RQO's*	*Desktop Reserve*	*Rapid Reserve*	*Intermediate Reserve*	*Comprehensive Reserve*
Amount of data collection	*increasing cost, time and complexity* →					
	Low	Low	Low	Moderate	High	Very high
No. of site visits required	0	1	0	1	2	2 to 3
Type of wetland:	**Description/Citation of method:**					
Seepage wetlands	Standard conditions/RQO's	EcoStatus and RQOs				
Pans	Standard conditions/RQO's	EcoStatus and RQOs	Fluvius, 2007 (summarised in Rountree, 2012)	Rountree *et al.*, 2012	(not yet developed)	
Wetland Flats	Standard conditions/RQO's	EcoStatus and RQOs	*Undertake Groundwater Reserve and monitor wetlands as indicator of groundwater resource condition (similarly for other wetlands that are primarily groundwater fed).*			
Lakes	Standard conditions/RQO's	EcoStatus and RQOs			DWAF, 1999	DWAF, 1999
Unchannelled Valley Bottoms	Standard conditions/RQO's	EcoStatus and RQOs	Use current desktop model	Rountree *et al.*, 2012	(not yet developed)	
Channelled Valley Bottoms	Standard conditions/RQO's	EcoStatus and RQOs	Use current desktop model	Rountree *et al.*, 2012	No formal publication, but refer to approaches used on Nyl floodplain by Birkhead *et al.* (2007).	
Floodplains	Standard conditions/RQO's	EcoStatus and RQOs	Use current desktop model	Rountree *et al.*, 2012	No formal publication, but refer to approaches used at EWR site 7 on the large Wilge Floodplain (DWA, 2010).	

Figure 4.2 Characteristics of the various levels of RDM assessments (published methods) according to wetland type and level of Reserve study (DWA, 2012)

4.3 ASSESS / VALIDATE ECOSTATUS OF PRIORITY WETLANDS

The EcoStatus was assessed, or where an assessment existed, was validated for wetlands with Very High (and at times High) priority. WET-Health (MacFarlane *et al*., 2007) was used to determine the PES for large floodplains and representative channelled valley-bottom wetlands (WET-Health spreadsheets and Google Earth kml shapes are available in electronic format). SANLC data (2020) were used to populate WET-Health and augment assessments. SANLC classes were each assigned an ecological integrity score (see Appendix A) that ranged from 1, completely natural to 0, completely impacted. PESEIS (DWS, 2014) metrics for the riparian/wetland assessments were used as a starting point for most channelled and unchannelled valley-bottom wetlands and were verified using SANLC data and Google Earth ©, and seeps were evaluated in the same way using Google Earth and associated with the nearest SQ.

4.3.1 W1 Catchment (Main River: Mhlathuze)

The SQs that have a Very High wetland priority form 4 groups and include W12E-03475 (Mhlathuze leading into the Mhlathuze swamp system), W12H-03459 (mostly lower reaches of Nseleni, including Nsezi and portions of the Mhlathuze floodplain), W12J-03450 (Nundwane, mainly Mzingazi), W12J-03392 (Mpisini) and W12J-03403 (extensive channelled valley bottom wetlands leading into Richard's Bay Estuary, and W12J-03411 (Depressions and seeps near the Nlabane estuary). **Table 4.1** shows summary data for each and a note about which portions were additionally included in further assessments. Note that the main reason for wetland prioritization is to reduce the number of wetlands to be further investigated so that the task is achievable. In this regard only the highest priority wetlands (in this case wetlands with a Very High priority) were considered for addition assessment. If wetlands with a High priority in W1 were also included in would mean the addition of wetlands within another 17 SQs (refer to **Table 3.1**).

Table 4.1 Summary of wetland PES, IEI and priority per SQ in the Mhlathuze catchment

Group	SQ	SQ Name	Wetland PES*	Note	Wetland IEI	Priority
1	W12E-03475	Mhlathuze	C	Riverine wetlands along the Mhlathuze River leading into the Mhlathuze swamp system, including Lake Mpangeni.	HIGH	4
2	W12H-03459	Nseleni	C	Floodplains along lower reaches of Nseleni, including Nsezi and portions of the Mhlathuze floodplain. For the sake of completeness, the remainder of the floodplain along the Mhlathuze (W12F-03494) was also included in the assessment.	HIGH	4
3	W12J-03411		C	Depressions and seeps surrounding the Nlabane estuary.	HIGH	4
4	W12J-03392	Mpisini	C	Extensive channelled and unchanneled valley bottom wetlands leading into Richard's Bay Estuary, includes Mzingazi. Mzingazi was historically part of the Richard's Bay estuary, but a weir was built between the lake and the connection to the ocean which results in the lake currently being a freshwater system.	HIGH	4
	W12J-03403		C		HIGH	4
	W12J-03450	Nundwane	C		HIGH	4

* PES based on PES/EI/ES, Wetcon (NFEPA, NWM).

1) Mhlathuze Riverine Wetlands

This SQ is comprised mainly of riverine wetlands along the Mhlathuze River leading into the Mhlathuze swamp system downstream, and includes Lake Mpangeni, which is not along the main channel. The PES for this stretch of river was updated / re-evaluated, using Google Earth ©, in this project as part of the River assessment and included the assessment of these riverine wetlands. The new ratings for riparian / wetland zone continuity modification were 2 (near natural or slightly modified) and 3 (moderately modified) for riparian / wetland zone modification with an overall PES of C/D for the SQ and an REC of C. Main impacts included cultivation, sand mining, roads and blocked valley bottom wetlands / water body with cultivation on the shores.

2) Mhlathuze Floodplain

Includes floodplains along the lower reaches of Nseleni, including Lake Nsezi and portions of the Mhlathuze floodplain. For the sake of completeness, the remainder of the floodplain along the Mhlathuze (W12F-03494) was also included in the assessment, and because this SQ also had a High wetland priority. The extent of the Mhlathuze floodplain that was assessed is shown in **Figure 4.3**, and includes two HGMs: Both portions of floodplain along different rivers (Nseleni and

Mhlathuze), HGM 1 is 3148 Ha and HGM 2 is 1661 Ha. The floodplain delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Table 4.2**. Commercial sugar cane is clearly the major impact.

The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of an E category, where the two HGMs were weighted according to extent (wetland area), and since this is considered ecologically unsustainable the REC was set to a category D:

HGM 1: Floodplain	
Ecological Integrity Score:	43.5
Ecological Category:	**D**
Area (Ha):	3147.8
HGM 2: Floodplain	
Ecological Integrity Score:	21.8
Ecological Category:	**E/F**
Area (Ha):	1661.2
WETLAND PES	
Ecological Integrity Score:	36.0
Ecological Category:	**E**
Area (Ha):	4809.0
WETLAND REC	
Ecological Integrity Score:	42.0
Ecological Category:	**D**

The vegetation component of WET-Health calculated an ecological category of E with a negative trajectory:

Vegetation Health

Present Vegetation State	**E**
Trajectory of change	↓

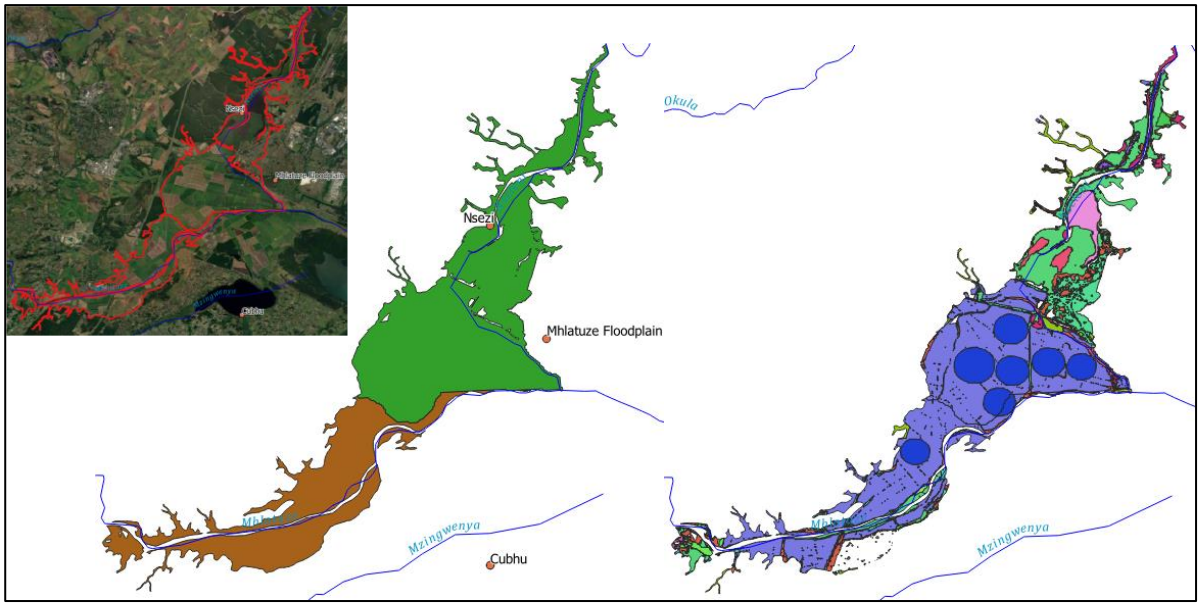

Figure 4.3 Mhlathuze floodplain (2 floodplain HGMs shown in green and brown, left) that were assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth ©. Inset shows NWM (2018) delineation relative to satellite imagery

Table 4.2 Extent of land cover / disturbance within the Mhlathuze floodplain

HGM 1 (2018 NLC Class Name)	**Cover (% wetland area)**
Cultivated Commercial Sugarcane Non-Pivot (all other)	34.8
Herbaceous Wetlands (previous mapped extent)	17.8
Cultivated Commercial Sugarcane Pivot Irrigated	16.1
Natural Grassland	8.3
Contiguous Low Forest & Thicket (combined classes)	6.0
Natural Lakes	3.8
Contiguous (indigenous) Forest (combined very high, high, medium)	3.7
Contiguous & Dense Planted Forest (combined classes)	3.4
Artificial Dams (incl. canals)	1.6
Dense Forest & Woodland (35 - 75% cc)	1.4
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Cultivated Commercial Sugarcane Non-Pivot (all other)	59.8
Mines: Waste (Tailings) & Resource Dumps	9.9
Contiguous Low Forest & Thicket (*combined classes*)	6.8
Herbaceous Wetlands (previous mapped extent)	6.4
Cultivated Commercial Sugarcane Pivot Irrigated	5.3
Natural Grassland	4.5
Dense Forest & Woodland (35 - 75% cc)	2.4
Contiguous & Dense Planted Forest (*combined classes*)	1.3
Subsistence / Small-Scale Annual Crops	1.0
Herbaceous Wetlands (currently mapped)	0.7

3) Nlabane Estuary Wetlands

This group of wetlands includes depressions and seeps surrounding the Nlabane estuary (**Figure 4.4**) but excludes the estuary itself. The HGM delineations used for the assessment were from the NWM (2018). The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Table 4.2**. Contiguous & Dense Planted Forest is clearly the major impact in the area. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a D category, and with a suggested REC of a C/D:

WETLAND PES	
Ecological Integrity Score:	52.7
Ecological Category:	**D**
Area (Ha):	546.9
WETLAND REC	
Ecological Integrity Score:	58.0
Ecological Category:	**C/D**

The vegetation component of WET-Health however, calculated an ecological category of E with a stable trajectory:

Vegetation Health

Present Vegetation State	**E**
Trajectory of change	→

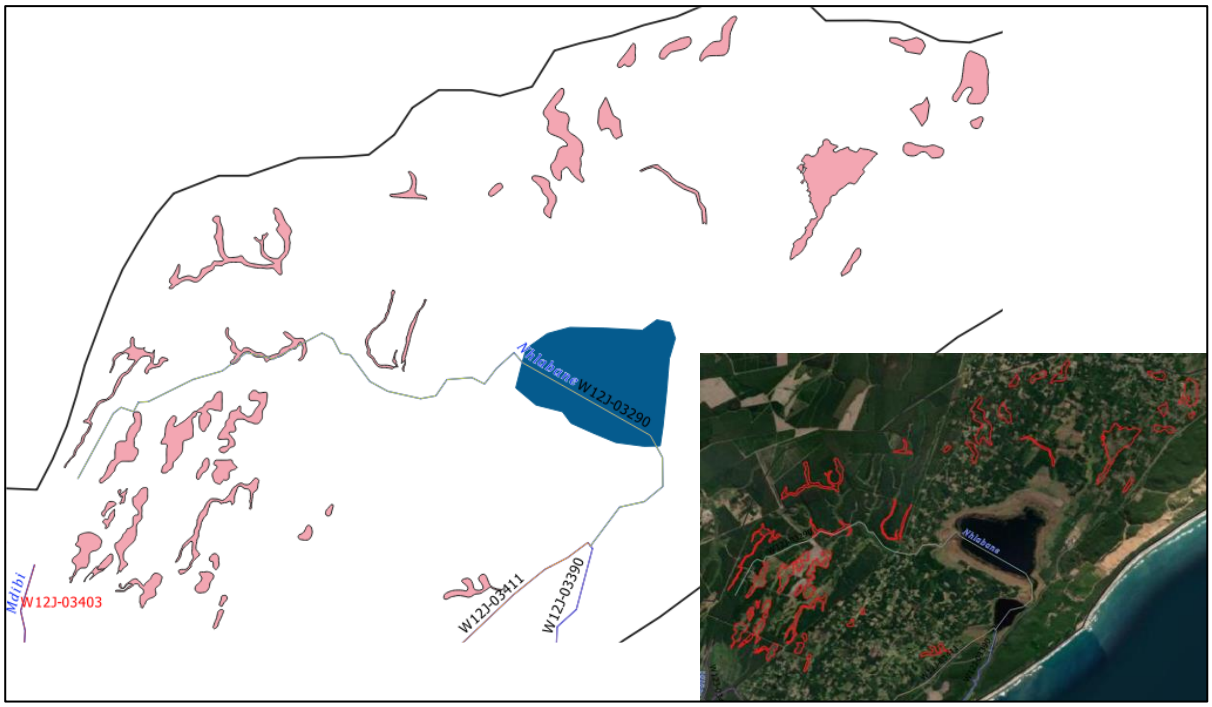

Figure 4.4 Nlabane esturay wetlands that were assessed with SANLC data (2020) and WET-Health Level 2 using Google Earth ©. Inset shows NWM (2018) delineation relative to satellite imagery

Table 4.3 Extent of land cover / disturbance within the Nlabane wetlands

HGM 1 (2018 NLC Class Name)	Cover (% wetland area)
Contiguous & Dense Planted Forest (combined classes)	49.1
Herbaceous Wetlands (previous mapped extent)	17.1
Contiguous (indigenous) Forest (combined very high, high, medium)	9.6
Temporary Unplanted Forest	8.7
Contiguous Low Forest & Thicket (combined classes)	5.3
Natural Grassland	3.3
Residential Formal (Tree)	2.1
Dense Forest & Woodland (35 - 75% cc)	2.1
Residential Formal (low veg / grass)	1.2
Herbaceous Wetlands (currently mapped)	0.6

4) Mzingazi and surrounding wetlands

Extensive channelled and unchanneled valley bottom wetlands leading into Richard's Bay Estuary, includes Mzingazi (**Figure 4.5**). Mzingazi was historically part of the Richard's Bay estuary, but a weir was built between the lake and the connection to the ocean which results in the lake currently being a freshwater system. The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Table 4.4**. Many of the land cover types within the wetlands are natural with

contiguous and dense planted forest being the major impact. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a B/C category, where the two HGMs were weighted according to extent (wetland area), and since this is a near natural to slightly modified condition, the REC was set maintain the PES (B/C category):

..

HGM 1: Valley-bottom with a channel	
Ecological Integrity Score:	75.0
Ecological Category:	C
Area (Ha):	785.4
HGM 2: Valley-bottom with a channel	
Ecological Integrity Score:	83.1
Ecological Category:	B
Area (Ha):	903.6
WETLAND PES	
Ecological Integrity Score:	79.3
Ecological Category:	B/C
Area (Ha):	1689.0
WETLAND REC	
Ecological Integrity Score:	79.3
Ecological Category:	B/C

The vegetation component of WET-Health calculated an ecological category of C with a stable trajectory:

Vegetation Health

Present Vegetation State	C
Trajectory of change	→

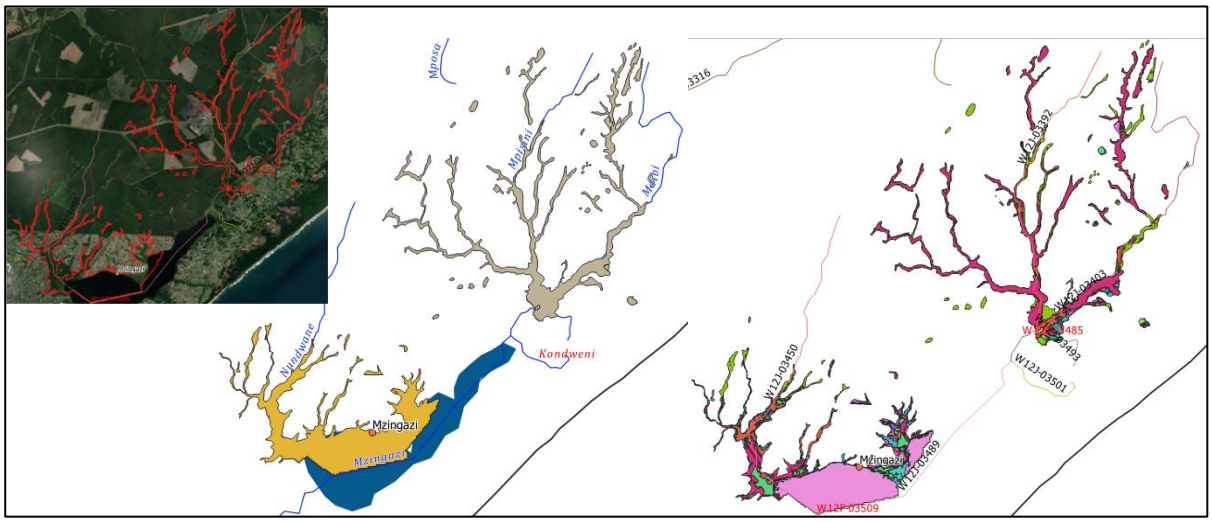

Figure 4.5 Mzingazi valley bottom wetlands (2 HGMs shown in orange and brown, left) that were assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth ©. Inset shows NWM (2018) delineation relative to satellite imagery

Table 4.4 Extent of land cover / disturbance within the Mzingazi wetlands

HGM 1 (2018 NLC Class Name)	Cover (% wetland area)
Contiguous (indigenous) Forest (*combined* very high, high, medium)	55.9
Contiguous & Dense Planted Forest (*combined classes*)	21.2
Contiguous Low Forest & Thicket (*combined classes*)	9.5
Residential Formal (Tree)	3.5
Temporary Unplanted Forest	2.6
Residential Formal (low veg / grass)	2.5
Natural Grassland	1.5
Herbaceous Wetlands (currently mapped)	1.0
Dense Forest & Woodland (35 - 75% cc)	0.5
Mines: Surface Infrastructure	0.5
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Natural Lakes	45.8
Contiguous Low Forest & Thicket (*combined classes*)	11.8
Contiguous (indigenous) Forest (*combined* very high, high, medium)	9.7
Herbaceous Wetlands (previous mapped extent)	7.8
Residential Formal (Tree)	6.8
Residential Formal (low veg / grass)	5.8
Contiguous & Dense Planted Forest (*combined classes*)	4.5
Dense Forest & Woodland (35 - 75% cc)	3.7
Natural Grassland	1.2
Other Bare	0.7

4.3.2 W2 Catchment (Main River: Umfolozi)

The SQs that have a Very High or High wetland priority form 4 groups and include W21G-02885, W21H-02897 and W21H-03004 (mainly the White Mfolozi, and mainly because PES is B and WRUI is high). Some SQs with High priority wetlands were also included, mainly because they contain known wetlands of importance and recognised as priority in other studies. These included Aloeboom vlei, Mvamanzi pan and the Mfolozi swamp. **Table 4.5** shows summary data for each and a note about which portions were additionally included in further assessments.

Table 4.5 Summary of wetland PES, IEI and priority per SQ in the Umfolozi catchment

Group	SQ	SQ Name	Wetland PES*	Note	Wetland IEI	Priority
1	W21G-02885	White Mfolozi	B	These SQs contain riverine wetlands along the White Mfolozi, and have a very high priority mainly because the PES is B and WRUI is high.	VERY HIGH	4
	W21H-02897	White Mfolozi	B		VERY HIGH	4
	W21H-03004	White Mfolozi	B		VERY HIGH	4
2	W22A-02586	Black Mfolozi	C	These SQs comprise the Aloeboom vlei.	HIGH	3
	W22A-02591		C/D		MODERATE	3
	W22A-02596	Black Mfolozi	C		HIGH	3
3	W23A-03160	Mvamanzi	C/D	Mvamanzi Pan	MODERATE	3
4	W23C-03180	Msunduzi	E	The Mfolozi and Msunduzi rivers both form part of the Mfolozi swamp in their lower reaches.	MODERATE	3
	W23D-03108	Mfolozi	E		MODERATE	3

* PES based on PES-EI-ES, Wetcon (NFEPA, NWM).

1) White Mfolozi Riverine Wetlands

This SQ is comprised mainly of riverine wetlands along the White Mfolozi River and mainly through the gorge area along SQ W21H-02897. The PES for this stretch of river was updated / re-evaluated, using Google Earth ©, in this project as part of the River assessment and included the assessment of these riverine wetlands. The new ratings for riparian / wetland zone continuity modification were 1 (natural) and 2 (near natural or slightly modified) for riparian / wetland zone modification with an overall PES of B for the SQ and a REC to maintain the PES at B. Main impacts included localised road crossings, over-grazing in places and sediments from upstream.

2) Aloeboom Vlei

Aloeboom vlei was noted as a priority wetland by Cowan (1995 in DWS, 2014) and Begg (1989) as well having a High priority in this study process. The extent of the Aloeboom vlei that was assessed is shown in **Figure 4.6**, and includes two HGMs: The main portion of vlei is comprised of chanelled valley bottom wetlands (260 Ha) and the second HGM by hillslope seeps linked to the channel (84 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetland is shown in **Table 4.6**. Temporary unplanted forest and contiguous and dense planted forest are the main impacts.

The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a C category, where the two HGMs were weighted according to extent (wetland area), and since the valley-bottom HGM is already a B/C, the REC was set to improve to a category B/C overall:

HGM 1: Valley-bottom with a channel	
Ecological Integrity Score:	79.8
Ecological Category:	**B/C**
Area (Ha):	259.7
HGM 2: Hillslope seepage linked to a stream channel	
Ecological Integrity Score:	60.0
Ecological Category:	**C/D**
Area (Ha):	84.1
WETLAND PES	
Ecological Integrity Score:	74.9
Ecological Category:	**C**
Area (Ha):	343.8
WETLAND REC	
Ecological Integrity Score:	78.0
Ecological Category:	**B/C**

The vegetation component of WET-Health calculated an ecological category of C with a negative trajectory:

Vegetation Health

Present Vegetation State	**C**
Trajectory of change	↓

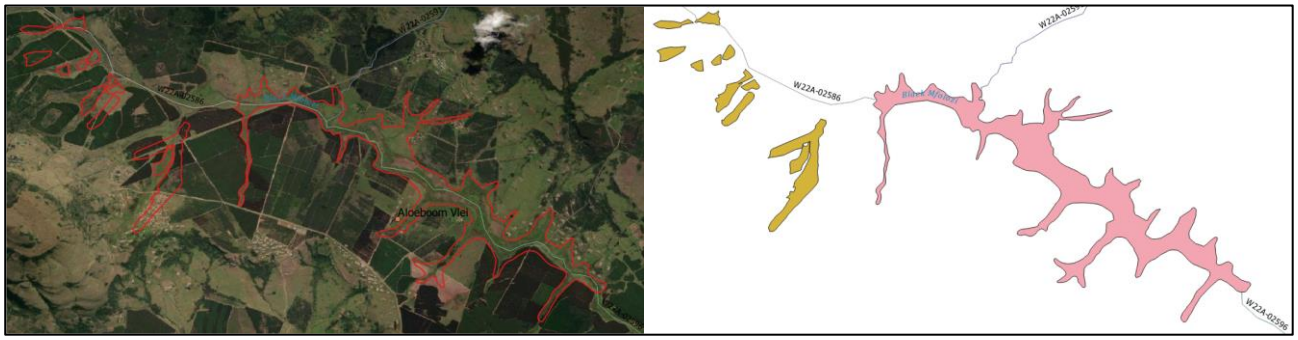

Figure 4.6 Aloeboom vlei (2 HGMs shown in orange (Seep) and pink (CVB)) that were assessed with SANLC data (2020) and WET-Health Level 2 using Google Earth © (left, delineation shown in red)

Table 4.6 Extent of land cover / disturbance within the Aloeboom Vlei

HGM 1 (2018 NLC Class Name)	Cover (% wetland area)
Natural Grassland	27.5
Herbaceous Wetlands (currently mapped)	24.4
Herbaceous Wetlands (previous mapped extent)	13.7
Temporary Unplanted Forest	9.1
Contiguous & Dense Planted Forest (*combined classes*)	7.4
Fallow Land & Old Fields (wetlands)	6.6
Subsistence / Small-Scale Annual Crops	2.9
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	2.3
Dense Forest & Woodland (35 - 75% cc)	2.1
Contiguous Low Forest & Thicket (*combined classes*)	1.3
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Contiguous & Dense Planted Forest (*combined classes*)	26.8
Natural Grassland	21.3
Herbaceous Wetlands (previous mapped extent)	18.0
Temporary Unplanted Forest	10.4
Herbaceous Wetlands (currently mapped)	8.1
Residential Formal (low veg / grass)	6.7
Open & Sparse Planted Forest	2.8
Village Dense (bare only)	2.4
Residential Formal (Bare)	1.1
Village Scattered (bare only)	1.0

3) Mvamanzi Pan

The Mvamanzi pan appears to be a depressional formation at the end of the Mvamanzi River (W23A-03160). The HGM delineation used for the assessment was from the NWM (2018) but while the NWM records the wetland as a seepage, it appears to be a channelled valley-bottom wetland leading into a depressional area (**Figure 4.7**). The extent and nature of the main land cover types / disturbances within the wetland is shown in **Table 4.7**. Most of the land cover types within the wetland are natural with the major impacts, although small, being subsistence / small-scale annual crops and fallow fields. The assessment of internal wetland integrity by assigning

ecological integrity scores to the various land cover types produced and overall outcome of a B/C category, and with a suggested REC of maintaining the PES at B/C:

WETLAND HGM: Valley-bottom with a channel	
WETLAND PES	
Ecological Integrity Score:	78.3
Ecological Category:	**B/C**
Area (Ha):	485.1
WETLAND REC	
Ecological Integrity Score:	78.3
Ecological Category:	**B/C**

The vegetation component of WET-Health however, calculated an ecological category of C with a stable trajectory:

Vegetation Health

Present Vegetation State	**C**
Trajectory of change	→

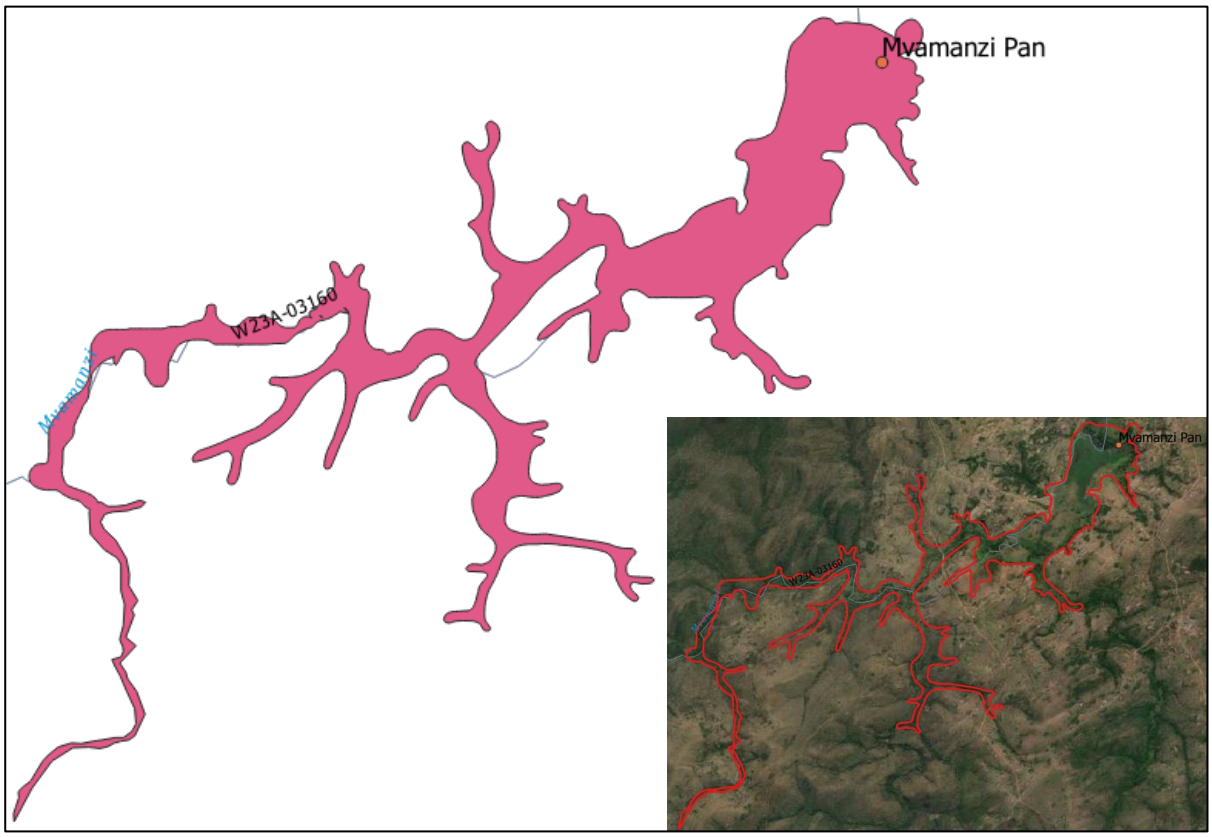

Figure 4.7 Mvamanzi pan that was assessed with SANLC data (2020) and WET-Health Level 2 using Google Earth ©. Inset shows NWM (2018) delineation relative to satellite imagery

Table 4.7 Extent of land cover / disturbance within Mvamanzi pan

(2018 NLC Class Name)	Cover (% wetland area)
Contiguous Low Forest & Thicket (combined classes)	21.6
Dense Forest & Woodland (35 - 75% cc)	21.4
Herbaceous Wetlands (currently mapped)	10.4
Subsistence / Small-Scale Annual Crops	9.7
Natural Grassland	9.6
Herbaceous Wetlands (previous mapped extent)	8.7
Fallow Land & Old Fields (Trees)	4.9
Residential Formal (Tree)	4.8
Residential Formal (low veg / grass)	4.0
Residential Formal (Bare)	2.7

4) Mfolozi Swamp

The Mfolozi (W23C-03180) and Msunduzi (W23D-03108) rivers both form part of the Mfolozi swamp in their lower reaches with extensive floodplains connecting the two rivers (**Figure 4.8**). The wetland delineation used for the assessment was that from the NWM (2018) which shows the wetlands along the Mfolozi as floodplain wetlands and those along the Msunduzi to its confluence with the Mfolozi as estuarine, which was historically connected to the St Lucia estuary. This area is more like floodplain in character however and has been denoted as such and included in this assessment. The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Table 4.8**. The main impacts within the wetlands are cultivated commercial sugarcane non-pivot and contiguous and dense planted forest. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a D category, where the two HGMs were weighted according to extent (wetland area). Given that the impacts resulting in this score are difficult to change it is unlikely that an improvement could be made so the REC has been set to maintain the PES, but if improvement was sought it would mean reducing the impacts of sugarcane agriculture:

HGM 1: Floodplain	
Ecological Integrity Score:	40.2
Ecological Category:	**D/E**
Area (Ha):	3732.0
HGM 2: Floodplain	
Ecological Integrity Score:	52.5
Ecological Category:	**D**
Area (Ha):	8179.1
WETLAND PES	
Ecological Integrity Score:	48.7
Ecological Category:	**D**
Area (Ha):	11911.1
WETLAND REC	
Ecological Integrity Score:	48.7
Ecological Category:	**D**

The vegetation component of WET-Health calculated an Ecological Category of E with a stable trajectory:

Vegetation Health

Present Vegetation State	**E**
Trajectory of change	→

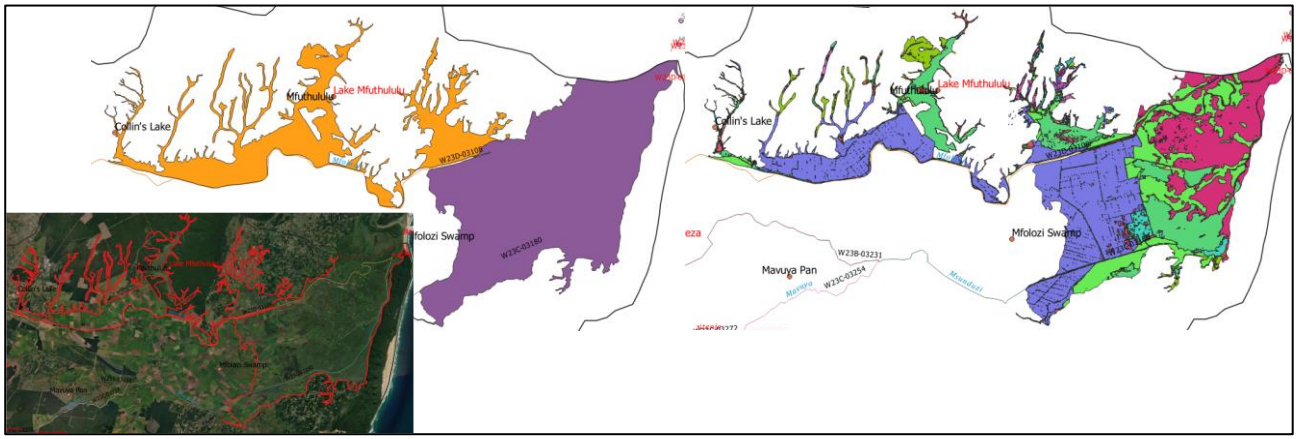

Figure 4.8 **Mfolozi swamp floodplains (2 HGMs shown in orange and purple, left) that were assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth ©. Inset shows NWM (2018) delineation relative to satellite imagery**

Table 4.8 **Extent of land cover / disturbance within the Mzingazi wetlands**

HGM 1 (2018 NLC Class Name)	**Cover (% wetland area)**
Cultivated Commercial Sugarcane Non-Pivot (all other)	42.0
Herbaceous Wetlands (previous mapped extent)	22.4
Contiguous & Dense Planted Forest (combined classes)	9.4
Contiguous Low Forest & Thicket (combined classes)	5.2
Natural Grassland	4.2
Subsistence / Small-Scale Annual Crops	3.2
Residential Formal (low veg / grass)	2.5
Dense Forest & Woodland (35 - 75% cc)	2.4
Residential Formal (Tree)	1.8
Residential Formal (Bare)	1.2
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Cultivated Commercial Sugarcane Non-Pivot (all other)	31.5
Contiguous (indigenous) Forest (combined very high, high, medium)	27.4
Subsistence / Small-Scale Annual Crops	21.2
Herbaceous Wetlands (previous mapped extent)	12.1
Dense Forest & Woodland (35 - 75% cc)	3.2
Contiguous Low Forest & Thicket (combined classes)	1.6
Natural Grassland	1.3
Artificial Dams (incl. canals)	0.5
Contiguous & Dense Planted Forest (combined classes)	0.5
Coastal Sand Dunes & Beach Sand	0.2

4.3.3 W3 Catchment (Main River: Mkuze)

The RUs that have a Very High, and in some cases High wetland priority form 5 groups and include W31-4 (Mkuze and Nhlonhlela rivers including Nhlonhlela Pan), W33-7 (Hluhluwe, Nyalazi and Mpate, including Nyalazi, Bushlands Pan and Hluhluwe River Vlei and the St Lucia RU) and the St Lucia RU which includes the Mkuze River with swamps and floodplain before entering the estuary. Some of the wetlands with a High priority were also included because they are well known wetlands, or have a large extent, or have been highlighted in other studies as priority wetlands e.g. Hluhluwe and Mkuze floodplains. **Table 4.9** shows summary data for each and a note about which portions were additionally included in further assessments.

Table 4.9 Summary of wetland PES, IEI and priority per SQ in the Mkuze catchment

Group	SQ	SQ Name	Wetland PES*	Note	Wetland IEI	Priority
1	W31J-02469	Mkuze	B	Mkuze and Nhlohlela rivers including Nhlonhlela Pan near their confluence	VERY HIGH	4
	W31J-02501	Nhlohlela	B		HIGH	3
2	W32F-02835	Hluhluwe	D/E	Hluhluwe River floodplain before entering the St Lucia estuary.	MODERATE	3
3	W32H-02854	Nyalazi	C/D	Depressional wetlands with swamp forest in the Nyalazi River catchment. Many pans are in the area known as the Makhakathana Flats but the largest, Nyalazi pan was taken to represent the area.	MODERATE	3
4	W32H-02998	Mpate	B	Channelled valley-bottom and depressional wetlands in the Mpate River catchment that leads into St Lucia	VERY HIGH	4
5	W32B-02535	Mkuze	N/A	Mkuze River including the Mkuze swamp system and the Mkuze floodplain. The NWM coverage was insufficient, so desktop delineation has been added.	VERY HIGH	3

* PES based on PES-EI-ES, Wetcon (NFEPA, NWM); N/A = not assessed.

1) Nhlohlela Pan

The Mkuze River (very high priority) and the Nhlohlela River (high priority) confluence area including Nhlonhlela Pan, a depressional wetland (**Figure 4.9**). The pan has been highlighted to represent wetlands associated with these two SQ. The extent and nature of the main land cover types / disturbances within the wetland is shown in **Table 4.15**. All of the land cover types within the wetland are natural with no notable impacts The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a A category, and with a suggested REC of maintaining the PES:

WETLAND HGM: Depression (includes Pans)	
WETLAND PES	
Ecological Integrity Score:	100.0
Ecological Category:	**A**
Area (Ha):	8.2
WETLAND REC	
Ecological Integrity Score:	100.0
Ecological Category:	**A**

The vegetation component of WET-Health however, calculated an ecological category of A with a stable trajectory:

Vegetation Health

Present Vegetation State	**A**
Trajectory of change	→

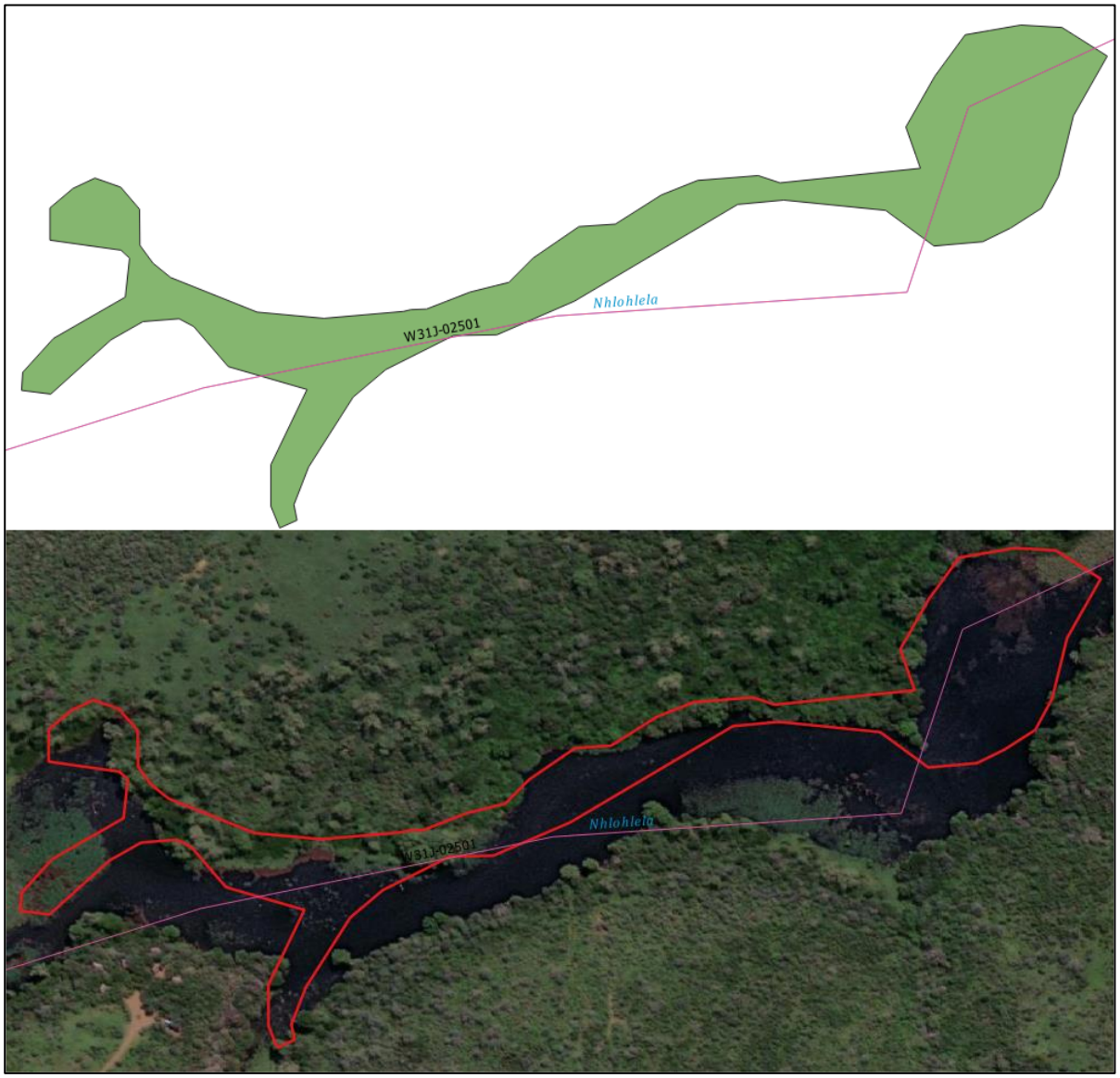

Figure 4.9 Nhlonhlela pan that was assessed with SANLC data (2020) and WET-Health Level 2 using Google Earth ©. The NWM (2018) delineation relative to satellite imagery (below) lacks accuracy

Table 4.10 Extent of land cover / disturbance within Nhlonhlela pan

(2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (currently mapped)	53.8
Natural Grassland	43.2
Contiguous (indigenous) Forest (*combined* very high, high, medium)	3.0

2) Hluhluwe River floodplain

The Hluhluwe River (W32F-02835) and its floodplain before entering the St Lucia estuary (**Figure 4.10**). The wetland delineation used for the assessment was that from the NWM (2018) which shows the floodplain as estuarine. The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Table 4.11**. Most of the land cover types within the wetland are natural but the main impacts within the wetland are cultivated commercial and emerging farmer sugarcane non-pivot. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a C/D category. Given that the score is close to a C, the REC has been set to slightly improve the PES by reducing the impacts of sugarcane agriculture:

WETLAND HGM: Floodplain	
WETLAND PES	
Ecological Integrity Score:	61.2
Ecological Category:	**C/D**
Area (Ha):	2310.1
WETLAND REC	
Ecological Integrity Score:	62.0
Ecological Category:	**C**

The vegetation component of WET-Health calculated an ecological category of C, but with a negative trajectory:

Vegetation Health

Present Vegetation State	**C**
Trajectory of change	↓

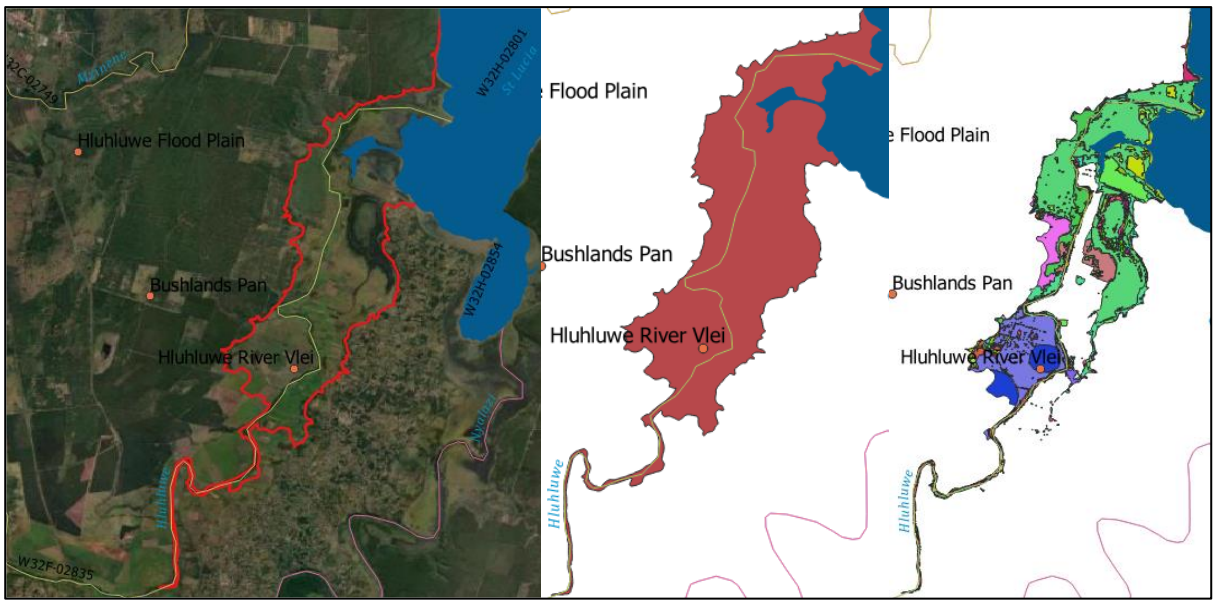

Figure 4.10 Hluhluwe floodplain that was assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth © (left; wetland delineation shown in red)

Table 4.11 Extent of land cover / disturbance within the Hluhluwe floodplain

(2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (previous mapped extent)	24.6
Natural Estuaries & Lagoons	20.5
Cultivated Emerging Farmer Sugarcane Non-Pivot (all other)	17.7
Cultivated Commercial Sugarcane Non-Pivot (all other)	7.9
Natural Grassland	5.1
Fallow Land & Old Fields (wetlands)	3.4
Cultivated Commercial Sugarcane Pivot Irrigated	3.1
Fallow Land & Old Fields (Grass)	2.5
Temporary Unplanted Forest	2.5
Subsistence / Small-Scale Annual Crops	2.5

3) Nyalazi Pan

Depressional wetlands with swamp forest in the Nyalazi River catchment (W32H-02854). Many pans are in the area known as the Makhakathana Flats but the largest, Nyalazi pan was taken to represent the area (**Figure 4.11**). The extent and nature of the main land cover types / disturbances within the wetland is shown in **Table 4.12**. The main impacts associated with the pan are contiguous and dense planted forest and temporary unplanted forest. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a C category, and with a suggested REC of maintaining the PES:

WETLAND HGM: Depression (includes Pans)	
WETLAND PES	
Ecological Integrity Score:	77.4
Ecological Category:	**C**
Area (Ha):	43.2
WETLAND REC	
Ecological Integrity Score:	77.4
Ecological Category:	**C**

The vegetation component of WET-Health however, calculated an ecological category of C with a stable trajectory:

Vegetation Health

Present Vegetation State	**C**
Trajectory of change	→

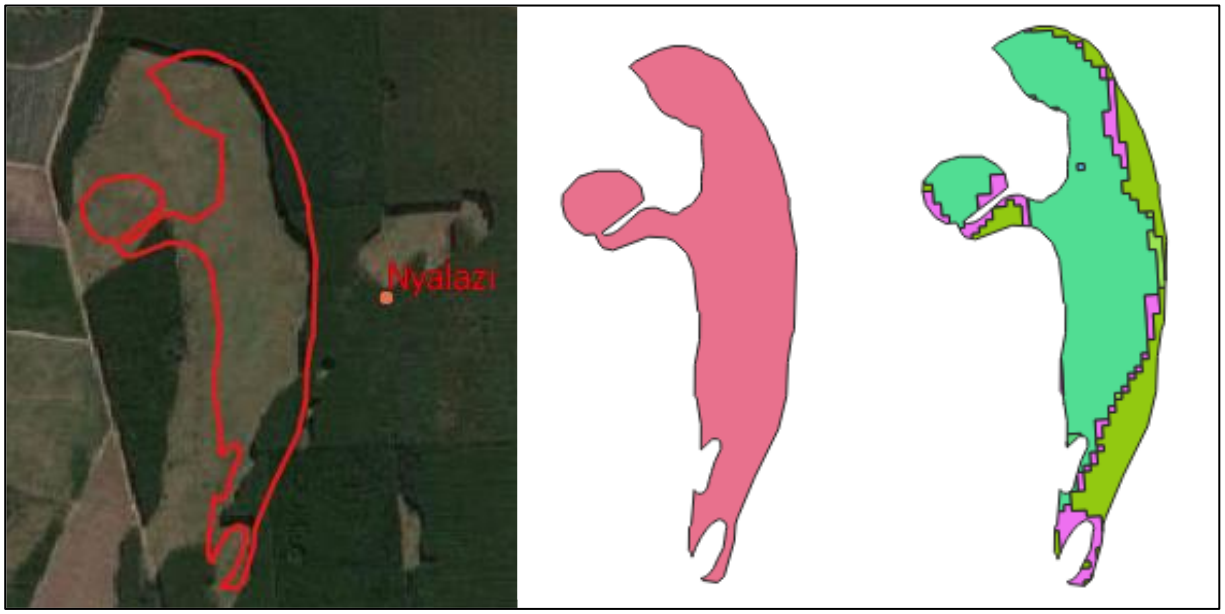

Figure 4.11 Nyalazi pan that was assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth ©. The NWM (2018) delineation relative to satellite imagery (left) lacks accuracy

Table 4.12 Extent of land cover / disturbance within Nyalazi pan

(2018 NLC Class Name)	Cover (% wetland area)
Natural Grassland	66.2
Contiguous & Dense Planted Forest (combined classes)	21.7
Temporary Unplanted Forest	10.6
Herbaceous Wetlands (currently mapped)	1.2
Herbaceous Wetlands (previous mapped extent)	0.3
Dry Pans	0.1
Contiguous (indigenous) Forest (combined very high, high, medium)	0.0
Contiguous Low Forest & Thicket (combined classes)	0.0
Dense Forest & Woodland (35 - 75% cc)	0.0
Open Woodland (10 - 35% cc)	0.0

4) Mapate

Channelled valley-bottom and depressional wetlands in the Mpate River (W32H-02998) catchment that leads into St Lucia (**Figure 4.12**). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Table 4.13**. The majority of land cover types within the wetlands were natural with negligible impacts subsistence and small-scale annual crops. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a A category, where the two HGMs were weighted according to extent (wetland area). Given that the wetland condition is natural, the REC has been set to maintain the PES:

HGM 1: Valley-bottom with a channel	
Ecological Integrity Score:	96.8
Ecological Category:	**A**
Area (Ha):	164.7
HGM 2: Depression (includes Pans)	
Ecological Integrity Score:	99.0
Ecological Category:	**A**
Area (Ha):	72.2
WETLAND PES	
Ecological Integrity Score:	97.5
Ecological Category:	**A**
Area (Ha):	236.9
WETLAND REC	
Ecological Integrity Score:	97.5
Ecological Category:	**A**

The vegetation component of WET-Health calculated an ecological category of A with a stable trajectory:

Vegetation Health

Present Vegetation State	**A**
Trajectory of change	→

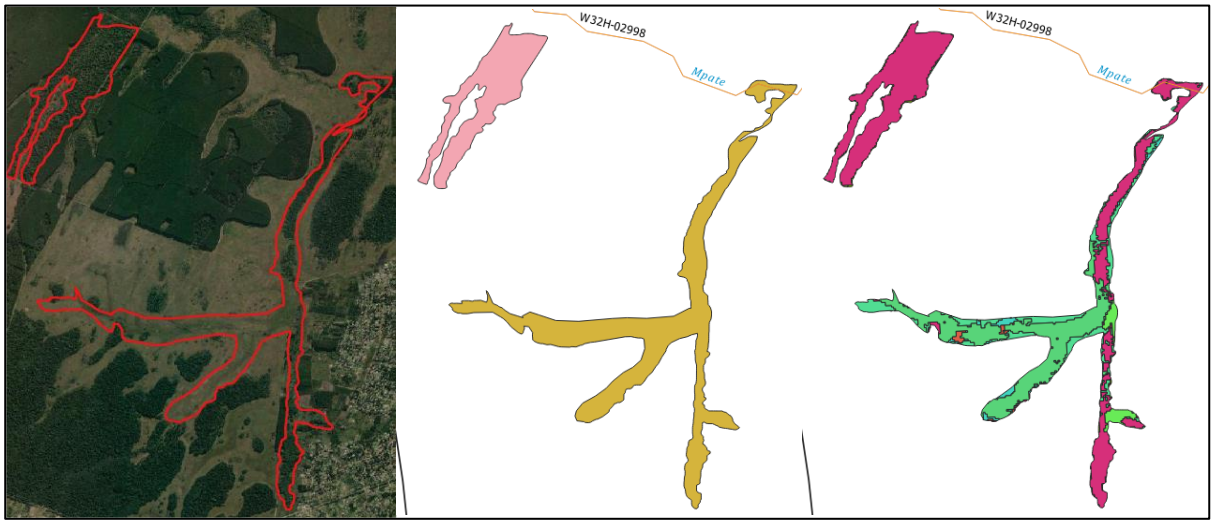

Figure 4.12 Mapate wetlands (2 HGMs shown in orange and pink, centre) that were assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth © (left; wetland delineation shown in red)

Table 4.13 Extent of land cover / disturbance within the Mapate wetlands

HGM 1 (2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (previous mapped extent)	39.5
Contiguous (indigenous) Forest (*combined* very high, high, medium)	31.8
Natural Grassland	18.2
Dense Forest & Woodland (35 - 75% cc)	4.4
Subsistence / Small-Scale Annual Crops	4.4
Contiguous Low Forest & Thicket (*combined classes*)	1.5
Contiguous & Dense Planted Forest (*combined classes*)	0.2
Residential Formal (Tree)	0.0
Open Woodland (10 - 35% cc)	0.0
Open & Sparse Planted Forest	0.0
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Contiguous (indigenous) Forest (combined very high, high, medium)	96.4
Herbaceous Wetlands (currently mapped)	1.5
Contiguous & Dense Planted Forest (combined classes)	1.2
Natural Grassland	0.5
Herbaceous Wetlands (previous mapped extent)	0.4
Temporary Unplanted Forest	0.0
Dense Forest & Woodland (35 - 75% cc)	0.0
Subsistence / Small-Scale Annual Crops	0.0
Contiguous Low Forest & Thicket (combined classes)	0.0
Residential Formal (Tree)	0.0

5) Mkuze swamps

Mkuze River (W32B-02535) including the Mkuze swamp system and the Mkuze floodplain (**Figure 4.13**). The NWM coverage was insufficient, so a desktop delineation has been added. The extent and nature of the main land cover types / disturbances within the wetland is shown in **Table 4.14**. The main impacts associated with the floodplain are subsistence and small-scale annual crops. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a B category, and with a suggested REC of maintaining the PES:

WETLAND HGM: Floodplain	
WETLAND PES	
Ecological Integrity Score:	87.6
Ecological Category:	**B**
Area (Ha):	11222.9
WETLAND REC	
Ecological Integrity Score:	87.6
Ecological Category:	**B**

The vegetation component of WET-Health however, calculated an ecological category of C with a negative trajectory:

Vegetation Health

Present Vegetation State	C
Trajectory of change	↓

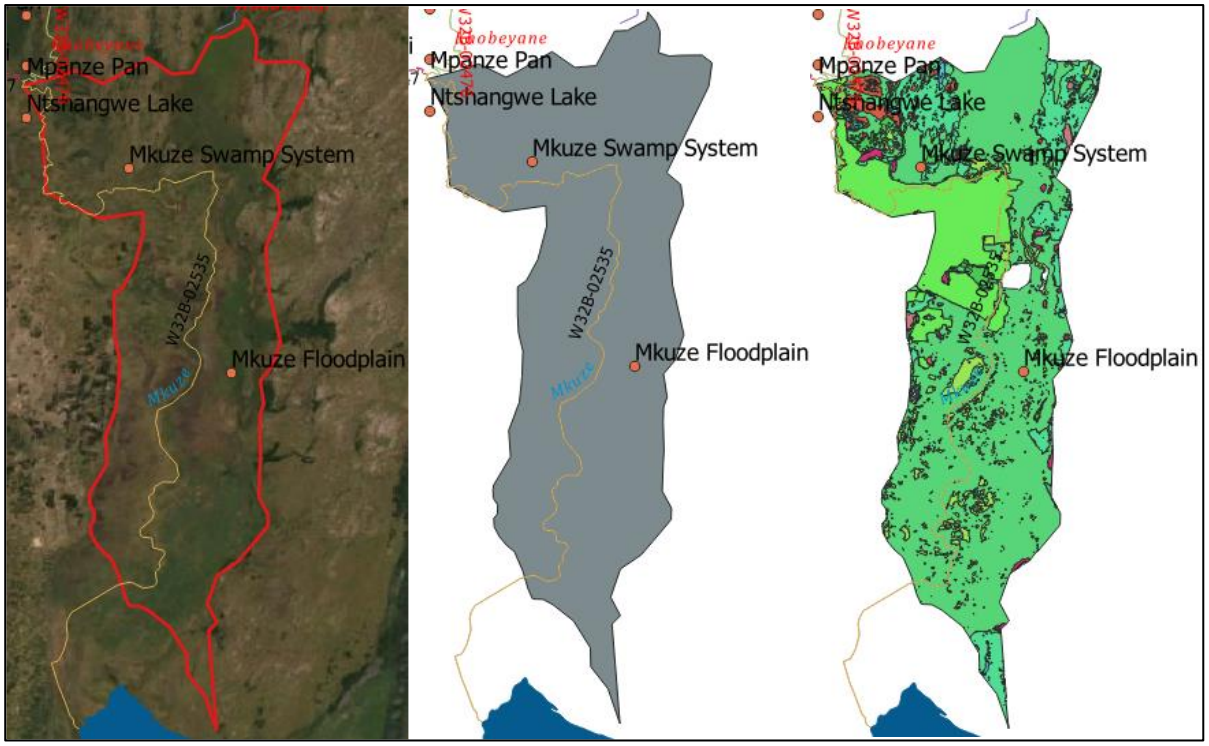

Figure 4.13 Mkuze swamps that were assessed with SANLC data (2020, right) and WET-Health Level 2 using Google Earth © (left; wetland delineation shown in red)

Table 4.14 Extent of land cover / disturbance within the Mkuze swamps.

(2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (previous mapped extent)	60.7
Subsistence / Small-Scale Annual Crops	15.5
Natural Grassland	11.7
Herbaceous Wetlands (currently mapped)	5.4
Contiguous Low Forest & Thicket (combined classes)	2.0
Fallow Land & Old Fields (wetlands)	1.1
Dense Forest & Woodland (35 - 75% cc)	0.9
Contiguous (indigenous) Forest (combined very high, high, medium)	0.8
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	0.6
Fallow Land & Old Fields (Grass)	0.4

4.3.4 W4 Catchment (Main River: Pongola - excluding Eswatini)

The RUs that have been considered for further assessment form 2 groups: W41-1 (Bivane) is recorded as having a Very High wetland priority and W45-1 (Pongola floodplain). Although the Pongola floodplain had a High priority and not Very High, it has been included for assessment as it has been recognised for its social and ecological importance. This is mainly due to poor ecological state (PES is mainly C/D, D or worse) even though ecological importance and WRUI were high.

Table 4.15 shows summary data for each and a note about which portions were additionally included / excluded in further assessments.

Table 4.15 Summary of wetland PES, IEI and priority per SQ in the Pongola catchment.

Group	SQ	SQ Name	Wetland PES*	Note	Wetland IEI	Priority
1	W41B-02431	Bivane	B	This short section of river triggered a Very High priority because the WRUI was high and the PES was a B, but the updated PES (an exercise of this project) is a B/C due to agriculture on the floodplain and alien invasive plant species.	VERY HIGH	4
2	W45A-02216	Zibayeni	C/D	An unexpected outcome of the prioritisation process was that the Pongola floodplain had a High priority and not Very High. This is mainly due to poor ecological state (PES is mainly C/D, D or worse) even though ecological importance and WRUI were high.	MODERATE	3
	W45A-02245	Zibayeni	D		MODERATE	3
	W45A-02246	Phongolo	D		MODERATE	3
	W45A-02256	Lubambo	C/D		MODERATE	3
	W45A-02275	Mpontshane	D		MODERATE	3
	W45A-02282	Phongolo	D		MODERATE	3
	W45A-02285	Mpontshane	C/D		MODERATE	3
	W45A-02310	Mangqwashi	D/E		MODERATE	3
	W45A-02316	Mfongosi	C		MODERATE	3
	W45A-02356	Mlambo	C		MODERATE	3
	W45A-02367	Phongolo	C/D		MODERATE	3
	W45A-02368	Phongolo	D/E		MODERATE	3
	W45B-02029	Phongolo	D		MODERATE	3
	W45B-02105	Phongolo	D		MODERATE	3

* PES based on PES/EI/ES, Wetcon (NFEPA, NWM).

1) Bivane

This short section of river triggered a Very High priority because the WRUI was high and the PES was a B, but the updated PES (an exercise of this project) is a B/C due to agriculture on the floodplain and alien invasive plant species (Wattle and *Salix babylonica*). There are two small oxbows in otherwise farmed floodplain and do not warrant further assessment (**Figure 4.14**).

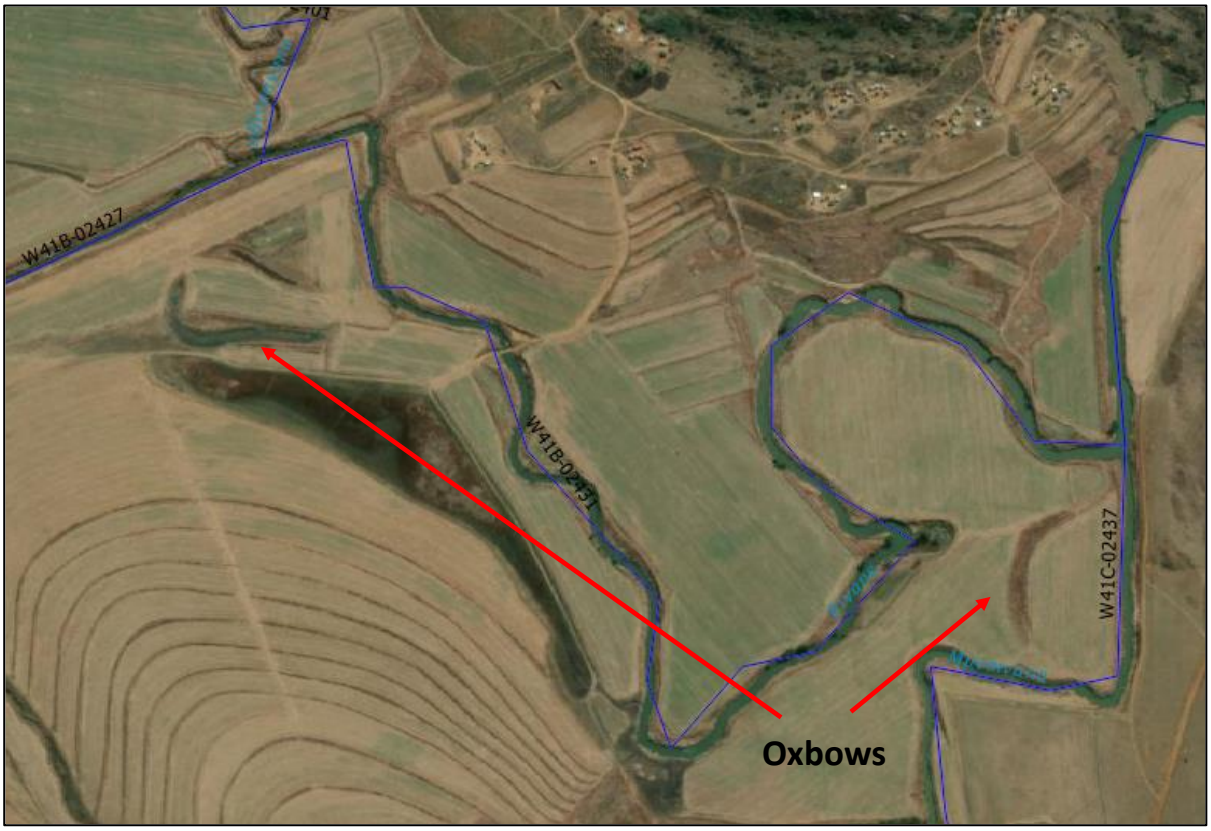

Figure 4.14 Bivane River showing agriculture on the floodplain and two remaining oxbow wetlands. Satellite imagery from Google Earth ©

2) Pongola Floodplain

An unexpected outcome of the prioritisation process was that the Pongola floodplain had a High priority and not Very High. This is mainly due to poor ecological state (PES is mainly C/D, D or worse) even though ecological importance and WRUI were high. Nevertheless, the floodplain has been recognized as a priority wetland by several authors and has the Ndumo Game reserve (a RAMSAR site) in its lower reaches and has therefore been included in this study for further assessment. The extent of the Pongola floodplain that was assessed is shown in **Figure 4.15**, and includes two HGMs: Channelled valley bottoms along the Pongola River (1885 Ha) and the floodplain wetlands (9918 Ha). The floodplain delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the floodplain is shown in **Figure 4.16**. Subsistence and small-scale annual crops is clearly the major impact on wetland integrity. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of an D category, where the two HGMs were weighted according to extent (wetland area), and the REC was set to a category C:

HGM 1: Valley-bottom with a channel	
Ecological Integrity Score:	72.6
Ecological Category:	C
Area (Ha):	1884.6
HGM 2: Floodplain	
Ecological Integrity Score:	52.4
Ecological Category:	D
Area (Ha):	9918.0
WETLAND PES	
Ecological Integrity Score:	55.6
Ecological Category:	D
Area (Ha):	11802.6
WETLAND REC	
Ecological Integrity Score:	62.0
Ecological Category:	C

The vegetation component of WET-Health calculated an ecological category of D with a negative trajectory:

Vegetation Health

Present Vegetation State	D
Trajectory of change	↓

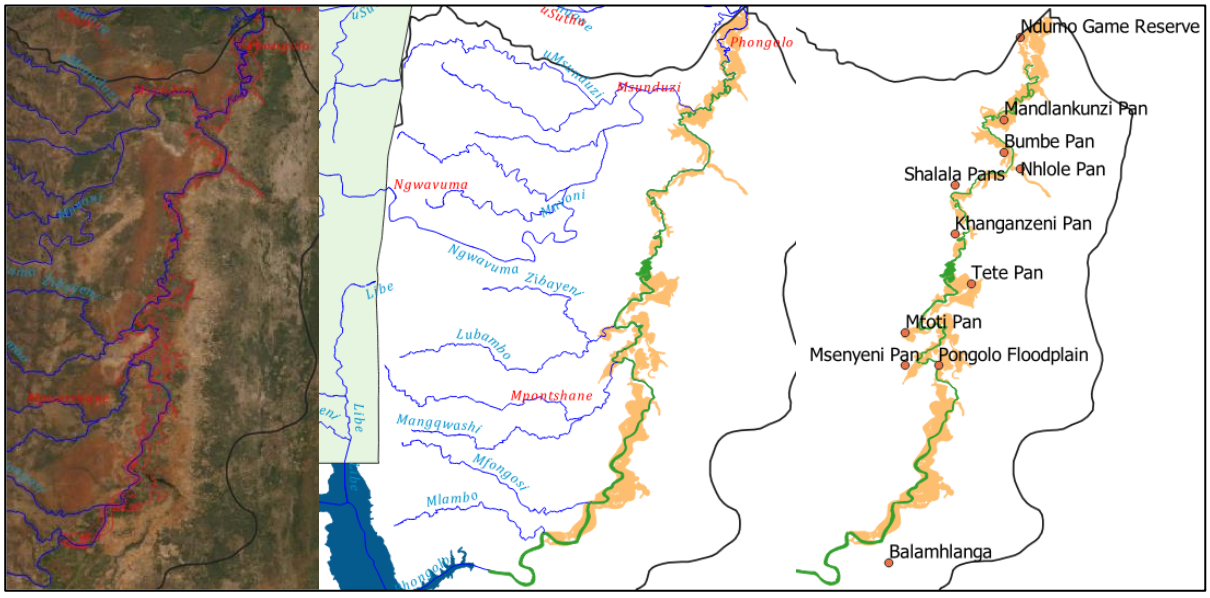

Figure 4.15 Pongola floodplain (2 floodplain HGMs shown in green and brown, center) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.16 Extent of land cover / disturbance within the Pongola floodplain

HGM 1 (2018 NLC Class Name)	Cover (% wetland area)
Subsistence / Small-Scale Annual Crops	26.5
Contiguous (indigenous) Forest (combined very high, high, medium)	17.3
Herbaceous Wetlands (previous mapped extent)	14.5
Dense Forest & Woodland (35 - 75% cc)	12.1
Natural Grassland	7.2
Natural Rivers	6.4
Contiguous Low Forest & Thicket (combined classes)	4.7
Bare Riverbed Material	4.0
Cultivated Emerging Farmer Sugarcane Non-Pivot (all other)	1.8
Herbaceous Wetlands (currently mapped)	1.6
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Subsistence / Small-Scale Annual Crops	49.9
Herbaceous Wetlands (previous mapped extent)	18.5
Herbaceous Wetlands (currently mapped)	10.2
Natural Grassland	6.9
Dense Forest & Woodland (35 - 75% cc)	5.2
Contiguous Low Forest & Thicket (combined classes)	3.2
Other Bare	1.0
Fallow Land & Old Fields (wetlands)	0.9
Natural Pans (flooded @ obsv time)	0.8
Dry Pans	0.8

4.3.5 W5 Catchment (Main River: Usutu - excluding Eswatini)

The RUs that have been considered for further assessment form 6 groups: The RUs that include Very High priority wetlands include W51-2 (Boesmanspruit and Assegaai), W51-3 (Swartwater and Mhkondvo), W53-1 (Sandspruit and Ngwempisi), W54-1 (uSuthu, including Coalbank and Liefgekozen, and Seganagana) and W55-1 (Mpumalanga pan district around Chrissiesmeer, Majosie se Vlei and Mpuluzi) and W57-1 (uSuthu, Banzi Pan Ndumo, Shokwe Pan). **Table 4.17** shows summary data for each and a note about which portions were additionally included / excluded in further assessments.

Table 4.17 Summary of wetland PES, IEI and priority per SQ in the Usutu catchment

Group	SQ	Name	Wetland PES*	Note	Wetland IEI	Priority
1	W51C-01981	Assegaai	C/D	Floodplains along the Assegaai (W51C-01981 and W51D-02044 mainly) and tributary chanelled valley-bottom wetlands.	MODERATE	3
	W51C-02011		C		HIGH	4
	W51C-02022	Assegaai	E		MODERATE	3
	W51C-02067	Assegaai	C/D		MODERATE	3
	W51C-02074	Anysspruit	C/D		MODERATE	3
	W51C-02109	Boesmanspruit	C		HIGH	4
	W51D-02044	Assegaai	C/D		MODERATE	3
	W51D-02151	Swartwater	D		LOW	3
	W51D-02160		C		MODERATE	3

Group	SQ	Name	Wetland PES*	Note	Wetland IEI	Priority
	W51D-02171	Klein-Assegaai	D		MODERATE	3
	W51D-02177	Klein-Assegaai	C		MODERATE	3
	W51D-02193	Swartwater	C		HIGH	4
2	W53A-01757	Sandspruit	C	Extensive channelled valley bottom wetlands along the Sandspruit (W53A-01757 mainly).	HIGH	4
	W53A-01804	Ngwempisi	E		MODERATE	3
	W53A-01853	Ngwempisi	C/D		MODERATE	3
3	W54A-01534	uSuthu	C	Extensive channelled valley bottom wetlands upstream of the Sandcliff Dam but not along an official SQ, rather a tributary of W54A-01534, the Usutu.	HIGH	4
	W54A-01630		C		HIGH	4
4	W54B-01569	uSuthu	D	Floodplain and channelled valley-bottom wetlands along the Seganagana (W54B-01623) upstream of the Westoe Dam.	MODERATE	3
	W54B-01623	Seganagana	C		HIGH	4
5	W55A-01375	Mpuluzi	C	Mpumalanga pan district around Chrissiesmeer, Majosie se Vlei and Mpuluzi. Most of the pans are not directly associated with an official SQ. The area has high density of pans, extensive seepage wetlands and large areas of channelled valley-bottoms. These 3 HGM types were grouped to for amalgamated assessment.	HIGH	4
	W55A-01423	Majosie se Vlei	C		MODERATE	4
	W55C-01395	Mpuluzi	C/D		MODERATE	4
6	W57J-01923	uSuthu	A/B	Wetlands in this RU did not trigger as High priority but have been included here because floodplains along W57k-02025 form part of the Pongola floodplains in the Ndumo Game Reserve area and Banzi Pan occurs along the Usutu River (W57k-01929), and are part of the RAMSAR site.	VERY HIGH	2
	W57K-01929	uSuthu	B		VERY HIGH	2
	W57K-02025		B/C		HIGH	1

* PES based on PES/EI/ES, Wetcon (NFEPA, NWM).

1) Assegaai

Floodplains along the Assegaai (W51C-01981 and W51D-02044 mainly) and tributary channelled valley-bottom wetlands. The extent of the Assegaai floodplain and valley-bottoms that was assessed is shown in **Figure 4.16**, and includes two HGMs: Channelled valley bottoms along tributaries (1885 Ha) and the floodplain wetlands along the Assegaai River (9918 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.18**. Fallow lands, old fields and contiguous and dense planted forest are the major impacts on wetland integrity. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a C category, where the two HGMs were weighted according to extent (wetland area), and the REC was set to maintain the PES:

HGM 1: Floodplain	
Ecological Integrity Score:	73.8
Ecological Category:	C
Area (Ha):	642.4
HGM 2: Valley-bottom with a channel	
Ecological Integrity Score:	87.4
Ecological Category:	B
Area (Ha):	244.0
WETLAND PES	
Ecological Integrity Score:	77.6
Ecological Category:	C
Area (Ha):	886.4
WETLAND REC	
Ecological Integrity Score:	77.6
Ecological Category:	C

The vegetation component of WET-Health calculated an ecological category of C with a stable trajectory:

Vegetation Health

Present Vegetation State	C
Trajectory of change	→

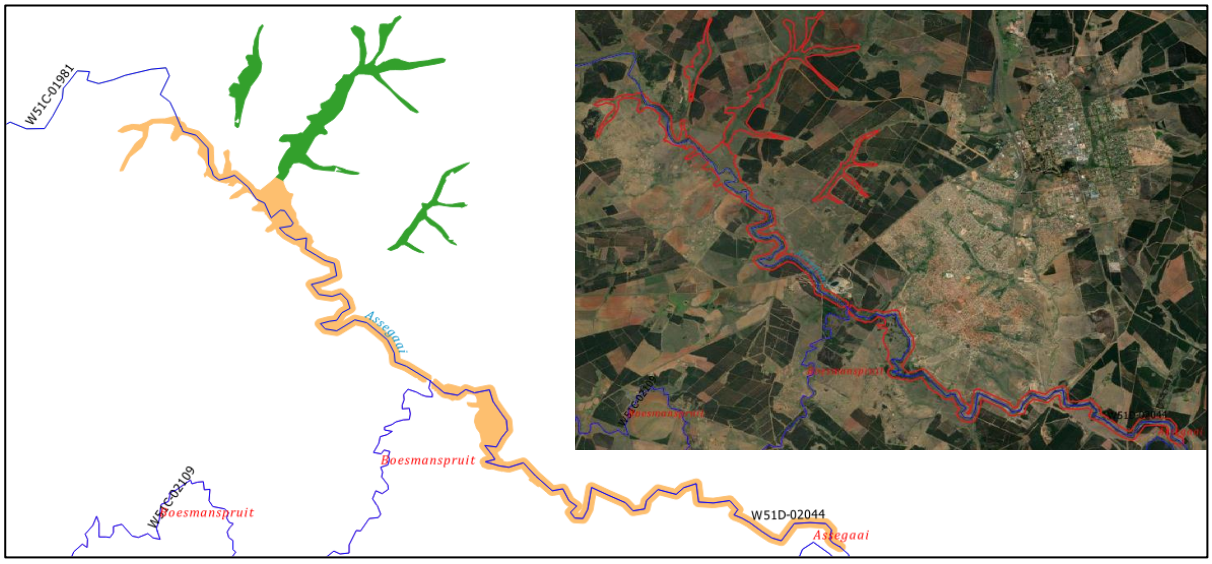

Figure 4.16 Assegaai floodplain and valley-bottoms (2 HGMs shown in green and brown, left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.18 Extent of land cover / disturbance within the Assegaai wetlands

Floodplain: (2018 NLC Class Name)	Cover (% wetland area)
Natural Grassland	41.6
Herbaceous Wetlands (previous mapped extent)	12.8
Fallow Land & Old Fields (Grass)	11.2
Contiguous & Dense Planted Forest (combined classes)	11.1
Fallow Land & Old Fields (wetlands)	7.3
Temporary Unplanted Forest	3.6
Dense Forest & Woodland (35 - 75% cc)	3.1
Natural Rivers	1.8
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	1.7
Herbaceous Wetlands (currently mapped)	1.5
Valley-bottom with a channel: (2018 NLC Class Name)	**Cover (% wetland area)**
Herbaceous Wetlands (previous mapped extent)	44.0
Natural Grassland	34.0
Fallow Land & Old Fields (wetlands)	6.3
Fallow Land & Old Fields (Grass)	4.5
Contiguous & Dense Planted Forest (combined classes)	4.3
Temporary Unplanted Forest	2.4
Herbaceous Wetlands (currently mapped)	2.0
Open Woodland (10 - 35% cc)	0.7
Subsistence / Small-Scale Annual Crops	0.5
Open & Sparse Planted Forest	0.4

2) Sandspruit

Extensive channelled valley bottom wetlands along the Sandspruit (W53A-01757 mainly) towards the headwaters. The extent of the Sandspruit valley-bottoms (1677 Ha) that were assessed is shown in **Figure 4.17**. The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.19**. Fallow lands, old fields and commercial annual crops (dryland) are the major impacts on wetland integrity. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a C category, and the REC was set to maintain the PES:

WETLAND HGM: Valley-bottom with a channel	
WETLAND PES	
Ecological Integrity Score:	68.4
Ecological Category:	**C**
Area (Ha):	1676.8
WETLAND REC	
Ecological Integrity Score:	68.4
Ecological Category:	**C**

The vegetation component of WET-Health calculated an ecological category of C with a stable trajectory:

Vegetation Health	
Present Vegetation State	C
Trajectory of change	→

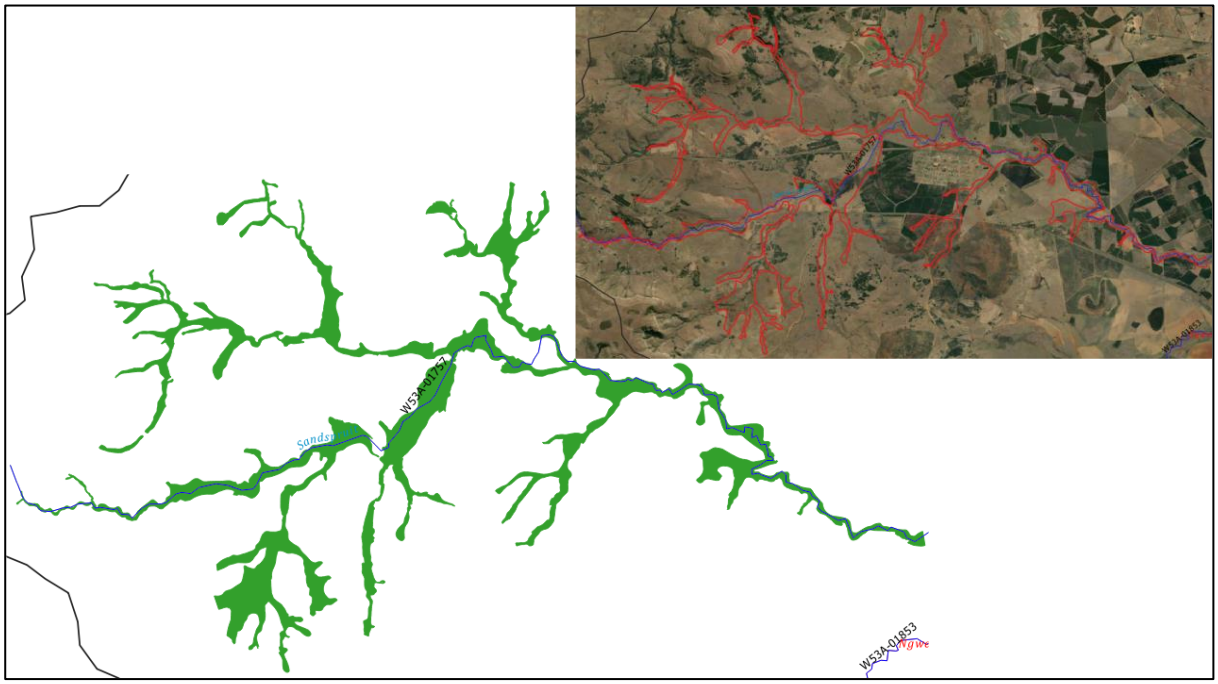

Figure 4.17 Sandspruit valley-bottoms (HGM shown in green, left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.19 Extent of land cover / disturbance within the Sandspruit wetlands

Valley-bottom with a channel : (2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (previous mapped extent)	23.5
Natural Grassland	20.9
Fallow Land & Old Fields (wetlands)	20.2
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	15.1
Fallow Land & Old Fields (Grass)	8.9
Herbaceous Wetlands (currently mapped)	4.8
Contiguous & Dense Planted Forest (combined classes)	2.6
Dense Forest & Woodland (35 - 75% cc)	1.5
Temporary Unplanted Forest	1.0
Fallow Land & Old Fields (Trees)	0.7

3) Usutu (upper)

Extensive channelled valley bottom wetlands upstream of the Sandcliff Dam but not along an official SQ, rather a tributary of W54A-01534 (Usutu). The extent of the Upper Usutu valley-bottoms (767 Ha) that were assessed is shown in **Figure 4.18**. The wetland delineation used for

the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.20**. Commercial annual crops (dryland) are the major impacts on wetland integrity. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a B/C category, and the REC was set to maintain the PES:

WETLAND HGM: Valley-bottom with a channel	
WETLAND PES	
Ecological Integrity Score:	81.9
Ecological Category:	**B/C**
Area (Ha):	767.2
WETLAND REC	
Ecological Integrity Score:	81.9
Ecological Category:	**B/C**

The vegetation component of WET-Health calculated an ecological category of B with a stable trajectory:

Vegetation Health

Present Vegetation State	**B**
Trajectory of change	→

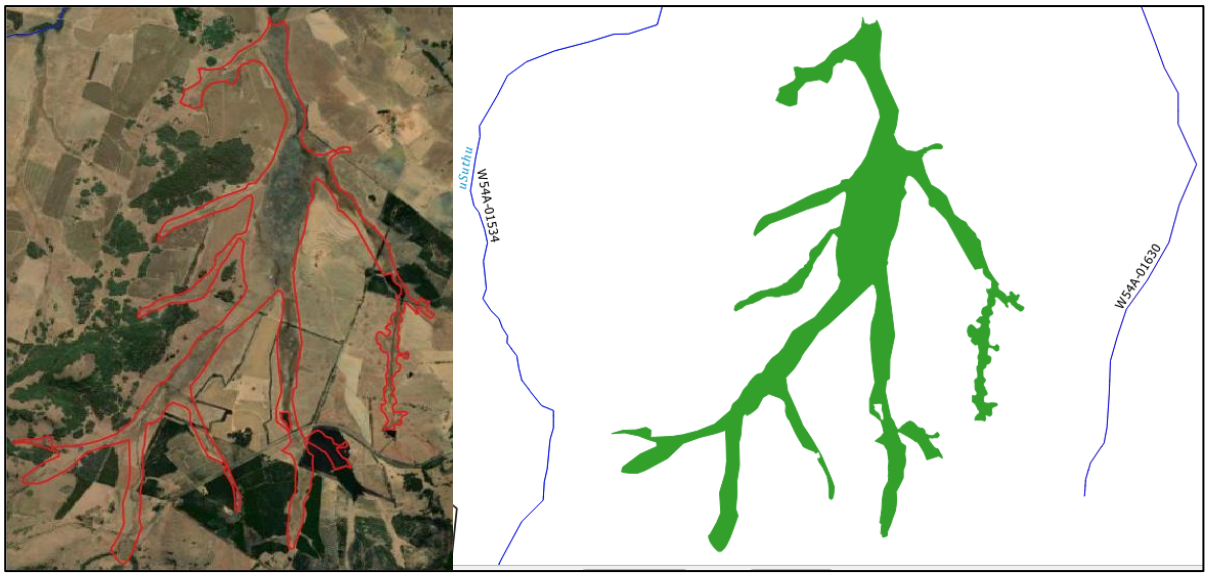

Figure 4.18 Upper Usutu valley-bottoms (HGM shown in green, left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.20 Extent of land cover / disturbance within the Upper Usutu wetlands

Valley-bottom with a channel: (2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (currently mapped)	33.5
Herbaceous Wetlands (previous mapped extent)	29.9
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	13.3
Natural Grassland	9.4
Fallow Land & Old Fields (wetlands)	7.8
Fallow Land & Old Fields (Grass)	3.0
Contiguous & Dense Planted Forest (combined classes)	2.0
Temporary Unplanted Forest	0.5
Dense Forest & Woodland (35 - 75% cc)	0.3
Fallow Land & Old Fields (Trees)	0.1

4) Seganagana

Floodplain and channelled valley-bottom wetlands along the Seganagana (W54B-01623) upstream of the Westoe Dam. The extent of the Seganagana floodplain and valley-bottoms that was assessed is shown in **Figure 4.19**, and includes two HGMs: Channelled valley bottoms (710 Ha) and the floodplain wetlands along the Seganagana River (554 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.21**. Most of the land cover types are natural with a small impact from fallow lands and old fields. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a A category, where the two HGMs were weighted according to extent (wetland area), and the REC was set to maintain the PES:

HGM 1: Floodplain	
Ecological Integrity Score:	96.6
Ecological Category:	**A**
Area (Ha):	554.2
HGM 2: Valley-bottom without a channel	
Ecological Integrity Score:	93.9
Ecological Category:	**A**
Area (Ha):	710.5
WETLAND PES	
Ecological Integrity Score:	95.1
Ecological Category:	**A**
Area (Ha):	1264.7
WETLAND REC	
Ecological Integrity Score:	95.1
Ecological Category:	**A**

The vegetation component of WET-Health calculated an ecological category of A with a stable trajectory:

Vegetation Health

Present Vegetation State	**A**
Trajectory of change	→

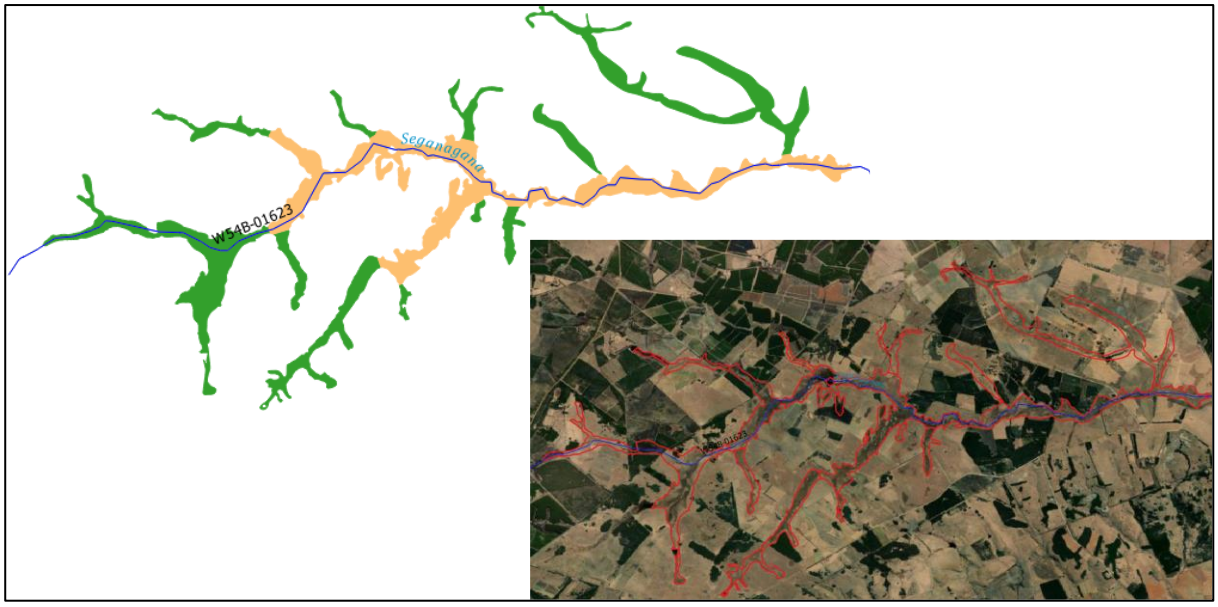

Figure 4.19 Seganagana floodplain and valley-bottoms (2 HGMs shown in green and brown, left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.21 Extent of land cover / disturbance within the Seganagana wetlands

Floodplain: (2018 NLC Class Name)	**Cover (% wetland area)**
Herbaceous Wetlands (previous mapped extent)	50.3
Natural Grassland	24.7
Herbaceous Wetlands (currently mapped)	16.2
Dense Forest & Woodland (35 - 75% cc)	2.6
Fallow Land & Old Fields (wetlands)	2.2
Fallow Land & Old Fields (Grass)	1.9
Open Woodland (10 - 35% cc)	0.8
Contiguous & Dense Planted Forest (combined classes)	0.5
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	0.3
Artificial Dams (incl. canals)	0.1
Valley-bottom without a channel: (2018 NLC Class Name)	**Cover (% wetland area)**
Herbaceous Wetlands (previous mapped extent)	42.3
Natural Grassland	27.7
Herbaceous Wetlands (currently mapped)	18.5
Fallow Land & Old Fields (wetlands)	3.2
Fallow Land & Old Fields (Grass)	2.3
Dense Forest & Woodland (35 - 75% cc)	1.9
Contiguous & Dense Planted Forest (combined classes)	1.6
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	1.2
Natural Rock Surfaces	0.4
Temporary Unplanted Forest	0.3

5) Pan District

Mpumalanga pan district around Chrissiesmeer, Majosie se Vlei and Mpuluzi. Most of the pans are not directly associated with an official SQ. The area has a high density of pans, extensive seepage wetlands and large areas of channelled valley-bottoms. These three HGM types were grouped to for amalgamated assessment. The extent of the depressions, seeps and valley-bottoms that were assessed is shown in **Figure 4.20**, and includes three HGMs: Depressions (8347 Ha), Channelled valley bottoms (5843 Ha) and hillslope seeps (7457 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.22**. Most of the land cover types are natural with a small impact from fallow lands and old fields, commercial annuals crops (dryland, rain-fed) and contiguous and dense planted forest. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a A/B category, where the three HGMs were weighted according to extent (wetland area), and the REC was set to maintain the PES:

HGM 1: Depression (includes Pans)	
Ecological Integrity Score:	97.0
Ecological Category:	**A**
Area (Ha):	8347.7
HGM 2: Valley-bottom with a channel	
Ecological Integrity Score:	89.2
Ecological Category:	**A/B**
Area (Ha):	5843.0
HGM 3: Hillslope seepage linked to a stream channel	
Ecological Integrity Score:	85.3
Ecological Category:	**B**
Area (Ha):	7157.6
WETLAND PES	
Ecological Integrity Score:	90.9
Ecological Category:	**A/B**
Area (Ha):	21348.2
WETLAND REC	
Ecological Integrity Score:	90.9
Ecological Category:	**A/B**

The vegetation component of WET-Health calculated an ecological category of A with a stable trajectory:

Vegetation Health

Present Vegetation State	**A**
Trajectory of change	→

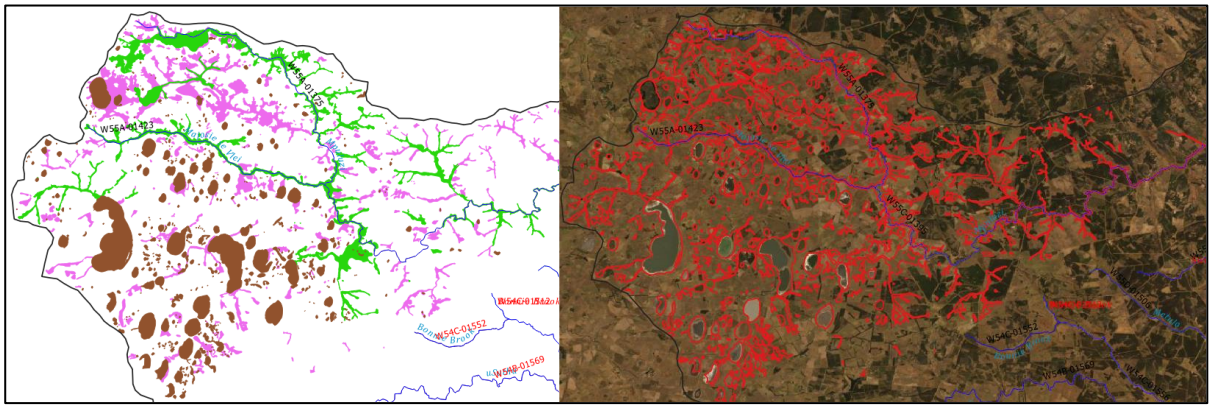

Figure 4.20 Pans district wetland HGMs (3 HGMs shown in green [CVB], brown [DEP] and purple [SEEP], left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.22 Extent of land cover / disturbance within the Pans district

Depression (includes Pans): (2018 NLC Class Name)	**Cover (% wetland area)**
Natural Pans (flooded @ obsv time)	49.3
Natural Grassland	36.5
Herbaceous Wetlands (currently mapped)	5.9
Dry Pans	3.8
Fallow Land & Old Fields (Grass)	2.4
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	1.0
Contiguous & Dense Planted Forest (combined classes)	0.4
Fallow Land & Old Fields (Trees)	0.3
Fallow Land & Old Fields (Bush)	0.3
Open & Sparse Planted Forest	0.1
Valley-bottom with a channel: (2018 NLC Class Name)	**Cover (% wetland area)**
Natural Grassland	33.5
Herbaceous Wetlands (currently mapped)	28.8
Herbaceous Wetlands (previous mapped extent)	20.7
Fallow Land & Old Fields (Grass)	4.7
Fallow Land & Old Fields (wetlands)	3.3
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	3.2
Contiguous & Dense Planted Forest (combined classes)	1.6
Artificial Dams (incl. canals)	1.3
Temporary Unplanted Forest	1.3
Dense Forest & Woodland (35 - 75% cc)	0.7
Hillslope seepage linked to a stream channel: (2018 NLC Class Name)	**Cover (% wetland area)**
Natural Grassland	50.6
Herbaceous Wetlands (currently mapped)	16.4
Herbaceous Wetlands (previous mapped extent)	9.8
Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	7.9
Fallow Land & Old Fields (Grass)	5.8
Fallow Land & Old Fields (wetlands)	3.3

Contiguous & Dense Planted Forest (combined classes)	3.1
Temporary Unplanted Forest	1.2
Dense Forest & Woodland (35 - 75% cc)	1.1
Natural Pans (flooded @ obsv time)	0.2

6) Usutu (Ndumo)

Wetlands in this RU did not trigger as High priority but have been included here because floodplains along W57K-02025 form part of the Pongola floodplains in the Ndumo Game Reserve area and Banzi Pan occurs along the Usutu River (W57k-01929) and are part of the RAMSAR site. The extent of the floodplain and valley-bottoms that was assessed is shown in **Figure 4.21**, and includes two HGMs: Unchannelled valley bottoms (862 Ha) and the floodplain wetlands (448 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.23**. Most of the land cover types are natural with a small impact from fallow lands and old fields, and some damming. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of an A category, where the two HGMs were weighted according to extent (wetland area), and the REC was set to maintain the PES:

HGM 1: Floodplain	
Ecological Integrity Score:	99.4
Ecological Category:	**A**
Area (Ha):	448.0
HGM 2: Valley-bottom without a channel	
Ecological Integrity Score:	98.3
Ecological Category:	**A**
Area (Ha):	862.0
WETLAND PES	
Ecological Integrity Score:	98.7
Ecological Category:	**A**
Area (Ha):	1310.0
WETLAND REC	
Ecological Integrity Score:	98.7
Ecological Category:	**A**

The vegetation component of WET-Health calculated an ecological category of A with a stable trajectory:

Vegetation Health

Present Vegetation State	**A**
Trajectory of change	→

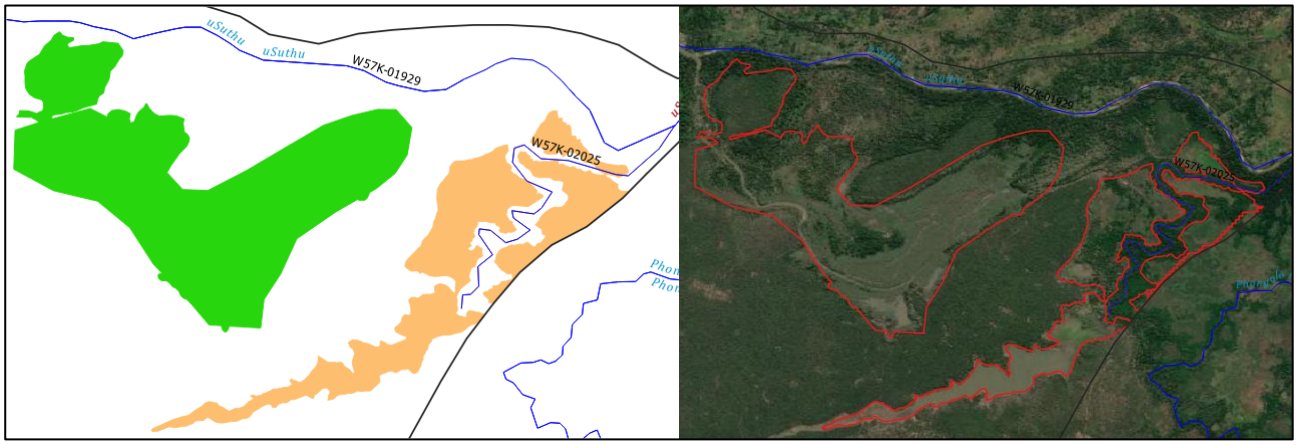

Figure 4.21 Lower Usutu floodplain and valley-bottoms at Ndumo (2 HGMs shown in green and brown, left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.23 Extent of land cover / disturbance within the lower Usutu wetlands at Ndumo

Floodplain: (2018 NLC Class Name)	**Cover (% wetland area)**
Herbaceous Wetlands (previous mapped extent)	68.7
Natural Rivers	19.4
Dense Forest & Woodland (35 - 75% cc)	3.3
Herbaceous Wetlands (currently mapped)	2.3
Contiguous (indigenous) Forest (combined very high, high, medium)	1.3
Dry Pans	1.2
Open Woodland (10 - 35% cc)	1.1
Natural Grassland	0.8
Artificial Dams (incl. canals)	0.6
Contiguous Low Forest & Thicket (combined classes)	0.5
Valley-bottom without a channel: (2018 NLC Class Name)	**Cover (% wetland area)**
Herbaceous Wetlands (previous mapped extent)	55.5
Contiguous Low Forest & Thicket (combined classes)	24.9
Dense Forest & Woodland (35 - 75% cc)	7.4
Contiguous (indigenous) Forest (combined very high, high, medium)	6.7
Natural Rivers	2.3
Artificial Dams (incl. canals)	1.3
Natural Grassland	0.7
Fallow Land & Old Fields (wetlands)	0.5
Herbaceous Wetlands (currently mapped)	0.5
Fallow Land & Old Fields (Trees)	0.2

4.3.6 W7 Catchment (Kosi Estuary and Sibaya Lake)

The RUs that have been considered for further assessment form 2 groups: The RUs that have a Very High priority wetlands include W70-1 (Swamanzi) and W70-3 (Lake Sibaya, Muzi swamps). **Table 4.24** shows summary data for each and a note about which portions were additionally included / excluded in further assessments.

Table 4.24 Summary of wetland PES, IEI and priority per SQ in the Kosi / Sibaya catchment

Group	SQ	SQ Name	Wetland PES*	Note	Wetland IEI	Priority
1	W70A-02278 W70A-02301 W70A-02381	Lake Sibaya	B/C	Includes Lake Sibaya and surrounding wetlands	VERY HIGH	4
2	W70A-02030	Muzi Swamps	N/A	Depressional and floodplain wetlands that comprise the Muzi swamps.	N/A**	4

* PES based on DWS, 2015a.

** No assessment available since there is no SQ assigned to the Muzi Swamps.

1) Lake Sibaya

Includes Lake Sibaya and surrounding wetlands. The extent of the depressions, seeps and valley-bottoms that were assessed is shown in **Figure 4.22**, and includes three HGMs: Depressions (9108 Ha), Channelled valley bottoms (409 Ha) and hillslope seeps (640 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.25**. Most of the land cover types are natural with a small impact from fallow lands and old fields, subsistence / small-scale annuals crops (dryland, rain-fed) and contiguous and dense planted forest. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a B category, where the three HGMs were weighted according to extent (wetland area), and the REC was set to maintain the PES:

HGM 1: Depression (includes Pans)	
Ecological Integrity Score:	87.3
Ecological Category:	**B**
Area (Ha):	9108.1
HGM 2: Hillslope seepage linked to a stream channel	
Ecological Integrity Score:	84.1
Ecological Category:	**B**
Area (Ha):	650.1
HGM 3: Valley-bottom with a channel	
Ecological Integrity Score:	94.4
Ecological Category:	**A**
Area (Ha):	409.7
WETLAND PES	
Ecological Integrity Score:	87.4
Ecological Category:	**B**
Area (Ha):	10168.0
WETLAND REC	
Ecological Integrity Score:	87.4
Ecological Category:	**B**

The vegetation component of WET-Health calculated an ecological category of B with a stable trajectory:

Vegetation Health

Present Vegetation State	**B**
Trajectory of change	→

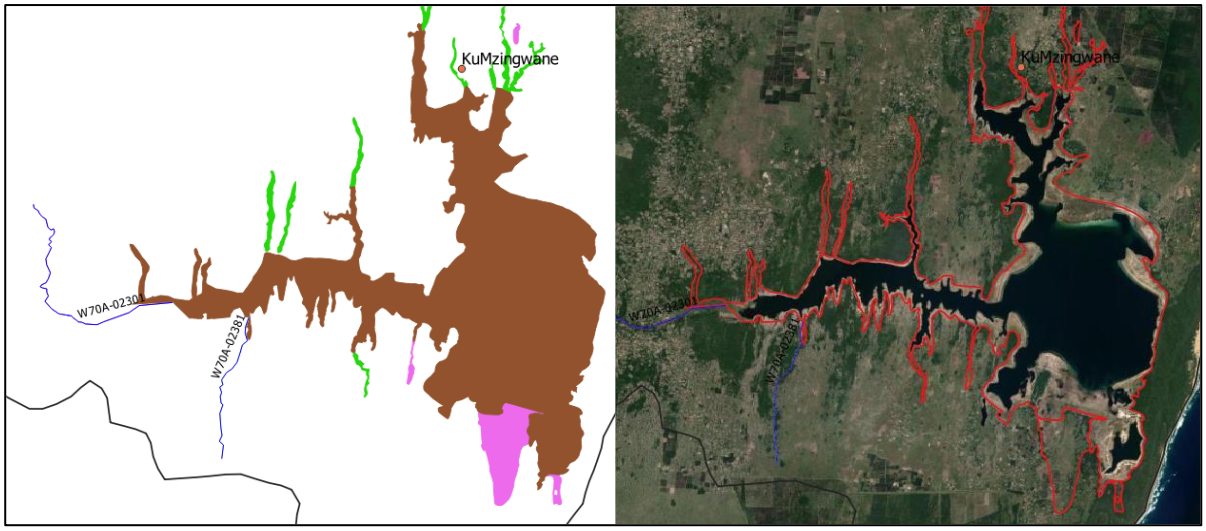

Figure 4.22 Lake Sibaya wetland HGMs (3 HGMs shown in green [CVB], brown [DEP] and purple [SEEP], left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.25 Extent of land cover / disturbance within the Lake Sibaya wetlands

HGM 1 (2018 NLC Class Name)	**Cover (% wetland area)**
Natural Lakes	58.6
Natural Grassland	19.1
Other Bare	17.5
Contiguous Low Forest & Thicket (combined classes)	2.4
Dense Forest & Woodland (35 - 75% cc)	1.4
Residential Formal (Tree)	0.3
Open Woodland (10 - 35% cc)	0.2
Contiguous (indigenous) Forest (combined very high, high, medium)	0.1
Residential Formal (low veg / grass)	0.1
Natural Rock Surfaces	0.1
HGM 2 (2018 NLC Class Name)	**Cover (% wetland area)**
Natural Grassland	52.7
Subsistence / Small-Scale Annual Crops	11.4
Contiguous Low Forest & Thicket (combined classes)	9.7
Herbaceous Wetlands (previous mapped extent)	8.5
Dense Forest & Woodland (35 - 75% cc)	6.9
Contiguous & Dense Planted Forest (combined classes)	3.2
Residential Formal (low veg / grass)	1.4
Temporary Unplanted Forest	1.2
Other Bare	1.0
Residential Formal (Tree)	0.9

HGM 3 (2018 NLC Class Name)	Cover (% wetland area)
Herbaceous Wetlands (previous mapped extent)	36.1
Natural Grassland	17.7
Contiguous Low Forest & Thicket (combined classes)	17.6
Dense Forest & Woodland (35 - 75% cc)	9.8
Contiguous (indigenous) Forest (combined very high, high, medium)	8.3
Fallow Land & Old Fields (wetlands)	2.3
Other Bare	1.7
Natural Lakes	1.3
Fallow Land & Old Fields (Grass)	1.1
Herbaceous Wetlands (currently mapped)	1.0

2) Muzi Swamps

Depressional and floodplain wetlands that comprise the Muzi swamps. The extent of the floodplain and depressions that was assessed is shown in **Figure 4.23**, and includes two HGMs: Depressional wetlands including pans (3407 Ha) and the floodplain wetlands (22002 Ha). The wetland delineation used for the assessment was that from the NWM (2018). The extent and nature of the main land cover types / disturbances within the wetlands is shown in **Table 4.26**. Most of the land cover types are near natural with moderate impact from contiguous and dense planted forest, subsistence / small-scale annual crops, and some formal residential areas. The assessment of internal wetland integrity by assigning ecological integrity scores to the various land cover types produced and overall outcome of a C category, where the two HGMs were weighted according to extent (wetland area), and the REC was set to maintain the PES:

HGM 1: Floodplain	
Ecological Integrity Score:	68.6
Ecological Category:	C
Area (Ha):	22002.3
HGM 2: Depression (includes Pans)	
Ecological Integrity Score:	86.8
Ecological Category:	B
Area (Ha):	3407.6
WETLAND PES	
Ecological Integrity Score:	71.1
Ecological Category:	C
Area (Ha):	25409.9
WETLAND REC	
Ecological Integrity Score:	71.1
Ecological Category:	C

The vegetation component of WET-Health calculated an ecological category of C with a negative trajectory:

Vegetation Health

Present Vegetation State	C
Trajectory of change	↓

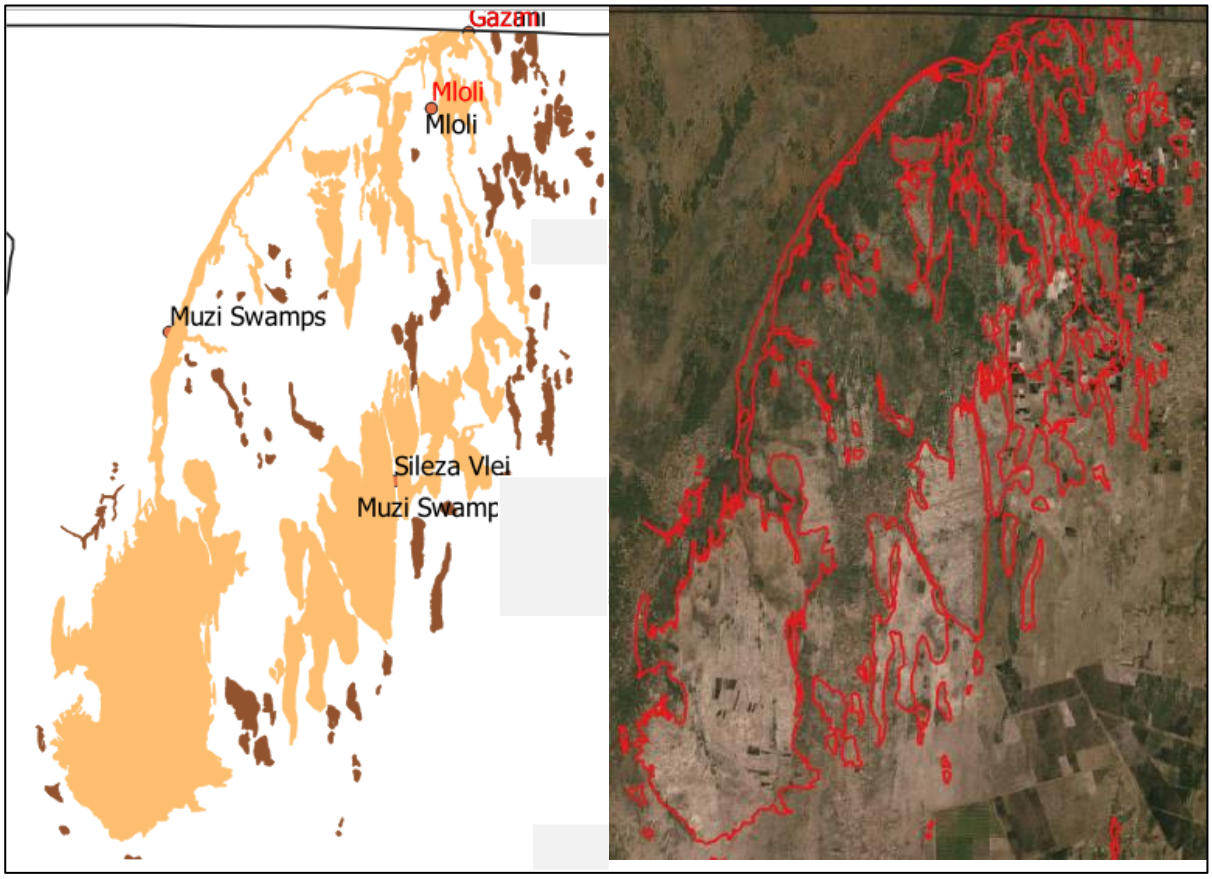

Figure 4.23 Muzi swamps (2 HGMs shown in light and dark brown, left) that were assessed with SANLC data (2020) and WET-Health Level 2. Google Earth © shows NWM (2018) delineation relative to satellite imagery

Table 4.26 Extent of land cover / disturbance within the Muzi swamps

Floodplain: (2018 NLC Class Name)	**Cover (% wetland area)**
Other Bare	34.4
Natural Grassland	32.4
Herbaceous Wetlands (previous mapped extent)	18.5
Contiguous & Dense Planted Forest (combined classes)	3.0
Subsistence / Small-Scale Annual Crops	2.7
Dense Forest & Woodland (35 - 75% cc)	2.1
Contiguous Low Forest & Thicket (combined classes)	1.8
Herbaceous Wetlands (currently mapped)	1.0
Temporary Unplanted Forest	1.0
Residential Formal (low veg / grass)	0.8
Depression (includes Pans): (2018 NLC Class Name)	**Cover (% wetland area)**
Dry Pans	47.5
Natural Grassland	30.0
Herbaceous Wetlands (currently mapped)	5.9
Contiguous & Dense Planted Forest (combined classes)	4.4
Subsistence / Small-Scale Annual Crops	3.3
Residential Formal (Bare)	2.1
Residential Formal (low veg / grass)	1.6

Temporary Unplanted Forest	1.3
Fallow Land & Old Fields (Grass)	1.1
Village Scattered (bare only)	1.1

4.4 DETERMINATION OF THE EWR (OR OTHER RDM)

Since river EWR sites could not be used to infer flow requirements for most of the Very High, and in some cases High priority wetlands, it was decided to take the EcoStatus approach whereby the vegetation component of WET-Health (MacFarlane *et al.,* 2007) and the SANLC data (2020) was used to score the PES and REC. Conservation and maintenance of the REC would then be a compromise of flow requirements, and as such the aim of the EWR would then be to achieve and maintain the REC, and quantification of land-use cover within each wetland system would lend itself to the quantification of ecological specifications for this purpose i.e. what can be done to achieve and maintain the REC (this is the wetland reserve). Previous EWR assessments of the Pongola floodplain and Lake Sibaya were also incorporated into these data (DWS, 2015a,b).

4.4.1 Riverine Wetlands

The PES for riverine wetlands updated / re-evaluated, using Google Earth ©, in this project as part of the river assessment and included the assessment of these riverine wetlands. The new ratings for riparian / wetland zone continuity modification and riparian / wetland zone modification contribute to an overall PES and REC for the SQ, along with a description of main impacts. The EWR comprises a fully detailed flow requirement done as part of the river assessment where an EWR site exists or an extrapolated EWR using the desktop.

4.4.2 Floodplains

The EWR of high priority floodplain wetlands may be a quantitative flow regime, mostly related to specific flood events that are required for floodplain inundation and sediment and nutrient dynamics and can be extrapolated to up- or downstream similar floodplains utilising procedures outlined as part of the river process. However, this option is low confidence and only possible where EWR river sites also include, or are close to, floodplains. Instead, the EWR for floodplains in this assessment has made use of an aerial estimation of impacts within respective floodplains (using the vegetation component of WET-Health), the SANLC data (2020) and the NWM delineation to quantify a PES. Based on the impacts and what is practically achievable, a REC has been proposed and the maintenance of this REC forms the EWR of the floodplain (see **Table 4.27** for impact estimations and REC strategies).

4.4.3 Valley bottoms and seeps

The EWRs of high priority channelled and unchannelled valley-bottom and seep wetlands are expressed through ecological specifications (or EcoSpecs) that protect the habitat. To provide these specifications, the EWRs are expressed in terms of a REC (see **Table 4.27**), which is dependent on the PES, and the ecological importance denotes whether the REC is the same as the PES or an improvement, if at all possible. Where the REC is an improvement of the PES, this will involve management of land use. The most common method to achieve the REC where it is higher than the PES is to remove alien vegetation, reduce agricultural encroachment of wetlands and manage (usually reduce) grazing pressures which can promote erosion.

4.4.4 Lake Sibaya

An EWR assessment for Lake Sibaya was done at an Intermediate level in 2015 (DWS, 2015a) and is summarised herein under. The Lake Water-Level Requirement Approach (LWR) was used, which is in line with that for determining the Reserve for lakes and pans provided by Harding (1999), and involves the following steps:

- Identify the reference conditions of the resource unit.
- Discuss the present operation of the lakes for the provision of water.
- Assess the present status for each of the ecological determinants of the resource unit.
- Assess the habitat integrity for the water body and the littoral / riparian zone.
- Determine the ecological importance of the resource unit.
- Determine the social importance of the resource unit.
- Assess an achievable Ecological Management Class (EMC) for the water body and the littoral / riparian zone.
- Consider the future management classes either side of the EMC and list the flow related and non-flow related activities which would be required to meet these classes.
- Prioritise and list the objectives required to attain the EMC. Recommend the water levels required to achieve the EMC and motivate these levels based on ecological grounds backed up by hydrological records where available.
- Specify the degree of confidence in the recommendations and identify further work required to increase the confidence.

The EWR for the lake was outlined as a set of lake level requirements as follows:
REC water levels should:

- Reflect natural climate conditions, in particular five to six year averages in rainfall, as well as shorter term (one year) rainfall conditions.
- Retain variability, including periods of high and low water levels.
- Median water levels over a 30-year period should be between 17.39 and 18.48 masl.
- Should not have more than five consecutive years < 16.5 masl (DROUGHT water level threshold).
- Should have at least six years in a 30 year cycle > 19.2 masl.

4.4.5 Pongola Floodplain

An EWR assessment for the Pongola Floodplain was done at an Intermediate level in 2015 (DWS, 2015b) and is summarised herein under. There are no formal RDM methods that are prescribed for use in floodplains such as the Pongola Floodplain, which, for an EWR to be meaningful also required a reliable and efficient hydrodynamic model to predict the extent and duration or flooding on the floodplain.

For this reason, the approach adopted for the Pongola Floodplain EWR assessments was to:

- Focus on developing a reliable and efficient hydrodynamic model to predict the extent and duration or flooding on the floodplain.
- Undertake wetland typing and EcoStatus assessment.
- Review the literature for fish and undertake an EcoStatus assessment based on existing information.
- Identify key social concerns with respect to the timing and magnitude of flooding.

- Populate a Downstream Response to Imposed Flow Transformations (DRIFT) Decision Support System (King *et al*., 2003; Brown *et al*., 2013) for use in the assessment of flood releases on the Pongola Floodplain.
- Evaluate the ecological and social outcome for a suite of release options from Jozini Dam.

The EWR comprised a release scenario that represented the best outcome for the ecosystem and social aspects combined. The releases for this scenario can be summarised as follows:

October:
- One day at 600 m^3/s.
- Remaining days at 2.4 m^3/s.

December:
- Three days at 150 m^3/s.
- Remaining days at 2.4 m^3/s.
- Two days at 56 m^3/s.
- Four days at 28 m^3/s.
- Remaining days at 2.4 m^3/s.

January:
- Two days at 50 m^3/s.
- One day at 35 m^3/s; followed by one day at 65 m^3/s. Repeat three times.
- Remaining days at 2.4 m^3/s.

February:
- Five days at 150 m^3/s.
- Remaining days at 50 m^3/s.

March:
- Fifteen days at 35 m^3/s.
- Remaining days at 50 m^3/s.

4.4.6 Summary

A summary of high priority wetlands is shown in **Table 4.27** with some indication of a proposed REC and strategies to achieve said.

Table 4.27 Validated PES, trajectory and REC for wetlands with High or Very High priority

Name	Includes SQs	Size (Ha)	PES	Trajectory	REC	How to achieve the REC
W1 Mhlatuze						
Mhlathuze Riverine Wetlands	W12E-03475	N/A	**C**	N/A	**C**	Maintain PES.
Mhlathuze Floodplain	W12H-03459	4809.0	**E**	↓	**D**	Reduce / control sugarcane cultivation.
Nlabane Wetlands	W12J-03411	546.9	**D**	↓	**C/D**	Reduce / control forestry.
Mzingazi	W12J-03392 W12J-03403 W12J-03450	1689.0	**B/C**	→	**B/C**	Control expansion of forestry and residential development.
W2 Umfolozi						
White Mfolozi Riverine Wetlands	W21G-02885 W21H-02897 W21H-03004	N/A	**B**	N/A	**B**	Maintain PES.
Aloeboom Vlei	W22A-02586	343.8	**C**	↓	**B/C**	Reduce / control forestry,

Name	Includes SQs	Size (Ha)	PES	Trajectory	REC	How to achieve the REC
	W22A-02591					control formal residential expansion.
	W22A-02596					
Mvamanzi Pan	W23A-03160	485.1	B/C	→	B/C	Control expansion of subsistence / small-scale crops and formal residential areas.
Mfolozi Swamps	W23C-03180	11911.1	D	→	D	Reduce / control sugarcane cultivation.
	W23D-03108					
W3 Mkuze						
Nhlonhlela Pan	W31J-02469	8.2	A	→	A	Preventative conservation: prevent expansion of surrounding forestry.
	W31J-02501					
Hluhluwe Floodplain	W32F-02835	2310.1	C/D	↓	C	Reduce / control cultivation of commercial and emerging farmer sugarcane.
Nyalazi Pan	W32H-02854	43.2	C	→	C	Control existing forestry extent
Mpate Wetlands	W32H-02998	236.9	A	→	A	Preventative conservation: prevent expansion of forestry and small-scale subsistence farming.
Mkuze Floodplain	W32B-02535	11222.9	B	→	B	Control extent of subsistence / small-scale annual crops.
W4 Pongola						
Bivane Riverine Wetlands	W41B-02431	N/A	B	N/A	B	Maintain PES
Pongola Floodplain	W45A-02216	11802.6	D	↓	C	Reduce / control subsistence and small-scale annual crops, continued implementation of EWR determined in 2015 (DWS, 2015b).
	W45A-02245					
	W45A-02246					
	W45A-02256					
	W45A-02275					
	W45A-02282					
	W45A-02285					
	W45A-02310					
	W45A-02316					
	W45A-02356					
	W45A-02367					
	W45A-02368					
	W45B-02029					
	W45B-02105					
W5 Usutu						
Assegaai Floodplain	W51C-01981	886.4	C	→	C	Control expansion of forestry and informal farming.
	W51C-02011					
	W51C-02022					
	W51C-02067					
	W51C-02074					
	W51C-02109					
	W51D-02044					
	W51D-02151					
	W51D-02160					
	W51D-02171					

Name	Includes SQs	Size (Ha)	PES	Trajectory	REC	How to achieve the REC
	W51D-02177					
	W51D-02193					
Sandspruit Wetlands	W53A-01757	1676.8	C	→	C	Control expansion of commercial annual crops and dry-land agriculture.
	W53A-01804					
	W53A-01853					
Upper Usutu Wetlands	W54A-01534	767.2	B/C	→	B/C	Control expansion of commercial annual crops and dry-land agriculture.
	W54A-01630					
Seganagana Wetlands	W54B-01569	1264.7	A	→	A	Preventative conservation: Control expansion of forestry and dry-land agriculture.
	W54B-01623					
Pans District	W55A-01375	21348.2	A/B	→	A/B	Preventative conservation: Control expansion of forestry and commercial annual crops, rain-fed.
	W55A-01423					
	W55C-01395					
Lower Usutu (Ndumo)	W57J-01923	1310.0	A	→	A	Preventative conservation: prevent expansion of nearby slash and burn agricultural activities.
	W57K-01929					
	W57K-02025					
W7 Kosi & Sibaya						
Lake Sibaya	W70A-02278	10168.0	B	→	B	Prevent expansion of surrounding forestry, residence and dry-land agriculture. Continued implementation of EWR determined in 2015 (DWS, 2015a).
	W70A-02301					
	W70A-02381					
Muzi Swamps	None	25409.9	C	↓	C	Control forestry and subsistence and small-scale annual crops, address erosion.

5 CONCLUSION

The results of desktop EcoClassification and prioritisation of wetlands is summarised at the SQ level in **Chapter 3** per secondary catchment and outlined in **Figures 3.1** to **3.6** and **Tables 3.1** to **3.6**. The outcomes of the prioritisation process resulted in smaller subsets of wetlands with very high or high priority, within each secondary catchment, that were again assessed for PES at a more detailed level, using additional and more current / updated data. The resultant PES scores / categories and dominant impacts are presented in **Chapter 4** from **Table 4.1** to **Table 4.25**, and summarised as follows:

1) W1 (Mhlathuze) – Four groups of wetlands including riverine wetlands along the Mhlathuze River leading into the Mhlathuze swamp system, lower reaches of Nseleni, including Nsezi and portions of the Mhlathuze floodplain, Nundwane, mainly Mzingazi, extensive channelled valley bottom wetlands leading into Richard's Bay Estuary, and depressions and seeps near the Nlabane estuary.
2) W2 (Umfolozi) – Four groups of wetlands including riparian wetlands along the White Mfolozi River, Aloeboom vlei, Mvamanzi pan and the Mfolozi swamp.
3) W3 (Mkuze) – Five groups of wetlands including Mkuze and Nhlonhlela rivers including Nhlonhlela Pan, Hluhluwe, Nyalazi and Mpate, including Nyalazi, and the Mkuze River with swamps and floodplain before entering the estuary.
4) W4 (Pongola) – Two groups of wetlands including riparian wetlands along the Bivane River and the Pongola floodplain.
5) W5 (Usutu) – Six groups of wetlands including Boesmanspruit and Assegaai River, Sandspruit and Seganagana, Mpumalanga pan district around Chrissiesmeer, lower Usutu River including Banzi Pan and Ndumo.
6) W7 (Kosi & Sibaya) – Two groups of wetlands including Lake Sibaya and the Muzi swamps.

Besides Lake Sibaya and the Pongola floodplain which have quantitative flow requirements expressed as Lake levels and dam releases respectively (DWS, 2015a,b), the EWR of very high priority floodplains, channelled and unchannelled valley-bottom, and seep wetlands is expressed through ecological specifications that protect the habitat. To provide these specifications, the EWRs are expressed in terms of a REC, which is dependent on the PES and the ecological importance, which denotes whether the REC is the same as the PES or an improvement, if at all possible. Where the REC is an improvement of the PES, this will involve management of land use. The most common method to achieve the REC where it is higher than the PES is to remove alien vegetation, reduce agricultural / forestry encroachment of wetlands and manage (usually reduce) grazing pressures which can promote erosion. A summary of high priority wetlands is shown in **Table 4.27** with some indication of a proposed REC and strategies to achieve said.

6 REFERENCES

Berliner, D. & Desmet, P. 2007. Eastern Cape Biodiversity Conservation Plan: Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria. 1 August 2007.

Brown, C.A., Joubert, A.R., Beuster, J., Greyling, A. and King, J.M. 2013. DRIFT: DSS sofware development for Integrated Flow Assessments. WRC Project No. 1873. Water Research Commission, Pretoria.

Cowan G.I., (ed) 1995. Wetlands of South Africa. Department of Environmental Affairs and Tourism, Pretoria. South Africa.

Department of Water Affairs (DWA). 2012. Guideline for identifying appropriate levels of Resource Protection Measures for inland Wetlands: Version 1.0. Joint Department of Water Affairs and Water Research Commission report, prepared by M. W. Rountree, B. Weston and J. Jay. Department of Water Affairs, Pretoria.

Department of Water and Sanitation (DWS), South Africa. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Compiled by RQIS-RDM: http://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx

Department of Water and Sanitation (DWS). 2015a. Resource Directed Measures: Reserve determination study of selected surface water and groundwater resources in the Usuthu/Mhlathuze Water Management Area. Lake Sibaya – Intermediate EWR Assessment Report. Report produced by Tlou Consulting (Pty) Ltd. Report no: RDM/WMA6/CON/COMP/1713.

Department of Water and Sanitation (DWS). 2015b. Chief Directorate – Water Ecosystems: Reserve determination study of selected surface water and groundwater resources in the Usuthu/Mhlathuze Water Management Area. Pongola Floodplain – EWR Report. Prepared by Tlou Consulting (Pty) Ltd and Southern Waters Ecological Research and Consulting cc. Report no: RDM/WMA6/CON/COMP/1213.

King, J.M., Brown C.A. and Sabet, H. 2003. A scenario-based holistic approach to environmental flow assessments for regulated rivers. Rivers: Research and Application. 19, 619-639.

MacFarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. (2007) WET-Health: a technique for rapidly assessing wetland health. Version 1.0. Water Research Commission, Pretoria.

McCarthy, T., Cairncross, B., Huizenga, J.M. & Bachelor, A. 2007. Conservation of the Mpumalanga Lakes District. Unpublished report. Johannesburg.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L., and

Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas Project. WRC Report No. 1801/2/11.

Ollis, DJ., JA Day, HL Malan, JL Ewart-Smith and NM Job. 2014. Development of Decision-Support Tools for Assessment of Wetland Present Ecological Status (PES) Vol 2: Development of a Decision-Support Framework for Wetland Assessment in South Africa and a Decision-Support Protocol for the Rapid Assessment of Wetland Ecological Condition. Report to the Water Research Commission. WRC Report No. TT 609/14.

Rountree, M.W., H. Malan and B. Weston (editors). 2013. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). Joint Department of Water Affairs/Water Research Commission Study. Report No. 1788/1/13. Water Research Commission, Pretoria.

South African National Biodiversity Institute (SANBI). 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E. & Snaddon, K. 2018. South African National Biodiversity Assessment 2018: Technical Report. Volume 2a: South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Version 3, final released on 3 October 2019. Council for Scientific and Industrial Research (CSIR) and South African National Biodiversity Institute (SANBI): Pretoria, South Africa. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.

7 APPENDIX A: LAND COVER CLASS INTEGRITY SCORES

No.	Legend Colour	2018 NLC Class Name	Integrity Score
1		Contiguous (indigenous) Forest (*combined* very high, high, medium)	1
2		Contiguous Low Forest & Thicket (*combined classes*)	1
3		Dense Forest & Woodland (35 - 75% cc)	1
4		Open Woodland (10 - 35% cc)	1
5		Contiguous & Dense Planted Forest (*combined classes*)	0.1
6		Open & Sparse Planted Forest	0.2
7		Temporary Unplanted Forest	0.5
8		Low Shrubland (other regions)	1
9		Low Shrubland (Fynbos)	1
10		Low Shrubland (Succulent Karoo)	1
11		Low Shrubland (Nama Karoo)	1
12		Sparsely Wooded Grassland (5 - 10% cc)	1
13		Natural Grassland	1
14		Natural Rivers	1
15		Natural Estuaries & Lagoons	1
16		Natural Ocean, Coastal	1
17		Natural Lakes	1
18		Natural Pans (flooded @ obsv time)	1
19		Artificial Dams (incl. canals)	0
20		Artificial Sewage Ponds	0
21		Artificial Flooded Mine Pits	0
22		Herbaceous Wetlands (currently mapped)	1
23		Herbaceous Wetlands (previous mapped extent)	1
24		Mangrove Wetlands	1
25		Natural Rock Surfaces	1
26		Dry Pans	1
27		Eroded Lands	0.2
28		Sand Dunes (terrestrial)	1
29		Coastal Sand Dunes & Beach Sand	1
30		Bare Riverbed Material	1
31		Other Bare	0.3
32		Cultivated Commercial Permanent Orchards	0.2
33		Cultivated Commercial Permanent Vines	0.1
34		Cultivated Commercial Sugarcane Pivot Irrigated	0
35		Commercial Permanent Pineapples	0.1
36		Cultivated Commercial Sugarcane Non-Pivot (all other)	0
37		Cultivated Emerging Farmer Sugarcane Non-Pivot (all other)	0
38		Commercial Annuals Pivot Irrigated	0.1
39		Commercial Annuals Non-Pivot Irrigated	0.2
40		Commercial Annuals Crops Rain-Fed / Dryland / Non-Irrigated	0.3
41		Subsistence / Small-Scale Annual Crops	0.3
42		Fallow Land & Old Fields (Trees)	0.4
43		Fallow Land & Old Fields (Bush)	0.4
44		Fallow Land & Old Fields (Grass)	0.4
45		Fallow Land & Old Fields (Bare)	0.2
46		Fallow Land & Old Fields (Low Shrub)	0.4
47		Residential Formal (Tree)	0.1
48		Residential Formal (Bush)	0.1

No.	Legend Colour	2018 NLC Class Name	Integrity Score
49		Residential Formal (low veg / grass)	0.1
50		Residential Formal (Bare)	0
51		Residential Informal (Tree)	0.1
52		Residential Informal (Bush)	0.1
53		Residential Informal (low veg / grass)	0.1
54		Residential Informal (Bare)	0
55		Village Scattered (bare only)	0.1
56		Village Dense (bare only)	0
57		Smallholdings (Tree)	0.2
58		Smallholdings (Bush)	0.2
59		Smallholdings (low veg / grass)	0.2
60		Smallholdings (Bare)	0
61		Urban Recreational Fields (Tree)	0.1
62		Urban Recreational Fields (Bush)	0.1
63		Urban Recreational Fields (Grass)	0.1
64		Urban Recreational Fields (Bare)	0
65		Commercial	0
66		Industrial	0
67		Roads & Rail (Major Linear)	0
68		Mines: Surface Infrastructure	0
69		Mines: Extraction Sites: Open Cast & Quarries *combined*	0
70		Mines: Extraction Sites: Salt Mines	0
71		Mines: Waste (Tailings) & Resource Dumps	0
72		Land-fills	0
73		Fallow Land & Old Fields (wetlands)	0.4

Where: 1 = natural, 0 = completely impacted.

8 APPENDIX B: COMMENTS AND RESPONSE REGISTER

No.	Sect	Comment	From	Addressed?
	Pg vi; 1-1	Pages vi and 1-1: How many Ramsar sites are there in the study area? This document says 5, while the BID indicates 6 with the 6th one being the Natal Drakensberg Park.	M Sekoele	Yes. The information in the BID is incorrect. There are 5 Ramsar sites.
1	Pg xvi	Glossary section: Check spacing between the words "Ecosystem services, EcoClassification and IUA" and also between the words "Channel" all the way to "Wetlands".	R Pillay	Yes.
2	Sec. 4.3.1 Pg 4-3	W1 Catchment (Main River: Mhlathuze) - It is noted that for W1, only the very high priority wetlands were included. Suggest provide a brief explanation as to why the high priority wetlands were not considered.	R Pillay	The main reason for wetland prioritization is to reduce the number of wetlands to be further investigated so that the task is achievable. In this regard only the highest priority wetlands (in this case, wetlands with a Very High priority) were considered for addition assessment. For e.g. if wetlands with a high priority in W1 were included in would be the addition of wetlands within another 17 SQs. This reasoning has been added to the report.
3	Sec. 4.3.4 Pg 4-14	W3 Catchment (Main River: Mkuze) - Include an explanation as to why the high wetland priorities were also included in W3. The reason for the inclusion of high priority wetland was provided for W2 but I could not see an explanation for W3.	R Pillay	Have added to the report: Some of the wetlands with a High priority were also included because they are well known wetlands, or have a large extent, or have been highlighted in other studies as priority wetlands e.g. Hluhluwe and Mkuze floodplains.
4	Sec 4.3.4	Figures 4.6, 4.10, 4.12 and 4.13: The figure title appears incomplete – does not refer to the inset delineation relative to satellite imagery.	R Pillay	Have addressed in the report for each.
5	Sec 4.3.7 Pg 4-36	The sentence at the start of section 4.3.7. The RUs that have a Very High priority wetlands include W70-1 (Swamanzi) and W70-3 (Lake Sibaya, Muzi swamps)". U70-3 was given a priority of 3 – is this correct or is it meant to be a priority 4 as referred to in the sentence above. Further to this, W70A-02030 is not included in Table 4.24 or if it is included, the SQ, wetland IEI and priority rating have been omitted. Clarity is sought in this regard.	R Pillay	There is no official SQ in W70A-2030 associated with the Muzi swamps hence the error has crept in. The Muzi swamps have a very high priority (4). Adjustments have been made in the report in both Tables 4.24 and 3.6.
6	Sec 4.3.5 pg 4-21	Section 4.3.5 W4 Catchment (Main River: Pongola - excluding Eswatini) – The sentence,"The RUs that have been considered for further assessment form 2 groups: W41-1 (Bivane) is recorded as having a Very High wetland priority and W45-1 (Pongola floodplain)". This ssentence	R Pillay	Added to the report - the reasoning given in Table 4.15 has been repeated at the start of the paragraph for clarity.

No.	Sect	Comment	From	Addressed?
		appears incomplete. It is note that the reason for the inclusion of high priority wetlands is provided under the Pongola Floodplain section, however I recommend including the reason at the start of the section 4.3.5.		
7	Table 4.24 Pg 4-37	Under group 2 (no SQ), the depressional and floodplain wetlands that comprise the Muzi swamps – it is colour coded red but not provided with a score for priority. What is the reason for this?	R Pillay	This relates to comment no 5. The Muzi swamps have no official SQ assigned to them, and the priority was manually set to V high. The N/A in the Table has been replaced with a 4.