High confidence Reserve determination study for surface water, groundwater and wetlands in the Upper Orange catchment

Background Information Document

2nd Project Steering Committee Meeting (PSC2) – 3 October 2023

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

PURPOSE OF THIS DOCUMENT

The purpose of this second Background Information Document is to provide members of the second Project Steering Committee (PSC) with information and high level summary/results in preparation for the meeting to be held on 3 October 2023.

This document contains a high level summary regarding:

- Study area and water resource components;
- Approaches to be followed for the determination of the high confidence Reserve;
- Study progress;
- Wetland Reserve;
- Groundwater Reserve and quantification; and
- River Eco-categorisation and EWR quantification.

OBJECTIVES OF THE PROJECT

The National Water Act (No. 36 of 1998) (NWA) is founded on the principle that National Government has the overall responsibility for and authority over water resource management for the benefit of the public without seriously affecting the functioning of water resource systems. To achieve this objective, Chapter 3 of the NWA provides for the protection of water resources through the implementation of Resource Directed Measures (RDM). As part of the RDM, a Reserve must be determined for a significant water resource, as a means to ensure a desired level of protection.

The objective of this study is, therefore, to determine the quantity and quality Reserve (ecological and basic human needs) for the priority rivers, wetlands and groundwater areas on a high level of confidence in the Upper Orange System. The results from the study will thereby guide the Department to meet the objectives of maintaining, and if possible, improving the state of the water resources within this catchment.

STUDY APPROACH

The approach and methodology that are followed for this study are in accordance with the 8-step process as outlined in Regulation 810 (Government Gazette 33541) dated 17 September 2010 (Figure 1), as well as the Reserve determination process as specified in the 'Development of Procedures to operationalise Resource Directed Measures (DWS, 2017). However, it must be noted that this study excludes the gazetting of the Reserve (step 8).

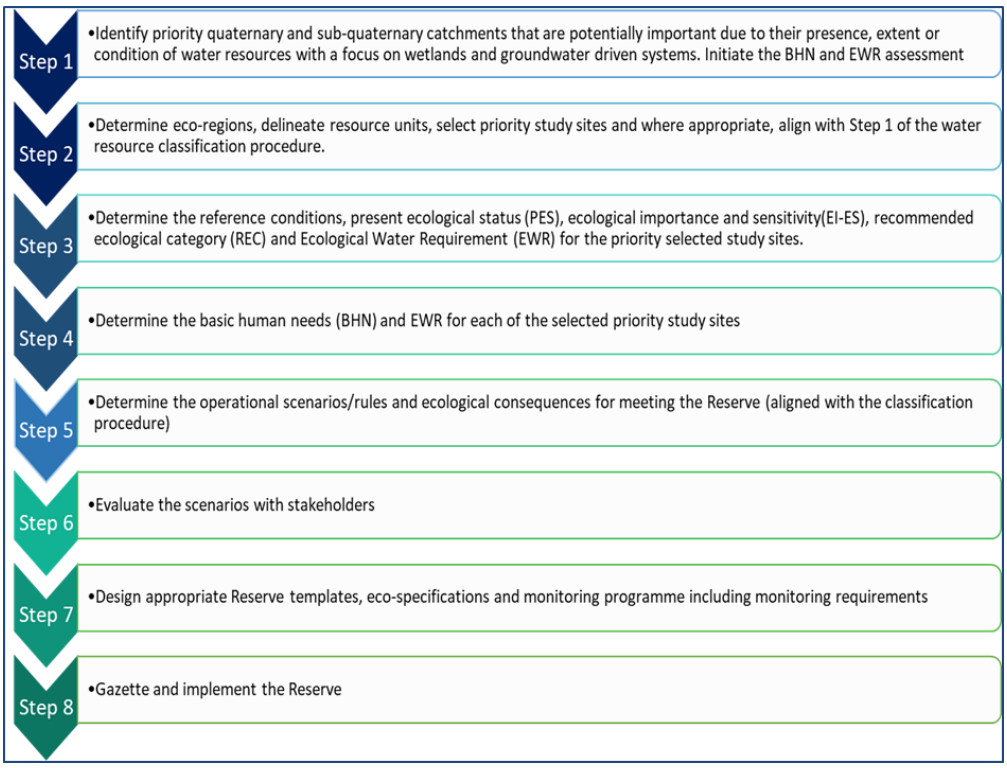


Figure 1: Integrated steps for the determination of the Reserve

STUDY AREA AND RESOURCE COMPONENTS

The study area comprises the water resources within the Upper Orange River catchment forming part of the Orange Water Management Area (WMA 6). It further forms part of the Orange-Senqu River Basin and hence, is a shared water course, not only with Lesotho in the upper reaches, but also with Botswana and Namibia in the Lower Orange River catchment. Henceforth, a consideration of the international responsibilities/commitments and bilateral agreements is imperative.

The water resource components that will be considered include rivers, wetlands and groundwater and where applicable, integration/ linkages between these components will be considered.

Rivers

The catchment is divided into four distinct sub-areas (see Figure 2), stretching across the Northern Cape, Free State and Eastern Cape provinces and includes:

- The Caledon River from its headwaters and its tributaries to the Gariep Dam;
- The Orange River from the Lesotho Border to the Gariep Dam, including the main tributaries namely Makhaleng (originates in Lesotho with lower reaches in South Africa), Kornetspruit, Sterkspruit and Stormbergspruit;
- The Kraai River Catchment; and
- The Orange River from the Gariep Dam, through Vanderfkloof Dam to Marksdrift Weir, just before the confluence with the Vaal River, including the Seekoei River in the south, and the Modder-Riet River (main tributaries of the Vaal River system) in the north.

Wetlands

Depression wetlands are some of the more common wetland types found within the Upper Orange catchment, which is largely associated with a combination of geology, rainfall and temperature. The majority of the identified wetlands are located within the Upper Karoo Bioregion, followed by the Mesic Highveld Grassland Bioregion.

Furthermore, the Modder River, a tributary of the Riet River has a large density of high priority National Freshwater Ecosystem Priority Areas (NFEPA) systems, consisting largely of depression wetlands.

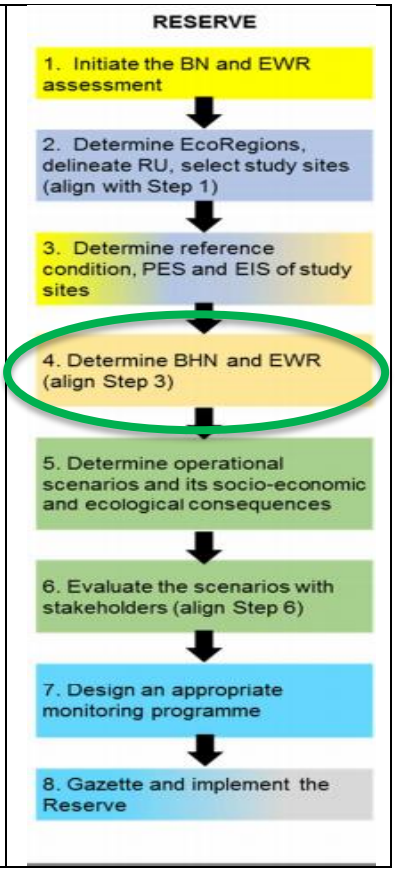
Groundwater

The regional geology is dominated by the Karoo Supergroup that was deposited in the Karoo Basin and is covered exclusively by the Karoo Supergroup sedimentary rocks with “fractured” and “fractured and intergranular” the main aquifer types.

STUDY PROGRESS

Steps 1 to 3 of the Reserve determination framework have been completed and the study team is currently conducting Step 4 (Figure 1). The completed activities include:

- <u>Assessment of data availability and gaps analysis</u>
  Several studies (i.e. ORASECOMs Joint Basin Surveys, reserve studies, environmental studies) have been undertaken for the water resources in the study area. Furthermore, various datasets were also available (i.e. GIS layers and information from previous initiatives (Desktop PES/EI/ES, 2014, NBA, 2018, WR2012, NFEPA wetlands, 2011, monitoring programmes, etc.). The major gaps identified was a lack of adequate gauging weirs in the study area and the consequent lack of long-term flow data, especially daily data that is invaluable for the setting of EWRs. Furthermore, recent water quality data to determine the present state. However, data available from the 2021 JBS3 study, coupled with the planned surveys forming part of this study, has assisted with mitigating these gaps.
- <u>Identification of Resource Units</u>
  Resource Units (RUs) were identified and prioritised per water resource component and were based on ecological, socio-cultural and water use considerations. These can be linear stretches of rivers, priority wetland areas, major dams, and important groundwater systems. The detail of the assessments undertaken was dependent on the level of priority, namely:
  Level 1 – Detailed assessments, including field surveys and determination of ecological specifications;
  Level 2 – Mainly desktop with limited field surveys with ecological specifications and conditions; and
  Level 3 – Desktop assessments using existing data, no field surveys.



WETLANDS

Wetland resource units have been identified and categorised based on the importance of a wetland from ecological, functioning, social and/or biodiversity perspective. Table 1 provides a summary of the identified wetlands and their Present Ecological State (PES) per priority WRU. Recommendations for the quantification of the EWRs for specific priority wetlands and where integration between groundwater and/ or rivers and wetlands are crucial were also made.

Figure 2: Philiptown Unchannelled Valley-Bottom Wetland Complex

Figure 3: Tiffindell Seep Wetland Complex

Table 1: Summary of the respective WRU identified and their identified PES

WRU	Wetland Name	HGM Type	PES		Summary of key recommendations	Require EWR quantification
WRU 02	Brandwater Foodplain	Floodplain Wetland	C		Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland. No further AIP encroachment in wetland.	No
WRU 03	Soutpan Depression Wetland Complex	Depression Wetlands	C	B	Conduct desktop assessment of wetland every 3-5 years.	No
WRU 04	Philiptown Unchannelled Valley-Bottom Wetland Complex *(Figure 1 above)*	Unchannelled Valley-Bottom Depression Wetlands	A	C	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland.	No
WRU 05	Wolwespruit Headwaters Wetland Complex	Unchannelled Valley-Bottom Hillslope Seep Wetlands	C	C	Conduct desktop assessment of wetland every 2-3 years. No further agriculture in wetland. No further dams or roads to be constructed in the wetland. No further boreholes/windmills to be drilled in the catchment without groundwater studies.	Yes. These wetlands are under high levels of pressure and the EWR is at risk of being compromised.
WRU 06	Klein-Wildebeespruit Wetland Complex	Channelled Valley-Bottom Hillslope Seep Wetlands	D	D	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland. No further dams or roads to be constructed in the wetland. No further AIP encroachment in wetland.	Yes. These wetlands are under high levels of pressure and the EWR is

WRU	Wetland Name	HGM Type	PES	Summary of key recommendations	Require EWR quantification
					at risk of being compromised. Opportunity to rehabilitate.
WRU 10	Luckhof Depression Wetland Complex	Depression Wetlands	B	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland. No further agricultural runoff to be discharged into the wetland.	No
WRU 11	Kaalspruit Wetland Complex	Channelled Valley-Bottom Discontinuously Channelled Valley-Bottom Depression Wetlands	C C	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland. No further dams or roads to be constructed in the wetland. Sediment sources into depression wetlands must be rehabilitated. Buffer zones around depression wetlands must be maintained.	Yes. These wetlands are under high levels of pressure and the EWR is at risk of being compromised. Opportunity to rehabilitate.
WRU 12	Aardoringsprut Wetland Complex	Discontinuously Channelled Valley-Bottom Wetland Flats	C C	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland.	No
WRU 13	Rantssho Wetland Complex	Floodplain, Channelled Valley-Bottom Unchannelled Valley-Bottom	D C	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland. No further dams or roads to be constructed in the wetland. Monitor discharge from livestock operations annually.	Yes. These wetlands are under high levels of pressure and the EWR is at risk of being compromised. Opportunity to rehabilitate.
WRU 15	Jagersfontein Discontinuously Channeled Valley-Bottom Wetland	Discontinuously Channelled Valley-Bottom	C	Conduct desktop assessment of wetland every 3-5 years. No further agriculture in wetland. No further dams or roads to be constructed in the wetland. Monitor water quality parameters within wetland annually, including diatoms, *E. coli*, temperature, turbidity and electrical conductivity at a minimum.	No
WRU 16	Barkley Pass Wetland Complex	Unchannelled Valley-Bottom Channelled Valley-Bottom Hillslope Seep Wetlands	A A	No further agriculture in wetland. No further AIP encroachment in wetland.	No
WRU 17	Tiffindell Seep Wetland Complex *(Figure 2 above)*	Unchannelled Valley-Bottom Hillslope Seep Wetlands	A	No further agriculture in wetland. No further AIP encroachment in wetland. No further dams or roads to be constructed in the wetland.	No

GROUNDWATER

The purpose of the Groundwater component was to provide detailed descriptions of the Present Status of the groundwater based on the assessment of the data from monitoring undertaken in the study area, and to quantify the stress index based on degree of impact. The available monitoring data, which comprises of groundwater levels, groundwater quality and surface flow were assessed to determine the groundwater Reserve.

In accordance with WRC (2012), components of the Groundwater Reserve include groundwater recharge, BHN from groundwater, as well as groundwater contribution to baseflow. Using the available data, the latter components were estimated to determine the Groundwater Reserve as a percentage of Recharge and a Stress Index (SI) per quaternary catchment. Groundwater Quality Reserves were determined for 18 of the 130 quaternary catchments as most quaternary catchments do not have groundwater quality data. As a result of this Groundwater Quality Reserves were aggregated to a GRU scale to represent quaternary catchments with no groundwater quality data.

The Groundwater Reserve varies from 0.01 % – 18.66 % of Recharge and the SI results show that all quaternary catchments have groundwater available for allocation. The SI categories vary from Natural to Fair. The majority of the quaternary catchments falls in the Good to Fair category (30%), followed by the Fair category (28%) and Good category (22%) (*Figure 4 below*).

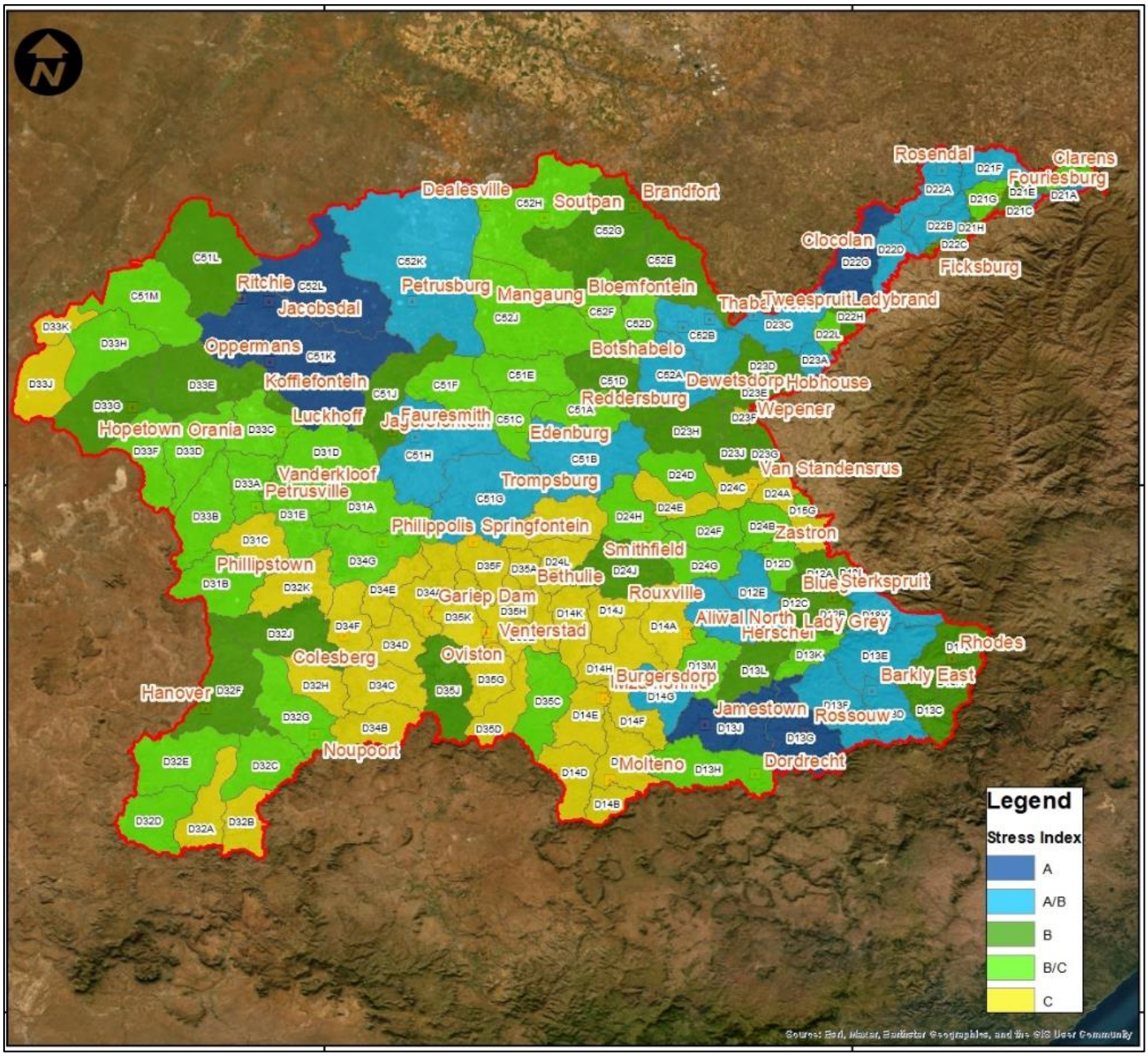


Figure 4: Groundwater stress index

RIVER ECO-CATEGORISATION AND EWR QUANTIFICATION

The Ecological Categorisation (Eco-Categorisation), of all EWR sites within the Upper Orange catchment was based on the information and data that is currently available through various previous studies and current surveys undertaken (July 2022 and May 2023). Please refer to a summary of the results of the eco-categorisation process in Table 2 below. These results will be used in the quantification of the Reserve for the selected Recommended Ecological Category (REC).

A conceptual flow management plan (FMP), opposed to the quantification of the EWRs was compiled for the sacrificial zones along the Orange River, between the two major dams, Gariep and Vanderkloof Dams and just downstream of the latter dam. For further information, please refer to the Eco-categorisation and EWR Quantification Reports.
In general, the findings of this study demonstrate that the Upper Orange catchment area predominantly exhibits moderately to seriously altered conditions (falling under ecological categories C and D). The main factors influencing the rivers are:

(i) compromised water quality, primarily caused by unmaintained and dysfunctional WWTW (particularly the Modder-Riet catchment area);
(ii) sediment deposits (particularly the Caledon and upper reaches of Orange River system) due to lack of land management and over-grazing;
(iii) water quantity, with extensive agricultural activities necessitating water abstraction for irrigation purposes throughout the catchment; and
(iv) flow modification, particularly noticeable at the Lower Orange River, can be attributed to the presence of the two major dams, Gariep and Vanderkloof Dams, which play a crucial role in fulfilling water and power supply requirements for South Africa.

Should the proposed recommendations be investigated and applied, the suggested REC can and will be achieved. Refer to Table 2 and Table 3 for a summary of the Intermediate/Rapid 3 EWR site results and the field verification sites selected respectively.

Table 2: Intermediate/Rapid 3 EWR site results

RU	EWR site code	River	Quat*	Main driving impacts	EcoStatus (2023)	Revised EI-ES	REC
INTERMEDIATE EWR SITES							
R_RU04	UO_EWR01_I	Middle Caledon	D22D	• Sediment deposition • Poor land and catchment management	E	Moderate, Moderate	D
R_RU01	UO_EWR02_I	Sterkspruit	D12B	• Water quality (nutrients, poorly maintained and dysfunctional WWTW)	D	Moderate, Moderate	C/D
R_RU02a	UO_EWR03_I	Upper Orange	D12F	• Sediment deposition • Sand mining	D	Moderate, Moderate	D
R_RU05	UO_EWR04_I	Lower Caledon	D24J	• Sediment deposition • Poor land and catchment management	D	Moderate, Moderate	C/D
R_RU06	UO_EWR05_I	Seekoei	D32J	• Water quality and quantity (abstraction, irrigation, return flows)	C	Moderate, Moderate	C
R_RU08	UO_EWR06_I	Upper Riet	C51F	• Water quality and quantity (abstraction, irrigation, return flows)	C	High, Moderate	C
R_RU09a	UO_EWR07_I	Upper Modder (Sannaspos)	C52G	• Water quality (nutrients, poorly maintained and dysfunctional WWTW)	D	Low, Moderate	C
R_RU03	UO_EWR08_I	Lower Kraai	D13M	• Water quality (abstraction, irrigation, return flows)	C	High, High	B/C
R_RU10	UO_EWR09_I	Lower Riet	C51L	• Water quality (abstraction, irrigation, return flows) • Water quality (upstream Modder River)	C	Very High, High	B/C

RU	EWR site code	River	Quat*	Main driving impacts	EcoStatus (2023)	Revised EI-ES	REC
R_RU07	UO_EWR10_I	Lower Orange	D33K	• Flow modification (hydropower) • Sediment deposition	C	Moderate, Moderate	C
RAPID 3 EWR SITES							
R_RU13	UO_EWR01_R	Little Caledon	D21D	• Water quality (nutrients, upstream town) • Water quantity (abstraction and irrigation)	C	High, High	B/C
R_RU14	UO_EWR02_R	Brandwater (Groot)	D21G	• Poor land and catchment management • Water quantity (abstraction)	C	High, Moderate	B/C
R_RU16	UO_EWR03_R	Mopeli	D22G	• Poor land and catchment management	C/D	Moderate, Moderate	C/D
R_RU11a	UO_EWR04_R	Upper Kraai	D13E	• Water quantity (abstraction)	C	High, High	B
R_RU12	UO_EWR05_R	Wonderbooms pruit	D14E	• Water quality (nutrients, poorly maintained and dysfunctional WWTW)	D	Moderate, Moderate	C/D
R_RU09b	UO_EWR06_R	Middle Modder (Soetdoring)	C52H	• Water quality and quantity (abstraction, irrigation, return flows)	D	High, Moderate	C/D

**Quaternary Catchment*

Table 3: Field verification site results

RU	EWR site code	River	Quat	Pes, 2014 EI-ESE	EcoStatus (2023)	REC
R_RU04	UO_EWR01_FV	Middle Caledon	D23A	Moderate, Moderate	D	C/D
R_RU30	UO_EWR02_FV	Meulspruit	D22B	Moderate, Moderate	D	D
R_RU31	UO_EWR03_FV	Witspruit	D24C	Moderate, Moderate	C/D	C
R_RU22	UO_EWR04_FV	Gryskopspruit	D12D	Moderate, Moderate	C	C
R_RU26	UO_EWR05_FV	Karringmelkspruit	D13K	Very High, High	B	B
R_RU23	UO_EWR06_FV	Bokspruit	D13A	Moderate, High	B/C	B
R_RU27	UO_EWR07_FV	Holspruit	D13J	High, Moderate	C	C
R_RU11b	UO_EWR08_FV	Sterkspruit (trib of Bell/Kraai)	D13C	Moderate, High	C	B/C
R_RU11c	UO_EWR09_FV	Bell	D13B	Moderate, High	B/C	B
R_RU32a	UO_EWR10_FV	Groenspruit	D24H	Moderate, Moderate	C/D	C
R_RU32b	UO_EWR11_FV	Skulpspruit	D24H	Moderate, Moderate	C	C
R_RU18	UO_EWR12_FV	Fouriespruit	C51A	High, Moderate	C	C
R_RU37	UO_EWR13_FV	Renoster	C52F	Moderate, Moderate	D/E	D
R_RU21	UO_EWR14_FV	Os-spruit	C52E	High, Moderate	B/C	B/C
R_RU33	UO_EWR15_FV	Hondeblaf	C31C	Low, Moderate	B	B
R_RU40	UO_EWR16_FV	Trib van Zyl	C51G	High, Moderate	C	C
-	UO_EWR17_FV	Slykspruit	D24L	Moderate, Moderate	B/C	B/C
R_RU11d	UO_EWR18_FV	Langkloofspruit	D13D	High, High	B/C	B
R_RU25	UO_EWR19_FV	Wasbankspruit	D13G	Moderate, High	C	B/C
R_RU39	UO_EWR20_FV	Lower Modder	C52K	Very High, High	C/D	C
R_RU19a	UO_EWR21_FV	Upper Kromellenboog	C51G	Moderate, Moderate	B	B
R_RU19b	UO_EWR22_FV	Lower Kromellenboog	C51H	Moderate, Moderate	C	B/C
R_RU41	UO_EWR23_FV	Tele	D18K	Moderate, Moderate	C	C

RU	EWR site code	River	Quat	Pes, 2014 EI-ESE	EcoStatus (2023)	REC
R_RU02b	UO_EWR24_FV	Orange	D12A	High, Moderate	C/D	C
R_RU42	UP_EWR25_FV	Maghaleng	D15H	Moderate, Moderate	C/D	C/D

NEXT STEPS

The next steps for the study will be assessing the ecological consequences from a biota perspective (fish and macroinvertebrates) for all identified scenarios. Subsequently, the ecological specifications for all components will be compiled, along with the monitoring plan and lastly prepare the Reserve template for the Upper Orange catchment area.

Figure 5 below illustrates some of the DWS colleagues from both regional and head office, who joined the capacity building campaign during the second river survey conducted in May 2023.

Figure 5: Capacity building with DWS

Reports can be accessed from.
https://www.dws.gov.za/rdm/currentstudies/default.aspx

Should you have any questions, queries, concerns on the reports, please get in touch with the study contacts below.

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