DETERMINATION OF WATER RESOURCE CLASSES, RESERVE AND RQOS IN THE LIMPOPO (A5-A9) CATCHMENTS & OLIFANTS (B9) CATCHMENT PRESENTATION TITLE

Public meeting – Makhado

Results for the Ecological Reserve, Water Resource Classes and the Resource Quality Objectives

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Date: 5th August 2025

WATER IS LIFE - SANITATION IS DIGNITY

water & sanitation

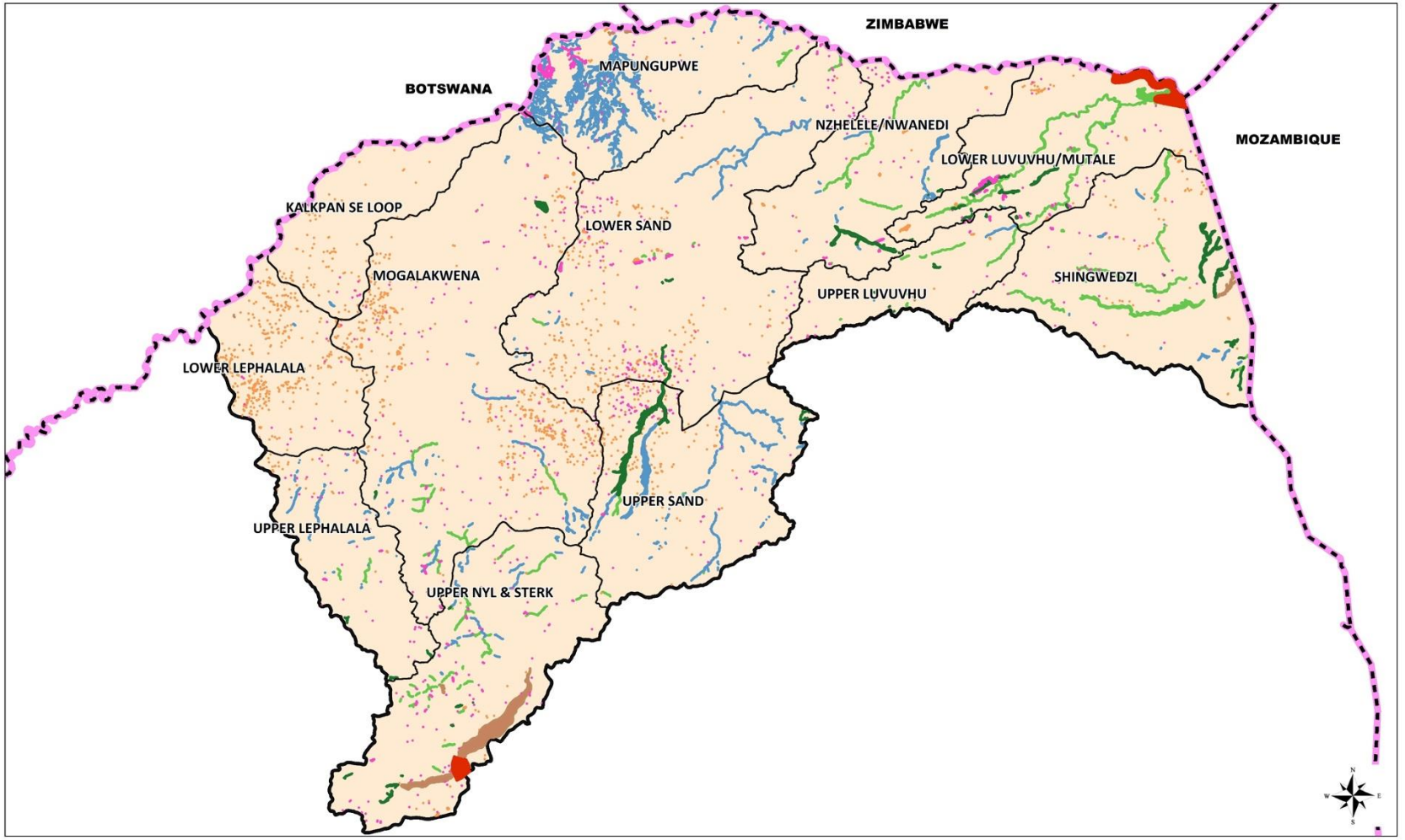
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

2030 NDP

30 YEARS OF FREEDOM
South Africa 1994 - 2024

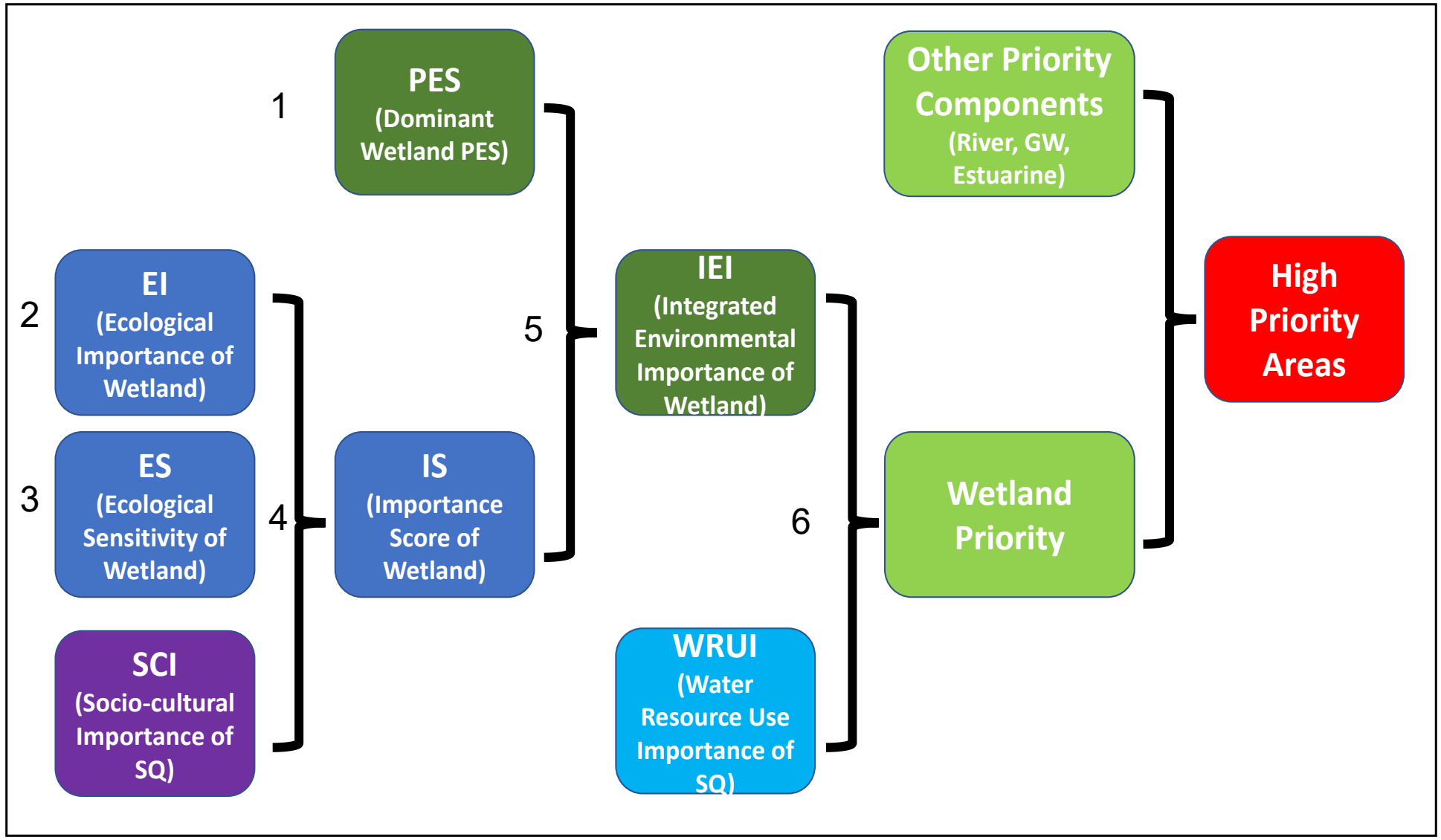
Wetlands in the Study Area

DWS definition: a wetland is defined as land that transitions between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water. In normal circumstances, this land supports or would support vegetation adapted to life in saturated soil.



- Over 84 000 Ha
- Different HGMs

WETLAND APPROACH: 6-STEP PRIORITISATION



Ecological Importance

The determination of EI considered the following criteria from the following data sources:

- **National Biodiversity Assessment** (new wetland map, 2018)
  - Diversity of wetlands.
  - Overall extent of wetlands.
- **NFEPA** (2011)
  - RAMSAR
  - Wetland FEPA status
  - Wetland Clusters (proximity to other wetlands)
  - Habitats for rare and endangered species including:
    - Cranes
    - Amphibians
    - Water Birds

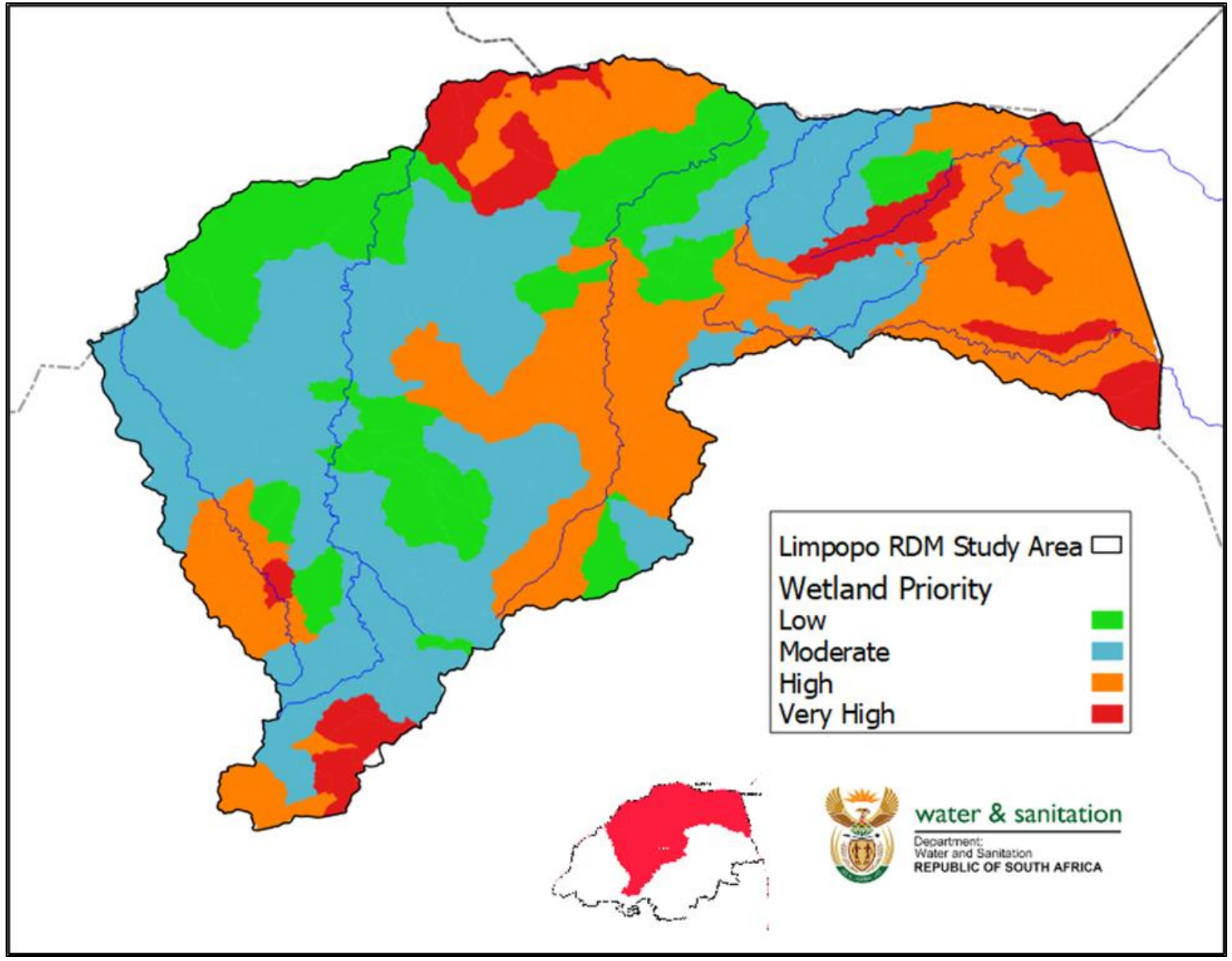
- Known important peatland sites.
- Important Birding Areas (2015) - BirdLife International Programme
- Regions / Centres of Plant Endemism (Van Wyk & Smith, 2001)
- Regional Conservation Plans including (eg):
  - Limpopo Conservation Plan, version 2 (2013)
  - KwaZulu Natal - Terrestrial Critical Biodiversity Areas (CBAs) in KZN developed 2010. This is an update to the 2007 terrestrial C-Plan (EKZNW, 2010)
  - Mpumalanga - Mpumalanga Biodiversity Conservation Plan (2006, 2014) comprising the Terrestrial Biodiversity and Freshwater Assessment (Lötter & Ferrar, 2006; Lötter, 2014; MTPA, 2014)

Ecological Sensitivity

The determination of ES considered the following criteria from the following data sources:

- National Biodiversity Assessment (new wetland map, Van Deventer *et al.*, 2018) -
  - Dominant protection level of wetlands
  - Dominant threat status of wetlands
- Threatened Ecosystems (SANBI, 2011, remaining extent of natural vegetation; NBA 2018 Technical Report Volume 1: Terrestrial Realm).
- Threatened Plant Species (SANBI, 2009).
- PES/EI/ES (DWS, 2014) – ES score (0 - 5)

WETLAND APPROACH: PRIORITY



WETLAND APPROACH: PRIORITY

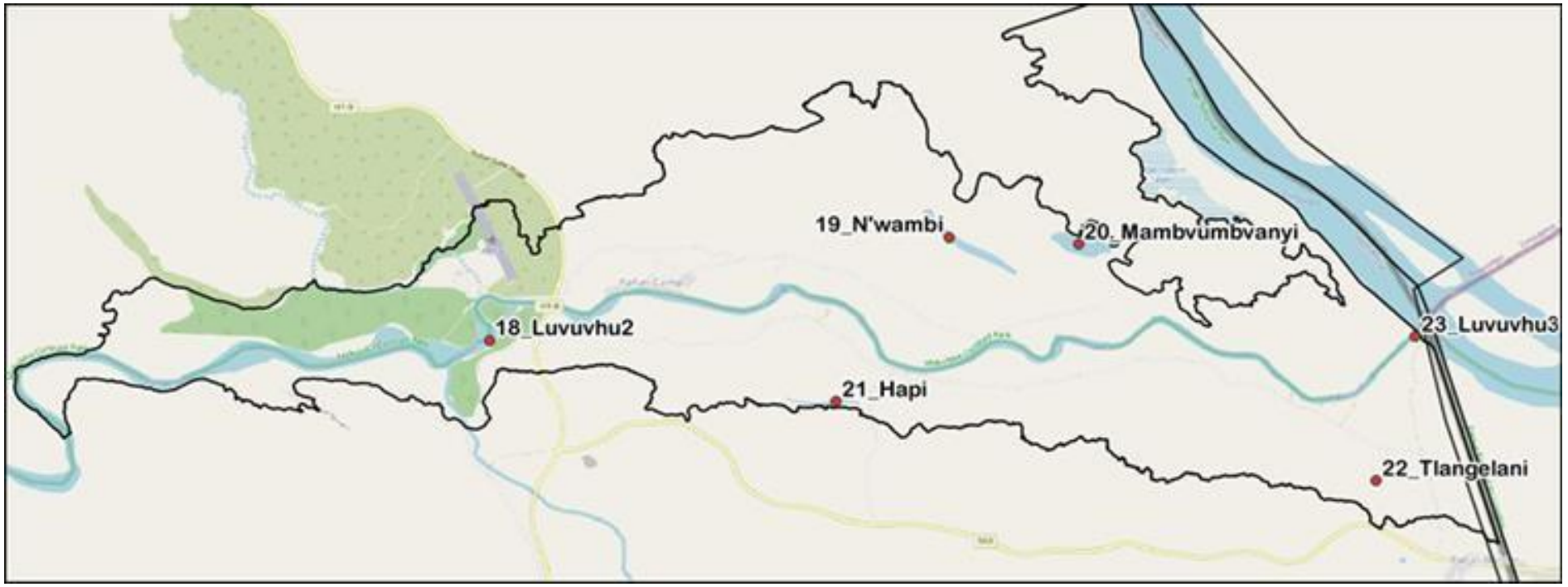
Very High priority wetlands comprised 9.7% of SQs and 37.7% of SQs had High priority wetlands with 52% of SQs with a Moderate and Low priority. The following high priority wetlands were assessed in the field for higher confidence validation / evaluation of the PES, EI and ES:

- Luvuvhu Floodplain (Makuleke)
- Nyl River Floodplain
- Wonderkrater
- Nyl Pans
- Maloutswa Floodplain (Mapungubwe)
- Kolope Wetlands
- Lake Fundudzi
- Mutale Wetlands
- Mokamole wetlands – a tributary of the Mogalakwena River
- Thermal spring / Peat domes in KNP (Malahlapanga; Mfayeni)
- Bububu wetlands – a tributary of the Shingwedzi River

WETLAND PES – EI - ES

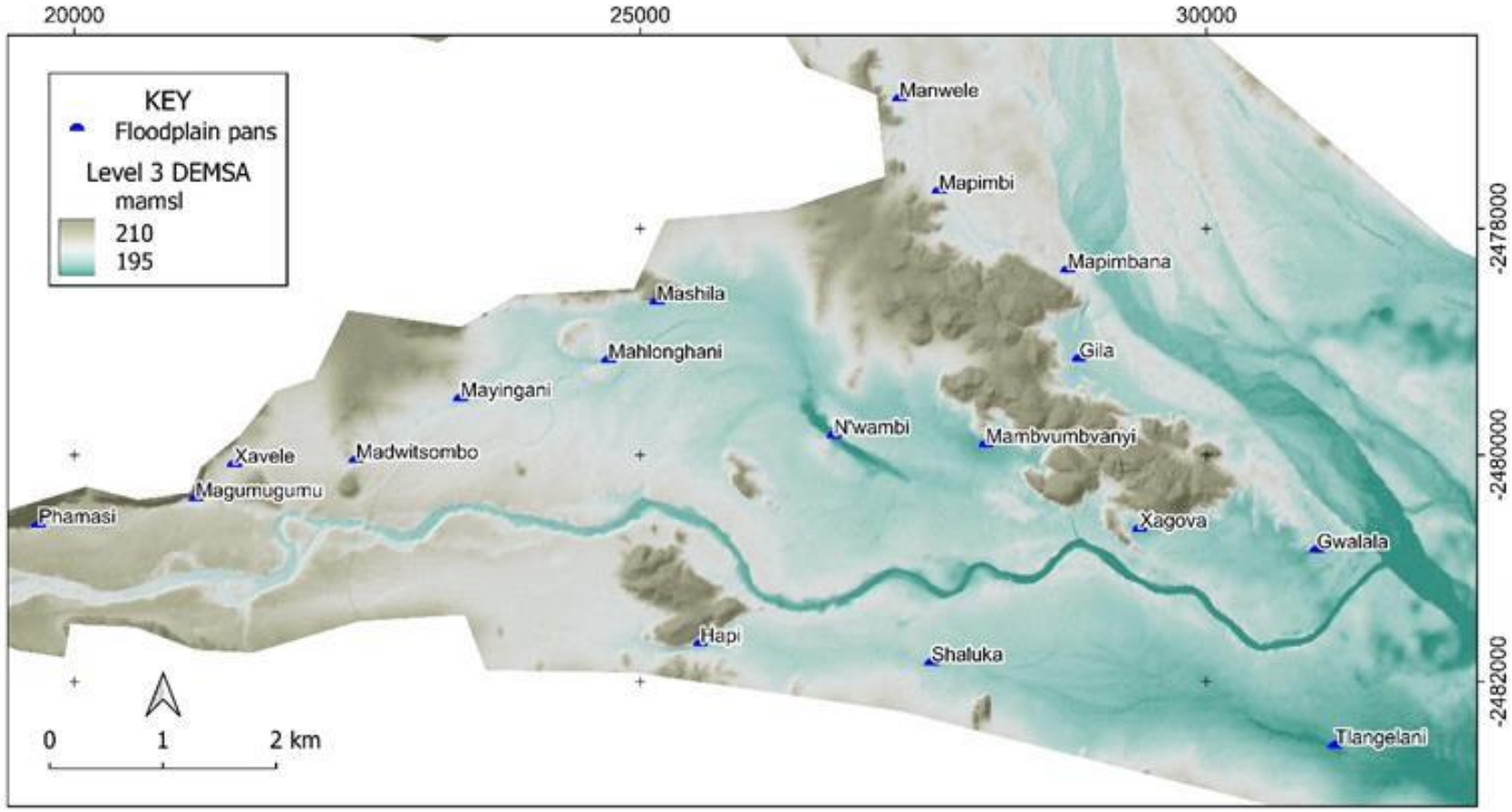
High Priority Wetland	PES Score	PES Category	EI	ES	REC	TEC	Reason for REC
Luvuvhu Floodplain (Makuleke)	80	B/C	Very High	High	B	B	Very High EI supports half category increase
Nyl River Floodplain	65	C	Very High	High	B/C	B/C	Very High EI supports half category increase
Wonderkrater	80	B/C	Very High	Moderate	B	B	Very High EI supports half category increase
Nyl Pans	57	D	High	High	C/D	C/D	Improve water quality
Maloutswa Floodplain	66	C	Very High	High	B/C	C	Very High EI supports half category increase
Kolope Wetlands	90	A/B	Very High	Low	A/B	A/B	Maintain PES as already near natural
Lake Fundudzi	78	B/C	Very High	High	B	B	Very High EI supports half category increase
Mutale Wetlands	62	C/D	Very High	High	C	C	Very High EI supports half category increase
Mokamole (tributary of the Mogalakwena)	80	B/C	High	High	B/C	B/C	Maintain PES
Malahlapanga	78	B/C	Very High	Moderate	B	B/C	Very High EI supports half category increase
Bububu wetlands (tributary of the Shingwedzi)	97	A	Very High	Moderate	A	A	Maintain PES as already natural

WETLAND EWR: Luvuvhu Floodplain



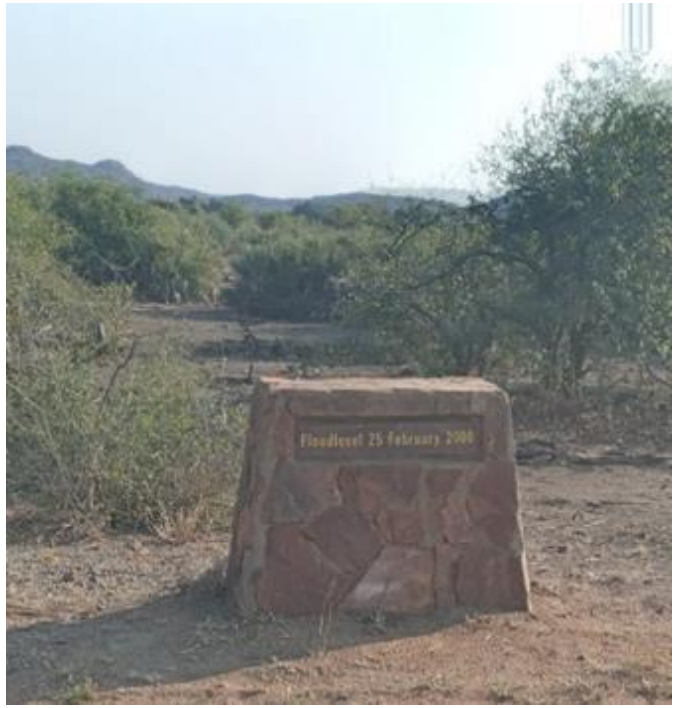
Map showing the Luvuvhu floodplain (new delineation) and the 6 EWR sites (4 pans and 2 river sites) used in DRIFT

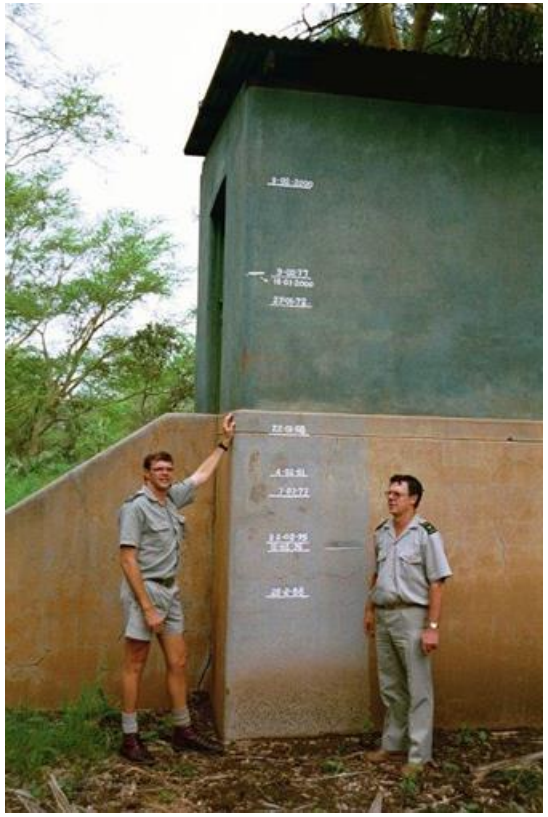
HYDRODYNAMIC MODEL: Luvuvhu



Digital Elevation Model (DEM) of the Luvuvhu River floodplain to the Limpopo River confluence

HYDRODYNAMIC MODEL: Luvuvhu





Marked historic floods levels: left) (February 2000) - on beacons on the tar road crossing the Luvuvhu River, Middle) marked on a wall at the Theba Pump House between 1958 and 2000 - date unknown, Right) includes the 2013 flood that is the second highest recorded after 2000 (photograph October 2022)

HYDRODYNAMIC MODEL: Luvuvhu

Conceptual approach adopted to develop a HECRAS 1-d model for the Luvuvhu and Limpopo Rivers and adjacent floodplains:

HYDRODYNAMIC MODEL: Luvuvhu

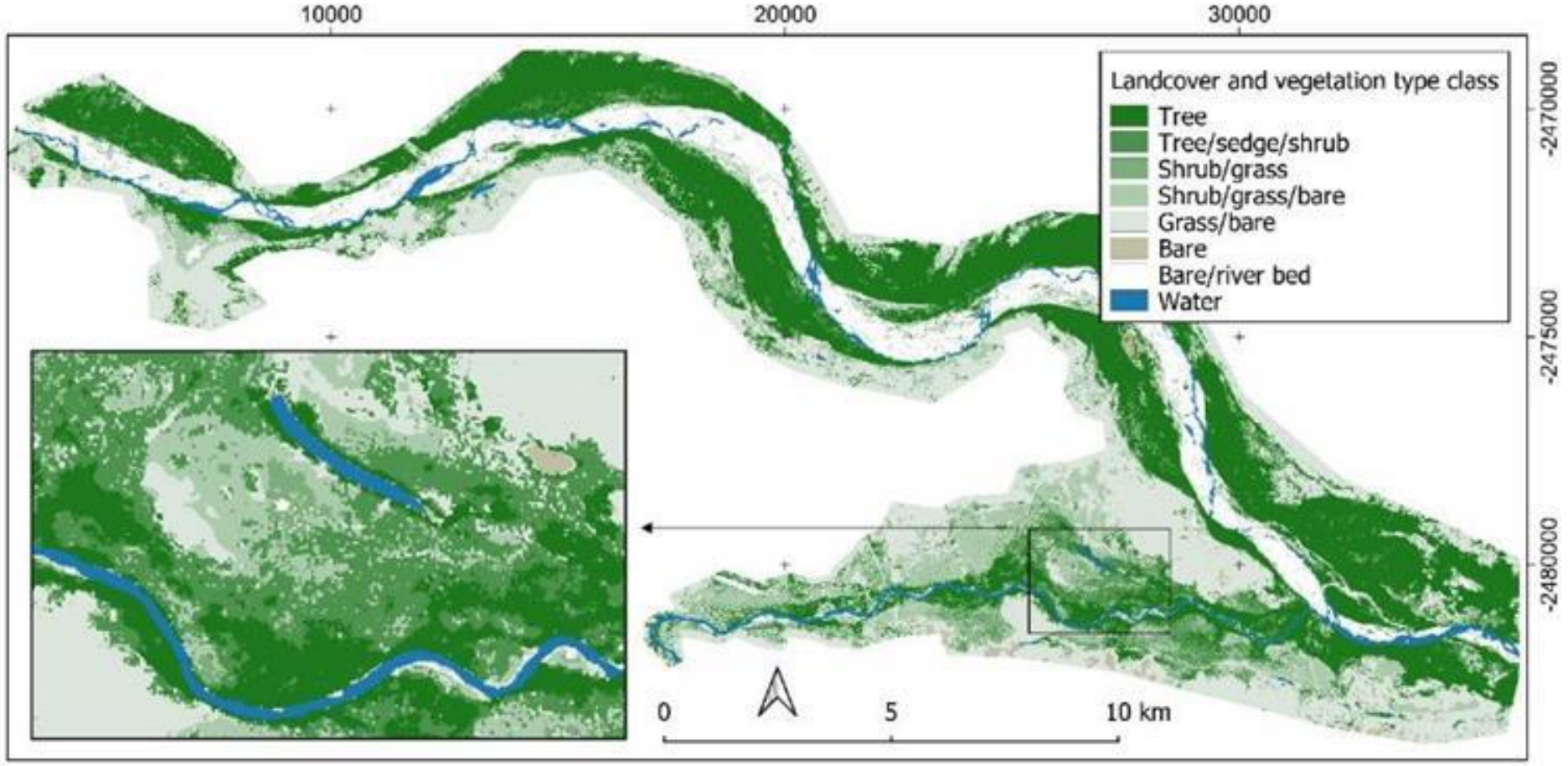
Return periods for filling pans through only overtopping of the Luvuvhu/Limpopo riverbanks (excludes rainfall and associated runoff).

Pan	Return period for flooding from Luvuvhu/Limpopo Rivers (years)											
	Natural			**PES (2022)**			Future1			Future2		
	I	B	O	I	B	O	I	B	O	I	B	O
Luvuvhu Floodplain												
N'wambi	7.0	2.8	2.8	**7.0**	**4.7**	**4.7**	9.3	5.1	5.1	18.7	7.0	7.0
Mambvum bvanyi	7.0	2.8	2.8	**7.0**	**4.7**	**4.7**	9.3	5.1	5.1	18.7	7.0	7.0
Hapi	9.3		9.3	**18.7**		**18.7**	18.7		18.7	56.0		56.0
Tlangelani	6.2	11.2	5.1	**6.2**	**14.0**	**5.6**	7.0	14.0	6.2	14.0	14.0	9.3

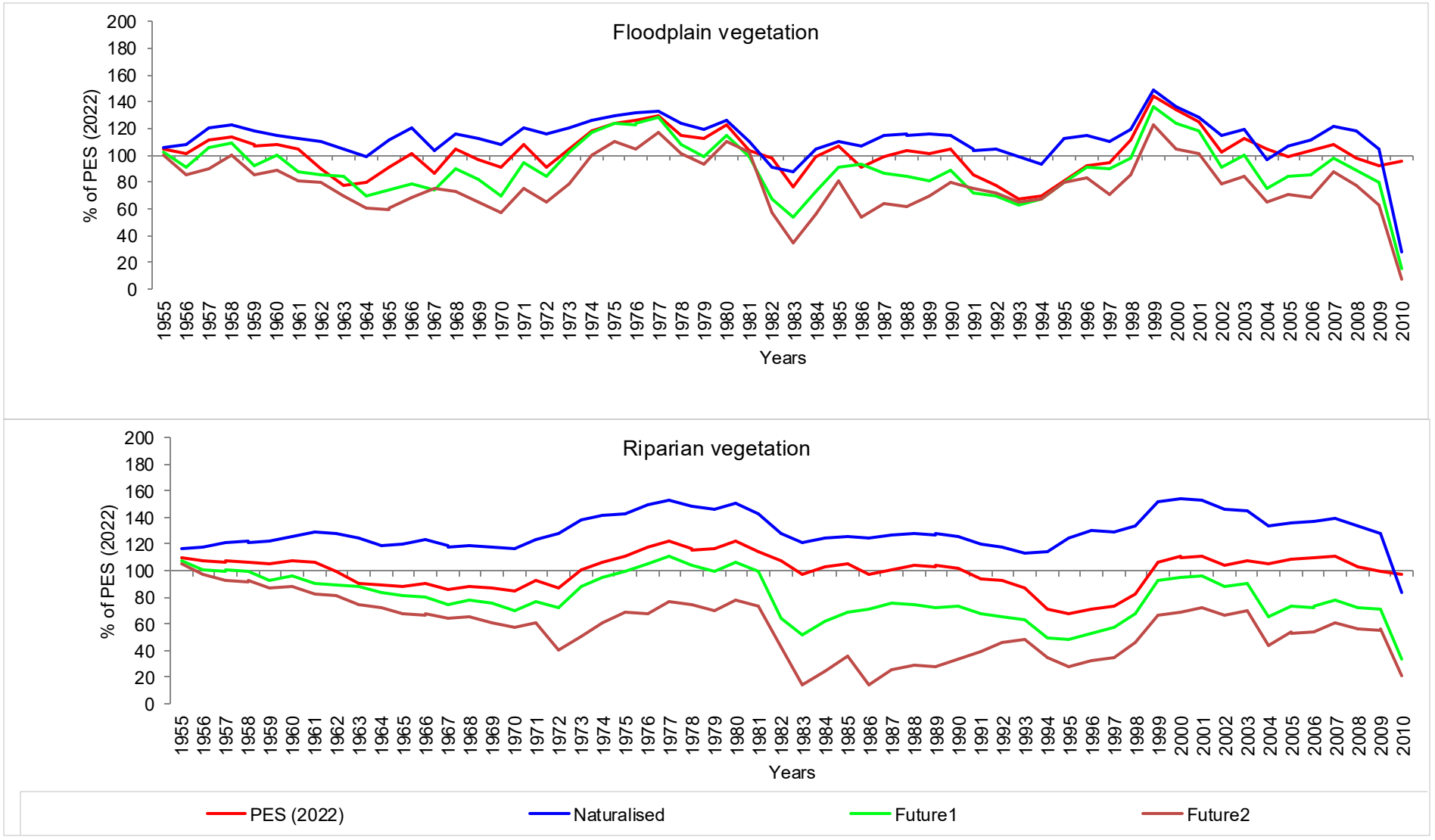
I: Inflow
B: Backfill
O: Overall

WETLAND EWR: Luvuvhu Floodplain

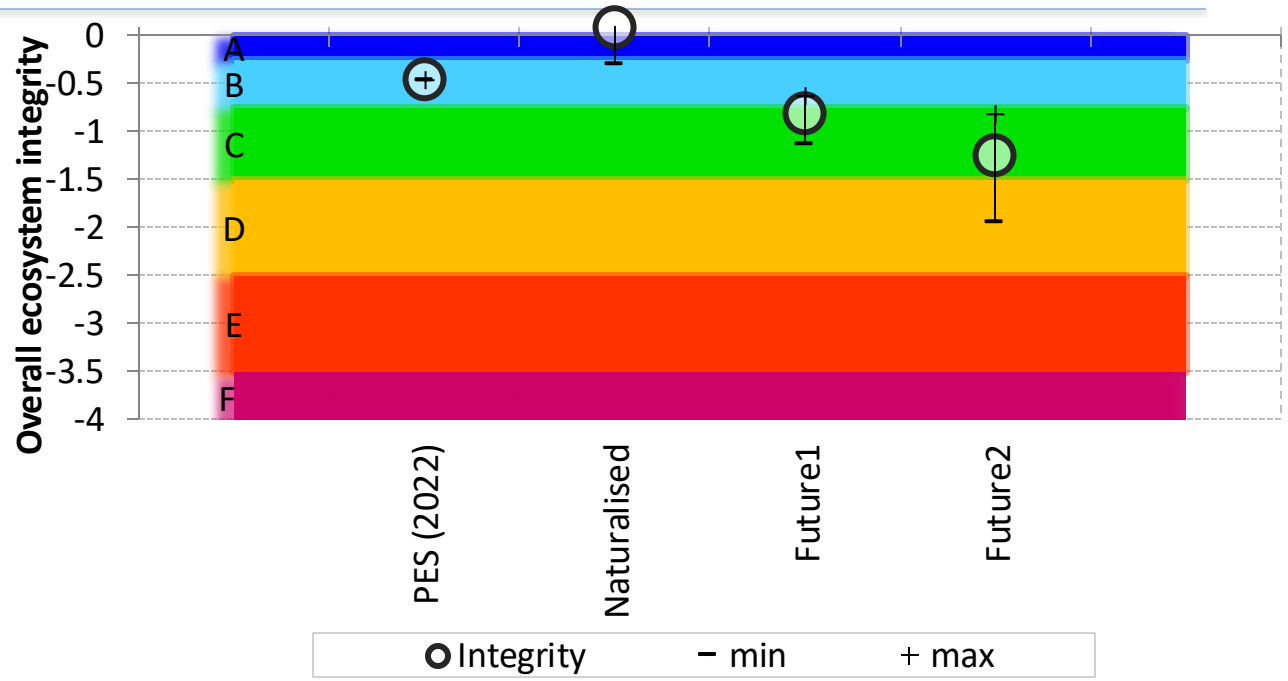
Landcover and vegetation types of the Luvuvhu and Limpopo floodplains



WETLAND EWR: Luvuvhu Floodplain



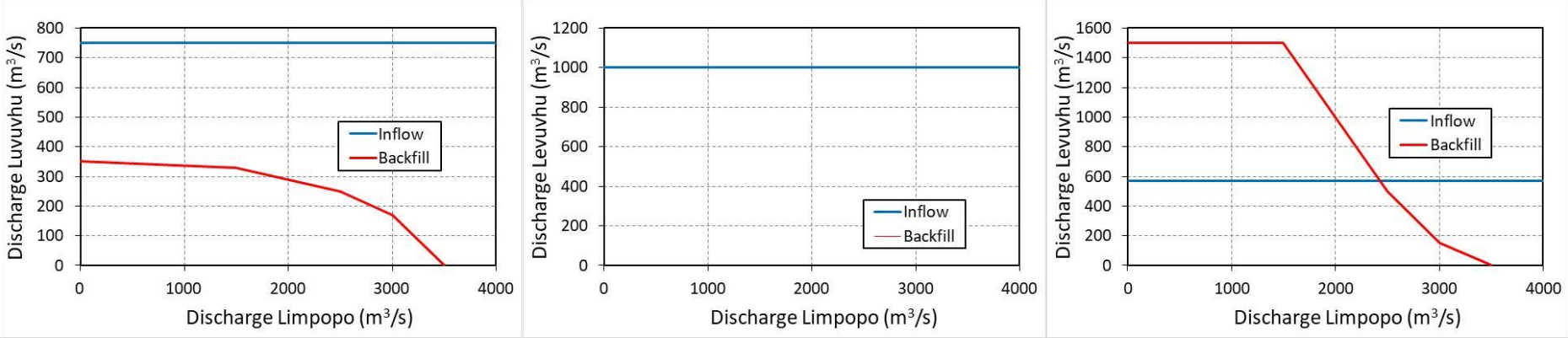
WETLAND EWR: Luvuvhu Floodplain



	PES (2022)	Naturalised	Future1	Future2
Vegetation	B	A	C	D
Fish	B/C	B	B/C	C
Birds	B/C	A	C	C/D
Wildlife	B	A	B/C	C
Overall	B/C	A	C	C/D

WETLAND EWR: Luvuvhu Floodplain

The combinations of discharge in the Luvuvhu and Limpopo Rivers that breach the levees and flood the floodplain to fill the Nwambi and Mambvumbvanyi (left), Hapi (centre) and Tlagelani (right) pans.

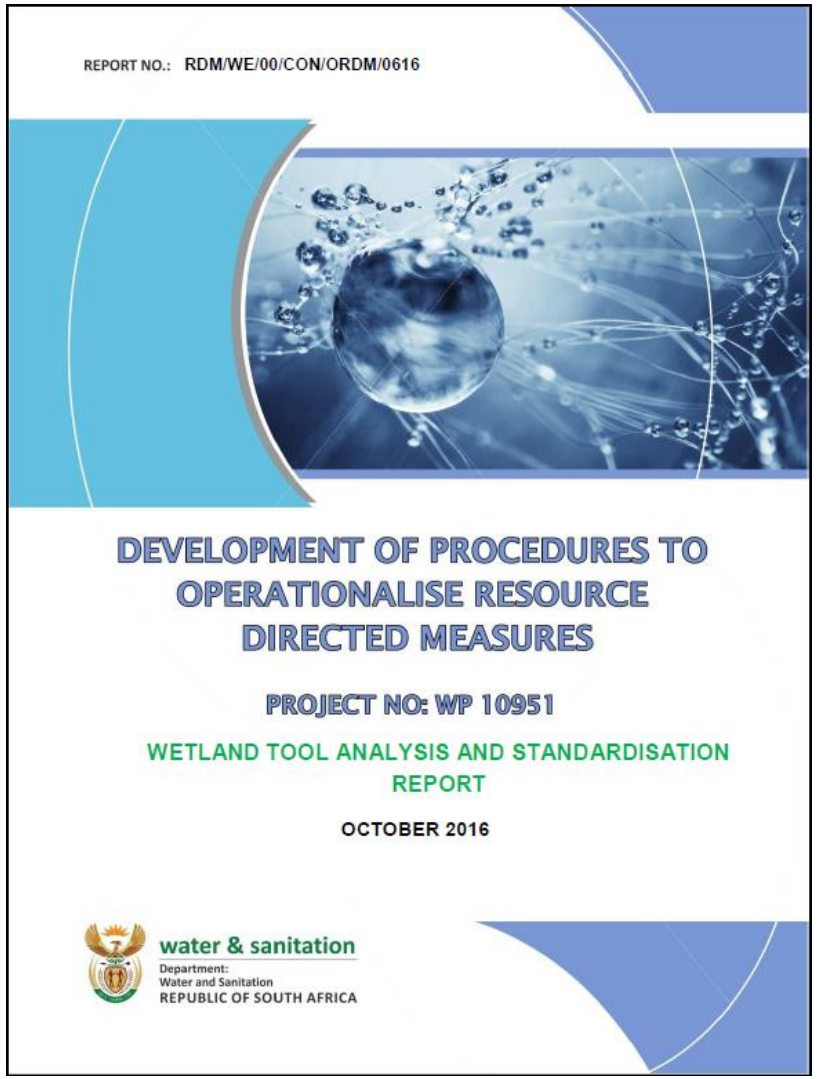


Flood requirements to maintain PES (2022) conditions of the Luvuvhu River floodplain and pans

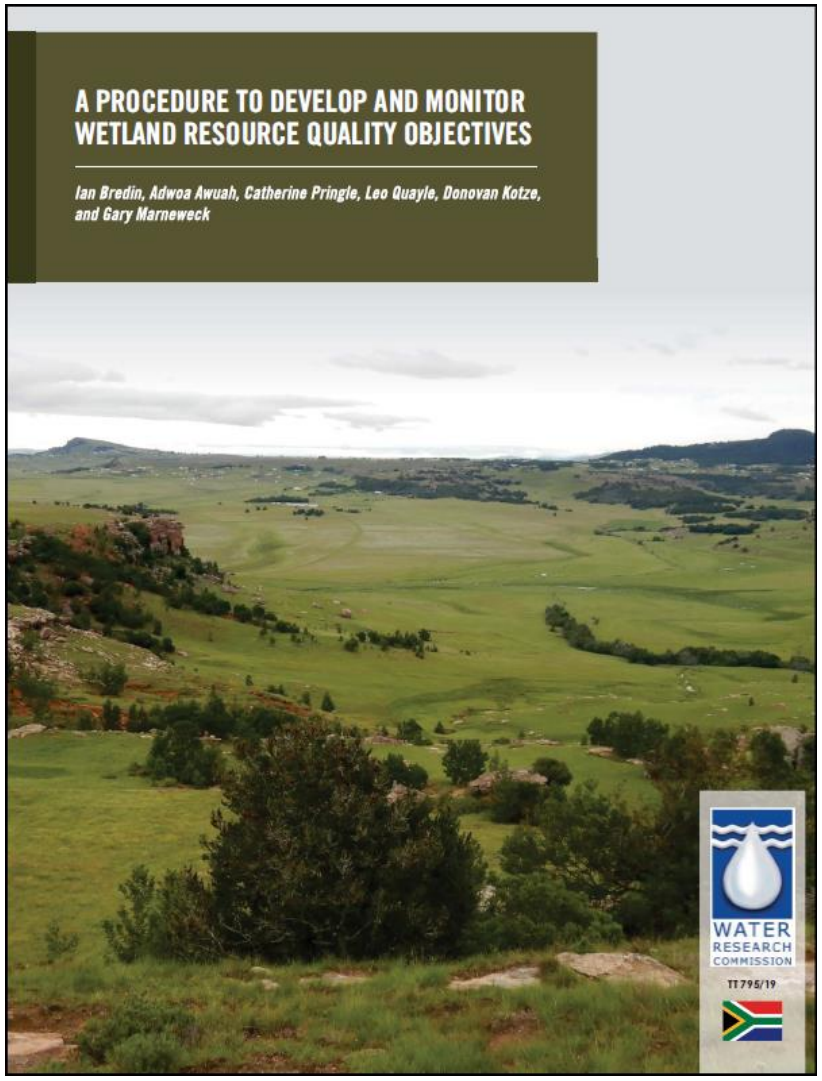
Pan	Return period of pan filling	Source of flood	Minimum discharge (m^3/s)
Nwambi and Mambvumbvanyi	1 : ~5 years*	Inflow (Luvuvhu River)	752
		Backfill (Luvuvhu and Limpopo River)	Refer to Figure above for a combination of floods to maintain desired frequency
Hapi	1 : ~20 years*	Inflow (Luvuvhu River)	1 000 – 1 204
		N/A.	N/A.
Tlangelani	1 : 5 years*	Inflow (Luvuvhu River)	575
		Backfill (Luvuvhu and Limpopo River)	Refer to Figure above for a combination of floods to maintain desired frequency

WETLAND RQOs

2016 - Ewart-Smith J, Rountree MW and MacKenzie J.



2019 - Ian Bredin, Adwoa Awuah, Catherine Pringle, Leo Quayle, Donovan Kotze, and Gary Marneweck



WETLAND RQOS: PROCESS

2019 (INR)

- Step 1: Identify potentially significant wetland resources;
- Step 2: Identify, verify and prioritize wetland resources to inform the delineation of Resource Units;
- Step 3: Desktop delineation, Present Ecological State and Importance and Sensitivity of Priority Wetland Resources to determine the Recommended Ecological Category and to inform the delineation of Resource Units;
- Step 4: Determine sub-components and indicators; and
- Step 5: Set Resource Quality Objectives, and numerical criteria, and provide implementation information

PROCESS: DEFINE NARRATIVE & NUMERIC RQOs

When setting RQOs for wetlands the underlying aim is to describe (narrative)and where possible quantify (numeric) the following:

- What defines the wetland
- What drives the wetland
- What maintains the wetland
- What impacts the wetland
- What benefits does the wetland provide

WETLAND RQOS: COMPONENTS & SUB-COMPONENTS

Components	Sub-components
Quantity	Water inputs
	Water distribution and retention patterns
Quality	Nutrients
	Salts
	System variables
	Toxics
	Microbial determinands
Habitat	Present Ecological State (PES)
	Geomorphology
	Wetland Vegetation
Biota	Fish
	Plant species
	Mammals
	Birds
	Amphibians & reptiles
	Periphyton
	Aquatic Invertebrates
	Diatoms

Wetland RQOs: e.g. – Luvuvhu Floodplain

Components	Method used for assessment	PES% Score	Ecological Category
Hydrology PES	WET-Health Hydro Module	70 %	C
Geomorphology PES	WET-Health Geomorph Module	90 %	A/B
Water quality PES	Wetland-IHI WQ Module	71 %	C
Vegetation PES	WET-Health Veg Module	87 %	B
Overall Wetland PES	WET-Health default weightings	80 %	B/C

Wetland RQOs: Luvuvhu Floodplain

Component	Subcomponent	Indicator	RQO Narrative	RQO Numerical	TPC
The RQOs outlined below for the Luvuvhu Floodplain (Makuleke) - river & floodplain complex with pans, are to maintain a B category (TEC), with a percentage score of at least 82%, and the EI should remain Very High and the ES High.					
Water quantity	Water Inputs	Hydrology (EWR)	Maintenance of perenniality, seasonality and wet and dry season baseflows is required to provide the necessary wetting regime required for supporting wetland components. The quantity and timing of inputs, depth to groundwater. and the distribution and retention patterns within the wetland must be maintained to avoid the loss of wetland hydrological function.	The EWR determined for the upstream Luvuvhu River site should be implemented (not shown here) i.e. main channel must remain perennial, and the EWR for the floodplain component (floods) is shown below.	Failure to implement the EWR determined for the upstream Luvuvhu River site OR loss of perenniality of the main channel

Floods. Flood can occur in the month before or after the month indicated

	Within year floods <1:2 years				Inter annual floods >=1:2 years			
Flood Class	Class1	Class2	Class3	Class4	1:2 year	1:5 year	1:10 year	1:20 year
Ave peak discharge (m^3/s)	11.1	23.4	50.4	88.7	200	593	1029	1660
Ave duration (days)	4	6	8	10	10	15	20	34
Number	2	2	2	1	As per return period			
Oct								
Nov	1							
Dec	1	1						
Jan		1	1					
Feb				1	1	1	1	1
Mar			1					
Apr	1							
May								
Jun								
Jul								
Aug								
Sep								
Vol (10^6m^3)	8.66	14.49	32.78	28.72	74.55	208.14	420.84	787.78
% PES (2022) MAR	1.81	3.04	6.87	6.02	15.62	43.61	88.19	165.08

Flood peaks beyond the specified range OR reduced return interval of occurrence for specified floods

Wetland RQOs: Luvuvhu Floodplain

Component	Subcomponent	Indicator	RQO Narrative	RQO Numerical	TPC
Water quantity	Water Inputs	Depth to ground water on the floodplain	The average depth to groundwater across the floodplain should remain shallow to support phreatophytic vegetation communities and pan levels.	The average depth to groundwater should range between 2.5m and 4.5m and should only extent to 6.5m during natural droughts.	The average depth to groundwater > 4.5m
	Water distribution and retention patterns	Flooding by damming with the wetland	Maintain the absence of artificial damming within the wetland complex (excludes pans).	Artificial damming within the delineated wetland area shall not exceed 0Ha (excludes pans).	Artificial damming within the delineated wetland area > 0Ha (excludes pans)
		Pan water level regime	Pan water level regimes are dependent on flooding regimes and rainfall for infilling. The return period for floods required by different pans should be adhered to as far as possible according to the EWR determined for pans.	The EWR determined for the floodplain component including pans should be implemented (See above).	Failure to implement the EWR determined for the floodplain component including pans

Wetland RQOs: Luvuvhu Floodplain

Component	Subcomponent	Indicator	RQO Narrative	RQO Numerical	TPC
Habitat	Wetland vegetation structure / composition	Extent of natural wooded land within the wetland complex (land cover classes 1-4, 2020)	The extent of natural wooded land within the wetland complex should remain a dominant component of overall vegetation	The extent of natural wooded land within the wetland complex should not decline below 2600Ha.	The extent of natural wooded land within the wetland complex < 2600Ha
		Extent of herbaceous wetlands (land cover classes 22-23, 2020)	The extent of herbaceous wetlands should not decline.	The extent of herbaceous wetlands should not decline below 49.6Ha.	The extent of herbaceous wetlands < 49.6Ha
	Habitat fragmentation with the wetland delineation	Extent of alien invasive plants within the wetland / complex	Dense patches of alien invasive plant species should be prevented from establishing within the wetland complex.	Dense patches of alien invasive plant species should not exceed 2% of the wetland area.	Dense patches of alien invasive plant species > 2% of the wetland area
		Developments within the wetland complex (includes mines and quarries, SANLC classes 68-72, built-up areas, infrastructure, canals, furrows and trenching , SANLC classes 47-67)	Wetland habitat loss or fragmentation due to developments should not be permitted within the wetland complex.*	The aerial extent of developments within the delineated wetland area shall not exceed 0Ha.	The aerial extent of developments within the delineated wetland area > 0Ha
		Land cover classes denoted to cultivated areas within the wetland complex (classes 32-46 & 73, 2020)	Wetland habitat loss due to direct agricultural activities and croplands should not be permitted within the wetland complex.	The aerial extent of agricultural activities and croplands within the delineated wetland area shall not exceed 0Ha.	The aerial extent of agricultural activities and croplands within the delineated wetland area > 0Ha

* - includes a 200m buffer

Wetland RQOs: Luvuvhu Floodplain

Component	Subcomponent	Indicator	RQO Narrative	RQO Numerical	TPC
Biota	Birds	Threatened bird species (water / wetland / riparian-dependent)	Populations of Pels Fishing Owl (Scotopelia peli) White Crowned Lapwing (Vanellus albiceps) Black Stork (Ciconia nigra), Yellow billed Stork (Mycteria ibis), Open billed stork (Anastomus lamelligerus), Saddle-billed Stork (Ephippiorhynchus senegalensis), Great White Pelican (Pelecanus onocrotalus), Greater Painted-Snipe (Rostratula benghalensis) and Pygmy Goose (Nettapus auritus) should be maintained within the wetland complex.	9 listed species should occur during the wet season	< 9 listed species during the wet season
		Bird species diversity within the wetland complex	The number of bird species (includes residents and migrants) that utilise the Luvuvhu River and its floodplain and pans should be maintained.	The number of bird species that utilise the Luvuvhu River and its floodplain and pans should be at least 450 species.	The number of bird species that utilise the Luvuvhu River and its floodplain and pans < 450 species
	Mammals	Elephant abundance	The abundance of elephants within the wetland complex should be strategically and adaptively managed to promote conservation targets for all species, and overall vegetation health.	N/A	
		Hippo abundance (VU)	The main Luvuvhu River and perennial and near-perennial pans within the floodplain should continue to supports pods of Hippopotamus (Hippopotamus amphibius, VU). The Luvuvhu main channel should remain perennial to maintain critical hippo habitats, especially during the dry season.	N/A	

Wetland RQOs: Luvuvhu Floodplain

Component	Subcomponent	Indicator	RQO Narrative	RQO Numerical	TPC
Biota	Reptiles	Crocodile abundance (VU)	The main Luvuvhu River and perennial and near-perennial pans within the floodplain should continue to supports Nile Crocodiles (Crocodylus niloticus, VU). The Luvuvhu main channel should remain perennial to maintain critical crocodile habitats, especially during the dry season.	N/A	
		Threatened reptile species (water-dependent)	The Nile crocodile (Crocodylus niloticus, CITES App. II; SA Red Data: Vulnerable) and African python (Python sebae, CITES App. II; SA Red Data: Vulnerable), should both remain an integral part of the wetland complex.	2 listed species should remain present within the wetland complex	< 2 listed species remain present within the wetland complex
	Fish	Species diversity in the Luvuvhu River and perennial pans	The number of fish species that occur in the Luvuvhu River and perennial pans should be maintained, and alien fish species should be kept as low as possible (especially Tilapia niloticus)	The number of fish species that occur in the Luvuvhu River and perennial pans should be at least 26 indigenous species in the wet season.	The number of fish species that occur in the Luvuvhu River and perennial pans < 26 indigenous species in the wet season
	Amphibians	Frogs and toads (species diversity)	The number of amphibian species that occur along the Luvuvhu River and within its floodplain and pans should be maintained.	The number of amphibian species that occur along the Luvuvhu River and within its floodplain and pans should be at least 30 species in the wet season.	The number of amphibian species that occur along the Luvuvhu River and within its floodplain and pans < 30 species in the wet season

Wetland RQOs: Luvuvhu Floodplain

Component	Subcomponent	Indicator	RQO Narrative	RQO Numerical	TPC
Biota	Vegetation	Alian invasive plants	The wetland complex should be maintained by removal of perennial alien plant species, especially Mimosa pigra.	There should be zero occurrence of Mimosa pigra within the wetland complex.	Presence of Mimosa pigra within the wetland complex
		Plant species diversity within the wetland complex	The number of plant species that occur along the Luvuvhu River and within its floodplain and pans should be maintained.	The number of plant species that occur along the Luvuvhu River and within its floodplain and pans should be at least 250 species.	The number of plant species that occur along the Luvuvhu River and within its floodplain and pans < 250 species
Water quality	Salts	Electrical conductivity (mS/m)	Water quality in the main Luvuvhu River channel should maintain the TEC (B/C).	95th percentile EC < 70 mS/m	95th percentile EC > 70 mS/m
	System Variables	pH		5.75 >= pH <= 9.0	pH < 5.75 or pH > 9.0
	Nutrients	Total inorganic nitrogen (TIN) (mg/l)		Median TIN < 1.90 mg/l	Median TIN > 1.90 mg/l
		Orthophosphate (mg/l)		Median PO4-P < 0.075 mg/l	Median PO4-P > 0.075 mg/l
		Ammonia (NH3-N) (mg/l)		Median NH3-N < 0.044 mg/l	Median NH3-N > 0.044 mg/l

THANK YOU!