

DEPARTMENT: WATER AND SANITATION

**CHIEF DIRECTORATE WATER ECOSYSTEMS
DIRECTORATE RESERVE DETERMINATION**

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

INCEPTION REPORT



April 2016

Final



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DEPARTMENT: WATER AND SANITATION

Directorate: Reserve Determination

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

WP10940

INCEPTION REPORT

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LIST OF ABBREVIATIONS

| | |
|--------|--|
| AMD | Acid Mine Drainage |
| BHN | Basic Human Needs |
| CD: WE | Chief Directorate: Water Ecosystems |
| DWS | Department of Water and Sanitation |
| DWA | Department of Water Affairs |
| DWAF | Department of Water Affairs and Forestry |
| EC | Electrical Conductivity |
| EIS | Ecological importance and sensitivity |
| EWR | Ecological Water Requirements |
| ESBC | Ecological Sustainable Base Configuration |
| FEPA | Freshwater Ecosystem Priority Areas |
| FIFHA | Flow, Invertebrate, Fish, Habitat Assessment |
| HGM | Hydro-geomorphic |
| IUA | Integrated Unit of Analysis |
| IWRM | Integrated Water Resource Management |
| IWRMP | Integrated Water Resources Management Plan |
| MC | Management Class |
| MIRAI | Macro-invertebrate Response Assessment Index |
| NFEPA | National Freshwater Ecosystem Priority Areas |
| NWA | National Water Act |
| PES | Presentation Ecological State |
| REC | Recommended Ecological Category |
| REMP | Resource Eco-status Monitoring Program |
| RDM | Resource Directed Measures |
| RHP | River Health Programme |
| RQOs | Resource Quality Objectives |
| RQS | Resource Quality Services |
| RUs | Resource Units |
| TPCs | Thresholds of Potential Concern |

| | |
|------|--------------------------------------|
| WE | Water Ecosystems |
| WMA | Water Management Area |
| WRCS | Water Resource Classification System |
| WRPM | Water Resources Planning Model |
| WRYM | Water Resource Yield Model |

EXECUTIVE SUMMARY

The Chief Directorate: Water Ecosystems has recently commissioned the study 'Determination, Review and Implementation of the Reserve in the Olifants/Letaba System'. With water resources in the Olifants Water Management Area (WMA 2) having been classified and Resource Quality Objectives determined (2011-2014) the preliminary Reserve determined in 2001 for the Olifants system and in 2006 for the Letaba system, is now required to be superseded by the Reserve. With the preliminary Reserve having been determined nine years prior to the water resource classification, a review and update is required to ensure that the Reserve is in accordance with the water resource classes and is applicable to the current system needs and demands.

The purpose of this study is thus to determine, review and implement the Reserve in the Olifants/Letaba System; with the aim of specifically addressing ecological gaps and reviewing and updating the preliminary Reserves that have been determined.

The proposed management classes and Resource Quality Objectives (RQOs) have been published for public comment by Government Notice and once approved by the Minister of Water and Sanitation will be gazetted and thereafter be implemented. As the class of the water resources for the Olifants/Letaba system have now been determined, the Reserve can be determined and gazetted.

This study will focus on:

- § Addressing ecological gaps at identified priority sites that have not been addressed by preliminary Reserve determination studies but require a degree of ecological protection afforded by a Reserve;
- § Addressing the ecological gaps at identified priority Ecological Water Requirement (EWR) sites that require an update of existing information;
- § Protection requirements, water quality measures and ecological specifications of identified priority wetlands within the system;
- § Updating the water quality component of the Reserve at the EWR sites and setting ecological specifications. In addition at strategic sub-catchments ecological water quality requirements will be specified to ensure that the water quality ecospecs at the EWR sites through the system can be achieved;
- § Identify the priority groundwater resources and systems and define appropriate protection requirements;
- § Assessing the operational scenarios as part of the implementation component to determine the EWRs and basic human needs (BHN) that are required and that can be met;
- § Taking cognisance of the reconciliation study that was recently being completed by the Department and is currently being implemented for the Olifants system, especially during the formulation of a management/implementation plan for the Reserve; and

§ Formulation of a water resource management plan as the final study output, that will serve to guide the Department to operationalise Resource Directed Measures (RDM) in the Olifants/Letaba system, thereby moving towards improving the state of the water resources within this system.

This report is intended to define the final scope, intended work programme and budget requirements of the project. Golder Associates Africa (Pty) Ltd in association with Wetland Consulting Services (WCS), JMM Stassen, Dr Wynand Vlok and Zitholele Consulting has been appointed to undertake the study. This Inception Report includes the final study plan which has been informed by the review of existing information, as well as feedback from the initial consultation with the client and the Project Management Committee (PMC).

The study will take place over a period of 18 months, which includes the following main phases:

- § Study Inception Phase;
- § Study Execution Phase; and
- § Study Closure Phase.

The study area is the Olifants WMA (WMA 2) and includes the Olifants, Letaba and Shingwedzi systems.

The study phases are described and defined in this report. The study approach and procedure is further described as well as assumptions and provisions determined by the study team. The aim of the report is to ensure that the client and the study team are clear and agree on the way forward in terms of the undertaking of the study and final outputs.

This report details the technical approach, the background to the study area, the project management and administrative aspects, deliverables, timeframes and associated costs of the study.

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1. INTRODUCTION

1.1 BACKGROUND AND CONTEXT

With the promulgation of The National Water Act (No. 36 of 1998) (NWA), water resources management in South Africa underwent a paradigm shift. The Department of Water and Sanitation (DWS) as custodian of the nation's water resources is mandated to protect, use, develop, conserve, manage and control the nation's water resources in a sustainable and equitable manner for the benefit of all South Africans. Sustainability encompasses both the long- and short-term protection of water resources to ensure that they can be developed and used effectively into the future.

An approach to managing water resources has been adopted that introduces measures to protect water resources by setting objectives for the desired condition of resources and putting measures in place to control water use to limit impacts to acceptable levels. Resource Directed Measures, together with Source Directed Controls are the key strategic approaches designed under the NWA to achieve equity, sustainability and efficiency in the management of water resources in South Africa.

Resource Directed Measures (RDM) is enabled through Chapter 3 of the NWA which provides for the protection of water resources through the Classification of water resources, determination of Resource Quality Objectives (RQOs) and determination of the Reserve. These measures collectively aim to ensure that a balance is reached between the need to protect and sustain water resources on one hand and the need to develop and use them on the other. The Reserve (quantity and quality) which has priority over other water uses provides for two components; (1) basic human needs (BHN), ensuring that the essential needs of individuals served by the water resource in question are provided for; and (2) the ecological Reserve ensuring the water required to protect aquatic systems of the water resource are provided for. In terms of the NWA the preliminary determinations of Reserves may be made if a water resource has not been classified. However once water resources have been classified the preliminary Reserve must be superseded by the Reserve.

To date the DWS has undertaken a number of preliminary Reserve determinations of water resources in the country in the absence of a Water Resource Classification System (WRCS). However with the promulgation of the WRCS regulations in 2010, a number of water resources have since been classified), which now permits the determination of the Reserve for these said water resources. Three such systems amongst others include the Olifants (Mpumalanga), Vaal and Olifants-Doorn.

The Chief Directorate: Water Ecosystems has recently commissioned the study 'Determination, Review and Implementation of the Reserve in the Olifants/Letaba System. With water resources in the Olifants Water Management Area (WMA 2) having been classified and RQOs determined (2011-2014) the preliminary Reserve determined in 2001 for the Olifants system and in 2006 for the Letaba system, is now required to be superseded by the Reserve. With the preliminary Reserve having been determined nine years prior to the water resource classification, a review and update is required to ensure that the Reserve is in accordance with the water resource classes and is applicable to the current system needs and demands.

Golder Associates Africa (Pty) Ltd (Golder) in association with Wetland Consulting Services, JMM Stassen, Dr Wynand Vlok and Zitholele Consulting has been appointed to undertake the study.

1.2 PURPOSE OF THE STUDY

The purpose of this study is to determine, review and implement the Reserve in the Olifants/Letaba System; with the aim of specifically addressing ecological gaps and reviewing and updating the preliminary Reserves that have been determined.

This study leads on from the recently completed classification and determination of RQOs for the water resources of the Olifants/Letaba system where water resources classes and associated RQOs have been set for significant water resources. The proposed management classes and RQOs have been published for public comment by Government Notice and once approved by the Minister of Water and Sanitation will be gazetted and thereafter implemented. As the various classes have been set for the demarcated integrated units of analysis (IUAs) for the Olifants/Letaba system, and the Reserve configurations related to the classes have been determined mostly for the rivers, the gaps identified related to wetlands and water quality amongst others need to be addressed. Once this has been completed, the final Reserve configuration (ecological categories) can be determined and gazetted which will also provide the opportunity to specify ecological specifications for the water resources that have a high to very high importance and sensitivity, conservation status or has a significant functionality in terms of supporting the main water resource systems in the WMA.

This study will thus focus on:

- ❖ Reviewing all relevant and applicable information stemming from the preliminary Reserve determination studies, the water resource classification study and the RQO determination study;
- ❖ Addressing ecological gaps at identified priority sites that have not been addressed by preliminary Reserve determination studies but require a degree of ecological protection afforded by a Reserve;
- ❖ Addressing the ecological gaps at identified priority Ecological Water Requirement (EWR) sites that require an update of existing information;
- ❖ Identifying and prioritising wetland systems and typing them according to their hydro-geomorphic characteristics, building on existing information and previous studies. Emphasis will be placed on wetland type and its functionality within the catchment landscape. The health or state of the wetland systems and their likely trajectory of change will also be considered in the prioritisation process. The intention is to produce a comprehensive priority wetland map for the entire WMA including additional wetlands (additional to those identified in previous studies) that may need to be considered in terms of the Reserve, taking into account aspects related to land and water use;
- ❖ Updating the water quality component of the Reserve at the EWR sites and setting ecological specifications. In addition at strategic sub-catchments ecological water quality requirements will be specified to ensure that the water quality ecological specification at the EWR sites through the system can be achieved;

- Identify the priority groundwater resources and systems and define appropriate protection requirements;
- Assessing the operational scenarios as part of the implementation component to determine the Ecological Water Requirements (EWRs) by assessing the ecological consequences of the proposed operational scenarios on the water resources and its health and the basic human needs (BHN) where people are directly dependent on the water resource for their subsistence use;
- Taking cognisance of the reconciliation study that was recently being completed by DWS and is currently being implemented for the Olifants system, especially during the formulation of a management/implementation plan for the Reserve;
- Development of ecological specifications, thresholds of potential concern (TPCs) and a monitoring plan that will specify monitoring requirements for wetlands, groundwater and surface water; and
- Formulation of a water resource management plan as the final study output, that will serve to guide the department to operationalise RDM in the Olifants/Letaba system, thereby moving towards improving the state of the water resources within this system. This plan will be an input into the Catchment Management Strategy to be developed for the WMA by the Catchment Management Agency.

1.3 PURPOSE OF THE REPORT

This Inception Report is a deliverable from the first task of the study, the inception phase, and describes the proposed activities and tasks that will be carried out. The inception report has been produced to better define the scope of work for the study, document any changes to the scope of work from the proposal, describe the information available to support the study, highlight related considerations that could influence the study, confirm the study programme and the associated study budget based on the initial assessments and reviews undertaken during the inception phase of the study.

1.4 STUDY AREA

The study area is the Olifants WMA (WMA 2) and includes the Olifants, Letaba and Shingwedzi systems. The spatial extent of the area includes tertiary drainage regions B11, B12, B20, B31, B32, B41, B42, B51, B52, B60, B71, B72 and B73 in the Olifants system, B81, B82 and B83 in the Letaba area, and B90, the Shingwedzi catchment.

The Olifants River originates at Trichardt, east of Johannesburg, and flows through the Kruger National Park. The Letaba River joins the Olifants River upstream of the border into Mozambique, where they join the Limpopo River before discharging into the Indian Ocean. The Shingwedzi River flows mostly in the Kruger National Park and then into Mozambique before it joins the Limpopo River.

The Olifants system falls within three provinces (Gauteng, Mpumalanga and the Limpopo Province). The main tributaries of the Olifants River 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.

The Letaba River catchment is drained by the Groot Letaba River and its major tributaries are the Klein-Letaba, Middle Letaba, Letsitele and Molototsi Rivers. The Shingwedzi River and its major tributaries the Shisha, Mphongolo and Phugwane drain the Shingwedzi River catchment.

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 and the scarcity of water resources. There is an urgency to ensure that water resources in the Olifants WMA are able to sustain their level of uses and be maintained at their desired ecological states.

The overview map of the WMA is shown in Figure 1 with the study area catchments Olifants, Letaba and Shingwedzi depicted in Figure 2, Figure 3 and Figure 4 respectively.

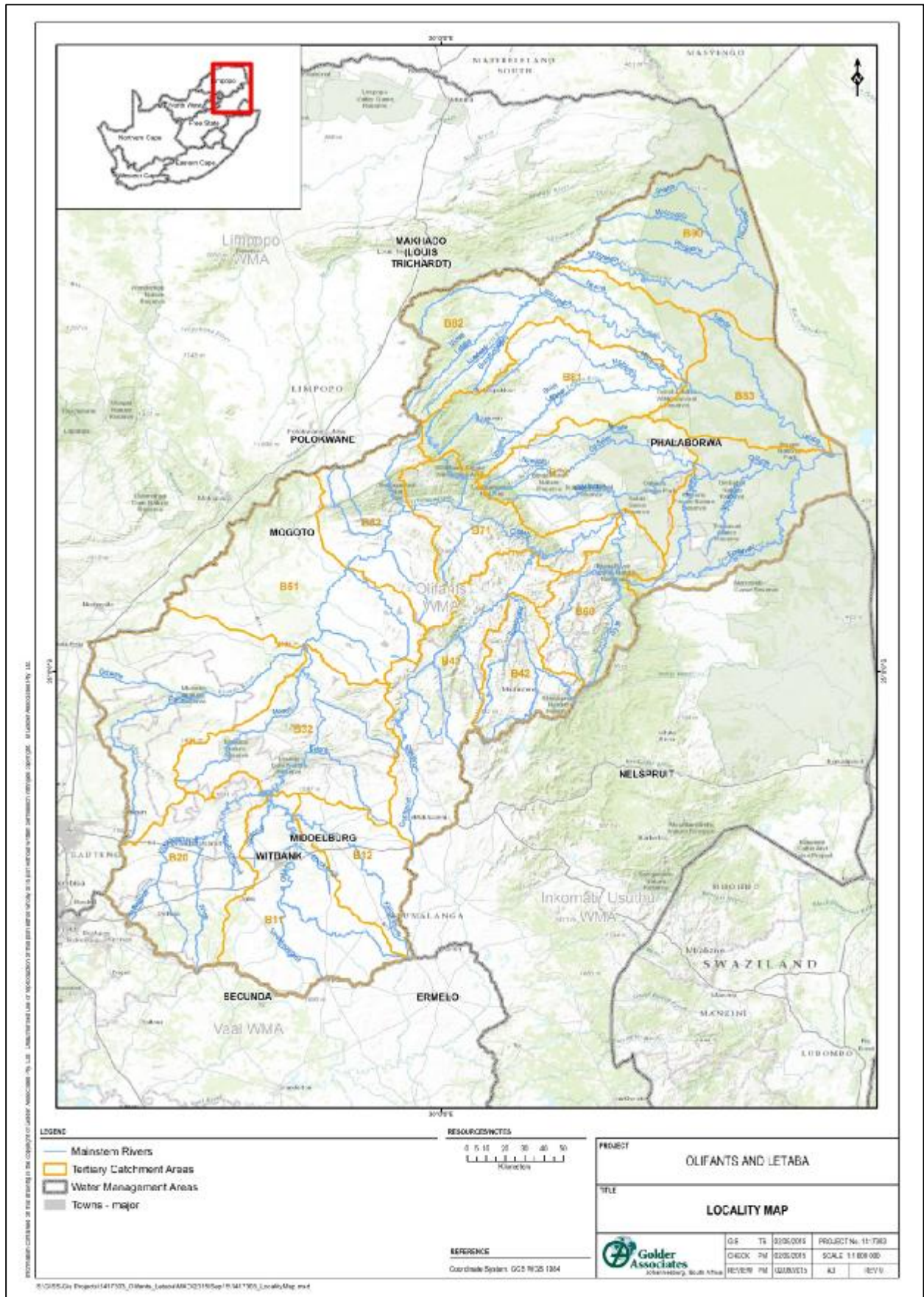


Figure 1: Olifants/Letaba System study area

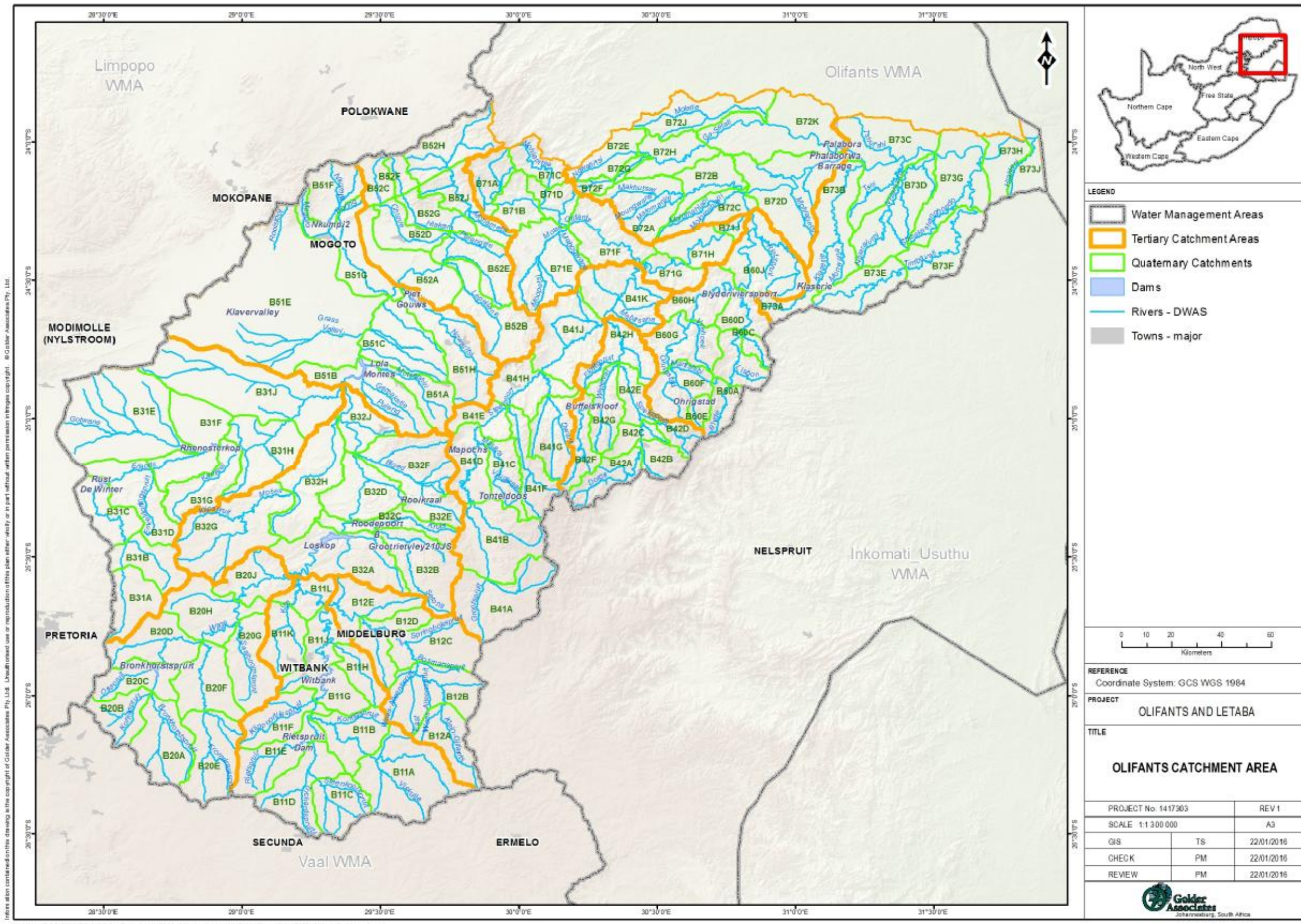


Figure 2: Olifants Catchment

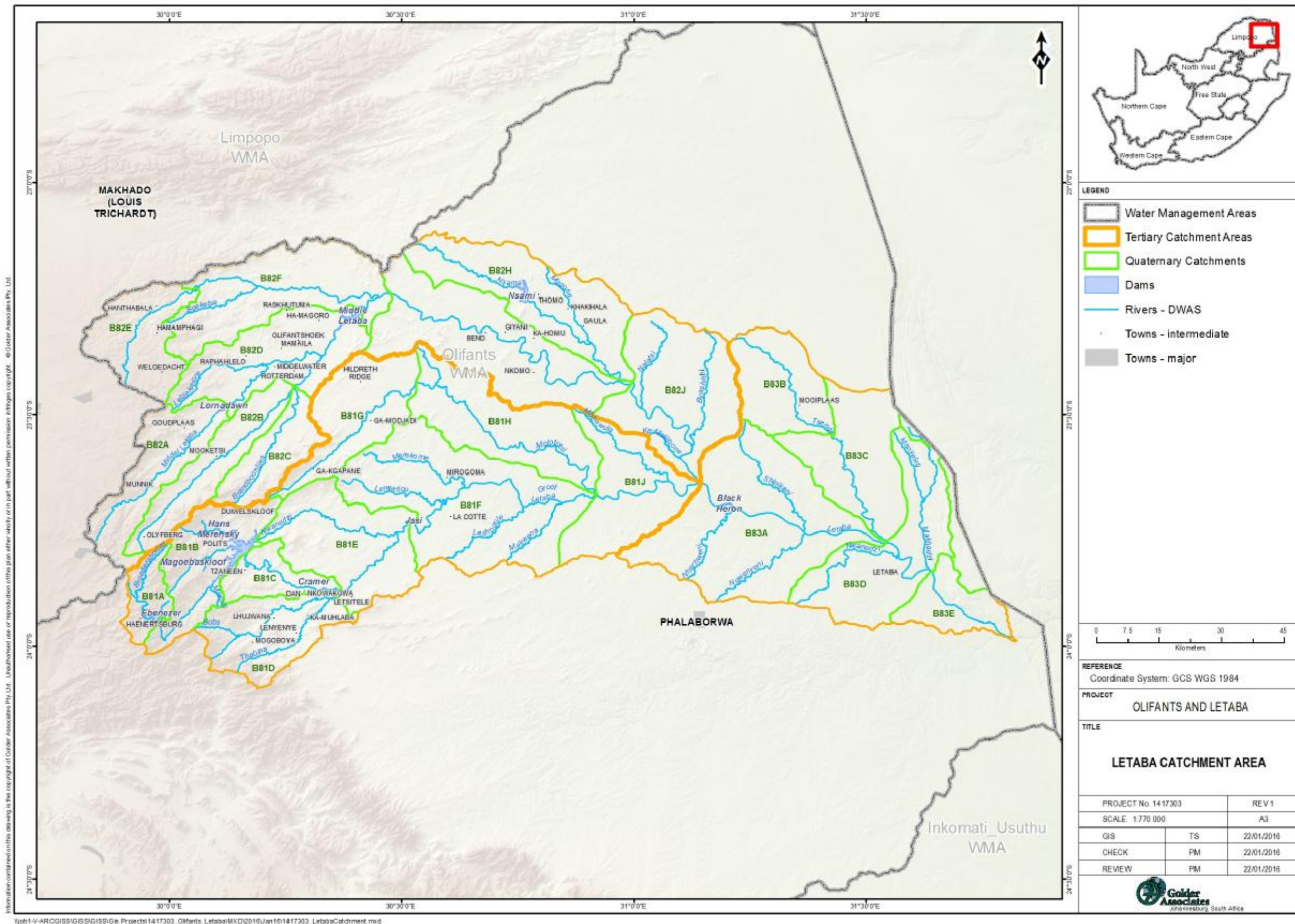


Figure 3: Letaba Catchment

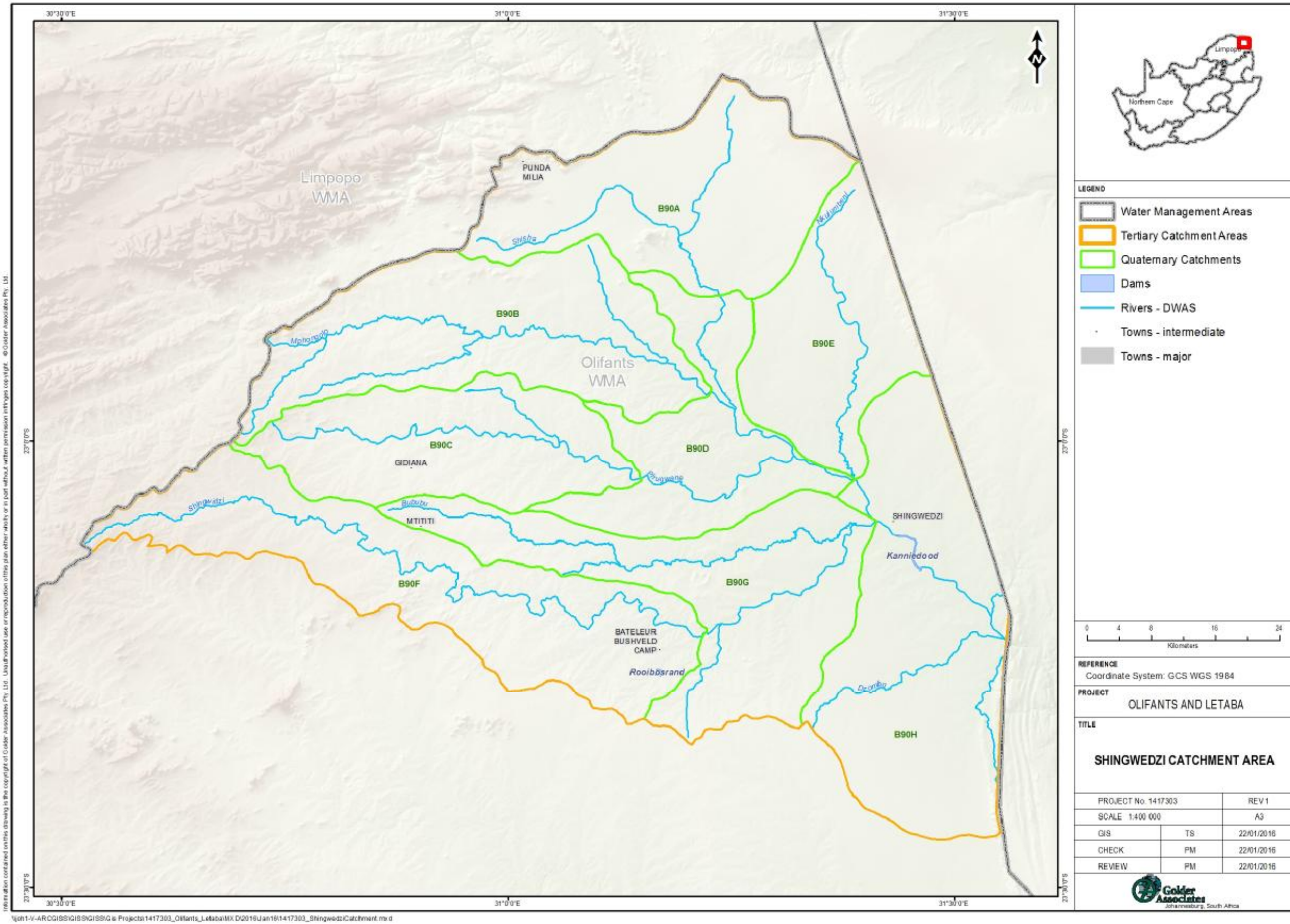


Figure 4: Shingwedzi Catchment

2 STUDY PARAMETERS

2.1 THE WATER RESOURCE COMPONENTS

This study focuses on determining gaps defined from previous studies and implementing the Reserve for water resources (rivers, wetlands and groundwater) in the Olifants/Letaba system.

The available information will be used to prioritise the important ecological gaps that exist to finalising the Reserve (Section 16 of the NWA, Act 36 of 1998), to prioritise important associated systems required for implementation of the Reserve and to identify areas requiring protection other than those forming part of the Reserve. Field work will be undertaken to address the ecological gaps identified for those river systems, wetlands and groundwater systems.

The priority rivers requiring protection and where the EWRs need revision or updating will be identified in this inception phase with the identified gaps filled through existing information and/or data obtained through field surveys. The ecological specifications and related conditions will be defined.

Priority wetland systems will be identified and typed according to their hydro-geomorphic characteristics, building on existing information and previous studies. Emphasis will be placed on wetland type and its functionality within the catchment landscape. Field work by the wetland specialists in the project team will be undertaken to collect sufficient information as part of the prioritisation process. The health or state of the wetland systems and their likely trajectory of change will also be considered in the prioritisation process. Surrogate information on current land-uses in the area or whether or not the wetlands are considered to be at risk from proposed new water uses in the area will also be considered in the assessment. The intention is to produce a comprehensive priority wetland map for the entire WMA including additional wetlands (additional to those identified in previous studies) that may need to be considered in terms of the Reserve, taking into account aspects related to land and water use.

Groundwater is important in some catchment areas within the Olifants/Letaba system. The aquifers in the catchment are not high yielding except in isolated areas associated with the dolomites. Groundwater therefore does not play a significant role in the water supply scenarios for the Olifants/Letaba system; although in certain cases it is the sole water supply for domestic and irrigations schemes. Where over-utilisation of the groundwater resources will negatively impact on the surface water resources and where groundwater resources are threatened, conditions will be recorded in the Reserve gazette template to support sustainable use and hence provide for adequate level of protection. The impact of groundwater utilisation on surface water systems is not fully investigated and this study will assist with identification of such areas where further studies will be required to quantify this aspect.

The main impact on groundwater resources is based on the natural (annual aquifer recharge vs natural discharges) and induced (water use) water balances. This aspect highlights itself in cases where surface water and groundwater resources interact due to hydrogeological conditions (e.g. limestone-dolomite aquifer systems). Although flow measurements in the surface water drainages may be sufficient to identify “gains” or losses” between these two resources, significant groundwater use areas and its related volumes are needed to understand and implement measures to direct/implement groundwater Reserves in the study area.

Past studies addressed these aspects on a desktop principle; thus the results were more a qualification of the Reserve measures which provides a defined baseline scenario for the next “quantification” of the Reserve requirement. The most important aspect of implementing a quantified Reserve is the water use. The best approach currently is through the WARMS initiative– however this must just be fully enforced and audited.

2.2 PRELIMINARY RESERVE DETERMINATION STUDIES AND WATER RESOURCE CLASSIFICATION

The preliminary Reserves determined in 2001 (Comprehensive), 2011 (Rapids), 2013 PES/EIS update for the Olifants catchment, and the 2006 Letaba Reserve determined , together with the classification and setting of RQOs in these catchments will serve as the core basis of the study. The preliminary Reserve Determinations and Classification Ecological Sustainable Base Configuration (ESBC) will be used as departure point.

2.3 ECOLOGICAL GAPS

Ecological gaps related to the existing preliminary EWRs and ecological specifications that have not been addressed through the previous studies will be filled. This will involve the identification of the priority quaternary catchments (with associated river reaches) that are important to the system from an ecological perspective or support the system to achieve the desired ecological condition. This process will also address wetland and groundwater systems and will include catchments where water quality serves as the driver.

Gaps for the rivers will be addressed either by (i) Rapid III assessments, (ii) re-survey of hydraulics at existing EWR sites, including biological surveys or (iii) biological surveys only. The information from these surveys will be used to revise the eco-status, re-assess the EWRs, especially at the previous comprehensive sites on the main stem rivers and major tributaries and to assess ecological consequences for the operational scenarios. Where current EWR sites cannot be used new sites will be identified for the required assessments as specified above.

Further to these, water quality sampling, wetland surveys and groundwater assessments will be undertaken to support the definition of the ecological specifications required. This will be determined through the gaps analysis step and prioritised to the extent that the system will be adequately protected by the selection of sites that best serve the needs of the system.

As far as possible the ecological gaps will be addressed through a dry season survey. However only where the data is not available to support it, will a wet season survey be undertaken to fill the required data.

2.4 OPERATIONAL SCENARIOS

This study will determine any consequences of the revised EWR requirements through the running of the Water Resource Yield Model (WRYM) and the Water Resource Planning Model (WRPM). The operational scenarios will be defined, taking into account the scenarios that were assessed during the WRCS study and then tested against the system water resource balance to determine what needs to be met and its achievability.

Linkages with the Olifants Reconciliation Strategy Maintenance Study' will be made.

The alignment to the Classification ESBC scenario and the ecological configurations will be checked to ensure that the Reserve and the Management Classes support each other. The ecological consequences of the final selected scenario will be stated clearly as part of the Reserve, especially where the system might be affected negatively (a downwards trend over time) or where the Reserve can't be met. Operational rules will be defined with specific goals to improve the system as part of the management plan.

The existing socio-economic information from the Classification Studies will be used.

2.5 WATER QUALITY SPECIFICATIONS/REQUIREMENTS

Water quality will be addressed in this study to the extent of setting water quality ecological specifications. No in-stream water quality objectives will be set accounting for all users. The water quality ecological specifications defined will be aligned to the water quality RQOs that have been set and will support the protection of the ecological condition of the river. At strategic sub-catchments ecological water quality requirements will be specified to ensure that the water quality ecospecs at the EWR sites through the system can be achieved.

Where specific conditions related to the management of water quality in the catchment area are required, these will be specified as a component to the draft gazette template.

The water quality consequences of the operational scenarios will be assessed qualitatively. This will ensure that the aquatic ecosystems are provided the necessary protection in areas where water quality is a problem.

2.6 WETLANDS

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

Key wetlands identified as part of the gap analysis will be visited and prioritised based on identified criteria (refer to section 4.4.1). The prioritisation will further be considered in the context of the health or state of the wetland system and its likely trajectory of change given the current land-uses in the area or whether or not it is considered to be at risk from proposed new water uses in the area. The intention is to produce a comprehensive priority wetland map for the entire WMA indicating additional wetlands that may need to be considered in terms of the Reserve.

2.7 GROUNDWATER

Groundwater use, water resource stability (*viz.* aquifer saturation levels and trends), groundwater quality status (specifically concentrations and trends) and the potential impact on surface water resources will be reassessed. The output will be an update of the groundwater status with relation to previous investigations and potential impact it will have on the implementation criteria for the groundwater component of the Reserve.

The status of these attributes will be based on the Reserve studies done by DWS (GRA II – 2005: major water balances), SWM (2003: The Role of Groundwater in the Reserve context), SRK (2009: An Intermediate Groundwater Reserve Determination) and reports produced by research teams in the area, e.g. “The development/implementation of a groundwater monitoring programme”. A catchment wide land use assessment, focussing on hydrogeological characteristics and anthropogenic activities that may be related to groundwater use will be done.

A summary of the groundwater monitoring programmes in the Olifants/Letaba System will be produced. A comprehensive groundwater-monitoring programme has for example been developed for SANPARKS in the Kruger.

Two aspects that will be important are (i) the groundwater conditions at wetlands based on available local hydrogeological information, and (ii) the coverage of groundwater monitoring networks/programmes with specific reference to registered water users (*i.e.* license condition audits).

The southern (B72 and B73) and northern (B82 and B90) tertiary catchments were not included in a Reserve related study yet – they will be included in this study; although the value will be based on the availability of Reserve related groundwater information.

2.8 DATA RELIABILITY

Significant gaps in biological and survey data could result in reduced confidence in the modelling of some catchment areas. However the preliminary data analysis undertaken shows that adequate data is available at most of the key points in the system to allow the setting of the final EWRs on the Olifants and Letaba Rivers.

There are significant gaps in water quality data within the study area. Many of the EWR sites and priority reaches identified are not supported by water quality monitoring data as part of the DWS Water Management System. In addition many of the tributary catchments points have monitoring data records are poor or absent. This will need to be addressed through the reliance on additional external data sources and catchment information that can be sourced. The once off water quality sampling to be undertaken at certain sites in the system may also support some of the identified gaps in the data.

2.9 HYDROLOGY

The updated hydrology for the Olifants and Letaba systems from the studies undertaken by the Directorate National Water Resources Planning in the Reconciliation Strategy development and as used during the WRCS studies will be utilised to set the Reserve. No additional hydrological work is included in this study. Major changes to the hydrology could have specific ecological consequences. This will be highlighted during the study if so identified.

2.10 SHINGWEDZI CATCHMENT

The Shingwedzi catchment (B90) has not been classified and a preliminary Reserve determination has not yet been undertaken for the water resources in this catchment. A preliminary Reserve and ecological specifications for identified sites will be determined as part of this study.

2.11 BASIC HUMAN NEEDS

The finalisation of the EWRs for the Olifants/Letaba system will incorporate the basic human needs component of the Reserve. The results of the preliminary Reserve will be compared to the requirements contained in the Reconciliation Strategy, and adjustments will be made if required.

The population data to be used will need to be confirmed with DWS. The 1996 census data was used for the 2001 Reserve. The latest available census data related to the people still directly dependant on the water resources for their subsistence use will be used and not the total population figures.

2.12 DRAFT GAZETTE TEMPLATES

The draft gazette templates as specified and provided by the Directorate: Reserve Determinations will be populated. It is proposed that the template be provided by the client by March 2016 to enable the capturing of information to suit the template requirements. The populated draft gazette templates will be provided, however the gazetting process is outside the scope of the study.

2.13 CAPACITY BUILDING

Nine DWS personnel are to be included and involved in the Olifants/Letaba system Reserve study within the proposed capacity building programme Refer to section 4.6 for more detail on the capacity building identified activities.

3 STUDY METHODOLOGY

This study is primarily of a technical nature being supported by identified stakeholder participation during Task 3 (scenario evaluation). This study is aimed at facilitating the implementation of “The Reserve”, which needs to happen in the context of the previous work and their outputs.

There are 4 main components that will be addressed through the study technical process. These include the:

- Review and analysis of existing information;
- Identifying and filling in of the ecological gaps identified;
- Scenario analysis and operational considerations; and
- Setting the Reserve, defining the ecological specifications and developing the resource management plan.

The study will further aim to provide a protection framework that will:

- Integrate the EWRs with the management and operation of the water resource system of the Olifants/Letaba system to ensure its implementation and associated improvement in the state of water resources as well as their continued sustainability;
- Improve the detail and level of ecological specifications and management conditions; and
- Formulate practicable indicators for compliance monitoring and monitoring of the ecological health and integrity of the water resources in the said study area.

The execution of this project will adhere to Regulation Number 810 (Government Gazette 33541), dated 17 September 2010, that gives effect to the WRCS and to the associated Reserve Determination Methodologies as prescribed by the DWS.

The following assumptions/considerations (as listed under section 3.1) will influence the study outputs, and it is important that CD: WE and the study team share a common understanding in this regard.

3.1 DATA AVAILABILITY AND ACCESSIBILITY

- The existing Water Resources Yield/Planning Model will be used to undertake the operational scenario analysis for the quantity component. The model will be adjusted to incorporate all the final EWRs at the selected sites to provide information for the ecological consequences assessment;
- The latest available hydrology from the reconciliation strategy studies will be used without any re-calibration or simulation. The simulated present day flows and scenario flows from the WRYM/WRPM will be used for the ecological consequences assessment;
- The existing DWS water quality database; *i.e.* DWS Water Management System will be used as the primary source of water quality data. However, wherever available, other external sources of water quality data will be used. Once off water quality samples and biological sampling will be done at the identified priority sites;

- i One dry season field survey will be undertaken, and supplemented by a wet season survey only where identified to fill in the data;
- i Reserve Models: The following models will be used during the study:
 - § The Desktop Reserve Model (DRM) will be used for the determination and/or extrapolation of the quantity component of the Reserve. Existing EWRs will be utilised and adjusted where required. Where appropriate the Flow Stressor Response model will be used to determine/refine existing or new EWRs;
 - § The ECO-STATUS4 1.01 model (August 2015) will be used to determine and/or revise the Present Ecological State (ECO-STATUS) for the EWR sites where additional data have been collected;
 - § The latest FIFHA model developed by DWS (Dr Neels Kleynhans) will be used for the interpretation of the scenarios to determine ecological consequences; and
 - § The MIRAI and FRAI models will be updated for the existing EWR sites with additional survey data that is collected.
- i Groundwater:
 - § Baseline groundwater data is available from the National Groundwater Archive (NGA), time series related data (water levels and quality) is available from Hydstra and the Water System Management platform and time series groundwater quality from the CHART system;
 - § Several DWS reports of the groundwater potential and availability (e.g. the Northern Springbok Flats, the Wolkberg Dolomites and the Gabbro-Norite Complexes) are available for references;
 - § Although the WARMS dataset is regarded as incomplete in some respect, the information is valuable, especially in terms of surface water allocations. It was noted in the SRK study (SRK, 2009) that the records for groundwater is not representative of the actual water use, however, an assessment of land use activities will be used based on the SRK dataset in an effort to update groundwater utilisation;
 - § Recent studies of the area, focussing on implementation of groundwater management protocols (e.g. monitoring programmes) are available for the northern parts of the Olifants/Letaba System, and
 - § It has been mentioned above that the northern two and southern two tertiary catchment of the former Letaba/Luvuvhu WMA is barren in terms of any resource directed measures investigations.
- i Data sources to be used will include amongst others the following:
 - § Existing information preliminary Reserve Studies and Water Resource Classification and RQOs determination information for the Olifants and Letaba Catchments;
 - § Relevant scientific papers on the Shingwedzi catchment area;
 - § The Water Resource Planning Model (WRPM) and the Water Resources Yield Model (WRYM) for the Olifants and Letaba systems (DWS, Directorate National Water Resource Planning);

- § Water demand and requirement projections from parallel studies (Reconciliation strategy studies, Directorate National Water Resource Planning);
- § Groundwater data will be collated from the 2014 WARMS dataset, groundwater monitoring data (especially the updated Kruger National Park's programme) and recent groundwater investigations (reports on significant aquifer systems in the Olifants/Letaba System). Data and information collated during two previous Reserve related studies in the former Olifants and Letaba/Luvuvhu WMA will be used as baseline criteria (WSM, 2006 and SRK, 2009);
- § Letaba Catchment Reserve Determination Study, Wetland Scoping Report Final February 2006;
- § Wetland inventory and classification. In: Ecological and economic evaluation of wetlands in the upper Olifants River catchment Water Research Commission Report No. 1162/1/02;
- § Supporting better decision-making around coal mining in the Mpumalanga Highveld through the development of mapping tools and refinement of spatial data on wetlands. Water Research Commission Report No TT 614/14, 2015;
- § Bio-monitoring data sources including the River Health Monitoring Programme data; Kruger National Park monitoring data and the River Ecosystem Monitoring Program (REMP) data (Mpumalanga Nature Conservation);
- § Technical Report for the National Freshwater Ecosystem Priority Areas Project. Water Research Commission (WRC) Report No. 1801/1/11, 2011; and
- § CSIR, Natural Resources and the Environment. Risk Assessment of Pollution in Surface Waters of the Upper Olifants River System: Implications for Aquatic Ecosystem Health and the Health of Human Users of Water. Report to the Olifants River Forum. March 2011. CSIR/NRE/WR/IR/2011/0041/B.

Information review has been underway in the inception phase and will be completed during the water resource and information gathering task (Task 2). For parallel studies ongoing liaison will be maintained with other study teams to ensure transfer of information, data and reports occurs. The assistance of the Department may be required to facilitate the acquisition of some of the above data sources. Unforeseen delays in sourcing information/data could impact on the study programme.

3.2 MODEL LIMITATIONS

- ! The WRPM/WRYM has been setup for the entire Olifants and Letaba catchments based on updated natural hydrology. No additional hydrological modelling will be undertaken and the shortcomings in the current hydrology (e.g. estimation of dolomitic flows) will be highlighted where applicable;
- ! The FIFHA model is based on the interpretation of scenarios from a quantitative perspective and does not take into consideration quality. At this stage the model is still under development by the DWS: Directorate RQS and will be applied should it become available during the duration of this study; and

- An integrated water quality model of the Olifants system is not available. There is no water quality model set up for the Letaba system. A mass balance using the measured water quality data and the flow rate will be used to assess the water quality Reserve set.

3.3 PEER REVIEW

An expert peer reviewer has been identified to review study outputs and deliverables. The reviewer will be confirmed through the project management team. Once the eco-classification process has been completed, the reviewer will be included in team workshops and through key steps in the study process, including the review of the final draft deliverables.

3.4 STAKEHOLDER ENGAGEMENT

Stakeholder engagement meetings *viz.* the project steering committee and/or key stakeholder meetings are dependent on the conclusion of the gazetting process for the classes and resource quality objectives for the Olifants system which is currently underway by the DWS. The timing of these meetings will thus only be confirmed at a later stage. Any delays in the RQO gazetting process may impact on this study in terms of the number and scheduling of relevant meetings. This process will need to be guided by the Directorate: Reserve Determinations.

Every effort will be made to link and align to existing structures and forums in an effort to eliminate stakeholder fatigue which currently is a reality in the Olifants/Letaba system. An extensive stakeholder database will be setup that will periodically be updated. The idea is not to consult with everybody, but rather with representatives of specific sectors of society. Stakeholder issues raised will be addressed as best as possible through the study process.

3.5 COMPLIANCE WITH LEGAL REQUIREMENTS

There are legal considerations that will have to inform the determination of the Reserve and adherence to Regulation Number 810 (Government Gazette 33541), dated 17 September 2010. This study will need to meet the legal requirements and comply with the specifications which need to be guided by the DWS: Legal Services through the direction of the Directorate: Reserve Determination. The study approach has highlighted the points in the process where the legal guidance and input is needed. It is important that this legal input is obtained timeously to avoid disruptions to the study programme. Of specific importance will be the format of the Reserve gazette template, its alignment to the WRCS and the specific type and format of content that is permitted. This will determine how the study team formulates the ecological specifications and conditions.

3.6 ALIGNMENT WITH OVERARCHING RDM INITIATIVES

The project outputs will align and meet the requirements of the overarching project 'Operationalisation of Resource Directed Measures', to ensure that there is consistency and no contradiction or variation to the standard that is defined in terms of the final Reserve templates and the related gazetting. It is important that this input from the said project is obtained timeously to avoid disruptions to this study programme.

The study outputs will also align to the WRC gazetting process and any guidance that may be forthcoming from similar initiatives and processes within the CD: WE.

4 SCOPE OF WORK

The study includes three main study phases: Study Inception, Study Execution and Study Closure. The main tasks to be undertaken in terms of the study Terms of Reference (TOR) include:

STUDY INCEPTION:

- Task 1: Project Inception.

STUDY EXECUTION:

- Task 2: Water Resources and Information Gathering;
- Task 3: Towards Implementation of the Reserve/EWR;
- Task 4: Communication and Liaison;
- Task 5: Capacity Building; and
- Task 6: Study Management, Co-ordination and External Review.

STUDY CLOSURE:

- Task 7: Study Closure.

This Inception report includes the final study plan which has been informed by the review of existing information as well as feedback from initial discussions with the project management committee.

An overview of the proposed study process is illustrated in Figure 5.

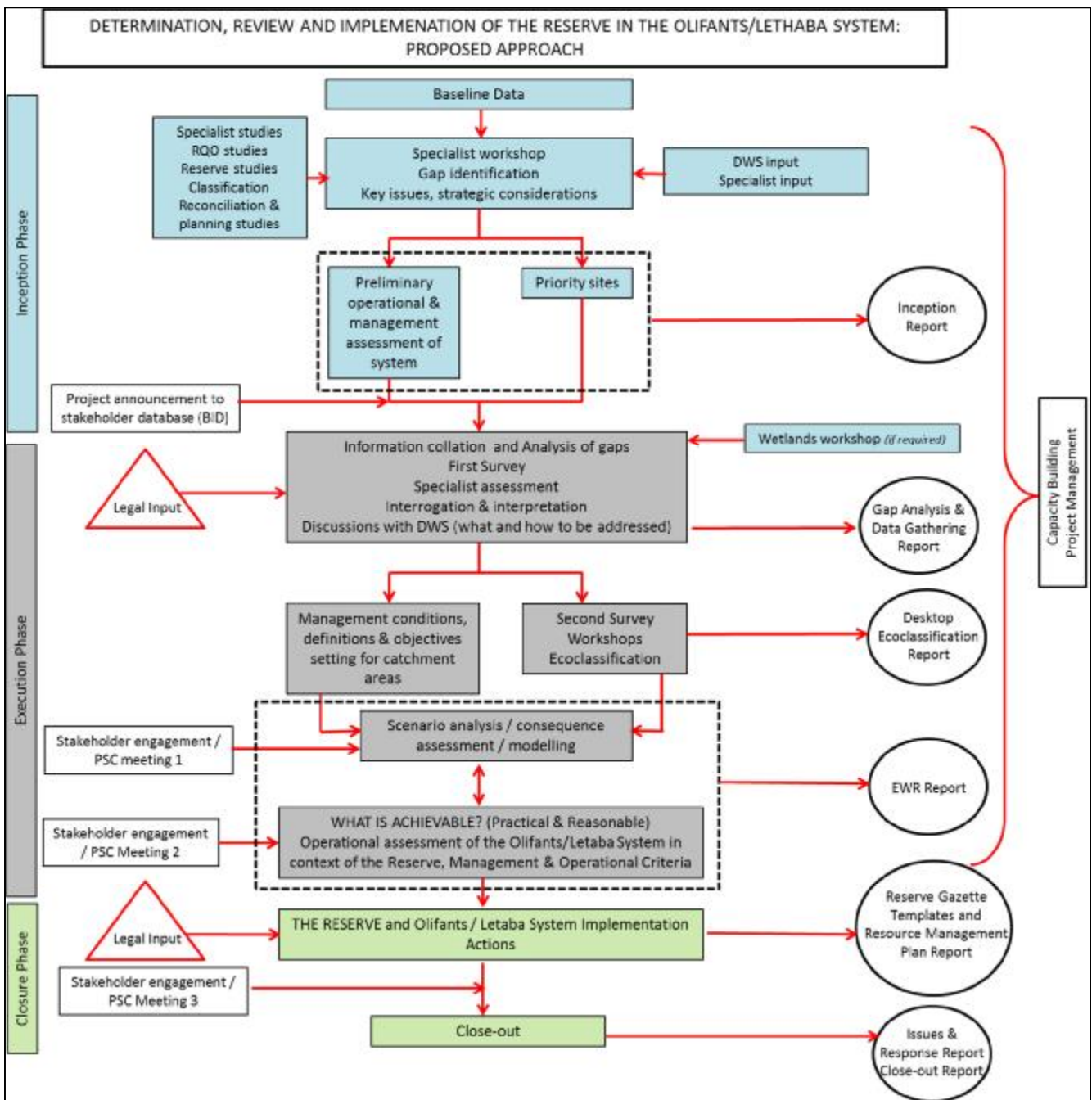


Figure 5: Proposed Study Approach

4.1 TASK 1: STUDY INCEPTION

The project inception phase has involved collating and reviewing of available information to refine and define the scope of work for the execution phase within the context of the study parameters outlined in section 2. Information has been sourced from the previous preliminary Reserve Studies and the Classification studies and determination of RQOs undertaken in the Olifants and Letaba catchments, desktop evaluation of water quality information, wetlands and groundwater have been undertaken and other relevant catchment reports and studies have been reviewed. Based on this review the priority gaps in the ecological data to support the finalisation of the Reserve and its implementation were identified. This also included identification of priority sites and catchment areas where water quality, wetland and groundwater gaps exist.

To date an inception meeting, a project kick off meeting and a Project Management Committee (PMC) meeting have been held with the study project manager, officials from the CD: WE, the DWS Mpumalanga and Limpopo Regional Offices and other relevant DWS Directorates responsible for water resource management to discuss the approach to be followed. The PMC was constituted during the inception phase (PMC members listed in Appendix A) and a first meeting was held on the 28th August 2015 at which the inception phase work has been presented and discussed. The membership of the Project Steering Committee (PSC) will be confirmed at a later stage and the required members invited to a meeting to be held at an appropriate point in the process.

Task 1 Deliverables –

- Study Inception Report;
- Study Programme; and
- Capacity Building Programme.

4.2 FINDINGS OF THE INCEPTION PHASE

4.2.1 Preliminary Reserve Determinations

The preliminary Reserve Determinations undertaken that currently apply in the Olifants/Letaba system are summarised below.

Olifants Catchment

A number of preliminary Reserve studies have been undertaken since 2001 on various levels of detail in the Olifants catchment. The most significant study was the comprehensive study undertaken during 2001 to 2003. This study included 16 EWR sites on a comprehensive level and focussed on the main stem Olifants River and its major tributaries. Some of the results from this study have been re-assessed in 2011 to update the PES and EIS information. Additional Intermediate and Rapid level III Reserve studies have also been undertaken during the last few years. These studies were undertaken mainly to address specific water use license applications and they were focused on smaller tributaries.

Nine additional Rapid preliminary Reserve determinations were undertaken during the Olifants Water Resource Classification Study to enhance the existing information and to enable the extrapolation of EWRs to all the identified nodes.

The EWR sites (existing and additional sites) are listed in Table 1 and Table 2 below and shown in

Figure 6.

Table 1: Comprehensive Reserve Study: EWR sites

| EWR site | River | Quaternary catchment | PES ¹⁾ 1999 (2010 update) | EIS | REC | NMAR ²⁾ (10 ⁶ m ³) | % EWR | Level |
|----------|----------------|----------------------|---|-----------|-----|---|-------|---------------|
| EWR1 | Olifants | B11J | E (D) | Moderate | C | 184.52 | 18.6 | Comprehensive |
| EWR2 | Olifants | B32A | C | High | B | 500.63 | 23.8 | Comprehensive |
| EWR3 | Klein Olifants | B12E | D (D) | Moderate | C | 81.54 | 27.0 | Comprehensive |
| EWR4 | Wilge | B20J | B (C) | High | B | 175.50 | 29.9 | Comprehensive |
| EWR5 | Olifants | B32D | C (C) | High | C | 570.98 | 19.1 | Comprehensive |
| EWR6 | Elands | B31G | E (C/D) | Moderate | D | 60.30 | 17.9 | Comprehensive |
| EWR7 | Olifants | B51G | E | Moderate | D | 726.52 | 12.7 | Comprehensive |
| EWR8 | Olifants | B71B | E (C/D) | Moderate | D | 813.04 | 15.2 | Comprehensive |
| EWR9 | Steelpoort | B41J | D (C/D) | High | D | 120.17 | 15.2 | Comprehensive |
| EWR10 | Steelpoort | B41K | D | High | D | 336.63 | 12.1 | Comprehensive |
| EWR11 | Olifants | B71J | E | High | D | 1321.8 | 13.7 | Comprehensive |
| EWR12 | Blyde | B60J | B (B/C) | High | B | 383.70 | 34.5 | Comprehensive |
| EWR13 | Olifants | B72D | C (C) | Moderate | B | 1760.7 | 23.6 | Comprehensive |
| EWR14a | Ga-Selati | B72H | C | Moderate | C | 52.20 | 31.2 | Comprehensive |
| EWR14b | Ga-Selati | B72K | E | Moderate | D | 72.74 | 24.8 | Comprehensive |
| EWR16 | Olifants | B73H | C (C) | Very high | B | 1916.9 | 21.6 | Comprehensive |
| TRE-EWR1 | Treur | B60C | A/B | Very high | A/B | 49.28 | 45.4 | Rapid 3 |
| NOU-EWR1 | Noupoortspruit | B11G | C/D | Moderate | C/D | 4.28 | 25.9 | Rapid 3 |
| DWA-EWR1 | Dwars | B41H | B/C | High | B/C | 31.43 | 25.9 | Intermediate |
| SPK_EWR1 | Spookspruit | B11H | C | Moderate | C | 9.322 | 30.12 | Intermediate |
| VBS_EWR1 | Vaalbankspruit | B12D | D | Moderate | D | 2.377 | 28.44 | Intermediate |
| SKS_EWR1 | Saalklapspruit | B20G | C | High | B/C | 10.84 | 38.17 | Intermediate |
| SKS_EWR2 | Saalklapspruit | B20G | C | High | C | 3.90 | 35.39 | Rapid 3 |

1) PES – the 1999 Eco-status is indicated, with the changed Eco-status reflected in brackets based on the 2010 assessment

2) NMAR – Natural Mean Annual Runoff is based on the updated hydrology from the DWA 2009 study

Table 2: Additional Rapid Assessments undertaken in 2011

| EWR site | River | Quaternary catchment | PES | EIS | REC | NMAR ¹⁾ (10 ⁶ m ³) | %EWR | Level |
|-----------|----------------------|----------------------|-----|-----------|-----|---|-------|---------|
| OLI-EWR1 | Upper Klein Olifants | B12C | C | Low | C | 44.46 | 28.86 | Rapid 3 |
| OLI-EWR2 | Upper Steelpoort | B41B | C | Moderate | C | 63.46 | 29.78 | Rapid 3 |
| OLI-EWR3 | Kranspoortspruit | B32A | B | Very High | A/B | 4.71 | 46.01 | Rapid 3 |
| OLI-EWR4* | Klip | B41F | C | Moderate | B/C | 5.20 | 27.49 | Rapid 1 |
| OLI-EWR5 | Watervals | B42G | C | Moderate | C | 36.39 | 23.48 | Rapid 3 |
| OLI-EWR6 | Upper Spekboom | B42D | C | High | B/C | 28.04 | 33.52 | Rapid 3 |
| OLI-EWR7 | Klaserie | B73A | B/C | High | B | 25.54 | 38.95 | Rapid 3 |
| OLI-EWR8* | Ohrigstad | B60H | C | Moderate | C | 65.49 | 26.35 | Rapid 2 |
| OLI-EWR9* | Dorpspruit | B42B | C/D | Low | C/D | 63.19 | 19.28 | Rapid 1 |

*No hydraulics

Letaba Catchment

A Comprehensive Reserve Determination study was undertaken for the Letaba catchment in 2006. This study included 7 EWR sites on a comprehensive level and focussed on the Groot Letaba River and its major tributaries the Klein Letaba, Middle Letaba, Letsitele and Molototsi rivers. Some of the results from this study have been re-assessed in 2013 to update the PES and EIS information during the Letaba Classification Study.

The EWR sites are listed in Table 3 below and shown in Figure 7.

Table 3: Comprehensive Reserve Study: EWR sites

| EWR site | River | Quaternary catchment | PES | EIS | REC | VMAR ¹⁾ (10 ⁶ m ³) | %EWR | Level |
|----------|--------------|----------------------|-----|----------|-----|---|------|---------------|
| EWR1 | Groot Letaba | B81B | C | Moderate | C | 99.84 | 20 | Comprehensive |
| EWR2 | Letsitele | B81D | C | Moderate | C | 116.55 | 23.7 | Comprehensive |
| EWR3 | Groot Letaba | B81F | C | High | B/C | 394.91 | 14.8 | Comprehensive |
| EWR4 | Groot Letaba | B81J | C | High | B/C | 441.39 | 19.2 | Comprehensive |
| EWR5 | Klein Letaba | B82G | C | Moderate | C | 124.18 | 16 | Comprehensive |
| EWR6 | Groot Letaba | B83A | C | High | B | 546.59 | 8.6 | Comprehensive |
| EWR7 | Groot Letaba | B83D | B/C | High | B | 646.28 | 17.8 | Comprehensive |

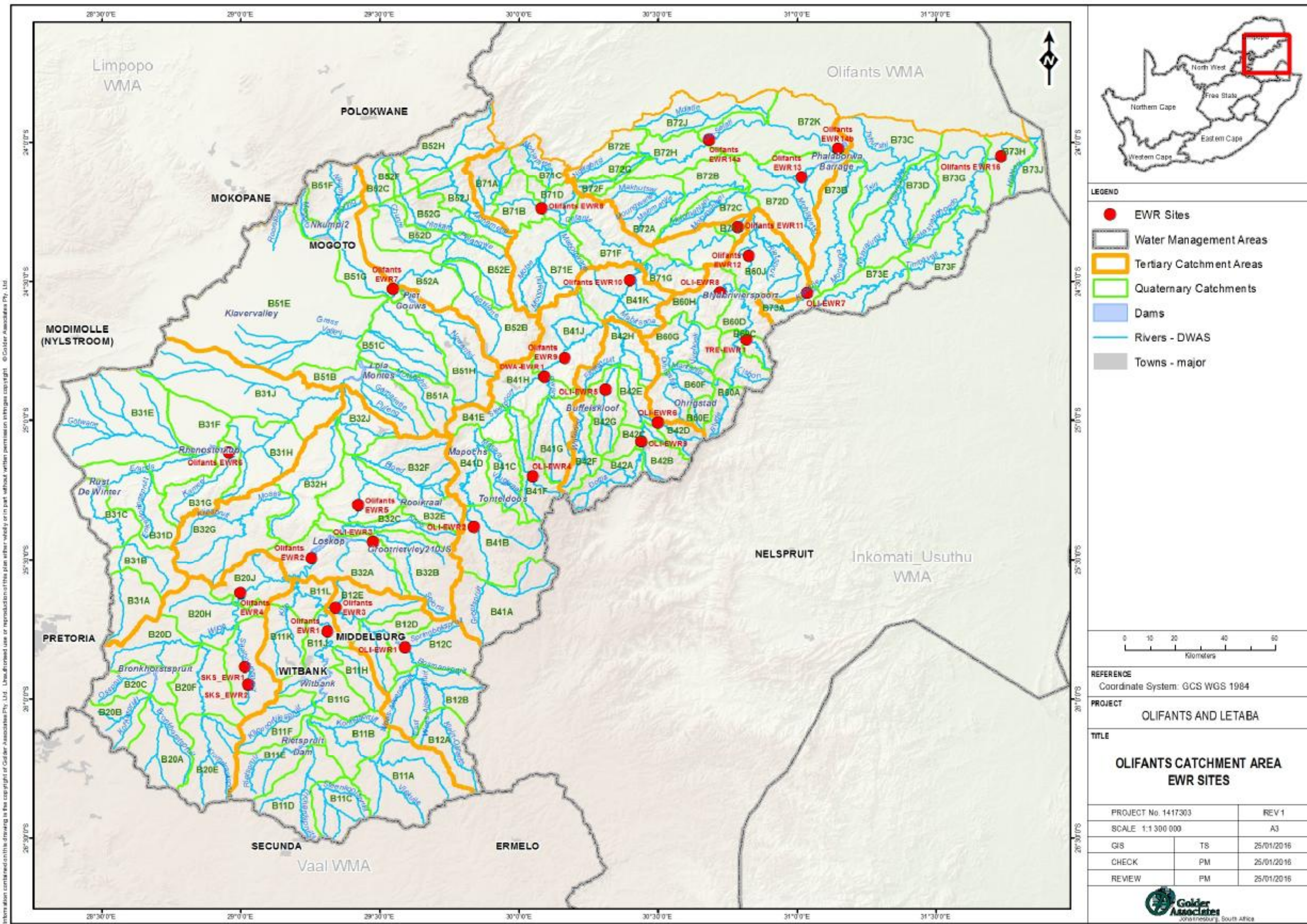


Figure 6: Olifants catchment EWR sites

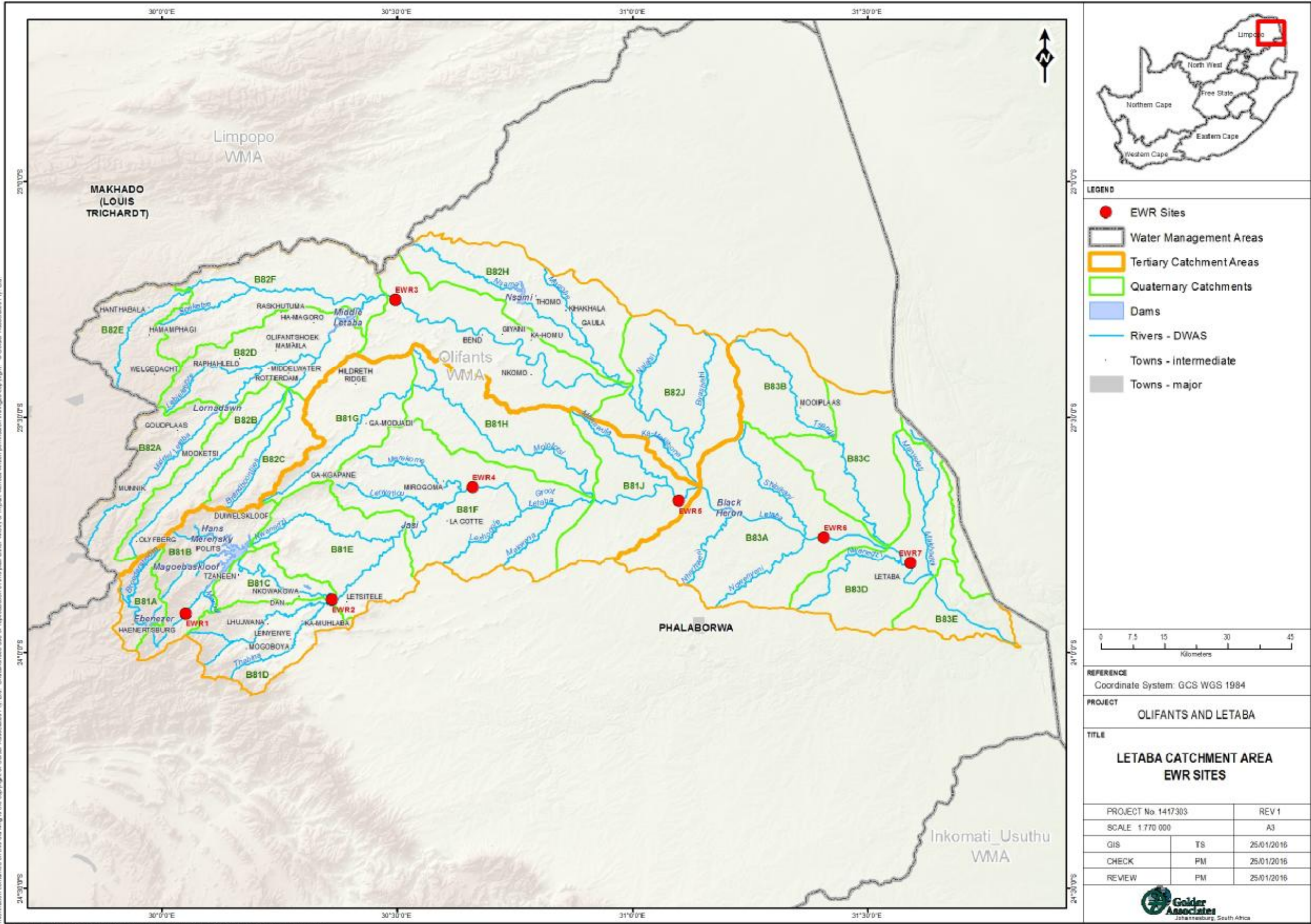
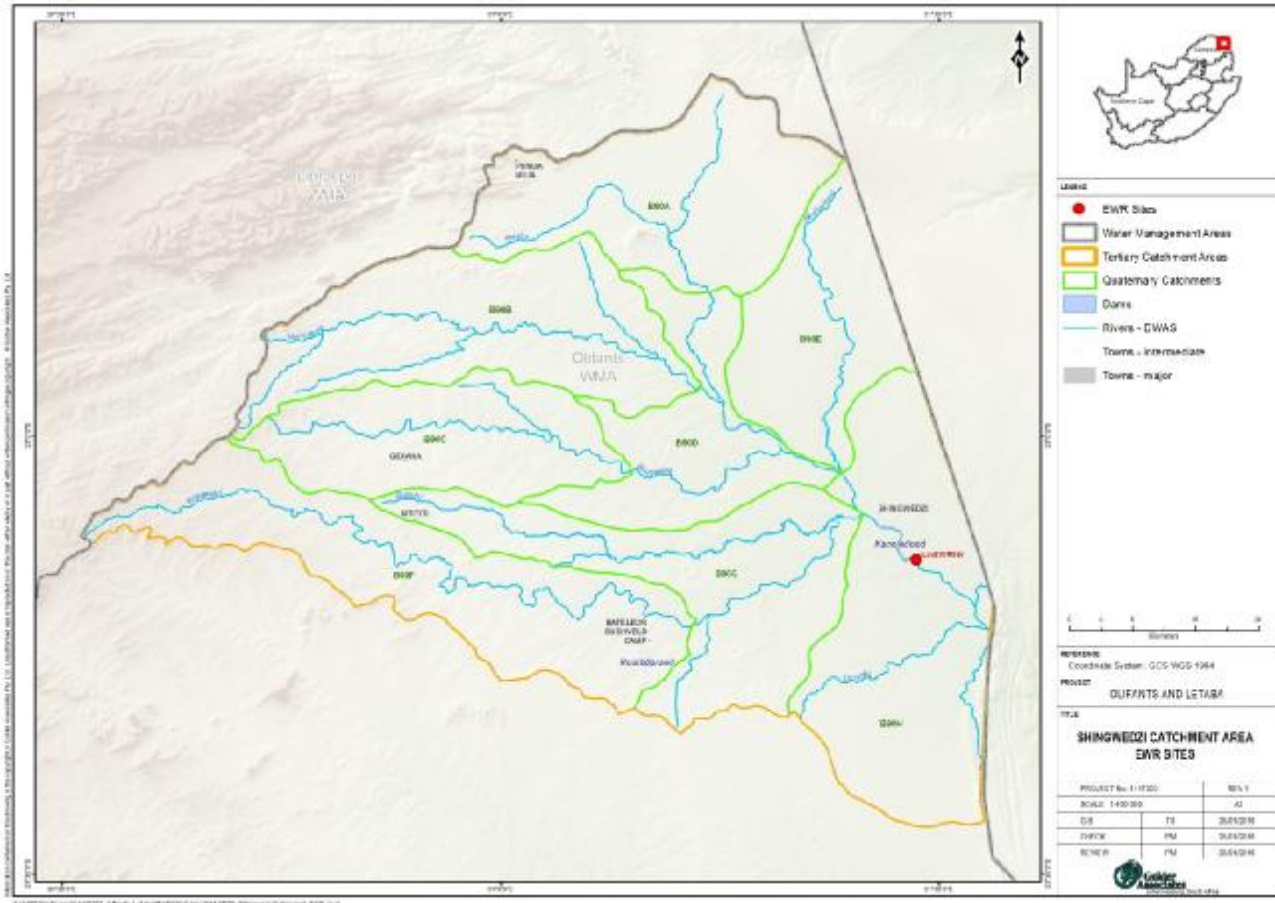


Figure 7:
Letaba catchment EWR sites

Shingwedzi Catchment

A Rapid II preliminary Reserve determination was undertaken on the Shingwedzi River below Kanniedood Dam.

Figure 8: Shingwedzi Catchment: Rapid II site



4.2.2 Ecological Gap Identification: Preliminary Priority Sites

A key activity that has been undertaken during the inception task is the identification of priority areas where ecological gaps have been identified. This has been based on the review of the preliminary Reserve Determinations, the Water Resource Classification studies, RQO determination studies, the Reconciliation Study, water resource management studies, water quality studies, ecological information and data and expert knowledge and experience. The results from the recently completed desktop PES/EI/ES study by the DWS together with the output of the above-mentioned studies, FEPA identified priority catchments and their relevant conservation information has been utilised to confirm the scope of the Reserve Determination required. The priority resources, quaternary and sub-quaternary catchments, EWR sites and wetlands and groundwater driven systems to be assessed were also confirmed based on this review. The prioritisation was confirmed during a specialist workshop held over the 27th to 31st July 2015. It was attended by the PSP study team members, specialists and the DWS study management team from the Directorate: Reserve Determinations.

This overview gap analysis has provided a list of priority quaternary catchments (with associated river reaches) that are important to the system from an ecological perspective or support the system to achieve the desired ecological condition, which require supplementary data, information or analysis to finalise the Reserve. The list of priority sub-catchments are listed in Table 4, Table 5 and Table 6.

Gaps will be addressed either by Rapid III assessments, re-survey of hydraulics at existing EWR sites, biological surveys and by the use of existing hydraulics for revision of requirements and ecological consequences. Further to these, water quality sampling, wetland surveys and groundwater assessments will be undertaken to support the definition of the ecological specifications needed. Table 7 summarises the level and type of survey and/or analysis to be undertaken.

As far as possible the ecological gaps will be addressed through a dry season survey scheduled for October 2015. However only where the data is not available to support it, will a wet season be undertaken in February 2016 to fill the required data gaps but only at specified sites.

In terms of wetlands and wetlands systems, Table 8 indicate those quaternary catchments that were provisionally identified within the study area where there were considered to be either:

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

A desktop review of existing wetland databases and of available imagery will be used to refine the list of quaternary catchments indicated in Table 8. A map of the targeted areas will then be provided as part of the in the Gap Analysis report. Where possible, desktop mapping will be used to capture some of the larger wetlands identified during the gap analysis.

Table 4: Olifants Catchment Gap Identification and Proposed survey sites

| IUA | Class for IUA | Quaternary catchments | EWR sites (c,i,r)** | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|-------------------------------------|---------------|--------------------------------|------------------------|---|---|--|---|--|
| 1 UPPER OLIFANTS RIVER CATCHMENT | III | B11C | | Piekespruit, Debeerspruit | B | | No ecological data. Biological survey required - including WQ, flow | Biological survey 2 sites: (1) 55 km u/Steenkoolspruit, (2) on Piekspruit and De Beers u/s |
| | | | | | | | Wetland Survey Required (FEPA) | Wetlands Piekespruit and Debeerspruit |
| | | B11D | | Dwars-in-die-Wegspruit, Trichardtspruit | C | C | Need biological information | Biological surveys: <ul style="list-style-type: none"> upstream confluence with Trichardspruit; downstream of the Steenkoolspruit confluence after Kriel but before confluence with the Riet); and WQ d/s confluence with Trichardspruit. |
| | | B11D, B11E | | Steenkoolspruit | D | D | Extrapolate EWR for D category using new EWR site on Steenkoolspruit | Biological surveys only for revised Eco-status and extrapolation of EWR with DRM |
| | | B11E | | Steenkoolspruit | D | D | Need to understand biological condition below tributaries | Biological survey at s26 08.1912, E 21.16.0693. Include WQ |
| | | B11G | NOU-EWR1r Boesmankraal | Noupoortspruit, Boesmankraal, Olifants | C/D | C/D | Need to re-assess - update | Rapid III EWR site (include WQ). Possible EWR site on Olifants in vicinity of B1H005 upstream Witbank Dam |
| | | B11J | Olifants-EWR1c | Olifants | E | D | Existing site EWR (Olifants-EWR1c) site is inundated due to weir and original hydraulics cannot be converted to current format. | Rapid III - Select new site in Olifants B11J. Include WQ |
| | | B11K | | Klipspruit, Blesbokspruit | E | D | Extrapolate EWR for D category using Spookspruit EWR site | Biological survey at just before quaternary boundary, include WQ |
| | | B11L | | Olifants, Klipspruit | B | B | Need biological information | Biological survey and WQ on the Olifants just before confluence with the Wilge Biological survey at just upstream of Olifants on the Klip |
| B12B | | Klein Olifants, Rietkuilspruit | D | D | Biota - Relate Rapid d/s data to quats 12A, 12B in terms of ecospecs. Access data on biological and decide on possible surveys. | WQ sample required just at confluences (Coetzee, East Woes-Alleenspruit and Woes-Alleenspruit) | | |

| IUA | Class for IUA | Quaternary catchments | EWR sites (c,i,r)** | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|---|---------------|-----------------------|---------------------|---|-----|--------------------------------------|---|--|
| 1 UPPER OLIFANTS RIVER CATCHMENT | | B12C | OLI-EWR1r | Klein Olifants | C | C | Need biological information | Biological survey and WQ on the Klein Olifants, just after confluences Springbokspruit and Boesmanspruit tributaries |
| | | B12C | | Klein Olifants (releases from Middelburg Dam) | D | D | | |
| | | B12E | Olifants-EWR3c | Klein Olifants | C | C | Possible new site, replace existing Olifants-EWR3 | |
| 2 WILGE RIVER CATCHMENT AREA | | B20C | | Osspruit, Bronkhorstspruit | D | D | WQ and biological data required (confirm PES) | Biological survey on Bronkhorstspruit |
| | | B20D | | Bronkhorstspruit (releases from Bronkhorstspruit Dam) | C | C | Use current biological monitoring information | |
| | | B20D | | Hondespruit | C | C | | |
| | | B20D | | Bronkhorstspruit | C | C | Extrapolate EWR using new EWR site in B20C on Bronkhorstspruit for releases from Bronkhorstspruit Dam | Biological surveys only for revised Eco-status and extrapolation of EWR with DRM |
| | | B20F | | Wilge | C | C | Gap in biological information | Biological survey on Wilge at WQ site (Kendall B2WIL/DEWAAL and 4OF148) |
| | | | | | | | No information available for reach. Need to understand biological and habitat state to meet requirements at EWR4 | Rapid III at bottom end of quat (include WQ) on Wilge (new site) |
| | B20J | Olifants-EWR4c | Wilge | C | C | Reassess EWR (flow stressor). EWR 4c | Re-survey existing EWR 4(hydraulics and flow stressor response needed); biological and Eco-status | |
| 3 SELONS RIVER AREA INCLUDING LOSKOP DAM | II | B32A | OLI-EWR3r | Kranspoortspruit | B | B | Fish, inverts, habitat. EWR2 and Kranspoortspruit due to fish <i>Petrocephalus wesselsi</i> and check adjacent tributary – B32B | Re-survey, biological, Eco-status and WQ Revisit for fish/diatoms |
| | | B32A | Olifants-EWR2c | Olifants | C | C | Re-assess EWR2c | Re-survey existing Olifants-EWR2c Rapid III |
| | | B32B | | Klipspruit | B | B | No ecological information | Biological survey: Include fish, inverts, habitat |
| | | B32C | | Kruis, Selons | B | B | No ecological information (<i>Heptageniidae</i> , <i>Perlidae</i>) | Biological survey - Fish, inverts, habitat. After Confluence of Klip and Selons New Rapid site III (32B or 32C) |

| IUA | Class for IUA | Quaternary catchments | EWR sites (c,i,r)** | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|--|---------------|-----------------------|---------------------|--|-----|-----|---|--|
| 4 ELANDS RIVER CATCHMENT AREA | III | B31A | | Elands | C | C | Unsure of condition of river | SASS 5 and WQ sample (Diatoms) Little Eden |
| | | | | | | | Minimal ecological information available | New Rapid III site, include WQ |
| | | B31F | | Elands | C | C | Minimal ecological information available | WQ – diatoms/potential biological survey necessary |
| | | B31G | | Kameel | D | D | Minimal ecological information available | Water quality sample-diatoms |
| | | B31G | Olifants-EWR6c | Elands | D | D | Existing hydraulics 2001 study (EWR6) - use with biological data to check drought and maintenance flows | Biological survey – Update EWR using existing hydraulics updated biological data from surveys |
| 5 MIDDLE OLIFANTS UP TO FLAG BOSHIELO DAM | III | B31H | | Elands | E | D | Address with EWR 6 and Kameel monitoring | |
| | | B31J | | Elands | D | D | Extrapolate flows from EWR 6. Biological data is outdated | Biological survey (in vicinity of B3H021 weir) |
| | | B32F | | Bloed | B | B | Water quality impacts | Water quality sample |
| | | B32H | | Moses | D | D | Prioritised for Fish – re-establish populations (RQOs) | Biological and Eco-status: Nutrients at RHP site B3 Mose-Groen (west of the town of Groblersdal)/weir. |
| | | B32D, B32J | Olifants-EWR5c | Olifants | C | C | Existing hydraulics 2001 study (EWR5) - use with biological data to check drought and maintenance flows | Biological survey |
| | | B51B | WQ | Olifants (releases from Flag Boshielo Dam) | D | D | Need to determine water quality (understand impacts) | WQ sample required |
| | | B51C | WQ | Olifants | C | C | Need to determine water quality (understand impacts) | WQ sample required |

| IUA | Class for IUA | Quaternary catchments | EWR sites (c,i,r)** | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|--|---------------|-----------------------|---------------------|--|-----|-----|--|---|
| 6 STEELPOORT RIVER CATCHMENT | III | B41A | | One node at outlet of B41A. Included: Grootspruit Langspruit, including Lakenvleispruit and Kleinspruit | C | C | Biological data needed; reassess Eco-status | Biological and Eco-status: 3 x sites <ul style="list-style-type: none"> • Historic site B4LAKE-CONFL (Lakenvleispruit); • Existing B4-STEE-WAPAD (inverts) (Grootspruit); and • New site (Langspruit). |
| | | B41C | | Masala, including Tonteldoos and Vlugkraal | C | C | To support the info for the dam RQOs | Biological and Eco-status: Outlet of quat on Masala. Upstream from RHP site B4TOND-R555B.Tonteldoos and Vlugkraal Dams |
| | | B41F | OLI-EWR4r* | Klip | C | C | Possible new Fish species | Biological and Eco-status: 2 x sites <ul style="list-style-type: none"> • One on upper section of Klip; and • Second site on lower section of Klip. |
| | | B41G | | Upper reaches of Dwars | C | C | Assess inverts | Invert site below Der Bruchen Dam. Biological survey (need to confirm existing information) |
| | | B41H | DWA-EWR1i | Dwars | B/C | B/C | Eco-status confirmation | B4DWAR-R555U/ EWR1i: Biological baseline at EWR1i site, include WQ. Confirm Eco-status |
| | | B41H | Olifants-EWR9c | Steelpoort | D | D | Assess site after Dam. Use existing Hydraulics for EWR-9 | WQ sample required |
| | | B41J, B41K | Olifants-EWR10c | Steelpoort | D | D | Priority RU for flow, nutrients, habitat, toxins, fish. RQOs must be met | Biological and Eco-status confirmation |
| 7 MIDDLE OLIFANTS BELOW FLAG BOSHIELO DAM TO U/S STEELPOORT RIVER | III | B51G, B51H | Olifants-EWR7c | Olifants | E | D | Maintenance/Drought flow – check required | Biological and Eco-status, WQ: Survey below EWR 7c just after the Ngwaritsi confluence _ RHP site B5OLIF - VEEPL |

| IUA | Class for IUA | Quaternary catchments | EWR sites (c,i,r)** | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|---|---------------|-----------------------|---------------------|-------------|-----|-----|--|--|
| 8 SPEKBOOM CATCHMENT | II | B42B | Rapid I (WQ) | Dorpspruit | | | Minimal ecological information available | Biological and Eco-status (old rapid 1 site – exit of quat); include WQ, bacteriological) |
| | | B42H | | Spekboom | B | B | EWR needed – above town. New site proposed. | Biological + Eco-status: New site, Full Rapid III with hydraulics, WQ (diatoms), below unnamed tributary (above Burgersfort) |
| 9 OHRIGSTAD RIVER CATCHMENT AREA | III | B60F | | Ohrigstad | D | D | Important biodiversity area. River “disappears” | Biological and Eco-status |
| | | B60H | OLI-EWR8r* | Ohrigstad | C | C | Revisit existing Rapid site – confirm Eco-status | Biological and Eco-status: EWR site above B6ORIG-BLYDE. Include WQ |
| 10 LOWER OLIFANTS | II | B60J | Olifants-EWR12c | Blyde | B | B | Reassess Eco-status. RQOs for fish | Resurvey; Biological and Eco-status at EWR site and WQ (EWR12c) |
| | | B71A | | Paardevelei | B | B | Fish assessment - important species BBIF, ACAT. Rare species | Biological and Eco-status. Survey before drops of the escarpment |
| | | B71C | | Mohlapitse | B | B | Minimal ecological information available | Fish survey, habitat (B7MOH-WOLKB); At the bridge just upstream of the confluence |
| | | B71D | | Mohlapitse | | | Minimal ecological information available | Fish survey, habitat, WQ |
| | | B71D, | | Olifants | D | D | Need to confirm drought and maintenance flows | New Rapid III site, include WQ |
| | | B71E | | Motse | E | D | WQ impacts | Water quality sample required at lower reach of river |
| | | B71G | | Olifants | E | D | No biological information available (long stretch to EWR 11) | Biological and Eco-status. Possible site B7OLIF-FOCHA. Include WQ. |
| | | B71J | Olifants-EWR11c | Olifants | E | D | Resurvey hydraulics and biological. Changes to system | Resurvey; biological and Eco-status |
| | | B72C | | Makhutswi | B | B | RQOs set | Biological survey and Eco-status |

| IUA | Class for IUA | Quaternary catchments | EWR sites (c,i,r)** | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|---|---------------|-----------------------|---------------------|---|-----|-----|--|--|
| 11 GA-SELATI RIVER AREA | III | B72E | | Ngwabatse | D | D | Habitat impairment and RQOs set. | Biological survey and Eco-status (impoundment IHI). Toues Dam |
| | | B72F | | Ga-Selati | B | B | Important fish species identified | Biological and Eco-status. Just after confluence in reserve (B7GASE-SCHEL) |
| | | B72K | Olifants-EWR14ac | Ga-Selati | C | C | Need biological survey at 72K EWR 14a | Biological and Eco-status at Olifants-EWR14a |
| | | B72K | Olifants-EWR14bc – | Ga-Selati | E | D | Update with current data | Biological, WQ sample required at EWR14b |
| 12 LOWER OLIFANTS WITHIN KRUGER NATIONAL PARK | II | B72D | Olifants - EWR13c | Olifants | C | C | Need to confirm flow and biological | Re-survey flow and hydraulics, WQ; Biological and Eco-status |
| | | B73A | OLI-EWR7r | Klaserie | B/C | B/C | Dam habitat integrity need to be maintained | OLI-EWR7r. Biological survey and Eco-status (impoundment IHI). Klaserie Dam |
| | | B73C | Mamba weir | Tsiri | B | B | Use current data (at biological site) | WQ sample required at weir |
| | | B73G | | Timbavati | B | B | Within the KNP - important habitat for fish and WQ. Desktop wetlands assessment | Biological survey_4OF-12 - after confluence with the Shisakashanghondo (include WQ upstream). Confirm Eco-status |
| | | B73H | Olifants-EWR16c | Olifants | C | B | Final site in system. All RQOs have been set in RU. | EWR 16c - re-survey. Biological and Eco-status |
| | | B73J | | Olifants | C | C | Need to determine WQ as Olifants flows into Mozambique | Water quality sample needed |
| 13 BLYDE RIVER CATCHMENT AREA | I | B60B | | Blyde | B | B | Ecological data gap exists | New site, Rapid III at gauging weir |
| | | B60C | TRE-EWR1 | Treur | A/B | A/B | Need to re-visit site | Biological survey and Eco-status at TRE--EWR1. Include WQ |
| | | B60D | | Blyde (inflow to Blyderivierspoort Dam) | B | B | Need to determine water quality and assess biological condition | Biological survey just upstream of the Blyderivierspoort Dam, include WQ |

* No hydraulics (rapid 1 or rapid 2)

** c – comprehensive; i – intermediate; r - rapid

Table 5: Letaba Catchment Gap Identification and Proposed survey sites

| IUA | Class for IUA | Quaternary catchments | EWR sites | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|--|---------------|-----------------------|--------------|---------------|-----|---|--|---|
| 1 LETABA UPSTREAM OF TZANEEN DAM | II | B81A | | Broederstroom | C | C | Invert data is lacking. Need ecological information at top of catchment | Rapid III (hydraulics), above Ebenezer. Look at invertebrates and habitat (above Dap Naude and Ebenezer dams) |
| | | B81B | | Politsi | C | C | Extrapolate flow from Broederstroom | Biological survey above Magoebaskloof (inverts, fish, veg) (2LF223) |
| | | | EWR1c | Great Letaba | C | C | Use existing hydraulics for Letaba-EWR1 | Possibly biological survey at EWR 1 - fish, inverts, veg, habitat |
| | | 81C | Great Letaba | D | B | WQ data gap. If biological data is not good need survey. Jamerna weir | Fish at weir and at RHP site B81GIET-YMOR; WQ - bacteriological required below Tzaneen | |
| 2 LETSITELE AND THABINA | III | 81D | | Bobs | B | B | Biological, WQ needed | |
| | | | EWR 2c | Letsitele | D | C | Biological, WQ needed; update Eco-status | Biological survey at confluence of 81E, 81C, 81D. Include water quality |
| 3 LETABA OWNSTREAM OF TZANEEN TO PROPOSED NWAMITA DAM | III | B81E | | Great Letaba | D | | Gap in biological data | Biological survey at B81GLET-JANET, include water quality |
| 4 LETABA FROM PROPOSED NWAMITA DAM TO KLEIN LETABA CONFLUENCE | II | 81F | EWR3c | Great Letaba | C | B/C | Revisit because of dam. Survey and ecological consequences | |
| | | | EWR4c | Great Letaba | D | D | Update hydraulics | Re-survey EWR 4- hydraulics, full biological |
| | | 81J | Great Letaba | C | B/C | Update EWR 4 information | Biological survey, WQ and one at the outlet B81GLET-SLABW | |

| IUA | Class for IUA | Quaternary catchments | EWR sites | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|--|---------------|-----------------------|-----------|----------------|-----|-----|--|---|
| 7 UPPER MIDDLE LETABA AND TRIBUTARIES UPSTREAM OF MIDDLE LETABA | III | B82A | | Middel Letaba | C | C | | Visual assessment - comment on flow, habitat. Possible wetland survey |
| | | B82B | | Koedoes | D | D | Need to identify if any gap for the wetlands exist | |
| | | B82C | | Brandboontjies | E | | RHAM to address flow RQOs in all tributaries (A to D). Look at biological data (RHP) | |
| | | 82D | | Middel Letaba | D | D | Update biological information | Biological survey, include WQ |
| 8 KLEIN LETABA UPSTREAM OF MIDDLE LETABA DAM | II | 82E | | Khwali | B | B | To check 82E and 82F for presence of wetlands | Assess presence and if so priority |
| | | 82F | | Little Letaba | C | C | Survey on Klein Letaba. Invert sites are present | Rapid III (flow, hydraulics); B8KLET-BRIDG |
| | | | | Little Letaba | D | D | Groundwater is important | Assess priority |
| 9 KLEIN LETABA DOWNSTREA M OF MIDDLE LETABA DAM | III | 82G, 82J | | Little Letaba | D | C | Full survey at existing site EWR 3 and second site - biological survey at bottom of quaternary | Re-survey (flow, hydraulics).and biological survey at B8KLET-SOUTI. Second biological survey at top of B82G |
| | | | | Little Letaba | B | | Biological data needed | At lower end of Letaba. Biological and WQ at outlet of B82J |
| 10 LOWER KLEIN LETABA TRIBUTARIES | I | B82H | | Nsama | B | B | Extrapolate flow from Klein Letaba site and look at biological information | Biological survey below of confluence of the tributaries (Magobe and Nsama) – RHP site B8NSAM-YOUTH |
| | | B82J | | Nalatsi | A | B | Extrapolate flow from Klein Letaba site and assess existing biological information available | Need to maintain status |

| IUA | Class for IUA | Quaternary catchments | EWR sites | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|--|---------------|------------------------------|-----------|------------|-----|-----|---|--|
| 11 LETABA MAIN STEM IN KRUGER NATIONAL PARK | II | B83A, B83B, B83C, B83D, B83E | | Letaba | B | B | Biological survey required at very top of Letaba | Biological survey, include WQ (just in KNP) |
| | | | EWR 6c | Letaba | C | B | Use existing hydraulics for Letaba -EWR6 | Biological Survey |
| | | | EWR7c | Letaba | C | B | Re-survey existing EWR 7 | Biological at EWR 7 and WQ (above Engelhard Dam). Re-survey hydraulics |
| | | | | Letaba | C | B | Biological data needed and lower reaches of the catchment | Biological survey, include WQ at B8GLET-KLIPA |

Table 6: Shingwedzi Catchment Gap Identification and Proposed survey sites

| Catchment | Quaternary catchments | EWR sites | River Name | PES | REC | Gaps identification/assessment | Proposed Surveys/Assessment |
|-----------------------------|-----------------------|------------|------------|-----|-----|---|--|
| SHINGWEDZI CATCHMENT | B90A | | Shisha | B | B | Site - outlet Vlakteplaas. Review KNP data | Full biological survey. Site - outlet Vlakteplaas (for Shisha B90A and B80D) |
| | B90B | | Mphongolo | D | C | No biological data | Full biological survey. Just inside Park - site present |
| | B90C | | Phugwane | C | B | No biological data | Full biological survey just outside park at Mashobye |
| | B90D | | Shisha | A | B | To confirm changes along gradient. Change in PES - need to look at | In B90D, just after confluence of the Shisha and Mphongolo |
| | | | Mphongolo | B | B | Need to confirm natural heritage status and to protect good condition of rivers | Full biological survey at confluence of the Mphongolo and Phugwane |
| | B90F | | Shingwedzi | C | B | No biological data available | Biological survey and WQ - R81 site below treatment works at Kawabambo. Very Up in catchment |
| | | | | | | | Biological survey and WQ. Border of the KNP |
| | B90G | | Shingwedzi | B | B | | Biological survey and WQ, after confluence with the Tshange -B9SHIN-REDRO |
| B90H | EWR06r | Shingwedzi | C | B | | Rapid III, Biological survey and WQ. Above Kanniedood Dam below camp | |

Table 7: Summary of proposed new rapid EWR sites, re-survey of existing EWR sites, use of existing hydraulics for revision of requirements, ecological consequences and biological surveys

| Quaternary catchment | Site no. | River | New rapid 3 | Re-survey existing EWR sites | Biological surveys | Comments |
|---|----------|------------------|-------------|------------------------------|--------------------|---|
| New rapid 3 or re-survey existing site | | | | | | |
| B11G | 1 | Olifants | x | | x | New rapid 3 |
| B11J | 2 | Olifants | x | | x | Replace existing Olifants-EWR1, rapid 3 |
| B12E | 3 | Klein Olifants | x | | x | Replace existing Olifants-EWR3, rapid 3 |
| B20F | 4 | Wilge | x | | x | New rapid 3 |
| B20J | 5 | Wilge | | x | x | Resurvey existing Olifants-EWR4 |
| B32A | 6 | Olifants | | x | x | Resurvey existing Olifants-EWR2 |
| B32B/B32C | 7 | Selons | x | | x | New rapid 3 |
| B31C | 8 | Elands | x | | x | New rapid 3 |
| B42H | 9 | Spekboom | x | | x | New rapid 3 |
| B60J | 12 | Blyde | | x | x | Resurvey existing Olifants-EWR12 |
| B60B/B60D | 11 | Blyde | x | | x | New rapid 3 |
| B71J | 13 | Olifants | | x | x | Resurvey existing Olifants-EWR11 |
| B72D | 14 | Olifants | | x | x | Resurvey existing Olifants-EWR13 |
| B73H | 15 | Olifants | | x | x | Resurvey existing Olifants-EWR16 |
| B81A | 16 | Broederstroom | x | | | New rapid 3 |
| B81F | 17 | Great Letaba | | x | | Resurvey existing Letaba-EWR4 (Hans Merensky) |
| B82F | 18 | Klein Letaba | x | | | New rapid 3 |
| B82G | 19 | Klein Letaba | | x | | Resurvey existing Letaba-EWR3 (Klein Letaba) |
| B83D | 20 | Letaba | | x | x | Resurvey existing Letaba-EWR7 (WQ) |
| B90H | 21 | Shingwedzi | x | | | New rapid 3 |
| Use existing hydraulics + updated biological data from surveys | | | | | | |
| B32A | 1 | Kranspoortspruit | | x | x | Use existing hydraulics for Olifants-OLI-EWR3 |
| B32D | 2 | Olifants | | | x | Use existing hydraulics for Olifants-EWR5 |
| B31G | 3 | Elands | | | x | Use existing hydraulics for Olifants-EWR6 |
| B41H | 4 | Steelpoort | | | x | Use existing hydraulics for Olifants-EWR9 |
| B41K | 5 | Steelpoort | | | x | Use existing hydraulics for Olifants-EWR10 |
| B51C | 6 | Olifants | | | x | Use existing hydraulics for Olifants-EWR7 |
| B71D | 7 | Olifants | | | x | Use existing hydraulics for Olifants-EWR8 |

| Quaternary catchment | Site no. | River | New rapid 3 | Re-survey existing EWR sites | Biological surveys | Comments |
|---|----------|--|-------------|------------------------------|--------------------|--|
| B72K | 8 | Ga-Selati | | | x | Use existing hydraulics for Olifants-EWR14b |
| B41H | 9 | Dwars | | | x | Use existing hydraulics for DWA-EWR1 |
| B81B | 10 | Great Letaba | | | x | Use existing hydraulics for Letaba-EWR1 |
| B81B | 11 | Letsitele | | | x | Use existing hydraulics for Letaba-EWR2 |
| B83A | 12 | Letaba | | | x | Use existing hydraulics for Letaba-EWR6 |
| Biological surveys only for revised Eco-status and extrapolation of EWR with DRM | | | | | | |
| B11E | 1 | Steenkoolspruit | | | x | Biological survey, WQ and discharge |
| B20C | 2 | Bronkhorstspruit | | | x | Biological survey and discharge |
| B72C | 3 | Makhutswi | | | x | Biological survey and discharge |
| B73G | 4 | Timbavati | | | x | Biological survey and discharge, WQ u/s |
| B81B | 5 | Politisi | | | x | Biological survey and discharge |
| Biological surveys and reassess Eco-status | | | | | | |
| B32H | 1 | Moses | | | x | Biological survey and reassess Eco-status |
| B41A | 2 | Lakenvleispruit | | | x | Biological survey and reassess Eco-status |
| | 3 | Grootspruit | | | x | Biological survey and reassess Eco-status |
| | 4 | Langspruit | | | x | New site. Biological survey and reassess Eco-status |
| B41C | 5 | Masala | | | x | Biological survey and reassess Eco-status |
| B41F | 6 | Upper Klip | | | x | Biological survey and reassess Eco-status |
| | 7 | Lower Klip | | | x | Biological survey and reassess Eco-status |
| B42B | 8 | Dorpspruit | | | x | Biological survey and reassess Eco-status ; WQ |
| B60F | 9 | Ohrigstad | | | x | Biological survey and reassess Eco-status |
| B60H | 10 | Ohrigstad | | | x | Biological survey and reassess Eco-status , WQ |
| B60J | 11 | Blyde | | | x | Biological survey and reassess Eco-status , WQ (EWR12) |
| B71A | 12 | Paardevelei | | | x | Biological survey and reassess Eco-status |
| B71G | 13 | Olifants | | | x | Biological survey and reassess Eco-status , WQ |
| B72E | 14 | Ngwabatse | | | x | Biological survey, habitat integrity and reassess Eco-status |
| B72F | 15 | Ga-Selati | | | x | Biological survey and reassess Eco-status |
| B72K | 16 | Ga-Selati | | | x | Biological survey and reassess Eco-status EWR14a |
| B73A | 17 | Klaserie | | | x | Biological survey, habitat integrity and reassess Eco-status |
| B90D | 18 | Shisha | | | x | Biological survey and reassess Eco-status |
| Biological surveys/Water Quality | | | | | | |
| B11C | 1 | Steenkoolspruit/Piekpruit and DeBeerspruit | | | x | Biological survey, WQ and discharge |

| Quaternary catchment | Site no. | River | New rapid 3 | Re-survey existing EWR sites | Biological surveys | Comments |
|----------------------|----------|--|-------------|------------------------------|--------------------|--|
| B11D | 2 | Trichardspruit | | | x | Biological survey and discharge |
| | 3 | Dwars-in-die Wegspruit | | | x | Biological survey, WQ and discharge |
| B11K | 4 | Klipspruit, Blesbokspruit | | | x | Biological survey and WQ |
| B11L | 5 | Olifants, Klipspruit | | | x | Biological and quality on Olifants, biological on Klip |
| B12B | 6 | Klein Olifants | | | | WQ (confluence Coetzee, East Woe-Alleenspruit and Woes-Alleenspruit) |
| B12C | 7 | Klein Olifants | | | x | Biological and quality (just after tributaries confluence) |
| B20F | 8 | Wilge | | | x | Biological survey at WQ site (Kendall B2WIL/DEWAAL and 4OF148) |
| B32B | 9 | Klipspruit | | | x | Biological survey and discharge |
| B31A | 10 | Elands | | | x | SASS5 and WQ (Little Eden) |
| B31F | 11 | Elands | | | x? | WQ and possibly biological? |
| B31G | 12 | Kameel | | | | WQ (Diatoms) |
| B31J | 13 | Elands | | | x | Biological |
| B32F | 14 | Bloed | | | | WQ |
| B51B | 15 | Olifants (releases from Flag Boshielo Dam) | | | | WQ |
| B51C | 16 | Olifants | | | | WQ |
| B41G | 17 | Upper Dwars | | | x | Biological survey |
| B41H | 18 | Olifants | | | | WQ (EWR9) |
| B71C | 19 | Mohlapitse | | | x | Fish survey; habitat integrity |
| B71D | 20 | Mohlapitse | | | x | Fish survey; habitat integrity, WQ |
| B71E | 21 | Motse | | | | WQ |
| B73C | 22 | Tsiri | | | | WQ |
| B73J | 23 | Olifants | | | | WQ |
| B60D | 24 | Blyde | | | x | Biological survey, WQ |
| B81C | 25 | Great Letaba | | | x | Biological survey, WQ |
| B81D | 26 | Bobs | | | x | Biological survey, WQ |
| B81E | 27 | Great Letaba | | | x | Biological survey, WQ |
| B81J | 28 | Letaba | | | x | Biological only |
| B82D | 29 | Middle Letaba | | | x | Biological survey, WQ (plus visual assessment of EWR site) |
| B82J | 30 | Middle Letaba | | | x | Biological survey, WQ (at outlet) |

| Quaternary catchment | Site no. | River | New rapid 3 | Re-survey existing EWR sites | Biological surveys | Comments |
|----------------------|----------|------------|-------------|------------------------------|--------------------|--|
| B82H | 31 | Nsama | | | x | Biological survey |
| B83A-B83E | 32 | Letaba | | | x | Biological survey, WQ |
| B90A | 33 | Shisha | | | x | Biological survey |
| B90B | 34 | Mphongolo | | | x | Biological survey |
| B90C | 35 | Phugwane | | | x | Biological survey |
| B90D | 36 | Shisha | | | x | Biological survey (confluence of Mphongolo and Phugwane) |
| B90F | 37 | Shingwedzi | | | x | Biological survey/WQ R81 site (upper catchment) |
| B90F | 38 | Shingwedzi | | | x | Biological survey/WQ border of KNP |
| B90G | 39 | Shingwedzi | | | x | Biological survey/WQ (confluence with Tshange) |

Table 8: Quaternary catchments with associated/potential important/priority wetlands considered for possible field visits based on a review of the available literature and a scan of the existing wetland databases

| | IUA | Quaternary | Wetlands | Notes |
|----|------------|------------|--|--|
| 1 | 1 | B12D | WetFEPA's | Some WetFEPA's to visit |
| 2 | 1 | B12E | Priority wetland and WetFEPA's | Some WetFEPA's to visit |
| 3 | 1 | B11B | Priority wetland only | Headwaters of unknown tributary to east and south to visit |
| 4 | 2 | B20B | WetFEPA's | Some WetFEPA's to visit |
| 5 | 5 | B32F | - | Wetland in lower reach of the Bloed River and FEPA at river confluence |
| 6 | 5 | B32G | WetFEPA's | Protected area in catchment, WetFEPA's to visit |
| 7 | 3 and 4 | B31A | Priority wetland and WetFEPA's | Priority wetlands and WetFEPA's to visit |
| 8 | 3 and 4 | B31F | WetFEPA's | Some WetFEPA's to visit |
| 9 | 5 | B51A | No WetFEPA's but granites | Motsephiri flowing into Flag Boshielo Dam on Granites |
| 10 | 5 | B51B | No WetFEPA's but granites | Granites and possible wetlands |
| 11 | 5 | B51C | No WetFEPA's but granites | Granites and possible wetlands |
| 12 | 7 | B51H | - | Dendritic drainage showing possible wetlands, granites |
| 13 | | B52A | Floodplain to consider | Floodplain area on the Olifants River, sand mining, potentially valuable floodplain, and dendritic drainage |
| 14 | | B52B | - | Dendritic drainage showing possible wetlands |
| 15 | | B52E | - | Dendritic drainage showing possible wetlands, land-use management related to quality |
| 16 | | B52G | WetFEPA's | Wolkberg forest belt IBA and wetland areas |
| 17 | | B52J | - | Interesting wetland along Mphogodina River near confluence with two tributaries and some dendritic drainage to the east of the Olifants, water quality |
| 18 | 6 | B41B | WetFEPA's | Steelpoort (almost entire catchment WetFEPA's), peatlands |
| 19 | 6 | B41F | Priority wetland and WetFEPA's | Verlorenvlei Ramsar Site and Steenkampsberg plateau wetlands |
| 20 | 8 | B42B | WetFEPA's | Special plants in one of the systems at Lydenburg and some WetFEPA's |
| 21 | 8 | B42F | WetFEPA's | Headwater of the Potspruit |
| 22 | 13 | B60B | WetFEPA's | Headwaters of the Treur River - check FEPA to west |
| 23 | 13 | B60C | Priority wetland and WetFEPA's | Headwaters of the Treur River, possible peatlands, land-use management recommendations |
| 24 | 9 and 10 | B60F | Priority wetland | Large priority wetland |
| 25 | 9 and 10 | B60H | Priority wetland | Check the priority wetland |
| 26 | 9 and 10 | B71C | - | Wetlands along the Mohlapitse River |
| 27 | 9 and 10 | B71D | WetFEPA's | Mohlapitse and some wetlands along river, Legalameetse Nature Reserve, some interesting wetlands |
| 28 | 10 and 11 | B72D | WetFEPA's | Wetlands indicated along the Olifants River |
| 29 | 10 and 11 | B72J | WetFEPA's | Good condition wetland next to the town |
| 30 | 12 | B73A | WetFEPA's | Crane habitat - check |
| 31 | 12 | B73B | WetFEPA's | Check |
| 32 | 12 | B73H | - | Wetlands identified in the catchment |
| 33 | 1 | B81A | Priority wetland (Letaba) | Wetland on the Broederstroom |
| 34 | 2, 3 and 4 | B81C | WetFEPA's and reach identified in Letaba study | Wetlands identified in the catchment |
| 35 | 2, 3 and 4 | B81D | WetFEPA's and reach identified in Letaba study | Wetlands identified in the catchment |
| 36 | 2, 3 and 4 | B81E | WetFEPA's and reach identified in Letaba study | Wetlands identified in the catchment |
| 37 | 2, 3 and 4 | B81F | WetFEPA's and reach identified in Letaba study | Wetlands identified in some of the sub-catchments |
| 38 | 7 | B82B | - | Many unmapped wetlands |
| 39 | 7 | B82C | - | Many unmapped wetlands |
| 40 | 8 and 9 | B82E | - | Mapped seepage wetlands |
| 41 | 8 and 9 | B82G | WetFEPA's | Thermal springs |

| | IUA | Quaternary | Wetlands | Notes |
|----|-----------|------------|-----------|--|
| 42 | 10 and 11 | B82H | - | Thermal springs |
| 43 | 10 and 11 | B82J | WetFEPA's | Geological spring wetlands and FEPA pans in the KNP - check with the KNP |
| 44 | 10 and 11 | B83A | WetFEPA's | Geological spring wetlands and FEPA pans in the KNP - check with the KNP |
| 45 | 10 and 11 | B83B | WetFEPA's | Geological spring wetlands and FEPA pans in the KNP - check with the KNP |
| 46 | 10 and 11 | B83C | WetFEPA's | Shawu wetland and pans |
| 47 | | B90A | WetFEPA's | Shisha River system and south of Punda Maria |
| 48 | | B90D | - | Babalala wetland, pans and unchannelled valley bottom systems |
| 49 | | B90H | WetFEPA's | No general wetland coverage data but many wetlands visible on imagery |

4.2.3 Groundwater

Previous Reserve related studies in the Olifants/Letaba System (WSM and SRK) provides a good baseline understanding of the Reserve requirements and criteria for addressing areas where groundwater utilisation is impacting on the balance of the Reserve requirements.

An assessment of the utilization of groundwater per quaternary catchment and its impact on the surface water components per quaternary catchment by Haupt 2003, and refined for the main stem Letaba System by WSM (DWA, 2006) shows that this impact has escalated (DWA, 2009). A ranking of the relevant quaternary catchments in the study area is shown in Table 9. A summary of the ranking above and including “*Moderately Utilised*”, based on the approach followed by WSM (2003 and 2006) for the National Coverage and the main stem Letaba System is presented in Table 10.

The impact on the groundwater resources has probably increased significantly since 2009 and this will be the focus of the groundwater component of this study. Updating of the groundwater related data has been identified as a priority in the inception phase.

Priority groundwater systems were identified based on the GRA II and the Groundwater Water Exploitation Potential datasets, with additional input from land use screening. This preliminary analysis considered the impact of groundwater on local surface water resources and groundwater utilisation. This will be built upon by also considering areas where groundwater quality deterioration has been identified. The grouping of quaternary catchments in the Olifants/Letaba System where the impact on the local surface water resource were based on the Baseflow Factor (C Haupt, 2003).

The remainder of the newly demarcated Olifants WMA (mostly the southern and northern quaternary catchments of the former Letaba WMA) will be addressed based on the same protocols WSM and SRK have applied.

The grouping of quaternary catchments in the Olifants-Letaba where the impact of groundwater utilisation is ranked according to water use estimations, based on the actual water use and the annual average groundwater recharge (a Stress Index) is indicated in Table 10.

Table 9: Ranking of Quaternary Catchments based on groundwater utilisation status and impact on surface water resources

| Quaternary Catchment | Ground water Utilisation Status | Impact on Surface water Resources | Quaternary Catchment | Ground water Utilisation Status | Impact on Surface water Resources |
|----------------------|---------------------------------|-----------------------------------|----------------------|---------------------------------|-----------------------------------|
| B20C | UNDER-UTILISED | HIGH | B60G | UNDER-UTILISED | iMODERATE |
| B41F | UNDER-UTILISED | HIGH | B60J | UNDER-UTILISED | iMODERATE |
| B41G | UNDER-UTILISED | HIGH | B72A | UNDER-UTILISED | iMODERATE |
| B42A | UNDER-UTILISED | HIGH | B72F | HEAVILY-UTILISED | iMODERATE |
| B42B | UNDER-UTILISED | HIGH | B81C | UNDER-UTILISED | iMODERATE |
| B42D | UNDER-UTILISED | HIGH | B11A | UNDER-UTILISED | LOW |
| B42F | UNDER-UTILISED | HIGH | B11B | UNDER-UTILISED | LOW |
| B60E | OVER-UTILISED | HIGH | B11C | UNDER-UTILISED | LOW |
| B71C | UNDER-UTILISED | HIGH | B11D | UNDER-UTILISED | LOW |
| B71D | UNDER-UTILISED | HIGH | B11E | UNDER-UTILISED | LOW |
| B71F | UNDER-UTILISED | HIGH | B11F | Na | LOW |
| B71G | UNDER-UTILISED | HIGH | B11G | UNDER-UTILISED | LOW |
| B72G | | HIGH | B11H | UNDER-UTILISED | LOW |
| B73A | UNDER-UTILISED | HIGH | B12A | UNDER-UTILISED | LOW |
| B60A | | HIGH | B12B | UNDER-UTILISED | LOW |
| B60B | UNDER-UTILISED | HIGH | B12C | UNDER-UTILISED | LOW |
| B60C | | HIGH | B12D | UNDER-UTILISED | LOW |
| B60D | UNDER-UTILISED | HIGH | B20A | UNDER-UTILISED | LOW |
| B81A | UNDER-UTILISED | HIGH | B20B | UNDER-UTILISED | LOW |
| B81B | UNDER-UTILISED | HIGH | B31A | UNDER-UTILISED | LOW |
| B81D | HEAVILY-UTILISED | HIGH | B31B | Na | LOW |
| B11J | UNDER-UTILISED | iMODERATE | B31C | HEAVILY-UTILISED | LOW |
| B11K | Na | iMODERATE | B31D | OVER-UTILISED | LOW |
| B11L | UNDER-UTILISED | iMODERATE | B31G | Na | LOW |
| B12E | UNDER-UTILISED | iMODERATE | B32D | UNDER-UTILISED | LOW |
| B20D | UNDER-UTILISED | iMODERATE | B31H | Na | LOW |
| B20E | UNDER-UTILISED | iMODERATE | B32E | UNDER-UTILISED | LOW |
| B20F | UNDER-UTILISED | iMODERATE | B32F | UNDER-UTILISED | LOW |
| B20G | UNDER-UTILISED | iMODERATE | B32G | Na | LOW |
| B20H | UNDER-UTILISED | iMODERATE | B32H | UNDER-UTILISED | LOW |
| B20J | UNDER-UTILISED | iMODERATE | B42C | UNDER-UTILISED | LOW |
| B32A | UNDER-UTILISED | iMODERATE | B42E | UNDER-UTILISED | LOW |
| B32B | Na | iMODERATE | B42G | UNDER-UTILISED | LOW |
| B32C | UNDER-UTILISED | iMODERATE | B60H | UNDER-UTILISED | LOW |
| B41A | UNDER-UTILISED | iMODERATE | B82A | UNDER-UTILISED | LOW |
| B41B | UNDER-UTILISED | iMODERATE | B82B | UNDER-UTILISED | LOW |
| B41C | MODERATELY-UTILISED | iMODERATE | B82C | Na | LOW |
| B41D | UNDER-UTILISED | iMODERATE | B82D | UNDER-UTILISED | LOW |
| B60F | UNDER-UTILISED | iMODERATE | B82E | UNDER-UTILISED | LOW |

Table 10: Ranking of Quaternary Catchments with moderately and higher utilisations (WSM, 2003)

| Quaternary Catchment | Ground water Utilisation Status | Impact on Swater Resources |
|----------------------|---------------------------------|----------------------------|
| B31C | HEAVILY-UTILISED | LOW |
| B51G | HEAVILY-UTILISED | NEGLIGABLE |
| B71B | HEAVILY-UTILISED | NEGLIGABLE |
| B72F | HEAVILY-UTILISED | MODERATE |
| B81D | HEAVILY-UTILISED | HIGH |
| B41C | MODERATELY-UTILISED | MODERATE |
| B41J | MODERATELY-UTILISED | NEGLIGABLE |
| B71E | MODERATELY-UTILISED | NEGLIGABLE |
| B31D | OVER-UTILISED | LOW |
| B60E | OVER-UTILISED | HIGH |

4.2.4 Wetlands

A desktop review of existing wetland databases and of available imagery will be used to refine the list of quaternary catchments indicated in Table 8. A map of the targeted areas will then be provided as part of the in the Gap Analysis report. Where possible, desktop mapping will be used to capture some of the larger wetlands identified during the gap analysis.

For areas in the Upper Olifants River catchment (UORC), the revised wetland coverage and associated threat status based on the 2015 Mpumalanga Highveld coverage (Mbona *et al*, 2015) will be used as the baseline wetland layer. An initial field visit will then be undertaken to as many of the representative key wetlands in the catchments identified as part of the gap analysis.

GIS will be used to intersect the various datasets and develop a composite map indicating the key wetlands identified in the Olifants, Letaba and Shingwedzi River catchments. Areas where the wetland coverage is poor will be identified and indicated on the base map. Where appropriate and depending on the resolution of the imagery, gaps will be filled using desktop delineation. Every attempt will be made to at least capture as many of the additional key wetland systems within the study area in the GIS layer as possible. Use will also be made of 1:50 000 topographical maps, Google Earth Imagery and available aerial photography to support the production of an updated digital base map of the wetlands. The relevant conservation agencies will be contacted in order to obtain updated information (and hopefully databases including mapping coverage) if available, which can be used to support this. These data will need to be made available to the team within a time frame that enables integration into the base map.

A second field visit will be undertaken to selected priority wetlands. These will be identified as part of the gap analysis as well as from the initial field assessment. PES and EIS categories will be derived for these based on a rapid field assessment method appropriate for the level of investigation. The A to F PES categories described by Kleynhans (1996 and 1999) and the low/marginal/to very high EIS categories described in DWAF (1999) will be used where appropriate or possible.

The intention is to at least get an idea of the current state and ecological importance of the additional priority wetlands so the REC can be derived.

4.2.5 Operation and Management of the Olifants/Letaba System – Preliminary Assessment

An initial evaluation of information from the Reconciliation Strategy, Classification Studies and the Olifants Letaba Environmental Management Framework report has identified the following as overarching key aspects in the Olifants Letaba System that have a bearing on its future management and operation:

- The ecological Reserve requirements of the catchment as a whole and of most rivers and streams that constitute it are not being implemented and allocations of water resources to meet the Reserve are required:

Relevance/Applicability to this study: Once gazetted the Reserve requirements must be met, and the water balance and reconciliation strategy be updated to accommodate for this. Management intervention related to the water resources especially the stressed and over utilised or those in high conservation areas will be a high priority. Improved operation of the system and management of the various impoundments and water uses will also be required, to ensure that all user requirements are met;

- Water is already over-allocated and further allocations must come from reallocation of existing rights and local resources:

Relevance/Applicability to this study: A process of water use verification and validation maybe required in the Olifants/Letaba catchment, followed by compulsory licensing to confirm the water requirements and facilitate water resource re-allocation. Future use will have to be sourced through urgent creative management intervention by implementing integrated catchment management;

- Pollution of water is having a negative effect on the water quality of the water resources in many catchments (mining, agricultural activities, settlements):

Relevance/Applicability to this study: Water quality deterioration is occurring in many areas within the catchment. This study will define ecological specifications for water quality where required. The specifications will be defined for water quality as it relates to sustainability and maintenance of the ecological condition and to ensure protection. However where identified conditions related to management and land use activities are required or available it will be proposed. This study will set up the necessary liaison and linkages with the Olifants Water Quality Management Plan Development study that is soon to be initiated;

- Erosion, turbidity and sediment deposition are diminishing the potential of the hydrological system. Runoff from commercial agricultural areas contains agro-chemicals, which are causing eutrophication or contamination of water. Loss of natural filters such as wetlands are also resulting in an increase in sediments in the water, increased erosion and terrestrial alien invasion. Mining activities are impacting significantly on the quality of the water resource system which is changing the characteristics of some of the water resources to such an extent that loses its ecological infrastructure value. Non-compliant wastewater treatment works also contribute to organic and nutrient loads to the river system:

Relevance/Applicability to this study: Ecological specifications will be defined as required and as related to the water quality ecological condition. Management actions and recommendations as identified will be forwarded through to the Olifants Water Quality Management Plan Development study to be implemented through water use authorisations.

Complete or partial loss of wetlands due to mining activities has, and continues, to impact on the water resource system. Decisions around future mining need to be informed by a better understanding of the cumulative long-term effects on the water resource system. This study will, if feasible using existing data surrogates, attempt to derive an estimate of the cumulative loss of wetlands due to land use practices (including mining) in the upper parts of the Upper Olifants River Catchment (UORC). This will provide a better understanding of the implications for the water resource system of further wetland loss. Using existing information from available reports and existing wetland databases, it will identify the priority wetlands/wetland systems that are threatened and those that require management and protection conditions, or in some cases, conditions to mitigate some of the functions that have been lost.

As part of this, the relationship between the threats/pressures and the expected change in condition of the priority wetlands identified will be determined. Wetland baseline condition or current PES will serve as the starting point. Expert judgement will be used to derive how the priority systems are likely to either stay the same or change depending on the pressures they are currently experiencing, or based on additional threats or pressures going forward. By taking this approach, it is envisaged that the team will be able to provide information to the DWS which will assist with filling in the gaps in the current wetland Reserve dataset, predominantly in relation to the identification of additional priority wetlands that may be under threat;

! Impoundments of the rivers are impacting on the in-stream biota:

Relevance/Applicability to this study: The necessary level of protection and ecological specifications will be defined as required and as related to the ecological condition. The RQOs for the resource units in which the dams are situated or are planned are in the process of being gazetted. These RQOs will be used as the baseline for setting conditions and where required more detailed ecological specifications for specific water resources *i.e.* wetlands and supporting tributaries, will be defined. The results of ecological consequences assessment and the development of the resource management plan will further provide guidance that may require adjustments and refinement of the operating rules that have already been identified for the system. Where no operating rules are available, the ecological water requirements related to the operation of the dam in the form of a monthly distribution curve will have to be developed. This will relate to the EWRs and ecological specifications that will apply downstream from the dam;

! Riparian vegetation in many systems is in a degraded state due to overgrazing and over utilization;

! In the Kruger to Canyons biosphere, uncontrolled alien invader plants pose a threat to natural vegetation and use excessive amounts of water in some places:

Relevance/Applicability to this study: The necessary level of protection and ecological specifications will be defined as where identified. However where identified conditions related to management and land use activities will be proposed. Buffer zones will need to be defined and specific areas related to or sensitive habitat reaches demarcated.

This will also apply to important/sensitive wetland systems that are threatened by land use activities;

- i The heavy abstraction of water such as in the Middle Olifants System is reducing the water available for ecological functioning downstream:

Relevance/Applicability to this study: The EWRs set will have to be implemented and met. The necessary level of protection and ecological specifications will be defined as required. The water resource management plan will highlight the recommendations on changes in system operation and water use that may apply in such water resources;

- i Absence of integrated operating rules for the entire Olifants system for releases from the various dams to satisfy the water demands without shortages:

Relevance/Applicability to this study: The EWRs set will have to be implemented and met. Integrated operating rules for the Olifants system will provide the necessary release plan for water use and compliance with the Reserve. The implications of meeting the Reserve on water availability will be identified and where required the consequence of not meeting the full EWRs will be assessed; and

- i Concerted and regular biological, water quality and flow monitoring is needed as well as a monitoring implementation plan that supports the Reserve.

4.2.6 Conclusion

The findings of the inception phase have been outlined above. The inception task also includes the definition of the role-players, project scope, interfacing with other initiatives and the study budget. This report forms the inception report to serve as a roadmap for the study roll out.

4.3 TASK 2: WATER RESOURCES INFORMATION AND DATA GATHERING

The main focus for this task will be a gap analysis and review of all existing literature, reports, maps, models, aerial photographs and any other relevant information on the study area that is supportive and required for the determination and implementation of the Reserve for the Olifants/Letaba System. The gap analysis will specifically put emphasis on the preliminary Reserve determination studies conducted (2001 and 2009 study in the Olifants catchment and the 2006 study in the Letaba) and a number of rapid/intermediate Reserve studies undertaken from 2007 to present for various smaller tributaries as part of the WRCS and mining related developments. The Reserve Methodologies have been revised since the Olifants and Letaba Reserve studies were undertaken thus the applicability of the EWRs and requirements with respect to implementation will be reviewed.

The gap analysis will further include information from water resource planning, other related RDM related studies, water quality studies, socio-economic, augmentation and reconciliation strategies and implementation plans. It will also include recommendations on the review of the Reserve results to include methods supported by the DWS that have been developed since the previous studies. Furthermore, information from the previously called River Health Programme now known as the Resource Eco-status Monitoring Program (REMP) and Working for Wetlands studies and other related studies will also be assessed in performing a gap analysis to determine if there is any other additional work required. The outcomes and implementation requirements of the Water Resource Classification and RQO Determination Studies will be assessed and EWR implementation will be aligned to these and vice versa.

The gap analysis will further place emphasis on the wetland types and their protection requirements based on their functionality in the landscape. This will mainly be informed by the NFEPA results and identified priority wetlands from the RQO determination study. Gaps in the water quality specifications/requirements will be addressed as part of the ecological Reserve and determined RQO for the various water resources, including priority groundwater areas.

This task will also include the sourcing of the applicable Water Resources Models and Water Quality models that have been used for the study area during previous studies. The model will be used to support the results obtained and improve the confidence level of the study results (implementation and achievability). All the above will be used to identify any data and information shortfalls. Specific recommendations will be made as to the collection of additional data and/or the extrapolation of existing data. This will be discussed with the client before finalization.

This task has been initiated concurrently with task 1, the inception phase, and a preliminary assessment has supported the ecological gap identification that has led to the list of priority sites. This task will further interrogate the information to provide an analysis and to identify any gaps that may require some additional data collection.

Task 2 Deliverables –

- Report on water resources information gap analysis and recommendations to address outstanding data requirements; and
- Water resource models and their applicability to this study.

4.4 TASK 3: IMPLEMENTATION OF THE ECOLOGICAL WATER REQUIREMENTS (EWR)/RESERVE

This task forms the key component of the study programme and results in the elements for implementation of the Reserve using appropriate methodology. The procedure that will be used to determine the Reserve will adhere to Regulation 810 of Government Gazette 33541, 17 September 2010. This task will follow an 8-step approach as per the breakdown illustrated in

Figure 9 below.

The Reserve Determination process will focus on the priority resources, including quaternary and sub-quaternary catchments, existing EWR sites and priority wetlands and groundwater driven systems where the Reserve must be determined/re-assessed or where ecological gaps need to be addressed in terms of the gaps identified in the Inception phase (Refer to Table 7). As the Reserve methodology has been updated since the preliminary Reserve studies undertaken for the Olifants/Letaba systems this component will need to address the specific data and implementation gaps. The EWR review and assessments undertaken during the Water Resource Classification Studies and the operational scenarios will be considered and aligned to the objectives of this study. Monitoring specifications will be developed in the form of ecological specifications related to specific water resources that require protection and in the case where the ecological category is higher as the ecological configuration specified for the class set.

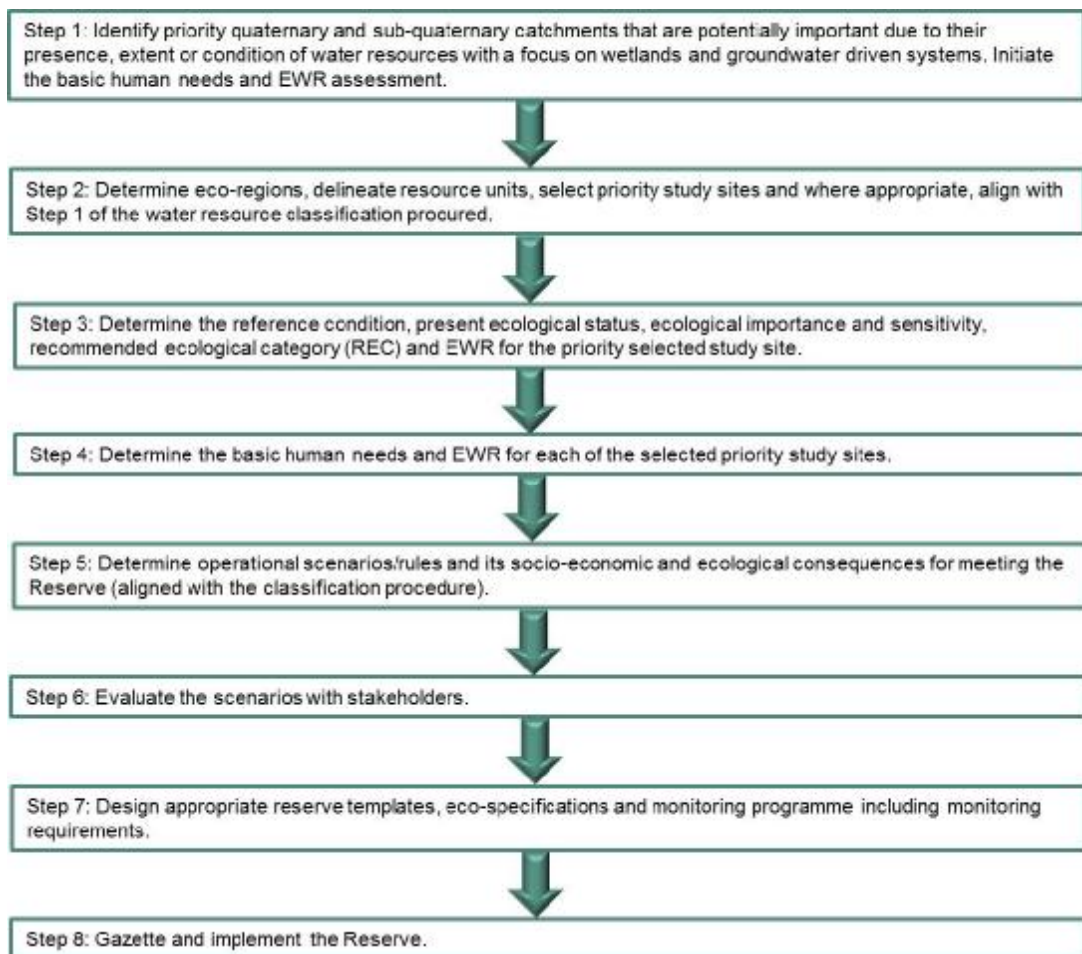


Figure 9: The EWR implementation process

In the Shingwedzi catchment where water resource classification has not been undertaken, information and results from the desktop, PES/EI/ES, FEPA and other related studies will be used to determine the preliminary Reserves for identified sites.

The various steps as defined in

Figure 9 and the approach to study execution indicated in Figure 5 will address the key requirements of the Terms of Reference, namely:

- ❖ Step 1 & 2 – Provides the context (management classes, RQOs, water use, river reaches, priority, priority catchments, wetlands and groundwater) to ensure protection or/and conservation of ecological important and heavily impacted areas. This will build on tasks 1 and 2 that will relate to the areas where ecological gaps exist. Based on the information collation and analysis, first survey and specialist assessment, the understanding of the scope of the Reserve determination and implementation requirements will be defined. At this stage legal direction will be sought to assist in guiding the outcomes and structure of the Reserve template that will be gazetted;
- ❖ Step 3 & 4 – Quantification of the ecological requirements of the identified water resources and definition of ecological specifications will be undertaken. This step will include the second survey if required and the Eco-classification. Where appropriate, specific protection measures will be specified to support the management class or biodiversity targets. Interaction of the various water resource components (river-groundwater, wetland-river and wetland-groundwater) will be taken into account to ensure that requirements are set to satisfy both the interaction requirements. The objectives and conditions required at a catchment level will also be assessed and defined. The basic human needs component of the Reserve will also be assessed where applicable. The results of the preliminary Reserve will be compared to the requirements contained in the Reconciliation Strategy, and adjustments will be made if required. This may require update of the water requirement projections;
- ❖ Step 5 & 6 – Specific scenarios will be developed taking cognisance of the scenarios assessed for the Reconciliation Strategy and Classification studies. These scenarios will be evaluated by the project team in terms of ecological and social consequences. A final set of scenarios will be presented to identify stakeholders for assessment and decision as to the most appropriate scenario to implement. This will consider what is achievable and practical while ensuring adequate protection. Operational assessment of the Olifants/Letaba System in context of the Reserve, management and operational criteria will be assessed. This final scenario will form the basis for the Implementation Plan to be developed as part of step 8;
- ❖ Step 7 – This step will involve the development of the draft gazette Reserve templates, including the ecological specifications, conditions and monitoring requirements for the selected priority water resources to ensure protection. The monitoring requirements will be presented in a way that the Department can develop indicators for compliance monitoring. Alignment with existing RQO study results will be done during this step to ensure that all the priority water resources, with emphasis on wetlands are included. Legal guidance will required at this stage to ensure that the gazetting process is supporting and the templates meet the requirements; and

Step 8 – This forms the final step in the process to develop an implementation plan for the Reserve to be gazetted.

This will include a Resource Management Plan for the Olifants/Letaba System that will define the implementation actions, management measures and interventions required to ensure that the Reserve is met.

This above finalisation of the EWRs will require application of the Water Resource Yield/Planning and water quality models in the Olifants/Letaba system to determine operational rules and requirements for meeting the Reserve. Methodologies/approaches that have been developed through the Department will be used for the implementation plan for the operationalization of the Reserve, including the DWA, 2009 'Operationalise the Reserve and the WRC, 2008 ' Methods and Software for the real-time implementation of the ecological Reserve'.

The stakeholder consultation will form a key component of the process and stakeholders will be brought along with the process to ensure that engagement undertaken will support the Reserve implementation process that is to follow. A robust and focused stakeholder engagement process will be undertaken that is aligned to the technical steps of the study. Stakeholders representing specific sectors of society (e.g. agriculture, mines, conservation, government and catchment based organisations) will be identified and asked to serve on a Project Steering Committee (PSC) for the duration of this project. It is the intention that these member representatives communicate the key outcomes and decisions of the study back their constituencies and communities. It is envisaged that three PSC meetings will be held during the course of the study, at key points in the project. The level of stakeholder engagement will range between technical involvement and consultation.

Stakeholders will be updated regularly on the status of the project. This will be done by the distribution of a) the announcement background information document b) invitations to stakeholders to attend the scenario workshops and lastly towards the end of the project it is anticipated to compile and distribute a newsletter that will provide information on the Reserve determined in the Olifants/Letaba system.

A proposed plan for Reserve implementation will be drafted as part of the study process. This will need to be taken forward through the DWS.

The Reserve determination and implementation will be followed as best suited to circumstances and conditions in the study area. This will be an iterative process and may have to be adapted according to the prevailing circumstances. The team will also strive to ensure that as much of the existing information will be used and the steps kept as simple as possible without comprising the validity of the process.

4.4.1 WETLANDS

Wetland typing, eco-classification and the identification of key drivers

The key wetlands visited will be classified in accordance with the Hydro-Geo-Morphic (HGM) classification system first described by Brinson (1993) and modified for application in South Africa by Marneweck and Batchelor (2002), Kotze, Marneweck, Batchelor, Lindley and Collins (2007) and SANBI (2009).

Given the extent of the study area, and based on experience of the wetland databases available, it is expected that Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) information will not be available for most systems.

As such, surrogate databases and information sources will be used where appropriate to derive general state and ecological importance indicators where possible. It is envisaged that regional and national land cover databases as well as provincial conservation plans, river health programme and FEPA information will be used as the baseline data for this purpose. Field observations will be used to support the eco-classification of the wetlands visited.

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

Prioritisation of the key wetlands visited

The key wetlands visited which will include those that form part of the gap analysis will then be prioritised based on consideration of the following criteria:

- Whether or not the system is, or occurs within, a Ramsar Site;
- Whether or not the system occurs within a conservation area;
- Whether or not the system is recognised as having cultural significance;
- Whether or not the system occurs in a database, regional, local or other, that indicates it as being an important wetland;
- Whether or not based on expert opinion, the system can be considered an important wetland;
- Whether or not the system is known to support rare or endangered species;
- Whether or not the system can be considered representative of a specific type representative of an eco-region;
- Systems known to contain peat (peatlands);
- Systems known or thought to be important in terms of supporting livelihoods or providing key ecosystem services;
- Systems thought to be important in terms of the hydrology, geohydrology and/or the biogeochemistry of a particular area or sub-catchment;
- Systems thought to be unique or representative of a type unique to a particular area or region;
- Whether or not the system forms part of a particular complex of wetlands that may be linked by certain attributes or a key driver; and
- Whether or not the system forms part of a biodiversity or landscape corridor that is considered important for a particular area or region or a particular species.

The above will further be considered in the context of the health or state of the wetland system and its likely trajectory of change given the current land-uses in the area or whether or not it is considered to be at risk from proposed new water uses in the area.

The intention is to produce a comprehensive priority wetland map for the entire WMA indicating additional wetlands that may need to be considered in terms of the Reserve, taking into account aspects related to land and water use issues in the WMA.

Scenario analysis

Using surrogate information such as land use datasets and the derived eco-classification of the additional priority wetlands, and based on known threats or pressures for development within the related catchment areas, the relationship between the threats/pressures and the expected change in condition of the priority wetlands identified will be determined. Wetland baseline condition or current PES will serve as the starting point. Expert judgement will be used to derive how the priority systems are likely to either stay the same or change depending on the pressures they are currently experiencing, or based on additional threats or pressures going forward. By taking this approach, it is envisaged that the team will be able to provide information to the DWS which will assist with filling in the gaps in the current wetland Reserve dataset, predominantly in relation to the identification of additional priority wetlands that may be under threat and which should be considered for inclusion in the wetland Reserve for the three main river systems.

Team workshops

It is envisaged that at least two additional workshop between the wetland specialists and other project specialists and the DWS will be held, one for the Olifants catchment and one for the Letaba and Shingwedzi catchments. The aim of the workshops will be to consider integration of the wetlands, groundwater and river components where possible.

4.4.2 GROUNDWATER

Previous groundwater studies related to the RDM process, and with reference to this study addressed (i) the understanding of the role of groundwater on the Reserve context (WSM, 2006) encompassing 23 quaternary catchments in the Letaba/Luvuvhu System (13 400 km²) and (ii) an Intermediate Reserve Determination (SRK, 2009) of 114 quaternary catchments in the former Olifants WMA (54 575 km²), will be used as reference.

No new approach/methodology for addressing the Reserve will be developed/implemented. The focus of the groundwater component of this investigation will be on rationalisation of previous reserve determination studies (i.e. the WSM and SRK approaches) and implementation of the groundwater reserve. Supporting groundwater management protocols, such as water use verifications and monitoring conditions for water users will be specified in more detail (per quaternary catchment related to the water utilisation status as per the Haupt approach).

Approach will be to run a groundwater use status assessment based on the latest monitoring and assessments (although individual reports where applicable for certain areas and compare the results with the results/recommendations of the WSM and SRK earlier studies. These studies were compiled in different (former) WMA and the critical issue will be to translate the results to a more common

baseline (*i.e.* the approach followed by the SRK project seems to be based on acceptable assessment procedures.

A way to assess the four outstanding tertiary catchments (B72, B73, B82 and B90) resource directed measures (reserve, classification and quality objectives) determination will be based on the SRK approach, but not limited to it.

Task 3 Deliverables –

- Desktop Eco-classification Report;
- Eco-classification report;
- EWR Report;
- Draft Gazette Reserve Templates (with ecological specifications and conditions);
- Monitoring programme and requirements; and
- Reserve implementation plan and Resource Management Plan.

4.5 TASK 4: COMMUNICATION AND LIAISON

A key component to the Reserve determination and implementation for the Olifants/Letaba system is the communication and liaison task. The study team will be responsible for the function and arrangement of the meetings for the specialist workshops, task teams, sectorial workshops, review committee and ad-hoc liaison. It is proposed that these meetings are scheduled in accordance with the study execution and deliverable schedule. Meeting members will be kept informed and updated as and when required. The stakeholder process for the project is summarised in Figure 10. The following sub-tasks will be undertaken.

4.5.1 Stakeholder identification and database

The identification of stakeholders will be an on-going process, refined throughout the process. Every effort will be made to link and align to existing structures and forums in the Olifants/Letaba System. The Classification and RQO Determination Study stakeholder databases will be used and built upon. This will periodically be updated if necessary. The idea is not to consult with everybody, but rather with representatives of specific sectors of society.

Typically, our team would identify stakeholders representing the following sectors of society:

- National, provincial (Mpumalanga and Limpopo) and local government (relevant local and district municipalities);
- Relevant residents' associations, rates payers organisations, community based organisations, agricultural organisations and NGOs;
- Environmental and water bodies, forums, groups and associations;
- Private sector (mining, business, industries) in the vicinity;
- Civil society; and
- Regional and local media.

The database is dynamic and will be constantly updated as more information becomes available and as stakeholder information change.

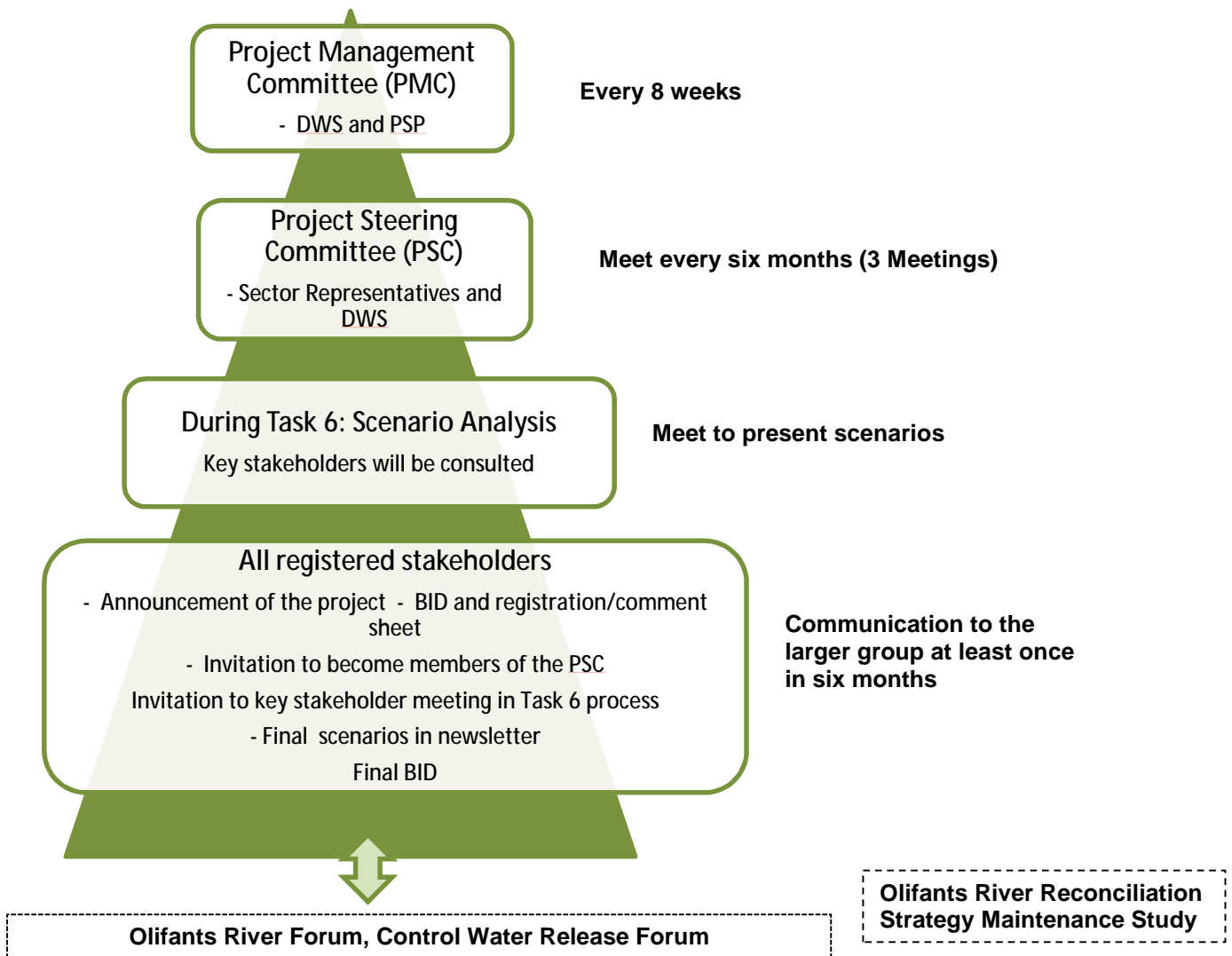


Figure 10: Summary of stakeholder engagement/communication

4.5.2 Announce the project

After the Inception Report is approved, a background information document (BID) will be compiled for distribution to all stakeholders that are listed in the database. The purpose of this document will be to announce that the DWS is undertaking the Reserve Determination study in the Olifants/Letaba system, the process to be followed, anticipated activities, key milestones, as well as how stakeholders can become involved in the project.

4.5.3 Issues and Response Report

An Issues and Responses Report will be compiled and updated throughout the period of the implementation of the project. This report will list all the comments from stakeholders (to be received from comment sheets, at meetings, via telephone calls, etc.) and responses from the project team.

4.5.4 Evaluation of scenarios with stakeholders – Step 6 of process

Stakeholders have to evaluate the scenarios presented by the DWS and its study team. The following approach and steps are anticipated:

- i Identification of stakeholders to be invited to a workshop where the scenarios are to be presented. These stakeholders will all be representatives of specific sectors in a specific catchment area;
- i Distribution of invitation letters and proposed agenda to the identified stakeholders providing them sufficient information about the status of the project, the purpose of the workshop/s and what will be expected of them (e.g. read through documents prior to the meeting/s and provide inputs and comments);
- i Compilation of a simplified document explaining the various scenarios which will be distributed to all stakeholders prior to the workshop to allow them to comment and provide input to other potential scenarios;
- i Hosting a workshop with the key stakeholders, the department and other organs of state and the project team to present the different scenarios. These will be minuted and will consist of an action list and will act as a comprehensive record of recommendations related to the stakeholder comments and inputs; and
- i Distribution of minutes of the workshop.

Should the scenarios which were presented have changed significantly with the consideration of stakeholder comments, the process to invite stakeholder inputs on the revised scenarios will have to be repeated to reach an acceptable level of agreement with stakeholders.

Once the scenarios have been agreed upon, stakeholders have to be informed of the final scenarios, its ecological consequences and the target ecological categories that is to be which will be submitted for final sign-off and gazetting.

4.5.5 Establishing a Project Steering Committee

Stakeholders representing specific sectors of society (e.g. agriculture, mines, conservation, government sectors, etc.) will be identified and asked to serve on a Project Steering Committee (PSC) for the project. The PSC should be a relatively small group of people of key representative bodies that will provide strategic advice and guidance; and ensure the objectives of the project are achieved. The PSCs that supported the Classification and RQO determination Studies for the Olifants and Letaba catchments will be used as a basis to identify members. The PMC of the study will be responsible for identifying PSC members.

The PSC will be invited to a meeting only when the study team has new information to discuss with the stakeholders. It is anticipated that the PSC will not meet more than three times over the 18 month period.

4.5.6 Collaborating with existing projects / structures in the Olifants/Letaba system

Existing projects of the DWS in the Olifants WMA, such as the Olifants Reconciliation Strategy Maintenance Study and organisations such as the Olifants River Forum and the Olifants Joint Water Forum will also be used to as platforms for the project communication and awareness creation.

Task 4 Deliverables –

- Stakeholder database;
- Background Information Document, Project Newsletter (at conclusion);
- Notes and minutes of the PSC and stakeholder meetings held;
- Registers of stakeholders of all meetings; and
- Issues and response report.

4.6 TASK 5: CAPACITY BUILDING

In terms of building capacity and ensuring skills transfer in DWS staff, the nine individuals who have been identified through the DWS project will be involved in the execution of specific tasks on the project and will attend training workshops addressing specific components or disciplines. There is also the opportunity for members from the Department to be seconded to the study team to assist in the study. These opportunities will be explored as the study unfolds.

The nine DWS individuals and their area of interest include:

| Name | Component |
|---|---|
| G Makhado | Hydraulics, Geomorphology, Wetlands |
| H Khumalo | Hydrology, Hydraulics, Wetlands |
| T Machaba | Water quality, Habitat Integrity, Geomorphology, Wetlands |
| V Thenga | Water quality, Macro-invertebrates, Wetlands |
| B Sejamoholo | Hydrology, Habitat Integrity, Wetlands |
| M Sekoele | Habitat Integrity, Wetlands |
| H Maluleke | Groundwater |
| Two officials from Mpumalanga and Limpopo regions | |

In terms of capacity building the study team proposes the following:

- Reserve Determination for a quaternary catchment (undertake process from start to end);
- Conduct introductory workshop on the Revised Desktop Model;
- Conduct introductory workshops on Eco-status models and the eco-classification process;
- Involve personnel in site assessments, data collection and analysis;
- Involve the DWS personnel in the process of EWR extrapolation – run the models for a given site;
- Conduct an introductory workshop on water resources modelling related to scenario analysis;

- Include personnel in scenario development and analysis– Project team workshops;
- Conduct an introductory workshop on wetland assessment and classification;
- A special session explaining the groundwater concepts and value of baseline datasets will be arranged during Task 3 of the investigation;
- Conduct a workshop on the requirements of the monitoring components of the study; and
- Include personnel in the development of ecological specifications and Reserve gazette template population.

The proposed capacity building programme is included as Appendix B.

Task 5 Deliverables –

- Capacity building report.

4.7 TASK 6: STUDY MANAGEMENT

Mr Trevor Coleman will be the study leader responsible for overall project direction and management. Mr Coleman is supported by Ms Kylie Farrell and Ms Priya Moodley with the management and coordination of the study. In order to ensure effective management of this study with the appropriate guidance from various levels of DWS the following management structures will be used for both guidance and review:

4.7.1 Client liaison

Liaison with the DWS Study Manager will include the following activities:

- Co-ordination on the arrangement Project Management Committee (PMC) meetings during the course of the study as required and support with PSC and technical meetings;
- Establishing interim communication (between meetings) to advise the DWS Study Manager of, inter alia, important events or problem situations, possible changes to the scope of work, appointment of sub-consultants, etc.; and
- Attending and addressing administrative and project management related requests.

4.7.2 Coordination of Study Team

The Study Manager will be responsible for overall coordination of the PSP Study Team and activities will include:

- Serving as link between DWS Study Manager and the study team;
- Ensuring that the sub-consultants and specialists are properly briefed prior to commencing with work;
- Convening regular meetings with the Task Leaders as dictated by programme and progress;
- Rendering guidance and assistance to the Task Leaders; and
- Monitoring and control of performance, programming and cost of study, including revision of the Study Programme, if and when necessary.

4.7.3 Financial control

A financial control system will be used to monitor and control costs.

Budgets will be assigned to the key activities for each main Task. Actual costs incurred will be correlated with completion targets to ensure compliance with progress. Should deviations from the allocated costs for the key activities become evident, the PSP Study Manager shall assess the reason/s and impact of such deviations and in liaison with the DWS Study Manager, institute corrective action as required.

No additional expenses outside the approved budget will be allowed without the prior written approval of the Client.

4.7.4 Study administration

Study administration duties to be performed will include:

- Compiling, certifying and submitting monthly invoices to the Client. The Client will be presented with only one invoice monthly (or as per deliverable) from the study team. The PSP Study Manager will arrange payment to the other members of the Study Team after receiving the payment from the Client;
- Keeping minutes of meetings with the Client and other stakeholder bodies and distribution thereof to the interested parties once it has been approved by the client;
- Assisting with the compilation of quarterly progress reports as well as progress reports;
- Ensuring that all project files are kept up to date and accessible to the Client if and when required; and
- The Study Manager will provide a secretariat to perform the required duties at identified stakeholder meetings.

4.7.5 Reporting and Reviewing System

The Project Management Committee will give overall guidance to the Study Team. Progress meetings will take place in accordance with the project programme.

4.7.6 Peer reviewer

An Expert peer reviewer has been identified to be included to review study outputs and the final deliverables. The reviewer will be confirmed through the project management team.

Task 6 Deliverables –

- Progress reports documenting work progress against programme and actual expenditure against cash flow estimates
- Minutes of the meetings
- Financial and administration information as required


4.8 TASK 7: STUDY CLOSURE

The study closure will involve finalising all deliverables: final reports, photographs, maps, datasets used in the study in spreadsheet format. All electronic data and reports will be collated onto CDs and

PDF versions of the final reports will be prepared.

This will include the raw data used to populate the models.

A study close out report will be submitted at the conclusion of the project.

Task 7 Deliverable –
 Study Close out Report

4.9 SUMMARY OF DELIVERABLES

The summary of deliverables for the study as outlined per task is included in Table 11 below.

Table 11: Summary of study deliverables

| DELIVERABLE | Due Date |
|---|-----------------------|
| Task 1: Study Inception | |
| <ul style="list-style-type: none"> Study Inception Report | 30 September 2015 |
| Task 2: Water Resource Information and Data gathering | |
| <ul style="list-style-type: none"> Information Gap Analysis Report | 31 December 2015 |
| Task 3: Implementation of the Ecological Water Requirements | |
| <ul style="list-style-type: none"> Eco-Classification Report | 31 March 2016 |
| <ul style="list-style-type: none"> Ecological Water Requirements Report | 30 June 2016 |
| <ul style="list-style-type: none"> Draft Gazette Reserve Templates and Final EWRs | 30 September 2016 |
| <ul style="list-style-type: none"> Reserve implementation plan and Resource Management Plan Report | 15 December 2016 |
| Task 4: Communication and Liaison | |
| <ul style="list-style-type: none"> Stakeholder database | 15 December 2016 |
| <ul style="list-style-type: none"> Background Information Document and Newsletter | As completed |
| <ul style="list-style-type: none"> Notes and minutes of PSC and stakeholder meetings held | As completed |
| <ul style="list-style-type: none"> Registers of stakeholders of all meetings | As completed |
| <ul style="list-style-type: none"> Issues and response report | 15 December 2016 |
| Task 5: Capacity Building | |
| <ul style="list-style-type: none"> Capacity building report | 15 December 2016 |
| Task 6: Study Management | |
| <ul style="list-style-type: none"> Progress reports | Monthly and quarterly |
| <ul style="list-style-type: none"> Financial and administration information | As required |

| DELIVERABLE | Due Date |
|--|------------------|
| Task 7: Study Closure | |
| <ul style="list-style-type: none"> Study Close Out Report | 15 December 2016 |

5 STUDY PROGRAMME

The study programme of the study tasks is provided as a bar chart programme of the tasks in Appendix C. In terms of the programme the study is runs for 18 months and will terminate on 31 January 2017.

6 STUDY TEAM

6.1 GENERAL

The study team consists of Golder Associates Africa, Wetland Consulting Services, JMM Stassen, Dr Wynand Vlok and Zitholele Consulting.

The study will be led by Trevor Coleman who has worked extensively on water resource projects over the years. He was involved in the Classification of Water Resources in the Olifants WMA, in development of the IWRM Plan for the Upper and Middle Olifants catchment and is extensively involved in the Management of the Controlled Released scheme for the Witbank and Middelburg Catchments. Trevor Coleman will be supported by Ms Priya Moodley as the project manager and Kylie Farrell as study co-ordinator. Task leaders include Retha Stassen, Eddie van Wyk, Warren Aken and Gary Marneweck, who are all experienced in working on ecological studies and water resource related projects and will provide an experienced support base to the study leadership.

The Study Leader will be responsible for the liaison with the Client and the general supervision of the Study.

6.2 TEAM MEMBERS

Details of the members that will be involved in the study are listed in Table 12 below.

Table 12: Team members involved in study

| Name | Study Role | Company | Hourly rate (R/hour) |
|----------------|--|----------------|-----------------------------|
| Trevor Coleman | Study Leader, Water Resource Operations and System Analysis | Golder | 1 990 |
| Priya Moodley | Project Manager and water quality | Golder | 990 |
| Warren Aken | Aquatic Biologist (Fish) | Golder | 850 |
| Kylie Farrell | Study Co-ordinator Aquatic Ecologist (aquatic macro-invertebrates) | Golder | 670 |
| Gary Marneweck | Wetlands Task Leader | WCS | 850 |
| Retha Stassen | Co-study Manager: Hydrologist, Integration of Ecology | JMM Stassen | 650 |
| Trevor Pike | Hydraulics | Specialist | 850 |
| Dieter Kassier | Wetlands assistant | WCS | 650 |

| Name | Study Role | Company | Hourly rate (R/hour) |
|--------------------|-------------------------------------|------------|----------------------|
| Patiswa Mngokoyi | Stakeholder Engagement Co-ordinator | Zitholele | 350 |
| Dr Wynand Vlok | Freshwater Ecologist (Mentor) | Specialist | 750 |
| Andrew Zinn | Terrestrial Ecologist (Vegetation) | Golder | 670 |
| Dr Etienne van Wyk | Groundwater Task Leader | Golder | 1 675 |
| Collen Monokofala | Groundwater | Golder | 1 260 |
| Tracy Skinner | GIS | Golder | 350 |

The following changes to the team have been made since the proposal was developed and contract signed:

- The role of Surita Siebrits as the GIS support has been replaced by Tracy Skinner.

6.3 ORGANISATIONAL STRUCTURE

The organisational structure related to task components is presented in Figure 11 below.

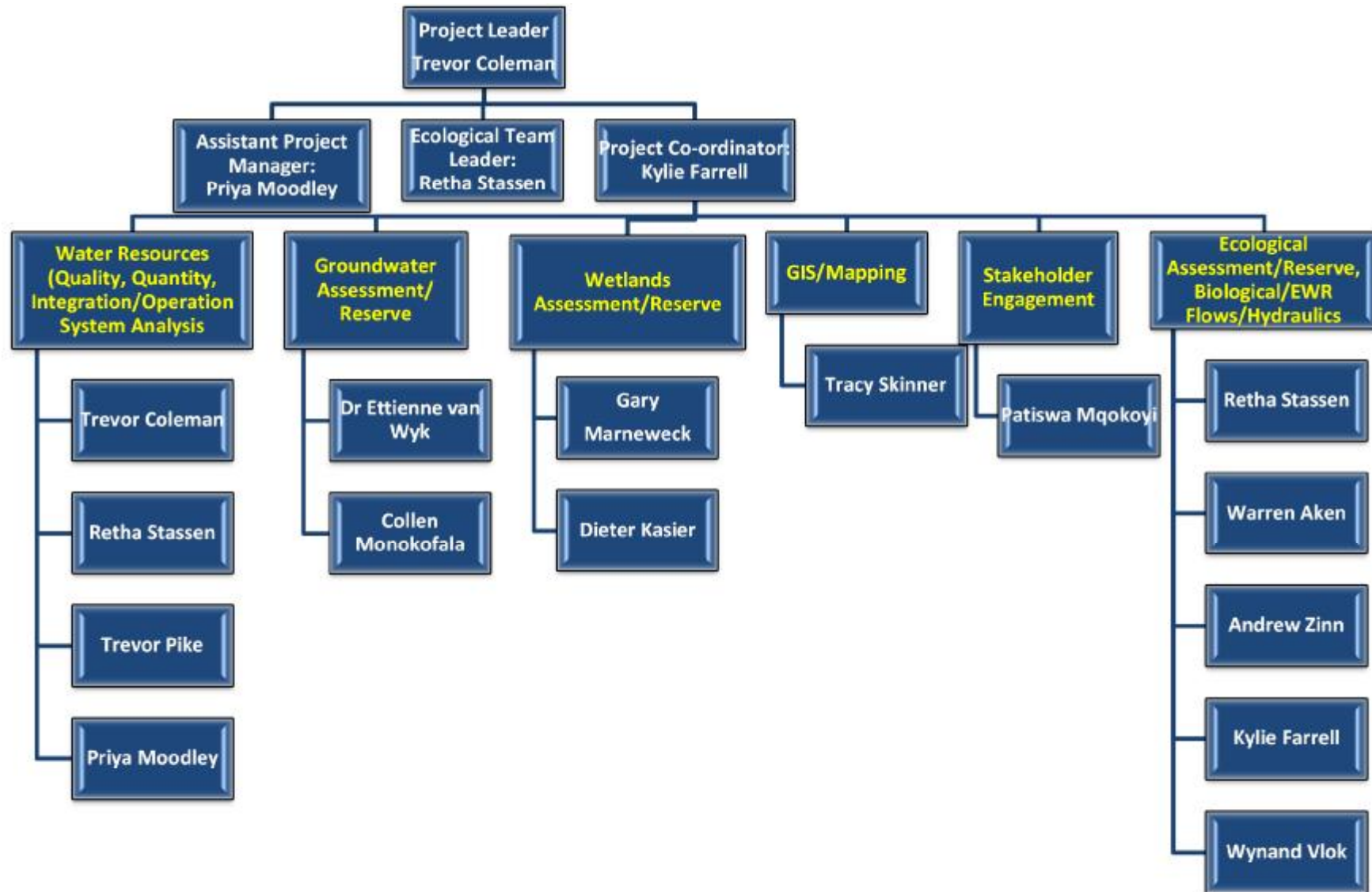


Figure 11: Organisational structure related to task breakdown

7 STUDY COSTS

7.1 SUMMARY COSTS

The cost estimates presented in this section are based on the tasks and are applicable to the study period, which has been programmed for 18 months, ending 31 January 2017. Table 13 represents the summary of the total study costs, with the breakdown of the costs being reflected in the following sub-sections.

Table 13: Summary of Study Costs

| Cost item | Costs (R) | | | % of Total |
|--------------------|-----------------------|---------------------|-----------------------|-------------|
| | Excl. VAT | VAT | Incl VAT | |
| Professional fees | R 3 483 530.00 | R 487 694.20 | R 3 971 224.20 | 93% |
| Disbursement costs | R 249 200.00 | R 34 888.00 | R 284 088.00 | 7% |
| Total | R 3 732 730.00 | R 522 582.20 | R 4 255 312.20 | 100% |

7.2 SUMMARY COST BREAKDOWN PER STUDY DELIVERABLE

A summary of the breakdown of the costs for the study deliverables for the study phases is provided in Table 14.

Table 14: Summary of cost breakdown per deliverable

| Phase/Deliverable | Cost | | |
|--|----------------------|-----------------------|-----------------------|
| | Excl VAT | VAT | Incl VAT |
| Study Inception Report | R 685129.60 | R 95 918.14 | R 781 047.74 |
| Gap Analysis Report | R 606884.80 | R 84 963.87 | R 691 848.67 |
| Implementation of the EWR: Survey and Eco-classification Report | R 590 251.60 | R 82 635.22 | R 672 886.82 |
| Implementation of the EWR: Draft EWR Report (including Consequences and Scenario Analysis) | R 718 908.00 | R 100 647.12 | R 819 555.12 |
| Final EWR Report, Draft Gazette Templates and Reserve Implementation Plan | R 807 328.00 | R 113 025.92 | R 920 353.92 |
| Project Finalisation: Resource Management Plan, Study Close Out and Issues and Response Report | R 324 228.00 | R 45 391.92 | R 369 619.92 |
| SUB TOTAL PROFESSIONAL FEES | R3 483 530.00 | R487 694.20.00 | R 3 971 224.20 |

| Phase/Deliverable | Cost | | |
|----------------------------|----------------------|---------------------|-----------------------|
| | Excl VAT | VAT | Incl VAT |
| TOTAL DISBURSEMENTS | R 249 200.00 | R 34 888.00 | R 284 088.00 |
| TOTAL STUDY COST | R3 732 730.00 | R 522 582.20 | R 4 255 312.20 |

7.3 DISBURSEMENTS

The proposed disbursement costs for the Study are R 249 200.00 (excl. VAT) and are allowed for in this study as lump sum amounts. Disbursements will be charged to the Client without mark-up and economy air travel will be used in all cases. The standard government rates for car travel will be used and any other similar items will be agreed with the Client. The proposed rates for disbursements and expenses are indicated in Table 15.

Table 15: Proposed Disbursements

| No. | Disbursements | |
|-----|--|---------------------|
| 1 | Travel | R 70 200.00 |
| 2 | Printing | R 10 000.00 |
| 3 | Communication | R 4 000.00 |
| 4 | Miscellaneous | R 62 500.00 |
| 5 | Venue hire | R 60 000.00 |
| 6 | Accommodation | R 22 500.00 |
| 7 | Subsistence | R 20 000.00 |
| | Total Disbursements (Excluding VAT) | R 249 200.00 |
| | VAT | R 34 888.00 |
| | Total Disbursements (Including VAT) | R 284 088.00 |

7.4 CONTINGENCIES

No allowance for contingencies has been made and any changes in costs will first have to be approved and then dealt with as variation orders.

7.5 CASH FLOW PROJECTION

A cash flow projection is provided in Appendix D.

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APPENDIX A

PROJECT MANAGEMENT COMMITTEE (PMC) MEMBERSHIP FOR THE STUDY

| Name | Affiliation | Contact Details | | Email address |
|----------------------|--|-----------------|--------------|--|
| Barbara Weston | DWS: Directorate: Reserve Determinations: Surface Water | 012 336 8821 | 083 631 0801 | WestonB@dwa.gov.za |
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APPENDIX B

CAPACITY BUILDING PROGRAMME

**DETERMINATION, REVIEW AND IMPLEMENTATION OF THE RESERVE IN THE OLIFANTS/LETABA SYSTEM
CAPACITY BUILDING PROGRAMME (Task 5)**

| CAPACITY BUILDING ACTIVITY PER STUDY TASKS | | LEVEL OF TRAINING | TIMEFRAME | KEY PERFORMANCE AREA | LEARNING AREA ADDRESSED | Jul-15 | Aug-15 | Sep-15 | Oct-15 | Nov-15 | Dec-15 | Jan-16 | Feb-16 | Mar-16 | Apr-16 | May-16 | Jun-16 | Jul-16 | Aug-16 | Sep-16 | Oct-16 | Nov-16 | Dec-16 | | |
|--|--|--|-----------|---|---|--------------|---------|--------|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---|--|
| TASK 1: INCEPTION and TASK 6: STUDY MANAGEMENT | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1 | Prioritisation of catchments/sites | Discussion and demonstration | 40 hours | IWRM | Prioritisation, Rationalisation process, information requirements, system and catchment understanding | ▲ 27 - 31 | | | | | | | | | | | | | | | | | | | |
| 1.2 | Project Management | Application | Ongoing | Project Management | Co-ordination and running of PMC meetings, meeting minutes, presentation, Project administration and financial management | | ▲ 28 | | ▲ 29 | | ▲ | | ▲ | | ▲ | | ▲ | | ▲ | | ▲ | | ▲ | | |
| TASK 2: WATER RESOURCES INFORMATION AND DATA GATHERING | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1 | Assessment of data, models, information | Discussion and demonstration | 6 hours | Water Resource Modelling | Understanding basin systems and modelling Understanding of RDM and Ecstatus models | | | | ◆ | | | | | | | | | | | | | | | | |
| | | | 6 hours | | | | | | | | | | | | | | | | | | | | | | |
| TASK 3: IMPLEMENTATION OF EWR/RESERVE | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1 | Surveys (biological, rapid, hydraulic, wetlands) | Discussion and demonstration and Application (Pilot catchment) | 56 hours | Implementation of the Reserve Determination Process | Field work, site selection, Site assessments, surveys, how to undertake a Rapid III assessment | | | | ▲ 6 to 17 | | | | ▲ | | | | | | | | | | | | |
| 3.2 | Application of Ecstatus Models | Application | 8 hours | | Ecoclassification | | | | | ◆ | ▲ | ▲ | ▲ | | | | | | | | | | | | |
| 3.3 | Rapid Reserve assessments | Discussion and demonstration | 4 hours | | Running of Desktop RDM model | | | | | ◆ | | | | | | | | | | | | | | | |
| | | Application | 16 hours | | | | | | | | | | ▲ | ▲ | ▲ | ▲ | | | | | | | | | |
| 3.4 | EWRs determination (extrapolation /update) | Discussion and demonstration | 6 hours | | Determination of EWRs | | | | | | | | | | | ◆ | | | | | | | | | |
| 3.5 | Scenario development | Discussion and demonstration | 8 hours | | Scenario generation and understanding of trade-offs within larger IWRM process | | | | | | | | | | | | | ◆ | | | | | | | |
| 3.6 | Scenario analysis | Application | 8 hours | | Running of models and determination of implications of alternate scenarios | | | | | | | | | | | | | | ▲ | | | | | | |
| 3.7 | Application of the above for selected quaternary catchment | Application | 80 hours | | Understand how to apply the complete Reserve process | | | | | | | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ | | | | | | |
| 3.8 | Groundwater Assessments | Discussion and demonstration | 8 hours | | Explanation the groundwater concepts and value of baseline datasets | | | | | | | ◆ | | | | | | | | | | | | | |
| 3.9 | Wetland Assessment | Discussion and demonstration | 8 hours | | Understanding classification and wetlands and setting of the Reserve | | | | | | | | | ◆ | ◆ | | | | | | | | | | |
| 3.10 | Ecological specification definition | Discussion and demonstration | 6 hours | How to develop ecological specifications | | | | | | | | | | | | | | | | | ◆ | | | | |
| TASK 3 and 7: IMPLEMENTATION OF EWR/RESERVE and STUDY CLOSURE | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.1 | Population of Reserve gazette templates | Discussion and demonstration and application | 4 hours | Gazetting Process | Population of the Reserve template, Integration with the Classification and RQOs, legal understanding | | | | | | | | | | | | | | | | | | ◆ | ▲ | |

| | |
|---|----------------|
| ▲ | = Detail |
| ◆ | = Introduction |

APPENDIX C
STUDY PROGRAMME

| Year | Schedule | Phases/Components | Tasks and Deliverables |
|--|---------------------------|---|---|
| 2015 / 2016 (Q2 and Q3) | July 2015 - December 2015 | Study Inception, gap analysis and Information Gathering Phase | Task 1: Project Inception |
| | | | Information collation and gathering |
| | | | Development of Water Resource Maps (Classifications, RQOs, current activities, priority wetlands) |
| | | | Project team workshop meeting |
| | | | Specialist workshop - priority site identification |
| | | | Inception report (Q2 deliverable) (30 September 2015) |
| | | | Capacity building programme |
| | | | Task 2: Water Resources and Information Gathering |
| | | | Gap analysis and review |
| | | | Priority sites confirmation |
| | | | Wetland specialist technical workshop |
| | | | Review of applicable models |
| | | | Field survey of priority sites in the Olifants catchment (current and additional sites) (7-16 Oct'15) |
| | | | Gap Analysis Report (Q3 deliverable) (15 December 2015) |
| | | | Task 4 (on-going): Communication and Liaison |
| Initiation of stakeholder communication - BID | | | |
| Task 6 (on-going): Study Management | | | |
| On-going project management (meeting schedules, meetings (2 PMC), progress reports, meeting minutes) (study team management and invoicing) | | | |
| 2015 / 2016 (Q4) | January 2016 - March 2016 | Implementation of the EWR - Review, Update, Refinement | Task 3: Implementation of the EWR/Reserve |
| | | | Preliminary Desktop Eco-classification |
| | | | Field survey of selected priority sites in Letaba and Shingwedzi catchments (and where wet season information is required for sites in the Olifants catchment) (Feb'16) |
| | | | Specialist workshop and report compilation |
| | | | Desktop eco-classification report (Q4 deliverable) (31 March 2016) |
| | | | Task 4 (on-going): Communication and Liaison |
| | | | PSC Meeting 1 |
| On-going project management (meetings (2 PMC), progress reports, meeting minutes) (study team management and invoicing) | | | |
| Capacity building (linked to surveys and workshops) (progress report) | | | |
| 2016/2017 (Q1) | April 2016 to June 2016 | | Task 3: Implementation of the EWR/Reserve |
| | | | Consequences and scenario analysis |
| | | | Liaison with DWS Directorates: Planning and Options Analysis |
| | | | Preliminary eco-specification definition |

| Year | Schedule | Phases/Components | Tasks and Deliverables |
|---|------------------------------|---|---|
| | | | EWR Report (including wetland report) (Q1 deliverable) (30 June 2015) |
| | | | Task 4 (on-going): Communication and Liaison |
| | | | Stakeholder meeting (Consequences Workshop) |
| | | | PSC meeting 2 |
| | | | Task 6 (on-going): Study Management |
| | | | On-going project management (meetings (2 PMC), progress reports, meeting minutes) (study team management and invoicing) |
| 2016/2017 (Q2) | July 2016 - September 2016 | Gazette Templates and Implementation Plan | Task 3: Implementation of the EWR/Reserve |
| | | | Specialist workshop and update report |
| | | | Final EWR Report (including wetland report) (Q2 deliverable) (30 September 2016) |
| | | | Task 3: Implementation of the EWR/Reserve |
| | | | Definition of final eco-specs and special conditions |
| | | | Gazette draft templates (Q2 deliverable) (30 September 2016) |
| | | | Reserve implementation plan (30 September 2016) |
| | | | Task 4 (on-going): Communication and Liaison |
| | | | PSC meeting 3 |
| | | | Stakeholder communication - BID (September 2016) |
| | | | Task 6 (on-going): Study Management |
| On-going project management (meetings (2 PMC), progress reports, meeting minutes) (study team management and invoicing) | | | |
| Capacity building (linked to Gazetting) (progress report) | | | |
| 2016/2017 (Q3) | October 2016 - December 2016 | Project finalisation | Task 7: Study Closure |
| | | | Resource Management Plan for Olifants/Letaba WMA (Q3 deliverable) (15 December 2016) |
| | | | Issues and response report (15 December 2016) |
| | | | Task 6 (on-going): Study Management |
| | | | On-going project management (meetings (2 PMC), progress reports, meeting minutes) (study team management and invoicing) |
| Close-out and study report (includes lessons learnt and recommendations) (Q3 deliverable) (15 December 2016) | | | |

APPENDIX D
CASH FLOW PROJECTION

Determination, Review and Implementation of Reserve in the Olifants/Letaba System WP10940

CASHFLOW REPORT AS AT 30 SEPTEMBER 2015

| Study Phase/Component | CASHFLOW PROJECTIONS | | | | | | | | ACTUAL EXPENDITURE (incl. VAT) | | Per Quarter | |
|--|----------------------|--------|----------------|--------------------------------|----------------------------------|---|---|-----------------------|-----------------------------------|--|--|--------------|
| | Invoice | Month | Financial Year | Proposed Projected Expenditure | Cumulative Projected Expenditure | Proposed Projected Expenditure (incl VAT) | Cumulative Projected Expenditure (incl VAT) | Invoiced (excl. VAT) | Cumulative invoiced | Total Actual Expenditure per Quarter (excl. VAT) | Total Actual Expenditure per Quarter (incl. VAT) | |
| Phase 1: Study Inception, gap analysis and Information Gathering Phase | 1 | Jul'15 | 2015 / 2016 | R 280 046.63 | R 280 046.63 | R 319 253.16 | R 319 253.16 | R 319 253.16 | R 319 253.16 | R 1 419 459.48 | R 1 618 183.81 | |
| | | Aug'15 | | Q2 | R 0.00 | R 280 046.63 | R 0.00 | R 319 253.16 | R 0.00 | | | R 319 253.16 |
| | 2 | Sep'15 | | R 405 082.97 | R 685 129.60 | R 461 794.59 | R 781 047.74 | R 461 700.00 | R 780 953.16 | | | |
| Phase 2: Implementation of the EWR/Surveys and Eco-classification | | Oct'15 | 2015 / 2016 | R 318 881.60 | R 1 004 011.20 | R 363 525.02 | R 1 144 572.77 | | | R 0.00 | R 0.00 | |
| | | Nov'15 | | Q3 | R 343 881.60 | R 1 347 892.80 | R 392 025.02 | R 1 536 597.79 | | | | |
| | | Dec'15 | | R 44 121.60 | R 1 392 014.40 | R 50 298.62 | R 1 586 896.42 | | | | | |
| | | Jan'16 | Q4 | R 18 881.60 | R 1 410 896.00 | R 21 525.02 | R 1 608 421.44 | | | R 0.00 | R 0.00 | |
| | | Feb'16 | | R 242 822.00 | R 1 653 718.00 | R 276 817.08 | R 1 885 238.52 | | | | | |
| | | Mar'16 | | R 228 548.00 | R 1 882 266.00 | R 260 544.72 | R 2 145 783.24 | | | | | |
| Phase 3: Implementation of the EWR / Scenario Analysis | | Apr'16 | 2016 - 2017 | R 384 080.00 | R 2 266 346.00 | R 437 851.20 | R 2 583 634.44 | | | R 0.00 | R 0.00 | |
| | | May'16 | | Q1 | R 153 200.00 | R 2 419 546.00 | R 174 648.00 | R 2 758 282.44 | | | | |
| | | Jun'16 | | R 181 628.00 | R 2 601 174.00 | R 207 055.92 | R 2 965 338.36 | | | | | |
| Phase 4: Gazette Templates and Implementation Plan | | Jul'16 | 2016 / 2017 | R 206 540.00 | R 2 807 714.00 | R 235 455.60 | R 3 200 793.96 | | | R 0.00 | R 0.00 | |
| | | Aug'16 | | Q2 | R 231 540.00 | R 3 039 254.00 | R 263 955.60 | R 3 464 749.56 | | | | |
| | | Sep'16 | | R 369 248.00 | R 3 408 502.00 | R 420 942.72 | R 3 885 692.28 | | | | | |
| Phase 5: Project finalisation | | Oct'16 | 2016 / 2017 | R 130 560.00 | R 3 539 062.00 | R 148 838.40 | R 4 034 530.68 | | | R 0.00 | R 0.00 | |
| | | Nov'16 | | Q3 | R 168 748.00 | R 3 707 810.00 | R 192 372.72 | R 4 226 903.40 | | | | |
| | | Dec'16 | | R 24 920.00 | R 3 732 730.00 | R 28 408.80 | R 4 255 312.20 | | | | | |
| TOTAL | | | | R 3 732 730.00 | | R 4 255 312.20 | | R 1 419 459.48 | | R 1 419 459.48 | R 1 618 183.81 | |

