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

Background Information Document 2

1st Project Steering Committee Meeting – 30 June 2022

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 Project Steering Committee (PSC) with information and initial results in preparation for the meeting to be held on 30 June 2022.

This document contains information regarding:

- Study area and water resource components;
- Approaches to be followed for the determination of the high confidence Reserve;
- Information availability and gaps identified;
- Approach and results of the identification of priority Resource Units; and
- Wetland and groundwater surveys.

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).

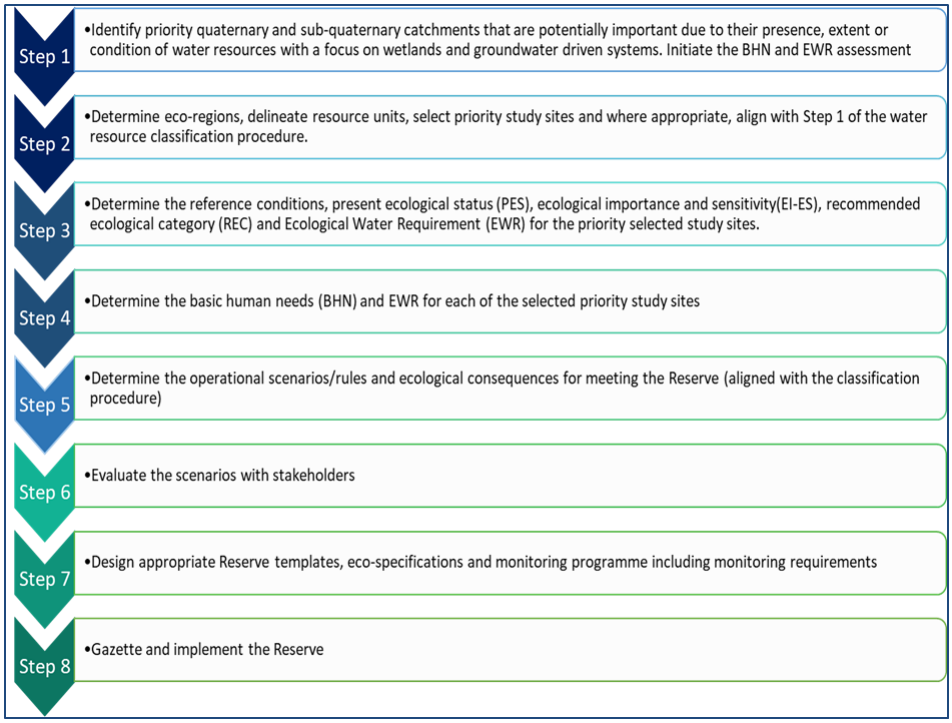

Figure 1: Integrated steps for the determination of the Reserve

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.

INFORMATION AVAILABILITY AND GAPS

A number of studies have been conducted for the Upper Orange River catchment, mainly focussed on long-term planning of the water resources, including the Integrated Water Quality Management Strategy, the Development of Reconciliation Strategies for Large Bulk Water Supply Systems, Groundwater Resources Assessments, All Towns Reconciliation Strategies, South African Inventory of Inland Aquatic Ecosystems and Provincial Strategic Plans for wetlands. Some of these studies were undertaken by DWS or in association with Lesotho, especially with the development of the Senqu River catchment for water transfers to the Upper Vaal system.

With the Upper Orange River catchment being a shared water resource, a number of studies have been initiated by ORASECOM in support of establishing a basin-wide Integrated Water Resources Management Plan as well as 5-yearly Joint Basin Surveys (JBS) where the Aquatic Ecosystem Health (AEH) monitoring programme is conducted.

Some Reserves studies have been undertaken for the rivers with the most detailed studies by ORASECOM on the Orange, Kraai and Caledon Rivers and the WRC study to develop a method for determining the environmental water requirements for non-perennial systems and tested on the Seekoei River. Most of these studies have been undertaken more than 10 years ago, resulting in the information being outdated and possible changes to the methodologies used to determine the Ecological Water Requirements (EWR).

Based on the review and analysis of the available datasets, GIS layers, information from previous studies, the project team has a better understanding of the availability, accessibility and usefulness of the information and data sources. However, various gaps do exist, of which some of these will be addressed during the study, through the collection of additional data during the field surveys.

The major gaps that will not be addressed during this study, as long-term monitoring is required are:

- 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; and
- 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, will assist with mitigating this gap.

IDENTIFICATION OF PRIORITY RESOURCE UNITS (RUs)

A priority RU represents a river reach, wetland or groundwater area with a high importance or where the water use impacts (quantity and/ or quality), or resource stress is high. These priority RUs provide an indication where detailed assessments should be required to protect the aquatic ecosystems.

The prioritisation was mainly based on the information available from the Desktop PES/EI/ES (DWS, 2014) for rivers, NWM5 map for wetlands and WR2012 data for groundwater. Additionally, results from the recently completed JBS3 surveys (ORASECOM, 2021), presence of Strategic Water Source Areas (SWSA) and expert knowledge were used to select the final priority RUs.

The prioritisation of the **river RUs** is based on ecological, socio-cultural and water use considerations with three priority levels:

(i) Level 1 – detailed assessments, including field surveys with detailed ecological specifications (intermediate)
(ii) Level 2 – mainly desktop with limited field surveys with ecological specifications and conditions (rapid 3)
(iii) Level 3 – desktop assessments using existing data, no field surveys

For selected river RUs with a high Ecological Importance and Sensitivity and still in a good present state, with no or little water use, field verification (biological) assessments have been included to provide additional confidence in the desktop Ecological Water Requirements. Conceptual input into a Flow Management Plan will also be provided for the river reaches of the Orange River downstream of Gariep and Vanderkloof Dams.

A Multiple Criteria Analysis (MCA) process was followed to define those **wetlands** that were considered more important and thus a priority for further assessments. This was based on variables important from a wetland ecological, functioning, and social and/or biodiversity perspective.

The delineation of priority **groundwater** resource units was based on quaternary catchment boundaries, aquifer type (primary aquifer, secondary aquifer, karst aquifer), borehole yields groundwater quality, stressed catchments (catchments where the groundwater recharge is less than the sum of groundwater abstraction, groundwater contribution to baseflow and basic human needs), groundwater recharge and geo-political boundaries (logistical, management and functional).

Areas/ RUs where integration between rivers, groundwater and wetlands were considered important have been included based on available data (see Figure 3). The final selected RUs from an integration perspective includes the Upper Kraai River (rivers, wetlands, groundwater), Upper Seekoei River (wetlands and groundwater, and to a lesser extent rivers) and the Modder River (wetlands and groundwater, and water quality).

SURVEYS UNDERTAKEN TO DATE (APRIL 2022, ANNEXURE 1)

Groundwater

A hydrocensus investigation was conducted for six prioritised groundwater RUs (see Table 1). The hydrocensus focussed on WMS, Hydstra, municipal groundwater resources, as well as a few surface water bodies in proximity to groundwater resources. The objectives of the hydrocensus were to:

i. Identify and verify groundwater resources in the catchment
ii. Collect field data, i.e. measurements of borehole depth, water levels, borehole yield and basic water chemistry

Table 1: Summary of Prioritised Groundwater Resource Units visited during surveys

Resource Units	Quaternary Catchment/s	City / Town
GW_RU03	C52G, C52J, C52F, C52D, C51H	Bloemfontein, Jagersfontein
GW_RU04	C52H, C52G	Soutpan
GW_RU05	C52K	Petrusburg
GW_RU14	C52K, D33K, D33C	Dealesville, Ritchie, Jacobsdal, Luckhoff
GW_RU10	D32A, D32B, D32E	Hanover, Noupoort
GW_RU07	D13D, D13E, D18K, D13K, D13A,	Barkley East, Rhodes, Lady Grey

Borehole data was collected as follows:

- Site coordinates and elevation by use of a hand-held GPS
- Borehole depths and water levels by use of a dip meter where possible
- Water samples by use of a bailer
- Field measurements of EC, pH, Total Dissolved Solids (TDS), Oxygen Reduction Potential (ORP) and Temperature by use of handheld EC/pH and ORP/Temp multi-meters.

Wetlands

The wetland RUs visited during the fieldwork, were selected based on the following criteria:

- Catchment related impacts;
- Within wetland impacts and the relative intactness of the wetland(s);
- Proximity to a priority river;
- The current demand for water within the catchment;
- Proximity of the wetland(s) to priority water supply dams;
- Whether the wetland is supplying significant and important ecosystem services to downstream users; and
- Whether the wetland is a priority wetland according to the NFEPA/FEPA spatial dataset.

Figure 4 indicates the wetland systems that were visited, and Table 2 provides a brief description of each wetland.

Table 2: Descriptions of wetlands visited

Site name	River	Description
WRU02 (D21G)	Brandwater	A large floodplain wetland associated with the Brandwater River, approximately 260ha in size and is located to the south of the R26 road between Fouriesburg and Ficksburg.
WRU03 (C52H)	No rivers	A large depression wetland complex consisting of a total of 27 depression wetlands that range in size from 6ha to 1 800ha. The largest of these wetlands is known as Soutpan and is an active salt mine as the name suggests.
WRU04 (D31B)	Tributary of Hondeblaf	A complex of two different wetlands, a depression wetland approximately 1 100ha in size and an unchannelled valley-bottom wetland approximately 190ha in size.
WRU05 (D13G)	Wolvespruit	A large wetland complex consisting of a series of unchannelled valley-bottom wetlands which are fed by multiple hillslope seep wetlands. In total, the WRU covers an area of approximately 340ha. A large number of Blue and Crowned Cranes were noted in the wetland.
WRU09 (D31C)	Hondeblaf	A predominantly fluvial system that has wetland indicators which have formed in the flood back of a dam along the Hondeblaf River. Excluded due to artificial nature and is significantly smaller than initially expected based on the desktop assessment of the system.
WRU10 (D33C)	Lemoenspruit	A large series of depression wetlands that are hydrologically connected both via surface and groundwater. These depression wetlands range in size from 7ha to 1 200ha. These fluvially connected wetlands appear to flow in a south-easterly direction into the Lemoenspruit River which is a tributary of the Orange River.
WRU11 (C52J)	Kaalspruit	A large wetland complex consisting of a number of depression wetlands, a discontinuously channelled valley-bottom and a channelled valley-bottom wetland. The mainstem valley-bottom wetland is approximately 2 800ha in size with the depression wetlands scattered alongside this valley-bottom wetland.
WRU12 (C52G)	Rietspruit	A large wetland complex that includes a large wetland flat and a discontinuously channelled valley-bottom wetland. The entire complex is approximately 1 700ha in size and has a very gentle gradient.
WRU13 (D22D)	Rantsho	A large wetland complex approximately 275ha in size and is similarly located between the R26 road and the Mohokare/ Caledon River and is located on the Rantsho River. The floodplain wetland has three distinct sections that are separated by a very confined section of valley.
WRU15 (C51H)	Prosesspruit	A large contiguous series of wetlands that originate from four different rivers and coalesce into a valley-bottom wetland. The wetland type can be considered to be a discontinuously channelled valley-bottom wetland as the channel is not consistent throughout the HGM unit. The entire wetland complex is approximately 1 900ha in size.
WRU16 (D13D)	Tributary of Lankloofspruit	A significant wetland complex consisting of multiple valley-bottom and hillslope seep wetlands which, in total, spread across an area of approximately 230ha. Forms an extremely important water source to the Kraai River.
WRU17 (B13B)	Tributary of Upper Kraai	A high-altitude wetland complex consisting of a series of hillslope seeps and valley-bottom wetlands which cover a total area of 190ha. These wetlands are characterised by very shallow soils and the predominance of Merxmuellera disticha.

NEXT STEPS

The dry season surveys for the rivers will be undertaken in July 2022.

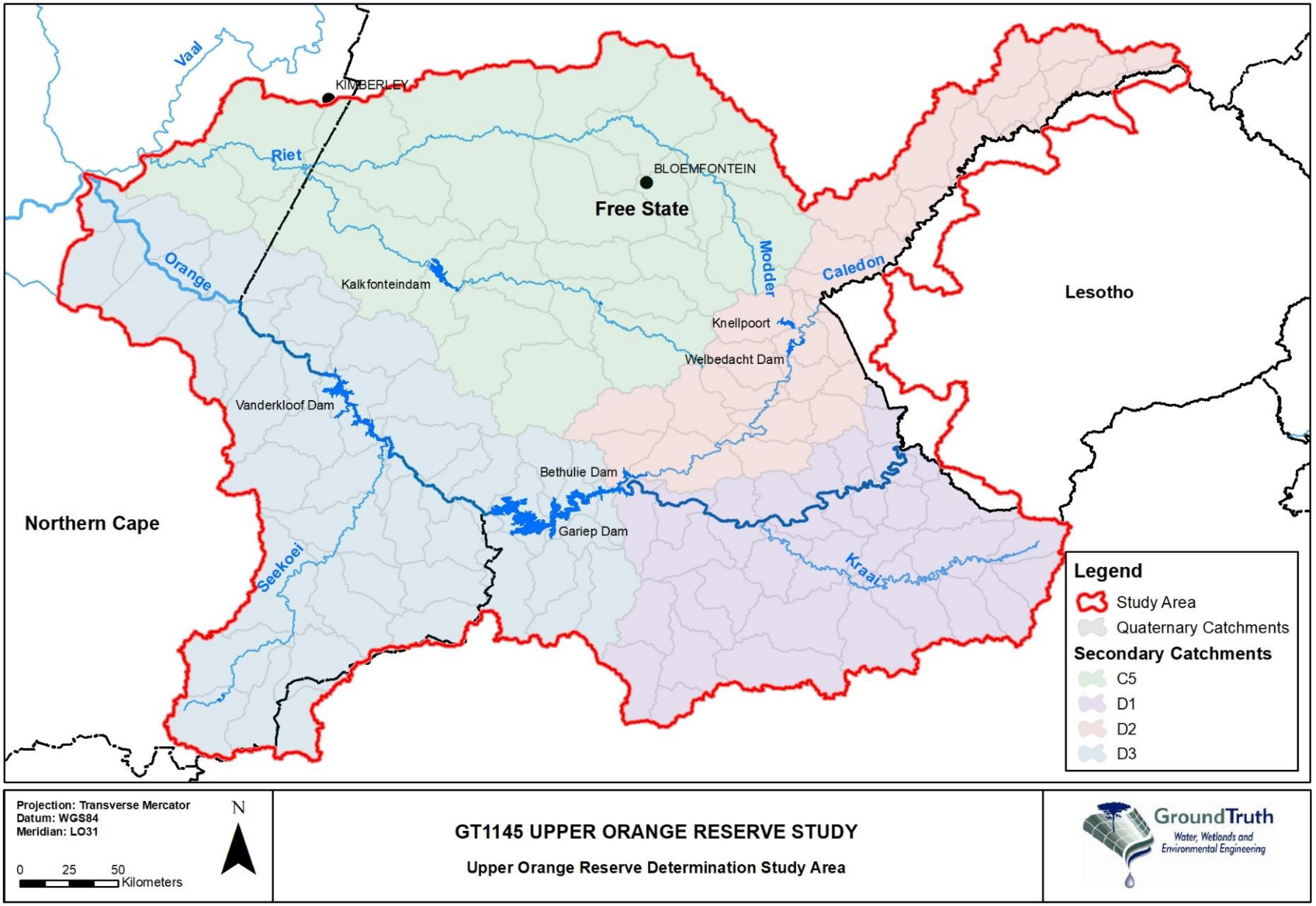

Figure 2: Upper Orange River study area

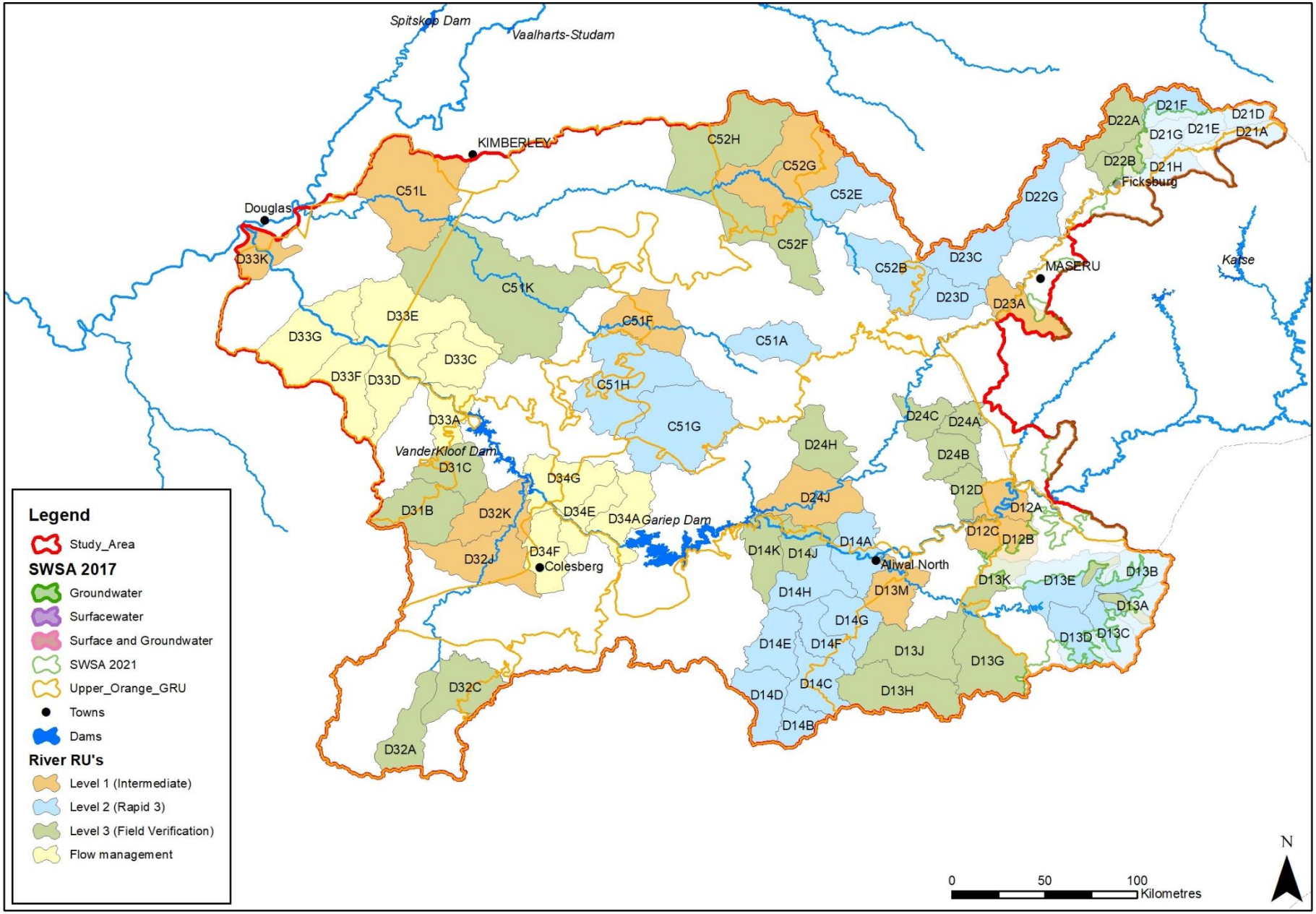

Figure 3: Map illustrating the integration between surface water, groundwater and wetlands, including SWSA

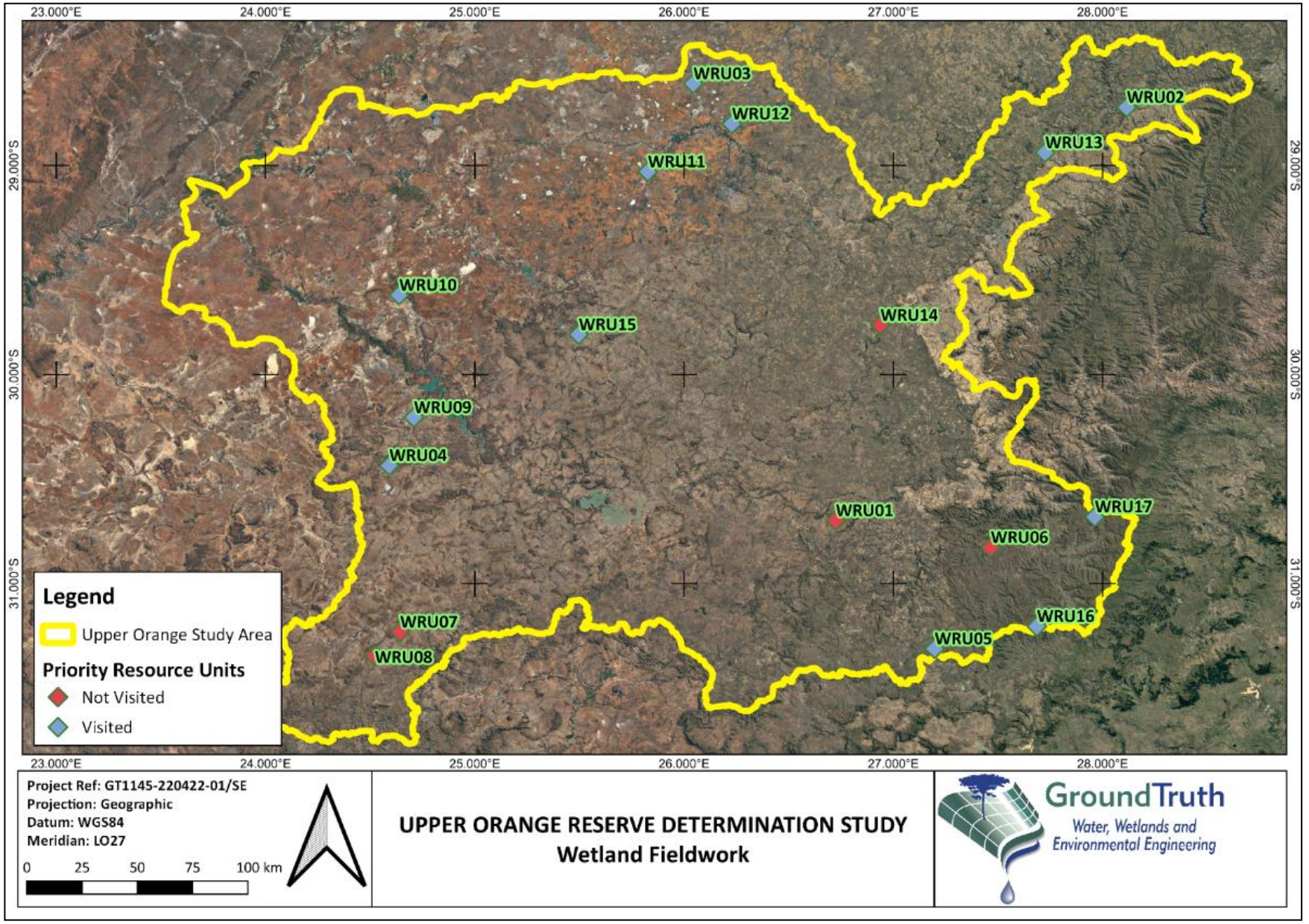

Figure 4: Overview of screened sites that were visited during the field surveys

ANNEXURE 1: PHOTO RECORD OF SURVEYS UNDERTAKEN TO DATE (APRIL 2022)

Photo 1: The groundwater specialist team at UO-BH-01 north of Bloemfontein with members from the DWS.

Photo 2: Confluence of the Bell and Kraai Rivers

Photo 3: Large depression wetland forming a part of W_RU11. This depression wetland is unique in that it receives water from the main valley-bottom wetland at its head and feeds water back into the valley-bottom wetland at its toe

Photo 4: Groundwater monitoring in Petrusburg

Photo 5: Modder River in full flood

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