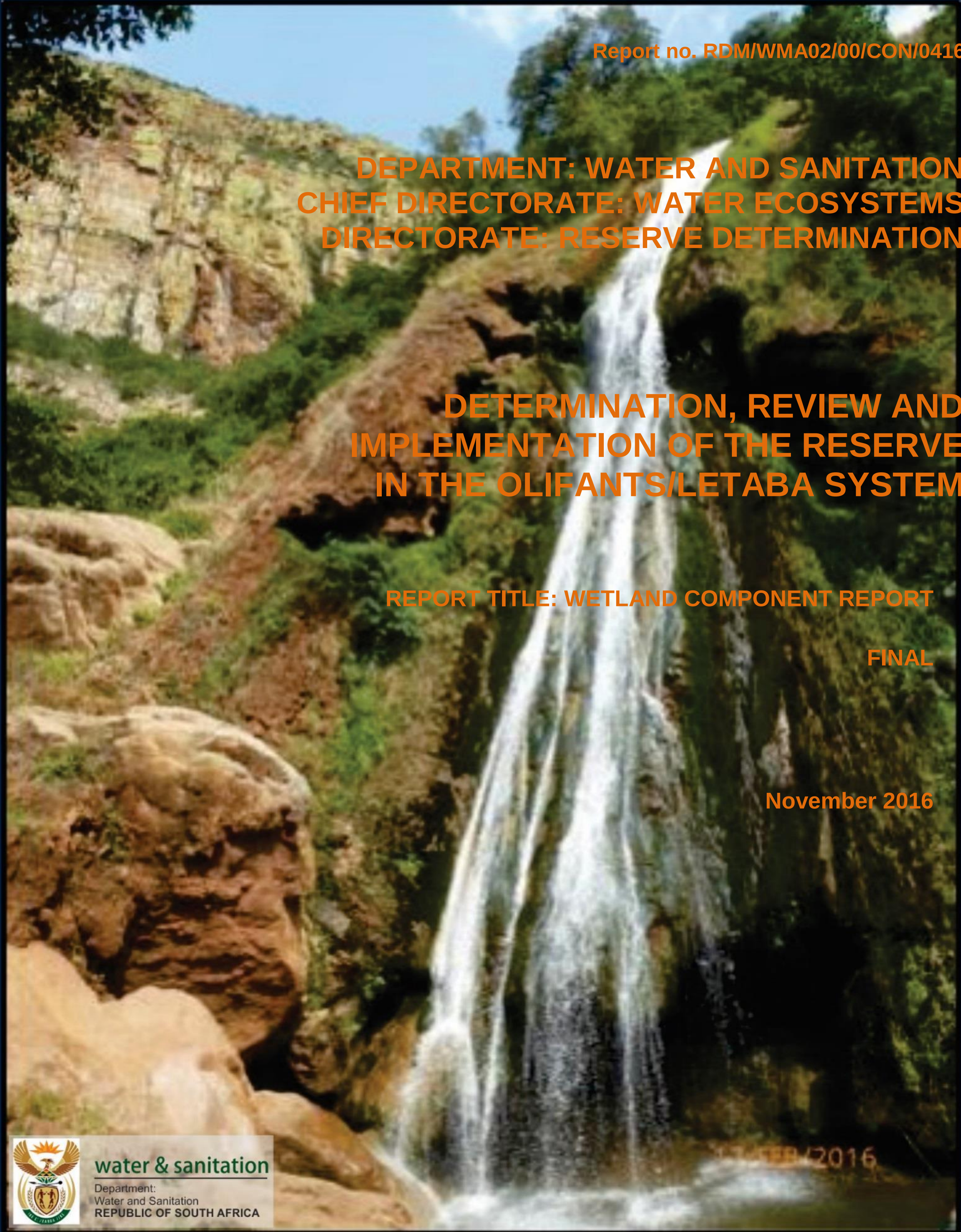

Report no. RDM/WMA02/00/CON/0416

DEPARTMENT: WATER AND SANITATION
CHIEF DIRECTORATE: WATER ECOSYSTEMS
DIRECTORATE: RESERVE DETERMINATION

DETERMINATION, REVIEW AND IMPLEMENTATION OF THE RESERVE IN THE OLIFANTS/LETABA SYSTEM

REPORT TITLE: WETLAND COMPONENT REPORT

FINAL

November 2016

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA




DEPARTMENT: WATER AND SANITATION

Directorate: Reserve Determination

DETERMINATION, REVIEW AND IMPLEMENTATION OF THE RESERVE IN THE OLIFANTS/LETABA SYSTEM

WP10940

WETLANDS COMPONENT REPORT

REPORT NO.: RDM/WMA02/00/CON/0416

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Prepared by:

Golder Associates Africa, Wetland Consulting Services, JMM Stassen and WRP Consulting Engineers

Title: *Wetlands Component Report*

Authors: *Gary Marneweck, Dieter Kassier*

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Bold type indicates this report.

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LIST OF ABBREVIATIONS

CR	Critical
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EN	Endangered
HGM	HydroGeoMorphic
IUA	Integrated Unit of Analysis
LT	Least threatened
RDM	Resource Directed Measures
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
WCS	Wetland Consulting Services (Pty) Ltd
WetFEPAs	Wetland Freshwater Ecosystem Priority Areas
WMA	Water Management Area
WUL	Water Use Licenses
VU	Vulnerable

1. BACKGROUND

The Olifants Water Management Area (WMA) is a highly utilised and regulated catchment and like many other WMAs in South Africa its water resources are becoming more stressed. This is largely due to accelerated rates of development and changing weather patterns. The Department of Water and Sanitation (DWS) recognised the urgency to ensure that the water resources in the WMA are able to sustain the levels of use, while at the same time, are maintained in an environmentally acceptable state.

In recognition of the above, the Chief Directorate: Water Ecosystems of the DWS initiated the Reserve study, the purpose of which was to determine, review and implement the Reserve in the Olifants\Letaba System, with the aim of specifically addressing ecological gaps and reviewing and updating the preliminary Reserves that have been determined. Wetlands form part of the water resource and therefore a wetland study was required as part of the process.

The purpose of this specific report is to present the findings of the review and update of the wetland prioritisation for the Olifants/Letaba System. This report follows on from the inception report and gap analysis report previously compiled.

2. BRIEF

The summarised scope of work for this component of the study is as follows:

- Review available existing information that could be used to contribute to the identification and prioritisation of wetlands within the study area;
- Compile an inventory of these wetlands based on this information;
- Identification of important quaternary catchments from a wetland perspective for targeted site visits (undertaken in the form of a team workshop in July 2015);
- Undertake a site visit to as many of the representative key wetlands in as many of the catchments identified as possible;
- Review of the priority wetland systems previously identified (DWS, 2014);
- Where possible, identify additional priority wetlands (based on size and/or ecological, social and/or economic criteria) within the study area;
- Where possible, determine the general health in the form of Present Ecological State (PES) of these priority wetlands using existing information;
- Where possible, determine the general Ecological Importance and Sensitivity (EIS) of these priority wetlands using existing information;
- Where possible, determine the Recommended Ecological Category (REC) of these priority wetlands using the criteria indicated in Rountree *et. al.* (2013);
- Derive Ecological Specifications and associated protection, management and monitoring requirements for all the identified priority wetlands; and
- Compile a report detailing the outcomes and results from the above tasks.

3. APPROACH

3.1 Identification of key target areas

Important quaternary catchments (in terms of wetlands) identified during a team workshop in July 2015 were considered for possible field visits based on a review of the available literature and a scan of the existing wetland databases. 49 quaternary catchments were identified for further investigation, many of which were then also targeted for field investigations (Section 3.3 below).

The catchments were selected based on the following considerations:

- Important wetlands that should possibly be visited (already identified/prioritised in the current Reserve documents) for various reasons; and/or
- Potential gaps where additional important wetlands may exist and which should possibly also be included or prioritised in the Reserve process.

Table 1: Quaternary catchments with associated/potential important/priority wetlands considered for possible field visits based on a review of the available literature and a scan of the existing wetland databases during the July 2015 workshop.

3.2 Compilation of Base Wetland Layer and Desktop Mapping

A base wetland layer was compiled through consolidation of existing wetland data sources. For areas on the Mpumalanga Highveld (upper reaches of the Olifants catchment), the revised wetland coverage and associated threat status based on the 2015 Mpumalanga Highveld coverage (Mbona *et al*., 2015) was used as the baseline wetland layer. For the remainder of the Olifants catchment and the Letaba and Shingwedzi catchments, the wetland coverage detailed in the 2011 NFEPA dataset (Nel *et al*., 2011) was utilised.

The GIS was used to merge the various wetland datasets and develop a composite map indicating the key wetlands identified in the Olifants, Letaba and Shingwedzi River catchments.

Where appropriate and depending on the resolution of the imagery, gaps were filled using desktop delineation. Every attempt was made to capture as many of the additional key wetland systems within the study area in the GIS layer as possible. Use was made of 1:50 000 topographical maps, Google Earth Imagery and available aerial photography to support the production of an updated base map of the wetlands.

Given the size of the overall study area, it was however not possible to map all wetlands within quaternary catchments targeted as part of the gap analyses and only a sample of wetlands was mapped.

3.3 Field Visit

A series of field visits were undertaken to as many of the representative key wetlands in as many of the catchments identified during the initial team workshop as requiring further investigation (Section 3.1) as possible. Field visits were limited to public roads and publicly accessible wetlands.

Field visits focussed on collecting data to allow for the typing and eco-classification of wetlands, as well as the identification of key drivers and key threats. No verification of wetland boundaries was undertaken.

3.4 Wetland Typing, Eco-Classification and the Identification of Key Drivers

The key wetlands visited were classified in accordance with the HydroGeoMorphic (HGM) classification system first described by Brinson (1993) and modified for application in South Africa by Marneweck and Batchelor (2002), Kotze, Marneweck, Batchelor, Lindley and Collins (2007), and SANBI (2009). For wetlands that were not visited in the field (the overwhelming majority of wetlands), existing data (NFEPA wetland layer from Nel *et al*. (2011) as well as Mpumalanga Highveld Wetlands layer from Mbona *et al*. (2015)) was utilised to determine wetland HGM types.

Given the extent of the study area, and based on experience of the wetland databases available, field verified Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) information was not available for most systems. As such, existing information based mostly on desktop assessments was utilised and supplemented with field observations for those sites visited, to derive general state and ecological importance indicators where possible. Existing datasets utilised included the NFEPA wetland layer from Nel *et al*. (2011) as well as the Mpumalanga Highveld Wetlands layer from Mbona *et al*. (2015).

Key drivers are essentially automatically derived as part of the HGM classification. This is the strength of the HGM system as each HGM wetland type has conceptually distinct hydrological drivers based on the input, throughput and output of flows or water (see Kotze *et. al*., 2007). This process was further strengthened by taking a catchment-based approach in considering possible groundwater links and the potential occurrence of peat.

3.5 Prioritisation of wetlands

An initial list of priority wetlands was compiled through consolidation of the following:

- Previously identified priority wetlands in the Olifants catchment (DWS, 2014);
- All Ramsar wetlands within the Olifants/Letaba catchment;
- All FEPA wetlands identified in the Mpumalanga Highveld coverage (Mbona *et al*., 2015); and
- All FEPA wetlands identified in the 2011 NFEPA dataset (Nel *et al*., 2011) for that portion of the catchment not covered by the Mbona *et al*. (2015) data.

This initial dataset was then revised and further refined based on consideration of the following aspects:

- Whether or not the system occurs within a conservation area;
- Whether or not the system is recognised as having cultural significance;
- Whether or not the system occurs in a database, regional, local or other, that indicates it as being an important wetland;
- Whether or not the system is known to support rare or endangered species;
- Whether or not the system can be considered representative of a specific type or representative of an eco-region;
- Systems known to contain peat (peatlands);
- Systems known or thought to be important in terms of supporting livelihoods or providing key

ecosystem services;
- Systems thought to be important in terms of the hydrology, geohydrology and/or the biogeochemistry of a particular area or sub-catchment;
- Systems thought to be unique or representative of a type unique to a particular area or region;
- Whether or not the system forms part of a particular complex of wetlands that may be linked by certain attributes or a key driver; and
- Whether or not the system forms part of a biodiversity or landscape corridor that is considered important for a particular area or region or a particular species.

The above criteria were considered in the context of the health or state of the wetland system and its likely trajectory of change given the current land-uses in the area or whether or not it is considered to be at risk from proposed new water uses in the area. Expert opinion also formed a key consideration in wetland prioritisation. The intention was to produce a comprehensive priority wetland map for the entire Olifants/Letaba System indicating wetlands that may need to be considered in terms of the Reserve, taking into account aspects related to land and water use issues in the Olifants/Letaba System.

4. LIMITATIONS

Due to the scale of the project, budget constraints for extensive site visits, and the inability to access private land over much of the area, extensive ground truthing was not possible. For this reason a detailed classification of the wetlands was not viable and as such no detailed classification maps were produced. Where possible though, the general wetlands types occurring in particular IUAs were described with reference to their HGM classification as were individually prioritised systems for which the classification was already known or which was determined based on the field visits.

Much of the ground truthing therefore involved simply viewing wetlands from roads. Where sites could be accessed, the focus was on taking photographs and recording what could be seen.

No detailed boundary delineations were undertaken nor were any baseline studies done on any of the systems. Information was collected based on observations only and interpretation was based on experience. Where available, additional information or experience based on having previously visited an area or worked on a site was also used.

It should also be noted that there are likely to be other wetlands that have not been identified or covered as part of this study due to the level of investigation undertaken, the extent of the study area, the limited nature of field verification, and accuracy and level of detail of the information used to derive the wetland coverage. Some of these could also potentially rank as important. It is envisaged that with time the coverage will be improved as more information becomes available. The coverage and classification included in this report cannot therefore be considered finite but rather a first attempt to provide a general, course and filtered wetland coverage of the study area.

These data should be used and viewed in the context of this study only and not be used, other than as reference, for more detailed studies for requirements such as Water Use Licenses (WUL), Environmental Impact Assessments (EIAs) or other such related legislative or other requirements. Detailed, site-specific wetland studies therefore remain a requirement for development proposals in the study area where wetlands may be affected and should be guided by the Protection, Management and Monitoring Requirements detailed for each of the priority wetland catchments identified in this study. The findings from such detailed wetland assessments, which must include thorough field verification, should supplement (and where necessary replace) the data and findings of this report where such data and findings are based on predominantly desktop assessments.

5. RESULTS

5.1 Base Wetland Layer

The base wetland layer compiled from existing databases (Mbona *et al*., 2015 and Nel *et al*., 2011) and supplemented with additional desktop mapping in some key gap areas identified is illustrated in **Figure1** below.

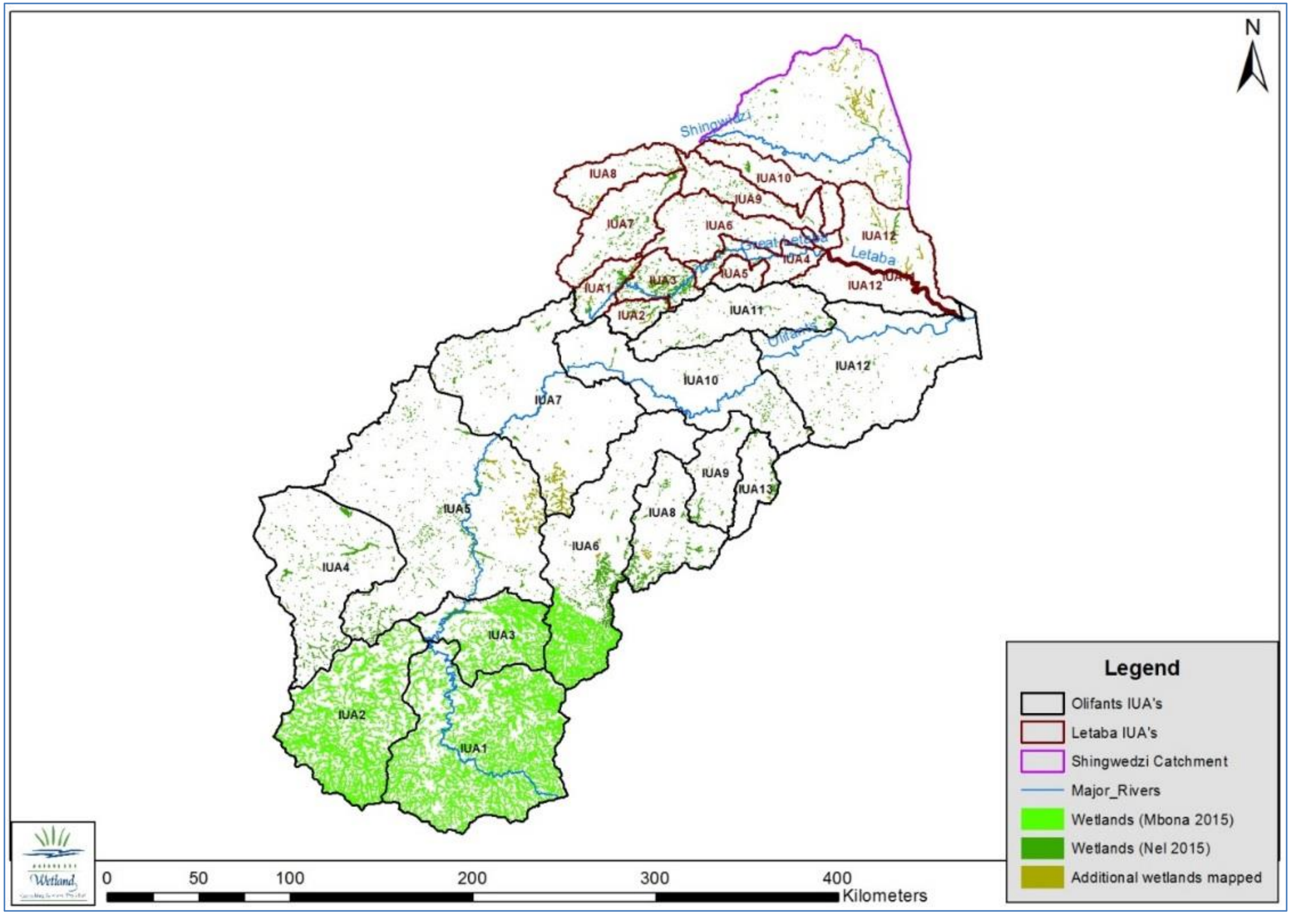

Figure 1: Map showing the base wetland layer consolidated from Mbona et al. (2015) and Nel et al. (2011) data, supplemented with additional desktop mapping in some areas

It is clear from the map in **Figure 1**that the bulk of mapped wetland extent occurs within the upper reaches of the Olifants Catchment (Integrated Unit of Analysis (IUAs) 1, 2, 3 and part of IUA 6). This area overlaps with the area covered by the 2015 Mpumalanga Highveld coverage (Mbona *et al*., 2015) and more detailed wetland coverage is available for this area than for the remainder of the Olifants/Letaba System. Significant additional wetland areas were mapped in especially the central regions along the boundary between IUA 5 and IUA 7, as well as within the Kruger National Park section of the Shingwedzi Catchment. Further additional wetlands were mapped in numerous locations across the catchment. This would suggest that the 2011 NFEPA data (Nel *et al*., 2011) represents an underestimate of the wetland extent within the Olifants/Letaba System. For many areas, the Nel *et al*. (2011) data is however the best currently available.

5.2 Identification of Priority Wetlands

A list of priority wetlands for the Olifants/Letaba System was compiled from the base wetland layer (**Figure 1**), and is summarised at a secondary catchment level in **Figure 2** below.

All priority wetlands identified during the 2014 Resource Unit Prioritisation Report (DWS, 2014a) for the Olifants Catchment have been retained in the current list of priority wetlands, with minor modifications. This represents a total of 29 wetland units, the bulk of which (24) are located within only 3 IUA's, namely IUA 1 (Upper Olifants River Catchment), 2 (Wilge River Catchment) and 6 (Blyde River Catchment).

The Verloren Valei Nature Reserve Ramsar Site was included as a priority wetland. This is the only Ramsar wetland complex within the Olifants/Letaba System.

A further 17 additional priority wetlands were then identified as part of the current study, bringing the total number of priority wetlands within the Olifants/Letaba System to 47. Additional priority wetlands were identified as per the list of criteria detailed in Section 4.3 above.

The identified priority wetlands include a number of wetland systems identified and mapped during the course of the desktop review and wetland mapping exercise undertaken as part of this study.

These are wetlands that were not previously mapped or flagged in the databases consulted, but which were considered to represent important wetland systems based on a range of criteria (Section 4.3) and include regionally unique and rare systems such as thermal springs and tufa waterfalls, as well as functionally valuable systems that are considered to play an important role in regulating and supporting services related to for example water quality maintenance and flow regulation.

5.3 Identification of Priority Wetland Catchments

In addition to the priority wetlands identified, a number of priority wetland catchments were identified. This was initially based on the distribution of wetland FEPA's, with all quaternary catchments containing a cluster of FEPA wetlands considered for priority wetland catchment status. For wetlands within the Mpumalanga Highveld region, FEPA wetlands from Mbona *et al*. (2015) were utilised, and FEPA wetlands from Nel *et al*. (2011) were utilised for the remainder of the study area.

Not all quaternary catchments including wetland FEPAs were however included in the final list of priority wetland catchments; where wetland FEPA's occurred as small isolated systems these quaternary catchments were excluded, as were quaternary catchments where doubt existed as to the validity of the wetland FEPA's.

In addition to the above priority wetland catchments selected due to the presence of wetland FEPAs, a number of quaternary catchments were also selected as priority wetland catchments (**Figure 2**) based on their location in the headwaters of important river systems that support extensive wetland habitat in relatively good condition. The wetlands within these catchments are considered to play a vital role in not only biodiversity maintenance, but also in important regulating and supporting services related to for example water quality maintenance and flow regulation. Priority wetland catchments are also illustrated in **Figure 2** and number a total of 27 quaternary catchments.

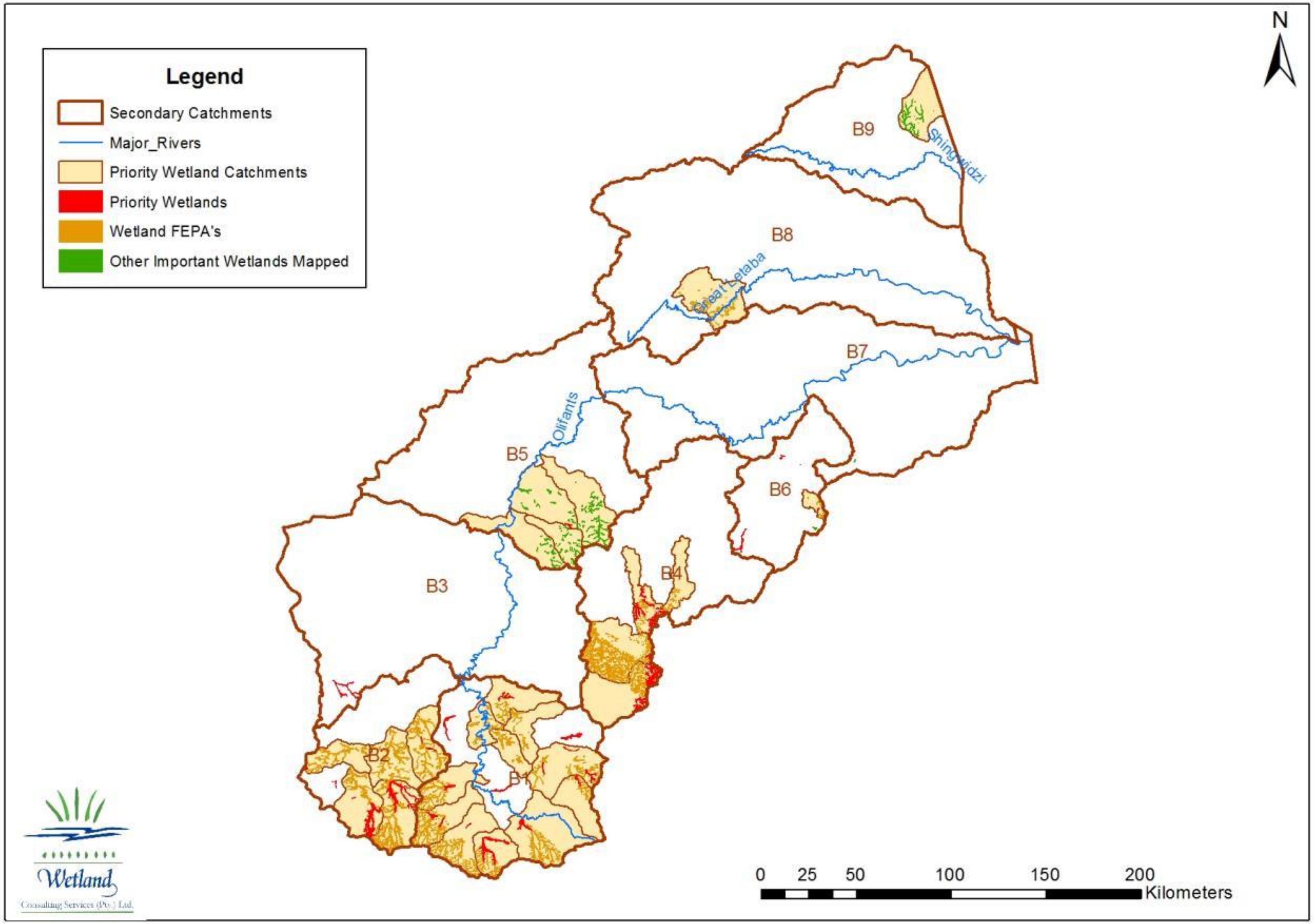

Figure 2: Secondary catchment summary of priority wetlands (in red) and priority wetland catchments (in light orange).

5.4 Olifants IUA 1 - Upper Olifants River Catchment

The Upper Olifants River Catchment (UORC) includes the towns of eMalahleni (Witbank), Middelburg, Hendrina, Douglas, Kriel and Kinross. The headwaters of the Olifants River and the Klein-Olifants River fall within this IUA, as do the Witbank and Middelburg Dams. The IUA is economically important and is characterized by intensive and extensive opencast and underground coal mining and associated energy and manufacturing activities. As a consequence the IUA and its water resources are highly used and impacted. The area further includes steel industries, urban areas and return flows, dryland agriculture and a wide variety of industrial and commercial sectors.

Wetlands within the IUA are extensive and make up a significant portion of the wetlands within the entire WMA. All hydro-geomorphic wetland types occur within the IUA. The larger rivers and drainage lines are mostly associated with broad floodplain or channelled valley bottom wetlands, with fewer unchannelled valley bottom wetland systems remaining.

Many historically unchannelled valley bottom systems have become channelled as a result of landuse changes leading to changes in hydrology, as well as the flow confinement impacts of linear infrastructure crossings.

Hillslope seepage wetlands occur throughout the landscape and are especially widespread and extensive in areas characterised by sandy soils derived from Karoo Sandstones. They often form the dominant wetland type within the landscape in terms of extent.

Pans typically occupy positions on the landscape crest and range from fresh to saline, and temporary to permanent, depending on localised conditions.

Pans are recognized as being important for biodiversity support and more recently their links to other wetland systems in relation to landscape hydrology have also been highlighted. Pans are also unique in terms of their individual biogeochemical attributes.

Water resources, including wetlands, within this IUA have been significantly impacted and water quality is a concern in many rivers and valley bottom wetlands, as well as some pans. Direct wetland loss and transformation due to mining and agricultural activities is extensive, with erosion and incision of wetlands being a further concern.

Mining activities have resulted in both direct and indirect impacts to wetlands and extensive wetland areas have been lost to especially opencast coal mining activities. Estimating the extent or percentage of wetland area lost due to mining activities using existing wetland data is complicated by a lack of detailed pre-mining wetland information. Direct and indirect loss of wetland habitat has affected valley bottom, seepage and pan wetlands.

Commercial agriculture has also resulted in widespread impacts to wetlands. Cultivation often extends into the temporary edges of seepage wetlands, while valley bottom wetlands are impacted by farm dams and linear infrastructure crossings that concentrate flows and lead to erosion and channel incision.

Figure 3 shows photographs of wetlands found within IUA 1.

Figure 3: Photographs of wetlands within Olifants IUA 1. Clockwise from top left: broad valley bottom wetland showing channel incision; unchannelled valley bottom wetland within a mining setting; typical Highveld pan with Greater Flamingo; and hillslope seepage wet

Water quality concerns experienced within the IUA highlight the importance of wetland systems that play a role in water quality maintenance and enhancement. As a consequence, a number of quaternary catchments within the IUA have been selected as priority wetland catchments:

- B11A
- B11C
- B11D
- B11E
- B11F
- B11H
- B11J
- B12A
- B12B
- B12D
- B12E

In order to maintain or improve the condition of the rivers draining these priority wetland catchments in the face of ongoing and expanding mining activities, it is important that all wetlands and the functions they support, including water quality maintenance, be protected and improved where possible. The wetlands within these priority wetland catchment areas are also generally in better condition than wetlands within the central region of the IUA and therefore play an important role as refugia for biodiversity. It is these considerations that have led to the selection of these quaternary catchments as priority wetland catchments.

A total of 14 priority wetlands were identified within the catchment, which includes 11 wetland systems identified as priority wetlands during the DWS (2014) study. In addition, extensive wetland FEPA's have been flagged for protection within this catchment (Nel et al., 2011 and Mbona et al., 2015). These FEPA clusters are generally located in the headwaters of tributaries to the main rivers draining the IUA. Priority wetlands are illustrated in **Figure 4** below, and further detail on wetlands within the priority catchments is provided in **Table 1**.

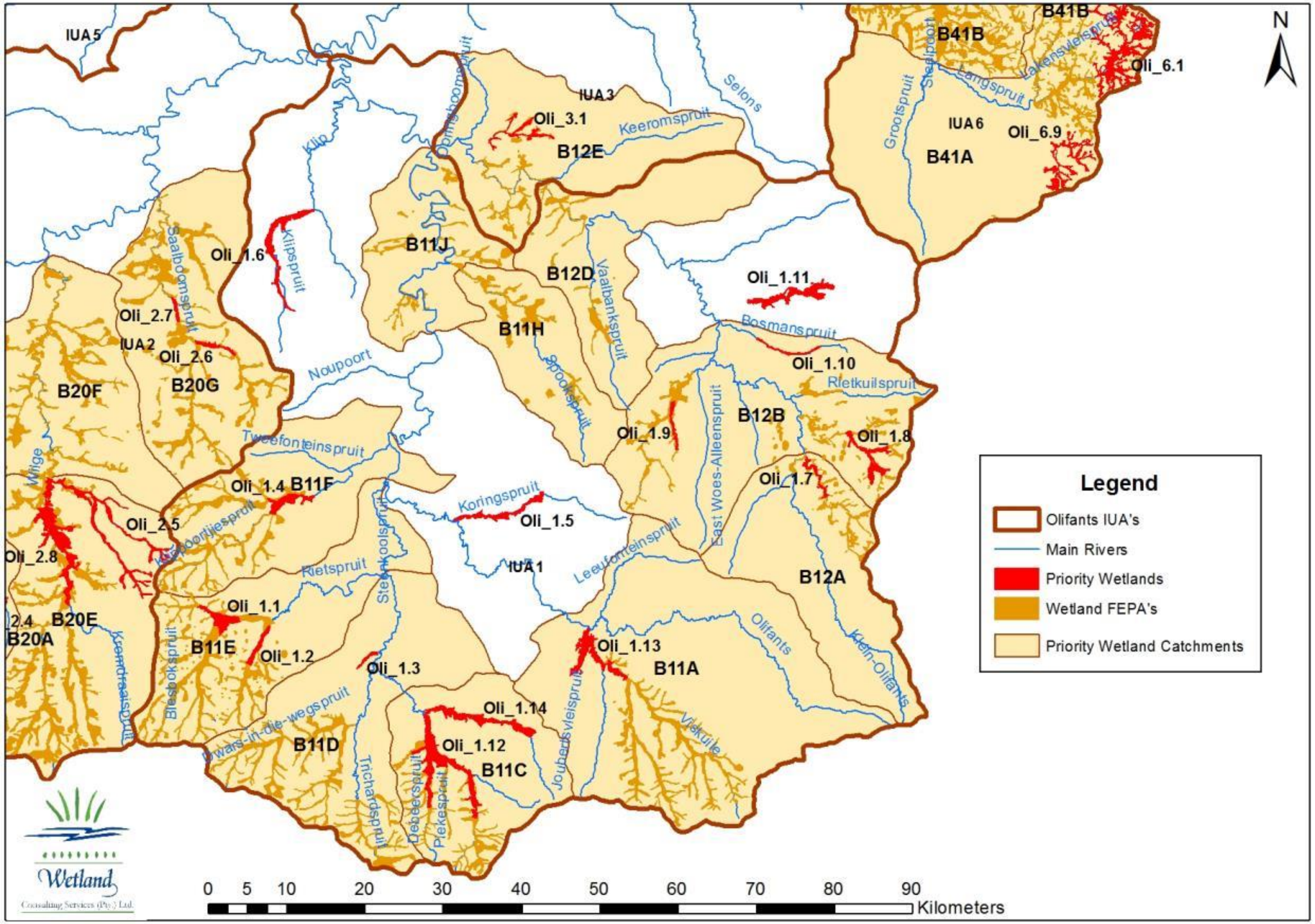

Figure 4: Map showing priority wetlands as well as priority catchments and associated FEPA wetlands within Olifants IUA 1.

Table 1: List of priority wetlands in IUA 1 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems.

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B11A									
Oli_1.13 Viskuile floodplain complex	Floodplain	C (Mbona et al., 2015)	High to Very High	A/B to B/C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	Partially		
	Pans /Depression	A/B-C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4- LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU Eastern Temperate Freshwater - VU	Yes		
	Channelled Valley bottom	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU Eastern Temperate Freshwater - VU	Yes		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4- LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU Eastern Temperate Freshwater - VU	Yes		
	Floodplain	C-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4- LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU Eastern Temperate Freshwater - VU	Yes		Large remaining floodplain systems unique to the region and good representative examples of relatively intact systems.
B11B									
Oli_1.5 Koringspruit wetland	Channelled valley bottom (section of	D (Mbona et al., 2015)	Moderate (desktop)	C	Mesic Highveld Grassland Group 4- LT	Eastern Highveld Grassland - VU	No		

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
	unchannelled valley bottom)								
B11C									
Oli_1.12 Debeerspruit/ Piekespruit floodplain	Floodplain	A/B (Mbona et al., 2015)	High	A/B	Mesic Highveld Grassland Group 3 – LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU	Yes		
Oli_1.14 Steenkoolspruit floodplain	Floodplain	D (Mbona et al., 2015)	High	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	No		
	Pans /Depression	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU	Yes		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU	Yes		
	Floodplain	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU	Yes		
B11D									
Oli_1.3 Kriel wetland	Channelled valley bottom	C/D (Mbona et al., 2015)	Moderate	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	No		
	Hillslope seepage wetlands	C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland - VU	YES		
	Floodplain	D (Mbona	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland	YES		

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
		et al, 2015)							
	Channelled valley bottom	C-E (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Soweto Highveld Grassland	YES		
B11E									
Oli_1.1 Blesbokspruit wetland	Floodplain	E/F (Mbona et al., 2015)	High	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	Yes		
Oli_1.2 Rietspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al., 2015)	High	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	Yes		
	Channelled valley bottom	C-E (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Eastern Temperate Freshwater - VU Soweto Highveld Grassland - VU	Yes		
	Floodplain	D-E (Mbona et al, 2015)		Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Eastern Temperate Freshwater - VU Soweto Highveld Grassland - VU	Yes		
	Hillslope seepage	B-E (Mbona et al, 2015)		Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Eastern Temperate Freshwater - VU Soweto Highveld Grassland - VU	Yes		
	Pan/ Depression	B-E (Mbona et al, 2015)		Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Eastern Temperate Freshwater - VU Soweto Highveld Grassland - VU	Yes		
B11F									
Oli_1.4 Klippoortjiesspruit	Unchannelled valley bottom	D (Mbona et al., 2015)	High	C					

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
	Hillslope seepage	B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	Yes		
	Floodplain	Mostly D (Mbona et al, 2015)		Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	Yes		
	Channelled valley bottom	Mostly D (Mbona et al, 2015)		Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU	Yes		
B11H									
	Channelled valley bottom	A/B - C (Mbona et al, 2015)	Low-High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland – VU Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
	Pans/ Depression	A/B - C (Mbona et al, 2015)	Moderate High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4- LT	Rand Highveld Grassland – VU Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
	Hillslope seepage wetlands	A/B-C (Mbona et al, 2015)	Low-High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland – VU Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B11J									
	Channelled valley bottom	A/B-D (Mbona et al, 2015)	Low-High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland – VU Loskop Mountainlands - VU	Yes		
	Pans/ Depression	A/B - C (Mbona et al, 2015)	Moderate High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4- LT	Rand Highveld Grassland – VU Loskop Mountainlands - VU	Yes		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Low High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland – VU Loskop Mountainlands - VU	Yes		
B11K									
Oli_1.6 Klipspruit wetland	Unchannelled valley bottom	D (Mbona et al., 2015)	High (B1 Olifants PESEIS 2011)	C	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU	No		
B12A									
Oli_1.7 Klein-Olifants tributary	Channelled valley bottom; Hillslope seepage	D (Mbona et al., 2015)	High	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU	Yes		
	Pans/ Depression	A/B-C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Soweto Highveld Grassland – VU	Yes		

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
	Channelled Valley bottom	A/B-C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Soweto Highveld Grassland – VU	Yes		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Soweto Highveld Grassland – VU	Yes		
	Floodplain	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 – LT Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Soweto Highveld Grassland – VU	Yes		
B12B									
Oli_1.8 Matla wetland	Channelled valley bottom	C (Mbona et al., 2015)	Moderate (desktop)	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU	Yes		
Oli_1.9 Woesalleenspruit wetland	Unchannelled valley bottom	C (Mbona et al., 2015)	Moderate to High (B1 Olifants PESEIS 2011)	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU	Yes		
Oli_1.10 Bosmanspruit wetland	Unchannelled valley bottom	C (Mbona et al., 2015)	Moderate to High (B1 Olifants PESEIS 2011)	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU	No		
	Channelled valley bottom	A/B - E (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
	Floodplain	A/B - D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
	Hillslope seepage	A/B - D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
	Pan/depressio n	A/B - D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
B12C									
Oli_1.11 Kopermyn wetland	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	C (Mbona et al., 2015)	High	B/C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU	No		
B12D									
	Pans/ Depression	Not availabl e	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4- LT	Rand Highveld Grassland – VU Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
	Channelled valley bottom	A/B-D (Mbona et al, 2015)	Low High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland – VU Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Low High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland – VU Eastern Highveld Grassland – VU Eastern Temperate Freshwater - VU	Yes		

5.4.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

Inherent in trying to assess the possible effects of different water use scenarios on wetlands is understanding the underlying drivers of the different wetland types that occur. For example, wetlands such as hillslope seepage systems that are maintained by interflow can be expected to respond separately to water use scenarios that may affect the river in the same catchment. Wetlands maintained by regional groundwater would also less likely be affected by surface water use scenarios, but certainly would be affected by future groundwater use scenarios. Floodplains and channelled valley bottom wetlands will be more affected by changes to high flows or floods in most cases, but under certain circumstances elevated baseflows too may have an effect through causing channel erosion which reduces the frequency of bank overtopping and hence leaving the floodplain drier for longer. These are some the factors that were considered in trying to understand how the future water use scenarios might affect the priority wetland systems identified.

For pans, impact scenarios are not generally related to changes in flow in the rivers. Flow related changes to these systems generally occur as a result of changes in hydrology from catchment-related (indirect impacts), or direct impacts such as opencast mining, and in some cases agricultural activities. In some cases underground mining may also impact on pans as a result of, for example, the loss of water to underground workings, subsidence and changes in soil saturation. Water quality impacts as a result of mining and agriculture and even intentional discharge into pans potentially pose a high risk to these systems in the long term. Maintaining water quality is a critical aspect in pans as this determines pan geochemistry which in turn drives the biodiversity aspects. Strict compliance monitoring will be required to ensure that the REC is achieved in the case of individual mining and other development assessments and applications.

For hillslope seepage wetlands, impact scenarios are also not related to changes in flow in rivers. Non-flow related impacts such as developments within and adjacent to these systems poses a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of changes to hydrology due to changes in landuse within the catchment, typically opencast coal mining, agricultural activities and increases in hardened surfaces within the catchment (including urbanisation). Interruption and interception of interflow within the catchment resulting from mining activities or other excavations pose the main flow related threat to the remaining systems in the long-term. Alien vegetation poses a further impact to flow due to increase water utilisation.

For valley bottom and floodplain wetlands, impact scenarios are related to both changes in flow in rivers and non-flow related changes. Flow related changes to these systems can occur as a result of changes in hydrology from catchment-related (indirect impacts), or direct impacts such as opencast mining, but can also occur as a result of abstraction and flow impoundment, which can decrease flows, or discharges that could lead to increased flow. Non-flow related impacts can be derived from amongst others overgrazing and changes to wetland habitat and biota, roads and other linear infrastructure crossings concentrating flows, incision of the channel and decreased bank-overtopping, sedimentation, alien vegetation and changes in water quality.

5.4.2 Recommended Protection, Management and Monitoring Requirements for Priority Catchments

Impacts on wetlands due to the construction of infrastructure or mining-related activities such as opencast pits, shafts, pipelines, powerlines, roads, overland conveyors, dams and their servitudes should be managed and strictly controlled to minimize damage to the wetlands and therefore to their functioning. All WUL applications related to the above should clearly demonstrate application of the mitigation hierarchy (DEA et al., 2013). Where impacts on wetlands occur, whether direct or indirect, mitigation must be implemented to minimise the effects on wetland functioning. Mitigation requirements must consider the following:

- Development footprints must be fenced off from wetlands;
- Suitable hydrological and ecological buffer zones around wetlands should be determined and implemented;
- Operations, including the crossing of wetlands by vehicles, and storage of equipment in wetlands, are to be prevented as far as possible. Where crossings of wetlands are necessary or unavoidable, suitable mitigations measures must be put in place to protect the wetlands;
- Stormwater management plans must be developed and implemented prior to all phases of mining operations. These must include measures to prevent erosion and siltation of wetlands as well as slope, bank, channel, and/or drainage stabilization measures to reinstate the pre-development hydrology (including both surface and sub-surface hydrology). Stormwater should ideally be conveyed in environmentally engineered or natural channels rather than cement lined canals or excavated trenches. Discharge points into the environment should be protected against erosion and designed to disperse flow and be subjected to regular maintenance. The stormwater management plan must be submitted to the DWS for approval prior to the commencement of any activities on site;
- In order to reduce the potential impacts associated with the introduction of contaminants, dissolved or suspended, in the runoff from infrastructure areas and construction sites, no runoff should be introduced into wetlands directly. Introduction into dryland areas is preferred and management measures must be put in place to protect wetlands from such runoff;
- Potential contaminants associated with mining or other developments must be stored and managed in such a way as to prevent spills and leaks. Management plans to prevent and deal with, contain and/or clean up spills, must form part of any WUL application;
- Where applicable, disturbed areas (i.e. for those areas that will not form part of the development operational footprint but which will be disturbed as part of the construction activities) should be rehabilitated using site-appropriate measures, specific to the region and type of wetland system affected. A rehabilitation plan must be drawn up for this purpose and a suitably qualified specialist should oversee this process;
- An alien vegetation management plan must be developed and implemented covering all phases of the mining project or development;
- Where conveyors, pipelines, culverts, roads, powerlines, drains or any other infrastructure or servitude crosses or impacts a wetland, Method Statements must be developed indicating how impacts during the construction and operational period will be minimised and managed. This must include recommendations for dealing with and rehabilitating all compacted areas or areas where flow has been diverted, concentrated or drained. Method Statements must include construction and rehabilitation management and monitoring plans;

- Seasonality must be considered as part of the construction phase of any development, whether mining or other, in order to minimise the risk to the hydrology of the wetland systems as well as to prevent excessive sediment and debris being washed into wetland areas;
- No threatened flora should be collected or harvested from wetlands and no fauna, especially threatened fauna, should be hunted or poached from wetlands. Search and rescue plans for fauna and flora must form part of any WUL application;
- Wetland protection, rehabilitation and monitoring measures must be incorporated into mine closure plans as part of decommissioning and closure planning and related activities;
- No equipment including vehicles should be washed in streams, rivers and/or wetlands, and if washing facilities are provided, these must be placed outside of the buffer zones applicable to the wetlands and/or watercourses and designed so as not to impact the wetlands and streams, in terms of both water quality and quantity/flow;
- No abstraction of water from wetlands, streams and rivers should be allowed, unless specifically authorized in terms of the WUL;
- It is recommended that prior to any new mining activities taking place, suitable clean and dirty water diversion/separation and storage facilities be put in place to deal with possible AMD and prevent contamination of the wetlands, streams and rivers adjacent to and downstream of the mining operation. Clean and dirty water areas must be separated and no contaminated water should come into contact with clean water areas including wetlands, streams and rivers. Clean water should ideally be conveyed in natural systems or where this is not possible, in environmentally engineered or natural channels rather than cement lined canals, other hard structures, pipes or excavated trenches. Discharge points into the environment should be protected against erosion and designed to disperse flow and be subjected to regular maintenance;
- The likelihood of decant, whether from opencast or underground mining, as well as its expected location, quantity and quality should be determined and measures put in place to ensure that any such decant meets the resource quality objectives for the Olifants River catchment. As a minimum, any discharge water should meet the catchment standards as indicated in applicable Preliminary Reserves, EMP's, WUL's and other relevant authorisations. The risk to the receiving environment in terms of water quality, flow modification, erosion and biological effects must be established and assessed and appropriate mitigation put in place to deal with these;
- Where the water quality RQO's and/or water quality discharge requirements are exceeded, contaminated water will need to be treated. In this regard it is recommended that suitably designed water treatment plants (which could be passive systems as and when the technology allows) be established and that water levels within the mined out areas are actively managed post-mining to ensure decant is prevented and no contaminated water is discharged into the environment untreated. It is important to ensure financial and logistical capacity for long-term maintenance of treatment or infrastructural requirements to protect wetland and river systems from water quality impacts resulting from mine water contamination;
- No mine contaminated water should be allowed to enter wetlands and mechanisms must be put in place to protect wetlands from any form of mine-related contamination;
- Flow supplementation from water treatment plants to affected wetlands is recommended in all cases where there is an indirect loss of wetland functioning as a result of mining. This must

be implemented according to a flow management plan which includes specific design and wetland protection measures, a schedule for the releases as well as a provision for adaptive management informed by monitoring;

- Where clean water is discharged into the environment from water treatment or from infrastructure such as detention facilities, suitably designed and appropriate -erosion protection measures should be put in place;
- Methods should be put in place to limit the amount of water entering mining voids which will further reduce the risks of long-term decant into adjacent and downstream/affected wetlands;
- Should mitigation, via supplementation of the flows that will be lost in the affected wetlands, be unachievable resulting in a residual impact associated with the decrease in the health or PES of the wetland systems, measures must be put in place to offset the entire, or part of, the net loss expected. This must take into account both wetland functional and ecosystem conservation hectare equivalents;
- Similarly, where there is a residual impact associated with the direct loss of wetland systems, measures must be put in place to offset the entire, or part of, the net loss expected. This applies to mining-related as well as other developments. This can be achieved through a Wetland Offset or Rehabilitation Strategy. This must include the rehabilitation, protection, management and monitoring of remaining or other wetlands to achieve a suitable functional hectare equivalent target and certain ecosystem conservation targets recommended by the authorities. Wetland rehabilitation activities should be targeted to try to achieve a net gain in functional hectare equivalents. The draft SANBI Wetland Offsetting Guidelines (SANBI and DWS, 2014) or any updated revision of this approach/document should be used to guide the process of offsetting;
- A monitoring programme must be developed to monitor the condition/health/state of any wetlands affected by a proposed development. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. Any such monitoring strategy must be developed by a suitably qualified specialist and submitted to the DWS for review and approval. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- For pans affected by a proposed development, and particularly a mining development, it is recommended that monitoring of pan water chemistry be conducted according to a specified schedule and for certain key elements including, but not limited to: pH; Electrical Conductivity; Total Dissolved Solids; Total Alkalinity as $CaCO3$; Sodium; Calcium; Magnesium; Sulphate; Iron; Chloride; Potassium; Magnesium; Manganese; Aluminium; Phosphorous; Silica; Ammonia; Nitrate; and Fluoride. An independent water laboratory should be used to conduct the analyses and records should be maintained for inspection by the DWS. If there are any signs of deterioration in water quality or contamination of any pan during monitoring, then the Regional Office of the DWS must be informed together with an indication of the probable cause and time span associated with the water quality problem. Mitigation measures will also need to be indicated in order to remedy the situation in the case of water quality deterioration

resulting from the development. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;

- Similarly, for pans affected by a proposed development, and particularly a mining development, it is recommended that Macroinvertebrates and diatoms should be monitored according to a specified schedule. The monitoring must be conducted by a suitably qualified specialist and the results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- A groundwater monitoring programme should be established in order to monitor groundwater quality and groundwater level changes up- and downstream of any proposed mining project/operation. This must be designed to include both the shallow and deeper aquifer systems separately, and include water quality and quantity according to a specified schedule. For deeper aquifer systems, this should include as a minimum, the recording of daily pit dewatering rates, and monthly sampling and analysis of major and trace elements of pumped water. As part of this groundwater monitoring programme, changes of shallow groundwater levels in wetlands (where groundwater effects may be expected as a result of the proposed mining operation), must be monitored. The monitoring must be conducted by a suitably qualified specialist and the results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- The monitoring of important biota may also be relevant to a particular development, especially where endangered animal species occur in the wetlands. Records should be kept of sightings in order to help establish whether or not the wetland management practices and rehabilitation efforts are having a positive impact on these species and where appropriate, the local district conservation officer should be contacted to obtain further information on monitoring of important species;
- Where water quality impacts are expected in wetlands, water quality must be regularly monitored according to an appropriate protocol that will need to be put in place based on a regular schedule and for recommended variables. The monitoring plan must include a provision for appropriate and timeous remedial interventions in the case of non-compliance. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL; and
- Water quality monitoring must be undertaken in accordance with the Water Quality Ecospecs where these are available for a particular development application. Records should be maintained for inspection by the DWS. If any measured value exceeds the RWQOs (95th percentile) included in the Water Use Licence, then the Regional Office of the DWS shall be informed together with an indication of the probable cause and time span of the exceedance. Mitigation measures will also need to be indicated in order to remedy the situation in the case of exceedance or non-compliance. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL.

5.5 Olifants IUA 2 - Wilge River Catchment area

The Wilge River catchment includes the towns of Delmas and Bronkhorstspruit, with Ogies and Cullinan located on the catchment boundaries. The headwaters of the Wilge River and the Bronkhorstspruit fall within this catchment, with the catchment outlet located at the confluence of the

Wilge River with the Olifants River. The Bronkhorstspruit Dam falls within this IUA.

This IUA is largely similar to the adjacent IUA 1 in terms of wetland types and habitats, though in many cases somewhat less impacted, especially in terms of water quality. This is also reflected in the classification of the Wilge River IUA as a Class 2 system.

Land use is dominated by extensive dryland cultivation and other agricultural activities. Irrigation agriculture occurs in the vicinity of Delmas and along the Wilge and Bronkhorstspruit Rivers. The lower reaches of the IUA are characterised by steeper, rocky terrain and is less suited to cultivation. Natural grasslands occur in this area, as well as the Ezemvelo Nature Reserve.

Coal mining is an important component of the economy and occurs especially in the southern and eastern reaches of the catchment, both as opencast and underground mining activities. Two coal-fired power stations occur in the catchment - Kendal and Kusile. Water quality within this IUA has not been as impacted by mining activities as in the adjacent IUA 1, though the increase in mining activity within the Wilge River catchment raises this as a future threat. Wetlands are considered to play an important role in maintaining the water quality within this IUA.

As is the case with IUA 1, the Wilge River catchment supports extensive wetlands, which include all of the hydro-geomorphic wetland types. The larger rivers and drainage lines are mostly associated with broad floodplain or channelled valley bottom wetlands, with fewer unchannelled valley bottom wetland systems remaining. Hillslope seepage wetlands occur throughout the landscape and are especially widespread and extensive in areas characterised by sandy soils derived from Karoo Sandstones. Pans typically occupy positions on the landscape crest and range from fresh to saline, and temporary to near-permanent, depending on localised conditions.

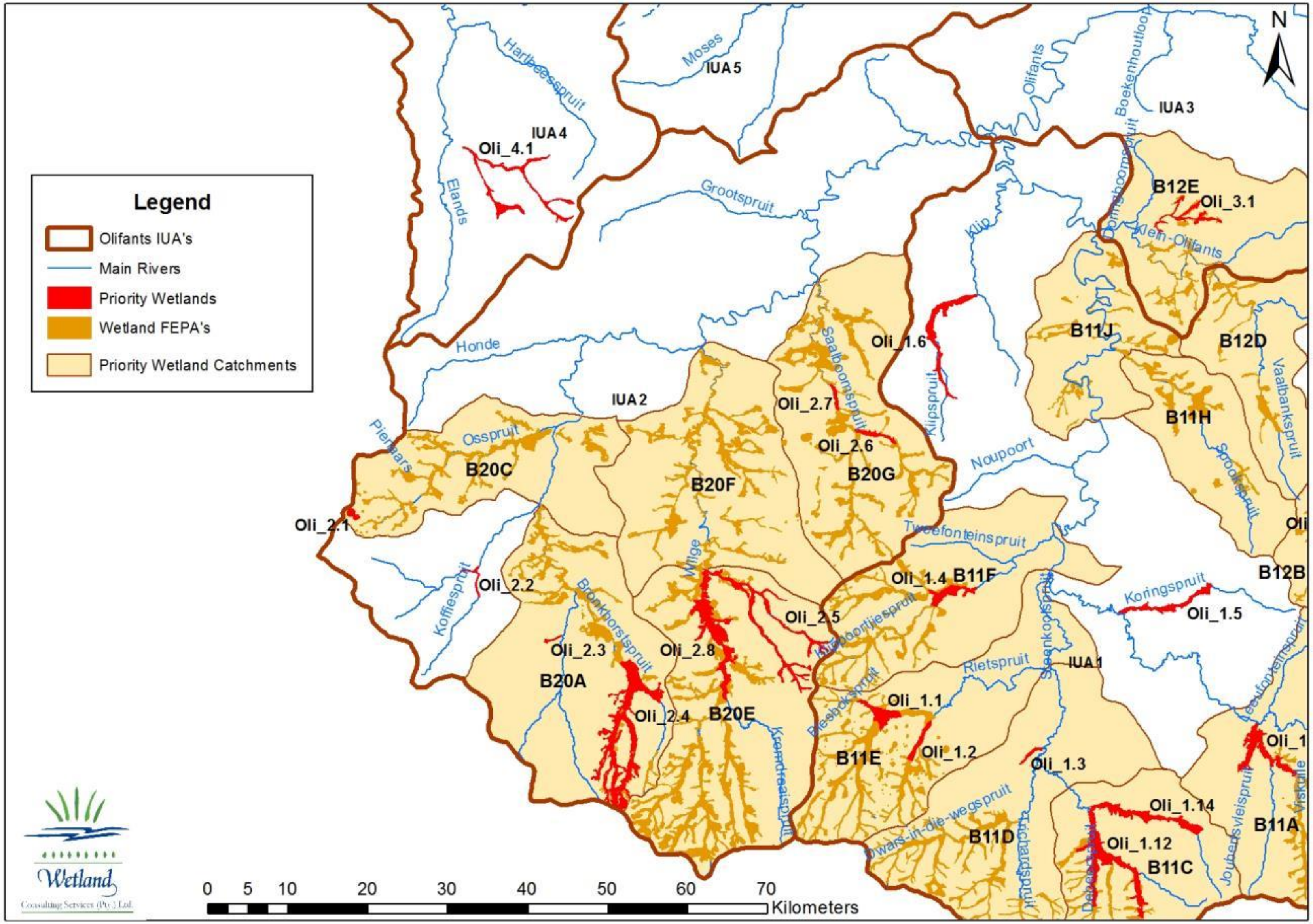

Figure 5: Map showing priority wetlands as well as priority catchments and associated FEPA wetlands within Olifants IUA 2

The Wilge River plays an important role in diluting poor water quality from the Olifants River (IUA 1). In order to maintain and improve the integrity and water quality of the Wilge River and other water resources within this IUA, it is important that wetland systems that play a role in moderating water quality and quantity be protected. As a consequence, a number of quaternary catchments that form the headwaters to important river systems have also been selected as priority wetland catchments in this IUA:

- B20A
- B20C
- B20E
- B20F
- B20G

Priority wetlands within the catchment consist of 8 wetland systems, 7 of which were identified as priority wetlands during the DWS (2014) study.

Priority wetlands and priority catchments are illustrated in **Figure 5**above, with further detail on wetlands within the priority catchments provided in**Table 2** below.

Table 2: Summary of FEPA wetlands within the priority wetland catchments identified in Olifants IUA 2 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems (where applicable).

Wetland	**Type**	**PES**	**EIS**	**REC**	**NFEPA Wetland Vegetation Group and Threat Status**	**Part of a Threatened Ecosystem**	**Identified as a WETFEPA**	**Notes**	**Unique features**
B20A									
Oli_2.3 Delmas wetland	Unchannelled valley bottom	D (Mbona et al., 2015)	Moderate	C	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU	No		
Oli_2.4 Bronkhorstspruit tributary	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	C (Mbona et al., 2015)	High	B	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland – VU Soweto Highveld Grassland - VU	Yes		
	Pans/depression	A/B - C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU Rand Highveld Grassland - VU	Yes		
	Channelled Valley bottom	A/B - C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU Rand Highveld Grassland - VU	Yes		

	Hillslope seepage wetlands	A/B - C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU Rand Highveld Grassland - VU	Yes		
	Floodplain	A/B (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU Rand Highveld Grassland - VU	Yes		
B20B									
Oli_2.2 Koffiespruit tributary	Unchannelled valley bottom	A/B (Mbona et al., 2015)	Moderate to High (B2 Olifants PESEIS 2011)	A/B	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU	No		
B20C									
Oli_2.1 Elandsvlei pans	Pan/depression; Hillslope seepage	C (Mbona et al., 2015)	High	B	Mesic Highveld Grassland Group 4 - LT	Blesbokspruit Highveld Grassland - CR	Yes		
	Pans/depression	A/B to C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU Eastern Highveld Grassland - VU Bronkhorstspruit Highveld Grassland - EN Blesbokspruit Highveld Grassland - CR	Yes		

	Channelled valley bottom	A/B to C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU Eastern Highveld Grassland - VU Bronkhorstspruit Highveld Grassland - EN Blesbokspruit Highveld Grassland - CR	Yes		
	Hillslope seepage wetlands	A/B to C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU Eastern Highveld Grassland - VU Bronkhorstspruit Highveld Grassland - EN Blesbokspruit Highveld Grassland - CR	Yes		
	Floodplain	A/B to C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU Eastern Highveld Grassland - VU Bronkhorstspruit Highveld Grassland - EN Blesbokspruit Highveld Grassland - CR	Yes		
B20E									
Oli_2.5 Wilge tributary	Floodplain; Channelled valley bottom	A/B to C (Mbona et al., 2015)	Moderate to High	B/C	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU Eastern Highveld Grassland - VU	Partially		
Oli_2.8 Upper Wilge River floodplain	Floodplain	D (Mbona et al., 2015)	High (B2 Olifants PESEIS 2011)	C	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU	Yes		

	Pans/depression	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 – LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Some of them		
	Channelled Valley bottom	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Some of them		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Some of them		
	Floodplain	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 3 - LT Mesic Highveld Grassland Group 4 - LT	Soweto Highveld Grassland - VU Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Some of them		
B20F									

	Channelled valley bottom	A/B - C (Mbona et al, 2015)	Low - High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU	Yes		
	Pans/depression	A/B (Mbona et al, 2015)	Moderate - High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Yes		
	Floodplain	A/B (Mbona et al, 2015)	High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU	Yes		
	Hillslope seepage wetlands	A/B-C (Mbona et al, 2015)	Low - High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU	Yes		
B20G									
Oli_2.6 Zaalklap wetland	Unchannelled valley bottom	D (Mbona et al., 2015)	High	C	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU	Yes		

Oli_2.7 Saalboomspruit/ Saalklapspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al., 2015)	Moderate to High (B2 Olifants PESEIS 2011)	C	Mesic Highveld Grassland Group 4 - LT	Rand Highveld Grassland - VU	Yes		
	Floodplain	D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU			
	Hillslope seepage	A/B - D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Yes		
	Unchannelled valley bottom	Not available	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Yes		
	Channelled valley bottom	A/B - E (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Yes		
	Pans/depression	A/B - C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - LT	Eastern Highveld Grassland - VU Rand Highveld Grassland - VU Eastern Temperate Freshwater Wetlands - VU	Yes		

5.5.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

Inherent in trying to assess the possible effects of different water use scenarios on wetlands is understanding the underlying drivers of the different wetland types that occur. For example, wetlands such as hillslope seepage systems that are maintained by interflow can be expected to respond separately to water use scenarios that may affect the river in the same catchment. Wetlands maintained by regional groundwater would also less likely be affected by surface water use scenarios, but certainly would be affected by future groundwater use scenarios. Floodplains and channelled valley bottom wetlands will be more affected by changes to high flows or floods in most cases, but under certain circumstances elevated baseflows too may have an effect through causing channel erosion which reduces the frequency of bank overtopping and hence leaving the floodplain drier for longer. These are some the factors that were considered in trying to understand how the future water use scenarios might affect the priority wetland systems identified.

For pans, impact scenarios are not generally related to changes in flow in the rivers. Flow related changes to these systems generally occur as a result of changes in hydrology from catchment-related (indirect impacts), or direct impacts such as opencast mining, and in some cases agricultural activities. In some cases underground mining may also impact on pans as a result of, for example, the loss of water to underground workings, subsidence and changes in soil saturation. Water quality impacts as a result of mining and agriculture and even intentional discharge into pans potentially pose a high risk to these systems in the long term. Maintaining water quality is a critical aspect in pans as this determines pan geochemistry which in turn drives the biodiversity aspects. Strict compliance monitoring will be required to ensure that the REC is achieved in the case of individual mining and other development assessments and applications.

For hillslope seepage wetlands, impact scenarios are also not related to changes in flow in rivers. Non-flow related impacts such as developments within and adjacent to these systems poses a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of changes to hydrology due to changes in landuse within the catchment, typically opencast coal mining, agricultural activities and increases in hardened surfaces within the catchment (including urbanisation). Interruption and interception of interflow within the catchment resulting from mining activities or other excavations pose the main flow related threat to the remaining systems in the long-term. Alien vegetation poses a further impact to flow due to increase water utilisation.

For valley bottom and floodplain wetlands, impact scenarios are related to both changes in flow in rivers and non-flow related changes. Flow related changes to these systems can occur as a result of changes in hydrology from catchment-related (indirect impacts), or direct impacts such as opencast mining, but can also occur as a result of abstraction and flow impoundment, which can decrease flows, or discharges that could lead to increased flow. Non-flow related impacts can be derived from amongst others overgrazing and changes to wetland habitat and biota, roads and other linear infrastructure crossings concentrating flows, incision of the channel and decreased bank-overtopping, sedimentation, alien vegetation and changes in water quality.

5.5.2 Recommended Protection, Management and Monitoring Requirements for Priority Catchments

Impacts on wetlands due to the construction of infrastructure or mining-related activities such as opencast pits, shafts, pipelines, powerlines, roads, overland conveyors, dams and their servitudes should be managed and strictly controlled to minimize damage to the wetlands and therefore to their functioning. All WUL applications related to the above should clearly demonstrate application of the mitigation hierarchy (DEA et al., 2013). Where impacts on wetlands occur, whether direct or indirect, mitigation must be implemented to minimise the effects on wetland functioning. Mitigation requirements must consider the following:

- Development footprints must be fenced off from wetlands;
- Suitable hydrological and ecological buffer zones around wetlands should be determined and implemented;
- Operations, including the crossing of wetlands by vehicles, and storage of equipment in wetlands, are to be prevented as far as possible. Where crossings of wetlands are necessary or unavoidable, suitable mitigations measures must be put in place to protect the wetlands;
- Stormwater management plans must be developed and implemented prior to all phases of mining operations. These must include measures to prevent erosion and siltation of wetlands as well as slope, bank, channel, and/or drainage stabilization measures to reinstate the pre-development hydrology (including both surface and sub-surface hydrology). Stormwater should ideally be conveyed in environmentally engineered or natural channels rather than cement lined canals or excavated trenches. Discharge points into the environment should be protected against erosion and designed to disperse flow and be subjected to regular maintenance. The stormwater management plan must be submitted to the DWS for approval prior to the commencement of any activities on site;
- In order to reduce the potential impacts associated with the introduction of contaminants, dissolved or suspended, in the runoff from infrastructure areas and construction sites, no runoff should be introduced into wetlands directly. Introduction into dryland areas is preferred and management measures must be put in place to protect wetlands from such runoff;
- Potential contaminants associated with mining or other developments must be stored and managed in such a way as to prevent spills and leaks. Management plans to prevent and deal with, contain and/or clean up spills, must form part of any WUL application;
- Where applicable, disturbed areas (i.e. for those areas that will not form part of the development operational footprint but which will be disturbed as part of the construction activities) should be rehabilitated using site-appropriate measures, specific to the region and type of wetland system affected. A rehabilitation plan must be drawn up for this purpose and a suitably qualified specialist should oversee this process;
- An alien vegetation management plan must be developed and implemented covering all phases of the mining project or development;
- Where conveyors, pipelines, culverts, roads, powerlines, drains or any other infrastructure or servitude crosses or impacts a wetland, Method Statements must be developed indicating how impacts during the construction and operational period will be minimised and managed. This must include recommendations for dealing with and rehabilitating all compacted areas or areas where flow has been diverted, concentrated or drained. Method Statements must

include construction and rehabilitation management and monitoring plans;

- Seasonality must be considered as part of the construction phase of any development, whether mining or other, in order to minimise the risk to the hydrology of the wetland systems as well as to prevent excessive sediment and debris being washed into wetland areas;
- No threatened flora should be collected or harvested from wetlands and no fauna, especially threatened fauna, should be hunted or poached from wetlands. Search and rescue plans for fauna and flora must form part of any WUL application;
- Wetland protection, rehabilitation and monitoring measures must be incorporated into mine closure plans as part of decommissioning and closure planning and related activities;
- No equipment including vehicles should be washed in streams, rivers and/or wetlands, and if washing facilities are provided, these must be placed outside of the buffer zones applicable to the wetlands and/or watercourses and designed so as not to impact the wetlands and streams, in terms of both water quality and quantity/flow;
- No abstraction of water from wetlands, streams and rivers should be allowed, unless specifically authorized in terms of the WUL;
- It is recommended that prior to any new mining activities taking place, suitable clean and dirty water diversion/separation and storage facilities be put in place to deal with possible AMD and prevent contamination of the wetlands, streams and rivers adjacent to and downstream of the mining operation. Clean and dirty water areas must be separated and no contaminated water should come into contact with clean water areas including wetlands, streams and rivers. Clean water should ideally be conveyed in natural systems or where this is not possible, in environmentally engineered or natural channels rather than cement lined canals, other hard structures, pipes or excavated trenches. Discharge points into the environment should be protected against erosion and designed to disperse flow and be subjected to regular maintenance;
- The likelihood of decant, whether from opencast or underground mining, as well as its expected location, quantity and quality should be determined and measures put in place to ensure that any such decant meets the resource quality objectives for the Wilge River catchment. As a minimum, any discharge water should meet the catchment standards as indicated in applicable Preliminary Reserves, EMP's, WUL's and other relevant authorisations. The risk to the receiving environment in terms of water quality, flow modification, erosion and biological effects must be established and assessed and appropriate mitigation put in place to deal with these;
- Where the water quality RQO's and/or water quality discharge requirements are exceeded, contaminated water will need to be treated. In this regard it is recommended that suitably designed water treatment plants (which could be passive systems as and when the technology allows) be established and that water levels within the mined out areas are actively managed post-mining to ensure decant is prevented and no contaminated water is discharged into the environment untreated. It is important to ensure financial and logistical capacity for long-term maintenance of treatment or infrastructural requirements to protect wetland and river systems from water quality impacts resulting from mine water contamination;
- No mine contaminated water should be allowed to enter wetlands and mechanisms must be put in place to protect wetlands from any form of mine-related contamination;

- Flow supplementation from water treatment plants to affected wetlands is recommended in all cases where there is an indirect loss of wetland functioning as a result of mining. This must be implemented according to a flow management plan which includes specific design and wetland protection measures, a schedule for the releases as well as a provision for adaptive management informed by monitoring;
- Where clean water is discharged into the environment from water treatment or from infrastructure such as detention facilities, suitably designed and appropriate -erosion protection measures should be put in place;
- Methods should be put in place to limit the amount of water entering mining voids which will further reduce the risks of long-term decant into adjacent and downstream/affected wetlands;
- Should mitigation, via supplementation of the flows that will be lost in the affected wetlands, be unachievable resulting in a residual impact associated with the decrease in the health or PES of the wetland systems, measures must be put in place to offset the entire, or part of, the net loss expected. This must take into account both wetland functional and ecosystem conservation hectare equivalents;
- Similarly, where there is a residual impact associated with the direct loss of wetland systems, measures must be put in place to offset the entire, or part of, the net loss expected. This applies to mining-related as well as other developments. This can be achieved through a Wetland Offset or Rehabilitation Strategy. This must include the rehabilitation, protection, management and monitoring of remaining or other wetlands to achieve a suitable functional hectare equivalent target and certain ecosystem conservation targets recommended by the authorities. Wetland rehabilitation activities should be targeted to try to achieve a net gain in functional hectare equivalents.
- The draft SANBI Wetland Offsetting Guidelines (SANBI and DWS, 2014) or any updated revision of this approach/document should be used to guide the process of offsetting;
- A monitoring programme must be developed to monitor the condition/health/state of any wetlands affected by a proposed development. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. Any such monitoring strategy must be developed by a suitably qualified specialist and submitted to the DWS for review and approval. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- For pans affected by a proposed development, and particularly a mining development, it is recommended that monitoring of pan water chemistry be conducted according to a specified schedule and for certain key elements including, but not limited to: pH; Electrical Conductivity; Total Dissolved Solids; Total Alkalinity as CaCO3; Sodium; Calcium; Magnesium; Sulphate; Iron; Chloride; Potassium; Magnesium; Manganese; Aluminium; Phosphorous; Silica; Ammonia; Nitrate; and Fluoride. An independent water laboratory should be used to conduct the analyses and records should be maintained for inspection by the DWS. If there are any signs of deterioration in water quality or contamination of any pan during monitoring, then the

Regional Office of the DWS must be informed together with an indication of the probable cause and time span associated with the water quality problem. Mitigation measures will also need to be indicated in order to remedy the situation in the case of water quality deterioration resulting from the development. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;

- Similarly, for pans affected by a proposed development, and particularly a mining development, it is recommended that Macroinvertebrates and diatoms should be monitored according to a specified schedule. The monitoring must be conducted by a suitably qualified specialist and the results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- A groundwater monitoring programme should be established in order to monitor groundwater quality and groundwater level changes up- and downstream of any proposed mining project/operation. This must be designed to include both the shallow and deeper aquifer systems separately, and include water quality and quantity according to a specified schedule. For deeper aquifer systems, this should include as a minimum, the recording of daily pit dewatering rates, and monthly sampling and analysis of major and trace elements of pumped water. As part of this groundwater monitoring programme, changes of shallow groundwater levels in wetlands (where groundwater effects may be expected as a result of the proposed mining operation), must be monitored. The monitoring must be conducted by a suitably qualified specialist and the results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- The monitoring of important biota may also be relevant to a particular development, especially where endangered animal species occur in the wetlands. Records should be kept of sightings in order to help establish whether or not the wetland management practices and rehabilitation efforts are having a positive impact on these species and where appropriate, the local district conservation officer should be contacted to obtain further information on monitoring of important species;
- Where water quality impacts are expected in wetlands, water quality must be regularly monitored according to an appropriate protocol that will need to be put in place based on a regular schedule and for recommended variables. The monitoring plan must include a provision for appropriate and timeous remedial interventions in the case of non-compliance. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL; and
- Water quality monitoring must be undertaken in accordance with the Water Quality Ecospecs where these are available for a particular development application. Records should be maintained for inspection by the DWS. If any measured value exceeds the RWQOs (95th percentile) included in the Water Use Licence, then the Regional Office of the DWS shall be informed together with an indication of the probable cause and time span of the exceedance. Mitigation measures will also need to be indicated in order to remedy the situation in the case of exceedance or non-compliance. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL.

5.6 Olifants IUA 3 - Selons River area including Loskop Dam

IUA 3, which includes the Loskop Dam and associated protected area, incorporates the Olifants River from its confluence with the Wilge River to just below Loskop Dam. It includes the Selons and Kruis Rivers, and a section of the Klein-Olifants. The largest town is a section of Mhluzi that falls within this IUA. The remainder of the IUA is largely rural in nature. As a consequence the agricultural sector is an important component of the economy.

The western and north eastern areas of the IUA are characterised by hilly, undulating terrain with incised valleys and a dense drainage system of rivers and streams. Land use consists of extensive areas of natural vegetation used for grazing and un-proclaimed, private nature reserves and game farms. Cultivation is limited to the broader valley bottom wetlands and is generally irrigated. Fewer wetlands occur in this area as the steeper slopes encourage surface runoff rather than water retention and wetland formation.

The southern and eastern parts of the IUA are more typical of the Mpumalanga Highveld and support extensive wetland habitat, much as is the case in IUA's 1 and 2 described above. Wetlands include extensive hillslope seepage wetlands, valley bottom wetlands and some pans. These wetlands occur in a landscape dominated by agricultural activities, mostly dryland cultivation. Mining activity is limited, though some coal mining occurs along the southern boundary of the IUA.

Priority wetlands within the IUA are all located within quaternary catchment B12E (**Figure 6** and **Table 3**) and includes one wetland cluster selected as a priority wetland due to its classification as a FEPA and it being considered a representative example of wetland habitats in the area (DWS, 2014). This quaternary catchment has also been selected as a priority wetland catchment.

Table 3: Summary of priority wetlands and FEPA wetlands within the priority wetland catchments identified in Olifants IUA 3 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems.

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B12E									
Oli_3.1 Klein-Olifants Tributary	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B to C (Mbona et al., 2015)	High (desktop)	B	Mesic Highveld Grassland Group 4 - **LT**	Rand Highveld Grassland – **VU** Loskop Mountainlands - **VU**	Yes		
	Floodplain	C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT**	Rand Highveld Grassland – **VU** Loskop Mountainlands - **VU**	Yes		
	Channelled valley bottom	A/B - C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT**	Rand Highveld Grassland – **VU** Loskop Mountainlands - **VU**	Yes		
	Hillslope seepage	A/B - D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT**	Rand Highveld Grassland – **VU** Loskop Mountainlands - **VU**	Yes		

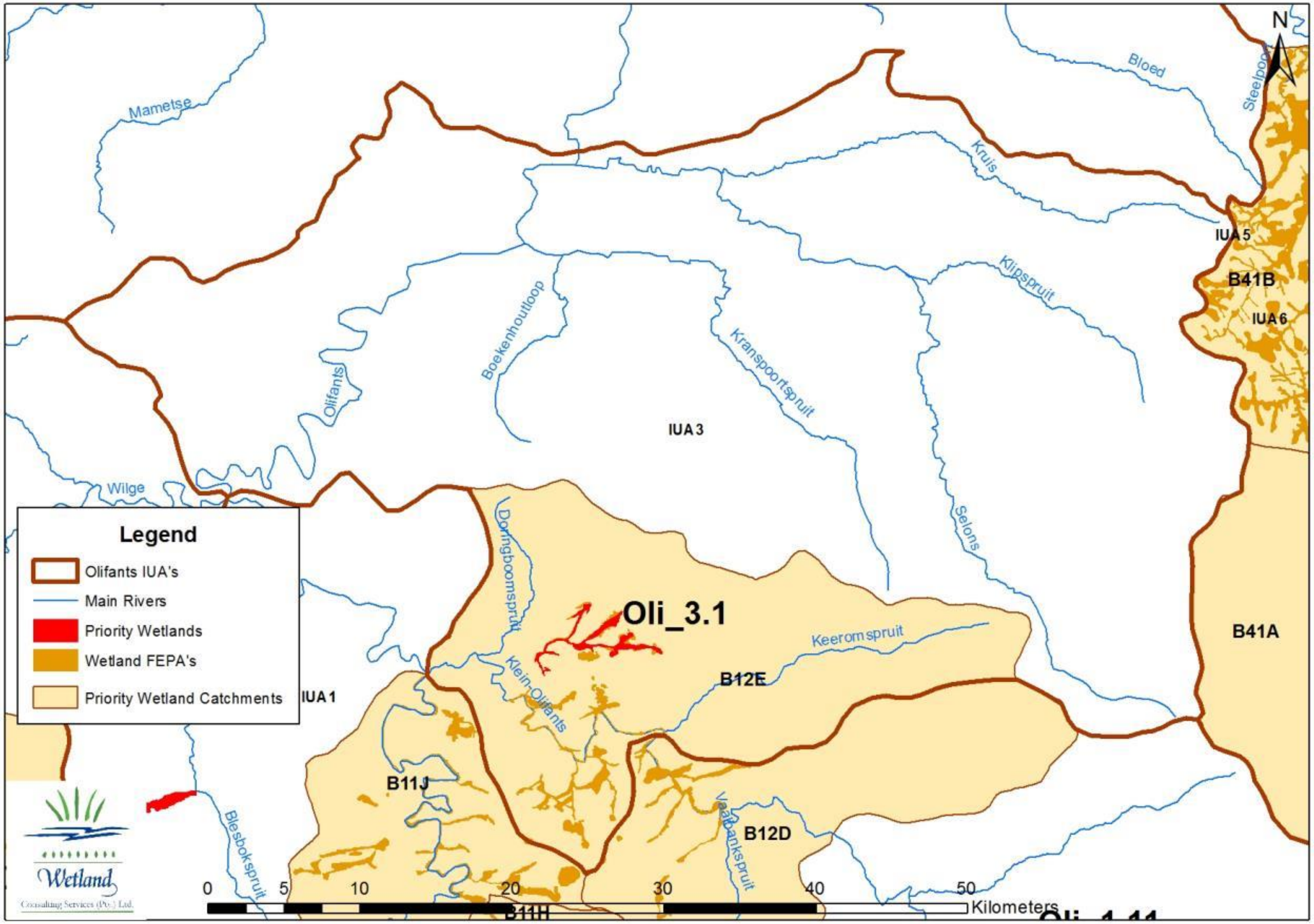

Figure 6: Map showing priority wetlands as well as priority catchments and associated FEPA wetlands within Olifants IUA 3

5.6.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The selected priority wetlands are located within a mostly agriclutural setting. Existing impacts are likely to persist. Developments within and adjacent to these systems pose a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of impoundments and abstraction, as well as changes to hydrology due to changes in landuse within the catchment, typically agricultural activities and increases in hardened surfaces within the catchment (including urbanisation).

5.6.2 Recommended Protection, Management and Monitoring Requirements for Priority Catchments

The wetland FEPA's need to be validated to confirm their PES, EIS and REC. Any development applications in these areas need to take cognisance of the presence and importance of these wetlands. Such development applications will need to be accompanied by detailed baseline wetland assessment reports that include the determination of the PES, EIS and REC of the affected wetlands, as well as an impact assessment that clearly demonstrates application of the mitigation hierarchy (DEA et al., 2013). The presence of important faunal and floral species in a number of wetlands in the area (e.g. cranes) also requires that these aspects be addressed in any development application.

For validated FEPA wetlands that do not meet the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS), it is recommended that rehabilitation plans are developed and implemented in consultation with an appropriate implementer such as Working for Wetlands.

For mining applications within this priority catchment, the protection manegement and monitoring requirements as detailed for Olifants IUA's 1 and 2 should be applied.

5.7 Olifants IUA 4 - Elands River Catchment area

IUA 4 includes the Elands, Kameel and Mkhombo Rivers. Important settlements include Cullinan in the south and KwaMahlanga in the central regions. Both the Rust de Winter and Mkhombo dams fall within this IUA. Landuse is dominated by agricultural activities, which include commercial agriculture in the south and northwest and subsistence and small-scale commercial agriculture in the central regions around KwaMhlanga. Significant areas of irrigation occur in the northwest of the IUA on the Springbok Flats around Settlers.

Wetland data for the IUA is limited, and only few wetlands are mapped. Mapped wetlands in the Nel *et al*. (2011) database for the area consist mostly of small, artificial farm dams. The most significant wetlands of the IUA occur in quaternary catchment B31A and consist of valley bottom wetlands and associated seepage wetlands located in an agricultural setting. The Elands Tributary Wetland was selected as a priority wetland due to its role in biodiversity support, specifically crane conservation (DWS, 2014). A number of FEPA wetlands occur in the same quaternary catchment, B31A. Priority wetlands are illustrated in **Figure 7** and further detailed in **Table 4.**

Table 4: Summary of priority wetlands identified in Olifants IUA 4 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B31A									
Oli_4.1 Elands tributary wetland	Channelled valley bottom; Hillslope seepage	C (Nel et al., 2015)	High (desktop)	B/C	Central Bushveld Group 3 – **EN**	No	No		
	Channelled valley bottom	Not available	Specific to individual systems	Specific to individual systems	Central Bushveld Group 3 – **EN** Mesic Highveld Grassland group 3 - **LT**	Rand Highveld Grassland - **VU**	Yes		
	Hillslope seepage	Not available	Specific to individual systems	Specific to individual systems	Central Bushveld Group 3 – **EN** Mesic Highveld Grassland group 3 - **LT**	Rand Highveld Grassland - **VU**	Yes		
	Pan/Depression	Not available	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland group 3 - **LT**	Rand Highveld Grassland - **VU**	Yes		

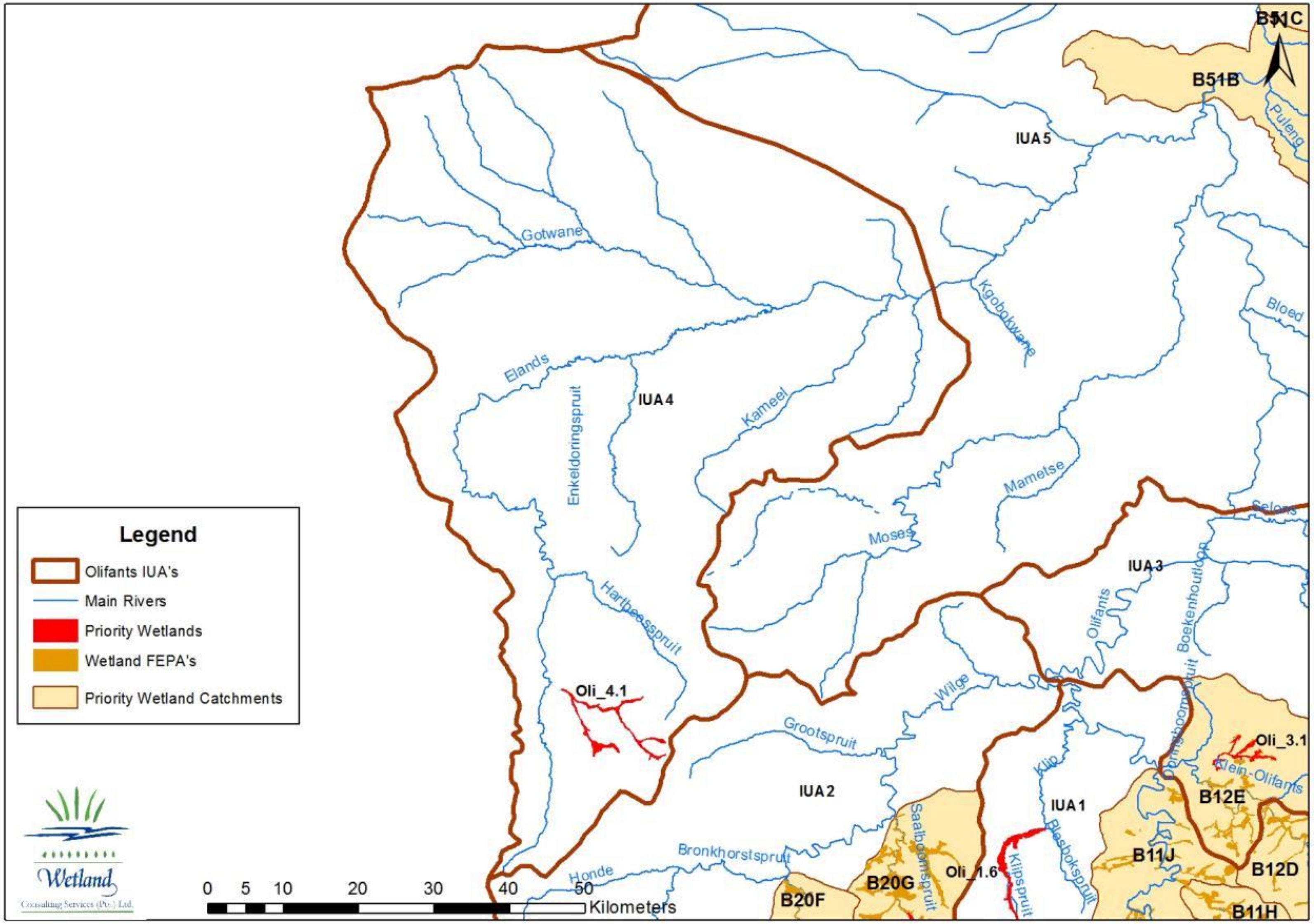

Figure 7: Map showing priority wetlands within Olifants IUA 4.

5.7.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The selected priority wetlands are located within a mostly agricultural setting, though numerous extensive rural townships occur. Existing impacts are likely to persist. Developments within and adjacent to these systems pose a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of impoundments and abstraction, as well as changes to hydrology due to changes in landuse within the catchment, typically agricultural activities and increases in hardened surfaces within the catchment (including urbanisation). The systems are expected to continue to deteriorate unless rehabilitation and management interventions are implemented. Stormwater management and waste water management is also likely to require attention in the future as the peri-urban and urban development expands around these systems.

5.8 OLIFANTS IUA 5 & 7: MIDDLE OLIFANTS CATCHMENT AREA

Wetland data for both these IUA's is limited and only few wetlands are mapped. Within the east of IUA 5 and across the boundary into IUA 7 a number of quaternary catchments are underlain by granite lithology; B51A, B51B, B51C and B51H. Extensive wetlands were identified and mapped as part of this study within these catchments. Soils in this area are generally coarse-grained, sandy and shallow within a gently undulating topography; attributes which are conducive to the formation of valley bottom and seepage wetland systems. Unchannelled valley bottom wetlands in these areas are mostly dominated by temporary and seasonal wetland zones, and driven predominantly by subsurface seepage of water through the shallow, sandy catchment soils. Channelled valley bottom wetlands generally incorporate a central channel with adjacent seepage zones on either side, mostly consisting of temporary wetland with a patchy mosaic of seasonal wetland. These are driven predominantly by longitudinal and lateral surface flow and lateral subsurface seepage. These wetlands form the upper reaches of tributaries to the Olifants and include the Motsephiri, Puleng, Ga-Makatle, Makotswane, Motseleope, Madibjaneng, Motsemohlaba and Ngwaritsi Rivers. Given the water quantity and quality concerns experienced within the Olifants River along it reach within IUA 5 and IUA 7, water inputs from these tributaries can play a vital role in improving the water resource along the Olifants River. For this reason the wetlands feeding these tributaries were selected as priority wetlands.

Subsistence agriculture and small-scale commercial agriculture have impacted significantly on these wetlands through direct transformation of habitat.

Livestock trampling and the associated onset of erosion was also observed. Stormwater inputs from the numerous villages in the area are likely to have impacted on water quality, and have also increased the velocity and erosive energy of flows entering wetlands.

This impact will likely become even more severe into the future as hardened surface within these rural villages increase. The ability of these wetlands to improve and maintain water quality is therefore also considered important.

Of special significance was also the observation of small peat deposits associated with springs within at least one of the hillslope seepage wetlands near Phokwane (**Figure 8**). Peat wetlands had not previously been known to occur within this area.

In terms of biodiversity support, these wetlands were found to support the Giant Bullfrog (*Pyxicephalus adspersus*) (**Figure 8**) and a number of unidentified orchid species.

Identified priority wetlands and priority wetland catchments are illustrated in **Figure 9** and further detailed in **Table 5**.

Figure 8: Photographs of wetlands in the area. Clockwise from top left: Spring that has formed a small peat dome within a hillslope seepage wetland; view across hillslope seepage wetland with granite dome in background; livestock grazing and trampling in wetlands is a significant impact; Giant Bullfrog observed in one of the wetlands

Table 5: Summary of priority wetlands and wetlands within the priority wetland catchments identified in Olifants IUA 5 and 7 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems.

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B51A									
	Channelled Valley bottom	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		
	Unchannelled VB	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		
	Hillslope seepage wetlands	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		Large stands of Orchids and high densities of unique species were recorded in some seepage wetlands.
B51B									
	Channelled Valley bottom	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		

	Unchannelled VB	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		
	Hillslope seepage wetlands	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		
B51C									
Oli_5.1 Makotswane	Channelled valley bottom; Hillslope seepage	C	Very High	B	Central Bushveld Group 3 – EN	No	No		
	Channelled Valley bottom	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		
	Unchannelled VB	A/B - E (Mbona et al, 2015)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No	Flow regulatory services in the catchment. Associated hillslopes comprise deep sand which helps to maintain water quality in the associated hillslope seepage wetlands which feed thr valley bottom systems and associated streams. This flow regulation service is an important function in this relatively arid region. Likely to provide important water quality enhancement function which may help to buffer the poor water quality in this section of the Olifants River (DWS, 2014a).	Peat related to what appear to be artesian springs occurs in some of the systems. Unique granitic peatlands. Giant bullfrog has been recorded in the wetlands of the area. Large stands of Orchads and high densoties of unique species have been recorded on the seepage wetlands.

	Hillslope seepage wetlands	A/B - E ((Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland - VU	No		Large stands of Orchids and high densities of unique species were recorded in some seepage wetlands.
B51H									
	Channelled Valley bottom	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland – VU	No		
	Unchannelled VB	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland – VU	No		
	Hillslope seepage wetlands	A/B - E (Nel, et.al., 2011)	Moderate to Very High High (Enviro_con) from (DWS, 2014a supporting GIS data)	Specific to individual systems	Central Bushveld Group 3 – EN	Rand Highveld Grassland – VU	No		Large stands of Orchids and high densoties of unique species were recorded in some seepage wetlands.

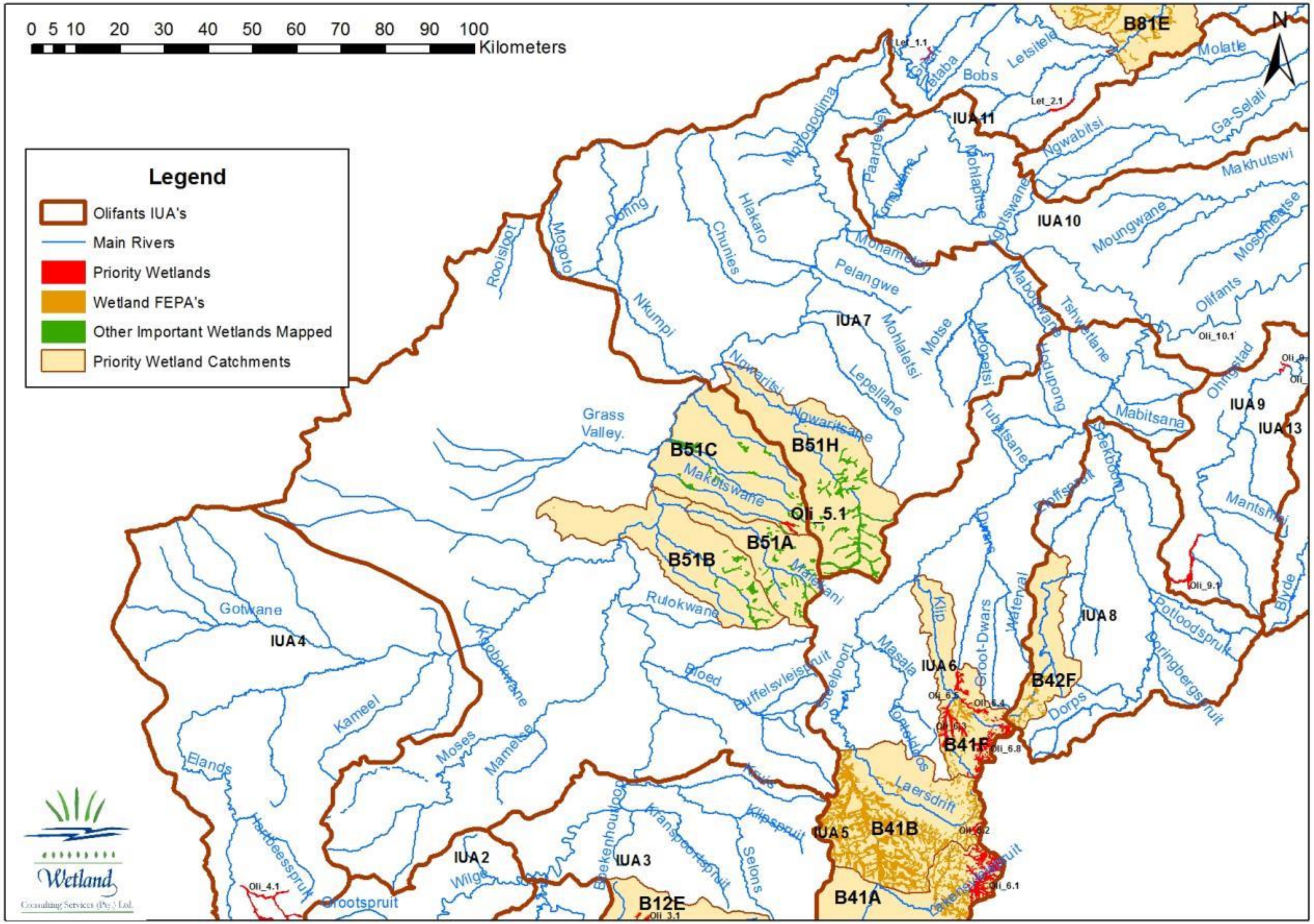

Figure 9: Map showing priority wetlands as well as priority catchments and associated FEPA wetlands within Olifants IUA's 5 and 7

5.8.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The systems are all degraded to a greater or lesser degree as a result of cultivation in and adjacent to the wetlands and overgrazing. The systems are expected to continue to deteriorate unless rehabilitation and management interventions are implemented. Stormwater management and waste water management is also likely to require attention in the future as the peri-urban and urban development expands around these systems. The peats associated with these systems appear to be related to local artesian springs which provide essential stream flow regulation functions in the catchment.

5.8.2 Recommended Protection, Management and Monitoring Requirements

For any application the wetlands will need to be assessed to confirm their PES, EIS and REC. Any development applications in these areas need to take cognisance of the presence and importance of these wetlands. Such development applications will need to be accompanied by detailed baseline wetland assessment reports that include the determination of the PES, EIS and REC of the affected wetlands, as well as an impact assessment that clearly demonstrates application of the mitigation hierarchy (DEA et al., 2013).

For wetlands that do not meet the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS), it is recommended that rehabilitation plans are developed and implemented in consultation with an appropriate implementer such as Working for Wetlands, in consultation/collaboration with the local community. The plans should address the cultivation, erosion/headcutting and overgrazing in these systems and make provision, not only for structural interventions, but also the development of a grazing and cultivation management plan for the systems and their catchments. Targeted wetland management actions and rehabilitation interventions should be implemented to safeguard and improve the wetland structure and functioning and associated peat and artesian springs.

5.9 Olifants IUA 6 - Steelpoort River Catchment

IUA 6 includes the entire catchment of the Steelpoort River from its headwaters in the south to its confluence with the Olifants mainstem in the north. Towns inlcude Belfast in the south, Stoffberg in the west and Steelpoort in the north. The recently completed De Hoop Dam falls within this catchment.

Landuse within the catchment is varied and ranges from forestry and coal mining around Belfast, through dryland cultivation and livestock grazing to extensive platinum mining in the north around Steelpoort.

Extensive wetlands occur within the southern portion of the IUA in quatenaries B41A, B41B and B41F. This includes the wetlands along the Steenkampsberg Plateau, an important wetland area including numerous peat wetlands, one of which is the Verloren Valei Nature Reserve Ramsar Site (Ramsar Site No. 1110).

The Verloren Valei Nature Reserve falls on the eastern boundary of IUA 6 and extends into the adjacent Inkomati River catchment. The large Lakenvlei wetland system, which is located just north of Belfast and contains extensive peat deposits, also falls within this IUA.

According to DWS (2014), the Lakenvlei wetland complex is one of the largest, pristine peatland wetland systems in Mpumalanga and supports important populations of threatened bird species, including the Grey Crowned Crane (EN), Wattled Crane (CR) and White-winged Flufftail (CR). Some rehabilitation has taken place on sections of the wetland. It is also a major supplier of high quality water. A number of mining applications in the area pose a future threat to this wetland system.

Very few wetlands are mapped within the northern half of the IUA. The drier climate and generally steeper terrain is less favourable for the formation of wetlands. Wetlands do however occur, generally in the form of valley bottom wetlands and smaller seepage wetlands along drainage lines.

Three quaternary catchments have been selected as priorty wetland catchments (**Figure 10**):

- B41A – headwaters of Steelpoort;
- B41B - headwaters of Steelpoort; and
- B41F – Klip River, tributary to Steelpoort (includes Ramsar Site).

All three of these catchments support important priority wetlands and peat wetlands. The wetlands, especially those containing peat, play an important role in regulating flow within the rivers draining the catchments and help in maintaining the high quality of water within these rivers. From a biodiversity perspective these wetlands are some of the most important within the Olifants/Letaba System and include a number of pristine wetlands.

Further priority wetlands within the catchment include 7 wetland systems identified as priority wetlands during the DWS (2014) study. Identified priority wetlands are illustrated in **Figure 10** and further detailed in **Table 6**.

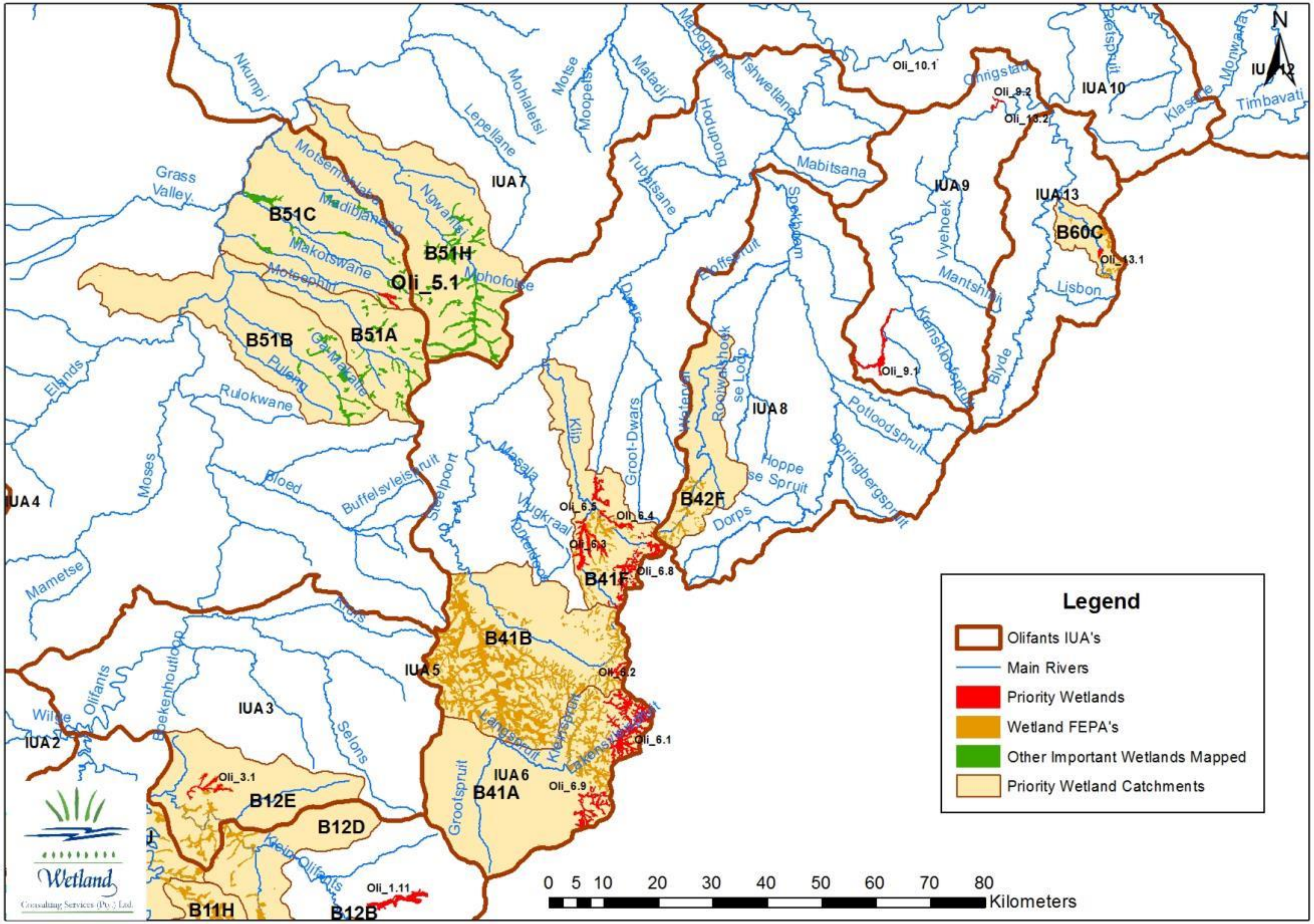

Figure 10: Map showing priority wetlands and FEPA wetlands within Olifants IUA 6

Table 6: List of priority wetlands in Olifants IUA 6 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems.

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B41A									
Oli_6.1 Lakenvlei wetland complex	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B (Mbona et al, 2015)	Very High	A/B	Mesic Highveld Grassland Group 6- **LT**	Dullstroom Plateau Grassland - **EN**	Yes	The Lakenvlei wetland complex is one of the largest, pristine peatland wetland systems in Mpumalanga. The wetland supports important populations of threatened bird species including the Grey Crowned Crane (EN), Wattled Crane (CR) and White-winged Flufftail (CR). Some rehabilitation has taken place on sections of the wetland. It is also a major supplier of high quality water.	The wetland supports important populations of threatened bird species including the Grey Crowned Crane (EN), Wattled Crane (CR) and White-winged Flufftail (CR).
Oli_6.9 Belfast wetland complex	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B to C (Nel et al, 2011)	High to Very High (B4 Olifants PESEIS 2011)	A/B to B	Mesic Highveld Grassland Group 7- **EN**	Dullstroom Plateau Grassland - **EN**	No	This valley bottom wetland is located in an urban setting alongside Belfast town and upstream of the Belfast dam. It is therefore well placed to improve water quality in this important local catchment.	
	Pans/Depression	A/B-C (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT** Mesic Highveld Grassland Group 6 - **LT** Mesic Highveld Grassland Group 7 - **EN**	Stoffberg Mountainlands – EN Rand Highveld Grassland – VU Eastern Temperate Freshwater – VU Eastern Highveld Grassland – VU Dullstroom Plateau Grassland - EN	Yes		

	Channelled Valley bottom	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT** Mesic Highveld Grassland Group 6 - **LT** Mesic Highveld Grassland Group 7 - **EN**	Stoffberg Mountainlands – EN Rand Highveld Grassland – VU Eastern Temperate Freshwater – VU Eastern Highveld Grassland – VU Dullstroom Plateau Grassland - EN	Yes		
	Unchannelled valley bottom	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT** Mesic Highveld Grassland Group 6 - **LT** Mesic Highveld Grassland Group 7 - **EN**	Stoffberg Mountainlands – EN Rand Highveld Grassland – VU Eastern Temperate Freshwater – VU Eastern Highveld Grassland – VU Dullstroom Plateau Grassland - EN	Yes		
	Hillslope seepage wetlands	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT** Mesic Highveld Grassland Group 6 - **LT** Mesic Highveld Grassland Group 7 - **EN**	Stoffberg Mountainlands **– EN** Rand Highveld Grassland **– VU** Eastern Temperate Freshwater – **VU** Eastern Highveld Grassland – **VU** Dullstroom Plateau Grassland - **EN**	Yes		

	Floodplain	A/B-D (Mbona et al, 2015)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT** Mesic Highveld Grassland Group 6 - **LT** Mesic Highveld Grassland Group 7 - **EN**	Stoffberg Mountainlands – **EN** Rand Highveld Grassland – **VU** Eastern Temperate Freshwater – **VU** Eastern Highveld Grassland – **VU** Dullstroom Plateau Grassland - **EN**	Yes		
B41B									
Oli_6.2 Welgevonden wetland	Channelled valley bottom; Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	A/B	Mesic Highveld Grassland Group 4 - **LT/Not Protected** Mesic Highveld Grassland Group 6 - **LT/Well Protected** Mesic Highveld Grassland Group 7 - **ED/Not Protected**			This FEPA wetland system is located in the upper reaches of the catchment and forms part of a priority wetland cluster. The wetland is important for biodiversity conservation as it contains peatland areas and supports important crane populations.	Peatland areas which supports crane populations
	Pans/Depression	A/B (Mbona et al, 2015 and Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6- **LT/Well Protected**	Dullstroom Plateau Grassland – **EN** Stoffberg Mountainlands – **EN** Rand Highveld Grassland – **VU** Sekhukhune Mountainlands - **EN**			

	Channelled Valley bottom	A/B-C (Mbona et al, 2015 and Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 7 - **ED/Not Protected** Mesic Highveld Grassland Group 6 - **LT/Well Protected**		Some of them		
	Hillslope seepage wetlands	A/B-C (Mbona et al, 2015 and Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 4 - **LT/Not Protected** Mesic Highveld Grassland Group 7 - **ED/Not Protected** **M**esic Highveld Grassland Group 6**-** **LT/Well Protected**		Some of them		
	Floodplain	A/B-C (Mbona et al, 2015 and Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 7 - **ED/Not Protected**				
B41F									
Oli_6.3 Draaikraal wetland_1	Channelled valley bottom	C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	B	Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands - **EN**	Yes	This large FEPA wetland system is located within an agricultural context and important for biodiversity conservation as it contains peatland areas and supports important crane populations. The site has been historically targeted for	

								rehabilitation by WFWetlands (DWS, 2014a).	
Oli_6.4 Draaikraal wetland_2	Channelled valley bottom	A/B to C (Nel et al., 2011)	High to Very High (desktop)	A/B to B	Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands - **EN**	Yes	The wetland is still in good condition despite surrounding agricultural land use pressures (DWS, 2014a).	This NFEPA wetland system contains important peatland areas and supports threatened crane populations (DWS, 2014a).
Oli_6.5 Draaikraal wetland_3	Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	A/B	Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands - **EN**	No	This large unchannelled peatland has been identified as a FEPA and supports breeding populations of cranes. Wetland rehabilitation was previously implemented in this wetland to address impacts of historical drainage (DWS, 2014a).	Peatland FEPA wetland which supports breeding populations of cranes (DWS, 2014a).
Oli_6.8 Verloren Valei	Hillslope seepage; Channelled valley bottom; Unchannelled valley bottom	A/B (Nel et al., 2011)	Very High	A					
	Pans/Depression	A/B (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6- **LT** Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands – **EN** Dullstroom Plateau Grassland – **EN**	Some of them		
	Channelled Valley bottom	A/B-C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6- **LT** Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands – **EN** Dullstroom Plateau Grassland – **EN**	Some of them		

	Unchannelled VB	A/B (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6- **LT** Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands – **EN** Dullstroom Plateau Grassland – **EN**	Some of them		
	Hillslope seepage wetlands	A/B-C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6- **LT** Mesic Highveld Grassland Group 7 - **EN**	Sekhukhune Mountainlands – **EN** Dullstroom Plateau Grassland – **EN**	Some of them		

5.9.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

Inherent in trying to assess the possible effects of different water use scenarios on wetlands is understanding the underlying drivers of the different wetland types that occur. For example, wetlands such as hillslope seepage systems that are maintained by interflow can be expected to respond separately to water use scenarios that may affect the river in the same catchment. Wetlands maintained by regional groundwater would also less likely be affected by surface water use scenarios, but certainly would be affected by future groundwater use scenarios. Floodplains and channelled valley bottom wetlands will be more affected by changes to high flows or floods in most cases, but under certain circumstances elevated baseflows too may have an effect through causing channel erosion which reduces the frequency of bank overtopping and hence leaving the floodplain drier for longer. These are some of the factors that were considered in trying to understand how the future water use scenarios might affect the priority wetland systems identified.

Landuses and economic activity across this IUA differs significantly between regions, resulting in a number of differing impact scenarios for the various regions. The upper regions of the IUA include areas of coal mining, forestry and extensive agriculture, while tourism (including recreational fishing) and conservation also play an important role in the Dullstroom area and the greater Steenkampsberg Plateau, including the Verloren Vallei Ramsar site. The central regions of the IUA around Steelpoort and Burgersfort fall along the eastern limb of the Bushveld igneous complex and support extensive mining activity, both opencast and underground. Furthermore the IUA supports large tracts of agricultural and rural land, and numerous informal townships. All of these activities can be expected to impact differently on wetlands, while wetland types also vary between regions within the IUA.

Along the Steenkampsberg Plateau (stretching along the high-lying area from Belfast in the south to north of Verloren Vallei), a number of priority wetlands occur. This area includes numerous peat wetlands, with peat found associated with artesian springs but also with large valley bottom wetlands (e.g. Lakenvlei). The occurrence of peat within these wetlands indicates the discharge of groundwater and/or the presence of a shallow groundwater table. The wetlands are therefore sensitive to lowering of the shallow groundwater table through activities such as groundwater abstraction, commercial forestry and alien vegetation, but also including mining activities that affect groundwater quantity or quality. The utilisation of this area for tourism, including recreational fishing mostly for introduced species (trout), has resulted in the construction of a large number of small dams within wetlands, rivers and streams. Such dams can lead to decreased flows downstream, as well as flow concentration and resultant erosion and incision of wetlands. The Steenkamspberg Plateau and its wetlands support a high diversty of species, both fauna and flora, and are known to also support a number of wetland dependant Red Data species.

5.9.2 Recommended Protection, Management and Monitoring Requirements

Impacts on wetlands due to the construction of infrastructure or mining-related activities such as opencast pits, shafts, pipelines, powerlines, roads, overland conveyors, dams and their servitudes should be managed and strictly controlled to minimize damage to the wetlands and therefore to their functioning. All WUL applications related to the above should clearly demonstrate application of the mitigation hierarchy (DEA et al., 2013). Where impacts on wetlands occur, whether direct or indirect, mitigation must be implemented to minimise the effects on wetland functioning. Mitigation requirements must consider the following:

- Development footprints must be fenced off from wetlands;
- Suitable hydrological and ecological buffer zones around wetlands should be determined and implemented;
- Operations, including the crossing of wetlands by vehicles, and storage of equipment in wetlands, are to be prevented as far as possible. Where crossings of wetlands are necessary or unavoidable, suitable mitigations measures must be put in place to protect the wetlands;
- Stormwater management plans must be developed and implemented prior to all phases of mining operations. These must include measures to prevent erosion and siltation of wetlands as well as slope, bank, channel, and/or drainage stabilization measures to reinstate the pre-development hydrology (including both surface and sub-surface hydrology). Stormwater should ideally be conveyed in environmentally engineered or natural channels rather than cement lined canals or excavated trenches. Discharge points into the environment should be protected against erosion and designed to disperse flow and be subjected to regular maintenance. The stormwater management plan must be submitted to the DWS for approval prior to the commencement of any activities on site;
- In order to reduce the potential impacts associated with the introduction of contaminants, dissolved or suspended, in the runoff from infrastructure areas and construction sites, no runoff should be introduced into wetlands directly. Introduction into dryland areas is preferred and management measures must be put in place to protect wetlands from such runoff;
- Potential contaminants associated with mining or other developments must be stored and managed in such a way as to prevent spills and leaks. Management plans to prevent and deal with, contain and/or clean up spills, must form part of any WUL application;
- Where applicable, disturbed areas (i.e. for those areas that will not form part of the development operational footprint but which will be disturbed as part of the construction activities) should be rehabilitated using site-appropriate measures, specific to the region and type of wetland system affected. A rehabilitation plan must be drawn up for this purpose and a suitably qualified specialist should oversee this process;
- An alien vegetation management plan must be developed and implemented covering all phases of the mining project or development;
- Where conveyors, pipelines, culverts, roads, powerlines, drains or any other infrastructure or servitude crosses or impacts a wetland, Method Statements must be developed indicating how impacts during the construction and operational period will be minimised and managed. This must include recommendations for dealing with and rehabilitating all compacted areas or areas where flow has been diverted, concentrated or drained. Method Statements must include construction and rehabilitation management and monitoring plans;
- Seasonality must be considered as part of the construction phase of any development, whether mining or other, in order to minimise the risk to the hydrology of the wetland systems as well as to prevent excessive sediment and debris being washed into wetland areas;
- No threatened flora should be collected or harvested from wetlands and no fauna, especially threatened fauna, should be hunted or poached from wetlands. Search and rescue plans for fauna and flora must form part of any WUL application;

- Wetland protection, rehabilitation and monitoring measures must be incorporated into mine closure plans as part of decommissioning and closure planning and related activities;
- No equipment including vehicles should be washed in streams, rivers and/or wetlands, and if washing facilities are provided, these must be placed outside of the buffer zones applicable to the wetlands and/or watercourses and designed so as not to impact the wetlands and streams, in terms of both water quality and quantity/flow;
- No abstraction of water from wetlands, streams and rivers should be allowed, unless specifically authorized in terms of the WUL;
- It is recommended that prior to any new mining activities taking place, suitable clean and dirty water diversion/separation and storage facilities be put in place to deal with possible AMD and prevent contamination of the wetlands, streams and rivers adjacent to and downstream of the mining operation. Clean and dirty water areas must be separated and no contaminated water should come into contact with clean water areas including wetlands, streams and rivers. Clean water should ideally be conveyed in natural systems or where this is not possible, in environmentally engineered or natural channels rather than cement lined canals, other hard structures, pipes or excavated trenches. Discharge points into the environment should be protected against erosion and designed to disperse flow and be subjected to regular maintenance;
- The likelihood of decant, whether from opencast or underground mining, as well as its expected location, quantity and quality should be determined and measures put in place to ensure that any such decant meets the resource quality objectives for the Wilge River catchment. As a minimum, any discharge water should meet the catchment standards as indicated in applicable Preliminary Reserves, EMP's, WUL's and other relevant authorisations. The risk to the receiving environment in terms of water quality, flow modification, erosion and biological effects must be established and assessed and appropriate mitigation put in place to deal with these;
- Where the water quality RQO's and/or water quality discharge requirements are exceeded, contaminated water will need to be treated. In this regard it is recommended that suitably designed water treatment plants (which could be passive systems as and when the technology allows) be established and that water levels within the mined out areas are actively managed post-mining to ensure decant is prevented and no contaminated water is discharged into the environment untreated. It is important to ensure financial and logistical capacity for long-term maintenance of treatment or infrastructural requirements to protect wetland and river systems from water quality impacts resulting from mine water contamination;
- No mine contaminated water should be allowed to enter wetlands and mechanisms must be put in place to protect wetlands from any form of mine-related contamination;
- Flow supplementation from water treatment plants to affected wetlands is recommended in all cases where there is an indirect loss of wetland functioning as a result of mining. This must be implemented according to a flow management plan which includes specific design and wetland protection measures, a schedule for the releases as well as a provision for adaptive management informed by monitoring;
- Where clean water is discharged into the environment from water treatment or from infrastructure such as detention facilities, suitably designed and appropriate -erosion protection measures should be put in place;

- Methods should be put in place to limit the amount of water entering mining voids which will further reduce the risks of long-term decant into adjacent and downstream/affected wetlands;
- Should mitigation, via supplementation of the flows that will be lost in the affected wetlands, be unachievable resulting in a residual impact associated with the decrease in the health or PES of the wetland systems, measures must be put in place to offset the entire, or part of, the net loss expected. This must take into account both wetland functional and ecosystem conservation hectare equivalents;
- Similarly, where there is a residual impact associated with the direct loss of wetland systems, measures must be put in place to offset the entire, or part of, the net loss expected. This applies to mining-related as well as other developments. This can be achieved through a Wetland Offset or Rehabilitation Strategy. This must include the rehabilitation, protection, management and monitoring of remaining or other wetlands to achieve a suitable functional hectare equivalent target and certain ecosystem conservation targets recommended by the authorities. Wetland rehabilitation activities should be targeted to try to achieve a net gain in functional hectare equivalents. The draft SANBI Wetland Offsetting Guidelines (SANBI and DWS, 2014) or any updated revision of this approach/document should be used to guide the process of offsetting;
- A monitoring programme must be developed to monitor the condition/health/state of any wetlands affected by a proposed development. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. Any such monitoring strategy must be developed by a suitably qualified specialist and submitted to the DWS for review and approval. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- For pans affected by a proposed development, and particularly a mining development, it is recommended that monitoring of pan water chemistry be conducted according to a specified schedule and for certain key elements including, but not limited to: pH; Electrical Conductivity; Total Dissolved Solids; Total Alkalinity as $CaCO3$; Sodium; Calcium; Magnesium; Sulphate; Iron; Chloride; Potassium; Magnesium; Manganese; Aluminium; Phosphorous; Silica; Ammonia; Nitrate; and Fluoride. An independent water laboratory should be used to conduct the analyses and records should be maintained for inspection by the DWS. If there are any signs of deterioration in water quality or contamination of any pan during monitoring, then the Regional Office of the DWS must be informed together with an indication of the probable cause and time span associated with the water quality problem. Mitigation measures will also need to be indicated in order to remedy the situation in the case of water quality deterioration resulting from the development. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- Similarly, for pans affected by a proposed development, and particularly a mining development, it is recommended that Macroinvertebrates and diatoms should be monitored according to a specified schedule. The monitoring must be conducted by a suitably qualified specialist and the results of the monitoring (monitoring reports) must form part of the reporting

requirements in the WUL;

- A groundwater monitoring programme should be established in order to monitor groundwater quality and groundwater level changes up- and downstream of any proposed mining project/operation. This must be designed to include both the shallow and deeper aquifer systems separately, and include water quality and quantity according to a specified schedule. For deeper aquifer systems, this should include as a minimum, the recording of daily pit dewatering rates, and monthly sampling and analysis of major and trace elements of pumped water. As part of this groundwater monitoring programme, changes of shallow groundwater levels in wetlands (where groundwater effects may be expected as a result of the proposed mining operation), must be monitored. The monitoring must be conducted by a suitably qualified specialist and the results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL;
- The monitoring of important biota may also be relevant to a particular development, especially where endangered animal species occur in the wetlands. Records should be kept of sightings in order to help establish whether or not the wetland management practices and rehabilitation efforts are having a positive impact on these species and where appropriate, the local district conservation officer should be contacted to obtain further information on monitoring of important species;
- Where water quality impacts are expected in wetlands, water quality must be regularly monitored according to an appropriate protocol that will need to be put in place based on a regular schedule and for recommended variables. The monitoring plan must include a provision for appropriate and timeous remedial interventions in the case of non-compliance. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL; and
- Water quality monitoring must be undertaken in accordance with the Water Quality Ecospecs where these are available for a particular development application. Records should be maintained for inspection by the DWS. If any measured value exceeds the RWQOs (95th percentile) included in the Water Use Licence, then the Regional Office of the DWS shall be informed together with an indication of the probable cause and time span of the exceedance. Mitigation measures will also need to be indicated in order to remedy the situation in the case of exceedance or non-compliance. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL.

Impacts on wetlands due to commercial forestry activities should be managed and strictly controlled to minimize damage to the wetlands and therefore to their functioning. All WUL applications related to the above should clearly demonstrate application of the mitigation hierarchy (DEA et al., 2013). Where impacts on wetlands occur, whether direct or indirect, mitigation must be implemented to minimise the effects on wetland functioning. Mitigation requirements must consider the following:

- Suitable hydrological and ecological buffer zones around wetlands should be determined and implemented. Where existing plantations infringe on wetlands or their buffer zones, these should be withdrawn;
- An alien vegetation management plan must be developed and implemented. Invasive alien species should be targeted, especially those with high water utilisation. The management plan should make provision for follow-up work to prevent re-establishment and should also prioritise

areas where forestry has been recently withdrawn from wetland areas or their associated buffer zones;

- A fire management plan for wetlands and their buffers must be developed and implemented;
- Where roads or any other infrastructure or servitude crosses or impacts a wetland, Method Statements must be developed indicating how impacts during the construction and operational period will be minimised and managed. This must include recommendations for dealing with and rehabilitating all compacted areas or areas where flow has been diverted, concentrated or drained. Method Statements must include construction and rehabilitation management and monitoring plans; and
- A monitoring programme must be developed to monitor the condition/health/state of any wetlands affected by a proposed development. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. Any such monitoring strategy must be developed by a suitably qualified specialist and submitted to the DWS for review and approval. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL.

5.10 Olifants IUA 8 - Spekboom Catchment

IUA 8 covers the Spekboom catchments and includes the towns of Mashishing (Lydenburg) and Burgersfort. Several protected areas occur within the IUA and include the Sterkspruit and Gustav Klingbiel Nature Reserves. Landuse consists of mostly dryland cultivation and livestock grazing, though platinum mining occurs in the north around Burgersfort.

Although wetland mapped extent in the IUA is generally low, a number of FEPA wetlands occur in the upper reaches of quaternary catchment B42F and feed into the Potspruit and Waterval Rivers (B42F). These wetlands have been included as priority wetlands and are illustrated in **Figure 11** and further detailed in **Table 7**.

Table 7: Summary of FEPA wetlands within the priority wetland catchments identified in Olifants IUA 8 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B42F									
	Channelled Valley bottom	A/B -C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6 - LT	Dullstroom Plateau Grasslands - En	Yes		
	Hillslope seepage wetlands	A/B - D (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic Highveld Grassland Group 6 - LT	Dullstroom Plateau Grasslands - En	Yes		

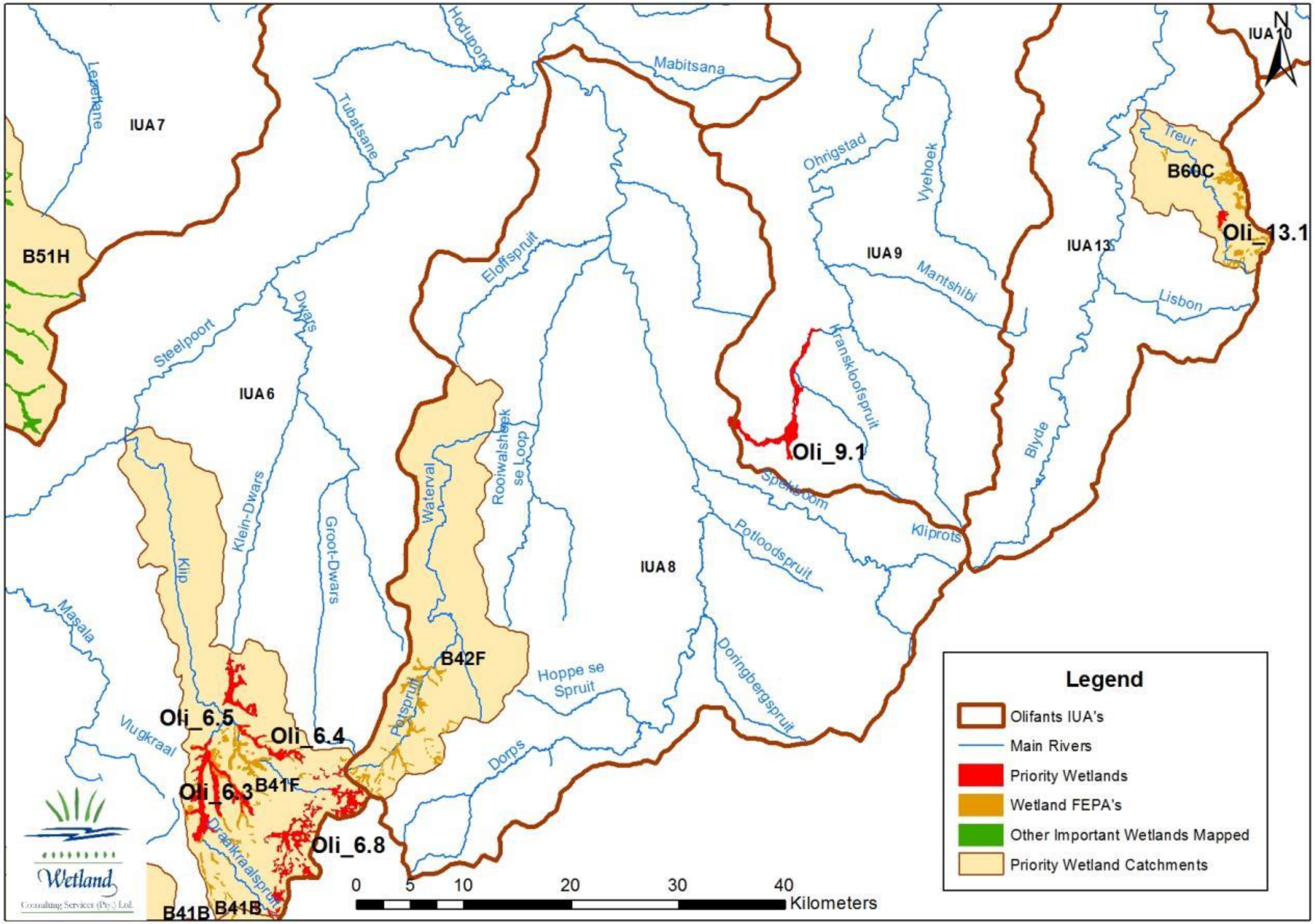

Figure 11: Map showing priority wetland catchments and FEPA wetlands within Olifants IUA 8

5.10.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The selected priority wetlands are located within a mostly agriclutural setting. Existing impacts are likely to persist. Developments within and adjacent to these systems pose a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of impoundments and abstraction, as well as changes to hydrology due to changes in landuse within the catchment, typically agricultural activities and increases in hardened surfaces within the catchment (including urbanisation).

5.10.2 Recommended Protection, Management and Monitoring Requirements for Priority Catchments

The wetland FEPA's need to be validated to confirm their PES, EIS and REC. Any development applications in these areas need to take cognisance of the presence and importance of these wetlands. Such development applications will need to be accompanied by detailed baseline wetland assessment reports that include the determination of the PES, EIS and REC of the affected wetlands, as well as an impact assessment that clearly demonstrates application of the mitigation hierarchy (DEA et al., 2013). The presence of important faunal and floral species in a number of wetlands in especially the upper reaches of the IUA also requires that these aspects be addressed in any development application.

For validated FEPA wetlands that do not meet the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS), it is recommended that rehabilitation plans are developed and implemented in consultation with an appropriate implementer such as Working for Wetlands, in consultation/collaboration with the local community. The plans should address cultivation, erosion/headcutting and overgrazing in these systems and make provision, not only for structural interventions, but also the development of grazing management plans for the systems and their catchments.

5.11 Olifants IUA 9 - Ohrigstad River Catchment area

The Ohrigstad River Catchment area stretches from the headwaters of the Ohrigstad River to its confluence with the Blyde River in the Blydepoort Dam. The Ohrigstad Dam also falls within this IUA.

Two priority wetlands identified during the previously compiled Resource Unit Prioritisation Report (DWS, 2014) occur within this IUA, the Kranskloofspruit tributary wetland in quaternary catchment B60F and the Ohrigstad floodplain wetland in B60H.

The Kranskloofspruit tributary wetland is an unusually large unchannelled valley bottom wetland (DWS, 2014) and is considered important in ameliorating impacts to water quality from surrounding agricultural impacts. The Ohrigstad floodplain wetland is a heavily degraded FEPA wetland which was prioritised as an indicator wetland for the IUA and for water quality enhancement (DWS, 2014). The Ohrigstad valley is intensively cultivated, mostly under irrigation, with irrigation return flows impacting on water quality. Both these wetlands are illustrated in **Figure 12** and detailed in **Table 8**.

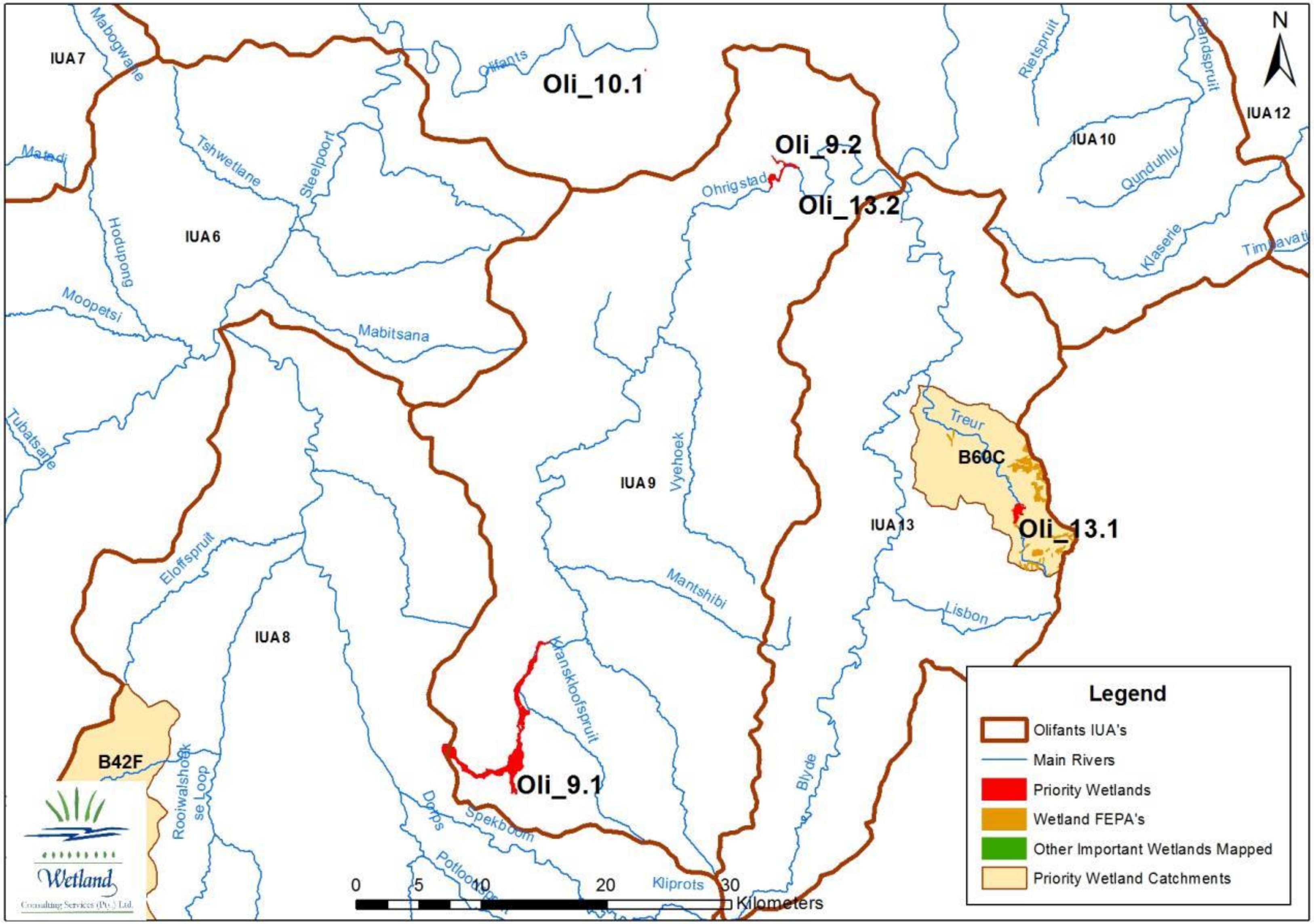

Figure 12: Map showing priority wetlands within Olifants IUA 9.

Table 8: Summary of priority wetlands identified in Olifants IUA 9 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B60F									
Oli_9.1 Krankloofspruit tributary	Channelled valley bottom	C (Nel et al., 2011)	Moderate (desktop)	C	Mesic Highveld Grassland Group 7 - **EN**	No	No	This is an unusually large unchannelled valley bottom wetland located in the upper reaches of this IUA. Despite significant impacts, the wetland was to ameliorate impacts from agricultural activities (DWS, 2014a).	
B60H									
Oli_9.2 Ohrigstad wetland	Channelled valley bottom	C (Nel et al., 2011)	Likely to be High to Very High (B4 Olifants PESEIS 2011)	B	Central Bushveld Group 1 - **CR**	No	Yes	While identified as a wetland FEPA, this floodplain system has been heavily degraded by subsistence cultivation. Few wetlands are located in this IUA however, and given the anticipated water quality impacts associated with agricultural use upstream, this wetland was prioritized for water quality enhancement (DWS, 2014a).	

5.11.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The selected priority wetlands are located within a mostly agriclutural setting. Existing impacts are likely to persist.

Developments within and adjacent to these systems pose a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of impoundments and abstraction, as well as changes to hydrology due to changes in landuse within the catchment, typically agricultural activities and increases in hardened surfaces within the catchment (including urbanisation).

5.12 Olifants IUA 10 - Lower Olifants

The extent of wetlands within this IUA is low, with few wetlands mapped. A single wetland is proposed for prioritisation, the tufa waterfall along the Abel Erasmus Pass. This is a waterfall composed of limestone or calcium carbonate formed by the precipitation of carbonate minerals. It is a very rare type of waterfall in South Africa and as such can be considered as having a Very High EIS.

The tufa waterfall (photo in **Figure 13**) occurs along the Tswenyane River, a minor perennial tributary of the Olifants mainstem. The Tswenyane River and associated tufa waterfall is supported by groundwater discharge from dolomite. Any increase in groundwater abstraction could therefore be a threat to the tufa waterfall. (**Figure 14** and **Table 9**).

Figure 13: Photograph of the Abel Erasmus Pass tufa waterfall (Tswenyane River).

Table 9: Summary of priority wetlands identified in Olifants IUA 10 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B71G									
Oli_10.1 Tufa waterfall	Tufa waterfall	B	Very High	A/B	Lowveld Group 3 - **CR**	No	No	Tufa waterfall. Cultural importance	

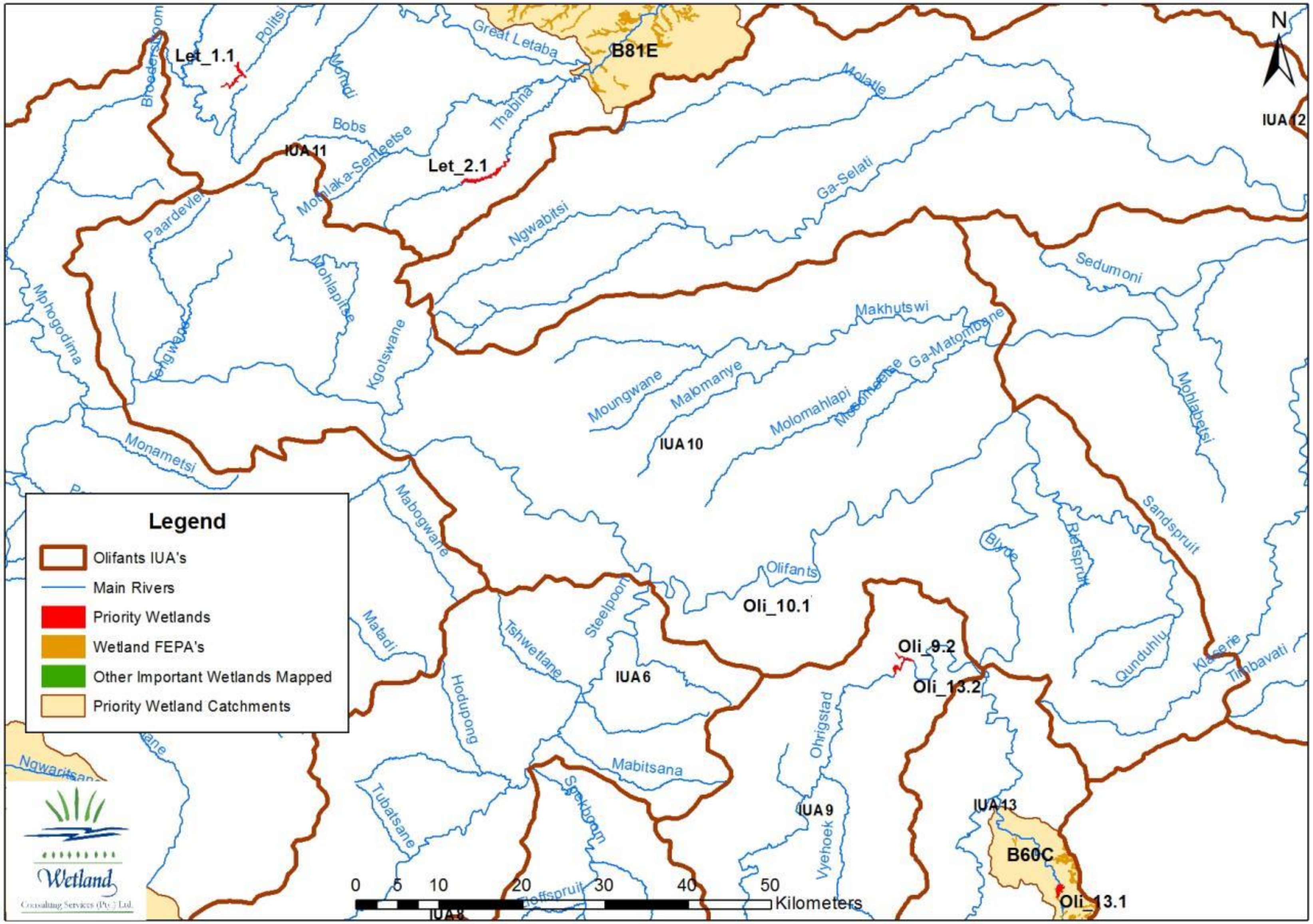

Figure 14: Map showing priority wetlands within Olifants IUA 10.

5.12.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

Possible groundwater and surface water abstraction as well as pollution of the stream and/or groundwater poses a possible risk to this system. Measures must be investigated to limit water contamination in the vicinity of the eye/spring by livestock due to the potential health hazards of elevated nitrate levels in drinking water. Possible contamination of the groundwater may also occur as a result of septic tanks and long drops in the vicinity of the associated stream and spring/eye. Being from a dolomitic source, the water quality in the system is expected to be good (of high quality) and as such should be maintained as such.

5.13 Olifants IUA 13 - Blyde River Catchment area

This IUA is located along the western edge of the northern escarpment. The Blyde and Treur Rivers drain the IUA, which has the Blydepoort Dam and Motlatse River Canyon located at its downstream end.

Both the Blyde and Treur Rivers are considered to be in good condition and the IUA has been classified as Class 1. Although few wetlands are mapped within the IUA, the wetlands located along the upper edge of the catchment likely contribute to maintaining the good quality water within the rivers.

A number of FEPA wetlands occur along the eastern edge of the IUA. These systems drain in a westerly direction away from the escarpment edge in the area north of God's Window. Numerous peat wetlands are known to occur here, including the Treur wetland, which has been selected as a priority wetland. These wetlands are threatened by forestry, which is the dominant landuse in this part of the IUA (photos in **Figure 16**). Identified priority wetlands are illustrated in **Figure 15** and further detailed in **Table 10**.

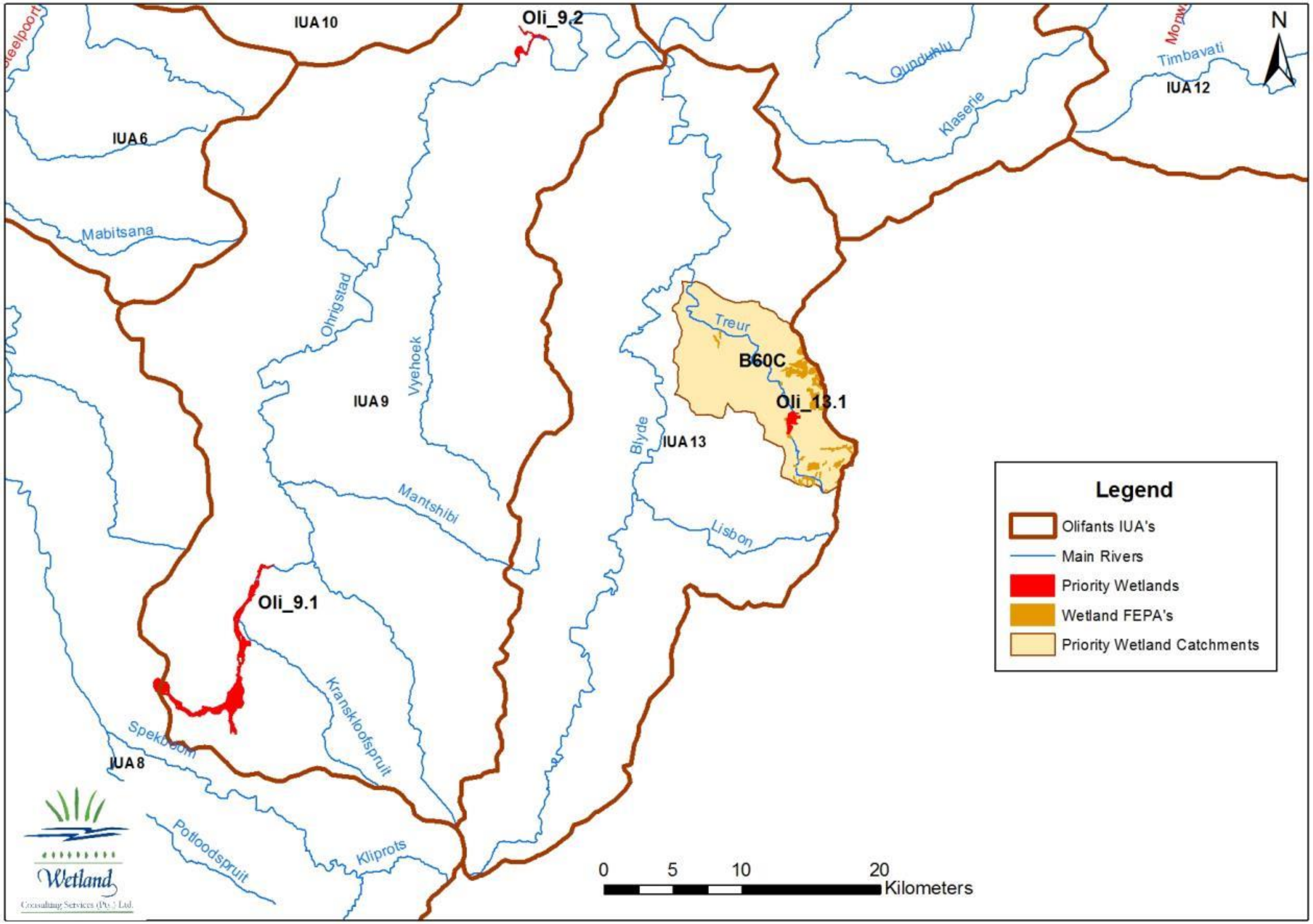

Figure 15: Map showing priority wetlands as well as priority catchments and associated FEPA wetlands within Olifants IUA 13

Table 10: Summary of priority wetlands and FEPA wetlands within the priority wetland catchments identified in Olifants IUA 13 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B60C									
Oli_13.1 Treur wetland	Hillslope seepage; Channelled valley bottom	C 9Nel et al., 2011)	Likely to be Very High (B4 Olifants PESEIS 2011)	A/B	Mesic highveld grassland group 9 - LT	Blyde quartzite grassland - EN	Yes	The wetland and associated biota are threatened by existing forestry & proposed future mining activities.	This is an important peatland system. The associated river supports the endemic treur river barb (*barbus treurensis*) which has an extremely limited distribution.
	Channelled valley bottom	A/B-C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic highveld grassland group 9 - LT	Blyde quartzite grassland - EN	Yes		
	Hillslope seepage wetlands	A/B-C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Mesic highveld grassland group 9 - LT	Blyde quartzite grassland - EN	Yes		Some systems contain peat
B60D									
Oli 13.2 Kadishi waterfall	Tufa waterfall	A/B	Very High	A/B	Lowveld group 3 - CR	No	No	Tufa waterfall Motlatse canyon nature reserve	Tufa waterfall

Figure 16: Photographs showing wetlands of the area. Note the forestry and erosion impacts

5.13.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The bulk of the identified priority wetlands within Olifants IUA 13 are located within the boundaries of the Blyde River Canyon Nature Reserve. The bulk of the priority wetlands are therefore formally protected and the threats to these systems are limited. A number of priority wetlands do however extend into adjacent areas utilised for commercial forestry. The occurrence of peat within these wetlands indicates the discharge of groundwater and/or the presence of a shallow groundwater table. The wetlands are therefore sensitive to lowering of the shallow groundwater table through activities such as groundwater abstraction, commercial forestry and alien vegetation. Incision brought about by flow concetration (e.g. from linear infrastructure developments, including roads) is a further risk.

For the tufa waterfall, possible groundwater and surface water abstraction as well as pollution of the stream and/or groundwater poses a possible risk to this system. Being from a dolomitic source, the water quality in the system is expected to be good (of high quality) and as such should be maintained as such. The waterfall is located within the Blyde River Canyon Nature Reserve and as such is located within a formal protected area.

5.13.2 Recommended Protection, Management and Monitoring Requirements

A monitoring programme must be developed to monitor the condition/health/state of a selected sample of wetlands. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. For impacted systems that do not meet the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS), it is recommended that rehabilitation plans are developed and implemented for these systems in consultation with an appropriate implementer such as Working for Wetlands, in consultation/collaboration with the relevant conservation authority and/or landowner.

Impacts on wetlands due to commercial forestry activities should be managed and strictly controlled to minimize damage to the wetlands and therefore to their functioning. All WUL applications related to the above should clearly demonstrate application of the mitigation hierarchy (DEA et al., 2013). Where impacts on wetlands occur, whether direct or indirect, mitigation must be implemented to minimise the effects on wetland functioning. Mitigation requirements must consider the following:

- Suitable hydrological and ecological buffer zones around wetlands should be determined and implemented. Where existing plantations infringe on wetlands or their buffer zones, these should be withdrawn;
- An alien vegetation management plan must be developed and implemented. Invasive alien species should be targeted, especially those with high water utilisation. The management plan should make provision for follow-up work to prevent re-establishment and should also prioritise areas where forestry has been recently withdrawn from wetland areas or their associated buffer zones;
- A fire management plan for wetlands and their buffers must be developed and implemented;
- Where roads or any other infrastructure or servitude crosses or impacts a wetland, Method Statements must be developed indicating how impacts during the construction and operational period will be minimised and managed. This must include recommendations for dealing with and rehabilitating all compacted areas or areas where flow has been diverted, concentrated or drained. Method Statements must include construction and rehabilitation management and monitoring plans; and
- A monitoring programme must be developed to monitor the condition/health/state of any wetlands affected by a proposed development. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. Any such monitoring strategy must be developed by a suitably qualified specialist and submitted to the DWS for review and approval. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL.

5.14 Letaba IUA's 1, 2, & 3

Letaba IUA's 1, 2, and 3 represent the upper catchment of the Letaba River and include the regionally important economic centre of Tzaneen. The large Tzaneen Dam is also located within this area.

Landuse varies from plantation forestry in the higher-lying western parts, with the lower-lying eastern parts characterised by rural villages and subsistence agriculture in some areas, and intensive commercial agriculture under irrigation in others.

A number of additional wetlands were mapped in this area and included as priority catchments for various reasons. With quaternary catchments B81A and B41B large valley bottom wetland systems located upstream of the Ebenezer and Tzaneen dams respectively were selected due to the role these wetlands can play in maintaining or improving water quality entering the dams. Both these wetlands are located in forestry areas and have been impacted by reduced flows and alien vegetation invasions.

Within quaternary catchment B81D a valley bottom wetland was mapped along the Thabina River upstream of the FEPA wetland. This wetland is located in a rural setting and is extensively utilised for subsistence agriculture and livestock grazing. The provisioning services provided by this wetland are considered to be important, while the wetland is also well place to improve water quality from impacts associated with urban runoff. The wetland has therefore been included as a priority wetland.

A large number of FEPA wetlands are located in quaternary B81E, resulting in this quaternary catchment being selected as a priority wetland catchment (**Figure 17** and **Table 11**). Little information is however available on these FEPA wetlands.

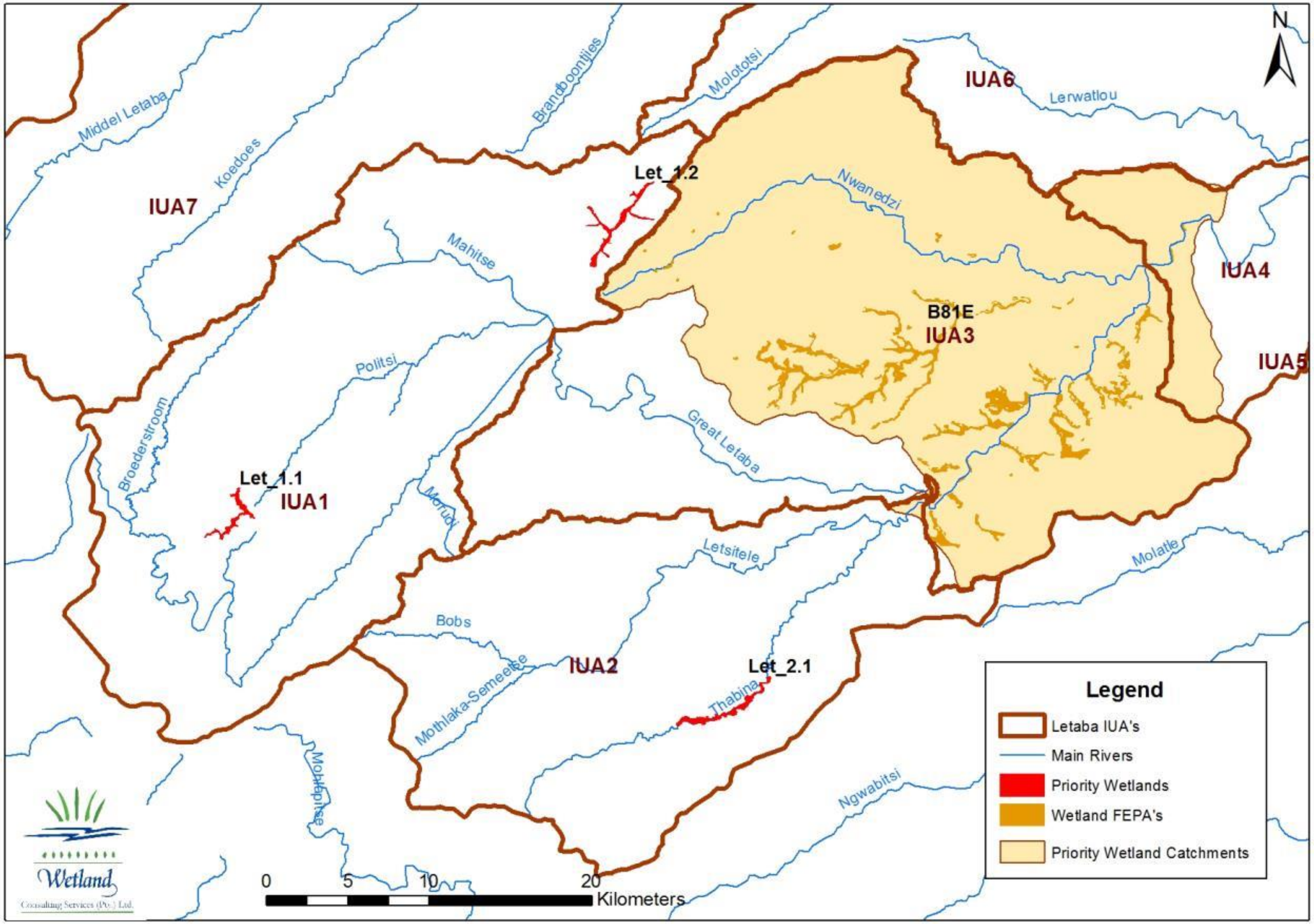

Figure 17: Map showing priority wetlands as well as priority catchments and associated FEPA wetlands within Letaba IUA's 1, 2, and 3.

Table 11: Summary of priority wetlands and FEPA wetlands within the priority wetland catchments identified in Letaba IUA's 1, 2, and 3 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B81A									
Let_1.1 Stanford wetland	Floodplain	D	Moderate	C					
B81B									
Let_1.2 Tzaneen dam wetland	Unchannelled valley bottom; Channelled valley bottom	D/E	Moderate	C/D	Lowveld Group 7 – **CR**	Tzaneen Sour Bushveld – **VU**	No		
B81D									
Let_2.1 Thabina wetland	Channelled Valley bottom	C	High	B	Lowveld Group 7 – **CR** Lowveld Group 3 - **CR**	No	Some of them		
B81E									
	Channelled valley bottom	Mostly C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Lowveld Group 3 – **CR**	Tzaneen Sour Bushveld – **VU**	Yes		
	Unchannelled valley bottom	Mostly C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Lowveld Group 3 – **CR**	Tzaneen Sour Bushveld – **VU**	Yes		
	Hillslope seepage wetlands	Mostly C (Nel, et.al., 2011)	Specific to individual systems	Specific to individual systems	Lowveld Group 3 – **CR**	Tzaneen Sour Bushveld – **VU**	Yes		

5.14.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

The selected priority wetlands are located within a mostly agricultural setting, though numerous extensive rural townships occur. Existing impacts are likely to persist. Developments within and adjacent to these systems pose a risk to remaining systems. Direct transformation of wetland habitat and resultant loss of wetland biota can occur due to cultivation, overgrazing, conversion to planted pastures and invasion by alien vegetation. Flow related impacts occur as a result of impoundments and abstraction, as well as changes to hydrology due to changes in landuse within the catchment, typically agricultural activities and increases in hardened surfaces within the catchment (including urbanisation). The systems are expected to continue to deteriorate unless rehabilitation and management interventions are implemented. Stormwater management and waste water management is also likely to require attention in the future as the peri-urban and urban development expands around these systems.

5.14.2 Recommended Protection, Management and Monitoring Requirements

The wetland FEPA's need to be validated to confirm their PES, EIS and REC. Any development applications in these areas need to take cognisance of the presence and importance of these wetlands. Such development applications will need to be accompanied by detailed baseline wetland assessment reports that include the determination of the PES, EIS and REC of the affected wetlands, as well as an impact assessment that clearly demonstrates application of the mitigation hierarchy (DEA et al., 2013). The presence of important faunal and floral species in a number of wetlands in the area (e.g. cranes) also requires that these aspects be addressed in any development application.

For validated FEPA wetlands that do not meet the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS), it is recommended that rehabilitation plans are developed and implemented in consultation with an appropriate implementer such as Working for Wetlands, in consultation/collaboration with the local community. The plans should address cultivation, erosion/headcutting and overgrazing in these systems and make provision, not only for structural interventions, but also the development of grazing management plans for the systems and their catchments.

Impacts on wetlands due to commercial forestry activities should be managed and strictly controlled to minimize damage to the wetlands and therefore to their functioning. All WUL applications related to the above should clearly demonstrate application of the mitigation hierarchy (DEA et al., 2013). Where impacts on wetlands occur, whether direct or indirect, mitigation must be implemented to minimise the effects on wetland functioning. Mitigation requirements must consider the following:

- Suitable hydrological and ecological buffer zones around wetlands should be determined and implemented. Where existing plantations infringe on wetlands or their buffer zones, these should be withdrawn;
- An alien vegetation management plan must be developed and implemented. Invasive alien species should be targeted, especially those with high water utilisation. The management plan should make provision for follow-up work to prevent re-establishment and should also prioritise areas where forestry has been recently withdrawn from wetland areas or their associated buffer zones;

- A fire management plan for wetlands and their buffers must be developed and implemented;
- Where roads or any other infrastructure or servitude crosses or impacts a wetland, Method Statements must be developed indicating how impacts during the construction and operational period will be minimised and managed. This must include recommendations for dealing with and rehabilitating all compacted areas or areas where flow has been diverted, concentrated or drained. Method Statements must include construction and rehabilitation management and monitoring plans; and
- A monitoring programme must be developed to monitor the condition/health/state of any wetlands affected by a proposed development. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. Any such monitoring strategy must be developed by a suitably qualified specialist and submitted to the DWS for review and approval. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. The results of the monitoring (monitoring reports) must form part of the reporting requirements in the WUL.

5.15 Letaba IUA 9

A single wetland was selected as a priority wetland from this IUA, the Baleni hot spring (photo in **Figure 18**). This is one of only a few remaining undeveloped hot springs in the Olifants/Letaba System. The spring maintains a water temperature of around 42 degrees and supports a peat dome. Flow from the spring also supports small pools of water within the adjacent Klein-Letaba River. These pools were observed to support fish.

The spring is understood to be of spiritual significance, and is also used by local women for salt harvesting. Salt harvesting is undertaken during the winter dry season when salt crystals form due to evaporation of water.

At the time of the site visit in early 2016, the spring and downslope wetland was heavily trampled and grazed by livestock, with some signs of erosion evident.

Given the uniqueness and cultural significance of the spring, this wetland was selected as a priority wetland.

The location of the hot spring is illustrated in **Figure 19,** with further details provided in **Table 12**.

Figure 18: Photographs of the Baleni hot spring.

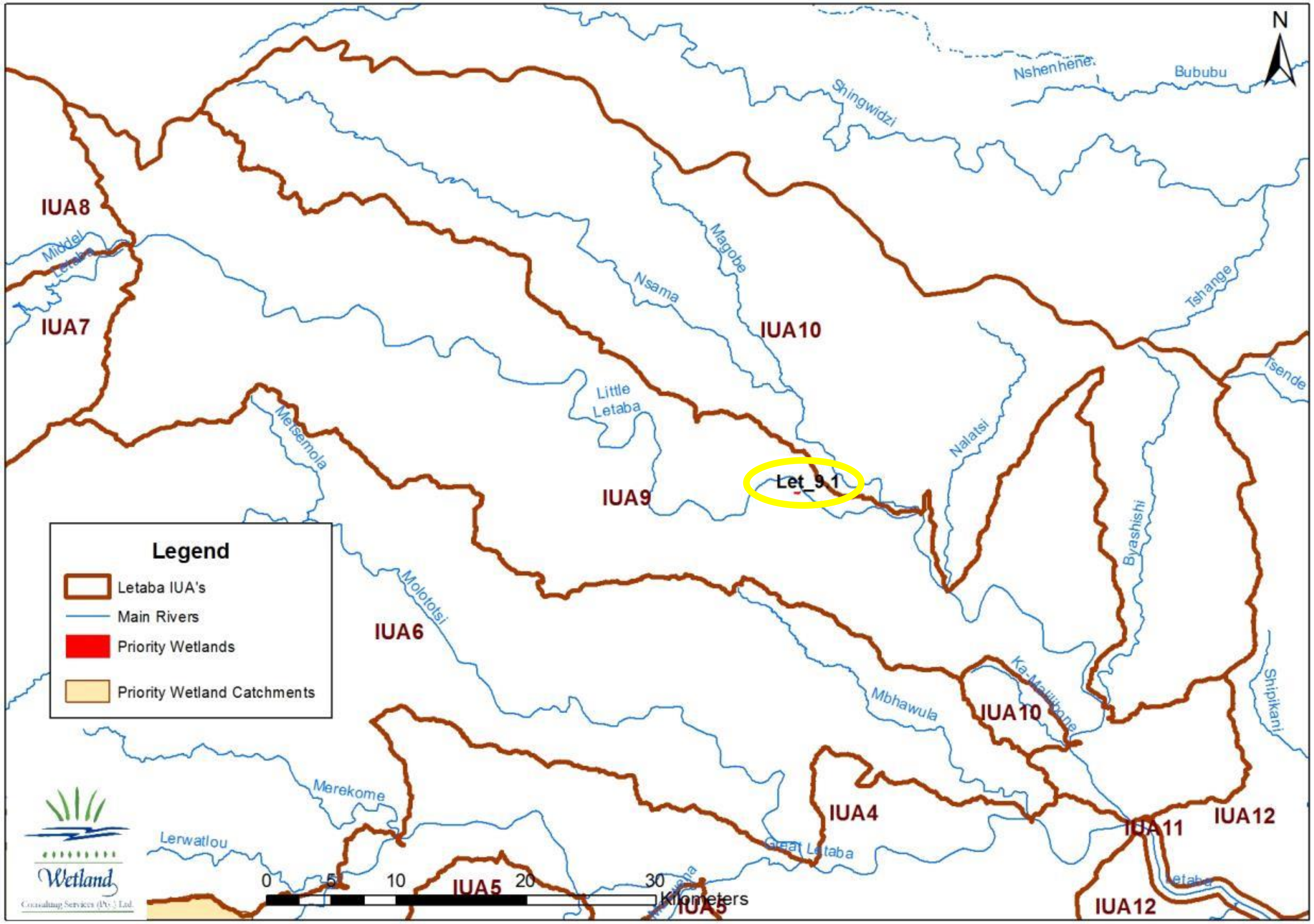

Figure 19: Map showing priority wetlands within Letaba IUA 9.

Table 12: Summary of priority wetlands identified in Letaba IUA 9 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B82G									
Let_9.1 Baleni	Thermal spring	B	Very High	A/B	Mopane Group 4 –	No	No	Thermal spring with peat. Cultural importance	Peat; Cultural importance; Salt harvesting

5.15.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

Main risk to this system is likely to be groundwater abstraction. Being a spring, groundwater abstraction could potentially pose a high risk to the system.

5.16 Letaba IUA 12

The bulk of this IUA falls within the Kruger National Park and can therefore be considered largely intact.

Existing wetland coverage for the area from Nel *et al*. (2011) is sparse and was found to represent a considerable underestimate of wetland extent, especially within the eastern sections of the catchment where a number of additional wetland systems were identified. Also located in this area is the Nshawu vlei, a well-known Kruger National Park wetland system and FEPA wetland.

The general wetland systems found in the northern Kruger National Park areas are located on basalt. The basalt areas are generally very flat in nature and characterised by fairly clayey soils with a vegetation cover dominated by low mopani woodland. Wetlands occur mostly as channelled or unchannelled valley bottom systems in slightly lower lying areas where water accumulates (**Figure 21**). These systems are expected to be surface water driven, with the clay soils allowing for limited lateral seepage of water through the soil profile and groundwater expected to be too deep to impact on the wetlands, though some wetlands that show increased and extended wetness hint at possible groundwater inputs.

Soils derived from these basalts have a high concentration of exchangeable sodium. Large amounts of sodium influences the physical properties of the soil, such as soil structure. Sodium changes the aggregate structure of the soil from preventing the particles to clump together changing the porosity of the soil. Particles are dispersed and result in clay particles losing their tendency to stick together when wet which eventually leads to unstable soils exposed to dangers of erodibility and or impermeable sheet like layers for both water and roots. This is evidenced in highly eroded sodic areas associated with the verges of most of the wetlands in this area.

Identified priority wetlands are illustrated in **Figure 20** and further detailed in **Table 13**.

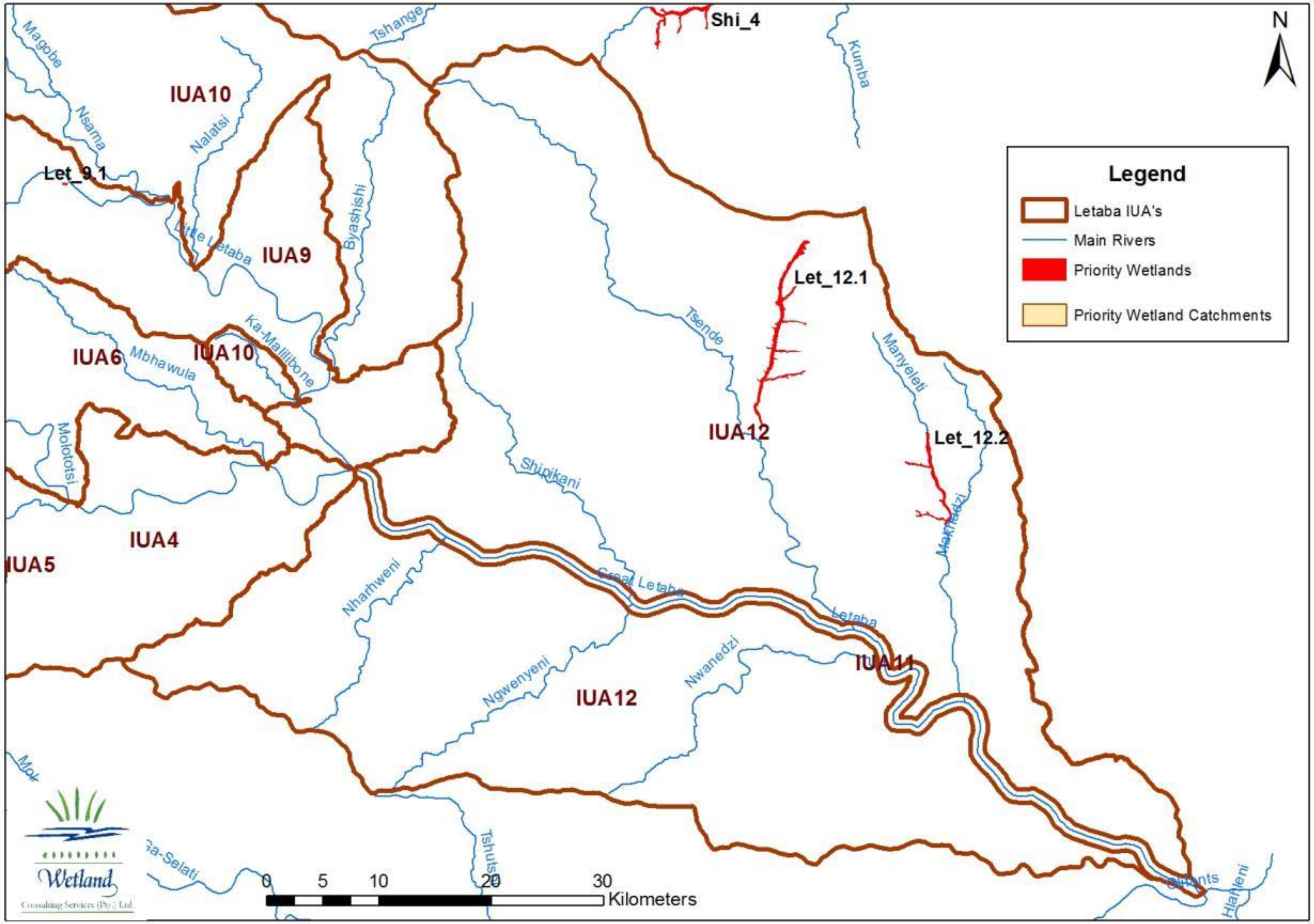

Figure 20: Map showing priority wetlands within Letaba IUA 12

Table 13: Summary of priority wetlands identified in Letaba IUA 12 indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B83C									
Let_12.1 Nshawu	Unchannelled valley bottom; Channelled valley bottom	C	High	B	Mopane Group 3 – LT	No	Some of them	Kruger National Park	

Figure 21: Photographs of typical wetland systems found on basalts in northern Kruger

5.16.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

All of the identified priority wetlands within Letaba IUA 12 are located within the boundaries of the Kruger National Park. All of the priority wetlands are therefore formally protected. Despite this, a number of the wetlands show signs of degradation, and it can be assumed that such degradation could continue.

For valley bottom wetlands, impacts are related to channel incision resulting from flow concentration (including from road crossings and dams) and erosion nick-points, some of which are likely related to bioturbation (utilisation of wetlands by animals). It is thought that these wetlands could also be sensitive to changes in shallow groundwater levels and thus be sensitive to groundwater abstraction. Overutilisation of wetland habitat by animals also occurs were formal water points are located within or in close proximity to these wetland areas (e.g. Mooiplaas waterhole).

5.17 Shingwedzi Catchment

The bulk of the Shingwedzi catchment is located within the boundaries of the Kruger National Park and is therefore largely intact and characterised by natural vegetation. The upper reaches outside the Kruger National Park boundaries are dotted with rural villages and characterised by rural subsistence agriculture and livestock grazing.

Existing wetland coverage for the area from Nel *et al*. (2011) is sparse and was found to represent a considerable underestimate of wetland extent, especially within the eastern sections of the catchment where a number of additional wetland systems were identified.

The general wetland systems found in the northern Kruger National Park areas are located on basalt. The basalt areas are generally very flat in nature and characterised by fairly clayey soils with a vegetation cover dominated by low mopani woodland. Wetlands occur mostly as channelled or unchannelled valley bottom systems in slightly lower lying areas where water accumulates. These systems are expected to be surface water driven, with the clay soils allowing for limited lateral seepage of water through the soil profile and groundwater expected to be too deep to impact on the wetlands, though some wetlands that show increased and extended wetness hint at possible groundwater inputs.

Soils derived from these basalts have a high concentration of exchangeable sodium. Large amounts of sodium influences the physical properties of the soil, such as soil structure.

Sodium changes the aggregate structure of the soil from preventing the particles to clump together changing the porosity of the soil. Particles are dispersed and result in clay particles losing their tendency to stick together when wet which eventually leads to unstable soils exposed to dangers of erodibility and or impermeable sheet like layers for both water and roots. This is evidenced in highly eroded sodic areas associated with the verges of most of the wetlands in this area.

Two spring mires also occur within the Shingwedzi Catchment within the boundaries of the Kruger National Park, the Malahlapanga (**Figure 22**) and Mafiyeni spring mires. Both these springs are geo-thermal in nature and support peat domes. These wetlands have been studied by Grootjans et al. (2010).

Figure 22: Photographs of the Malahlapanga spring mire.

Identified priority wetlands are illustrated in **Figure 23** and further detailed in **Table 14**.

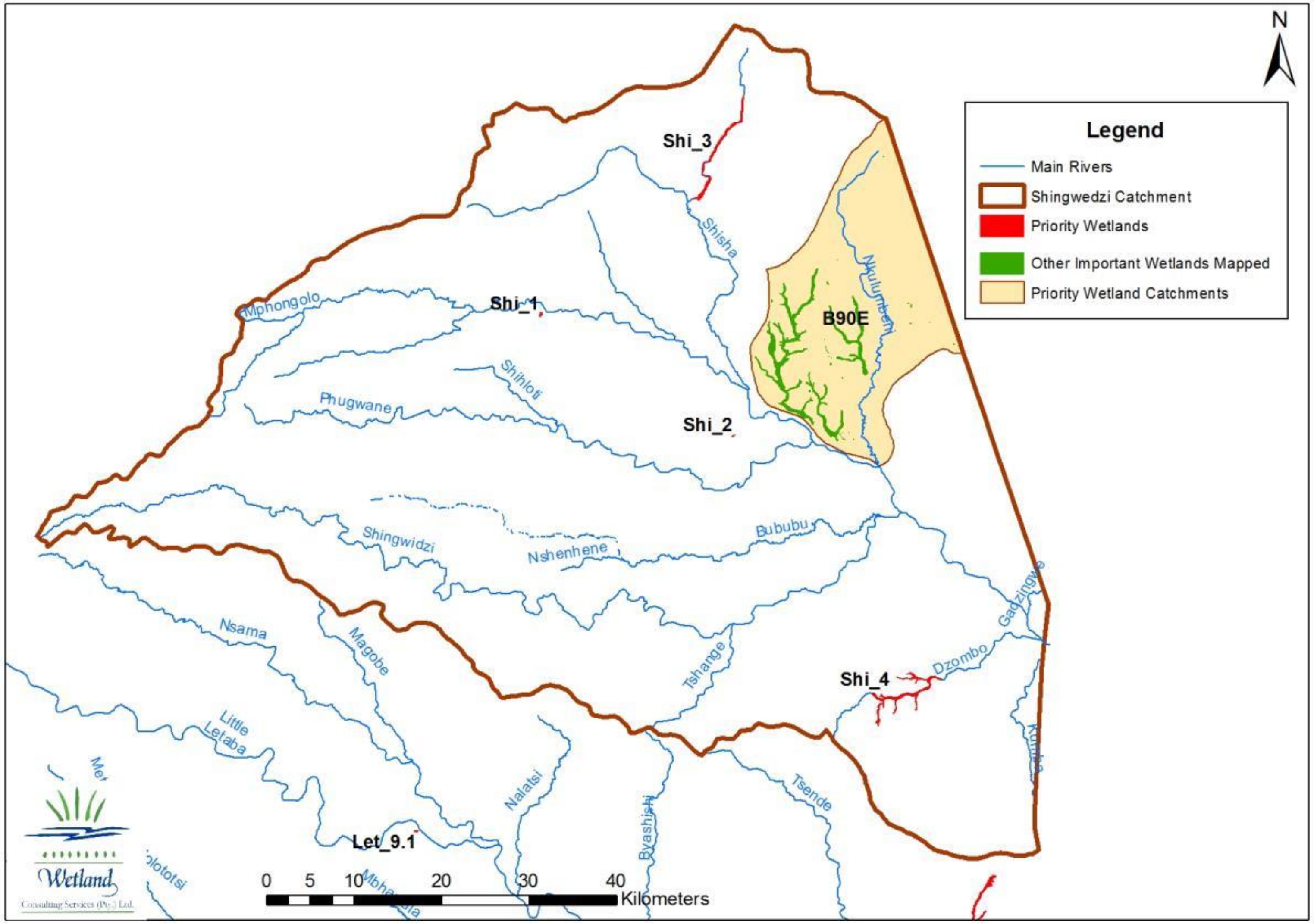

Figure 23: Map showing priority wetlands within the Shingwedzi Catchment, as well as priority wetland catchments and associated important wetlands mapped.

Table 14: List of priority wetlands in the Shingwedzi Catchment indicating the type of system, range of PES and EIS based on existing information, the NFEPA Vegetation Group and Threat Status, whether the system forms part of a Threatened Ecosystem (according to GN 1002, National List of Ecosystems that are Threatened and in need of Protection), whether the system is identified as a WETFEPA, and a brief description of any unique features associated with the wetland systems

Wetland	Type	PES	EIS	REC	NFEPA Wetland Vegetation Group and Threat Status	Part of a Threatened Ecosystem	Identified as a WETFEPA	Notes	Unique features
B90A									
Shi_3 Shisha tributary	Unchannelled valley bottom	A/B	Moderate	A/B					
B90B									
Shi_1 Malahlapanga	Thermal spring	E	High	C/D	Mopani Group 4 - **CR**	No	No		Hot spring with peat
B90D									
Shi_2 Mafiyeni	Thermal spring	C	Very high	A/B	Mopane Group 3 – **LT**	No	No		Hot spring with peat
B90E									
	Channelled valley bottom	Not available	Specific to individual systems	Specific to individual systems	Mopane Group 3 – **LT**	No	No		
	Unchannelled valley bottom	Not available	Specific to individual systems	Specific to individual systems	Mopane Group 4 – **CR**	No	No		
	Depression	Not available	Specific to individual systems	Specific to individual systems	Lowveld Group 2 - **CR**	No	No		
B90H									
Shi_4 Dzombo	Channelled valley bottom	B	High	B					

5.17.1 Changes that may be expected based on general (quaternary catchment-related) or specific (wetland-related) scenarios

All of the identified priority wetlands within the Shingwedzi River catchment, including both the Malahlapanga and Mafiyeni spring mires, are located within the boundaries of the Kruger National Park. All of the priority wetlands are therefore formally protected. Despite this, a number of the wetlands show signs of degradation, and it can be assumed that such degradation could continue.

For valley bottom wetlands, impacts are related to channel incision resulting from flow concentration (including from road crossings and dams) and erosion nick-points, some of which are likely related to bioturbation (utilisation of wetlands by animals). It is thought that these wetlands could also be sensitive to changes in shallow groundwater levels.

For the spring mires, impacts are related to changes in groundwater discharge and heavy utilization by animals leading to erosion and desiccation of peat domes. The Malahlapanga spring mire shows desiccation of peat domes and severe erosion. Changes in groundwater discharge may be related to natural variations. The Mafiyeni spring mire could not be visited in the field but is understood to be in better condition (*pers. comm*. SANParks Section Ranger). Main risks to these systems are likely to be groundwater abstraction. Being spring fed, groundwater abstraction could potentially pose a high risk to the systems.

5.17.2 Recommended Protection, Management and Monitoring Requirements

For the valley bottom wetlands, a monitoring programme must be developed to monitor the condition/health/state of a selected sample of wetlands. This must be done in order to determine whether or not the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS) for each of the affected wetlands is being met or maintained. This should include monitoring of important biota (fauna and flora) as well as diatoms and invertebrates where appropriate. The use of appropriate wetland assessment tools should form part of the monitoring method for wetlands. For impacted systems that do not meet the Recommended Ecological Category (REC)/Target Ecological Category (TEC), and where appropriate, the Best Attainable State (BAS), it is recommended that rehabilitation plans are developed and implemented for these systems in consultation with an appropriate implementer such as Working for Wetlands, in consultation/collaboration withSANParks. The plans should address the erosion/headcutting and flow concentration in these systems and make provision, not only for structural interventions, but also the development of a management plan for such structures given the likely utilisation by large animals such as elephants.

6. MOTIVATION FOR SELECTION OF PRIORITY WETLANDS

Table 15 indicates the priority wetland systems identified within the Olifants, Letaba and Shingwedzi catchments and details the motivation for the selection of each of the individual wetlands or wetland complexes. Also shown is the Integrated Unit of Analysis (IUA) and quaternary catchment in which the wetland system is found as well as the Wetland ID, Wetland Name, and Wetland Type. The Present Ecological State (PES) Category and Ecological Importance and Sensitivity (EIS) Category, as determined using a combination of available surrogate information and field verification for some of the systems, is also indicated.

Table 15. Table showing the Integrated Unit of Analysis (IUA), Quaternary Catchment, Wetland ID, Wetland Name, Wetland Type, Present Ecological State (PES) Category, Ecological Importance and Sensitivity (EIS) Category and motivation for why the system was considered as a priority wetland in the Olifants, Letaba and Shingwedzi catchments.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
1	B11E	Oli_1.1	Blesbokspruit wetland	Floodplain	E/F (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). It has also been flagged for protection through the NFEPA process (Nel *et al*., 2011 and Mbona *et al.*, 2015). The wetland is well placed to provide a water quality and flood protection function but is threatened by headward erosion. Wetland has been prioritized to ensure that water quality enhancement and biodiversity maintenance functions are not impaired. Parts of the wetland have been undermined. Possible risk of water quality deterioration.
1	B11E	Oli_1.2	Rietspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D(Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). It has also been flagged for protection through the NFEPA process (Nel *et al*., 2011 and Mbona *et al.*, 2015). The system provides a corridor for species movement in a mining altered landscape, with otters utilising the area. The wetland is also well placed to provide a water quality and flood protection function. Wetland attributes have therefore been prioritized to help ensure that key services identified are maintained. Preventing incision is regarded as critical for maintaining habitat attributes.
1	B11D	Oli_1.3	Kriel wetland	Channelled valley bottom	C/D(Mbona et al. 2015)	Moderate	Identified as a priority wetland in DWS (2014). The wetland is located directly downstream of mining operations and power stations in the catchment upstream of Witbank Dam. Livestock watering is also important downstream but can be jeopardized by poor water quality. While being well placed to provide an important water quality enhancement function, the wetland is affected by headward erosion that is affecting the system's ability to perform these functions.
1	B11F	Oli_1.4	Klipoortjiespruit wetland	Unchannelled valley bottom	D(Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). It has been flagged for protection through the NFEPA process (Nel *et al*., 2011 and Mbona *et al*., 2015) and is one of the more intact unchannelled valley bottom wetlands remaining in the upper Olifants River catchment. Extensive existing mining activities as well as future proposed mining activities in the upstream catchment leave this wetland well-placed to play an important role in water quality maintenance.
1	B11B	Oli_1.5	Koringspruit wetland	Channelled valley bottom (section of unchannelled valley bottom)	D(Mbona et al. 2015)	Moderate (desktop)	Identified as a priority wetland in DWS (2014). This wetland is located within a mining landscape upstream of the Witbank dam. Most wetlands in the area have been affected by mining operations and channel incision that has affected their functional value. This wetland includes a section of unchannelled valley bottom habitat important for water quality enhancement but is threatened by headward erosion.
1	B11K	Oli_1.6	Klipspruit wetland	Unchannelled	D(Mbona et al.	High (B1	Identified as a priority wetland in DWS (2014). This extensive unchannelled

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
				valley bottom	2015)	Olifants PESEIS 2011)	valley bottom wetland is located directly downstream of Witbank Town and receives water from old mines, urban areas and waste water treatment works. Given the sites location downstream of these impacts and upstream of Loskop dam and other areas used for recreational activities, the wetland clearly provides a critical water quality enhancement function.
1	B12A	Oli_1.7	Klein-Olifants tributary	Channelled valley bottom; Hillslope seepage	D(Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014) and a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015). This wetland, though moderately modified and somewhat incised, is likely to be a representative wetland of this wetland vegetation group. The wetland also falls within an area where wetlands have been flagged as important for crane conservation. Maintenance of wetland vegetation and associated wetland habitat for cranes is therefore regarded as a priority.
1	B12B	Oli_1.8	Matla wetland	Channelled valley bottom	C(Mbona et al. 2015)	Moderate (desktop)	Identified as a priority wetland in DWS (2014) and a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015). This wetland is located in the upper catchment and is largely intact and is therefore a useful intact example of wetlands within this wetland vegetation group. The wetland also falls within an area where wetlands have been flagged as important for crane conservation. Maintenance of wetland vegetation and associated wetland habitat for cranes and other wetland-dependant biota is therefore regarded as a priority.
1	B12B	Oli_1.9	Woes-alleenspruit wetland	Unchannelled valley bottom	C(Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014) and a wetland FEPA by Mbona *et al*. (2015). The wetland is located in the Middleburg Dam catchment and directly downstream of extensive coal mining operations. It is therefore well placed to provide a water quality enhancement function.
1	B12B	Oli_1.10	Bosmanspruit wetland	Unchannelled valley bottom	C (Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This unchannelled valley bottom wetland is located in the Middleburg Dam catchment and directly adjacent to extensive coal mining operations. It is therefore well placed to provide a water quality enhancement function.
1	B12C	Oli_1.11	Kopermyn wetland	Unchannelled valley bottom; Channelled valley bottom Hillslope seepage	C(Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). This is a large example of reasonably intact valley bottom wetland downstream of mining operations with further mining anticipated in the catchment (high mining potential). The wetland provides useful habitat for wildlife and provides a range of regulating and supporting services important for downstream users. Middelburg Dam is located only several kilometres downstream of the wetland.
1	B11C	Oli_1.12	Debeerspruit/Piekespruit floodplain	Floodplain	A/B(Mbona et al. 2015)	High	Identified as a wetland FEPA (Mbona *et al*., 2015). This is a good representative example of a floodplain type wetland within the Upper Olifants River Catchment. The system is extensive and in relatively good condition.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
							This system is important for flood attenuation and biodiversity support. The system is potentially at risk from future mining applications.
1	B11A	Oli_1.13	Viskuile floodplain complex	Floodplain	C (Mbona et al. 2015)	High to Very High	The Viskuile floodplain complex is a largely intact wetland system located in the upper catchment of the Olifants River. It is considered a good example of this wetland type within this wetland vegetation group. The wetland provides important habitat for wildlife and provides a range of regulating and supporting services important for downstream users. Existing and future mining activities within the wetland catchment indicate that the wetland complex is well placed to provide a water quality enhancement function. A large population of *Crinum bulbispernum* occurs within the floodplain.
1	B11C	Oli_1.14	Steenkoolspruit floodplain	Floodplain	D(Mbona et al. 2015)	High	Identified as a wetland FEPA (Mbona *et al*., 2015). This is a good representative example of a floodplain type wetland within the Upper Olifants River catchment. The system is extensive and in relatively good condition. This system is important for flood attenuation and biodiversity support. The system is potentially at risk from future mining applications.
2	B20C	Oli_2.1	Elandsvlei pans	Pan/depression; Hillslope seepage	C(Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). This cluster of pans was identified as an area of exceptional biodiversity importance as part of the NFEPA process (Nel *et al*., 2011 and Mbona *et al*., 2015). They have also been highlighted as providing important habitat for African Grass Owls (*Tyto capensis*) within a largely transformed catchment. The pans are also utilised recreationally for bird watching purposes.
2	B20B	Oli_2.2	Koffiespruit tributary	Channelled valley bottom	A/B(Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This wetland is largely intact and is likely to be a representative wetland of this wetland vegetation group. Maintaining vegetation characteristics is regarded as most important from a biodiversity perspective.
2	B20A	Oli_2.3	Delmas wetland	Channelled valley bottom	D(Mbona et al. 2015)	Moderate	Identified as a priority wetland in DWS (2014). This wetland is located in an urban context and downstream of a waste water treatment works and old waste disposal facilities. Management of the waste water treatment works is reportedly problematic with a blue drop score of 18% obtained in 2011. The wetland is therefore well placed to improve poor water quality and reduce potential negative health effects for local communities. This function is however threatened by channel incision.
2	B20A	Oli_2.4	Bronkhorstspruit tributary	Unchannelled valley bottom; Channelled valley bottom Hillslope seepage	C(Mbona et al. 2015)	High	This large, extensive unchannelled valley bottom wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) provides important habitat for the African Grass Owl (*Tyto capensis*). Given the agricultural context and anticipated expansion of future mining operations, the wetland is also well placed to improve water quality. This is also the headwaters of the Bronkhorstspruit. The wetland is located in a groundwater stressed catchment (see Groundwater Report).

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
2	B20E	Oli_2.5	Wilge tributary	Floodplain; Channelled valley bottom	A/B to C(Mbona et al. 2015)	Moderate to High	Identified as a priority wetland in DWS (2014). A portion of the wetland system has also been identified as a FEPA by Mbona *et al*. (2015). This is one of few largely intact valley bottom wetlands that remain in the upper Wilge River catchment. The wetland system is also located within a priority mining and power generation area and is therefore well placed to reduce water quality impacts to the Wilge River.
2	B20G	Oli_2.6	Zaalklap wetland	Unchannelled valley bottom	D(Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). This naturally unchannelled valley bottom has been flagged as a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) based on its importance for biodiversity maintenance. The wetland supports healthy populations of Marsh Owls whilst the reed beds are used for roosting by large numbers of Cattle Egrets. Given the wetlands location directly downstream of existing coal mining operations and likely future mining operations, the wetland is also well placed to improve water quality for downstream users. Rehabilitation efforts have already been successfully undertaken on parts of the wetland to improve the functionality of the system.
2	B20G	Oli_2.7	Saalboomspruit/ Saalklapspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This naturally unchannelled valley bottom has been flagged as a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) and is known to support unusually large populations of African Snipe (*Gallinago nigripennis*). Given the wetlands location directly downstream of coal mining operations and the Phola waste water treatment works, it is also well placed to improve water quality for downstream users.
2	B20E	Oli_2.8	Upper Wilge River Floodplain	Floodplain	D(Mbona et al. 2015)	High (B2 Olifants PESEIS 2011)	This floodplain wetlands forms part of the Upper Wilge River system and has been identified by Mbona *et al*. (2015) as a wetland FEPA. The system is extensive and is considered important for flood attenuation and biodiversity support. The system is potentially at risk from future mining applications.
3	B12E	Oli_3.1	Klein-Olifants tributary	Floodplain; Channelled valley bottom; Hillslope seepage	A/B to C (Mbona et al. 2015)	High (desktop)	Identified as a priority wetland in DWS (2014). This wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) is largely intact and is a useful example of this wetland vegetation group. The wetland also falls within an area prioritized for crane conservation. Maintenance of wetland vegetation and associated wetland habitat is therefore regarded as a priority.
4	B31A	Oli_4.1	Elands tributary wetland	Channelled valley bottom; Hillslope seepage	C (Nel et al., 2011)	High (desktop)	Identified as a priority wetland in DWS (2014). Despite being moderately modified, this large wetland has been identified as a wetland FEPA (Nel *et al*., 2011) supporting crane populations. Maintenance of appropriate habitat attributes is therefore regarded as important.
5	B51C	Oli_5.1	Makotswane	Channelled valley bottom; Hillslope seepage	C	Very High	This wetland is a good representative example of a granitic peatland. The wetland is likely to provide flow regulatory services in the catchment. Associated hillslopes comprise deep sand which helps to maintain water quality and feed the valleybottom systems and associated streams. This flow

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
							regulation service is an important function in this relatively arid region. Likely to provide important water quality enhancement function which may help to buffer the poor water quality in this section of the Olifants River. Peat related to what appear to be artesian springs occurs in this system. Appears to be a good example of the unique granitic peatlands that occur in this region. Giant bullfrog has been recorded in the wetlands of the area.
6	B41A	Oli_6.1	Lakenvlei wetland complex	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B(Mbona et al. 2015)	Very High	The Lakenvlei wetland complex has been identified as a wetland FEPA (Mbona *et al*., 2015) and is one of the largest, pristine peat wetlands in Mpumalanga. The wetland supports important populations of threatened bird species including the Grey Crowned Crane (EN), Wattled Crane (CR) and White-winged Flufftail (CR). Some rehabilitation has taken place on sections of the wetland. It is also expected to be important for the supply of high quality water.
6	B41B	Oli_6.2	Welgevonden wetland	Channelled valley bottom; Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	Identified as a priority wetland in DWS (2014). This FEPA wetland system (Nel *et al*. 2011) is located in the upper reaches of the catchment and forms part of a priority wetland cluster. The wetland is important for biodiversity conservation as it contains areas of peat and supports important crane populations.
6	B41F	Oli_6.3	Draaikraal wetland 1	Channelled valley bottom	C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This large FEPA (Nel *et al*., 2011) wetland system, located within an agricultural context, is important for biodiversity conservation as it contains areas of peat and supports important crane populations. The site has been historically targeted for rehabilitation by WFWetlands.
6	B41F	Oli_6.4	Draaikraal wetland 2	Channelled valley bottom	A/B to C (Nel et al., 2011)	High to Very High (desktop)	Identified as a priority wetland in DWS (2014). This FEPA (Nel *et al*., 2011) wetland system contains peatland supports threatened crane populations. The wetland is still in good condition despite surrounding agricultural land-use pressures.
6	B41F	Oli_6.5	Draaikraal wetland 3	Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	Identified as a priority wetland in DWS (2014). This large unchannelled peatland has been identified as a wetland FEPA (Nel *et al*., 2011) and supports breeding populations of cranes. Wetland rehabilitation was previously implemented in this wetland to address impacts of historical drainage.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
6	B41F	Oli_6.8	Verloren Valei	Comprises a mosaic of hillslope seepage wetlands and channelled and unchannelled valley bottom wetlands	A/B (Nel et al., 2011)	Very High	Verloren Valei has been listed as a Wetland of International Importance in terms of the Convention on Wetlands of International Importance (Ramsar, 1971). Verloren Valei Nature Reserve is a Provincial Nature Reserve which was proclaimed in 1983. This is the only Ramsar Wetland within the Olifants River Catchment. The wetland complex is known to support important populations of threatened bird species including the Grey Crowned Crane (EN), Wattled Crane (CR) and Blue Crane (VU). It is a botanically diverse system supporting numerous conservation important plant species.
6	B41A	Oli_6.9	Belfast wetland complex	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B to C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	Portions of this wetland complex were identified as a priority wetland in DWS (2014). Part of this wetland complex is located in an urban setting and directly upstream of Belfast dam which is used to supply Belfast town with potable water. Upstream mining activities together with overflow from the waste water treatment works pose a threat to water quality. This wetland has therefore been prioritized based on its water quality enhancement functions. Peat may occur in this system.
9	B60F	Oli_9.1	Krankloofpsruit wetland	Channelled valley bottom	C (Nel et al., 2011)	Moderate (desktop)	Identified as a priority wetland in DWS (2014). Although not identified as a wetland FEPA, this is an unusually large unchannelled valley bottom wetland located in the upper reaches of this IUA. Despite significant impacts, the wetland was prioritized due to its role in ameliorating impacts from agricultural activities.
9	B60H	Oli_9.2	Ohrigstad wetland	Channelled valley bottom	C (Nel et al., 2011)	Likely to be High to Very High (B4 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014), and identified as a wetland FEPA (Nel *et al*., 2011), this floodplain system has been heavily degraded by subsistence cultivation. Few wetlands are located in this IUA however, and given the anticipated water quality impacts associated with agricultural use upstream, this wetland was prioritized for water quality enhancement. This wetland is located a short distance upstream of the Blyde River Dam.
10	B71G	Oli_10.1	Tufa waterfall	Tufa waterfall	B	Very High	One of only two known active tufa waterfalls within the Olifants River Catchment. Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent discharge of groundwater out of dolomitic aquifers. The tufa waterfall is an important cultural site that appears to be extensively utilised for this purpose. It is also a tourist attraction in the area. .
13	B60C	Oli_13.1	Treur wetland	Hillslope seepage	C (Nel et al., 2011)	Likely to be Very High (B4 Olifants	Identified as a priority wetland in DWS (2014), and identified as a wetland FEPA (Nel *et al*., 2011). This is an important peatland system. The associated stream supports the endemic Treur River Barb (*Barbus treurensis*) which has an extremely limited distribution. The wetland and associated biota are threatened by existing forestry.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
						PESEIS 2011)	
13	B60D	Oli_13.2	Kadishi waterfall	Tufa waterfall	A/B	Very High	One of only two known active tufa waterfalls within the Olifants River Catchment. Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent discharge of groundwater out of dolomitic aquifers. The tufa waterfall is an important tourism attraction within the Blyde/Mohlatse River Canyon Nature Reserve.
1	B81A	Let_1.1	Stanford wetland	Floodplain	D	Moderate	A large floodplain wetland located within an afforested area upstream of Stanford Lake and within the Ebenezer Dam catchment. The wetland is well placed to provide water quality enhancement and flow maintenance functions. Afforestation has impacted on the current state of the system through decreased flow and alien vegetation encroachment.
1	B81B	Let_1.2	Tzaneen Dam wetland	Unchannelled valley bottom; Channelled valley bottom	D/E	Moderate	This unchannelled valley bottom wetland is located upstream of Tzaneen Dam within an afforested area. It is therefore well placed to provide a water quality enhancement and flow maintenance function. Afforestation has impacted on the current state of the system through decreased flow and alien vegetation encroachment.
2	B81D	Let_2.1	Thabina wetland	Channelled valley bottom	C	High	A large channelled valley bottom wetland within a densely populated rural area. The wetland is important from a direct use perspective with cultivation along and within its margins, collection of natural resources and collection of water observed. The location of the wetland within a densely populated area without formal sewage or sanitation systems makes it likely that the wetland plays a very important role in water quality maintenance.
9	B82G	Let_9.1	Baleni hot spring	Spring	B	Very High	This is one of only a few remaining undeveloped hot springs in the Olifants/Letaba System. The spring maintains a water temperature of around 42 degrees and supports a peat dome. Flow from the spring also supports small pools of water within the adjacent Klein-Letaba River. These pools were observed to support fish. The spring is understood to be of spiritual significance, and is also used by local women for salt harvesting. Salt harvesting is undertaken during the winter dry season when salt crystals form due to evaporation of water. Being a spring, groundwater abstraction could potentially pose a high risk to the system.
12	B83C	Let_12.1	Nshawu	Unchannelled valley bottom; Channelled valley bottom	C	High	The Nshawu vlei is a well-known Kruger National Park wetland system and FEPA wetland (Nel *et al*., 2011). The system is currently heavily utilised by game and has a number of dams/excavations along its length. Headcutting and erosion has been identified as a risk to the system. Groundwater abstraction for water points in and around the wetland pose a potential risk to the condition of the system.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
12	B83D	Let_12.2	Manyeleti/Makhadzi wetland	Unchannelled valley bottom	A	High	A large unchannelled valley bottom wetland in the Kruger National Park displaying seasonal to permanent saturation in some places. Found to be a wetter system than most of the other valley bottom wetlands in the area (and therefore unique) supporting numerous deeper pools of open water occupied by hippos. As is the case for most of these valley bottom wetlands, plant species diversity is likely fairly low, though a high diversity of faunal and avifaunal species are expected to be supported by the wetland.
-	B90B	Shi_1	Malahlapanga	Spring	E	High	This spring mire occurs within the boundaries of the Kruger National Park. The spring is geo-thermal in nature and supports several peat domes. The system is currently heavily impacted by trampling, overgrazing and to some extent runoff from a management road. This has resulted in erosion and lack of vegetation cover in and around the springs and wetland. Desiccation of the peat domes is likely the result of changes in groundwater (Grootjans *et al*., 2010).
-	B90D	Shi_2	Mafiyeni	Spring	C	Very High	This spring mire occurs within the boundaries of the Kruger National Park. The spring is geo-thermal in nature and supports one large and little-disturbed cupola/dome plus a few smaller highly mineralised and desiccated domes (Grootjans *et al*., 2010). The system has been somewhat impacted by trampling and overgrazing. This has resulted in reduced vegetation cover in and around the springs and wetland. Desiccation of the peat domes is likely the result of changes in groundwater (Grootjans *et al.*, 2010).
-	B90A	Shi_3	Shisha tributary	Unchannelled valley bottom	A/B	Moderate	This is a large, seasonally saturated unchannelled valley bottom wetland located in the northern Kruger National Park which was flagged by Park Rangers as one of the largest and intact systems within the northern Kruger National Park. It is considered a good representative example of an unchannelled valley bottom wetland within the Lowveld Region of the Olifants River Catchment. Numerous locally rare antelope species utilise these wetlands within the Kruger National Park.
-	B90H	Shi_4	Dzombo	Channelled valley bottom	B	High	A channelled valley bottom wetland located within the Kruger National Park. The wetland supports a higher species and habitat diversity than most of the surrounding valley bottom wetlands and includes large stands of *Hyphaene coriacea*. Some impacts due to erosion and historical placement of water points are evident, while numerous road and track crossings also occur.

7. ECOLOGICAL SPECIFICATIONS FOR PRIORITY WETLANDS

Table 16 indicates the priority wetland systems identified within the Olifants, Letaba and Shingwedzi catchments. Also shown is the Integrated Unit of Analysis (IUA) and quaternary catchment in which the wetland system is found as well as the Wetland ID, Wetland Name, Wetland Type, Coordinates, and area of the wetland systems. The Present Ecological State (PES) Category and Ecological Importance and Sensitivity (EIS) Category, as determined using a combination of available surrogate information and field verification for some of the systems, is also indicated. The Recommended Ecological Category (REC) as determined using the criteria indicated in Rountree *et. al.* (2013). Finally, the table also provides a summary of the Ecological Specifications and Monitoring Requirements for each of the priority wetland systems.

Table 16. Table showing the Integrated Unit of Analysis (IUA), Quaternary catchment, Wetland ID and Name, Wetland Type, Present Ecological State (PES) Category, Ecological Importance and Sensitivity (EIS) Category, Recommended Ecological Category (REC), preliminary Ecological Specifications and Monitoring Requirements for the priority wetland systems identified within the Olifants, Letaba and Shingwedzi catchments.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
1	B11E	Oli_1.1	Blesbokspruit wetland	Floodplain	E/F (Mbona et al. 2015)	High	D	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B11E	Oli_1.2	Rietspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D(Mbona et al. 2015)	High	C/D	**Motivation**: Elevated flows are needed to inundate channelled sections of the wetland thereby providing the wetting regime required for supporting the vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on wetting for their life cycles. Increased channel incision threatens water retention within the wetland. Diffuse water distribution is required to optimise water quality enhancement functions.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
1	B11D	Oli_1.3	Kriel wetland	Channelled valley bottom	C/D(Mbona et al. 2015)	Moderate	C/D	**Motivation**: Erosion and channel incision threaten to undermine the water quality enhancement functions of the wetland. Diffuse water distribution is required to optimise water quality enhancement functions.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B11F	Oli_1.4	Klipoortjiespruit wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High	C/D	**Motivation**: Diffuse water distribution is required to optimise water quality enhancement functions.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B11B	Oli_1.5	Koringspruit wetland	Channelled valley bottom (section of unchannelled valley bottom)	D(Mbona et al. 2015)	Moderate (desktop)	C	**Motivation**: Erosion and channel incision threaten to undermine the water quality enhancement functions of the wetland. Diffuse water distribution is required to optimise water quality enhancement functions.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
									Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. Rehabilitation measures should be implemented in this system to improve its current state.	with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B11K	Oli_1.6	Klipspruit wetland	Unchannelled valley bottom	D(Mbona et al. 2015)	High (B1 Olifants PESEIS 2011)	C/D	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B12A	Oli_1.7	Klein-Olifants tributary	Channelled valley bottom; Hillslope seepage	D(Mbona et al. 2015)	High	C/D	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Lateral flow inputs are important to wet the valley bottom margins thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
1	B12B	Oli_1.8	Matla wetland	Channelled valley bottom	C(Mbona et al. 2015)	Moderate (desktop)	C	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Lateral flow inputs are important to wet the wetland margins thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B12B	Oli_1.9	Woes-alleenspruit wetland	Unchannelled valley bottom	C(Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B12B	Oli_1.10	Bosmanspruit wetland	Unchannelled valley bottom	C (Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
									Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B12C	Oli_1.11	Kopermyn wetland	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	C(Mbona et al. 2015)	High	B/C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Interflow is considered the key driver of the extensive hillslope seepage wetlands forming part of this wetland complex	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B11C	Oli_1.12	Debeerspruit/Piekespruit floodplain	Floodplain	A/B(Mbona et al. 2015)	High	A/B	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
1	B11A	Oli_1.13	Viskuile floodplain complex	Floodplain; Unchannelled valley bottom; Hillslope seepage wetlands	C (Mbona et al. 2015)	High to Very High	B	**Motivation**: High flows are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs also play an important role in wetting the floodplain verges, especially during lower rainfall years. Maintaining the unchannelled characteristic of parts of the systems as well as the vegetation structure of the system is essential for water quality enhancement.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. Rehabilitation measures should be implemented in this system to improve its current state.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
1	B11C	Oli_1.14	Steenkoolspruit floodplain	Floodplain	D(Mbona et al. 2015)	High	C/D	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs are also likely to play an important role in wetting the floodplain verges, especially during lower rainfall years.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20C	Oli_2.1	Elandsvlei pans	Pan/depression; Hillslope seepage	C(Mbona et al. 2015)	High	B/C	**Motivation**: Water inputs are important in shaping habitat characteristics of pan systems. Water quality is an important driver of pan biodiversity. Vegetation type and structure of the pan wetlands and associated hillslope seepage wetlands are important to support the African Grass Owls and other avifaunal species frequenting the pans.	**Protection, Maintenance and Management Requirements**: No increase in cultivation or habitat transformation within the pan catchments should be permitted. Water quality impacts to the pan system must be restricted to ensure that the water and sediment chemistry remain within an acceptable normal range (anion and cation concentration to pan volume relationship) for this particular water chemistry pan type. Lateral flow inputs from the catchment and hillslope seepage wetlands must be protected through the application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications,	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of landuse in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. An African Grass Owl monitoring strategy should be developed and implemented in conjunction with a local conservation authority or NGO. Collection and analysis of grab water samples for standard anions and cations. At least once every three years when

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
									and strict licensing conditions including monitoring of the systems should apply. Maintain suitable African Grass Owl habitat.	pans are inundated.
2	B20B	Oli_2.2	Koffiespruit tributary	Unchannelled valley bottom	A/B (Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	A/B	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential to secure the biodiversity maintenance function performed by the wetland.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20A	Oli_2.3	Delmas wetland	Unchannelled valley bottom	D(Mbona et al. 2015)	Moderate	D	**Motivation**: Drains and erosion threaten the mostly unchannelled nature of this wetland, as do increased flow from stormwater and waste water treatment works inputs. Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. Rehabilitation should be implemented to secure existing functions and values.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20A	Oli_2.4	Bronkhorstspruit tributary	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	C (Mbona et al. 2015)	High	B	**Motivation**: Elevated flows are needed to inundate the channelled section of the wetland thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles. Maintaining the unchannelled characteristic of sections of the wetland and maintaining the vegetation structure of the system is essential to secure the biodiversity maintenance and water quality maintenance functions	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
								performed by the wetland.	Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20E	Oli_2.5	Wilge tributary	Floodplain; Channelled valley bottom	A/B to C(Mbona et al. 2015)	Moderate to High	B/C	**Motivation**: Elevated flows are needed to inundate the wetland thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs are also likely to play an important role in wetting the floodplain verges, especially during lower rainfall years. Diffuse water distribution is required to optimise water quality enhancement functions.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20G	Oli_2.6	Zaalklap wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High	C/D	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
										WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20G	Oli_2.7	Saalboomspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D(Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	C/D	**Motivation**: Diffuse flows are important for maintaining habitat diversity and water quality enhancement functions. Historic drainage has impacted negatively on the wetland with headcut advancement threatening to cause further loss in functional values.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
2	B20E	Oli_2.8	Upper Wilge River floodplain	Floodplain	D(Mbona et al. 2015)	High (B2 Olifants PESEIS 2011)	C/D	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs are also likely to play an important role in wetting the floodplain verges, especially during lower rainfall years.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and SFR activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
3	B12E	Oli_3.1	Klein-Olifants tributary	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B to C (Mbona et al. 2015)	High (desktop)	B	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
									application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
4	B31A	Oli_4.1	Elands tributary wetland	Channelled valley bottom; Hillslope seepage	C (Nel et al., 2011)	High (desktop)	B/C	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Lateral flow inputs are important to wet the valley bottom margins thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles. Interflow is the key driver of hillslope seepage wetlands.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
5	B51C	Oli_5.1	Makotswane	Channelled valley bottom Hillslope seepage	C	Very High	B	**Motivation**: This wetland is likely to provide an important flow regulatory and water quality enhancement function which may help to buffer the poor water quality in the section of the Olifants River that this wetland feeds.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Targeted wetland management actions and rehabilitation interventions should be implemented to safeguard and improve the wetland structure and functioning and associated peat and artesian springs.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
6	B41A	Oli_6.1	Lakenvlei wetland complex	Unchannelled valley bottom Channelled valley bottom Hillslope seepage	A/B(Mbona et al. 2015)	Very High	A/B	**Motivation**: A constant baseflow should be maintained to ensure that the main valley bottom system is permanently inundated and side arms to the wetland remain permanently saturated. These flows will ensure that most of the marginal and instream vegetation remains inundated throughout the summer growing season and that the rooting zone is saturated throughout the year. This is a requirement for enabling perennial obligate hydrophytes to complete their life cycle and reproduce. This is also a requirement for maintaining peat and supporting crane breeding habitat.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. The overall biodiversity and viable populations of Red Data bird species must be maintained. No new dams should be constructed in the system without following detailed authorisation process. No increase in cultivation or habitat transformation within the hillslope seepage wetlands should be permitted. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC	Desktop mapping of all dams and surface flow reduction activities in the system. Repeat every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41B	Oli_6.2	Welgevonden wetland	Channelled valley bottom Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	A/B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.3	Draaikraal wetland 1	Channelled valley bottom	C (Nel et al., 2011)	High to Very High (B4	B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
						Olifants PESEIS 2011)		structure is required to ensure that existing biodiversity values are not undermined.	Unchannelled nature of sections of the wetland must be maintained. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.4	Draaikraal wetland 2	Channelled valley bottom	A/B to C (Nel et al., 2011)	High to Very High (desktop)	A/B to B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Unchannelled nature of sections of the wetland must be maintained. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.5	Draaikraal wetland 3	Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	A/B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Unchannelled nature of sections of the wetland must be maintained. Maintain existing vegetation structure and composition.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery.

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									Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.8	Verloren Valei	Comprises a mosaic of hillslope seepage wetlands and channelled and unchannelled valley bottom wetlands	A/B (Nel et al., 2011)	Very High	A	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Unchannelled nature of sections of the wetland must be maintained. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. The conservation measures and management practices as per the Ramsar Information Sheet (RIS) (https://rsis.ramsar.org/RISapp/files/RISrep/ZA1110RIS.pdf) for Verloren Valei Nature Reserve must be implemented and maintained together with any additional management plans/actions that have subsequently been implemented by the Mpumalanga Parks Board.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with Mpumalanga Parks Board. This should include: PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41A	Oli_6.9	Belfast wetland complex	Unchannelled valley bottom Channelled valley bottom Hillslope seepage	A/B to C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	B to A/B	**Motivation**: This wetland was prioritized for water quality enhancement. Maintaining the flow distribution and retention patterns and vegetation structure of the system is essential to maintain the water quality enhancement function.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Unchannelled nature of sections of the wetland must be maintained. Maintain existing vegetation structure and composition. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow reduction activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field

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									pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat.
9	B60F	Oli_9.1	Krankloofpsruit wetland	Channelled valley bottom	C (Nel et al., 2011)	Moderate (desktop)	C	**Motivation**: This wetland was prioritized for water quality enhancement. Maintaining the flow distribution and retention patterns and vegetation structure of the system is essential to maintain the water quality enhancement function.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow reduction activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years
9	B60H	Oli_9.2	Ohrigstad wetland	Channelled valley bottom	C (Nel et al., 2011)	Likely to be High to Very High (B4 Olifants PESEIS 2011)	B	**Motivation**: This wetland was prioritized for water quality enhancement. Maintaining the flow distribution and retention patterns and vegetation structure of the system is essential to maintain the water quality enhancement function.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow reduction activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
										impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years
10	B71G	Oli_10.1	Tufa waterfall	Tufa waterfall	B	Very High	A/B	<u>Motivation</u>: Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent permanent discharge of groundwater out of dolomitic aquifers.	<u>Protection, Maintenance and Management Requirements</u>: Maintenance of permanent water inputs to the tufa waterfall is critical for ongoing tufa formation. Any applications for groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Control of cultural activities within the wetland, e.g. salt harvesting. Site specific management measures should be developed in consultation with the local community to ensure the continued protection of this system.	Mapping of all groundwater abstraction activities within the catchment of the tufa waterfall on latest available aerial imagery. Repeat every 5 years.
13	B60C	Oli_13.1	Treur wetland	Hillslope seepage	C (Nel et al., 2011)	Likely to be Very High (B4 Olifants PESEIS 2011)	B	<u>Motivation</u>: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	<u>Protection, Maintenance and Management Requirements</u>: The unchannelled nature of sections of the wetland must be maintained. Maintain permanent saturation of peat wetlands. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Strict application of suitable forestry buffers. A viable populations of the Treur River Barb fish species should be maintained.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow reduction activities in the wetland & associated catchment on latest available aerial imagery, specifically forestry. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat. A Treur River Barb monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
13	B60D	Oli_13.2	Kadishi waterfall	Tufa waterfall	A/B	Very High	A/B	<u>Motivation</u>: Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent permanent discharge of groundwater out of dolomitic aquifers.	<u>Protection, Maintenance and Management Requirements</u>: Maintenance of permanent water inputs to the tufa waterfall is critical for tufa formation. Any applications for groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with Mpumalanga Parks Board. This should include: Mapping of all groundwater abstraction activities within the catchment of the Kadishi Waterfall.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
1	B81A	Let_1.1	Stanford wetland	Floodplain	D	Moderate	D	**Motivation**: This wetland is likely to provide important water quality enhancement and flow maintenance functions in the Ebenezer Dam catchment.	**Protection, Maintenance and Management Requirements:** The unchannelled nature of sections of the wetland must be maintained. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Strict application of suitable forestry buffers. Targeted wetland management actions and rehabilitation interventions should be implemented to improve the wetland structure and functioning. This must address in particular afforestation related rehabilitation measures.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow reduction activities in the wetland & associated catchment on latest available aerial imagery, specifically forestry. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years
1	B81B	Let_1.2	Tzaneen Dam wetland	Unchannelled valley bottom Channelled valley bottom	D/E	Moderate	D	**Motivation**: This wetland is likely to provide important water quality enhancement and flow maintenance functions.	**Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Strict application of suitable forestry buffers.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow reduction activities in the wetland & associated catchment on latest available aerial imagery, specifically forestry. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years
2	B81D	Let_2.1	Thabina wetland	Channelled valley bottom	C	High	B	**Motivation**: This wetland is likely to provide an important flow regulatory and water quality enhancement function. The wetland is important form a direct human use perspective.	**Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of the extent of dams and surface flow

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
									improved within natural seasonal variability. Targeted wetland management actions and rehabilitation interventions should be investigated and implemented if required to improve the wetland structure and functioning. Site specific management measures should be developed in consultation with the local community to ensure the maintenance and controlled utilisation of the wetland.	reduction activities in the wetland & associated catchment on latest available aerial imagery. Mapping to be undertaken at a scale of 1:10 000. Every 5 years. PES Score for hydrology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Must include detailed desktop mapping (supplement with field verification as far as possible) of impact features together with mapping and rating of discrete disturbance units with similar impacts. Every 3 years PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years
9	B82G	Let_9.1	Baleni hot spring	Spring	B	Very High	A/B	**Motivation**: A culturally important site and one of only a few remaining undeveloped thermal hot springs in the catchment. This is a peatland with high ecological importance. Maintaining permanent flow in the system is essential for its maintenance and the protection of the peat.	**Protection, Maintenance and Management Requirements**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintain existing vegetation structure and composition. Any applications for groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Control of cultural activities within the wetland, e.g. salt harvesting. Site specific management measures should be developed in consultation with the local community to ensure the continued protection of this system.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Mapping of all groundwater abstraction activities within a minimum 1km radius of the springs. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat.
12	B83C	Let_12.1	Nshawu	Unchannelled valley bottom Channelled valley bottom	C	High	B	**Motivation**: Being one of the largest wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. Opportunities exist to improve the current state of the system through management interventions.	**Protection, Maintenance and Management Requirements**: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition. No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks. This should include: PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
12	B83D	Let_12.2	Manyeleti/Makhadzi wetland	Unchannelled valley bottom	A	High	A	**Motivation**: Being one of the larger wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. The current state of the system should be maintained.	**Protection, Maintenance and Management Requirements**: Unchannelled nature of the wetland must be maintained. Maintain existing vegetation structure and composition. No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process. No increase in groundwater abstraction within the immediate vicinity of the wetland unless a detailed authorisation process has been followed.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks. This should include: PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications Objectives	Ecological Specifications Protection, Maintenance and Management Requirements	Monitoring Requirements
										minimum, wherever possible. Every 3 years.
-	B90B	Shi_1	Malahlapanga	Spring	E	High	D	__Motivation__: Being one of only a few thermal hot springs containing peat in the Kruger National Park, this wetland has important ecological value. Opportunities exist to improve the current state of the system through management interventions.	__Protection, Maintenance and Management Requirements__: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. No increase in groundwater abstraction within a minimum 1km radius of the springs. Maintain existing vegetation structure and composition. Targeted wetland management actions and rehabilitation interventions should be implemented to try to improve the wetland structure and functioning.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks. This should include: Mapping of all groundwater abstraction activities within a minimum 1km radius of the springs. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
-	B90D	Shi_2	Mafiyeni	Spring	C	Very High	B	__Motivation__: Being one of only a few thermal hot springs containing peat in the Kruger National Park, this wetland has important ecological value. Opportunities exist to improve the current state of the system through management interventions.	__Protection, Maintenance and Management Requirements__: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. No increase in groundwater abstraction within a minimum 1km radius of the springs. Maintain existing vegetation structure and composition. Targeted wetland management actions and rehabilitation interventions should be implemented to try to improve the wetland structure and functioning.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks. This should include: Mapping of all groundwater abstraction activities within a minimum 1km radius of the springs. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
-	B90A	Shi_3	Shisha tributary	Unchannelled valley bottom	A/B	Moderate	A/B	__Motivation__: Being one of the larger wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. The current state of the system should be maintained.	__Protection, Maintenance and Management Requirements__: Unchannelled nature of the wetland must be maintained. Maintain existing vegetation structure and composition. No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks. This should include: PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.
-	B90H	Shi_4	Dzombo	Channelled valley bottom	B	High	B	__Motivation__: Being one of the larger wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. Opportunities exist to improve the current state of the system through management interventions.	__Protection, Maintenance and Management Requirements__: Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition. No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks. This should include: PES Score for geomorphology based on a detailed (Level 2) assessment using Wet-Health (Macfarlane et al. 2007). Will require desktop and field-based assessments to quantify the impact of incised channels and erosion gullies on geomorphic integrity. Extent of existing channels and location of erosion headcuts should be marked in the field using a GPS as far as possible and mapped. Every 3 years. WET-Health Level 2 assessment (Macfarlane et al. 2007) of wetland vegetation. Vegetation assessment to be supported by vegetation transects as per WET-RehabEvaluate, as a minimum, wherever possible. Every 3 years.

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