Classification of water resources and determination of the Resource Quality Objectives in the Letaba Catchment

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PURPOSE OF THIS DOCUMENT

The purpose of this information document is to assist members of the Project Steering Committee (PSC) in preparing themselves for the first PSC meeting of 12 March 2013.

Included in this document you will find:

- Background information and more on the approach to this study;
- The process and components in determining the Status Quo;
- More about the visioning process;
- The role of the Project Steering Committee.

PSC members are invited to correspond with the public participation office or the technical team at the addresses provided below should you need more information regarding this study.

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Background

This study entitled “Classification of Water Resources and determination of the Resource Quality Objectives (RQOs) in the Letaba Catchment” was commissioned by the Chief Directorate Resource Directed Measures of the Department of Water Affairs (DWA) in October 2013.

The ultimate goal of the study is the implementation of the Water Resource Classification System (WRCS) in the Letaba catchment according to the steps proposed by the WRCS as well as to determine the Resource Quality Objectives in the catchment.

The WRCS is a set of guidelines and procedures for determining the desired characteristics of a water resource, and is represented by a Management Class (MC). The MC outlines those attributes that the DWA and society require of different water resources. The WRCS prescribes a consultative process to classify water resources (Classification Process) to help facilitate a balance between protection and use of the nation’s water resources. The determination of Management Classes (MCs) of the significant water resources in the Letaba will essentially describe the desired condition of the resource, and conversely, the degree to which it can be utilised by considering the economic, social and ecological goals of the users and stakeholders.

Study Approach

The Letaba River system has been the subject of various studies and information is available for this Classification study. Some of this information available includes water resource analysis (hydrology), development planning investigations (such as the recent completed '*Groot Letaba Water Resource Development Feasibility Study*') and the current study for the '*Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System*'. Various Ecological Water Requirement (EWR) determination studies have been carried out in the study area and the Letaba River is one of the few river systems where the implementation of the EWR has taken place in accordance with the recommendations and tools from the study on the '*Development and Pilot Implementation of a Framework to Operationalise the Reserve*'.

A detailed update of the hydrology and the development of high resolution network simulation models are underway as part of the above-mentioned Reconciliation Strategy Study. Application of the data in this Classification study is essential to ensure consistency in planning, operation and the selection of the appropriate management classes.

There are three DWA processes which forms the basis for the completion of this study. These are - the determination of the Reserve, the determination of the Management Classes (within the application of the NWRCS) and the description of the RQOs which qualitatively and numerically describe the Management Classes. Each of these processes has specific steps and various methods and tools which have been reviewed and or published by the DWA. The steps for each of the processes are linked and will be applied in an integrated manner during this study. Key aspects that will be assessed during this study are the determination of the status quo of the Letaba Catchment, the determination (including the use of existing Ecological Water Requirement results) of the Ecological Water Requirements for approximately 50 nodes in the Letaba system and, once the Management Classes have been accepted, RQOs will be developed to describe the Management Classes.

Determination of the Status Quo

The purpose of the status quo assessment is to define the current status of the water resources in the study area in terms of the water resource systems, the ecological characteristics, the socio-economic conditions and the Ecological Goods Services and Attributes. The status quo for each of the Integrated Units of Analysis (IUAs) will be provided in terms of the following aspects:

- Water resource infrastructure and availability;
- Ecological status;
- Socio-economic conditions; and
- Goods and services (communities and their well-being).

The evaluation of the status quo results of the three different sets of analysis, namely ecological, goods and services and socio – economic is to establish the baseline per individual section of the main stem or tributary. If during the analysis it appears that the ecological situation of certain river zones have deteriorated to a point where corrective action is necessary, it might involve an increase in water in the specific river section. There is a possibility that a negative economic impact or a cost increase might occur, should it involve a water availability curtailment due to another activity. If in a section of the main stem of the river more water is necessary to maintain or improve the status of the ecology of a specific the river section, the water will be supplied from the present available sources.

Below is a summary of the status quo findings which will be detailed in a Status Quo Report available the end of March 2013.

Integrated Unit of Analysis (IUA) - What is it and how is it used?

An IUA is a broad scale unit (or catchment area) that contains several biophysical nodes. These nodes define at a detail scale specific attributes which together describe the catchment configuration of the IUA. Scenarios are assessed within the IUA and relevant implications in terms of the Management Classes are provided for each IUA.

The identification and selection of the Integrated Units of Analysis (IUAs) were based on the following considerations:

- The resolution of the hydrological analysis and available water resource network configurations currently being

modelled.

- Location of significant water resource infrastructure.
- Distinctive functions of the catchments in context of the larger system.
- Available budget for refinement of the existing network and undertaking scenario analysis of each IUA. The Present Ecological State (PES) of each biophysical node was considered as well the type of impacts and the homogeneity of the state and impacts.

The following IUAs were delineated in the Letaba Catchment:

IUA 1: Letaba upstream of Tzaneen Dam
IUA 2: Letsitele and Thabina
IUA 3: Letaba downstream of Tzaneen Dam to the proposed Nwamitwa Dam
IUA 4: Letaba from proposed Nwamitwa Dam to Klein Letaba confluence
IUA 5: Southern tributaries of Letaba IUA 4
IUA 6: Northern tributaries of Letaba IUA 4
IUA 7: Upper Middel Letaba and tributaries upstream of Middel Letaba Dam
IUA 8: Klein Letaba upstream of Middel Letaba Dam
IUA 9: Klein Letaba downstream of Middel Letaba Dam
IUA 10: Lower Klein Letaba tributaries
IUA 11: Letaba main stem in the Kruger National Park
IUA 12: Letaba tributaries in the Kruger National Park

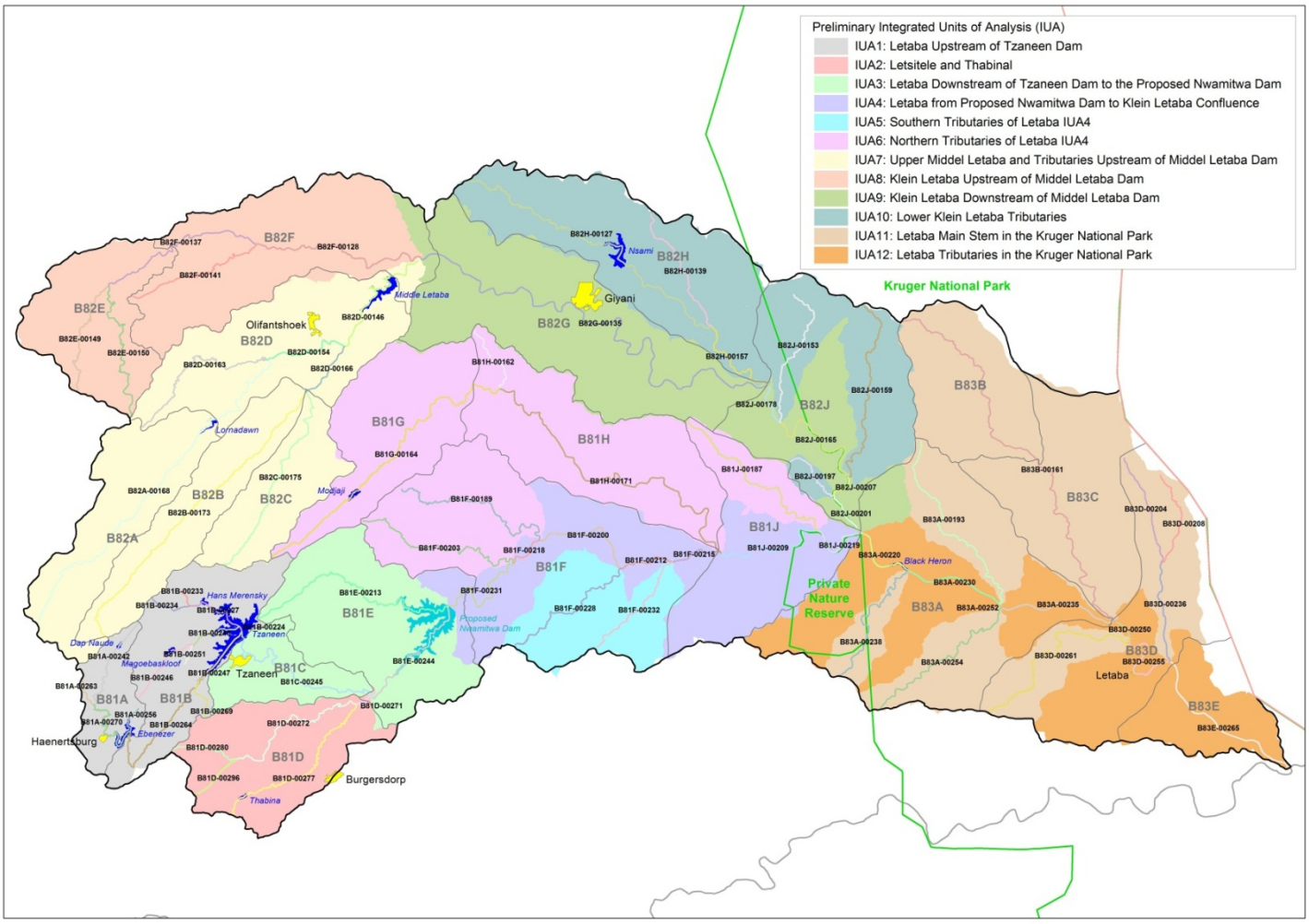

Figure 1: The twelve preliminary Integrated Units of Analysis (IUA) found in the Letaba Catchment

Water resources assessment

The Letaba River Catchment can be grouped into three major subsystems, namely:

- **The Groot Letaba River sub-system** stretching down to its confluence with the Klein Letaba River (includes Dap Naude, Ebenezer, Magoebaskloof, Tzaneen and Thabina Dams)
- **The Middel Klein Letaba River sub-system** stretching down to its confluence with the Groot Letaba River (includes Middel Letaba and Nsami Dams)
- **Lower Letaba River sub-system** which stretches from the confluence of the Klein and Groot Letaba Rivers to the confluence to the Olifants River just upstream of the border with Mozambique.

The water resources in the area can, in general, be described as fully utilised as the demand for water from the Letaba River already exceeds its yield capability. The Letaba River Catchment was delineated based on similar water resource operation, location of significant water resource infrastructure (including proposed infrastructure) and distinctive functions of the catchments in context of the larger system. This process was incorporated into the final identification and selection of the Integrated Units of Analysis (IUAs).

Water quality issues

Undesirable levels of water quality not only impact negatively on irrigation crop yields and quality and have an adverse impact on industrial water use, but also impact negatively on aquatic ecosystems, thereby degrading the very resource that so many services are dependent on. Bringing the quality of the water to acceptable levels for specific users can also be a costly process. The first step in the Classification process is evaluating the Status Quo of water quality across the catchment, for which an evaluation of land use is necessary.

Land use in the Letaba catchment consists largely of nature conservation in the form of national, provincial and private nature reserves and forest reserves. The primary land use along the rivers is citrus and sub-tropical fruit production, with grazing in the less fertile sandy loam soils. Removal of the vegetative cover by overgrazing has led to erosion in some places, resulting in an increased sediment load in the rivers. The main industrial development points are at Tzaneen (along the Groot Letaba River downstream of Tzaneen Dam), Nkowakowa and Giyani, with a number of sewage works spread throughout the catchment. Approximately 80 to 90% of the population can be considered as rural, scattered throughout the WMA. A large proportion of the population depends on subsistence farming. Intensive irrigation farming is practised in the upper parts of the Klein Letaba River catchment, upstream and downstream of the Middel Letaba Dam, and particularly along the Groot Letaba and Letsitele rivers. Land use in the catchment upstream of the Middel Letaba Dam is characterized by irrigated crop farming where tomato is the major crop.

There is little industrial or mining development in the catchment. Northern Canners at Politisi and the industrial complex at Nkowakowa near Tzaneen provide the major industries.

An extensive literature survey and review of Reserve data available to the study, has identified the following water quality hotspots, i.e. areas where water quality impacts range from large to serious. No critical water quality hotspot areas were identified. These are listed below:

- Poorly functioning WWTWs with concomitant impacts on elevated nutrients, salts and algal growth. These are in particular the Ga-Kgapene WWTW (Molototsi River; SQ B81G-00164); Modjadjiskloof-Duiwelskloof WWTW (Brandboontjies River; SQ B82C-00175); Lenyenye WWTW (Thabina River; SQ B81D-00277) and Giyani WWTW (Klein Letaba River; SQ B82G-00135).

- The extensive agricultural area of the Middel Letaba River, particularly upstream of Middel Letaba Dam, resulting in elevated nutrients, salts, algal growth and herbicides/fertilizers. Commercial fruit farms are fed by the Middel Letaba Canal Irrigation Scheme. Note that the tomato-growing area is on the upper section of the SQ due to high rainfall conditions. Location of the biophysical nodes will account for the spatial variability in water quality along the SQ.

- Citrus plantations, particularly on the Groot Letaba downstream from Die Eiland and the Letsitele River (at Letsitele Tank), with increases in nutrients, salts, algal growth and herbicides/fertilizers.

Ecological status quo

A desktop analysis was undertaken to determine the ecological status quo (otherwise referred to as the Present Ecological State (PES)) of 75 river reaches covering the Letaba catchment. The PES is described in terms of Ecological Categories (EC) of A to F with A being almost natural and F meaning critically modified. Reasons for the change from natural is provided and what is especially important, is whether these are flow (eg abstraction) or non-flow (eg riparian vegetation removal or land use practices) related.

The Letaba catchment is characterised by large dams, of which the majority are concentrated in the upper reaches of the Letaba, irrigation of mainly orchards, rural settlements and subsistence agriculture (with the often associated overgrazing, trampling and erosion) and the conservation areas at the lower end (Kruger National Parks and Letaba Ranch). Flow modification in terms of decreased flows is one of the most severe impacts (Letaba, Klein and Middel Letaba Rivers)

The main impacts upstream of Tzaneen Dam are related to forestry, abstraction, dams and their barrier effect, alien vegetation and irrigation.
The Letsitele River's PES varies from a B (near natural) Ecological Category (EC) (at the source) to a D (Largely modified) EC for most of the rest of the river. This is mainly due to the presence of many tributary dams, irrigation, settlements and abstraction. The Thabina tributary is also in a D PES, but it must be noted that the source zone and some other small sections are in a much better state than a D PES.

Two of the north east flowing tributaries are in a B PES as they both flow through private conservation areas.

The Middel and Klein Letaba Rivers are, outside of conservation areas, mostly in a D and C PES. The PES is mostly due to many dams (main river and mostly tributaries), irrigation and the presence of large settlements. Two of the rivers are in an E PES and the reasons for this are:

- Intensive irrigation and many dams present throughout the whole reach.
- Presence of a large dam in the reach which impacts on instream continuity and contributes to flow modification. There are also extensive canal systems present in this reach.

The lower section of the river in the conservation areas are a mix of mostly A PES for those rivers with their source and whole length of river in the conservation area, and a C PES for the main Letaba River. In these reaches the main Letaba River bears the brunt of all the severe utilisation of the water resources outside of the conservation areas, as well as sedimentation which impacts on the channel. In effect, the river is physically much smaller than natural within a very large macro channel which is maintained by the low frequency large floods that still come through.

Status quo of Ecological Goods, Services and Attributes

Ecological Goods, Services and Attributes (EGSA) are the goods and services provided by the river (and associated ecological systems) that result in a value being produced for consumers. Provisioning services are the most familiar category of benefit, often referred to as ecosystem 'goods', such as foods, fuels, fibres, medicine, etc., that are in manycases directly consumed. Other services include cultural services (ritual use of rivers, aesthetic or historical importance), regulating services (e.g. water quality inputs), and supporting services (e.g. nutrient formation).

The study area is located in a region that is largely rural in nature with a number of regionally important urban nodes and smaller satellite towns, as well as rural settlements. Based on the status quo analysis the catchment has been divided into zones that reflect the ecological goods and services attributes as a direct dependent of land use. For the purposes of this catchment five different land use forms that reflect types of ecological goods and services that might be associated with the usage have been identified. The land use based zones are:

- Commercial Agriculture and Plantation: This is largely given over to zones dominated by commercial farming entities. Utilisation of ecological goods and services tends to be low and restricted often to farm workers or incidental recreational aspects.

- Subsistence agriculture: These areas are dominated by subsistence agriculture but in areas where population densities are relatively low. Utilisation of ecological goods and services tends to be higher here and the populations that make use are often poor and marginal.

- Rural Closer Settlement – Subsistence: These are the former homeland areas that have generally higher population densities than the purely subsistence areas. In some instance densities are high enough to be categorised as closer settlement/informal urban. Utilisation of ecological goods and services tends to be higher here and the populations that make use are often poor and marginal. However, the population densities are such that resources tend to be under pressure.

- High Density Formal Urban: These are the SQs heavily influenced by the town of Tzaneen. The utilisation of ecological goods and services tends to be low as the populations tend to be urbanised and alienated from direct use of the resources.

- Recreational/Dams/Game Farms. These are areas given over to game farms (notably the Kruger Park) as well as SQs dominated by dams. Recreational usage tends to dominate ecological goods and services attributes.

Socio-economic status quo

The economic analysis consists of the status quo in the Letaba Catchment regarding the large water users such as irrigation agriculture, commercial forestry, saw mills, tomato and fruit juice fruit processing plants and eco-tourism. The economic value of water use for each economic sector was determined.

The use of the Water Impact Model (WIM) and Production Impact Model (PIM) was applied to the Letaba catchment. Some of the components that were used includes the Limpopo Social Accounting Matrix (SAM), computer based crop budgets (Combuds), turnover of industries such as the tomato and fruit juice factories. For eco-tourism the number of bed nights sold was also used. These the results were expressed GDP, job opportunities and distribution of household income to the low, medium and high income groups.
Direct employment creation and payments to low – income households is the two macro – economic parameters providing the best indication of the positive impact of a specific economic activity on the local social - economic conditions of the local population.

The irrigation agriculture sector appears to have the highest economic impact Letaba catchment, with citrus and tomato production the leading crops.. The income from the economic activity resulted in creating job opportunities and income being distributed to the low income households.

Determining the Resource Quality Objectives

Once the Management Classes have been accepted, RQOs will be developed to describe the Management Classes. Some RQOs will be numerical, and other descriptive; all depending on the extent of data available. The numerical RQOs will for example be used in monitoring which is very important to see that the Management Classes are being maintained and improvement within these Management Classes being achieved where necessary.

Visioning for each catchment

“It is widely acknowledged that a fundamental objective of integrated water resource management (IWRM) is to ensure that resource-based costs and benefits are appropriately distributed in society (Van Wyk et al., 2006a).” Visioning is a process of articulating society’s aspirations for the future – in this case, the ‘basket’ of benefits to be derived from aquatic ecosystem services and the costs associated with their use.”
The visioning process is important as it generates a dialogue that promotes ongoing shared awareness and understanding amongst resource users and encourages people to adjust their individual demands on the resource in the broader interests of sustainability and co-operative management. This promotes equity and shared understanding of the costs and benefits of different resource use options.

A visioning for the water resources of the Letaba Catchment will take place at the 1st PSC meeting on 12 March 2013. The visioning will help to link management actions to the vision and ensure that societal values and management objectives are linked and realised. The ‘water resource’ is defined to include a watercourse, surface water, estuary or aquifer, on the understanding that a watercourse includes rivers and springs, the channels in which water flows regularly or intermittently, wetlands, lakes and dams into or from which water flows, and where relevant the bed and banks of the

system." The quality of the resource (the 'resource' being the ecosystem providing services beneficial to people) is defined broadly to include fluxes in flow; physical, chemical and biological characteristics of the water; the character and condition of the in-stream and riparian habitat; and composition, condition and distribution of the aquatic biota.

The Letaba Catchment is a very large and diverse area in terms of its ecology, and the economic and social activities that characterise it. Therefore smaller areas will be used that have been identified based on their similar socio-ecological characteristics. These areas are called the units of integrated analysis (IUA) – see map on page 3. "Use and user needs, plus the state of the resource, are dynamic over space and time." It has therefore been divided into 29 IUAs based on socio-economic, ecological and water infrastructural characteristics.

Role of the Project Steering Committee

The Project Steering Committee (PSC) will be established at the first PSC meeting which will take place on 13 March 2013. A draft Terms of Reference will be discussed by all members. PSC members were invited from various sectors of society – as the objective is to have all sectors of society represented on the PSC. The main purpose of the PSC is to guide the process of the study, with the following specific objectives:

- Provide strategic direction and guidance on the study process and tasks;
- Guide the study team on the desired state of water resources within the Letaba catchment;
- Provide technical input and support information to the process where available;
- Provide direction on the significant water resources to be classified and integrated units of analysis to which they apply;
- Provide input to the scenarios to be evaluated as part of the classification process to be presented to stakeholders;
- Direct the study process to reach the desired objectives;
- Assist in the evaluation of study risks, and study risk management approaches and
- Serve as representatives of the stakeholder bodies and organisations and report back to them on an ongoing basis regarding the study decisions and results.

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Some definitions for terminology used in this document

Ecological Water Requirements (EWR): The flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components. The EWRs as determined by the Comprehensive Reserve study of 2001 will be applied in this study.

Ecological Water Requirement Sites: Ecological Water Requirement sites are set at specific points on the river. These sites provide sufficient indicators for the specialists to assess environmental flows and information about the variety of conditions in a river reach. An EWR site consists of a length of river which may consist of various cross-sections for both hydraulic and ecological purposes. EWRs for 16 sites were recommended for preliminary Reserve as part of the Comprehensive Reserve study and 3 additional sites on smaller tributaries were recommended for lower confidence preliminary Reserves in 2007.

Integrated unit of analysis (IUAs): The basic unit of assessment for the classification of water resources. The IUAs incorporates socio-economic zones and is defined by catchment area boundaries.

Reserve: The quantity and quality of water needed in a water resource (e.g. estuaries, rivers, lakes, groundwater and wetlands) to sustain basic human needs and protect aquatic ecosystems to ensure ecologically sustainable development and utilisation of a water resource.

Resource Quality Objectives (RQOs): Numeric or descriptive (narrative) goals for resource quality (includes all aspects of water quantity, water quality and aquatic ecosystem quality, the latter including the quality of in-stream and riparian habitats and aquatic biota) within which a water resource must be managed. These are given legal status by being published in a Government Gazette.

Resource Water Quality Objectives (RWQOs): RWQOs are numeric or descriptive in-stream water quality objectives set to provide detail upon which to base the management of water quality. RWQOs integrate ecological water quality requirements that and user fitness for use requirements.

Significant Water Resources: Water resources that are deemed to be significant from a water resource use perspective, and/or for which sufficient data exist to enable an evaluation of changes in their ecological condition in response to changes in their quality and quantity of water. Water resources are deemed to be significant based on factors such as, but not limited to, aquatic importance, aquatic ecosystems to protect and socio-economic value.

Nodes: These are modelling or evaluation points in the river system, representative of an upstream reach or area of an aquatic eco-system (rivers, wetlands, estuaries and groundwater) for which a suite of relationships apply. A node is typically set at the outlet of a tributary where the flow and water quality needed to be met for a particular scenario are set. The flows set to be present at the node are based on the relevant ecological categories defined at that point in the river.

Present Ecological State (PES): The PES describes the status of a river according to current ecological status or health compared to the natural status.