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

Determination of Resource Quality Objectives in the, Crocodile (West), Marico, Mokolo and Matlabas Catchments in the Limpopo Water Management Area

Project Steering Committee Meeting 2 - Background Information Document
Februarv 2017

PURPOSE OF THIS DOCUMENT

This Background Information Document (BID) serves to update stakeholders on the progress of the study being undertaken by the Department of Water and Sanitation (DWS), to determine Resource Quality Objectives (RQOs) for the water resources in the Mokolo, Matlabas, Crocodile West and Marico Catchments in the Limpopo Water North West Water Management Area (WMA01).

It provides:

- A brief overview of the study progress;
- A brief description of the RQO development process;
- An extract of proposed Draft RQOs for the upper reach of the Crocodile River for illustrative purposes.

Stakeholders are invited to participate in the process by attending stakeholder meetings or by corresponding with the stakeholder engagement office or the technical team at the addresses provided below.

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INTRODUCTION

Chapter 3 of the National Water Act, 1998 (NWA, Act 36 of 1998) lays down a series of measures which together are intended to ensure the comprehensive protection of all water resources. These measures includes the classification of water resources, setting the Reserve and establishing resource quality objectives. The aim of protection water resources is to ensure that water is available for current and future human use and sustaining our ecosystems. This is achieved by ensuring enough water of the desired quality is in the resource to maintain the overall ecological functioning of the rivers, wetlands, groundwater and estuaries. Protection of the water resource is therefore about the quantity and quality (overall health) of the nation's water resources.

It is within this framework that the Chief Directorate: Water Ecosystems (CD: WE) of the Department of Water and Sanitation (DWS) commissioned the study "Determination of Resource Quality Objectives (RQOs) in Crocodile (West), Marico, Mokolo and Matlabas catchments in the Limpopo Water Management Area (WMA)". Proposed water resource classes have been completed in these catchment areas and the determination of the RQOs follows on from this process. The purpose of the study is to implement the RQO determination procedure in the catchment area and in so doing determine the RQOs for the selected water resources. The proposed RQOs will be published for public comment by way of government gazette and once approved by the Minister, the management classes and RQOs will be gazetted and thereafter be implemented.

RQOs are defined by the National Water Act, 1998 as clear goals relating to the quality of the relevant water resources. RQOs translate the management class of the water resource (either Class I, II, or II) into flow, quality, habitat and aquatic ecosystem management goals that need to be achieved to meet the desired class. These objectives are a numerical or descriptive statement of the conditions which should be met in the receiving water resource in order to ensure that the water resource is adequately protected. The RQOs may inform decision-making relating to the use of water in a specific water resource**. RQOs are descriptors of conditions of water resources that need to be met in order to maintain or improve the overall quality of the resource.**

RESOURCE QUALITY OBJECTIVES

In terms of the National Water Act, the RQOs gives effect to the water resource class and may relate to the following:

- the Reserve;
- the in-stream flow;
- the water level;
- presence and concentration of particular substances in the water;
- the characteristics and quality of the water resource;
- the in-stream and riparian habitat quality;
- characteristics and distribution of aquatic biota; and
- the regulation or prohibition of in-stream or land-based which may affect the quantity of water in or quality of the water resource, and
- any other characteristic.

RQOs encompass four components of the resource:

- Water quantity;
- Water quality;
- Habitat integrity; and
- Biotic characteristics.

RQOs are important management objectives against which resource monitoring will be assessed. Compliance monitoring will provide an indication as to whether the water resource class is being maintained. In general, RQOs will form important sustainability indicators for water resource management.

STUDY AREA

The study area for the RQO Determination study is the Crocodile (West), Marico, Mokolo and Matlabas, (CWMMM) Catchments which are part of the Limpopo Water Management Area (WMA) (see Figure 1 on last page). Much of the area has low rainfall with significant inter-dependencies for water resources between catchments and with neighbouring WMAs.

The catchment areas lie predominately within the North West Province and include the northern part of Gauteng as well as the south-western portion of the Limpopo Province. Towards the north west it borders on Botswana. The main river systems within the catchment area are (Crocodile, Marico, Mokolo and Matlabas rivers) flow northwards to join the Limpopo River. Major tributary systems include the Pienaars, Apies, Moretele, Hennops, Jukskei, Magalies, Elands, Klein Marico, Molopo, and Ngotwane rivers.

The Pilanesburg Nature Reserve, the Cradle of Humankind Heritage Site, the Marakele Nature Reserve, the Bafokeng Tribal area, the dolomitic wetland or eye systems and large dams such as the Hartbeespoort, Vaalkop, Roodekopjes, Klipvoor, Roodeplaat, Molatedi and Mokolo Dams are all very important features in the catchment area. The Pilanesburg Nature Reserve, the Cradle of Humankind Heritage Site and Hartbeespoort Dam are key tourists' areas in South Africa.

The area is altered by catchment development, with economic activity dominated by urban areas and industrial complexes of northern Johannesburg and Tshwane, with platinum mining north-east of Rustenburg, and power generation and mining. In the Lephalale area. Economic activity is mainly centred around commercial agriculture, together with increasing mining operations, game and livestock farming and eco-tourism. The major land-use is irrigation farming, with private and Provincial nature reserves as well as extensive coal and platinum mining. Parts of the catchment area are also largely rural in nature.

The water resources of the catchment area support major economic activities and a population of approximately 5 million people. The surface water potential of the area has largely been developed. Large dolomitic groundwater aquifers occur along the southern part of the area. Groundwater is used extensively in the catchment area. The major groundwater uses are mainly for domestic and irrigation purposes. However, over exploitation occurs in certain areas of the catchment particularly (state where).

Several inter-water management area transfers (surface water) exist, all of which bring water into the catchment. A transfer from the Crocodile (West) catchment into the Mokolo catchment is being planned to support the power generation and expected growth in mining in the Lephalale area.

RQO STUDY PROCESS

The departmental Procedure to Determine and Implement Resource Quality Objectives is being employed to determine the RQOs for the water resources in the Crocodile (West),

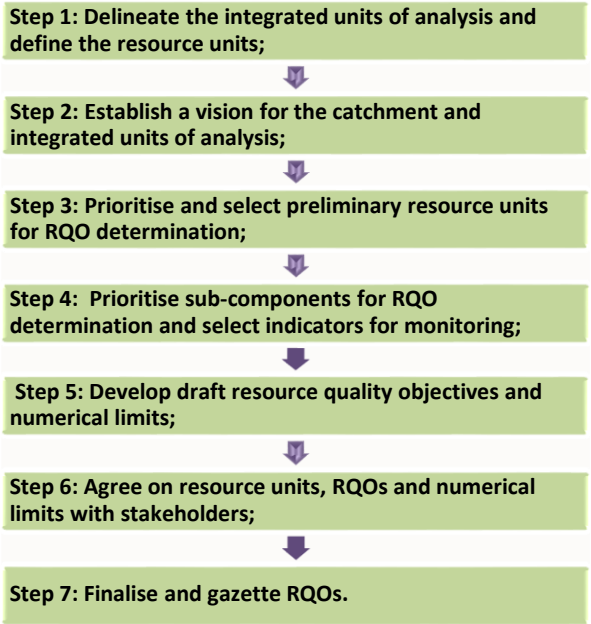

Figure 2: Steps to determine RQOs

Marico, Mokolo and Matlabas, Catchments. The guideline seven step process as depicted in Figure 2 is being implemented.

WHERE ARE WE IN THE RQO PROCESS?

The RQO determination study for the water resources in the Crocodile (West), Marico, Mokolo and Matlabas Catchments has progressed steadily over the past 11 months since project initiation in March 2016.

In terms of the seven step procedure outlined above the progress and outputs of the study thus far are briefly described in Table 1 below.

Table 1: Outputs of the study to date in terms of the RQO Determination Process

RQO PROCESS	Output
Determination of the Integrated Units of Analysis (IUAs)	Each integrated unit of analysis (IUAs) represents a homogenous catchment area of similar impacts which must be considered in the determination of RQOs. A total of 20 IUAs were delineated for the Crocodile (West), Marico, Mokolo and Matlabas Catchments area as an output of the Water Resource Classification Study, (2013).
Delineation and Prioritisation of Resource Units (RUs) (May to July 2016)	A resource unit (RU) is a section of a water resource within an IUA that is sufficiently and ecologically distinct to warrant its own specification of RQOs. In the Crocodile (West), Marico, Mokolo and Matlabas Catchments eighty two RUs were delineated. Subsequently, fifty-seven of these RUs (including river, groundwater wetland priority areas and eighteen dam RUs), have been prioritised. The prioritised resource units are listed in Table 2 and shown in a map in Figure 3.
Prioritisation of sub-components and selection of indicators (August to September 2016)	The components *viz*. habitat, biota, quantity and quality of the water resource per resource unit were evaluated and sub-components, (e.g. flow, salts, fish, in-stream habitat) were prioritised for development of RQOs. This was done in consultation with specialists and discussion with stakeholders at PSC meetings held in September 2016. Key indicators for monitoring the sub-components were then selected for each RU. Stakeholders were given an opportunity to provide input and feedback.
Development of Draft Resource Quality Objectives (RQOs) and Numerical Limits (October to December 2016)	Draft RQOs have been developed for the sub-components selected per RU. RQOs can either be narrative statements or numerical providing broad quantitative descriptions of the water resource. The RQOs relate to the components, sub-components and selected indicators of each RU in the catchment areas. Numerical limits associated with the RQOs were then developed where applicable. Numerical limits translate the narrative RQOs into numerical values which can be monitored and assessed for compliance. Numerical limits were formulated where applicable based on the classes already determined. RQOs will be set for rivers, dams, wetlands and groundwater

As part of the RQO development process thus far, key outputs included the prioritisation of resource units, the components, selection of sub-components and indicators for which RQOs should be set. The study is now at Step 6 of the RQOs process (**Figure 2**):

> **'Step 6: Agree on resource units, RQOs and numerical limits with stakeholders.'**

EXAMPLE OF PROPOSED RESOURCE QUALITY OBJECTIVES AND NUMERICAL LIMITS

An extract of the Crocodile (West), Marico, Mokolo and Matlabas Catchment RQO Template is provided in Table 3 below for illustrative purposes to provide an indication of what the RQOs and numerical limits will comprise of. This example illustrates the proposed draft RQOs for the Crocodile River from the Jukskei River confluence to inflow into Hartbeespoort Dam, RU 1_9. This illustrates the example for the rivers component. RQOs for priority wetlands and groundwater resources have also been developed.

STAKEHOLDER ENGAGEMENT

The RQO study process is supported by a focused stakeholder engagement that is aligned to the technical steps of the study. Stakeholders representing various and all relevant interests and sectors of society, technical specialists and the various relevant organs of state in the catchment areas form part of the process and have been invited to participate.

To date the study has been announced and a background information document has been distributed for information. Stakeholder registrations are done on an ongoing basis.

It is the intention of the Department, (DWS) that stakeholders be involved at key steps, oversee the RQO process and provide input, comment and guidance as well as communicate the key outcomes of the study back to their constituencies and communities. As part of the RQO development process,

stakeholders were consulted at the first round of Project Steering Committee meetings held in September 2016 were the prioritised RUs and the sub-components and indicators selected were confirmed.

At this stage of the process, step 6, it is appropriate that stakeholders are formally engaged on the draft RQOs and numerical limits proposed. It provides an opportunity for stakeholders to engage in the process and to review and provide guidance on the amendments to the draft RQOs. Therefore as part of the process, the second round of Project Steering Committee meetings are being planned to obtain comments, guidance and inputs of the proposed RQOs for the Mokolo, Matlabas, Crocodile (West) and Marico Catchment areas.

Project Steering Committee Members are invited to attend **any one** of the two meetings to be held. Registration for any one of these meetings may be done by contacting the stakeholder engagement office (details on page 1) or by completion of the registration sheet enclosed with this BID.

The Project Steering Committee meetings will be held as follows:

Rustenburg

Date: **Tuesday, 28 February 2017**
Time: **10h00 to 13h30**
Venue: **Protea Hunters Rest, Hotel**

Lephalale

Date: **Wednesday, 1 March 2017**
Time: **10h00 to 13h30**
Venue: **Palm Park Hotel**

Following the Project Steering Committee meetings, and after the comment period has been closed, the draft RQOs will be revised where necessary. The proposed RQOs and numerical limits agreed upon for the Crocodile (West), Marico, Mokolo and Matlabas catchment areas will be published by way of notice in the Government Gazette for public comments as the final step in the study process. Written comments may then also be submitted to the Department during the 60 day public comment period.

Thereafter, once comments are addressed, the final management classes and associated RQOs for the Crocodile (West), Marico, Mokolo and Matlabas Catchment areas will be gazetted for implementation.

DWS Study Managers

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Figure 1: Map of the study area

Table 2: Prioritised Resource Units for the Crocodile (West) catchment, Marico catchment and Mokolo and Matlabas catchments

IUA1	Upper Crocodile/Hennops/Hartebeespoort	
RU	**Delineation**	**Catchment**
1_1	Upper Hennops and Rietvlei Rivers to inflow to Rietvlei Dam	A21A
1_2	Rietvlei Dam	A21A
1_3	Hennops River from outflow Rietvlei Dam to the A21B catchment (including Kaalspruit and Olifantspruit tributaries)	A21B
1_4	Upper Pienaars River, Edendalespruit and Moretlele Rivers to Roodeplaat Dam	A23A
1_5	Roodeplaat Dam	A23A
1_6	Upper and middle reaches of Apies River, Skinnerspruit, Pienaars River from outflow Roodeplaat Dam to Boekenhoutpruit confluence, Roodeplaatspruit, Boekenhoutspruit	A23B, A23D, A23E
1_7	Jukskei, Klein Jukskei, Modderfonteinspruit	A21C
1_8	Upper reaches of Crocodile River and Bloubank Spruit	A21D, A21E
1_9	Crocodile River from Jukskei confluence to inflow Hartebeespoort Dam, Swartspruit	A21H
1_10	Hartebeespoort Dam	A21H
IUA2	**Magalies**	
RU	**Delineation**	**Catchment**
2_1	Maloneys Eye	South eastern portion of A21F
2_2	Magalies River, Klein Magalies, Bloubank, Skeerpoort Rivers	A21F, A21G
2_3	Surface water area linked to Maloney's Eye (catchment area)	A21F
IUA3	**Crocodile/Roodekopjes**	
RU	**Delineation**	**Catchment**
3_1	Crocodile River from outflow Hartebeespoort Dam to inflow Roodekopjes Dam, Rosespruit, Ramogatla and Kareespruit	A21J
3_2	Roodekopjes Dam	A21J
IUA4	**Hex/Waterkloofspruit/Vaalkop**	
RU	**Delineation**	**Catchment**
4_1	Sterkstroom from outflow Buffelspoort Dam to inflow Roodekopjes Dam, Maretwane, Tshukutswe	A21K middle and lower catchment below dam
4_3	Buffelspoort Dam	A21K
4_2	Upper reaches of Sterkstroom to inflow Bueffelspoort Dam , Kleinwater	A21K upper catchment to dam
4_4	Upper Hex River to Olifantsnek Dam, Rooikloofspruit	A22G
4_5	Olifantsnek Dam	A22G
4_6	Hex River outflow Olifantsnek Dam to inflow Bospoort Dam, Sandspruit	A22H
4_7	Bospoort Dam	A22H
4_8	Water Kloofspruit tributary catchment	A22H
4_9	Hex River outflow Bospoort Dam to inflow Vaalkop Dam	A22J
4_10	Vaalkop Dam	A22J
IUA5	**Elands/Vaalkop**	
RU	**Delineation**	**Catchment**
5_1	Upper reaches of Elands to Swartruggens Dam	A22A south eastern portion
5_2	Elands river downstream Swartruggens Dam to Lindleyspoort Dam	A22A
5_3	Lindleyspoort Dam	A22A
5_4	Upper Koster River to Koster Dam	A22B
5_6	Selons River, Kodoespruit, Dwarsspruit, lower Koster River	A22C, A22D
5_7	Elands River outflow Lindleyspoort Dam to inflow Vaalkop Dam, Brakkloofspruit, Roosspruit, Sandspruit Mankwe. Leragane, Molapongwamongana	A22E, A22F
IUA6a	**Klein Marico**	
RU	**Delineation**	**Catchment**
6_1	Upper Klein Marico to inflow Klein Maricopoort dam, Rhenosterfonteinspruit, Malmanieloop, Kareespruit	A31D
6_2	Klein Maricopoort dam	A31D
6_3	Klein Marico downstream Klein Maricopoort Dam to Kromellenboog Dam, Wilgeboomspruit	A31E
6_4	Kromellenboog Dam	A31E
IUA6b	**Groot Marico**	
RU	**Delineation**	**Catchment**
6_5	Groot Marico, Polkadraaispruit	A31B
6_6	Marico Bosveld Dam	A31B
IUA7	**Kaloog-se-Loop**	
RU	**Delineation**	**Catchment**
7_1	Marico Eye, Kaaloog-se-Loop, Bokkraal-se-Loop, Ribbokfontein-se-Loop, Rietspruit (southern eye), Kuilsfontein, Syferfontein and Bronkhorstfontein	A31A
IUA8	**Malmaniesloop**	
RU	**Delineation**	**Catchment**
8_1	Malmanie Eye, Dolomites	A31C

IUA9	Molopo	
RU	**Delineation**	**Catchment**
9_1	Bodibe Eye	D41A (Polfonteinspruit and Lotlhakane tributary catchment area)
9_2	Molopo Eye, Grootfontein Eye, Molopo headwaters to inflow Modimola dam	D41A
9_3	Molopo River mainstem only from Modimola Dam to Disaneng Dam	D41A (mainstem)
9_4	Setumo (Modimola) Dam	D41A
9_5	Disaneng Dam	D41A
IUA10	**Dinokana Eye/Ngotwane Dam**	
RU	**Delineation**	**Catchment**
10_1	Upper Ngotwane, Dinokane Eye	A10A
10_2	Ngotwane Dam	A10A
IUA11a	**Groot Marico/Molatedi Dam**	
RU	**Delineation**	**Catchment**
11a_1	Groot Marico from outflow Marico Bosveld Dam to Molatedi Dam, all tributaries	A31G, A31H, A31F, A31J, A32A, A32B, A32C
11a_2	Molatedi dam	A32A, A32B, A32C
IUA11b	**Groot Marico/Seasonal tributaries**	
RU	**Delineation**	**Catchment**
11b_1	Groot Marico mainstem from outflow Molatedi Dam, Rasweu, Maselaje rivers	A32D
11b_2	Elandslaagtespruit, Lengope la Kgamanyane, Lenkwane	A32E
IUA12	**Bierspruit**	
RU	**Delineation**	**Catchment**
12_1	Wilgespruit, Bofule, Kolobeng, Magoditshane, Motlhabe	A24D
12_2	Bierspruit outflow Bierspruit Dam to confluence with the Crocodile River, Brakspruit, Phufane, Sefatlhane, Lesobeng, lower reach Bofule	A24E, A24F
IUA13	**Lower Crocodile**	
RU	**Delineation**	**Catchment**
13_1	Crocodile River outflow Roodekopjes Dam to upstream Sand River confuence, Sleepfonteinspruit, Klipspruit tributaries	A21L, A24A, A24B, A24C
13_2	Sand River to confluence with the Crocodile River to Bierspruit confluence, Sondags, Vaalwaterspruit and Monyagole tributaries	A24G, A24H
13_3	Lower Crocodile from Bierspruit confluence to the Botswana border (Limpopo River)	A24J
IUA14	**Tolwane/Kulwane/Moretele/Klipvoor**	
RU	**Delineation**	**Catchment**
14_1	Apies River, Tshwane tributary	A23F
14_2	Pienaars River from Boekenshout confluence to Apies River confluence	A23C
14_3	Plat River	A23G
14_4	Moretele (Pienaars) River from Plat River confluence to Klipvoor Dam, Kutswane to Klipvoor Dam	A23J
14_7	Pienaars River from Klipvoor Dam to Crocodile Riverconfluence, Tolwane tributary	A23K, A23L
IUA15	**Upper Mokolo**	
RU	**Delineation**	**Catchment**
15_1	Moloko River in A42C, Sand River and Klein Sand, Brakspruit, Sondagsloop, Heuningspruit, Dwars, Jim se loop tributaries	A42C, A42E
15_2	Sterkstroom, Frikkie-se-Loop	A42D, A42E
15_3	Mokolo River in A42F to inflow Mokolo Dam, Taaibosspruit, Malmanies and Bulspruit tributaries	A42F
15_4	Mokolo Dam	A42F
15_5	Grootspruit and Sandspruit tributaries (Mokolo headwater catchment)	A42B
15_6	Mokolo River from Dwars river to confluence with Sterkstroom, Klein Vaalwaterspruit, Brakspruit	A42E
IUA16	**Lower Mokolo**	
RU	**Delineation**	**Catchment**
16_1	Tambotie river catchment	A42H (major portion -eastern)
16_2	Poer se Loop catchment	A42G
16_4	Sandloop	A42J and remaining portion of A42H
16_5_1	Mokolo mainstem - Mokolo from below EWR3 to the Tamboti confluence	A42G, H along mainstem
16_5_2	Mokolo mainstem - from Tamboti confluence to Limpopo.	A42J along mainstem
IUA17a	**Mothlabatsi/Mamba**	
RU	**Delineation**	**Catchment**
17a_1	Mothlabatsi, Mamba Rivers	A41A, A41B
17a_2	Headwaters Mothlabatsi (peatlands)	A41A (south eastern)
IUA17b	**Matlabas**	
RU	**Delineation**	**Catchment**
17b_1	Matlabas	A41D, A41C
17b_2	Catchment area including Steenbokpan	A41E

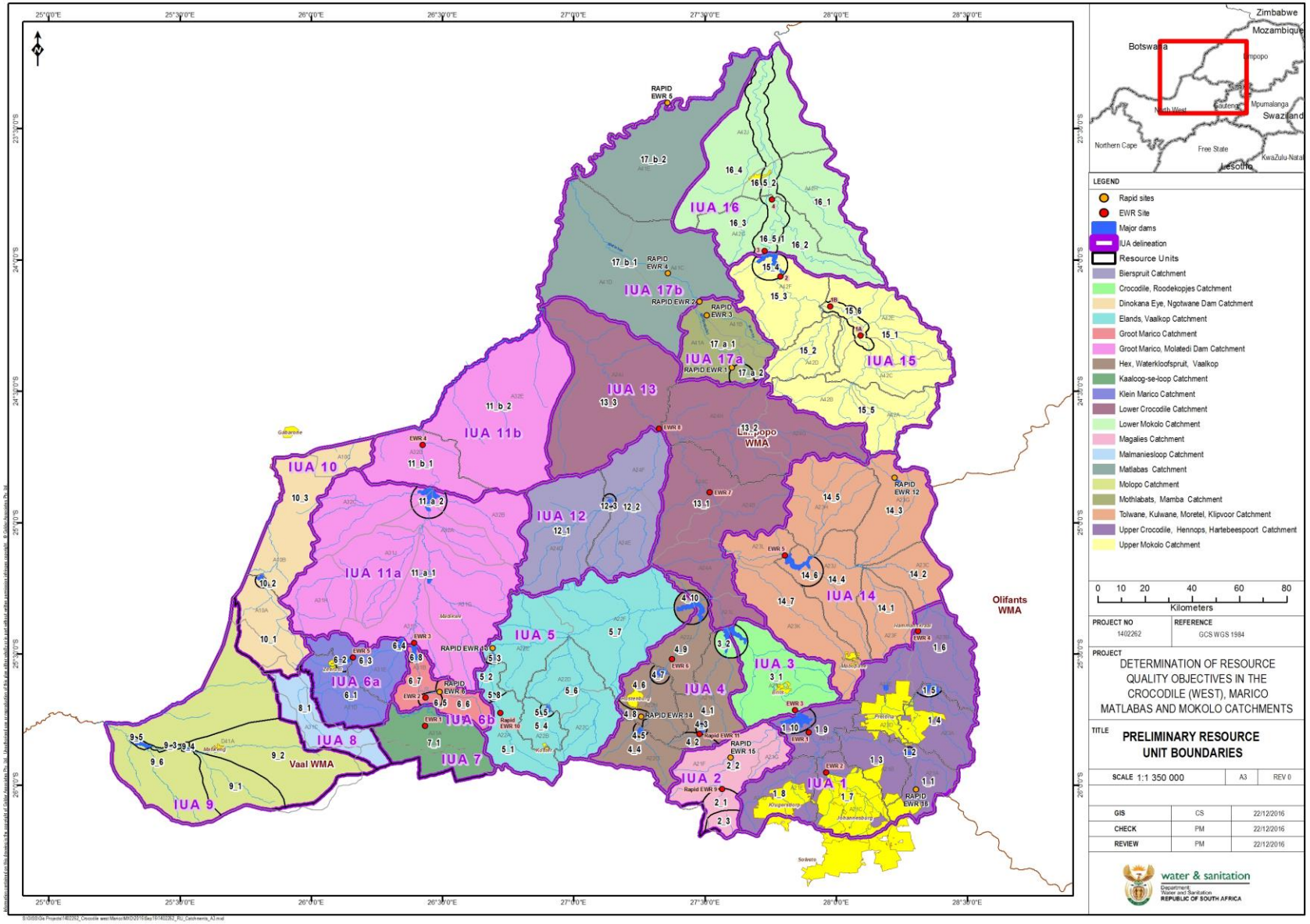

Figure 3: Map of resource units

Table 3: Extract of Draft RQOs for rivers in priority resource unit 1-9, Crocodile River in IUA 1 (Upper Crocodile/Hennops/Hartbeespoort)

Resource Unit	Component	Sub-component	RQO	Indicator	Numerical Limit	Context of the RQO and/or Numerical limit
1_9 **Crocodile River from Jukskei confluence to Hartbeespoort Dam** **A21H**	Quantity	Low flows	EWR maintenance low and drought flows: Crocodile River at CROC_EWR1 in A21H PMAR = 231.05x10^{6}m^{3} REC=D category The maintenance and drought flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem and users.	Base Flows Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Maintenance Low flows (m^3/s) / Drought flows (m^3/s): Oct 1.179 / 1.179 Nov 1.259 / 1.259 Dec 1.246 / 1.246 Jan 1.321 / 1.321 Feb 1.538 / 1.538 Mar 1.400 / 1.400 Apr 1.402 / 1.402 May 1.334 / 1.334 Jun 1.368 / 1.368 Jul 1.313 / 1.313 Aug 1.279 / 1.279 Sep 1.244 / 1.244	Flows specified are to maintain ecological categories of the water resource in prescribed ecological state and meet the Water resource class set. Percentiles (of required flow rate) determined through EWR determination process as per application of appropriate Reserve models and methodology (rule curves).
	Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category and the water quality requirements of the water users are met. Nutrient management required to improve current state and ensure sustainability of the system.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50th percentile)	Improvement in instream concentrations required. Meets ecological specfications
				Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)	Improvement in instream concentrations required. Meets ecological specfications
		Salts	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity (EC)	≤ 75 milliSiemens/metre (mS/m) (95th percentile)	Present state quality. Within prescribed ecological category for aquatic ecosystem, Ecological Reserve manual (2008).
				Sodium	≤ 60 milligrams/litre (mg/l) (95th percentile)	Maintain within present salinity state.
				Chloride	≤ 60 milligrams/litre (mg/l) (95th percentile)	Maintain within present salinity state
				Sulphate	≤ 75 milligrams/litre (mg/l) (95th percentile)	Maintain within present salinity state
		Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)	User specification. Limit is the target water quality range for full contact recreational use – South African Water Quality Guidelines (1996).
		System Variables	pH range must be maintained at within limits specified to support the aquatic ecosystem. .	pH range	6.5 (5th percentile) and 8.5 (95th percentile)	Aquatic ecosystem and user as the drivers
			A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.	No baseline data available. Monitoring required to determine present state.

Resource Unit	Component	Sub-component	RQO	Indicator	Numerical Limit	Context of the RQO and/or Numerical limit
		Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health.	Cyanide	≤ 0.045 milligrams/litre (95th percentile)	Aquatic ecosystem driver - Ecological Reserve manual (2008),
				Uranium (U) (238)	≤ 0.03 milligrams/litre (95th percentile)	WHO guideline
				Gross α	0.42 Bq/litres	Need to confirm with baseline monitoring data. South African Water Quality Guidelines (1996) (domestic)
				Gross β	0.42 Bq/litres	Need to confirm with baseline monitoring data. South African Water Quality Guidelines (1996) (domestic)
				Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)	Strictest of Ecological specifications or user requirements. Ecological Reserve manual (2008), SANS 241, South African Water Quality Guidelines (1996), SANS 241-1
				Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)	
				Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)	
				Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)	
				Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)	
				Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)	
				Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)	
				Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)	
	Habitat	Instream	No further degradation of the riparian zone and instream habitat should occur Habitat diversity should be improved from an E ecological category to a D category.	Index of Habitat Integrity, Geomorphic Assessment Index	Instream Habitat Integrity EC = D > 50%	Attainment of Water resource class and associated ecological category. Ecological Reserve.
		Riparian habitat	Alien invasive control required. Vegetation cover should be maintained at an ecological category D or improved upon. Riparian habitat rehabilitation required to support biota.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = D >50%	Attainment of Water resource class and associated ecological category. Ecological Reserve.
	Biota	Fish	Fish community should be maintained at a D ecological category or improved upon. Habitat and water quality improvement required for *CFLA* and flow should be adequate for flow dependant spp. BMAR, BPOL, CPRE	Fish Response Assessment Index (FRAI)	Fish ecology category = D >50%	Attainment of Water resource class and associated ecological category. Ecological Reserve.

Resource Unit	Component	Sub-component	RQO	Indicator	Numerical Limit	Context of the RQO and/or Numerical limit
		Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a largely modified condition or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI EC ≥ 42% SASS > 50 ASPT > 3.8 (at EWR1 = A2CROC-HARTB)	Based on available monitoring data. Attainment of Water resource class and associated ecological category. Ecological Reserve.
		Diatoms	Diatom assemblage must be maintained within a largely modified condition or improved upon.	Specific Pollution Index	Diatom EC ≥ 42% (at EWR1 = A2CROC-HARTB)	Based on available monitoring data. Attainment of associated ecological category. Indicator of water quality and health state of water resource.