CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN THE OLIFANTS WATER MANAGEMENT AREA: (WMA 4) - WP 10383

INTEGRATED UNITS OF ANALYSIS (IUA) DELINEATION REPORT

FINAL

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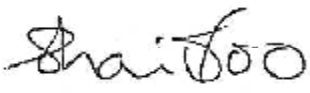

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Shane Naidoo

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EXECUTIVE SUMMARY

Background

The Chief Directorate: Resource Directed Measures (RDM) has initiated the Classification of Significant Water Resources Study for the Olifants Water Management Area. The purpose of this study is to coordinate the implementation of the 7 step process of the Water Resource Classification System (WRCS) in the Olifants WMA in order to determine a suitable management class (MC) for all significant water resources and in so doing deliver the IWRM template with recommendations for presentation to the delegated authority.

The determination of the MC is necessary to facilitate a balance between protection and use of water resources in the Olifants WMA. In determining the class, it is important to recognise that different water resources will require different levels of protection. In addition to achieving ecological sustainability of the significant water resources through classification, the process will allow due of the consideration of the social and economic needs of competing interests by all who rely on the water resources. The WRCS will be applied taking account of the local conditions, socio-economic imperatives and system dynamics within the context of the South African situation. The process will also require a wide range of complex trade-offs to be assessed and evaluated at a number of scales.

As part of the Classification process the first step is to delineate the units of analysis *i.e*. the spatial units that will be defined as significant water resources. Each integrated unit of analysis (IUA) represents a homogenous area which requires its own specification of the MC. This report therefore details the process of delineating and determining the IUAs for the water resources in Olifants WMA.

Integrated Units of Analysis (IUA) Delineation Approach

The process followed in terms of IUA delineation was that described in the WRCS Guidelines, Volumes 1 and 2 (Overview and the 7-step classification procedure; and Ecological, hydrological and water quality guidelines for the 7-step classification procedure) (DWA, February 2007).

Delineation of units of analysis is required as it would not be appropriate to set the same MC for all water resources in a catchment. The delineation of a WMA/catchment into IUAs for the purpose of determining the MC for significant rivers is done primarily according to a number of socio-economic criteria and drainage region (catchment area) boundaries. IUAs are thus a combination of socio-economic zones and watershed boundaries (DWA, 2007). Ecological information also plays a role in the delineation. .

The following was considered for delineation of IUAs within the Olifants WMA:

- Socio-economic zones (SEZs)
- Catchment area boundaries (drainage regions and water resource systems)
- Similar land use characteristics/land based activities
- Eco-regions and Geomorphology
- Ecological information

- Present status of water resources
- Stakeholder input

IUA Delineation Results

The results are tabled below and illustrated in the map below.

IUA	Delineation	Quaternary Catchment
1	Upper Olifants River catchment	B11A, B11B, B11C, B11D, B11E, B11F, B11G, B11H, B11J, B11K, B11L, B12A, B12B, B12C, B12D
2	Wilge River catchment area	B20A, B20B, B20C, B20D, B20E, B20F, B20G, B20H, B20J
3	Selons River area including Loskop Dam	B12E, B32A, B32B, B32C
4	Elands River catchment area	B31A, B31B, B31C, B31D, B31E, B31F, B31G
5	Middle Olifants up to Flag Boshielo Dam	B32D, B31H, B31J, B32E, B32F, B32G, B32H, B32J, B51A, B51B, B51C, B51D, B51E
6	Steelpoort River catchment	B41A, B41B, B41C, B41D, B41E, B41F B41G, B41H, B41J, B41K
7	Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River	B51F, B51G, B51H, B52A, B52B, B52C, B52D, B52E, B52F, B52G, B52H, B52J
8	Spekboom catchment	B42A, B42B, B42C, B42D, B42E, B42F B42G, B42H
9	Ohrigstad River catchment area	B60E, B60F, B60G,B60H
10	Lower Olifants	B60J, B71A, B71B, B71C, B71D, B71E, B71F, B71G, B71H, B71J, B72A, B72B, B72C
11	Ga-Selati River area	B72E, B72F,B72G, B72H, B72J, B72K
12	Lower Olifants within Kruger National Park	B72D, B73A, B73B, B73C, B73D, B73E B73F, B73G, B73H, B73J
13	Blyde River catchment area	B60A,B60B, B60C, B60D

Biophysical and Managements Nodes

Biophysical nodes are established to serve as points that account for interactions between ecosystems and management nodes (allocation) nodes are established to serve as modelling points for the Classification process in a catchment. The establishment of biophysical and management nodes are guided by a number of considerations. The key considerations are:

- Significant water resources
- Biophysical and eco-regional characteristics;
- Location of Ecological Water Requirement (EWR) sites and ecological information;
- Ecological Importance and Sensitivity categories of water resources;
- Present ecological state;
- Broad-scale hydrological and geomorphological characters;
- Water infrastructure;

- Water management, planning and allocation information.

Based on the above considerations proposed biophysical and allocation nodes have been established in each of the IUAs delineated for the Olifants WMA. The nodes proposed will be confirmed and finalised at the conclusion of Step 3 of the Classification Process.

The proposed biophysical and management nodes and quaternary catchments within each IUA is tabulated and illustrated in the map below. EWR sites are also indicated.

Current proposed biophysical and management nodes per IUA

IUA	Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
1	B11A	Olifants (MU8A, outlet of quaternary)	High	High	C	Management Unit, biophysical
	B11B	Olifants (outlet, confluence with Steenkoolspruit)				Water quality impacts
	B11C	Piekespruit (confluence with Steenkoolspruit)	High	High	B	Biophysical
	B11D	Dwars-indie-Wegspruit (confluence with Trichardtspruit) Steenkoolspruit (MU7B, outlet of quaternary)	High	High	C	Biophysical Management Unit, water quality impacts
	B11E	Blesbokspruit (confluence with Rietspruit) Steenkoolspruit (MU7C, confluence with Olifants)	High	High	B	Biophysical Management Unit, water quality impacts
	B11F	Olifants (MU9A, outlet of quaternary)				Management Unit, impacts of Klippoortjie & Tweefonteinspruit
	B11G	Noupoortspruit (MU6/EWR site) Olifants (MU9B, outlet of Witbank Dam)				Management Unit, water quality impacts on Witbank Dam Downstream Witbank Dam – releases from dam
	B11H	Spookspruit (MU26AB, confluence with Olifants)	High	High	C	Biophysical
	B11J	Olifants (EWR1)	Very high	Very high	B	Biophysical
	B11K, B11L	Klipspruit (MU18A, confluence with Olifants) Olifants (MU29 – *outlet of IUA1*)	 Very high	 Very high	 B	Management Unit, water quality impacts Biophysical & outlet of IUA1
	B12A	Boschmansfontein (confluence with Klein Olifants) Klein Olifants (MU10A, outlet of quaternary)	Moderate High	High High	C C	Biophysical Biophysical
	B12B	Klein Olifants (MU13, outlet of quaternary)	High	High	C	Biophysical, impacts of mining in tributary catchments
	B12C	Klein Olifants (MU15, outlet of Middelburg Dam)	High	High	C	Biophysical, downstream Middelburg Dam, releases from Dam
	B12D	Vaalbankspruit (confluence with Klein Olifants) Klein Olifants (MU27A, outlet of quaternary)	Moderate Moderate	High High	D D	Biophysical Management Unit, impacts from town of Middelburg and surrounding areas
2	B20A	Bronkhorstpruit (MU23A, outlet of quaternary)	Moderate	High	C	Management Unit, biophysical, impacts from Delmas area
	B20B	Koffiespruit (MU23B, confluence with Bronkhorstspruit)	Moderate	High	C	Biophysical
	B20C	Osspruit (inflow to Bronkhorstspruit Dam) Bronkhorstpruit (MU23C, outlet from Bronkhorstspruit Dam)	Moderate High	High High	D C	Biophysical Management Unit, biophysical

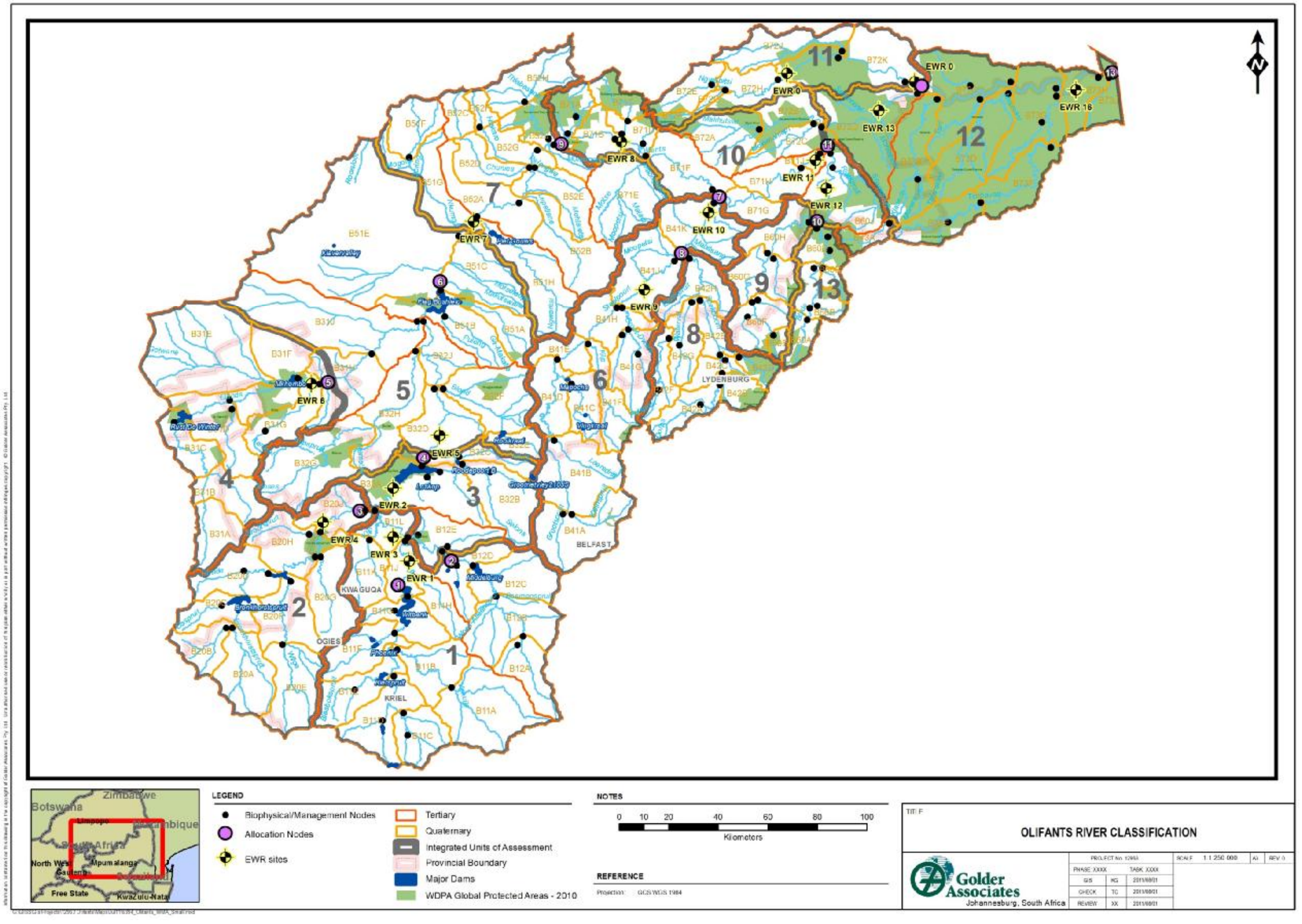
IUA	Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
	B20D	Hondespruit (MU24AB, confluence with Bronkhorstspruit)	High	High	C	Biophysical
		Bronkhorstpruit (MU24AC, outlet of quaternary)	High	Very high	C	Management Unit, biophysical, impacts from Bronkhorstspruit
	B20E, B20F	Wilge (MU22B, confluence with Bronkhorstspruit	High	Very high	C	Management Unit, biophysical
	B20G	Saalboomspruit (MU21, confluence with Wilge)				Management Unit, future mining impacts
	B20H	Grootspruit (MU25B, confluence with Wilge)	High	Very high	C	Biophysical
		Wilge (MU25AB, outlet of quaternary)	High	Very high	B	Management Unit, biophysical
	B20J	Wilge (EWR4, MU25C- *outlet of IUA2*)	High	Very high	B	Biophysical & outlet of IUA2
3	B12E	Doringboomspruit (confluence with Klein Olifants)	High	High	B	Biophysical
		Keeromspruit (confluence with Klein Olifants)	High	High	C	Biophysical
		Klein Olifants (EWR3, MU27B, outlet of quaternary)	High	High	C	Biophysical, Management Unit
	B32A	Kranspoortspruit (MU30B, inflow to Loskop Dam)	High	Very high	C	Biophysical
		Boekenhoutloop (inflow to Loskop Dam)	High	High	B	Biophysical
		Olifants (EWR2, MU30A, releases from Loskop Dam)	High	High	B	Management Unit, biophysical
	B32B , B32C	Klipspruit (confluence with Selons)	High	High	B	Biophysical
		Kruis (confluence with Selons)	High	High	B	Biophysical
		Selons (confluence with Olifants)	High	Very high	C	Biophysical
		Olifants (outlet of quaternary – *outlet of IUA3*)	High	High	D	Management Unit, biophysical & outlet of IUA3
4	B31A, B, C	One node at outlet of B31C, releases from RustdeWinter Dam	High	Very high	C	Management Unit, biophysical
		Included:				
		B31A (Elands)	High	High	C	Biophysical
		B31B (Hartbeesspruit)	High	Very high	C	Biophysical
	B31D	Enkeldoringspruit (confluence with Elands)	High	High	C	Biophysical
	B31F	Elands (releases from Mkumbe Dam)	High	High	C	Management Unit, biophysical
	B31G	Kameel (upper part only)	Moderate	High	D	Biophysical, before impacts of town and villages
		Elands (EWR6, outlet of quaternary– *outlet of IUA4*)				Management Unit & outlet of IUA4
5	B31H, B31J	Elands (outlet of quaternary, confluence with Olifants))				Management Unit

IUA	Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
	B32E, B32F	One node at confluence with Olifants in B32F Included: B32E (Bloed) B32F (Doringpoortloop, Diepkloof and Bloed)	 Moderate High	 High Moderate	 B C	Management Unit Biophysical Biophysical
	B32G, H	One node at outlet of B32H, confluence with Olifants Included: B32G (Moses) B32H (Mametse and Moses)	 High High	 High High	 C D	Management Unit Biophysical Biophysical
	B32D, B32J	Olifants (confluence with Elands)	High	Moderate	C	Management Unit, biophysical
	B51B	Puleng (upper part only) Olifants (outlet of quaternary, releases from Flag Boshielo Dam)	High	High	B	Biophysical Management Unit
	B51D, B51E	Olifants (outlet of quaternary– *outlet of IUA5*)				Management Unit & outlet of IUA5
6	B41A	Grootspruit (outlet of quaternary) Langspruit (confluence with Grootspruit), including Lakenvleispruit and Kleinspruit	High High	High Very high	C D	Biophysical Biophysical
	B41B	Laersdrift (confluence with Steelpoort)	High	Very high	D	Biophysical
	B41C	Masala (confluence with Steelpoort), including Tonteldoos and Vlugkraal)	High	High	C	Biophysical
	B41D, B41E	Steelpoort (outlet of quaternary, inflow to De Hoop Dam)	High	Very high	C	Biophysical & management unit
	B41F	Draaikraalspruit (confluence with Klip) Klip (inflow to De Hoop Dam)	High High	Very high Very high	B B	Biophysical Biophysical
	B41G	Kraalspruit (confluence with Groot Dwars) Klein Dwars (Confluence with Groot Dwars) Upper reaches of Dwars (before mining impacts)	High High High	Very high High Very high	B D C	Biophysical Biophysical Biophysical
	B41H	Dwars (EWR site, confluence with Steelpoort) Steelpoort (EWR9, releases from De Hoop Dam)	High High	High High	D D	Biophysical & management unit Biophysical & management unit
	B41J, B41K	Steelpoort (confluence with Olifants– *outlet of IUA6*)				Management Unit & outlet of IUA6

IUA	Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
7	B51F	Nkumpi (outlet of quaternary)	High	Moderate	C	Biophysical
	B51G	Olifants (EWR7)		High	D	Biophysical & management unit
	B52E	Palangwe (confluence with Olifants)	High	High	C	Biophysical
	B52F	Hlakaro (outlet)	High	High	C	Biophysical
	B52J	Mphogodima (confluence with Olifants)	High	High	C	Biophysical
	B52A, E, G, J	Olifants (outlet of quaternary – *outlet of IUA7*)				Management Unit & outlet of IUA7
8	B42A	Hoppe-se-Spruit (confluence with Dorps) Dorpspruit (outlet of quaternary)	Moderate Moderate	High High	C C	Biophysical Biophysical
	B42B	Dorpspruit (outlet of quaternary), including Doringbergspruit (confluence), Sterkspruit (confluence) and Klipgatspruit (confluence)	High	High	C	Biophysical
	B42C	Potloodspruit (confluence with Dorps)	High	High	C	Biophysical
	B42D, B42E	Dorps (confluence with Spekboom) Spekboom (confluence with Dorps)	High High	High Very high	C C	Biophysical, management unit & water quality impacts from Lydenburg Biophysical
	B42F	Potspruit (confluence with Watervals) Watervals (releases from Buffelskloof Dam)	High High	High Very high	C C	Biophysical Biophysical & management unit
	B42G	Rooiwalhoek-se-Loop (confluence with Watervals) Watervals (confluence with Spekboom)	High High	Very high Very high	B C	Biophysical Biophysical
	B42H	Spekboom (confluence with Steelpoort – *outlet of IUA 8*)	High	Moderate	B	Biophysical, management unit & outlet of IUA8
9	B60E, B60F	Kranskloofspruit (confluence with Ohrigstad) Mantshibi (confluence with Ohrigstad) Ohrigstad (outlet of quaternary)	High High Moderate	Very high Very high Very high	C C D	Biophysical Biophysical Biophysical & management unit
	B60G	Vyehoek (confluence with Ohrigstad)	High	Very high	C	Biophysical
	B60H	Ohrigstad (inflow to Blyderivierpoort Dam) – *outlet of IUA9B*	High	Very high	D	Biophysical, management unit & outlet of IUA 9B
10	B60J	Sandspruit (confluence), including Rietspruit and Qunduhlu Blyde (EWR12, confluence with Olifants & releases from	High	Moderate	B	Biophysical

IUA	Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
		Blyderivierpoort Dam)	Very high	Very high	C	Biophysical & management unit
	B71A	Paardevlei (confluence with Tongwane) Tongwane (confluence with Olifants)	High High	Very high High	B B	Biophysical Biophysical
	B71B	Olifants (EWR8)	High	High	C	Biophysical & management unit
	B71C	Mohlapitse (upper reaches)	Very high	Very high	B	Biophysical, conservation area
	B71D	Kgotswane (confluence with Olifants)		Moderate	B	Biophysical
	B71D, B71F	Olifants (confluence with Steelpoort)	High	Very high	D	Biophysical & management unit
	B71G, H, J	Olifants (EWR11, confluence with Blyde)	High	Very high	C	Biophysical & management unit
	B72A	Makhutswi (outlet), including Moungwane and Malomanye	High	High	C	Biophysical
	B72C	Olifants (outlet – *outlet of IUA10*)	High	High	C	Biophysical, management unit & outlet of IUA10
11	B72E	Ngwabatse (confluence with Ga-Selati)	High	Very high	D	Biophysical
	B72F, G	Ga-Selati (outlet of quaternary)	High	Very high	C	Biophysical
	B72H	Ga-Selati (EWR14a)	High	High	C	Biophysical
	B72J	Molatle (confluence with Ga-Selati)	Moderate	Moderate	B	Biophysical
	B72K	Ga-Selati (EWR14b, confluence with Olifants – *outlet of UIA11*)	High	High	E	Biophysical, management unit & outlet of IUA11
12	B72D	Olifants (EWR13, confluence with Ga-Selati)	High	High	C	Biophysical & management unit
	B73A	Klaserie (releases from Klaserie Dam)	High	Very high	C	Biophysical & management unit
	B73B	Monwana (confluence with Klaserie) Klaserie (confluence with Olifants)	High High	Low High	B C	Biophysical Biophysical
	B73C	Tsiri (confluence with Olifants) Tshutshi (confluence with Olifants) Olifants (EWR15)	High High	Low Very high	B C	Biophysical Biophysical Biophysical & management unit
	B73D	Nhlaralumi (confluence with Olifants), including Machaton, Nyameni and Thlaralumi	High	Low	B	Biophysical
	B73E	Sesete (confluence with Timbavati)	High	Low	B	Biophysical
	B73F	Timbavati (outlet of quaternary)	High	Moderate	B	Biophysical

IUA	Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
	B73G	Shisakashonghondo (confluence with Timbavati) Timbavati (confluence with Olifants)	High High	Low Moderate	A B	Biophysical Biophysical
	B73G, B73H	Olifants (EWR16)	Very high	High	C	Biophysical & management unit
	B73J	Hlahleni (confluence with Olifants) Olifants (outlet of quaternary – *outlet of IUA12*)	High High	Low Low	A C	Biophysical Biophysical, management unit & outlet of IUA12
13	B60A, B60B	Blyde (confluence with Lisbon) Lisbon (confluence with Blyde), including Heddelspruit and Watervalspruit	High High	Very high Very high	C B	Biophysical Biophysical
	B60C	Treur (EWR site, confluence with Blyde) Blyde (confluence with Treur)	High High	Very high Very high	B B	Biophysical Biophysical
	B60D	Kadishispruit (confluence with Blyde– dolomitic fountains) Belvedere (confluence with Blyde), including Muilhuisspruit Blyde (inflow to Blyderivierpoort Dam) – outlet of IUA 9A	 High	 Very high	 B	 Biophysical, conservation area



IUAs within Olifants WMA indicating location of proposed nodes and EWR sites

DOCUMENT INDEX

Reports as part of this study:

Bold type indicates this report.

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3	**RDM/WMA04/00/CON/CLA/0311**	**Integrated Units of Analysis Delineation Report**

LIST OF ABBREVIATIONS AND ACRONYMS

CD: RDM	Chief Directorate: Resource Directed Measures
CSIR	Council for Scientific and Industrial Research
DWA	Department of Water Affairs
EIS	Ecological Importance and Sensitivity
EWR	Ecological Water Requirements
GDP	Gross Domestic Product
IUA	Integrated Unit of Analysis
IUCN	World Conservation Union
IWRM	Integrated Water Resource Management
K2C	Kruger to Canyons Biosphere Reserve
KNP	Kruger National Park
MC	Management Class
Mt	Million tons
MU	Management Unit
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PGM	Platinum Group Metals
PES	Present Ecological State
RDM	Resource Directed Measures
REC	Recommended Ecological Category
ROM	Run of Mine
RQOs	Resource Quality Objectives
SEZ	Socio-Economic Zones
UNESCO	United Nations Education, Scientific and Cultural Organization
WMA	Water Management Area
WRC	Water Resource Classification
WRCS	Water Resource Classification System
WRYM	Water Resources Yield Model
WRPM	Water Resources Planning Model

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1 INTRODUCTION

1.1 Background

The National Water Act (Act No. 36 of 1998) (NWA) is founded on the principle that National Government has overall responsibility for and authority over water resource management for the benefit of the public without seriously affecting the functioning of the water resource systems. In order to achieve this objective, Chapter 3 of the NWA provides for the protection of water resources through the implementation of resource directed measures (RDM). As part of the RDM, a management class (MC) has to be determined for a significant water resource, as the means to ensure a desired level of protection. The purpose of the MC is to establish clear goals relating to the quantity and quality of the relevant water resource.

The classification system, the Reserve and Resource Quality Objectives (RQOs) together are intended to ensure comprehensive protection of all water resources. An important consideration in the determination of RDM is that they should be technically sound, scientifically credible, practical and affordable.

The Chief Directorate: Resource Directed Measures (CD:RDM) of the Department of Water Affairs (DWA) is tasked with the responsibility of ensuring that the water resources are classified in terms of the Water Resource Classification System (WRCS) to ensure that a balance is sought between the need to protect and sustain water resources on one hand and the need to develop and use them on the other. The CD: RDM has identified the need to undertake the classification of significant water resources (rivers, wetlands, groundwater and lakes) in the Olifants Water Management Area (WMA) in accordance with the WRCS.

The MC and associated RQOs will assist the DWA make more informed decisions regarding the authorisation of future water uses, operation and management of the system and the evaluation of the magnitude of the impacts of the present and proposed developments.

1.2 Study Area

The spatial extent for the classification study includes secondary drainage regions B1 to B7, the catchment area of the Olifants WMA. This includes the Upper, Middle and Lower Olifants and Steelpoort river sub-catchment areas within the Olifants WMA (see Figure 1). The Letaba River catchment area is not included in the study area.

The Olifants River originates at Trichardt to the east of Johannesburg and initially flows northwards before gently curving in a generally eastward direction through the Kruger National Park and into Mozambique, where it joins the Limpopo River before discharging into the Indian Ocean. The Olifants (WMA) corresponds with the South African portion of the Olifants River catchment (excluding the Letaba River catchment). It falls within three provinces, *viz*. a small part to the west within Gauteng, with the southern part mainly in Mpumalanga and the northern part in Limpopo Province. The main tributaries are the Wilge, Elands and Ga-Selati Rivers on the left bank and the Klein Olifants, Steelpoort, Blyde, Klaserie and Timbavati Rivers on the right bank.

Distinct differences in climate occur; from cool Highveld in the south to subtropical, east of the escarpment. Mean annual rainfall is in the range of 500 mm to 800 mm over most of the WMA.

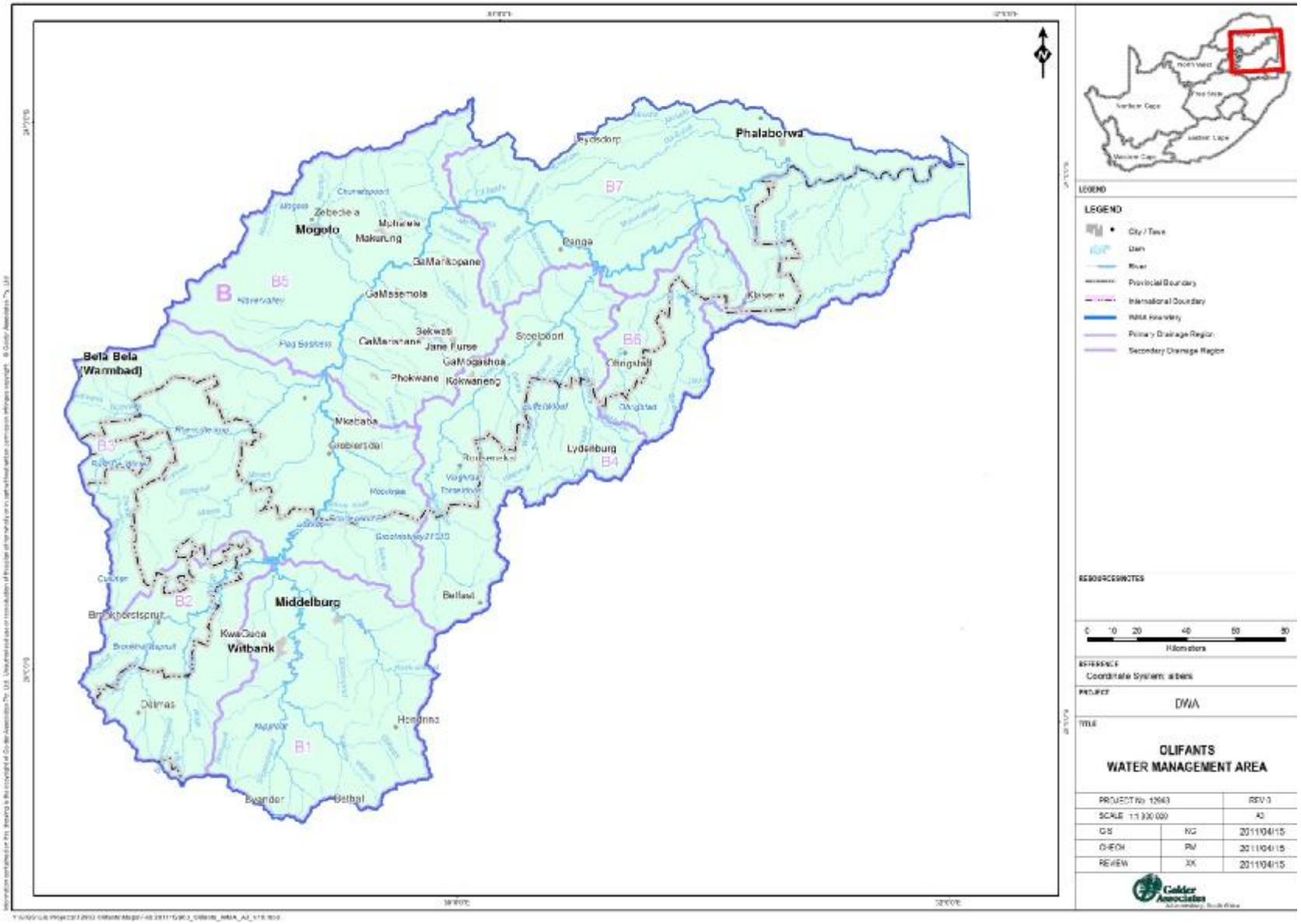

Figure 1: The Olifants WMA

The main economic activity in the WMA is related to coal, platinum, vanadium, chrome, copper and phosphate mining. The coal mining is located in the upper reaches of the catchment around Witbank, Middelburg and Delmas. There are large thermal coal fired power stations associated with the coal mining. The platinum, chrome and vanadium mines are located in the Steelpoort and middle areas of water management area while the copper and phosphate mining occurs in the lower Olifants around Phalaborwa. There are also large steel foundries located in Middelburg and Witbank.

Extensive irrigation occurs in the vicinity of the Loskop Dam, along the lower reaches of the Olifants River, near the confluence of the Blyde and Olifants Rivers, as well as in the Steelpoort valley and upper Selati catchment. Much of the central and north western areas of the water management area are largely undeveloped, with scattered rural villages where the people are mainly dependent on income from migrant workers in the Gauteng area, Witbank, Middelburg and Phalaborwa are the largest urban centres. Land use in the water management area is characterised by rain-fed cultivation in the southern and north-western parts, with grain and cotton as main products. While most of the water management area remains under natural vegetation for livestock and game farming as well as conservation, severe overgrazing is prevalent in many areas. Afforestation is found in some of the higher rainfall areas, with notable plantations in the upper Blyde River valley.

With the Olifants River flowing through the Kruger National Park, which is located at the downstream extremity of the water management area, the provision of water to meet ecological requirements is one of the controlling factors in the management of water resources throughout the water management area (DWAF, 2004).

Most surface runoff originates from the higher rainfall southern and mountainous areas. There are 9 major dams constructed in the Olifants River and the major tributaries which regulate the flow in the river system.

Large quantities of groundwater are abstracted for irrigation in the north-west of the water management area, as well as for rural water supplies throughout most of the area. Potential for increased groundwater utilisation has been identified on the Nebo Plateau north-east of Groblersdal. Substantial amounts of water are transferred into the water management area as cooling water for power generation, while smaller transfers are made to neighbouring water management areas.

1.3 Purpose of the Study: Classification of Significant Water Resources in the Olifants WMA

The purpose of this study is to coordinate the implementation of the 7 step process of the WRCS (see Figure 2) in the Olifants WMA in order to determine a suitable MC for the significant water resources and in so doing deliver the Integrated Water Resource Management (IWRM) template with recommendations for presentation to the delegated authority of DWA.

The determination of the MC is necessary to facilitate a balance between protection and use of water resources. In determining the class, it is important to recognise that different water resources will require different levels of protection. In addition to achieving ecological sustainability of the significant water resources through classification, the process will allow due consideration of the social and economic needs of competing interests by all who rely on the water resources.

The WRCS will be applied taking account of the local conditions, socio-economic imperatives and system dynamics within the context of the South African situation. The process will also require a wide range of complex trade-offs to be assessed and evaluated at a number of scales.

The Olifants WMA is a highly utilised and regulated catchment and like many other WMAs in South Africa its water resources are becoming more stressed due to an accelerated rate of development resulting in the scarcity of water resources. There is an urgency to ensure that water resources in the Olifants River catchment area are able to sustain their level of uses and be maintained at their desired states. The MC of the significant water resources in Olifants WMA will ensure that the desired condition of the water resources, and conversely, the degree to which they can be utilised is maintained and adequately managed within the economic, social and ecological goals of the water users. The MC of the water resource will therefore set the boundaries for the volume, distribution and quality of the Reserve and RQOs, and thus the potential allocable portion of a water resource for use.

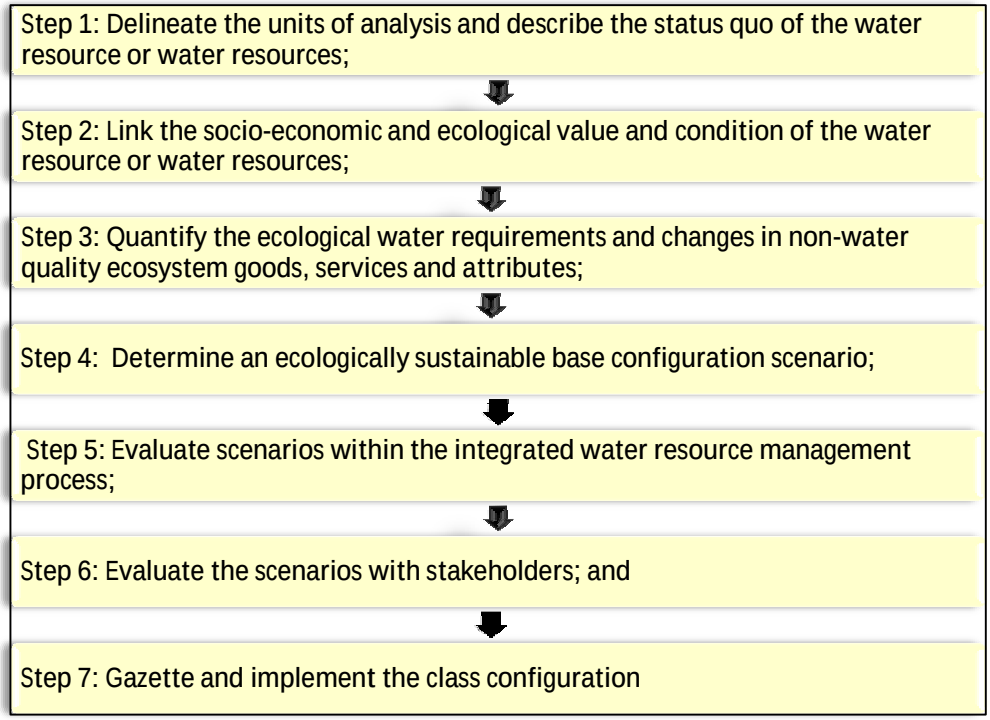

Figure 2: Steps to determine the Management Class

1.4 Purpose of the report

As part of the Classification process the first step is to delineate the units of analysis *i.e*. the spatial units that will be defined as significant water resources. Each integrated unit of analysis (IUA) represents a homogenous socio-economic area which requires its own specification of the MC. This report therefore details the process of delineating the IUAs for the water resources in Olifants WMA.

The purpose of this report is therefore:

- To provide the information used to delineate the IUAs;
- To detail the defined set of delineated IUAs within the Olifants WMA, and
- To list the biophysical nodes within the IUAs and management nodes at each IUA outlet.

2 INTEGRATED UNITS OF ANALYSIS DELINEATION

2.1 Approach

IUAs are the spatial units that are defined as significant water resources. The objective of defining IUAs is to establish broad scale units for assessing the socio-economic implications of different catchment configuration scenarios and to report on the ecological conditions at a sub-catchment scale (DWA, 2007a).

Delineation of units of analysis is required as it would not be appropriate to set the same MC for all water resources in a catchment. The delineation of a WMA/catchment into IUAs for the purpose of determining the MC for significant rivers is done primarily according to a number of socio-economic criteria and drainage region (catchment area) boundaries. IUAs are thus a combination of socio-economic zones and watershed boundaries (DWA, 2007b). Ecological information also plays a role in the delineation.

The process followed in terms of IUA delineation is that described in the WRCS Guidelines, Volumes 1 and 2 (Overview and the 7-step classification procedure; and Ecological, hydrological and water quality guidelines for the 7-step classification procedure) (DWA, 2007b).

In the IUA delineation process overlaying all of the above data does not necessarily result in a logical and clear delineation and expert judgement, a consultative process and local knowledge may be required for the final delineation of the IUAs. The practicalities of dealing with numerous significant water resources and associated tributaries within one study must also be considered to determine a logical and practical set of IUAs.

Biophysical nodes are established within an IUA to serve as modelling points for the Classification process in a catchment. The nodes are used to assess the response of upstream water resources to changes in water quality, quantity and timing (DWA, 2007b). Biophysical nodes should be located at the end points of eco-system reaches to allow for meaningful trade-offs. The establishment of biophysical nodes is guided by a number of considerations.

2.2 IUA Delineation

The following was considered for delineation of IUAs within the Olifants WMA:

- Socio-economic zones (SEZs)
- Catchment area boundaries (drainage regions and water resource systems)
- Similar land use characteristics/land based activities
- Eco-regions and Geomorphology
- Ecological information
- Present Ecological State
- Stakeholder input.

2.2.1 Socio-economic Zones

SEZ's determined for the Olifants WMA were based on broad socio-economic parameters. Figure 3 and Table 1 show and describe the broad socio-economic zones. Once the SEZs had been determined, twelve IUA's for the Olifants WMA were delineated, taking into account the above-mentioned guidelines.

Table 1: Description of the socio-economic zones (SEZ) for the Olifants Water Management Area

Descriptor	Primary economic characteristics and drivers	Secondary economic characteristics	IUAs
Energy Zone	Coal fields, coal mining, power generation, heavy manufacturing, N4 corridor	Annual crops grown (maize), general economic infrastructure associated with coal, energy and manufacturing	1 and 2 highly similar
Rural Agriculture Zone	Commercial agriculture (isolated irrigation), dense rural settlements, subsistence agriculture	Scattered tourism / protected areas, poverty, isolated mining activities (sand), some influence from Polokwane economy to the north	3, 4, 5, 7 (possibly separate commercial agriculture from rural/subsistence zones)
Conservation and Agriculture Zone	Protected areas and tourism, commercial agriculture and forestry	Supporting infrastructure for primary economies	8 – Agriculture/tourism 9,13 – Agriculture/tourism 10 - Agriculture/protected areas 12 – Protected area/tourism
Metallic Mineral Zone	Platinum reserves, Metals mining and manufacturing	Supporting infrastructure for primary economies	6 – Platinum zone 11

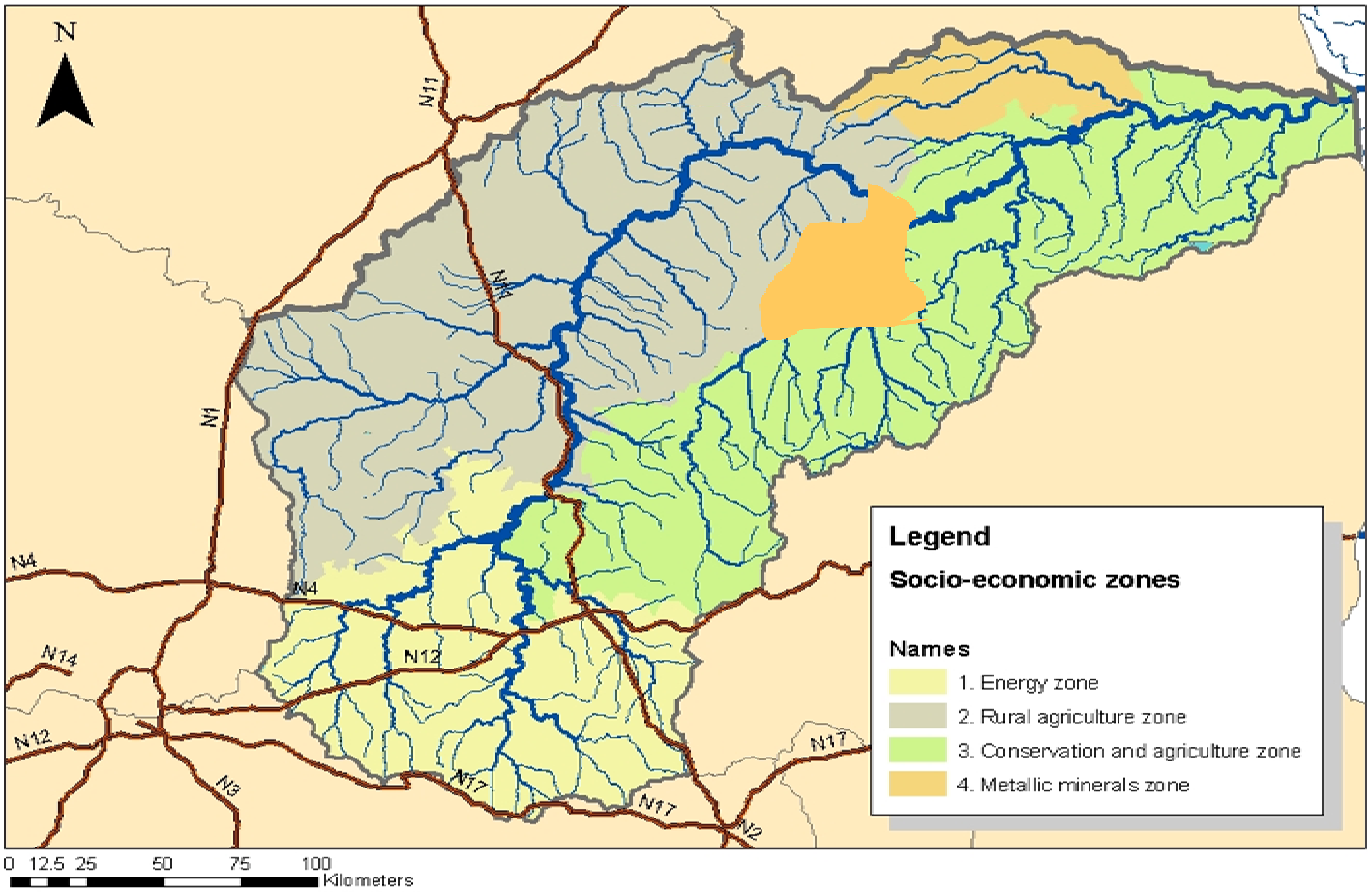

Figure 3: Socio-economic zones (SEZ) determined for the Olifants Water Management Area

2.2.2 A Social and Economic Overview of the Olifants WMA

The Olifants WMA is one of the most economically important WMA's in South Africa. Economic activity in the WMA is highly diverse and is characterised by mining, metallurgic activities, commercial agriculture, dry land and subsistence agriculture and eco-tourism. The economy of the WMA is largely driven by the mining sector, with large coal deposits found in the Emalahleni and Middelburg areas and large platinum group metal (PGM) deposits found in the Steelpoort and Phalaborwa areas. The WMA is home to several large thermal power stations, which provide energy to large portions of the country. Extensive agriculture can be found in the Loskop Dam area, the lower catchment near the confluence of the Blyde and Oilfants Rivers as well as the in the Steelpoort Valley and the upper Selati catchment.

According to the DWA (2004), the Olifants WMA generates approximately 5% of South Africa's gross domestic product (GDP). The key economic drivers in the area are:

- Agriculture,
- Mining,
- Electricity,
- Tourism, and
- The value chains associated with the above sectors.

Agriculture

Agriculture in the Olifants WMA can be broadly divided into subsistence/semi commercial farming (typically dry land), commercial dry land (typically large-scale and highly mechanized), and commercial irrigated farming (often export-oriented, highly mechanised) (IWRM, 2008) (Figure 4). Commercial dryland accounts for approximately 13% of the total Olifants WMA while irrigated farming and subsistence farming account for 2 and 4% respectively of the total land area (Table 2) (CSIR, 2003).

Table 2: Distribution of dryland, irrigated and subsistence farming in the Olifants Water Management Area

Type of farming	Total hectares	% of Olifants WMA
Dryland	732 149	13%
Irrigated	114 788	2%
Subsistence	245 575	4%

Maize is the dominant dryland crop grown throughout the catchment while commercial irrigated farming is highly diversified with wheat, maize and cotton comprising the bulk of the irrigated crop. A large portion of high value crops for export, such as citrus and grapes are grown in the catchment especially around the Groblersdal and Marble Hall areas (IWRM, 2008).

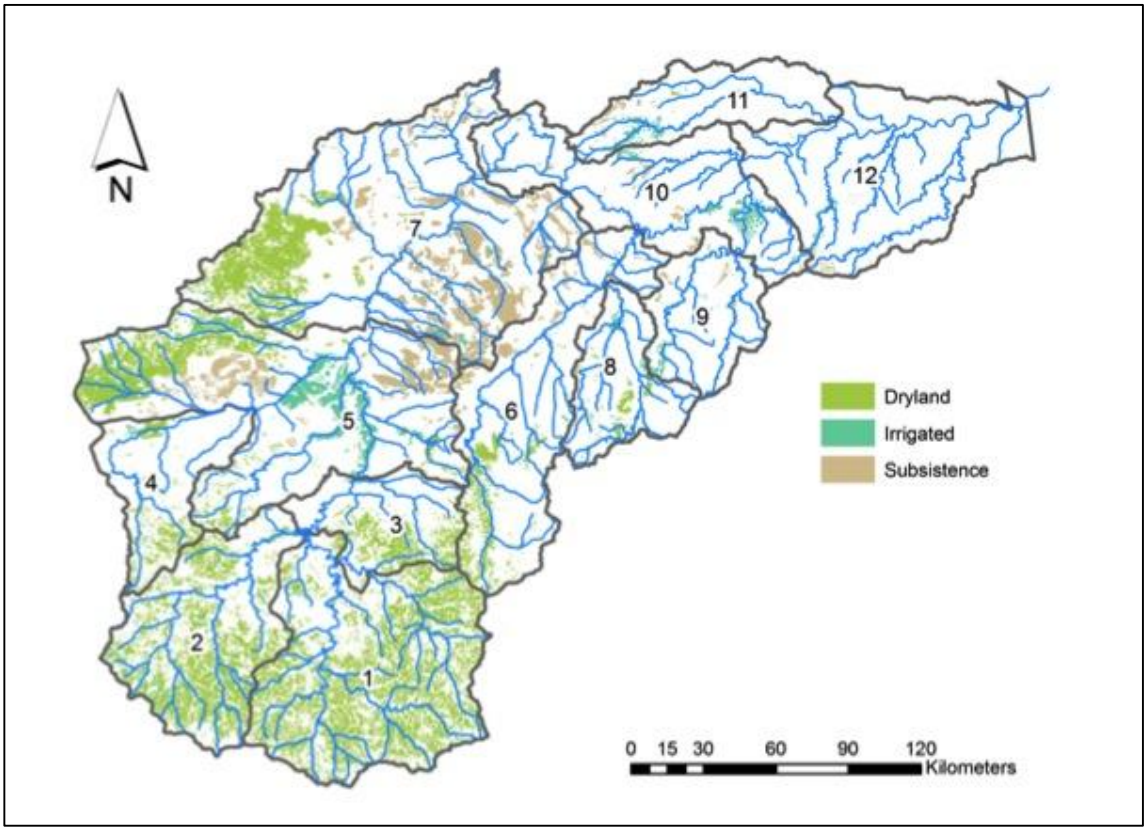

Figure 4: Distribution of agriculture within the Olifants Water Management Area

Mining

The rich mineral deposits present in the Olifants River Catchment, is a key economic driver in the area. Various mining activities span the Olifants River Basin. Three major concentrations of mining activities are of importance:

- Coal mining on the Mpumalanga Highveld;
- Platinum Group Metals (PGM) in the Middle Olifants and Steelpoort Valley; and
- Various mining activities around the Phalaborwa Industrial Complex and Gravelotte.

Mining within the Upper Olifants sub-catchment consists almost entirely of coal mining. The coal mining activities supply coal to the various power stations in the WMA.

Platinum mining dominates mining activities in the Middle Olifants zone. The Bushveld Igneous Complex (BIC) is the world's largest and most valuable layered intrusion. It holds over half the world's platinum, chromium, vanadium and refractory minerals and has ore reserves that could last for hundreds of years. These also include significant reserves of tin, fluorite and copper. Platinum group metals (as well as vanadium, chrome and iron) mining initiated in the Steelpoort/Mogoto and Mokopane areas will not be able to be implemented unless additional water resources are made available.

Intensive copper and phosphate mining operations exist around Palaborwa. The Phalaborwa Mining Company is South Africa's largest copper producer and in addition also produces

titaniferous magnetite, nickel, uranium, gold, silver, rare-earth elements, phosphates, vermiculite and PGM's. Foskor is a very large producer of phosphate and zirconium as well as small quantities of copper, PGMs and other minerals. To the west of Phalaborwa, rocks of the Gravelotte Group and Rooiwater Complex outcrop in the vicinity of the town of Gravelotte. Quartzite, schists, basic lava and granitic rocks dominate the Gravelotte Group lithology. These formations contain important deposits of antimony and gold, with minor deposits of mercury and zinc. An extensive deposit of heavy mineral sands (illmenite, rutile and zirconium) is located near the town of Gravelotte.

Tourism Economy

The Olifants WMA contains important natural heritage, especially in its lower reaches. These areas are water-dependent and play an important role in the tourism economy of the region. Some of these areas are closely associated with cultural heritage. Key areas include:

- The Kruger National Park and adjoining protected areas (Klaserie, Timbavati, Olifants Conservancy, Umbaba)
- The Wolkberg Wilderness Area on the northern rim of the Olifants catchment;
- The Legalametse Nature Reserve south east of the Wolkberg; and
- The Loskop Dam Nature Reserve.

Dullstroom and Lydenburg and up to the Steelpoort River and Burgersfort in the north is another important tourism area, with natural beauty and as well as being a premier fly-fishing destination.

The Kruger to Canyons Biosphere Reserve (K2C) is an internationally recognised development initiative that complies with and is accredited to UNESCO's Man and the Biosphere programme. Also in the Olifants WMA is an area that abuts onto the western boundary of the KNP. It lies between Acornhoek and Phalaborwa and is the largest area of privately owned conservation land in the world. The inclusion of the Timbavati, Balule, Klaserie, Umbaba and other private nature and game reserves has effectively added in excess of 250,000 ha (more than 10%) to the conservation area of the KNP (DWA 2005).

Electricity

Eskom is operating 7 coal fired power stations and constructing an eighth in the Olifants WMA. The seven operating stations produce approximately 70% of South Africa's electricity. The Olifants WMA thus plays a key strategic role in the national economy of South Africa.

Demography

The Olifants River Basin is home to 3,4 million people, which constitutes approximately 7% of South Africa's population (DWAF, 2002). The population of the Basin is predominantly rural with approximately 67% of the population living in rural areas. Approximately 60% of the population reside in the former homeland areas of Lebowa, KwaNdbele, and parts of Bophuthatswana and Gazankulu), which constitute 26% of the area in the basin (IWMI, 2008). According to Statistics SA (2001), 29% of the total population is employed, 24% are unemployed and 47% are not economically active. A striking observation is the large disparity between household income groups, with nearly 85% of households in the Very Poor and Poor Categories (Table 3). More in

depth information is given per IUA in the sections that follow.

Table 3: Annual household income categories in the Olifants WMA (Census 2001)

Income Category	Number of Households
Very Poor (no income-R9600)	261 827
Poor (R9601-R38 400)	133 456
Tolerable (38 401-R76 800)	35 036
Comfortable (R76 801-R153 600)	20 790
Wealthy (R153 601 & above)	13 286
Total	**464 395**

Table 4: Employment by sector in the Olifants WMA (Census 2001)

Sector	Employment
Agriculture; hunting, forestry and fishing	25 959
Mining and quarrying	33 858
Manufacturing	30 415
Electricity; gas and water supply	7 668
Construction	20 309
Wholesale and retail trade; repairs, hotels and restaurants	40 693
Transport, storage and communication	11 752
Financial intermediation; insurance; real estate and business services	16 711
Community; social and personal services	57 393
Private households	35 212
Extraterritorial organisations	11
Representatives of foreign governments	16
Undetermined	21 924
Total	**301 920**

2.2.3 Catchment Area Boundaries

The Olifants River catchment (including the Letaba and Shingwedzi catchments) is a sub-catchment of the Limpopo Basin and is the largest tributary of the Limpopo River. The Olifants River runs a long course from the Highveld across varying terrain and geology to meet with the Limpopo River in Mozambique. The Olifants WMA lies within the B primary drainage region. The catchment area includes the secondary drainage regions B1 to B7 (see Figure 5), 13 tertiary drainage areas and 117 quaternary catchments.

The WMA may be divided into four sub-areas based on watershed boundaries, namely the Upper Olifants (B1 and B2), Middle Olifants (B3 and B5), Lower Olifants (B6 and B7) and Steelpoort (B4) (Figure 5 and Table 5):

- Upper Olifants Catchment constitutes the catchment of the Olifants River down to Loskop Dam.
- Middle Olifants Catchment comprises the catchment of the Olifants River downstream from the Loskop Dam to the confluence with the Steelpoort River.
- Steelpoort Catchment corresponds to drainage region of the Steelpoort River.
- Lower Olifants Catchment represents the catchment of the Olifants River between the Steelpoort confluence and the Mozambique border.

Table 5: The sub-catchment areas within the study area

Sub-catchment	Catchment Area (km^2)	Quaternary catchments
Upper Olifants	12 250	B11 A-K, B12 A-E, B32A
Middle Olifants	22 550	B31 A-J, B32 B-J, B51 A-H, B52 A-J, B71 A-F
Steelpoort	7150	B41 A-K, B42 A-H
Lower Olifants	12 600	B60 A-J, B72 A-K, B73 A-J

IUAs were delineated based the socio-economic criteria and drainage region (catchment area) boundaries described above.

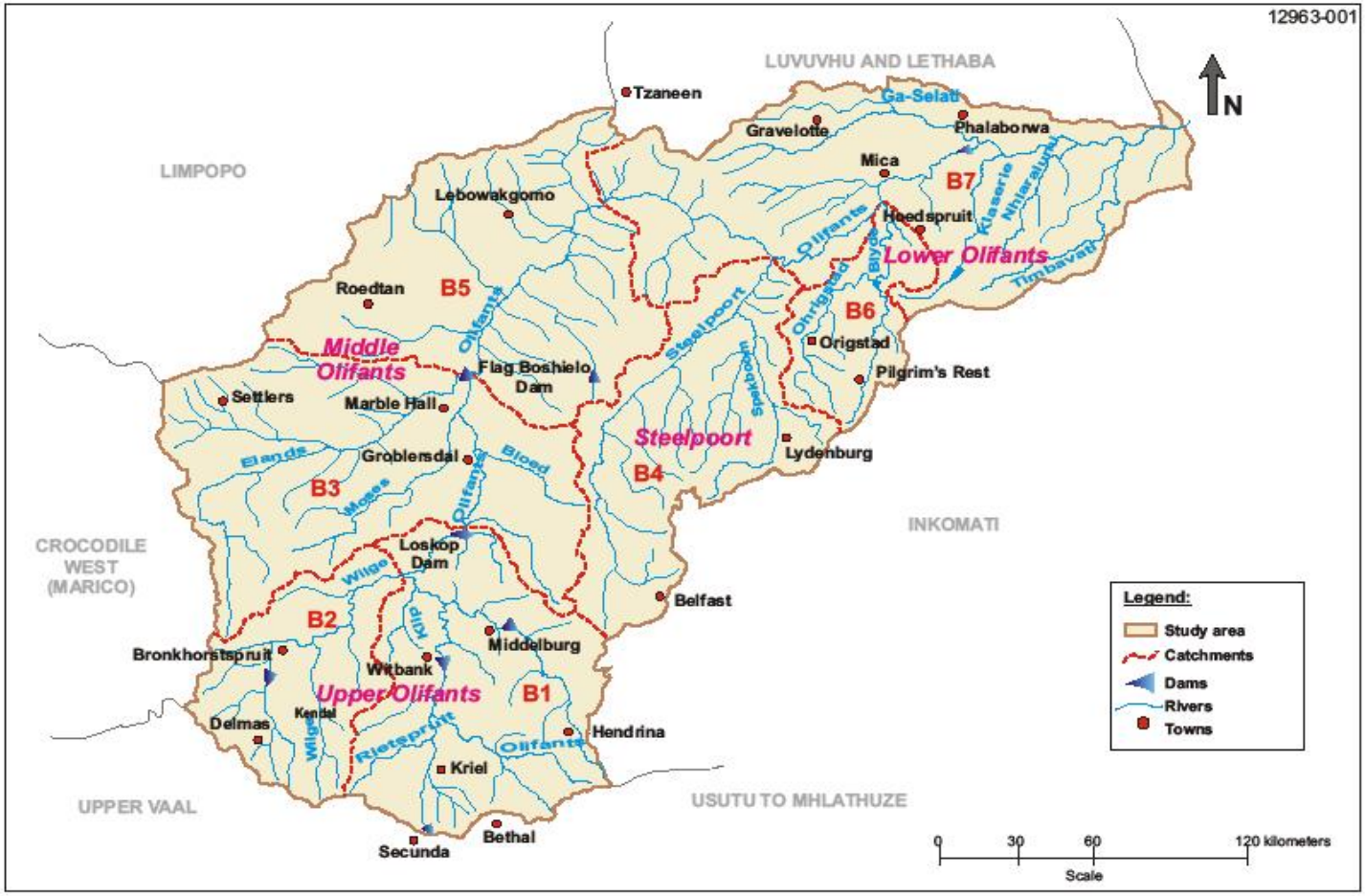

Figure 5: Secondary catchment area boundaries within the Olifants WMA (B1 to B7)

2.2.4 Land use/land based activities

Wide variations in social and economic development occur over the Olifants WMA, where the strong influence of mineral deposits on development is particularly evident. The level of development in the area is influenced by the mineral deposits. The main economic activity is concentrated in the mining and industrial centres of Witbank and Middelburg, near Phalaborwa and in the Steelpoort where a variety of minerals are found. Coal mining is the predominant mining activity, but copper, phosphate, chrome, platinum, vanadium and diamonds are also mined. The availability of a relatively cheap supply of coal has contributed to the development of both the electricity sector and the steel mills in Witbank. Some of the largest thermal power stations in the world are located in the Upper Olifants sub-area.

Extensive irrigation occurs in the vicinity of Loskop Dam, along the lower reaches of the Olifants River, near the confluence of the Blyde and Olifants Rivers as well as in the Steelpoort valley and upper Selati catchment. Much of the central and north western areas of the WMA are largely undeveloped, with scattered rural settlements. Land use in the WMA is characterised by rain-fed cultivation in the southern and north-western parts, with grain and cotton as main products.

While most of the WMA remains under natural vegetation for livestock and game farming as well as conservation, severe overgrazing is prevalent in many areas. Afforestation is found in some of the higher rainfall areas, with notable plantations in the upper Blyde River valley.

Ecotourism to the Kruger National Park and private game farms is also a contributor, as is the trout industry (DWAF 2003).

The predominant use of water in the Olifants WMA is by the irrigation sector, which represents about 57% of the requirements in the WMA. Other major uses are power generation with 19% and urban, industrial and mining together a further 19% (DWAF 2003). The water for power generation is transferred into the Olifants WMA from adjacent catchments

The current use of land/landcover in the Olifants and Letaba catchments is described in Table 6 below (DEAT, *et al*.,2009)

Table 6: Use of land/land cover (DEAT, 2009)

Land use/ Land cover	Surface Area (km^2)	Quaternary catchments
Indigenous Forest	374	0.51%
Woodland	14 643	19.89%
Thicket and Bushland (incl. Herbland)	21 656	29.41%
Grassland	11 066	15.03%
Planted Grass	17	0.02%
Forest Plantation	1 231	1.67%
Water Body/Wetland	580	0.79%
Bare Rock and Soil (Natural)	180	0.25%
Degraded Land	7 229	9.82%
Irrigated Agriculture	1 941	2.64%
Dryland Agriculture	11 886	16.14%

Urban/Built-up (Residential)	2 236	3.04%
Urban/Built-up (Smallholdings)	84	0.11%
Mining/Industrial	495	0.67%
Total area	**73 630**	**100**

2.2.5 Eco-regions and Geomorphology

Eco-regions

Eco-regional classification allows for the grouping of rivers according to similarities. The available information has been used to delineate eco-region boundaries at a very broad scale (*i.e.* Level I) for South Africa. Attributes such as physiography, climate, rainfall, geology and potential natural vegetation were evaluated in this process and thirty one Level I Eco-regions were identified for South Africa (Kleynhans et al., 2005). While eco-regions descriptions tend to be based on physical and vegetation attributes, the assumption is that the biota within a eco-region are likely to be more similar.

The Eco-region information was used to delineate the Olifants WMA. The eco-regions that occur in the Olifants WMA are as follows:

- ***Highveld***: This eco-region (high lying region) is characterized by plains with low to moderate relief, and various grassland vegetation types. The altitude ranges between 1100masl and 2100masl. Rainfall is concentrated in early to late summer, with a coefficient of annual variation of <20% to 35%. Mean annual air temperatures are between 12°C and 20°C.

- ***Eastern Bankenveld:*** The eco-region is characterized by closed hills and mountains with moderate and high relief together with North-eastern Mountain Grassland and Mixed Bushveld. The altitude ranges between 500masl and 2300masl. Rainfall is concentrated in early to mid summer, with a coefficient of annual variation of <20% to 34%. Mean annual air temperatures are between 10°C and 22°C.

- ***Bushveld Basin***: This eco-region consists predominantly of plains with a low relief with mixed Bushveld being the definitive vegetation type. In the east plains with a moderate relief and lowlands with a moderate relief occur. The altitude ranges between 700masl and 1700masl. Rainfall is concentrated in early to mid summer, with a coefficient of annual variation of 25% to 35%. Mean annual air temperatures are between 14°C and 22°C.

- ***Lowveld***: The eco-region is characterized by plains with a low to moderate relief and vegetation consisting of mostly Lowveld Bushveld types. The altitude ranges between 700masl and 1300masl. Rainfall is concentrated in early to late summer, with a coefficient of annual variation of <20% to 35%. Mean annual air temperatures are between 16°C to > 22°C.

- ***Northern Plateau***: The topography of this eco-region is dominated by plains with low to moderate relief characteristic of this plateau. Vegetation consists mainly of mixed bushveld, but with areas of mountain grassland. The altitude ranges between 900masl and 1500masl.

Rainfall is concentrated in early to mid summer, with a coefficient of annual variation of 25% to 35%. Mean annual air temperatures are between 16°C to 22°C.

- ***Northern Escarpment Mountains:*** The topography of this high lying area consists of closed hills and mountains with moderate to high relief. The altitude ranges between 500masl and 900masl. Rainfall is concentrated in early to mid summer, with a coefficient of annual variation of <20% to 35%. Mean annual air temperatures are between 10°C to 22°C.

- ***North Eastern Highlands:*** This is a mountainous area characterised by closed hills and mountains with moderate to high relief and vegetation comprising Highveld grassland and lowveld bushveld types. The altitude ranges between 300masl and 1300masl. Rainfall is concentrated in early to mid summer, with a coefficient of annual variation of <20% to 30%. Mean annual air temperatures are between 16°C to 22°C.

- ***Lebombo uplands:*** This long, thin eco-region is defined by closed hills and mountains with a moderate to high relief. The altitude ranges between 0masl and 500masl. Rainfall is concentrated in early to mid summer, with a coefficient of annual variation of <20% to 35%. Mean annual air temperatures are between 18°C to >22°C.

The Eco-regions of the Olifants WMA are illustrated in Figure 6.

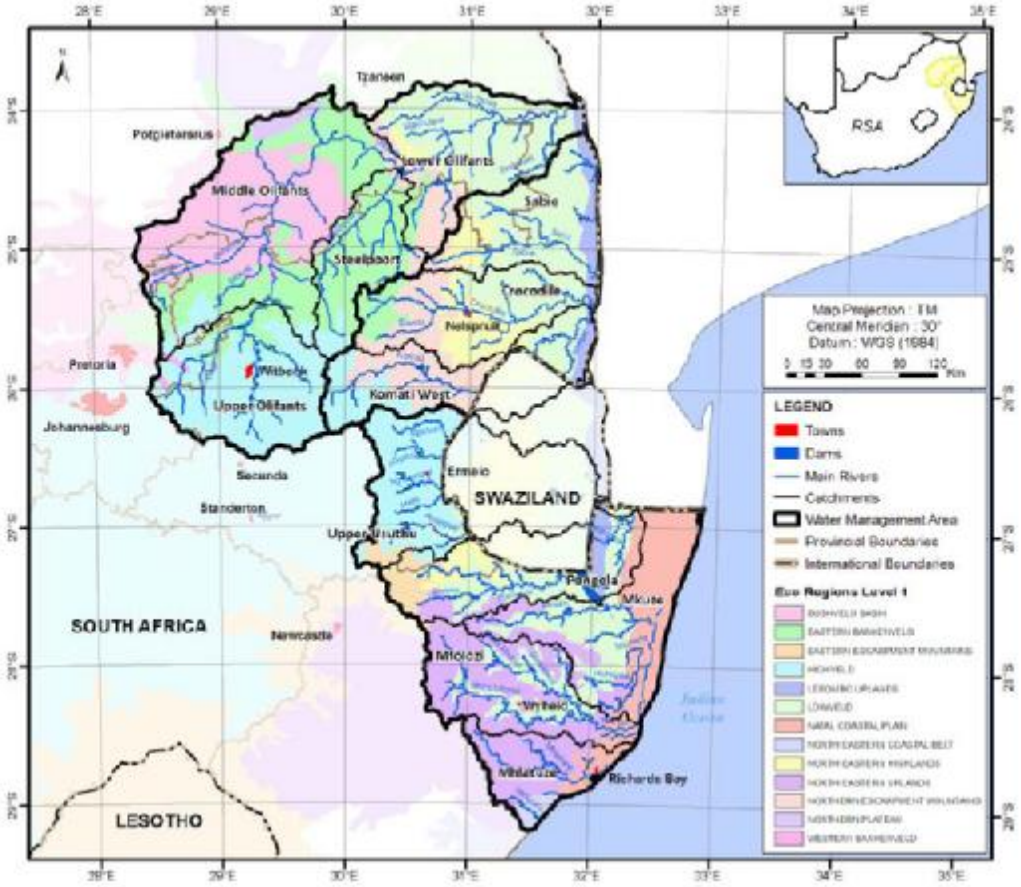

Figure 6: Eco-regions that occur in the Olifants WMA (Source: DWA, 2010)

Geomorphology

Geomorphology provides a basis of classification for the purpose of describing the physical habitat of riparian and aquatic ecosystems, as it encompasses the physical processes which have shaped the river channel. Rivers and streams change naturally along their lengths with respect to temperature, depth, current speed, substratum, turbidity and chemical composition. The longitudinal physical and chemical changes can be used to classify the reaches of rivers. Rowntree and Wadeson (1999) have developed a zonal classification system for Southern African rivers modified from Noble and Hemens (1978). On the basis of channel features ten geomorphological zone classes have been defined and are described in Table 7.

Table 7: Geomorphological zonation of South African river channels (Adapted from Rowntree and Wadeson, 1999)

Zone class	Zone	Gradient class
S	Source Zone	Not specified
A	Mountain Headwater Stream	>0.1
B	Mountain Stream	0.04 – 0.099
C	Transitional	0.02 – 0.039
D	Upper Foothills	0.005 – 0.019
Dr	Rejuvenated Upper Foothills	0.001 – 0.019
E	Lower Foothills	0.001 – 0.005
F	Lowland River	0.0001 – 0.0009
Er	Rejuvenated Lower Foothills	0.001 – 0.019

The geomorphological zones that occur in the Olifants WMA include:

- Lower Foothills
- Lowland River
- Upper Foothills
- Transitional
- Mountain stream
- Mountain Headwater stream.

2.2.6 Ecological information

There are a number of ecologically important areas within the Olifants WMA and various conservation areas have been proclaimed in the WMA. The most well known conservation area is the Kruger National Park (KNP) located in the Lower Olifants Sub-area of the Olifants WMA. There are other ecologically important areas in the WMA, which have not been proclaimed as conservancy areas (e.g. the Mohlapitse River).

There are also numerous pans and wetlands located in the Upper Olifants Sub-area. Many of these pans and wetlands are under threat by mining. This is due to undermining, mining through or the use of the pans for the storage and evaporation of saline mine water. There are also numerous gorges. The more important gorges are located upstream of the Mozambique border in the KNP, the transition from the highveld to the lowveld and upstream of Loskop Dam.

The results from comprehensive Olifants River Ecological Water Requirements study form the basis of the ecological information being used for the classification of water resources of the Olifants WMA. However, this information has been collected more than 10 years ago and in some areas the system has changed due to anthropogenic activities. This was confirmed during a site visit to a number of the existing site as part of an DWA/World Conservation Union (IUCN) study undertaken in 2008. The main results from the study are summarised in Table 8 and Table 9 .

Table 8: **Summary of Present Ecological Status (PES), Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC) per resource unit**

REACH	PES	EIS	REC
Upper Olifants River : Segment 1 - 8	D	Moderate	D
Upper Olifants River : Segment 9 - 13 (Witbank Dam)	E	Moderate	D
Upper Olifants River : Segment 14 (Doringpoort Dam) - 27 (At & excluding Klipspruit confluence)	D	Moderate	C
Upper Olifants River : Segment 29 (Wilge confluence) - 37 (upper end of Loskop Dam)	C	High	B
Klein Olifants River : Segment 1 - 4 (Middelburg Dam)	D	Moderate	D
Klein Olifants River : Segment 5 (Middelburg Dam) - 12 (Olifants confluence)	D	Moderate	D
Wilge River : Segment 1 (Bronkhorstspruit Dam) 7 (Premier Mine Dam) (Bronkhorstspruit River)	C	Moderate	C
Wilge River : Segment 7 (Premier Mine Dam) - 20 (Olifants confluence)	B	High	B
Middle Olifants River : Segment 39 (Loskop Dam Wall) - 45	C	High	B
Middle Olifants River : Segment 46 - 57 (Flag Bashielo Dam)	D	Moderate	D
Middle Olifants River : Segment 58 (Flag Bashielo Dam Wall) - 84	E	Moderate	D
Elands River : Segment 1 - 7 (Rust de Winter Dam)	C	Moderate	B
Elands River : Segment 8 (Rust de Winter Dam) - 15 (Mokhombo Dam)	E	Moderate	C
Elands River : Segment 16 (Mokhombo Dam) - 27 (Flag Bashielo Dam - Olifants confluence)	E	Moderate	D
Lower Olifants River : Segment 85 - 99 (Blyde confluence)	E	High	D
Lower Olifants River : Segment 100 (Blyde confluence) - 110 (Selati confluence)	C	High	B
Lower Olifants River : Segment 111 (Selati confluence) - 132 (Mozambique border)	C	High	B
Selati River : Segment 1 - 9	C	Moderate	C
Selati River : Segment 10 - 18	E	Moderate	D
Blyde River : Segment 1 (Blydepoort Dam) - 8 (Olifants River confluence)	B	High	B
Steelpoort River : Segment 1 - 8	D	High	D

Table 9: Summary of EWR site information (DWA, 2001)

EWR site	River	Quaternary	PES	REC	EIS	%EWR	EWR (MCM/a)
1	Olifants	B11J	E	C	Moderate	18.6	27.59
2	Olifants	B32A	C	B	High	23.8	116.38
3	Klein Olifants	B12E	D	C	Moderate	27	19.9
4	Wilge	B20J	B	B	High	29.9	57.74
5	Olifants	B32D	C	B	High	19.09	95.52
6	Elands	B31G	E	D	Moderate	17.9	11.33
7	Olifants	B51G	E	D	Moderate	12.7	89.39
8	Olifants	B71B	E	D	Moderate	15.2	127.05
9	Steelpoort	B41J	D	D	High	15.2	26.03
10	Steelpoort	B41K	D	D	High	12.1	49.17
11	Olifants	B71J	E	D	High	13.7	189.8
12	Blyde	B60J	B	B	High	34.5	132.33
13	Olifants	B72D	C	B	Moderate	23.6	434.86
14a	Selati	B72K	C	C	Moderate	31.2	17.13
14b	Selati	B72K	E	D	Moderate	24.8	16.12
16	Olifants	B73H	C	B	Very high	21.6	425.73

A desktop assessment of the water resources to update the 1999 spreadsheet of present ecological state and ecological importance and sensitivity per quaternary catchment utilizing all additional information available since the completion of the comprehensive Reserve determination study in 2001 was undertaken 2007. A 2010 update to the PES/EIS spreadsheet has recently been undertaken. This information is included as Appendix A and will be used in this classification study.

In the proceeding sections, the ecological state is discussed for each of the IUAs delineated.

2.2.7 Water Infrastructure

Several large dams have been constructed on the Olifants River and its tributaries, and the surface water resources are already highly developed. The main storage dams are:

- The Witbank and Middelburg Dams, which meet the urban and industrial demands of the Witbank and Middelburg centres.

- The Bronkhorstspruit Dam which supplies Bronkhorstspruit and the Western Highveld Region in the Elands River catchment with water for domestic and industrial use. There is also a supply for irrigation.
- The Mokhombo and Rust De Winter Dams are used to supply water for domestic use to the Western Highveld Region and for irrigation.
- Loskop Dam is used primarily to supply irrigation water to the Loskop Irrigation Board. Some water is supplied to the Western Highveld Region for domestic use.
- Flag Boshielo Dam was constructed to mainly supply water for irrigation, domestic use and support the transfer of water to Polokwane for domestic use. Many of the irrigation schemes have fallen into disrepair. Some of the irrigation schemes are in the process of being revitalised. The dam has been raised to increase the yield to supply the mines while the yield of the original dam supplies the irrigation schemes.
- Blyderivierspoort Dam, which supplies water for irrigation, local industrial and domestic demands and supports the supply from the Phalaborwa Barrage to the urban and industrial centre at Phalaborwa.

A new dam De Hoop Dam is being built on the Steelpoort River.

Large quantities of water are transferred into the water management area as cooling water for power generation. These are:

- from Nooitgedacht and Vygeboom Dams (Inkomati water management area);
- from Westoe, Jericho and Morgenstond Dams (Usutu to Mhlatuze water management area); and,
- from Grootdraai Dam (Upper Vaal water management area), partly using water from Heyshope Dam (Usutu to Mhlatuze water management area).

Rand Water supplies water from the Vaal River to several towns in the southern extremity of the water management area, while in the north water is supplied from the Letaba River (Levuvhu/Letaba water management area) for mining purposes near Gravelotte as well as to domestic users in the Olifants water management area. Water is transferred from the Olifantspoort Weir in the Middle Olifants sub-area to Polokwane (Limpopo WMA). A small transfer exists from the Wilge River to Cullinan (DWAF, 2004).

2.2.8 Present Status of water resources

Most the surface runoff in the Olifants WMA originates from the higher rainfall southern and mountainous areas. There are 9 major dams constructed in the Olifants River and the major tributaries which regulate the flow in the river system.

Groundwater is abstracted for irrigation in the north-west of the water management area, as well as for rural water supplies throughout most of the area. Potential for increased groundwater utilisation has been identified on the Nebo Plateau north-east of Groblersdal. Substantial amounts of water are transferred into the water management area as cooling water for power generation, while smaller transfers are made to neighbouring water management areas.

In the natural state, the quality of surface water is good. This, however, is highly impacted upon by coal mining in the Upper Olifants sub-area. Sophisticated remedial measures have been implemented to contain mine wash-off and leachate, and for controlled release of polluted water into the natural streams at times of high flows when sufficient assimilative capacity exists. Water

quality problems are also experienced due to the discharge of mine effluent in the Phalaborwa area. Land degradation contributes to high sediment loads.

In the Upper and Middle Olifants Sub-area Integrated Water Resources Management Plan has been developed for the catchment areas. The Resource Water Quality Objectives (RWQOs) set during these processes are being used to manage the catchments. The water quality in Upper Olifants sub-area is under threat from the coal mines. The management of mine water decant volumes is being addressed by the mining industry with a number of projects addressing treatment and irrigation management options. The water quality problems in the Middle and Steelpoort Sub-areas are salinity, eutrophication, toxicity and sediment. The salinity and eutrophication problems are due to the irrigation return flows, mining impacts and sewage treatment plant discharges. Pesticides and herbicides have been cited as the cause of the toxicity problems but this need to be confirmed by monitoring. The sediment is related to poor agricultural practice due to overgrazing in the rural areas. The production of sediment, particularly in the Middle Olifants Sub-area causes operational problems at the downstream Phalaborwa Barrage. In the Lower Olifants Sub-area, the water quality is influenced by the water quality of the return flows from the mining complex around Phalaborwa in the Ga-Selati River. This water quality is impacted in the Olifants River. The water emanating from the Blyde River is of a good quality and together with the good quality water from the Mohlapitse River maintains the water quality in the Olifants River in the KNP at an acceptable quality (DWAF, 2004).

2.2.9 Stakeholder input

As part of the WRC process the stakeholders in the Olifants WMA were engaged through stakeholder processes to obtain proposals and motivations on the IUA delineation for the WMA. In terms of the engagement that transpired between the DWA and stakeholders, the Mpumalanga Tourism and Parks Agency at a meeting held on 27 June 2011 in Lydenburg, proposed that the Blyde River and Ohrigstad River catchments warranted being delineated as two separate IUAs even though they are both located within the B60 secondary drainage region. The reasoning for this recommendation is that the Blyde River and its tributaries are mostly in a good ecological state with numerous conservation areas and special rivers and biota. The Ohrigstad River has been used extensively for agriculture and there are some areas where there is no flow in the river due to abstractions. The motivation is to rather have them as separate IUAs as one can then set a higher management class for the Blyde system to ensure protection in the light of ongoing pressure to develop the upstream parts of the catchment.

3 DELINEATION OF IUAS

Based on the SEZs determined and the assessment of the information and considerations outlined in Section 2.2, thirteen IUA's were delineated for the Olifants WMA. The availability of representative EWR sites within each IUA and catchment boundaries and catchment modelling schematics were also considered. The WRCS Guideline, Volume 2, Ecological, hydrological and water quality guidelines for the 7-step classification procedure (February 2007) was also followed in terms of IUA delineation.

The thirteen IUAs delineated are listed in Table 10 and illustrated in Figure 7. The identified IUAs have been discussed with the Department and accepted by stakeholders within the Olifants WMA.

Table 10: IUAs delineated in the Olifants WMA

IUA	
1	Upper Olifants River catchment
2	Wilge River catchment area
3	Selons River area including Loskop Dam
4	Elands River catchment area
5	Middle Olifants up to Flag Boshielo Dam
6	Steelpoort River catchment
7	Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River
8	Spekboom catchment
9	Ohrigstad River catchment area
10	Lower Olifants
11	Ga-Selati River area
12	Lower Olifants within Kruger National Park
13	Blyde River catchment area

3.1 IUA Descriptions

Each of the IUAs delineated in the Olifants WMA is described in further detail in the sections that follow.

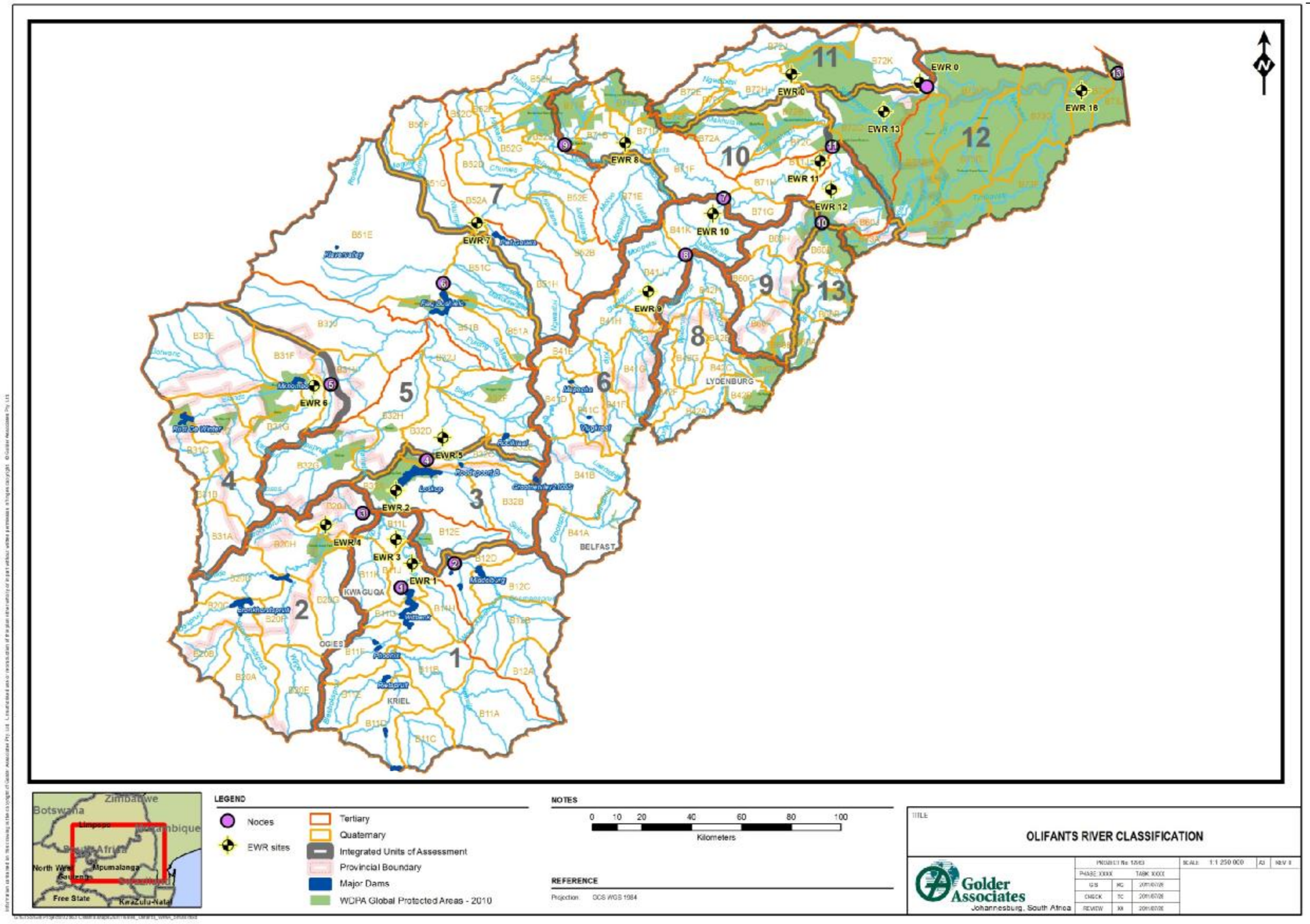

Figure 7: IUAs (13) delineated for the Olifants WMA

3.1.1 IUA 1: Upper Olifants River catchment

This IUA principally includes the local economy of eMalahleni (Witbank) and includes the towns of Middelburg, Hendrina, Douglas, Kriel and Kinross (Figure 8). The southern border of the IUA is located just north of Evander, Secunda and Bethal. The IUA includes the upper Olifants River and the Klein Olifants, Witbank Dam, Middelburg Dam and the Klip River. The IUA is characterized by intensive coal mining and associated energy and manufacturing economy. The IUA is highly used and impacted. The area includes a large number of coal mines, steel industry, urban areas and return flows. Secondary economic activities include dryland agriculture and a wide variety of industrial and commercial sectors.

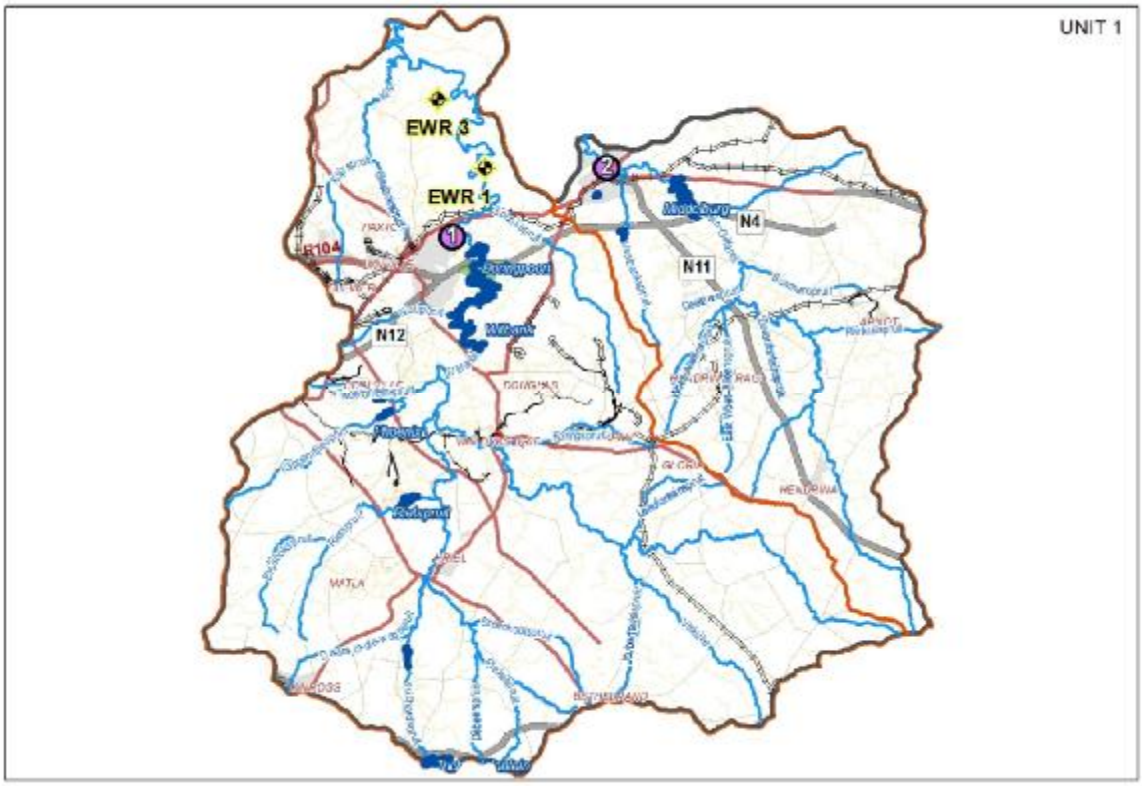

Figure 8: IUA 1 – Upper Olifants River catchment area

3.1.1.1 Demographic profile and basic services

The population of IUA 1 is approximately 369 808 (Census 2001) with approximately 104 648 households of which the large majority falls within the very poor and poor income categories (Table 11). Of the 104 648 households approximately 5 829 (6%) have no access to piped water (Census 2001).

Table 11: Household income categories for IUA 1

Income Category	Number of Households
Very Poor (no income-R9600)	36 958
Poor (R9601-R38 400)	35 840
Tolerable (38 401-R76 800)	13 564
Comfortable (R76 801-R153 600)	10 706
Wealthy (R153 601 & above)	7 579
Total	**104 648**

Of the total number of people interviewed in IUA 1 approximately 23% were unemployed (Table 12). The mining and quarrying sector supplied the largest number of jobs in IUA 1 (Table 13).

Table 12: Employment categories for IUA 1

Employment categories	Number
Unemployed	58 787
Employed	106 901
Not economically active	88 586
Total Interviewed	**254 273**

Table 13: Employment by sector in IUA 1

Sector	Employment
Agriculture; hunting, forestry and fishing	6 712
Mining and quarrying	20 865
Manufacturing	11 893
Electricity; gas and water supply	5 784
Construction	5 810
Wholesale and retail trade; repairs, hotels and restaurants	14 242
Transport, storage and communication	3 637
Financial intermediation; insurance; real estate and business services	7 067
Community; social and personal services	15 005
Private households	8 825
Representatives of foreign governments	0
Undetermined	7 060
Total	**106 901**

3.1.1.2 Mining

Coal mining is the predominate sector in this IUA. Much of the IUA falls within the Witbank Coalfield, where most of South Africa's coal is mined. Of the 71 operating collieries in South Africa

at the end of 2001, 39 (55%) of these were located in the Witbank Coalfield.

In 2001, the coalfield accounted for 155.132 million tons (Mt) (about 52.49%) of the total 295.546 Mt run of mine (ROM[1]) production in SA (Jeffrey, 2005).

Within the IUA, there are five major coal companies (BHP Billiton, Anglo Coal, Xstrata, Exxaro and Optimum Coal) that produce the bulk of coal in South Africa (Table 14). In addition there are a host of other smaller coal companies that produce coal in the IUA, but available information is limited. The above-mentioned companies produced approximately 143,9 Mt of coal in 2010, which was approximately 57% of the total coal produced in SA for 2010.

Table 14: Coal production (Mt ROM) for the five major coal-producing companies in IUA 1 in 2010

Company	Name	Location	Annual Production Capacity (Mt) (2010)
BHP Billiton	Douglas/Middelburg	Douglas/Middelburg	14,7
	Khutala	Near Witbank	10,8
	Klipspruit	Near Ogies	4,8
AngloCoal	Goedehoop Colliery	40km east of Witbank	7,5
	Greenside Colliery	15km south-west of Witbank	4,4
	Kleinkopje Colliery	8km south of Witbank.	4,5
	Zibulo Colliery	25km south-east of Ogies	7
	Landau Colliery	Witbank	4,2
	Mafube Colliery	37km east of Middelburg	4,2
	Kriel Colliery	45km south of Witbank near Bethal	10
	Isibonelo Colliery	120km east of Johannesburg	5
Xstrata	iMpunzi Mining Complex	27km south of Witbank	4
	Tweefontein Division	Close to Ogies	9
	Goedgevonden Colliery	7km south of Ogies	1,2
	Southstock Division		11
Exxaro	Arnot	43 km from Middelburg	5
	Leeuwpan	Near Delmas	3
	Matla	20km west of Kriel	14
	New Clydesdale	Near Witbank	1,4
	North Block Complex	East of Witbank	3,3
Optimum Coal	Optimum Collieries		13,9
	Koornfontein		1
		Total Produced	**143,9**

[1] The coal delivered from the mine that reports to the coal preparation plant is called run-of-mine, or ROM, coal. This is the raw material for the coal preparation plant (CPP), and consists of coal, rocks, middlings, minerals and contamination. Contamination is usually introduced by the mining process and may include machine parts, used consumables and parts of ground engaging tools. ROM coal can have a large variability of moisture and maximum particle size.

3.1.1.3 Energy

IUA 1 is home to a large number of thermal power plants, which provide a large proportion of SA's energy requirements. The seven thermal power plants (Table 15) provide 34% of Eskom's total installed capacity.

Table 15: Installed capacity of thermal power stations in IUA 1

Power Station	Installed Capacity (MW)
Arnot	2 100
Duvha	3 600
Hendrina	2 000
Kriel	3 000
Komati	1 000
Matla	3 600
Kendal	4116
Total	**19 416**

3.1.1.4 Manufacturing

Although there are several manufacturing operations within IUA 1, Evraz Highveld Steel is one of the largest operations within the IUA. The Steelworks, which is close to eMalahleni comprises the Iron Plant, the Steel Plant, the Flat Products and Structural Products Mills and operational support infrastructure. The Mapochs Mine in Roossenekal (IUA 6) supplies iron ore for the various operations. The production figures for the various operating divisions in the steelworks for 2009 and 2010 are given in Table 16.

Table 16: Production (tons) of steel products at Evraz Highveld Steel for 2009/2010

Production ('000 tons)	2009	2010
Liquid Iron	661	771
Blooms	231	281
Slabs	457	457
Billets	-	36
Structural sections	174	210
Plates	162	121
Coils	140	132

3.1.1.5 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 1 is given in Table 17 below (CSIR 2003). Maize (107 106 ha) is the most common crop planted in IUA 1, followed by pasture (65 529 ha) (Table 18).

Table 17: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 1

Farming Type	Area (ha)
Dryland	251 613
Irrigated	5 050
Subsistence	-
Total	**256 663**

Table 18: Crop types grown in IUA 1

Crop	Area (ha)
Drybeans	3 353
Fallow	6 730
Maize	107 106
Vegetables	5 532
Pasture	65 529
Sorghum	3 207
Soya	17 346
Sunflower	7 530
Weeds	8 427
Undetermined	92
Total	**224 852**

3.1.1.6 Ecological Characteristics

The ecological character of the water resources in IUA 1 is described in Table 19.

Table 19: Present ecological status, ecological importance and important water resources in IUA 1

Characteristic	Description
Present ecological state, ecological importance	**Olifants, Steenkoolspruit and Upper Klein Olifants rivers** The water resources in the IUA are degraded and mainly in an E category presently due to the coal mining activities, large dams and urbanisation. The ecological importance is low except around the Witbank Dam area. This area still has some local, undeveloped areas. A number of wetlands are present in the upper reaches of the catchment.
EWR sites	Olifants River downstream of Witbank Dam (EWR1, B11J) – Comprehensive site at Noupoortspruit and Rapid III (B11G)
Main rivers per quaternary catchment	• B11A Olifants, Viskuile • B11B Olifants, Koringspruit • B11C Steenkoolspruit

Characteristic	Description
	• B11D Trichardtspruit, Steenkoolspruit • B11E Rietspruit, Steenkoolspruit • B11F Klippoortjiespruit, Olifants • B11G Olifants, Noupoortspruit • B11H Spookspruit • B11J Olifants, Klipspruit • B11K Klipspruit, Blesbokspruit • B11L Olifants • B12A Klein Olifants • B12B Woesalleen, Bosmanspruit, Rietkuilspruit, Klein Olifants • B11C, D Klein Olifants

3.1.2 IUA 2: Wilge River catchment area

This IUA principally includes the towns of Bronkhorstspruit and Delmas as well as the Ezemvelo Game Reserve to the north (Figure 9). The town of Ogies is located on the border of the IUA and IUA 1. The town of Cullinan is located on the border of the IUA 2 and IUA 4. The IUA includes the Wilge River and tributaries. The economy of IUA 2 is dominated by mixed coal mining and dryland agricultural activities, supported by local economies around the key towns.

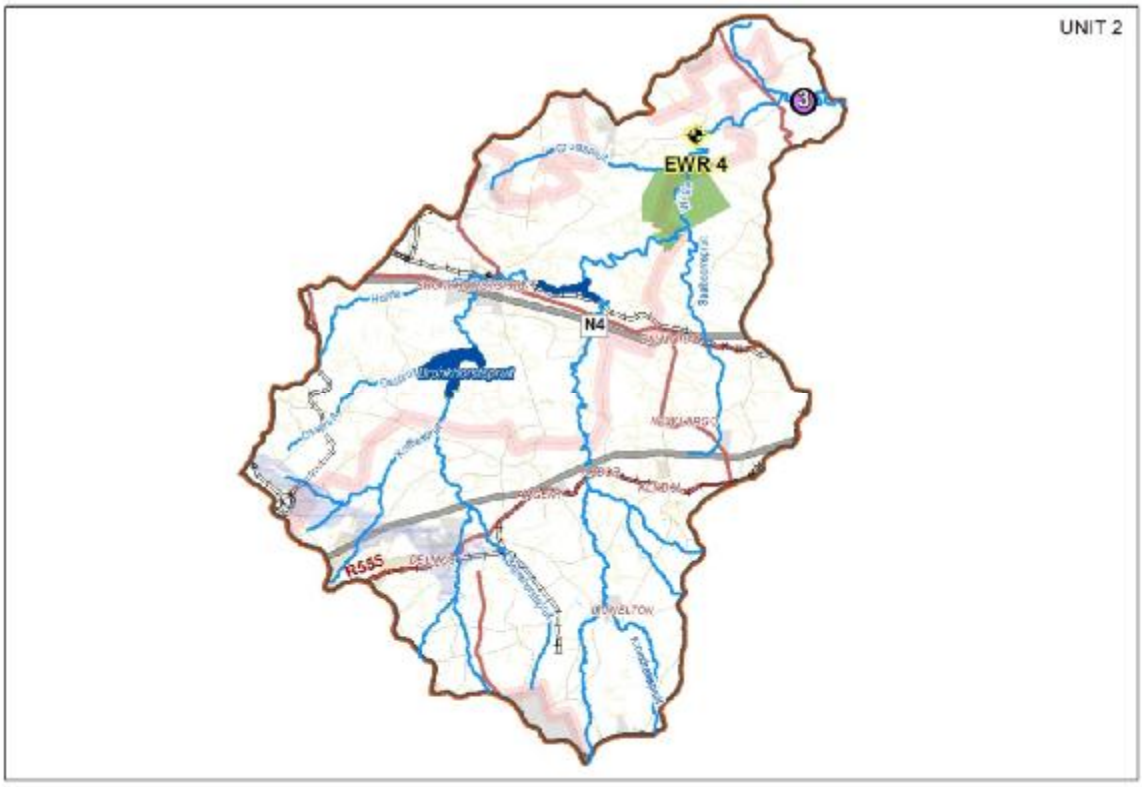

Figure 9: IUA 2 – Wilge River catchment area

3.1.2.1 Demographic profile and basic services

The population of IUA 2 is approximately 146 647 (Census 2001). The IUA has approximately 38 227 households of which the large majority falls within the very poor and poor income categories (Table 20). Of the 38 227 households approximately 2 333 (6%) have no access to piped water (Census 2001).

Table 20: Household income categories for IUA 2

Income Category	Number of Households
Very Poor (no income-R9600)	19 197
Poor (R9601-R38 400)	14 080
Tolerable (38 401-R76 800)	2 819
Comfortable (R76 801-R153 600)	1 207
Wealthy (R153 601 & above)	925
Total	**38 227**

Of the total number of people interviewed in IUA 2 approximately 31% were unemployed (Table 21). The manufacturing sector supplied the largest number of jobs in IUA 2 (Table 22). The mining and quarrying sector is also an important sector in terms of employment in IUA 2.

Table 21: Employment categories for IUA 2

Employment categories	Number
Unemployed	29 291
Employed	31 318
Not economically active	35 319
Total Interviewed	**95 928**

Table 22: Employment by sector in IUA 2

Sector	Employment
Agriculture; hunting, forestry and fishing	3 824
Mining and quarrying	3 910
Manufacturing	4 139
Electricity; gas and water supply	540
Construction	1 645
Wholesale and retail trade; repairs, hotels and restaurants	3 990
Transport, storage and communication	1 575
Financial intermediation; insurance; real estate and business services	1 510
Community; social and personal services	3 582
Private households	4 075
Extraterritorial organisations	4
Undetermined	2 526
Total	**31 318**

3.1.2.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 2 is given in Table 23 below (CSIR 2003). Maize (66 483 ha) is the most common crop grown in IUA 2 followed by pasture (26 644 ha) (Table 24).

Table 23: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 2

Farming Type	Area (Ha)
Dryland	141 323
Irrigated	8 430
Total	**149 752**

Table 24: Crop types grown in IUA 2

Crop	Area (ha)
Drybeans	285
Fallow	11 132
Maize	66 483
Vegetables	8 737
Pasture	26 644
Sorghum	1 038
Soya	15 338
Sunflower	5 579
Weeds	6 196
Undetermined	4 236
Total	**145 669**

3.1.2.3 Energy

There are two significant thermal power plants found in IUA 2, one of which is the proposed Kusile Power Station and the other is Kendal Power Station which is located out the catchment divide between IUA 1 and 2. The new power station will have an installed capacity of 4 800 MW, making it one of the largest thermal power stations in the world. Kendal

3.1.2.4 Ecological Characteristics

The ecological character of the water resources in IUA 2 is described in Table 25.

Table 25: Present ecological state, ecological importance and important water resources in IUA 2

Characteristic	Description
Present ecological state, ecological importance	**Bronkhorstspruit, Saalboomspruit and Upper Wilge rivers:**

Characteristic	Description
	The rivers in the IUA are in a moderately modified state (category C) with less developed areas in the catchment. Impacts within the catchment are related to agriculture, dams and some mining. The importance of the resources is moderate especially in terms of good water quality they contribute to the main stem Olifants above Loskop Dam.
EWR sites	Lower Wilge River, just below Emvelo game park (EWR4, B20J) – Comprehensive site.
Main rivers per quaternary catchment	• B20A Bronkhorstpruit • B20B Koffiespruit • B20C Osspruit, Bronkhorstpruit • B20D Bronkhorstpruit, un-named tributary • B20E Kromdraai, Wilge • B20F Wilge • B20G Saalboomspruit • B20H, J Wilge, un-named tributary

3.1.3 IUA 3: Selons River area including Loskop Dam

IUA 3 includes the Loskop Dam and its surrounding protected area (Figure 10). The IUA starts at the below the confluence of Olifants and the Wilge Rivers and also includes the Selons River and Kruis rivers. The IUA includes a section of the Klein Olifants between Mhluzi and the Doornkop protected area. The IUA has a largely natural and rural character and the agriculture sector is an important source of employment.

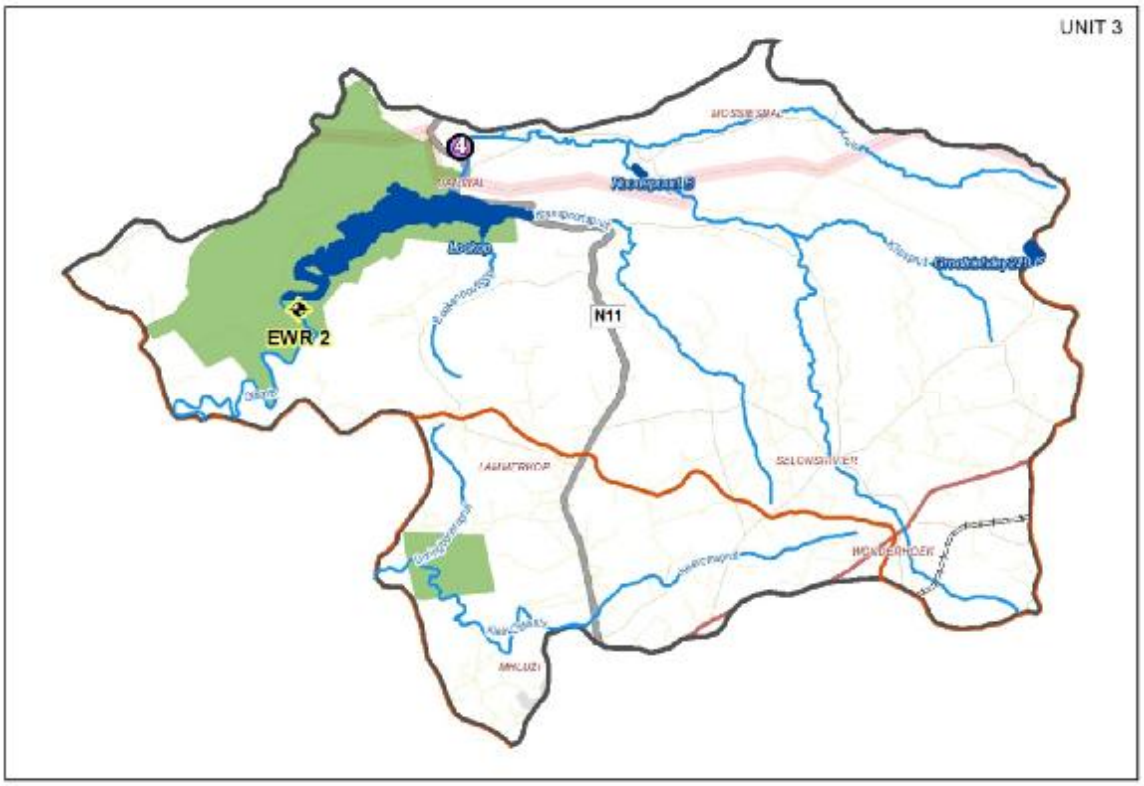

Figure 10: IUA 3 – Selons River catchment including Loskop Dam

3.1.3.1 Demographic profile and basic services

The population of IUA 3 is approximately 42 682 (Census 2001). The IUA has approximately 11 347 households of which the large majority falls within the very poor and poor income categories (

Table 26). Of the 11 347 households approximately 807 (7%) have no access to piped water (Census 2001).

Table 26: Household income categories for IUA 3

Income Category	Number of Households
Very Poor (no income-R9600)	5 127
Poor (R9601-R38 400)	4 518
Tolerable (38 401-R76 800)	895
Comfortable (R76 801-R153 600)	501
Wealthy (R153 601 & above)	306
Total	**11 347**

Of the total number of people interviewed in IUA 3 approximately 27% were unemployed (Table 27). The private households sector supplied the largest number of jobs in IUA 3 (Table 28). The wholesale and retail trade; repairs, hotels and restaurants sector is also an important sector in terms of employment in IUA 3.

Table 27: Employment categories for IUA 3

Employment categories	Number
Unemployed	7 393
Employed	11 299
Not economically active	9 149
Total Interviewed	**27 841**

Table 28: Employment by sector in IUA 3

Sector	Employment
Agriculture; hunting, forestry and fishing	1 147
Mining and quarrying	714
Manufacturing	1 418
Electricity; gas and water supply	103
Construction	914
Wholesale and retail trade; repairs, hotels and restaurants	1 857
Transport, storage and communication	322
Financial intermediation; insurance; real estate and business services	637
Community; social and personal services	1 266
Private households	2 046
Undetermined	875
Total	**11 299**

3.1.3.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 3 is given in Table 29 below (CSIR, 2003). Maize (14 678 ha) is the most common crop grown in IUA 3 followed by pasture (10 101 ha) (Table 30).

Table 29: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 3

Farming Type	Area (Ha)
Dryland	41 587
Irrigated	1 591
Subsistence	0
Total	**43 178**

Table 30: Crop types grown in IUA 3

Crop	Area (ha)
Fallow	3 534
Maize	14 678
Vegetables	1 546
Pasture	10 101
Sorghum	345
Soya	2 947
Sunflower	187
Weeds	17
Undetermined	105
Total	**32 459**

3.1.3.3 Ecological Characteristics

The ecological character of the water resources in IUA 3 is described in Table 31.

Table 31: Present ecological state, ecological importance and important water resources in IUA 3

Characteristic	Description
Present ecological state, ecological importance	**Lower Klein Olifants, Selons and Loskop Dam:** The state of the water resources in the IUA have been degraded (C to B category), mainly due to the upstream impacts from the Olifants and Klein Olifants. However, the presence of un-proclaimed wilderness areas and nature reserves provides habitats for the various biota in the system that give this area a high ecological importance.
EWR sites	Lower Wilge River, just below Emvelo game park (EWR4, B20J) – Comprehensive site

Characteristic	Description
Main rivers per quaternary catchment	• B20A Bronkhorstpruit • B20B Koffiespruit • B20C Osspruit, Bronkhorstpruit • B20D Bronkhorstpruit, un-named tributary • B20E Kromdraai, Wilge • B20F Wilge • B20G Saalboomspruit • B20H, J Wilge, un-named tributary

3.1.4 IUA 4: Elands River catchment area

IUA 4 includes the town of Cullinan in the South, Kwamahlanga, the Rust De Winter Dam, and the rural settlements (Siyabuswa) around the Mkhombo Dam. Bela Bela (Warmbaths falls outside of the IUA on the western boundary). The IUA includes the Elands, Kameel and Mkhombo Rivers. The IUA includes the Dinokeng protected area and Mdala Nature Reserve (**Figure 11**).

The economy has a rural characteristic with a large amount of smallholdings upon which a variety of economic activities take place (agriculture, grazing, light manufacturing, associated commercial activities and some tourism). The Elands River is mainly rural in the upper reaches with impacts from agriculture, dams and settlements in the lower reaches of the catchment.

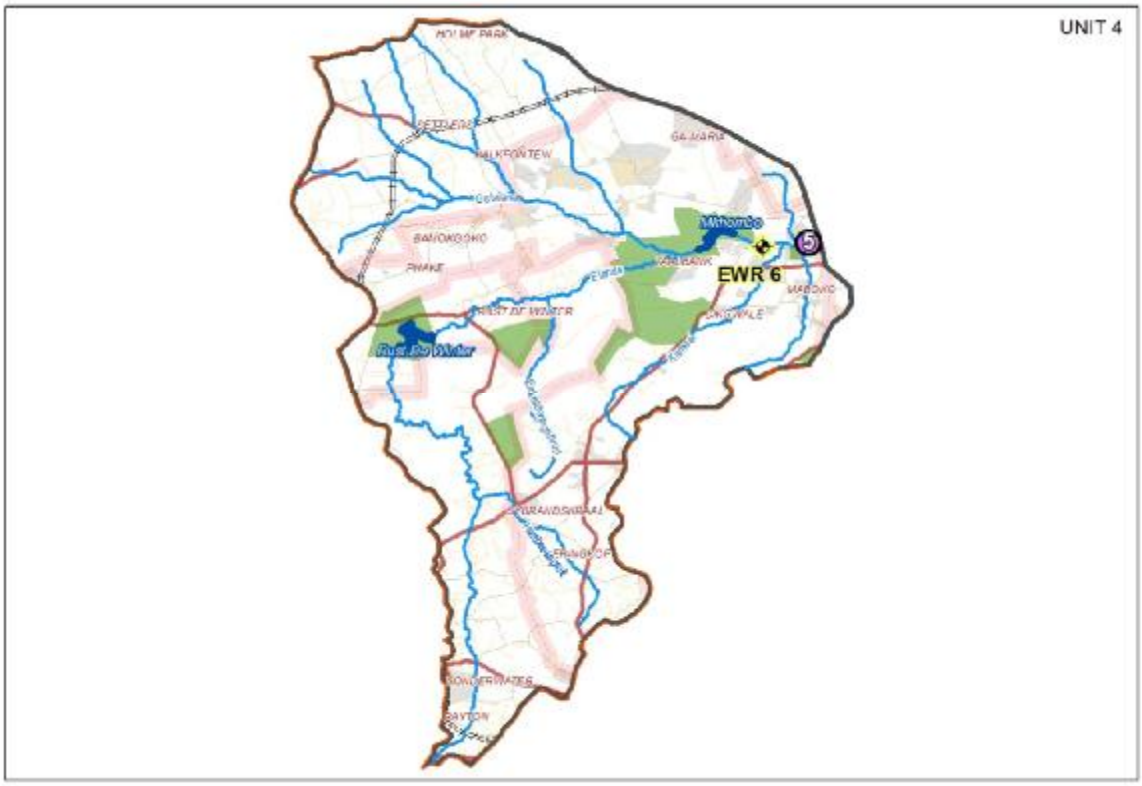

Figure 11: IUA 4: Elands River catchment area

3.1.4.1 Demographic profile and basic services

The population of IUA 4 is approximately 164 250 (Census 2001). The IUA has approximately 38 772 households of which the large majority falls within the very poor and poor income categories (Table 32). Of the 38 227 households approximately 4 647 (12%) have no access to piped water (Census 2001).

Table 32: Household income categories for IUA 4

Income Category	Number of Households
Very Poor (no income-R9600)	23 063
Poor (R9601-R38 400)	11 603
Tolerable (38 401-R76 800)	2 345
Comfortable (R76 801-R153 600)	1 128
Wealthy (R153 601 & above)	634
Total	**38 772**

Of the total number of people interviewed in IUA 4 approximately 23% were unemployed (Table 33). The community, social and personal services sector supplied the largest amount of jobs in IUA 4 (Table 34). The private households sector is also an important sector in terms of employment in IUA 4.

Table 33: Employment categories for IUA 4

Employment categories	Number
Unemployed	22 140
Employed	23 923
Not economically active	50 890
Total Interviewed	**96 953**

Table 34: Employment by sector in IUA 4

Sector	Employment
Agriculture; hunting, forestry and fishing	1 047
Mining and quarrying	551
Manufacturing	1 744
Electricity; gas and water supply	175
Construction	2 681
Wholesale and retail trade; repairs, hotels and restaurants	3 311
Transport, storage and communication	1 248
Financial intermediation; insurance; real estate and business services	1 344
Community; social and personal services	5 140
Private households	4 560
Representatives of foreign governments	6
Undetermined	2 115
Total	**23 923**

3.1.4.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 4 is given in Table 35 below (CSIR 2003). Vegetables (4 113 ha) is the most common crop grown in IUA 4 followed by maize (2 800 ha) (Table 36).

Table 35: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 4

Farming Type	Area (Ha)
Dryland	26 338
Irrigated	1 556
Subsistence	58
Total	**27 953**

Table 36: Crop types grown in IUA 4

Crop	Area (ha)
Fallow	2 742
Maize	2 800
Vegetables	4 113
Pasture	1 678
Sorghum	17
Soya	750
Sunflower	136
Weeds	458
Undetermined	2 251
Total	**14 945**

3.1.4.3 Ecological Characteristics

The ecological character of the water resources in IUA 4 is described in Table 37.

Table 37: Present ecological state, ecological importance and important water resources in IUA 4

Characteristic	Description
Present ecological state, ecological importance	**Elands River**: The IUA is mainly rural in the upper reaches of the catchment with impacts from agriculture, dams, towns and informal settlements in the lower reaches of the catchment. The upper reaches of the Elands River is still in a very good ecological state (B category), but degrades along the river to a D category below the dams. The river is a moderately important system as it provides good habitats for the biota present. Some conservation areas are present in this IUA.

Characteristic	Description
EWR sites	Elands River below Mkhombo Dam (EWR6, B31G)
Main rivers per quaternary catchment	• B31A, B, C Elands • B31D Elands, Enkeldoringspruit • B31E Gotwane • B31F Elands • B31G Kameel, Elands

3.1.5 IUA 5: Middle Olifants up to Flag Bashielo Dam

The IUA includes the towns of Marble Hall, Groblersdal and Roedtan. The IUA contains the Flag Boshielo Dam, the Bloed, Klipspruit and Grass Valley Rivers. Several protected areas occur within the IUA and include, Mbusa, Moutse, Kwaggavoetpad and Schuinsdraii Nature Reserves (Figure 12). The economy of the IUA is characterised by some intensive irrigation agriculture (specifically around Marble Hall and Groblersdal), commercial dryland agriculture (in the Springbok Flats region), some subsistence agriculture and some platinum mining.

Figure 12: IUA 5 – Middle Olifants up to Flag Bashielo Dam

3.1.5.1 Demographic profile and basic services

The population of IUA 5 is approximately is 366 051 (Census 2001). The IUA has approximately 81 474 households of which the large majority falls within the very poor and poor income categories (Table 38). Of the 81 474 households approximately 16 041 (20%) have no access to piped water (Census 2001).

Table 38: Household income categories for IUA 5

Income Category	Number of Households
Very Poor (no income-R9600)	52 336
Poor (R9601-R38 400)	22 342
Tolerable (38 401-R76 800)	4 266
Comfortable (R76 801-R153 600)	1 748
Wealthy (R153 601 & above)	783
Total	**81 474**

Of the total number of people interviewed in IUA 5 approximately 25% were unemployed (Table 39). The community, social and personal services sector supplied the largest amount of jobs in IUA 5 (Table 40). The private households sector is also an important sector in terms of employment in IUA 5.

Table 39: Employment categories for IUA 5

Employment categories	Number
Unemployed	51 724
Employed	38 771
Not economically active	118 447
Total Interviewed	**208 942**

Table 40: Employment by sector in IUA 5

Sector	Employment
Agriculture; hunting, forestry and fishing	2 128
Mining and quarrying	236
Manufacturing	2 811
Electricity; gas and water supply	279
Construction	4 448
Wholesale and retail trade; repairs, hotels and restaurants	5 492
Transport, storage and communication	2 181
Financial intermediation; insurance; real estate and business services	1 977
Community; social and personal services	9 336
Private households	6 744
Representatives of foreign governments	8
Undetermined	3 131
Total	**38 771**

3.1.5.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 5 is given in Table 41 below (CSIR 2003). Pasture (10 876 ha) is the most common crop type in IUA 5 followed by maize (5 080 ha). The IUA is highly reliant on the agricultural sector and several farms in the IUA grow high value crops such as citrus and grapes.

Table 41: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 5

Farming Type	Area (Ha)
Dryland	114 394
Irrigated	49 821
Subsistence	65 499
Total	**229 713**

3.1.5.3 Mining

While the majority of platinum mining in the Olifants WMA is situated in IUA 6, limited mining does occur in this IUA. The Blue Ridge Platinum Mine (operated by Aquarius) is situated 15km from Groblersdal and produces 35 000 oz. of platinum annually.

3.1.5.4 Ecological Characteristics

The ecological character of the water resources in IUA 5 is described in Table 42.

Table 42: Present ecological state, ecological importance and important water resources in IUA 5

Characteristic	Description
Present ecological state, ecological importance	**Olifants below Loskop Dam, Lower Elands, Moses rivers**: The water resources are mainly in a C category as the upstream impacts (mainly water quality related) are somewhat mitigated by Loskop Dam. The ecological importance is of the rivers in the IUA is moderate with a few conservation areas present. Large areas of this IUA are almost endorheic and groundwater is the major source of water in these catchments.
EWR sites	Olifants below Loskop Dam (EWR5, B32D) – Comprehensive site. No sites on Moses, Bloed or other smaller tributaries.
Main rivers per quaternary catchment	• B32D Olifants • B31H Elands • B31J Elands • B32E, F Bloed • B32G Moses, Klipspruit

Characteristic	Description
	• B32H Moses • B32J Olifants • B51A Motsephiri • B51B Puleng, Olifants • B51C Olifants • B51D, E Un-named tributaries, almost endorheic • B51F Nkumpi

3.1.5 IUA 6: Steelpoort River catchment

IUA 6 follows the Steelpoort River valley, starting from the Grootspruit River in the south; up to its confluence in the north with the Olifants River mainstem. It includes the towns of Belfast in the south, Steelpoort in the north and Stoffberg (Figure 13). The IUA includes a section of the Verloren Vallei Nature Reserve near Dullstroom. The economy of the IUA is characterized by mining, some irrigation and tourism.

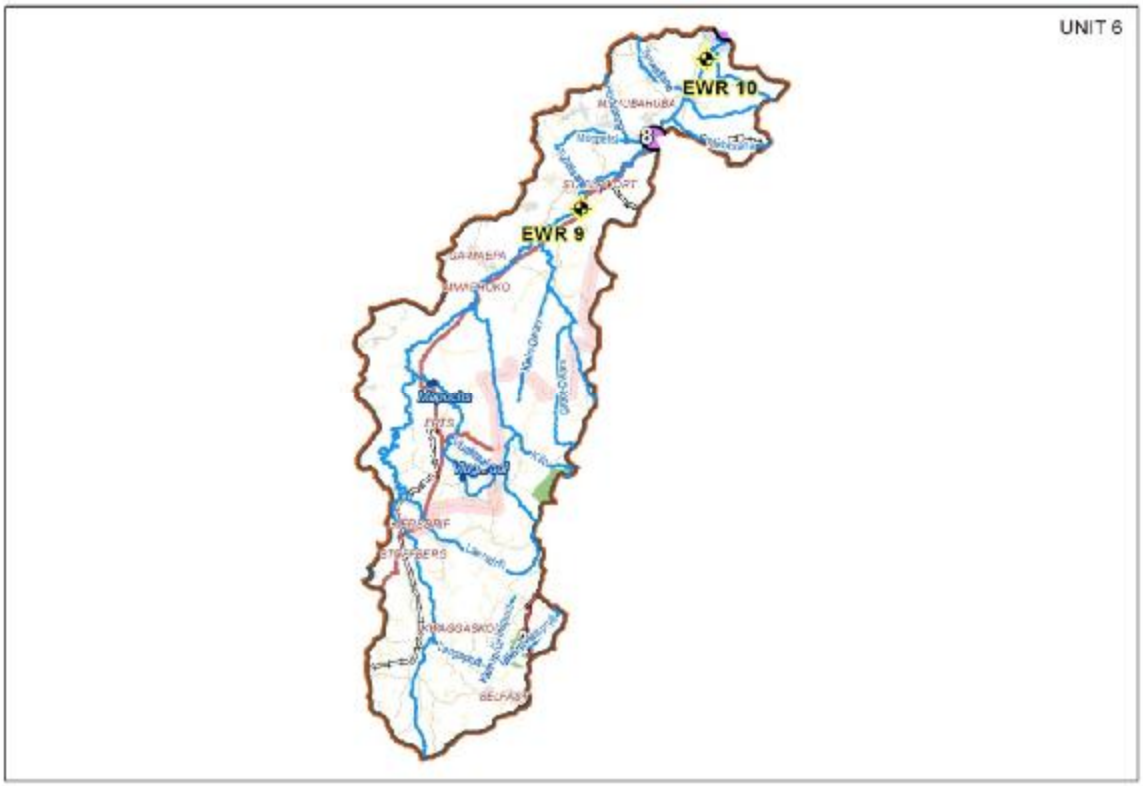

Figure 13: IUA 6 – Steelpoort River catchment

3.1.6.1 Demographic profile and basic services

The population of IUA 6 is approximately 37 958 (Census 2001). The IUA has approximately 8 489 households of which the large majority falls within the very poor and poor income categories (Table 43). Of the 8 489 households approximately 2 859 (34%) have no access to piped water (Census 2001).

Table 43: Household income categories for IUA 6

Income Category	Number of Households
Very Poor (no income-R9600)	5 043
Poor (R9601-R38 400)	2 561
Tolerable (38 401-R76 800)	536
Comfortable (R76 801-R153 600)	227
Wealthy (R153 601 & above)	122
Total	**8 489**

Of the total number of people interviewed in IUA 6 approximately 23% were unemployed (Table 44). The agriculture, hunting, forestry and fishing sector supplied the largest amount of jobs in IUA 6 (Table 45). The community, social and personal services sector is also an important sector in terms of employment in IUA 6.

Table 44: Employment categories for IUA 6

Employment categories	Number
Unemployed	5 131
Employed	5 689
Not economically active	11 089
Total Interviewed	**21 910**

Table 45: Employment by sector in IUA 6

Sector	Employment
Agriculture; hunting, forestry and fishing	1 176
Mining and quarrying	274
Manufacturing	367
Electricity; gas and water supply	20
Construction	317
Wholesale and retail trade; repairs, hotels and restaurants	841
Transport, storage and communication	216
Financial intermediation; insurance; real estate and business services	262
Community; social and personal services	996
Private households	799
Extraterritorial organisations	0
Representatives of foreign governments	0
Undetermined	420
Total	**4 689**

3.1.6.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 6 is given in Table 46 below (CSIR 2003). Maize (15 286 ha) is the most common crop grown in IUA 6 followed by pasture (5 030 ha) (Table 47).

Table 46: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 6

Farming Type	Area (Ha)
Dryland	36 311
Irrigated	3 662
Subsistence	17 499
Total	**57 472**

Table 47: Crop types grown in IUA 6

Crop	Area (ha)
Drybeans	35
Fallow	1 312
Maize	15 286
Vegetables	1 276
Pasture	5 030
Sorghum	55
Soya	1 865
Sunflower	375
Weeds	4 477
Undetermined	19
Total	**29 730**

3.1.6.3 Mining

Platinum mining is a major contributor to GDP in the Olifants WMA. The bulk of platinum mining falls within IUA 6 with some mining occurring in IUA 5 near Groblersdal. IUA 6 falls within the eastern limb of the Bushveld Complex, which contains the largest platinum deposits in the world (Figure 14).

There are three major platinum mining operators present (Amplats, Impala Platinum and Aquarius) in IUA 6, while other, smaller mining companies are present, information regarding their operation is however limited. The IUAs were responsible for producing approximately 552 000 oz. of platinum in 2010.

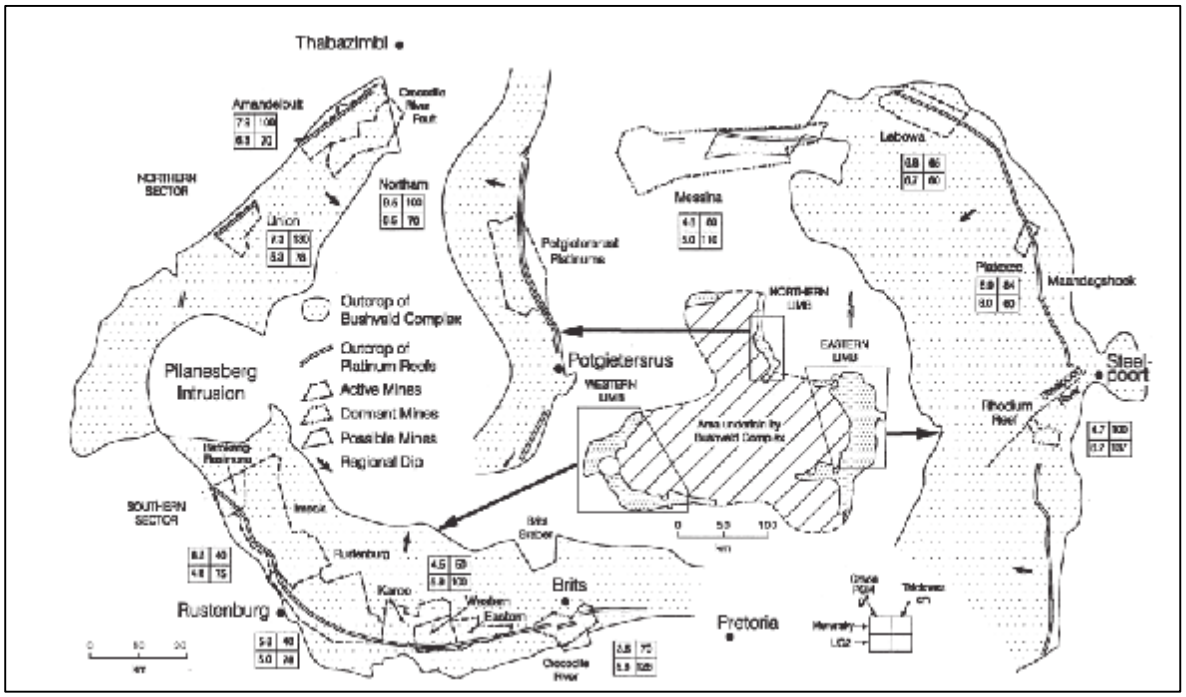

Figure 14: General map of the Bushveld Complex. The eastern limb is shown to the left of the map, which underlay IUAs 5 and 6 (Taken from Cawthorn 1999).

3.1.6.4 Manufacturing

Samancor operates the Tubatse Ferrochrome Plant (TFC) situated in Steelpoort, Mpumalanga that is in close proximity to the Eastern Chrome Mine. The core business of the operation is the production of charge. The expected useful life of the facility is at least 25 years.

Xstrata Alloys' Lion Ferrochrome Operation is located near Steelpoort. The annual production capacity of the plant is approximately 360kt.

3.1.6.5 Ecological Characteristics

The ecological character of the water resources in IUA 6 is described in Table 48.

Table 48: Present ecological state, ecological importance and important water resources in IUA 6

Characteristic	Description
Present ecological state, ecological importance	**Steelpoort, Klip and Dwars rivers:** The present state of the Steelpoort River has been modified from the natural (D category) due to impacts from agriculture and settlements. The Klip and Dwars rivers are still in a good present state. However, the impacts from mining on the Dwars has resulted in a moderately modified state (B/C category). The main stem Steelpoort River is of moderate ecological importance. However, the Klip and Dwars rivers have a high importance and sensitivity due to the presence of the Veloren Vallei nature reserve, the transition from mountain

Characteristic	Description
	to bushveld and the unique geology.
EWR sites	• Steelpoort below De Hoop Dam (EWR9, B41H) – Comprehensive site • Steelpoort just before confluence with the Olifants (EWR10, B41K) – Comprehensive site • Dwars just before the confluence with the Steelpoort (B41H) – Intermediate site.
Main rivers per quaternary catchment	• B41A Grootspruit • B41B Steelpoort • B41C Tonteldoos, Vlugkraal, Masala • B41D, E Steelpoort • B41F Klip • B41G Dwars, Klein Dwars • B41H Steelpoort, Dwars • B41J, K Steelpoort

3.1.7 IUA 7: Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River

The IUA consists primarily of dryland agriculture and rural subsistence farmers. It encompasses the Local Municipalities of Polokwane, Lepele-Nkumpi, Fetakgomo Makhuduthamaga (Figure 15). Some platinum mining occurs within the IUA.

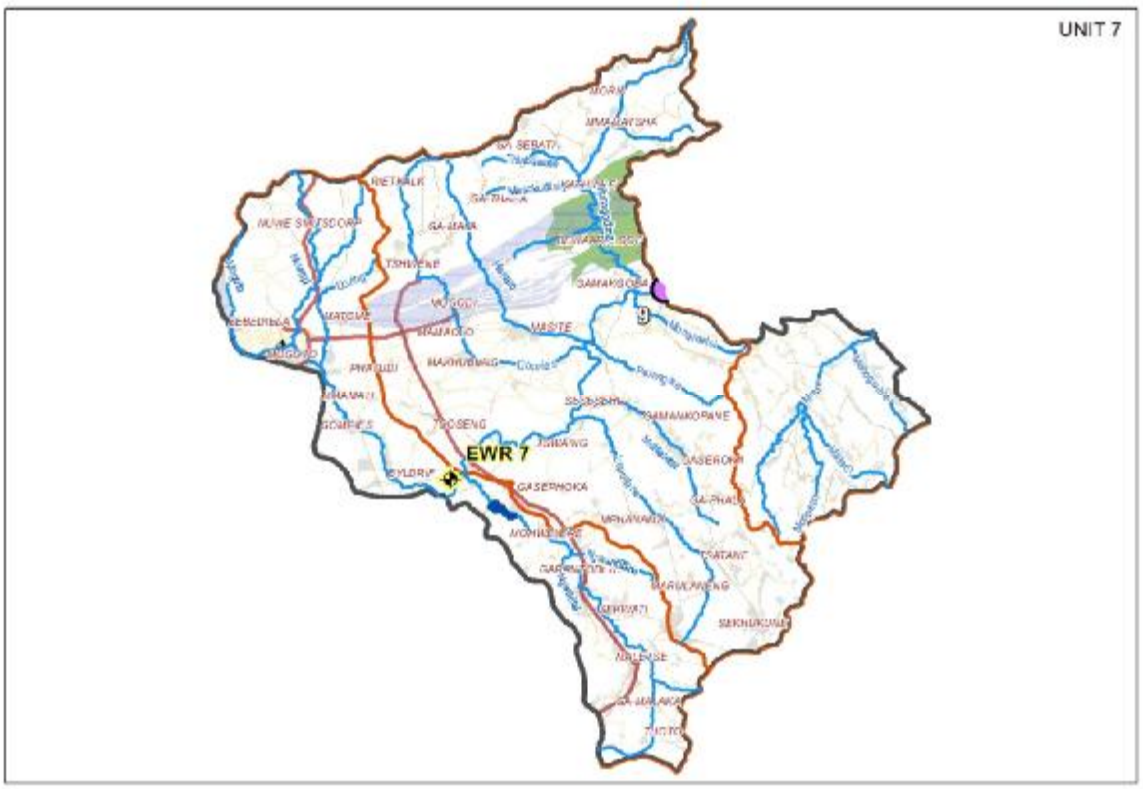

Figure 15: Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River

3.1.7.1 Demographic profile and basic services

The population of IUA 7 is approximately 550 871 (Census 2001). The IUA has approximately 123 234 households of which the large majority falls within the very poor and poor income categories (Table 49). Of the 123 234 households approximately 16 041 (43%) have no access to piped water (Census 2001).

Table 49: Household income categories for IUA 7

Income Category	Number of Households
Very Poor (no income-R9600)	87 711
Poor (R9601-R38 400)	25 306
Tolerable (38 401-R76 800)	6 255
Comfortable (R76 801-R153 600)	2 717
Wealthy (R153 601 & above)	1 245
Total	**123 234**

Of the total number of people interviewed in IUA 7 approximately 23% were unemployed (Table 50). The community, social and personal services sector supplied the largest number of jobs in IUA 7 (Table 50). The wholesale and retail trade, repairs, hotels and restaurants sector is also an important sector in terms of employment in IUA 7.

Table 50: Employment categories for IUA 7

Employment categories	Number
Unemployed	67 152
Employed	38 807
Not economically active	185 263
Total Interviewed	**291 222**

Table 51: Employment by sector in IUA 7

Sector	Employment
Agriculture; hunting, forestry and fishing	4 093
Mining and quarrying	1 119
Manufacturing	1 981
Electricity; gas and water supply	413
Construction	2 131
Wholesale and retail trade; repairs, hotels and restaurants	4 738
Transport, storage and communication	1 470
Financial intermediation; insurance; real estate and business services	1 701
Community; social and personal services	14 079
Private households	4 299
Extraterritorial organisations	6
Representatives of foreign governments	0
Undetermined	2 777
Total	**38 807**

3.1.7.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 7 is given in Table 52 below (CSIR 2003). It is important to note that subsistence agriculture makes up a large proportion of agriculture in this IUA.

Table 52: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 7

Farming Type	Area (ha)
Dryland	109 197
Irrigated	5 587
Subsistence	144 482
Total	**259 267**

3.1.7.3 Mining

While the majority of platinum mining in the Olifants WMA is situated in IUA 8, limited mining does occur in this IUA. The Marula Platinum Mine (operated by Impala Platinum) is situated north east of Burgersfort and produces 70 000 oz. of platinum annually. Platinum mining is discussed in more detail in the proceeding section.

3.1.7.4 Ecological characteristics

The ecological character of the water resources in IUA 7 is described in Table 53.

Table 53: Present ecological state, ecological importance and important water resources in IUA 7

Characteristic	Description
Present ecological state, ecological importance	**Main stem Olifants and smaller tributaries**: The ecological importance of these systems is low to moderate, especially for some of the tributaries. The present state of the main stem is in an E category that is mainly due to agricultural impacts.
EWR sites	Olifants below Flag Boshielo Dam (EWR7, B51G)
Main rivers per quaternary catchment	• B51G Nkumpi, Olifants • B51H Ngwaritse • B52A Olifants • B52B Lepellane • B52C Chunies • B52D Chunies • B52E Olifants • B52F Hlakaro

Characteristic	Description
	• B52G Olifants, Hlakaro • B52H Klipspruit • B52J Olifants, Klipspruit, Monametsi

3.1.8 IUA 8: Spekboom catchment

The IUA is situated within the Spekboom Catchment. The IUA includes the town of Mashishing (Lydenburg) in the south and Burgersfort in the north (Figure 16). Several protected areas occur within the IUA and include the Sterkspruit and Gustav Klingbiel Nature Reserves. The economy of the IUA is characterized by platinum mining, tourism, dryland and irrigated agriculture.

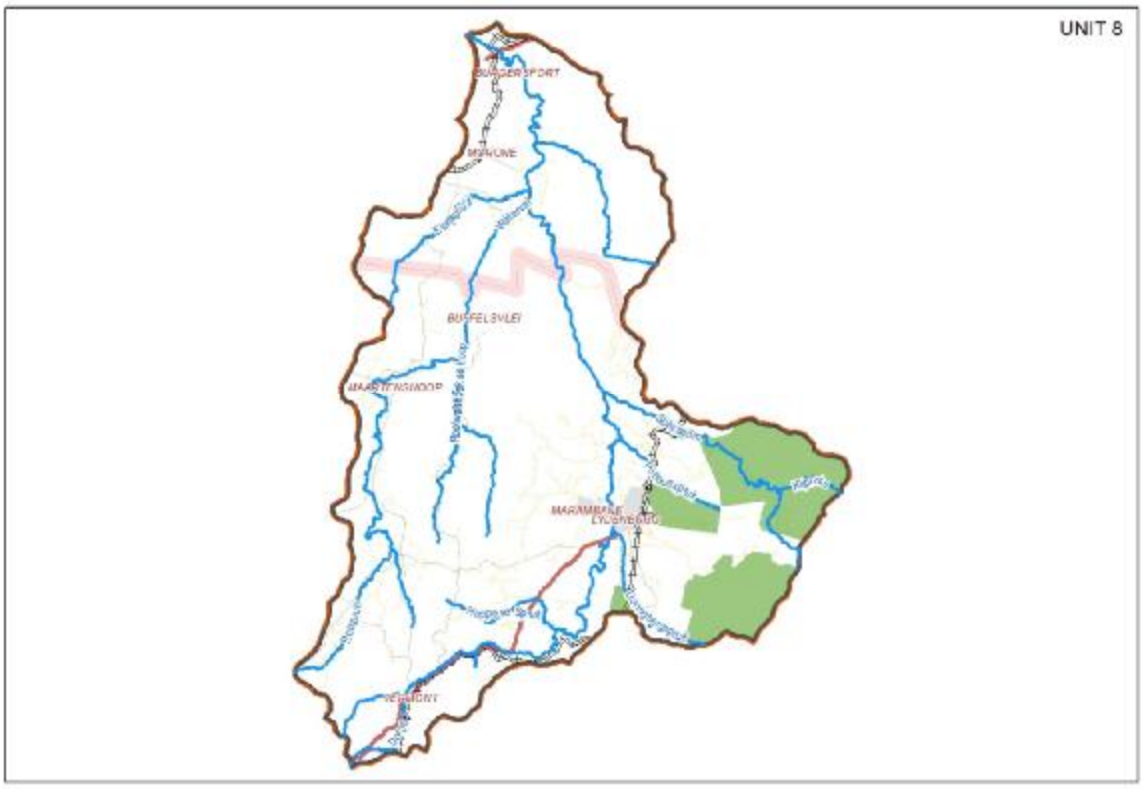

Figure 16: IUA 8: Spekboom catchment

3.1.8.1 Demographic profile and basic services

The population of IUA 8 is approximately 30 026 (Census 2001). The IUA has approximately 9 029 households of which the large majority falls within the very poor and poor income categories (Table 54). Of the 9 029 households approximately 234 (3%) have no access to piped water (Census 2001).

Table 54: Household income categories for IUA 8

Income Category	Number of Households
Very Poor (no income-R9600)	3 777
Poor (R9601-R38 400)	3 292
Tolerable (38 401-R76 800)	943
Comfortable (R76 801-R153 600)	650
Wealthy (R153 601 & above)	367
Total	**9 029**

Of the total number of people interviewed in IUA 8 approximately 20% were unemployed (Table 55). The wholesale and retail trade, repairs, hotels and restaurants sector supplied the largest number of jobs in IUA 8 (Table 56). The community, social and personal services sector is also an important sector in terms of employment in IUA 8.

Table 55: Employment categories for IUA 8

Employment categories	Number
Unemployed	3 947
Employed	9 369
Not economically active	6 732
Total Interviewed	**20 048**

Table 56: Employment by sector in IUA 8

Sector	Employment
Agriculture; hunting, forestry and fishing	1 550
Mining and quarrying	540
Manufacturing	991
Electricity; gas and water supply	37
Construction	510
Wholesale and retail trade; repairs, hotels and restaurants	1 908
Transport, storage and communication	261
Financial intermediation; insurance; real estate and business services	474
Community; social and personal services	1 588
Private households	1 089
Undetermined	419
Total	**9 369**

3.1.8.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 8 is given in Table 57 below (CSIR 2003). Pasture (2 720ha) is the most common crop type in IUA 8 followed by maize (1 954ha) (Table 58).

Table 57: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 8

Farming Type	Area (ha)
Dryland	9 544
Irrigated	6 550
Subsistence	168
Total	**16 262**

Table 58: Crop types grown in IUA 8

Crop	Area (ha)
Fallow	773
Maize	1 954
Vegetables	345
Pasture	2 720
Soya	1 502
Weeds	249
Undetermined	25
Total	**7 568**

3.1.8.3 Manufacturing

Xstrata Alloys operates the Lydenburg Ferrochrome plant near the town of Mashishing. The Plant has the capacity to produce 396kt of Ferrochrome per annum and provides employment for 545 employees.

3.1.8.4 Ecological characteristics

The ecological character of the water resources in IUA 8 is described in Table 59.

Table 59: Present ecological state, ecological importance and important water resources in IUA 8

Characteristic	Description
Present ecological state, ecological importance	**Spekboom, Dorps and Waterfalls rivers:** The present state of these rivers are ranging from almost natural (Waterfalls source) to degraded (Dorps). The ecological importance of the Spekboom and Waterfalls is high and moderate for the Dorps. A number of protected areas have been identified in the upper reaches of this IUA. The impacts are mainly from urbanisation and some agriculture in the catchment.
EWR sites	No EWR site is situated in this IUA.
Main rivers per quaternary catchment	• B42A, B, C Dorps • B42D Spekboom, Majupane • B42E Spekboom • B42F, G Waterfalls • B42H Spekboom

3.1.9 IUA 9: Ohrigstad River catchment area

The IUA contains the town of Ohrigstad (Figure 17). The economy of the IUA is characterized by irrigated, dryland and subsistence agriculture.

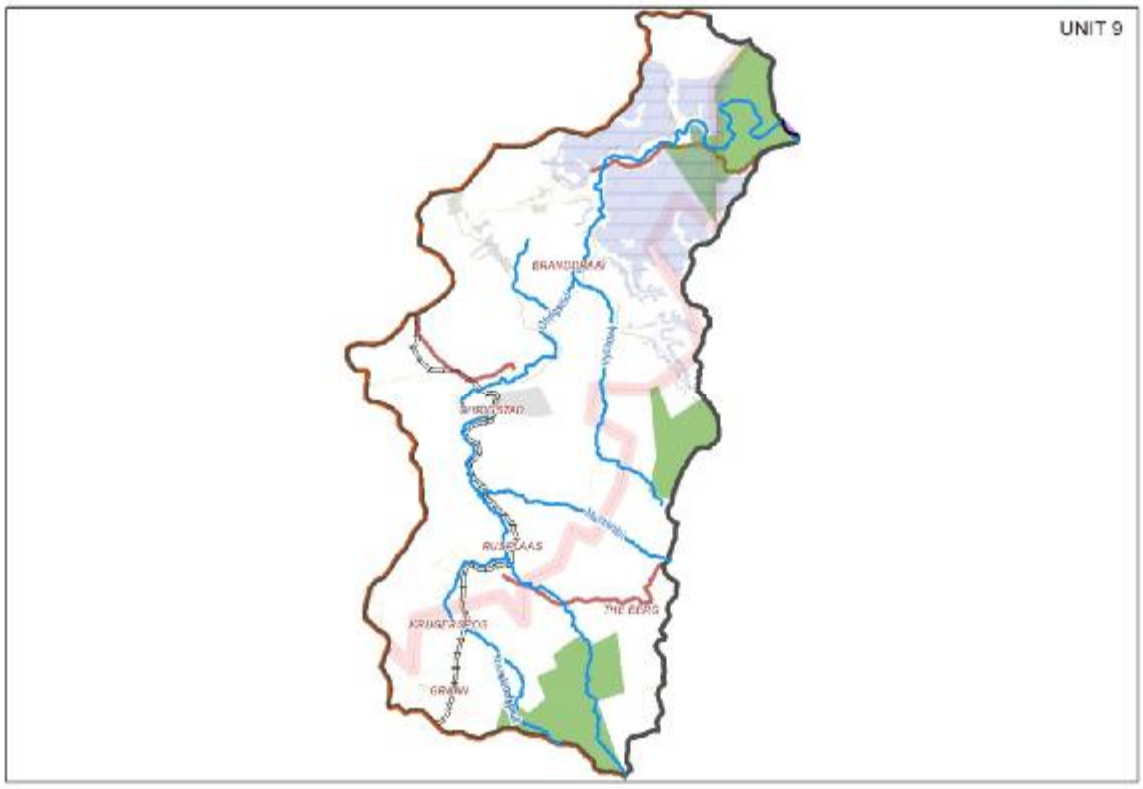

Figure 17: IUA 9: Ohrigstad River catchment area

3.1.9.1 Demographic profile and basic services

The population of IUA 9 is approximately 16 527 (Census 2001). The IUA has approximately 5 201 households of which the large majority falls within the very poor and poor income categories (Table 60). Of the 5 201 households approximately 416 (8%) have no access to piped water (Census 2001).

Table 60: Household income categories for IUA 9

Income Category	Number of Households
Very Poor (no income-R9600)	3 090
Poor (R9601-R38 400)	1 721
Tolerable (38 401-R76 800)	209
Comfortable (R76 801-R153 600)	110
Wealthy (R153 601 & above)	69
Total	**5 201**

Of the total number of people interviewed in IUA 9 approximately 18% were unemployed (Table 61). The manufacturing sector supplied the largest amount of jobs in IUA 9 (Table 62). The agriculture, hunting, forestry and fishing sector is also an important sector in terms of employment in IUA 9.

Table 61: Employment categories for IUA 9

Employment categories	Number
Unemployed	1 900
Employed	4 486
Not economically active	4 248
Total Interviewed	**10 635**

Table 62: Employment by sector in IUA 9

Sector	Employment
Agriculture; hunting, forestry and fishing	814
Mining and quarrying	104
Manufacturing	1 752
Electricity; gas and water supply	20
Construction	106
Wholesale and retail trade; repairs, hotels and restaurants	606
Transport, storage and communication	73
Financial intermediation; insurance; real estate and business services	130
Community; social and personal services	543
Private households	210
Undetermined	128
Total	**4 486**

3.1.9.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 9 is given in Table 63 below (CSIR 2003). Irrigation is a major component of the economy of IUA 9 with several irrigated crops occurring along the Orhigstad River. Pasture (2 069 ha) is the most common crop type in IUA 9 followed by maize (1 831 ha) (Table 80). High value crops such as citrus are not captured in Table 64 below, but are grown along the Orhigstad River.

Table 63: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 9

Farming Type	Area (ha)
Dryland	543
Irrigated	8 589
Subsistence	2 237
Total	**11 369**

Table 64: Crop types grown in IUA 9

Crop	Area (ha)
Fallow	1 071
Maize	1 831
Vegetables	459
Pasture	2 069
Soya	466
Sunflower	12
Weeds	686
Undetermined	44
Total	**6 637**

3.1.9.3 Ecological characteristics

The ecological character of the water resources in IUA 9 is described in Table 65.

Table 65: Present ecological state, ecological importance and important water resources in IUA 9

Characteristic	Description
Present ecological state, ecological importance	**Ohrigstad:** The Ohrigstad River has been impacted by agriculture and is presently in a C category.
EWR sites	No EWR site is situated in this IUA.
Main rivers per quaternary catchment	• B60E Ohrigstad • B60F Kranskloofspruit, Ohrigstad, Mantshibi • B60G Vyehoek, Ohrigstad • B60H Ohrigstad

3.1.10 IUA 10: Lower Olifants

The IUA contains the town of Hoedspruit (Figure 18). The IUA also contains the semi-urban areas of Hlohlokwe, Sofaya and Mahlomelong. The IUA contains several conservation areas, which include: Bewaarkloof Nature Reserve, the Wolkberg Wilderness area and a portion of the Blyde River Canyon catchment area. Important water resources include the Olifants River. The economy of the IUA is characterized by intensive agriculture (especially near Hoedspruit), rural subsistence, ecotourism and light commercial activities.

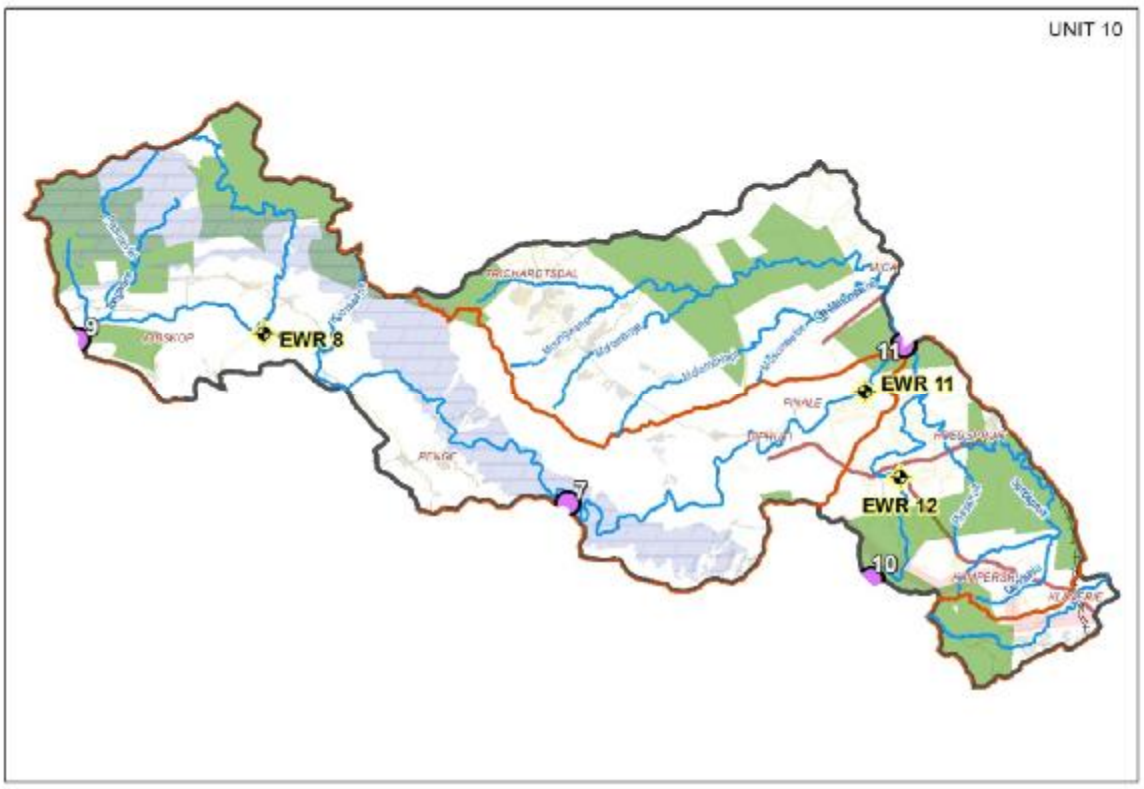

Figure 18: IUA 10 – Lower Olifants

3.10.1.1 Demographic profile and basic services

The population of IUA 10 is approximately 25 430 (Census 2001). The IUA has approximately 5 665 households of which the large majority falls within the very poor and poor income categories (Table 66). Of the 5 665 households approximately 1 217(21%) have no access to piped water (Census 2001).

Table 66: Household income categories for IUA 10

Income Category	Number of Households
Very Poor (no income-R9600)	4 292
Poor (R9601-R38 400)	1 110
Tolerable (38 401-R76 800)	175
Comfortable (R76 801-R153 600)	54
Wealthy (R153 601 & above)	35
Total	**5 665**

Of the total number of people interviewed in IUA 10 approximately 21% were unemployed (Table 67). The agriculture, hunting, forestry and fishing sector supplied the largest amount of jobs in IUA 10 (Table 68). The community, social and personal services sector is also an important sector in terms of employment in IUA 10.

Table 67: Employment categories for IUA 10

Employment categories	Number
Unemployed	2 824
Employed	1 625
Not economically active	8 823
Total Interviewed	**13 272**

Table 68: Employment by sector for IUA 10

Sector	Employment
Agriculture; hunting, forestry and fishing	478
Mining and quarrying	144
Manufacturing	70
Electricity; gas and water supply	11
Construction	87
Wholesale and retail trade; repairs, hotels and restaurants	177
Transport, storage and communication	28
Financial intermediation; insurance; real estate and business services	49
Community; social and personal services	342
Private households	102
Undetermined	136
Total	**1 625**

3.1.10.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 10 is given in Table 69 below

(CSIR 2003). There has been a significant increase in irrigation in IUA 10 over the last few years. High value crops such as citrus are grown around the Hoedspruit area.

Table 69: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 10

Farming Type	Area (Ha)
Dryland	345
Irrigated	13 696
Subsistence	9 618
Total	**23 659**

3.1.10.3 Ecological characteristics

The ecological character of the water resources in IUA 10 is described in Table 70.

Table 70: Present ecological state, ecological importance and important water resources in IUA 10

Characteristic	Description
Present ecological state, ecological importance	**Main stem Olifants, Lower Blyde and smaller tributaries:** The main stem Olifants is presently in a D category with the lower Blyde and Mohlapitse in a B. The impacts on the Olifants are from irrigation along the river and the Flag Boshielo Dam. The ecological importance is high for the lower Blyde (links Olifants to the Highveld) and Mohlapitse (Wolkberg area is a declared wilderness area, Tufa's Waterfalls, caves).
EWR sites	Olifants below confluence with Mohlapitse (EWR8, B71B) - Comprehensive Olifants upstream confluence with Blyde (EWR11, B71J) - Comprehensive Lower Blyde below Blyderivierspoort Dam (EWR12, B60J) – Comprehensive.
Main rivers per quaternary catchment	• B60J Blyde, Rietspruit • B71A, B Olifants • B71C Mohlapitse • B71D Mohlapitse, Olifants, Kgotswane • B71E Motse • B71F, G, H, J Olifants • B72A Makhutswi • B72B Makhutswi • B72C Olifants, Molomahlapi

3.1.11 IUA 11: Ga-Selati River area

This IUA contains the towns of Phalaborwa, Gravelotte and Mica. The IUA is bordered by the Kruger National Park to the west and other conservation areas to the east. The IUA also contains the semi-urban areas of Ga-Mashishimale and Namakgale (Figure 19). Important water resources include the Ga-Selati River. The economy of the IUA is characterized by intensive mining (including the Rio Tinto copper mine near Phalaborwa), ecotourism and agriculture.

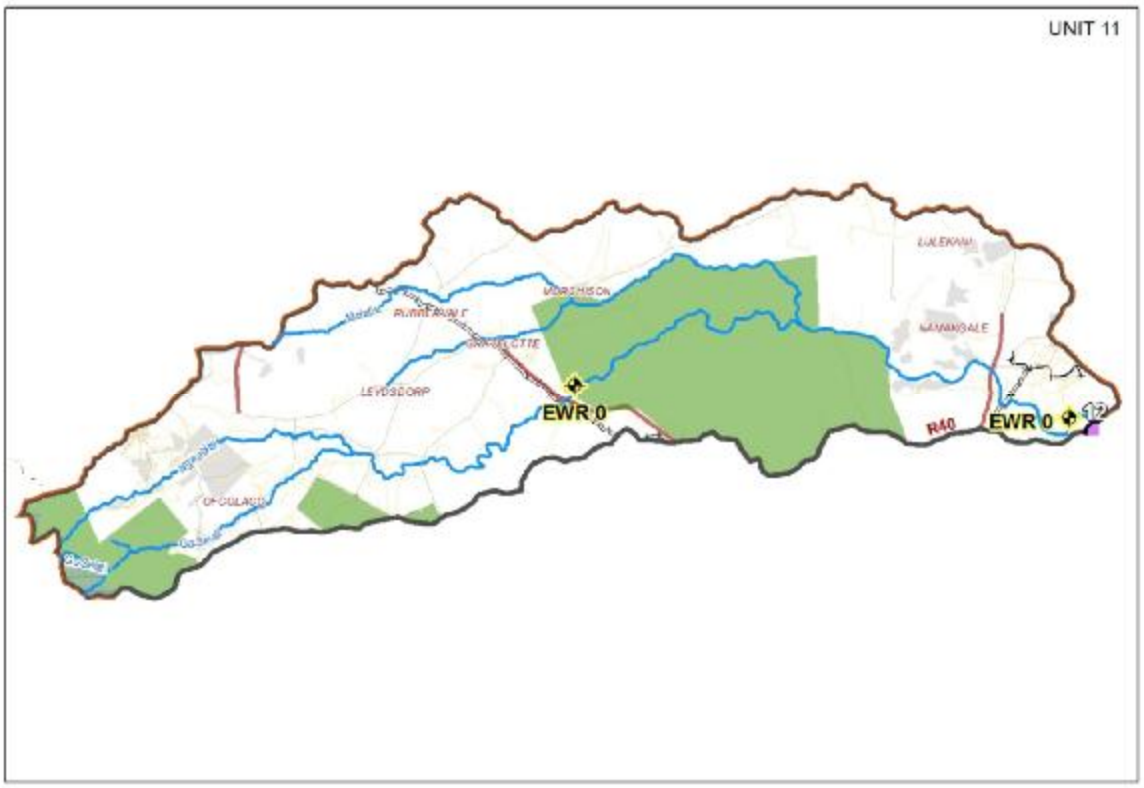

Figure 19: IUA 11 – Ga-Selati River Area

3.1.11.1 Demographic profile and basic services

The population of IUA 11 is approximately 134 894 (Census 2001). The IUA has approximately 33 156 households of which the large majority falls within the very poor and poor income categories (Table 71). Of the 33 156 households approximately 3 642 (11%) have no access to piped water (Census 2001).

Table 71: Household income categories for IUA 11

Income Category	Number of Households
Very Poor (no income-R9600)	18 659
Poor (R9601-R38 400)	9 283
Tolerable (38 401-R76 800)	2 706
Comfortable (R76 801-R153 600)	1 500
Wealthy (R153 601 & above)	1 008
Total	**33 156**

Of the total number of people interviewed in IUA 11 approximately 21% were unemployed (Table 72). The mining and quarrying sector supplied the largest amount of jobs in IUA 11 (Table 73). The community, social and personal services sector is also an important sector in terms of employment in IUA 11.

Table 72: Employment categories for IUA 11

Employment categories	Number
Unemployed	20 536
Employed	24 794
Not economically active	36 631
Total Interviewed	**81 961**

Table 73: Employment by sector in IUA 11

Sector	Employment
Agriculture; hunting, forestry and fishing	2 358
Mining and quarrying	4 609
Manufacturing	2 106
Electricity; gas and water supply	252
Construction	1 450
Wholesale and retail trade; repairs, hotels and restaurants	2 933
Transport, storage and communication	661
Financial intermediation; insurance; real estate and business services	1 360
Community; social and personal services	4 806
Private households	2 147
Extraterritorial organisations	1
Representatives of foreign governments	1
Undetermined	2 108
Total	**24 794**

3.1.11.2 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 11 is given in Table 74 below (CSIR 2003). There has been a significant increase in irrigation in IUA 11 over the last few years.

Table 74: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 11

Farming Type	Area (Ha)
Dryland	698
Irrigated	7 933
Subsistence	3 896
Total	**12 527**

3.1.11.3 Mining

Several mining activities occur in the IUA with the largest being the Phalaborwa Copper Mine operated by Rio Tinto near Phalaborwa. The operation encompasses a copper mine, smelter and refinery and produces approximately 80 000 tonnes of refined copper annually.

Other operations include the Consolidated Murchison Mine, which produces antimony and gold found near Mica and the mining of mica in the greater Gravelotte and Mica areas.

3.1.11.4 Ecological characteristics

The ecological character of the water resources in IUA 11 is described in Table 75.

Table 75: Present ecological state, ecological importance and important water resources in IUA 11

Characteristic	Description
Present ecological state, ecological importance	**Ga-Selati River:** The present state of the Ga-Selati River ranges from a C (in the upper reaches) to an E category just before the confluence with the Olifants. This is mainly due to the impacts from mining and town development in the lower reaches. The ecological importance of the system is high for the upper part (foothills zone) to low. The middle reaches of the IUA forms part of a protected area.
EWR sites	Ga-Selati (EWR14a, B72H) - Comprehensive Ga-Selati (EWR14b, B72K) - Comprehensive
Main rivers per quaternary catchment	• B72E Ngwabatse • B72F, G, H Ga-Selati • B72J Molatle • B72K Ga-Selati

3.1.12 IUA 12: Lower Olifants within the Kruger National Park

The IUA incorporates the lower Olifants catchment area (**Figure 20**). This area is largely a protected area with a high conservation status. It includes the world renowned Kruger National Park. The main economic activity is eco-tourism. The IUA incorporates the Olifants main stem river and tributaries.

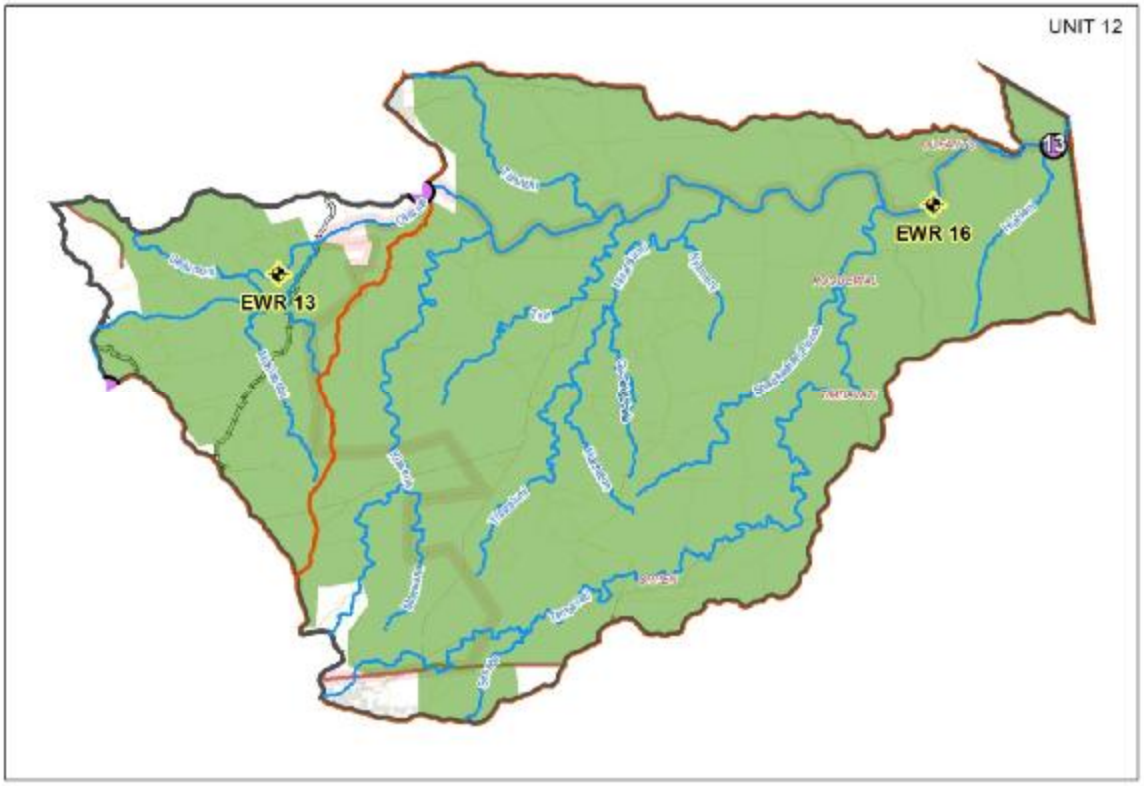

Figure 20: IUA 12 – Lower Olifants within the Kruger National Park

3.1.12.1 Demographic profile and basic services

The population of IUA 12 is approximately 7 721 (Census 2001). The IUA has approximately 2 471 households of which the large majority falls within the very poor and poor income categories (Table 76). Of the 2 471 households approximately 106 (4%) have no access to piped water (Census 2001).

Table 76: Household income categories for IUA 12

Income Category	Number of Households
Very Poor (no income-R9600)	981
Poor (R9601-R38 400)	914
Tolerable (38 401-R76 800)	214
Comfortable (R76 801-R153 600)	186
Wealthy (R153 601 & above)	176
Total	**2 471**

Of the total number of people interviewed in IUA 12 approximately 19% were unemployed (Table 77). The mining and quarrying sector supplied the largest amount of jobs in IUA 12 (Table 78). The community, social and personal services sector is also an important sector in terms of employment in IUA 12.

Table 77: Employment categories for IUA 12

Employment categories	Number
Unemployed	1 034
Employed	2 628
Not economically active	1 646
Total Interviewed	**5 307**

Table 78: Employment by sector in IUA 12

Sector	Employment
Agriculture; hunting, forestry and fishing	212
Mining and quarrying	738
Manufacturing	241
Electricity; gas and water supply	23
Construction	156
Wholesale and retail trade; repairs, hotels and restaurants	285
Transport, storage and communication	42
Financial intermediation; insurance; real estate and business services	132
Community; social and personal services	429
Private households	207
Undetermined	162
Total	**2 628**

3.1.12.1 Agriculture

The area of dryland, irrigated and subsistence agriculture for IUA 12 is given in Table 79 below (CSIR 2003).

Table 79: Area (ha) of dryland, irrigated and subsistence agriculture for IUA 12

Farming Type	Area (Ha)
Dryland	255
Irrigated	2 320
Subsistence	2 117
Total	**4 692**

3.1.12.2 Ecological characteristics

The ecological character of the water resources in IUA 12 is described in Table 80.

Table 80: Present ecological state, ecological importance and important water resources in IUA 12

Characteristic	Description
Present ecological state, ecological importance	**Olifants main stem and tributaries:** The water resources of this IUA fall almost entirely within the Kruger National Park and surrounding protected areas. The ecological importance is thus very high. However, the present state is in a C category that is mainly due to the impacts of the upstream developments on the Olifants River.
EWR sites	Olifants before confluence with Ga-Selati (EWR13, B72D) Olifants in KNP (EWR16, B73H)
Main rivers per quaternary catchment	• B72D Olifants, Mohlabetsi • B73A Klaserie • B73B Monwana, Klaserie • B73C Olifants, Tsiri, Tshutshi • B73D Nhlaralumi • B73E, F Timbavati • B73G Timbavati, Olifants • B73H Olifants • B73J Olifants, Hlahleni

3.1.13 IUA 13: Blyde catchment area

The IUA contains the town Pilgrims Rest (Figure 21). The IUA contains the upper portions of the Blyde and Treur Rivers. The economy of the IUA is characterized by limited forestry and subsistence agriculture. The IUA is predominately rural in nature and is relatively undisturbed.

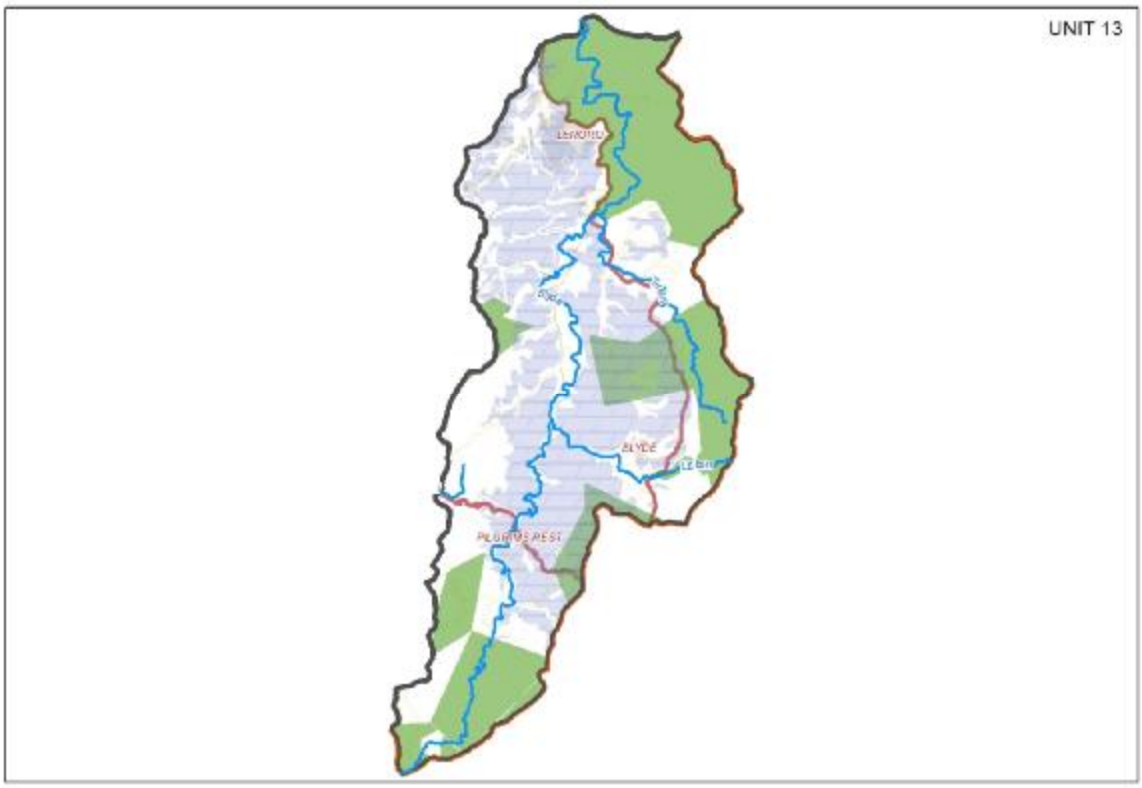

Figure 21: IUA 13: Blyde River catchment area

3.1.13.1 Demographic profile and basic services

The population of IUA 13 is approximately 8 260 (Census 2001). The IUA has approximately 2 600 households of which the large majority falls within the very poor and poor income categories (Table 81). Of the 2 600 households approximately 156 (6%) have no access to piped water (Census 2001).

Table 81: Household income categories for IUA 13

Income Category	Number of Households
Very Poor (no income-R9600)	1 545
Poor (R9601-R38 400)	860
Tolerable (38 401-R76 800)	104
Comfortable (R76 801-R153 600)	55
Wealthy (R153 601 & above)	34
Total	**2 600**

Of the total number of people interviewed in IUA 13 approximately 17% were unemployed (Table 82). The agriculture, hunting, forestry and fishing sector provided the most employment in IUA 13.

Table 82: Employment categories for IUA 13

Employment categories	Number
Unemployed	950
Employed	2 243
Not economically active	2 124
Total Interviewed	**5 317**

Table 83: Employment by sector in IUA 13

Sector	Employment
Agriculture; hunting, forestry and fishing	876
Mining and quarrying	52
Manufacturing	407
Electricity; gas and water supply	10
Construction	53
Wholesale and retail trade; repairs, hotels and restaurants	303
Transport, storage and communication	36
Financial intermediation; insurance; real estate and business services	65
Community; social and personal services	272
Private households	105
Undetermined	64
Total	**2 243**

3.1.13.2 Ecological characteristics

The ecological character of the water resources in IUA 13 is described in Table 84.

Table 84: Present ecological state, ecological importance and important water resources in IUA 13

Characteristic	Description
Present ecological state, ecological importance	**Treur and upper Blyde:** The ecological importance of the water resources in this IUA is high with the present state of the Treur and upper Blyde almost natural. A number of protected and conservation areas are present in this IUA.
EWR sites	Treur (B60C) – rapid III
Main rivers per quaternary catchment	• B60A Blyde • B60B Lisbon, Blyde • B60C Treur • B60D Blyde

4 BIOPHYSICAL AND ALLOCATION NODES

Biophysical nodes are established to account for interactions between ecosystems and management (allocation) nodes are established to account for specific catchment issues or impacts and to serve as modelling points for the Classification process in a catchment. The nodes are used to assess the response of upstream water resources to changes in water quality, quantity and timing (DWA, 2007). Biophysical nodes should be located at interactions between ecosystems and at the end points of eco-system reaches to account for interactions. Management or allocation nodes should be located at the downstream edge of a reach of interest, as required for modelling and to allow for meaningful trade-offs.

The establishment of biophysical and management (allocation) nodes is guided by a number of considerations. The key considerations are:

- Significant water resources
- Biophysical and eco-regional characteristics;
- Location of Ecological Water Requirement (EWR) sites and ecological information;
- Ecological Importance and Sensitivity categories of water resources;
- Present ecological state;
- Broad-scale hydrological and geomorphological characters;
- Water infrastructure;
- Water management, planning and allocation information.

4.1 Identification of proposed nodes per IUA within the Olifants

4.1.7 Rivers

The proposed nodes for the IUAs of the Olifants catchment are summarised in Table 85 below. These are preliminary nodes based on existing information. The nodes identified are currently a combination of where (i) EWR sites are situated, (ii) management units (hydro nodes) have been identified for the yield model and (iii) at the outlet of quaternary catchments. The various smaller tributaries as identified per quaternary catchment are indicated as new nodes in the table. These smaller tributaries will only be given separate node numbers if identified as water resources with a high EIS, currently in a good present state or for conservation purposes from NFEPA.

4.1.8 Wetlands

Nodes on the river downstream of important wetlands identified in the catchments of these tributaries and/or main stem rivers have been included.

4.1.9 Dams/lakes

For all major dams (water infrastructure) identified in the water resources reconciliation study, nodes have been included. Any other smaller dams recognised of having an important role in the regulation of the water resources have also been included.

4.1.10 Water quality

Water quality has also been considered for all the water resource components and where good quality or the need to improve water quality is a requirement additional nodes have been included.

4.1.11 Proposed Nodes

Based on the above considerations proposed biophysical and allocation nodes have been established in each of the IUAs delineated for the Olifants WMA. The nodes proposed will be confirmed and finalised at the conclusion of Step 3 of the Classification Process, during the 'quantification of the EWR and determination of the changes in non-water quality ecosystem goods, services and attributes'.

The nodes as tabled below (Table 85) and illustrated in Figure 22 has been updated with information from the 2010 PES/EIS study, NFEPA and information on important identified wetlands and groundwater areas. Those areas where water quality impacts exist and where management and planning information indicated an area of interest, nodes have been identified. Typically, areas or water resources with a high EIS or high conservation value has required the inclusion of a biophysical a node downstream of the area.

Table 85: Proposed biophysical and management (allocation) nodes per IUA within the Olifants WMA

Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
B11A	Olifants (MU8A, outlet of quaternary)	High	High	C	Management Unit, biophysical
B11B	Olifants (outlet, confluence with Steenkoolspruit)				Water quality impacts
B11C	Piekespruit (confluence with Steenkoolspruit)	High	High	B	Biophysical
B11D	Dwars-indie-Wegspruit (confluence with Trichardtspruit) Steenkoolspruit (MU7B, outlet of quaternary)	High	High	C	Biophysical Management Unit, water quality impacts
B11E	Blesbokspruit (confluence with Rietspruit) Steenkoolspruit (MU7C, confluence with Olifants)	High	High	B	Biophysical Management Unit, water quality impacts
B11F	Olifants (MU9A, outlet of quaternary)				Management Unit, impacts of Klippoortjie & Tweefonteinspruit
B11G	Noupoortspruit (MU6/EWR site) Olifants (MU9B, outlet of Witbank Dam)				Management Unit, water quality impacts on Witbank Dam Downstream Witbank Dam – releases from dam
B11H	Spookspruit (MU26AB, confluence with Olifants)	High	High	C	Biophysical
B11J	Olifants (EWR1)	Very high	Very high	B	Biophysical
B11K, B11L	Klipspruit (MU18A, confluence with Olifants) Olifants (MU29 – *outlet of IUA1*)	 Very high	 Very high	 B	Management Unit, water quality impacts Biophysical & outlet of IUA1
B12A	Boschmansfontein (confluence with Klein Olifants) Klein Olifants (MU10A, outlet of quaternary)	Moderate High	High High	C C	Biophysical Biophysical
B12B	Klein Olifants (MU13, outlet of quaternary)	High	High	C	Biophysical, impacts of mining in tributary catchments
B12C	Klein Olifants (MU15, outlet of Middelburg Dam)	High	High	C	Biophysical, downstream Middelburg Dam, releases from Dam
B12D	Vaalbankspruit (confluence with Klein Olifants) Klein Olifants (MU27A, outlet of quaternary)	Moderate Moderate	High High	D D	Biophysical Management Unit, impacts from town of Middelburg and surrounding areas
B20A	Bronkhorstpruit (MU23A, outlet of quaternary)	Moderate	High	C	Management Unit, biophysical, impacts from Delmas area
B20B	Koffiespruit (MU23B, confluence with Bronkhorstspruit)	Moderate	High	C	Biophysical
B20C	Osspruit (inflow to Bronkhorstspruit Dam) Bronkhorstpruit (MU23C, outlet from Bronkhorstspruit Dam)	Moderate High	High High	D C	Biophysical Management Unit, biophysical

Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
B20D	Hondespruit (MU24AB, confluence with Bronkhorstspruit)	High	High	C	Biophysical
	Bronkhorstpruit (MU24AC, outlet of quaternary)	High	Very high	C	Management Unit, biophysical, impacts from Bronkhorstspruit
B20E, B20F	Wilge (MU22B, confluence with Bronkhorstspruit	High	Very high	C	Management Unit, biophysical
B20G	Saalboomspruit (MU21, confluence with Wilge)				Management Unit, future mining impacts
B20H	Grootspruit (MU25B, confluence with Wilge)	High	Very high	C	Biophysical
	Wilge (MU25AB, outlet of quaternary)	High	Very high	B	Management Unit, biophysical
B20J	Wilge (EWR4, MU25C- *outlet of IUA2*)	High	Very high	B	Biophysical & outlet of IUA2
B12E	Doringboomspruit (confluence with Klein Olifants)	High	High	B	Biophysical
	Keeromspruit (confluence with Klein Olifants)	High	High	C	Biophysical
	Klein Olifants (EWR3, MU27B, outlet of quaternary)	High	High	C	Biophysical, Management Unit
B32A	Kranspoortspruit (MU30B, inflow to Loskop Dam)	High	Very high	C	Biophysical
	Boekenhoutloop (inflow to Loskop Dam)	High	High	B	Biophysical
	Olifants (EWR2, MU30A, releases from Loskop Dam)	High	High	B	Management Unit, biophysical
B32B , B32C	Klipspruit (confluence with Selons)	High	High	B	Biophysical
	Kruis (confluence with Selons)	High	High	B	Biophysical
	Selons (confluence with Olifants)	High	Very high	C	Biophysical
	Olifants (outlet of quaternary – *outlet of IUA3*)	High	High	D	Management Unit, biophysical & outlet of IUA3
B31A, B, C	One node at outlet of B31C, releases from RustdeWinter Dam	High	Very high	C	Management Unit, biophysical
	Included:				
	B31A (Elands)	High	High	C	Biophysical
	B31B (Hartbeesspruit)	High	Very high	C	Biophysical
B31D	Enkeldoringspruit (confluence with Elands)	High	High	C	Biophysical
B31F	Elands (releases from Mkumbe Dam)	High	High	C	Management Unit, biophysical
B31G	Kameel (upper part only)	Moderate	High	D	Biophysical, before impacts of town and villages
	Elands (EWR6, outlet of quaternary– *outlet of IUA4*)				Management Unit & outlet of IUA4
B31H, B31J	Elands (outlet of quaternary, confluence with Olifants))				Management Unit

Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
B32E, B32F	One node at confluence with Olifants in B32F Included: B32E (Bloed) B32F (Doringpoortloop, Diepkloof and Bloed)	 Moderate High	 High Moderate	 B C	Management Unit Biophysical Biophysical
B32G, H	One node at outlet of B32H, confluence with Olifants Included: B32G (Moses) B32H (Mametse and Moses)	 High High	 High High	 C D	Management Unit Biophysical Biophysical
B32D, B32J	Olifants (confluence with Elands)	High	Moderate	C	Management Unit, biophysical
B51B	Puleng (upper part only) Olifants (outlet of quaternary, releases from Flag Boshielo Dam)	High	High	B	Biophysical Management Unit
B51D, B51E	Olifants (outlet of quaternary– *outlet of IUA5*)				Management Unit & outlet of IUA5
B41A	Grootspruit (outlet of quaternary) Langspruit (confluence with Grootspruit), including Lakenvleispruit and Kleinspruit	High High	High Very high	C D	Biophysical Biophysical
B41B	Laersdrift (confluence with Steelpoort)	High	Very high	D	Biophysical
B41C	Masala (confluence with Steelpoort), including Tonteldoos and Vlugkraal)	High	High	C	Biophysical
B41D, B41E	Steelpoort (outlet of quaternary, inflow to De Hoop Dam)	High	Very high	C	Biophysical & management unit
B41F	Draaikraalspruit (confluence with Klip) Klip (inflow to De Hoop Dam)	High High	Very high Very high	B B	Biophysical Biophysical
B41G	Kraalspruit (confluence with Groot Dwars) Klein Dwars (Confluence with Groot Dwars) Upper reaches of Dwars (before mining impacts)	High High High	Very high High Very high	B D C	Biophysical Biophysical Biophysical
B41H	Dwars (EWR site, confluence with Steelpoort) Steelpoort (EWR9, releases from De Hoop Dam)	High High	High High	D D	Biophysical & management unit Biophysical & management unit
B41J, B41K	Steelpoort (confluence with Olifants– *outlet of IUA6*)				Management Unit & outlet of IUA6

Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
B51F	Nkumpi (outlet of quaternary)	High	Moderate	C	Biophysical
B51G	Olifants (EWR7)	~~High~~	High	D	Biophysical & management unit
B52E	Palangwe (confluence with Olifants)	High	High	C	Biophysical
B52F	Hlakaro (outlet)	High	High	C	Biophysical
B52J	Mphogodima (confluence with Olifants)	High	High	C	Biophysical
B52A, E, G, J	Olifants (outlet of quaternary – *outlet of IUA7*)				Management Unit & outlet of IUA7
B42A	Hoppe-se-Spruit (confluence with Dorps) Dorpspruit (outlet of quaternary)	Moderate Moderate	High High	C C	Biophysical Biophysical
B42B	Dorpspruit (outlet of quaternary), including Doringbergspruit (confluence), Sterkspruit (confluence) and Klipgatspruit (confluence)	High	High	C	Biophysical
B42C	Potloodspruit (confluence with Dorps)	High	High	C	Biophysical
B42D, B42E	Dorps (confluence with Spekboom) Spekboom (confluence with Dorps)	High High	High Very high	C C	Biophysical, management unit & water quality impacts from Lydenburg Biophysical
B42F	Potspruit (confluence with Watervals) Watervals (releases from Buffelskloof Dam)	High High	High Very high	C C	Biophysical Biophysical & management unit
B42G	Rooiwalhoek-se-Loop (confluence with Watervals) Watervals (confluence with Spekboom)	High High	Very high Very high	B C	Biophysical Biophysical
B42H	Spekboom (confluence with Steelpoort – *outlet of IUA 8*)	High	Moderate	B	Biophysical, management unit & outlet of IUA8
B60E, B60F	Kranskloofspruit (confluence with Ohrigstad) Mantshibi (confluence with Ohrigstad) Ohrigstad (outlet of quaternary)	High High Moderate	Very high Very high Very high	C C D	Biophysical Biophysical Biophysical & management unit
B60G	Vyehoek (confluence with Ohrigstad)	High	Very high	C	Biophysical
B60H	Ohrigstad (inflow to Blyderivierpoort Dam) – *outlet of IUA9B*	High	Very high	D	Biophysical, management unit & outlet of IUA 9B
B60J	Sandspruit (confluence), including Rietspruit and Qunduhlu Blyde (EWR12, confluence with Olifants & releases from	High Very high	Moderate Very high	B C	Biophysical Biophysical & management unit

Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
	Blyderivierpoort Dam)				
B71A	Paardevlei (confluence with Tongwane) Tongwane (confluence with Olifants)	High High	Very high High	B B	Biophysical Biophysical
B71B	Olifants (EWR8)	High	High	C	Biophysical & management unit
B71C	Mohlapitse (upper reaches)	Very high	Very high	B	Biophysical, conservation area
B71D	Kgotswane (confluence with Olifants)		Moderate	B	Biophysical
B71D, B71F	Olifants (confluence with Steelpoort)	High	Very high	D	Biophysical & management unit
B71G, H, J	Olifants (EWR11, confluence with Blyde)	High	Very high	C	Biophysical & management unit
B72A	Makhutswi (outlet), including Moungwane and Malomanye	High	High	C	Biophysical
B72C	Olifants (outlet – *outlet of IUA10*)	High	High	C	Biophysical, management unit & outlet of IUA10
B72E	Ngwabatse (confluence with Ga-Selati)	High	Very high	D	Biophysical
B72F, G	Ga-Selati (outlet of quaternary)	High	Very high	C	Biophysical
B72H	Ga-Selati (EWR14a)	High	High	C	Biophysical
B72J	Molatle (confluence with Ga-Selati)	Moderate	Moderate	B	Biophysical
B72K	Ga-Selati (EWR14b, confluence with Olifants – *outlet of UIA11*)	High	High	E	Biophysical, management unit & outlet of IUA11
B72D	Olifants (EWR13, confluence with Ga-Selati)	High	High	C	Biophysical & management unit
B73A	Klaserie (releases from Klaserie Dam)	High	Very high	C	Biophysical & management unit
B73B	Monwana (confluence with Klaserie) Klaserie (confluence with Olifants)	High High	Low High	B C	Biophysical Biophysical
B73C	Tsiri (confluence with Olifants) Tshutshi (confluence with Olifants) Olifants (EWR15)	High High	Low Very high	B C	Biophysical Biophysical Biophysical & management unit
B73D	Nhlaralumi (confluence with Olifants), including Machaton, Nyameni and Thlaralumi	High	Low	B	Biophysical
B73E	Sesete (confluence with Timbavati)	High	Low	B	Biophysical

Quaternary catchment	Nodes	EI	ES	PES	Node Type and considerations
B73F	Timbavati (outlet of quaternary)	High	Moderate	B	Biophysical
B73G	Shisakashonghondo (confluence with Timbavati)	High	Low	A	Biophysical
	Timbavati (confluence with Olifants)	High	Moderate	B	Biophysical
B73G, B73H	Olifants (EWR16)	Very high	High	C	Biophysical & management unit
B73J	Hlahleni (confluence with Olifants)	High	Low	A	Biophysical
	Olifants (outlet of quaternary – *outlet of IUA12*)	High	Low	C	Biophysical, management unit & outlet of IUA12
B60A, B60B	Blyde (confluence with Lisbon)	High	Very high	C	Biophysical
	Lisbon (confluence with Blyde), including Heddelspruit and Watervalspruit	High	Very high	B	Biophysical
B60C	Treur (EWR site, confluence with Blyde)	High	Very high	B	Biophysical
	Blyde (confluence with Treur)	High	Very high	B	Biophysical
B60D	Kadishispruit (confluence with Blyde– dolomitic fountains)				
	Belvedere (confluence with Blyde), including Muilhuisspruit				
	Blyde (inflow to Blyderivierpoort Dam) – outlet of IUA 9A	High	Very high	B	Biophysical, conservation area

MU = Management Units, Outlet = node at outlet of quaternary, confluence = node at confluence

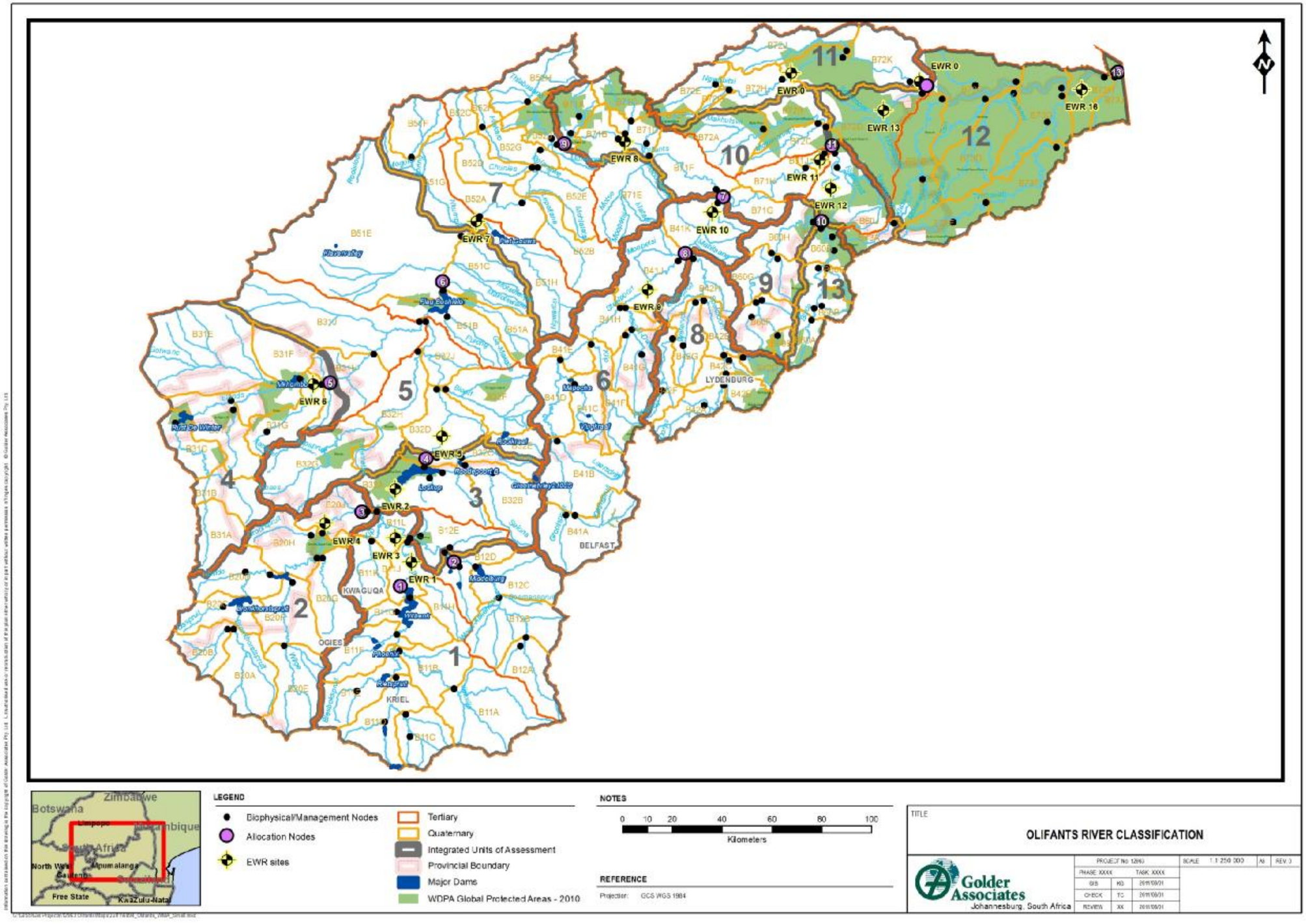

Figure 22: IUAs within the Olifants WMA indicating location of proposed nodes and EWR site

5 REFERENCES

Cawthorn, R.G. 1999. The platinum and palladium resources of the Bushveld Complex. South African Journal of Science 95:481-489.

CSIR, 2003. National Landcover dataset attributes. Satellite Applications Centre, ICOMTEX, Council for Scientific and Industrial Research, Pretoria.

DAFF. 2008. Field Crop Data. Directorate: Land Use & Soil Management.

Department of Water Affairs (2010). *The nature, distribution and value of aquatic ecosystem services of the Olifants, Inkomati and Usutu to Mhlatuze Water Management Areas*. Chief Directorate: Resource Directed Measures. Draft Report. April 2010. Pretoria.

Department of Water Affairs (2011). Directorate Water Resource Classification. April 2011. *Classification of Significant Water Resources in the Olifants Water Management Area (WMA 4):* Inception Report. Report No: RDM/WMA04/00/CON/CLA/0111. Pretoria. South Africa.

Department of Water Affairs and Forestry (2001). *Olifants River Ecological Water Requirements Assessment. Technical Input into the Ecological Management Class.* March 2001. Final report. Report No. PB 000-00-5 499. Directorate: Water Resources Planning. Pretoria.

Department of Water Affairs and Forestry (2003). Olifants Water Management Area. *Overview of Water Resources Availability and Utilisation*. Directorate National Water Resource Planning. Report No. P WMA 04/000/00/0203. Pretoria.

Department of Water Affairs and Forestry (2004). Water Management Area. *Internal Strategic Perspective.* Directorate National Water Resource Planning. Report No. P WMA 04/000/00/0304. Pretoria.

Department of Water Affairs and Forestry (2007a). The Development of the Water Resource Classification System (WRCS). First Edition. *Volume 1. Overview and 7–step classification procedure*. Chief Directorate: Resource Directed Measures.

Department of Water Affairs and Forestry (2007b). The Development of the Water Resource Classification System (WRCS). First Edition. *Volume 2. Ecological, hydrological and water quality guidelines for the 7-step classification procedure*. Chief Directorate: Resource Directed Measures.

Department of Water Affairs and Forestry (2007c). The Development of the Water Resource Classification System (WRCS). First Edition. *Volume 3. Socio-economic guidelines for the 7-step classification procedure*. Chief Directorate: Resource Directed Measures.

Department of Water Affairs and Forestry (2007d). The Development of the Water Resource Classification System (WRCS). First Edition. *Volume 4. Decision analysis (including the stakeholder engagement process for 7–step Classification Procedure*. Chief Directorate: Resource Directed Measures.

Department of Water Affairs and Forestry & DFID (2007e). *Undertake an assessment of the current water allocation status and potential for establishing viable water using enterprises in the Olifants and Inkomati WMA, State of the aquatic ecosystems in the Olifants WMA*. Contract no. WFSP/WRM/CON 2006

Department of Water Affairs and Forestry (2001). *Olifants River Ecological Water Requirements assessment*. Report no. PB 000-00-5 499

International Water Management Institute (IWRM). 2008. Baseline Report: Olifants River Basin in South Africa. http://www.iwmi.cgiar.org/

Jeffrey, L.S. 2005. Characterisation of the coal resources of South Africa. The Journal of the South African Institute of Mining and Metallurgy 95-102.

The World Conservation Union (IUCN) (2007). Olifants River Catchment Technical studies*. Scoping meeting report*. Bourkes Luck Pot Holes. Report produced by JMM Stassen and E Espach.

The World Conservation Union (IUCN), 2008. *Ecological Water Requirement sites: Evaluation and recommendations for the Olifants River, Mpumalanga*. Report produced by R Stassen, Dr C Brown, A Jordanova, C Todd & Dr J Engelbrecht.

APPENDIX A

RESULTS OF THE EVALUATION OF PES AND EIS PER QUATERNARY CATCHMENT IN THE OLIFANTS WMA (2010)

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Leeufonteinspruit	B11A-01331	MODERATE	HIGH	D	B
Olifants	B11A-01369	HIGH	HIGH	C	B
Viskuile	B11A-01430	HIGH	HIGH	C	B
Joubertsvleispruit	B11A-01443	MODERATE	HIGH	D	B
Olifants	B11A-01396	HIGH	HIGH	C	B
Viskuile	B11A-01411	MODERATE	HIGH	C	B
Koringspruit	B11B-01294	MODERATE	HIGH	D	B
Olifants	B11B-01327	HIGH	VERY HIGH	C	A
Olifants	B11B-01304	MODERATE	HIGH	E	B
Steenkoolspruit	B11C-01449	MODERATE	HIGH	C	B
Debeerspruit	B11C-01503	MODERATE	HIGH	C	B
	B11C-01527	MODERATE	HIGH	B	B
Piekespruit	B11C-01542	HIGH	HIGH	B	B
Piekespruit	B11C-01501	MODERATE	HIGH	B	B
Piekespruit	B11C-01472	MODERATE	HIGH	B	B
Dwars-in-die-wegspruit	B11D-01467	MODERATE	HIGH	C	B
Trichardspruit	B11D-01481	MODERATE	MODERATE	E	C
Dwars-in-die-wegspruit	B11D-01424	MODERATE	HIGH	D	B
Steenkoolspruit	B11D-01435	LOW	MODERATE	D	C
Steenkoolspruit	B11D-01366	MODERATE	HIGH	D	B
Blesbokspruit	B11E-01373	MODERATE	HIGH	B	B
Rietspruit	B11E-01399	MODERATE	HIGH	D	B
Rietspruit	B11E-01353	MODERATE	HIGH	E	B
Steenkoolspruit	B11E-01297	MODERATE	HIGH	D	B
Tweefonteinspruit	B11F-01257	LOW	MODERATE	E	C
Klippoortjiespruit	B11F-01286	MODERATE	HIGH	E	B
Tweefonteinspruit	B11F-01273	LOW	MODERATE	E	C
Olifants	B11F-01274	MODERATE	HIGH	D	B
Noupoort	B11G-01193	MODERATE	HIGH	D	B
Olifants	B11G-01225	MODERATE	HIGH	D	B
Spookspruit	B11H-01161	HIGH	HIGH	C	B
Olifants	B11J-01155	MODERATE	VERY HIGH	D	A
Olifants	B11J-01086	VERY HIGH	VERY HIGH	B	A
Blesbokspruit	B11K-01121	MODERATE	HIGH	E	B
Klipspruit	B11K-01127	MODERATE	HIGH	E	B
Klip	B11L-01051	HIGH	MODERATE	D	B
Olifants	B11L-01024	VERY HIGH	HIGH	C	A
Olifants	B11L-01044	HIGH	VERY HIGH	B	A
	B12A-01306	MODERATE	HIGH	C	B

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Klein-Olifants	B12A-01309	HIGH	HIGH	C	B
Bosmanspruit	B12B-01187	MODERATE	HIGH	D	B
Coetzerspruit	B12B-01191	LOW	MODERATE	E	C
Rietkuilspruit	B12B-01213	MODERATE	MODERATE	E	C
Woes-Alleenspruit	B12B-01223	MODERATE	HIGH	E	B
East Woes-Alleenspruit	B12B-01233	LOW	MODERATE	E	C
Zevenfonteinspruit	B12B-01241	MODERATE	MODERATE	E	C
Klein-Olifants	B12B-01256	HIGH	HIGH	C	B
Klein-Olifants	B12B-01207	MODERATE	HIGH	C	B
Woes-Alleenspruit	B12B-01222	VERY LOW	LOW		D
Klein-Olifants	B12B-01228	MODERATE	HIGH	D	B
Klein-Olifants	B12B-01217	MODERATE	MODERATE	D	C
Klein-Olifants	B12B-01192	MODERATE	HIGH	D	B
	B12C-01119	MODERATE	HIGH	D	B
Klein-Olifants	B12C-01153	MODERATE	HIGH	C	B
Vaalbankspruit	B12D-01144	MODERATE	HIGH	D	B
Klein-Olifants	B12D-01095	MODERATE	HIGH	D	B
Klein-Olifants	B12D-01118	MODERATE	HIGH	D	B
Doringboomspruit	B12E-01030	HIGH	HIGH	B	B
Keeromspruit	B12E-01050	HIGH	VERY HIGH	C	A
Klein-Olifants	B12E-01062	HIGH	VERY HIGH	C	A
Klein-Olifants	B12E-01078	HIGH	VERY HIGH	C	A
Bronkhorstspruit	B20A-01298	MODERATE	HIGH	D	B
	B20A-01362	MODERATE	MODERATE	C	C
	B20A-01374	MODERATE	HIGH	C	B
Bronkhorstspruit	B20A-01245	MODERATE	HIGH	D	B
	B20A-01308	MODERATE	HIGH	D	B
	B20B-01253	MODERATE	MODERATE	C	C
Koffiespruit	B20B-01285	MODERATE	MODERATE	D	C
	B20B-01303	MODERATE	MODERATE	C	C
Koffiespruit	B20B-01234	MODERATE	HIGH	C	B
	B20B-01283	MODERATE	HIGH	B	B
Osspruit	B20C-01170	MODERATE	HIGH	D	B
Bronkhorstspruit	B20C-01186	HIGH	HIGH	C	B
Hondespruit	B20D-01089	HIGH	HIGH	C	B
Bronkhorstspruit	B20D-01088	HIGH	VERY HIGH	C	A
Bronkhorstspruit	B20D-01146	HIGH	VERY HIGH	C	A
	B20E-01301	MODERATE	HIGH	D	B
	B20E-01310	MODERATE	HIGH	D	B

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Kromdraaispruit	B20E-01376	MODERATE	HIGH	C	B
Wilge	B20E-01383	HIGH	HIGH	C	B
	B20E-01290	MODERATE	MODERATE	D	C
Wilge	B20E-01292	MODERATE	HIGH	C	B
Wilge	B20F-01150	HIGH	VERY HIGH	C	A
Saalboomspruit	B20G-01099	MODERATE	HIGH	C	B
Grootspruit	B20H-01015	HIGH	VERY HIGH	C	A
Wilge	B20H-01067	HIGH	VERY HIGH	B	A
Wilge	B20H-01109	HIGH	VERY HIGH	B	A
	B20J-00979	HIGH	HIGH	B	B
Wilge	B20J-00998	HIGH	VERY HIGH	C	A
Elands	B31G-00769	LOW	MODERATE	E	C
	B31H-00780	MODERATE	MODERATE	E	C
Elands	B31H-00711	MODERATE	MODERATE	E	C
Elands	B31H-00738	MODERATE	MODERATE	E	C
Elands	B31H-00748	MODERATE	MODERATE	E	C
Elands	B31H-00767	LOW	MODERATE	E	C
	B31J-00672	LOW	MODERATE	E	C
Kleinspruit	B41A-01002	MODERATE	HIGH	C	B
Lakensvleispruit	B41A-01005	HIGH	MODERATE	D	B
Grootspruit	B41A-01025	HIGH	HIGH	C	B
Langspruit	B41A-01047	HIGH	VERY HIGH	D	A
Laersdrift	B41B-00905	HIGH	VERY HIGH	D	A
Steelpoort	B41B-00912	HIGH	VERY HIGH	D	A
Vlugkraal	B41C-00862	MODERATE	HIGH	C	B
Tonteldoos	B41C-00863	MODERATE	HIGH	C	B
Masala	B41C-00766	HIGH	HIGH	C	B
Steelpoort	B41D-00777	HIGH	VERY HIGH	C	A
Steelpoort	B41E-00689	HIGH	VERY HIGH	C	A
Klip	B41F-00848	HIGH	VERY HIGH	B	A
Draaikraalspruit	B41F-00851	HIGH	VERY HIGH	B	A
Klip	B41F-00699	HIGH	VERY HIGH	B	A
Klein-Dwars	B41G-00685	HIGH	HIGH	D	B
Groot-Dwars	B41G-00721	HIGH	VERY HIGH	C	A
	B41G-00726	HIGH	VERY HIGH	B	A
Groot-Dwars	B41G-00674	HIGH	VERY HIGH	D	A
Dwars	B41H-00640	HIGH	HIGH	D	B
Steelpoort	B41H-00610	HIGH	HIGH	D	B
Hodupong	B41J-00502	LOW	MODERATE	D	C
Moopetsi	B41J-00512	LOW	LOW	E	D

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Tubatsane	B41J-00562	LOW	VERY LOW	E	D
Moopetsi	B41J-00546	LOW	LOW	E	D
Steelpoort	B41J-00554	MODERATE	HIGH	D	B
Steelpoort	B41J-00563	MODERATE	HIGH	D	B
Steelpoort	B41J-00576	HIGH	HIGH	D	B
Tshwetlane	B41K-00476	MODERATE	LOW	E	C
	B41K-00496	MODERATE	MODERATE	C	C
	B41K-00527	MODERATE	MODERATE	C	C
Mabitsana	B41K-00544	MODERATE	HIGH	D	B
Steelpoort	B41K-00477	MODERATE	HIGH	D	B
Steelpoort	B41K-00487	MODERATE	HIGH	D	B
Steelpoort	B41K-00506	MODERATE	HIGH	E	B
Steelpoort	B41K-00515	MODERATE	HIGH	D	B
Steelpoort	B41K-00526	MODERATE	HIGH	D	B
	B42A-00815	LOW			D
Hoppe se Spruit	B42A-00825	MODERATE	HIGH	C	B
	B42A-00877	MODERATE	MODERATE	C	C
	B42A-00883	MODERATE	HIGH	B	B
Dorps	B42A-00900	MODERATE	HIGH	C	B
Dorps	B42A-00805	MODERATE	HIGH	C	B
Dorps	B42A-00814	HIGH	HIGH	C	B
Dorps	B42A-00852	MODERATE	HIGH	C	B
Dorps	B42A-00857	MODERATE	HIGH	C	B
Doringbergspruit	B42B-00807	MODERATE	HIGH	C	B
Potloodspruit	B42C-00746	MODERATE	HIGH	C	B
Dorps	B42C-00744	HIGH	HIGH	C	B
Kliprots	B42D-00762	HIGH	VERY HIGH	C	A
Spekboom	B42D-00788	HIGH	HIGH	D	B
Spekboom	B42D-00705	HIGH	VERY HIGH	C	A
Dorps	B42E-00725	HIGH	VERY HIGH	C	A
Spekboom	B42E-00633	HIGH	VERY HIGH	C	A
	B42F-00808	HIGH	VERY HIGH	C	A
Potspruit	B42F-00812	HIGH	HIGH	C	B
Waterval	B42F-00680	HIGH	VERY HIGH	C	A
	B42G-00733	HIGH	VERY HIGH	B	A
	B42G-00734	HIGH	VERY HIGH	B	A
Rooiwalshoek se Loop	B42G-00704	HIGH	VERY HIGH	B	A
Waterval	B42G-00634	HIGH	VERY HIGH	C	A
	B42H-00591	HIGH	HIGH	B	B

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Eloffspruit	B42H-00626	HIGH	MODERATE	C	B
Spekboom	B42H-00553	HIGH	MODERATE	C	B
Spekboom	B42H-00599	HIGH	MODERATE	C	B
Spekboom	B42H-00627	HIGH	MODERATE	B	B
Malekani	B51A-00682	LOW	LOW	D	D
Gemsbokspruit	B51A-00686	LOW	LOW	D	D
Motsephiri	B51A-00614	MODERATE	HIGH	D	B
Ga-Makatle	B51B-00646	MODERATE	MODERATE	C	C
Puleng	B51B-00649	MODERATE	MODERATE	C	C
Puleng	B51B-00638	HIGH	HIGH	B	B
Olifants	B51B-00589	MODERATE	HIGH	D	B
Olifants	B51B-00613	VERY LOW			D
Olifants	B51B-00620	VERY LOW			D
Motsemohlaba	B51C-00519	MODERATE	MODERATE	D	C
Madibjaneng	B51C-00556	MODERATE	MODERATE	D	C
Motseleope	B51C-00559	MODERATE	MODERATE	D	C
Makotswane	B51C-00585	MODERATE	MODERATE	D	C
Olifants	B51C-00411	MODERATE	VERY HIGH	D	A
Olifants	B51C-00509	MODERATE	HIGH	C	B
Olifants	B51C-00555	MODERATE	HIGH	C	B
Rooisloot	B51E-00389	LOW			D
	B51E-00480	VERY LOW			D
	B51E-00540	LOW			D
	B51E-00579	LOW			D
	B51E-00587	LOW			D
	B51E-00557	VERY LOW			D
	B51E-00577	LOW	VERY LOW	E	D
Grass Valley.	B51E-00483	MODERATE	LOW	D	C
Olifants	B51E-00548	MODERATE	HIGH	C	B
Olifants	B51E-00571	MODERATE	HIGH	D	B
Nkumpi	B51F-00313	MODERATE	MODERATE	C	B
	B51F-00317	MODERATE	LOW	B	C
Nkumpi	B51F-00372	MODERATE	LOW	C	C
Mogoto	B51G-00352	HIGH	MODERATE	C	B
Doring	B51G-00379	MODERATE	LOW	D	C
Nkumpi	B51G-00410	LOW	MODERATE	E	C
Nkumpi	B51G-00423	LOW	LOW	D	D
Olifants	B51G-00482	HIGH	HIGH	D	B
Ngwaritsane	B51H-00542	LOW	LOW	D	D
Mphofotse	B51H-00636	LOW	LOW	D	D

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Ngwaritsi	B51H-00637	LOW	MODERATE	E	C
Ngwaritsi	B51H-00491	MODERATE	MODERATE	D	C
Ngwaritsi	B51H-00547	LOW	MODERATE	D	C
Olifants	B52A-00397	HIGH	HIGH	D	B
Lepellane	B52B-00467	MODERATE	MODERATE	D	C
Chunies	B52D-00307	HIGH	HIGH	D	B
Pelangwe	B52E-00435	MODERATE	HIGH	C	B
Mohlaletsi	B52E-00452	LOW	LOW	E	C
Olifants	B52E-00309	MODERATE	HIGH	D	B
Olifants	B52E-00436	MODERATE	HIGH	D	B
Olifants	B52E-00439	MODERATE	HIGH	D	B
Olifants	B52E-00458	HIGH	HIGH	D	B
Hlakaro	B52G-00309	HIGH	HIGH	C	B
Olifants	B52G-00382	MODERATE	HIGH	D	B
	B52H-00259	MODERATE	HIGH	D	B
Thlabasane	B52H-00284	MODERATE	LOW	C	C
	B52H-00286	MODERATE	LOW	C	C
Masokuditsi	B52H-00320	MODERATE	LOW	C	C
Mphogodima	B52H-00295	LOW	VERY LOW	D	C
Mphogodima	B52H-00325	MODERATE	MODERATE	C	C
	B52J-00347	HIGH	VERY LOW	A	B
Monametsi	B52J-00417	LOW	LOW	E	D
Mphogodima	B52J-00315	HIGH	HIGH	C	B
Mphogodima	B52J-00350	MODERATE	LOW	C	C
Olifants	B52J-00415	MODERATE	HIGH	D	B
Blyde	B60A-00653	HIGH	VERY HIGH	C	A
Lisbon	B60B-00650	HIGH	VERY HIGH	B	A
Blyde	B60B-00566	HIGH	VERY HIGH	B	A
Treur	B60C-00581	HIGH	VERY HIGH	B	A
Blyde	B60D-00525	HIGH	VERY HIGH	B	A
Ohrigstad	B60E-00667	HIGH	VERY HIGH	C	A
Mantshibi	B60F-00632	HIGH	VERY HIGH	C	A
Kranskloofspruit	B60F-00658	HIGH	VERY HIGH	C	A
Ohrigstad	B60F-00644	MODERATE	VERY HIGH	D	A
	B60G-00550	MODERATE	HIGH	C	B
Vyehoek	B60G-00568	HIGH	VERY HIGH	C	A
Ohrigstad	B60G-00567	MODERATE	VERY HIGH	D	A
Ohrigstad	B60G-00570	MODERATE	HIGH	D	B
Ohrigstad	B60H-00485	HIGH	VERY HIGH	D	A
Rietspruit	B60J-00460	MODERATE	LOW	B	B

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
	B60J-00495	HIGH	HIGH	B	B
Qunduhlu	B60J-00498	HIGH	MODERATE	B	B
Sandspruit	B60J-00448	MODERATE	HIGH	D	B
Sandspruit	B60J-00453	HIGH	MODERATE	B	B
Blyde	B60J-00424	VERY HIGH	VERY HIGH	C	A
Blyde	B60J-00444	HIGH	VERY HIGH	C	A
	B71A-00314	HIGH	VERY HIGH	B	A
	B71A-00342	HIGH	MODERATE	B	B
	B72D-00356	HIGH	VERY LOW	B	B
	B72F-00361	HIGH	HIGH	A	B
	B72F-00381	HIGH	HIGH	A	B
	B72J-00287	MODERATE	LOW	C	C
Ga-Matombane	B72C-00394	MODERATE	VERY LOW	B	C
Ga-Sekgobela	B73D-00408	MODERATE	LOW	C	C
Ga-Selati	B72F-00368	HIGH	VERY HIGH	B	A
Ga-Selati	B72F-00367	HIGH	VERY HIGH	B	A
Ga-Selati	B72G-00321	HIGH	VERY HIGH	C	A
Ga-Selati	B72H-00282	HIGH	HIGH	C	B
Ga-Selati	B72K-00260	MODERATE	HIGH	E	B
Hlahleni	B73J-00323	HIGH	LOW	A	B
Kgotswane	B71D-00378	HIGH	MODERATE	B	B
Klaserie	B73A-00461	HIGH	VERY HIGH	C	A
Klaserie	B73B-00343	HIGH	HIGH	C	B
Mabogwane	B71E-00440	LOW	LOW	E	D
Machaton	B73D-00434	HIGH	LOW	A	B
Makhutswi	B72A-00364	HIGH	HIGH	C	B
Makhutswi	B72A-00360	MODERATE	LOW	C	B
Makhutswi	B72B-00322	MODERATE	LOW	B	C
Makhutswi	B72C-00387	MODERATE	VERY LOW	B	C
Malomanye	B72A-00405	HIGH	HIGH	C	B
Matadi	B71E-00468	LOW	LOW	E	D
Mohlabetsi	B72D-00399	HIGH	LOW	B	B
Mohlapitse	B71C-00292	HIGH	VERY HIGH	B	A
Molatle	B72J-00257	HIGH	MODERATE	C	B
Molatle	B72J-00258	MODERATE	MODERATE	B	C
Molomahlapi	B72C-00409	HIGH	LOW	C	B
Monwana	B73B-00463	HIGH	VERY LOW	B	B
Moopetsi	B71E-00474	LOW	LOW	E	D
Moopetsi	B71E-00466	LOW	VERY LOW	E	D
Mosomeetse	B72C-00419	MODERATE	LOW	B	B

Sub-quenary Name	Sub-quenary Reach	Mean EIS Class	Mean Ecological Sensitivity Class	PES Category	DEFAULT REC (Based on Median PES and highest of EI or ES means)
Motse	B71E-00447	MODERATE	LOW	D	C
Motse	B71E-00425	LOW	LOW	E	D
Motse	B71E-00429	LOW	LOW	E	D
Moungwane	B72A-00403	HIGH	VERY HIGH	C	A
Ngwabitsi	B72E-00291	HIGH	VERY HIGH	D	A
Nhlaralumi	B73D-00338	MODERATE	LOW	B	C
Nhlaralumi	B73D-00358	MODERATE	LOW	B	B
Nhlaralumi	B73D-00407	LOW	LOW	C	D
Nyameni	B73D-00365	MODERATE	MODERATE	B	C
Olifants	B71A-00390	MODERATE	HIGH	D	B
Olifants	B71A-00396	HIGH	HIGH	D	B
Olifants	B71B-00335	HIGH	HIGH	C	B
Olifants	B71D-00412	HIGH	HIGH	D	B
Olifants	B71D-00422	HIGH	HIGH	D	B
Olifants	B71F-00393	HIGH	VERY HIGH	D	A
Olifants	B71G-00428	HIGH	VERY HIGH	C	A
Olifants	B72C-00406	HIGH	HIGH	C	B
Olifants	B72D-00326	HIGH	HIGH	C	B
Olifants	B72D-00327	HIGH	HIGH	C	B
Olifants	B72D-00328	MODERATE	HIGH	E	B
Olifants	B72D-00377	HIGH	HIGH	C	B
Olifants	B73C-00293	HIGH	HIGH	C	B
Olifants	B73C-00318	HIGH	HIGH	D	B
Olifants	B73C-00329	HIGH	HIGH	C	B
Olifants	B73C-00332	HIGH	VERY HIGH	C	A
Olifants	B73G-00308	HIGH	HIGH	B	B
Olifants	B73H-00311	VERY HIGH	HIGH	C	A
Olifants	B73J-00304	VERY LOW			D
Paardevlei	B71A-00305	HIGH	VERY HIGH	B	A
Sedumoni	B72D-00341	MODERATE	LOW	B	C
Sesete	B73E-00522	HIGH	LOW	B	B
Shisakashanghondo	B73G-00391	HIGH	LOW	A	B
Thlaralumi	B73D-00431	HIGH	LOW	B	B
Timbavati	B73E-00493	MODERATE	MODERATE	C	C
Timbavati	B73F-00404	HIGH	MODERATE	B	B
Timbavati	B73G-00339	HIGH	MODERATE	B	B
Tongwane	B71A-00348	HIGH	HIGH	B	B
Tshutshi	B73C-00288	HIGH	LOW	B	B
Tsiri	B73C-00351	HIGH	VERY LOW	B	B