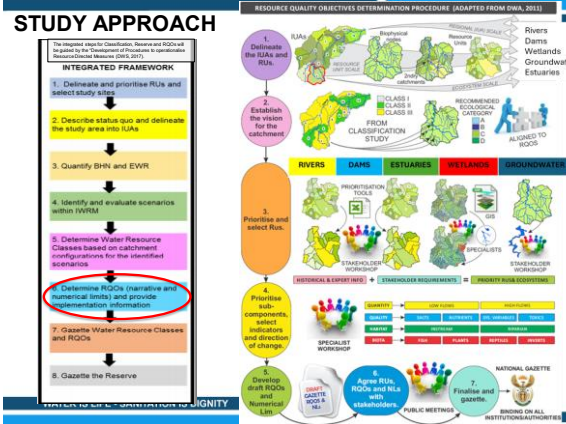


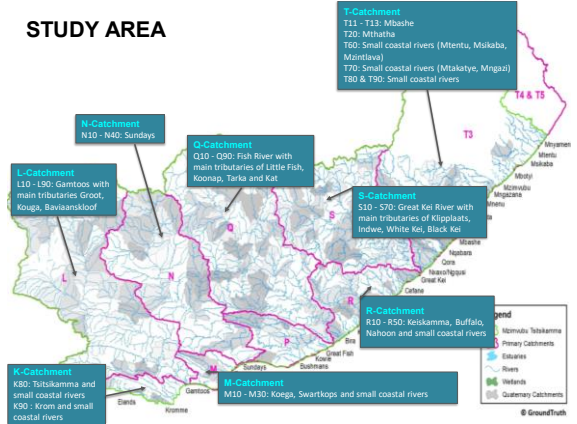


### STUDY APPROACH



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### STUDY AREA



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### STUDY APPROACH: RIVERS AND DAMS

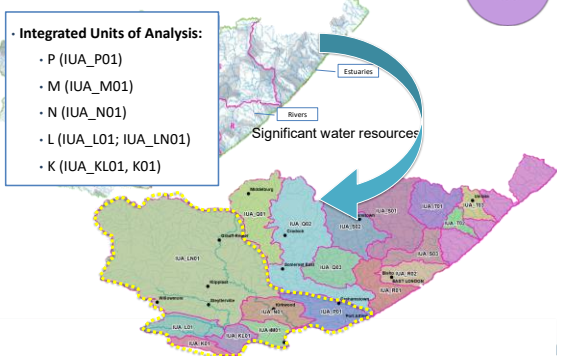
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### WATER RESOURCE CLASSIFICATION

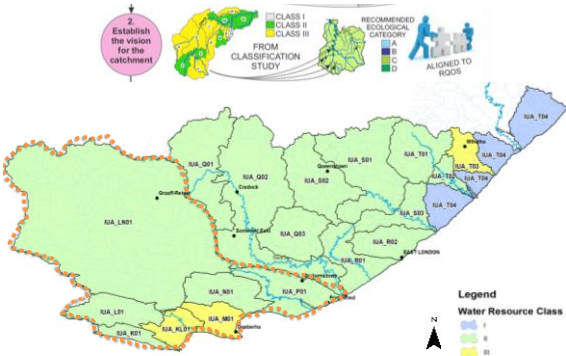
INTEGRATED UNITS OF ANALYSIS

- Integrated Units of Analysis:
  - P (IUA\_P01)
  - M (IUA\_M01)
  - N (IUA\_N01)
  - L (IUA\_L01; IUA\_LN01)
  - K (IUA\_KL01, K01)



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### WATER RESOURCE CLASSES



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### PRIORITY RESOURCE UNITS: RIVERS AND DAMS

- Position of RU within IUA
- Importance of each RU to users
- Level of threat posed to the water resource quantity and quality for users and ecology (resource stress)
  - High utilisation
  - Compromised water quality; and/or
  - Future water resource developments which are planned
- Present Ecological State, Ecological importance/ sensitivity
- Strategic Water Resource Areas
- Freshwater Ecosystem Priority Area (upstream/within)
- Conservation sensitivities (specifically conservation targets set by the DEA)
- Flagship and/or free flowing rivers (NB for ecosystem processes/ biodiversity value)

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### PRIORITY RESOURCE UNITS: RIVERS AND DAMS

3  
Prioritise and select RUs

- Threatened or sensitive vegetation ecosystems
- Alien vegetation infestation was assessed and considered if a problem
- Sensitive aquatic macroinvertebrates (water quality, flow, habitat)
- Fish support areas, fish sanctuaries, fish corridors with IUCN red listed fish species
- If any priority wetlands or groundwater areas, contributing to baseflows of rivers
- Social-Cultural Importance
- Management considerations
- Practical considerations
- Major dams

**Ultimately:**

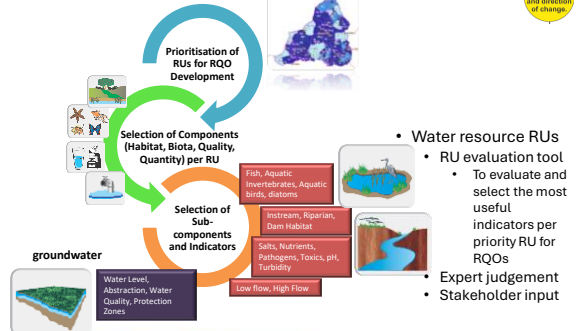
- Prioritise linear stretches of rivers
- Requiring different EWRs, due to different flow patterns
- Reaction of habitat and biota to stress
- Require different management and operational structures

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### RESOURCE QUALITY OBJECTIVES

4  
Prioritise sub-components, select indicators and direction of change



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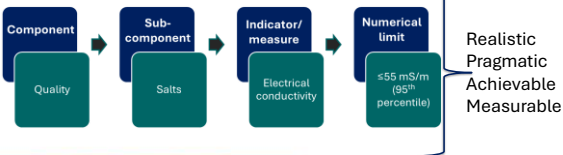
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### RESOURCE QUALITY OBJECTIVES

4  
Prioritise sub-components, select indicators and direction of change

- Components – sub-components – indicators: for setting the RQOs
- Based on:
  - Activities that impact on water resources
  - User requirements
- Protection of the resource

Indicators and numerical limits or descriptive statements for RQOs should be set



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### SUB-COMPONENT FOR WHICH RQOs HAVE BEEN SET

4  
Prioritise sub-components, select indicators and direction of change

Rivers	
Component	Sub-component
Quantity	Low Flows
	High Flows
Quality	Nutrients
	Salts
	System variables
	Toxics
	Pathogens
	Geomorphology
	Riparian vegetation
Habitat	Integrated Habitat (instream and riparian)
	Fish
Biota	Macroinvertebrates
	Diatoms

Dams	
Component	Sub-component
Quantity	Dam level
	Dam operating rules
Quality	Reduction in live storage
	Clarity/ Secchi Disc Indication
	Cyanobacteria
Vegetation	Alien aquatic plant species
	In-channel Phragmites sp./reeds

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### SETTING OF RESOURCE QUALITY OBJECTIVES

5  
Develop draft RQOs and Numerical Limit

#### Rivers

- Approach:
  - Data retrieved from all in-field assessments for this study
  - Intermediate: RQOs for all indicators (high confidences)
  - Rapid 3: RQOs for all indicators (high confidences), except geomorphology and riparian vegetation (IHI as surrogate)
  - Field verification: used RQO evaluation tool to identify sub-components
    - Rivers: REMP Data (inverts and fish)
    - Other previous EWR studies
  - Water quality:
    - DWS, 2008 – setting RQOs for water quality for Reserves in accordance EC
    - Inferred from diatoms/macroinvertebrates
    - Health risk guidelines or RQOs for faecal coliforms/Escherichia coli (as used by the National Microbial Monitoring Programme (NMMP) of South Africa (DWAF, 2002))

#### Dams

- Selected and major dams

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### RESOURCE QUALITY OBJECTIVES RIVERS AND DAMS



Groundfish  
groundfish.co.za

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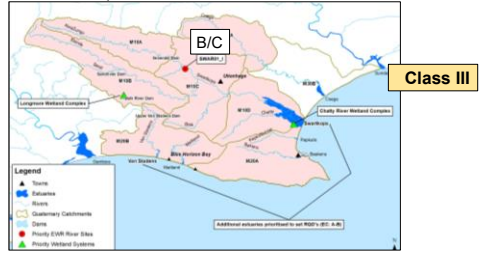
**SUMMARY OF IUAs – PRIORITY RU**

	IUA No.	IUA Code	River	Dams
Upper Kromme / coastal	1	IUA_KG1	✓	✓
Lower Kromme and Gamtoos	2	IUA_KL01	✓	✓
Kouga and Baviaanskloof	3	IUA_LD1	✓	✓
Swartkops	4	IUA_M01	✓	✓
Upper Sundays and Groot	5	IUA_LN01	✓	✓
Lower Sundays	6	IUA_N01	✓	✗
Bushmans and Kariega	7	IUA_P01	✓	✗

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**RESOURCE QUALITY OBJECTIVES: M CATCHMENT**



IUA No.	IUA Code	Rivers				Dams	
		RU No.	SQ Reach	Quat	River	RU No.	Dams
4	IUA_M01	4.1	M10B-08921	M10B	Elands	4.4	Groendal
		4.2	M10C-08897	M10C	Swartkops		
		4.3	M10C-08879	M10C	Swartkops		

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**RESOURCE QUALITY OBJECTIVES: RIVERS AND DAMS**

RU No.	SQ Reach	Quat	River	Rationale	Component													
					Quantity		Quality			Habitat			Biota					
					Low Flows	High Flows	Nutrients	SAQA	System variables	Trunks	Phytobenthos	Geomorphology	Riparian vegetation	DBH	Fish	Algal, Macroinvertebrates	Chironomids	
4.1	M10B-08921	M10B	Elands	Selected river for ecological risk support area, the Rating and SAQA are done to set RQOs														
4.2	M10C-08897	M10C	Swartkops	Reference only (SAQRU)	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4.3	M10C-08879	M10C	Swartkops	Refer to Swartkops Estuary and related Clarity RQOs priority and other water quality being implemented			X	X	X	X	X							

IUA No.	RU No.	Dams	Quantity		Quality			Vegetation		
			Dam operation and levels	System (dam) operating rules	Reduction in live storage	Clarity/Secchi Disc Indication	Cyanobacteria	Alien aquatic plant species	In-channel Phytobenthos sp./needs	
IUA_M01	4.4	Groendal Dam	X							X

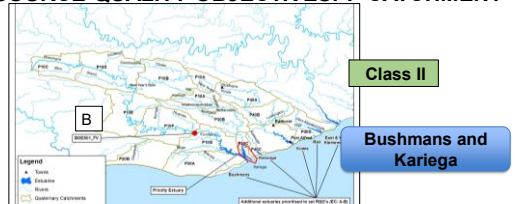
4.2: Swartkops and Groendal Dam

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**RESOURCE QUALITY OBJECTIVES: P CATCHMENT**



IUA No.	IUA Code	Rivers				Dams	
		RU No.	SQ Reach	Quat	River	RU No.	Dams
7	IUA_P01	7.1	P30A-08518	P30A	Kariega		
		7.2	P30B-08734	P30B	Kariega		
		7.3	P30C-08778	P30C	Kariega		
		7.4	P10D-08406	P10D	Boesmans		
		7.5	P10D-08482	P10D	Boesmans		
		7.6	P10G-08793	P10G	Bushmans		
		7.7	P40A-8472	P40A	Bloukrans		
		7.8	P40C-08731	P40C	Kowie		

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**RESOURCE QUALITY OBJECTIVES: RIVERS AND DAMS**

RU No.	SQ Reach	Quat	River	Rationale	Component													
					Quantity		Quality			Habitat			Biota					
					Low Flows	High Flows	Nutrients	SAQA	System variables	Trunks	Phytobenthos	Geomorphology	Riparian vegetation	DBH	Fish	Algal, Macroinvertebrates	Chironomids	
7.1	P30A-08518	P30A	Kariega	Dry-weather RQOs are set for the Kariega Estuary														
7.2	P30B-08734	P30B	Kariega	Dry-weather RQOs are set for the Kariega Estuary														
7.3	P30C-08778	P30C	Kariega	Dry-weather RQOs are set for the Kariega Estuary														
7.4	P10D-08406	P10D	Boesmans	Dry-weather RQOs are set for the Boesmans Estuary														
7.5	P10D-08482	P10D	Boesmans	Dry-weather RQOs are set for the Boesmans Estuary														
7.6	P10G-08793	P10G	Bushmans	Dry-weather RQOs are set for the Bushmans Estuary														
7.7	P40A-8472	P40A	Bloukrans	Selected according to the RQO evaluation tool			X	X	X	X	X				X	X		
7.8	P40C-08731	P40C	Kowie	Selected according to the RQO evaluation tool														

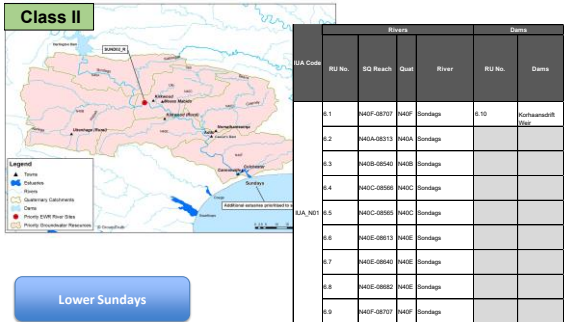
Estuaries take priority

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**RESOURCE QUALITY OBJECTIVES: N CATCHMENT**



IUA No.	IUA Code	Rivers				Dams	
		RU No.	SQ Reach	Quat	River	RU No.	Dams
5	IUA_N01	5.1	N40F-08707	N40F	Sandkops	5.10	Wichmannsdam
		5.2	N40A-08113	N40A	Sandkops		
		5.3	N40B-08940	N40B	Sandkops		
		5.4	N40C-08566	N40C	Sandkops		
		5.5	N40C-08555	N40C	Sandkops		
		5.6	N40E-08113	N40E	Sandkops		
		5.7	N40E-08940	N40E	Sandkops		
		5.8	N40E-08882	N40E	Sandkops		
		5.9	N40F-08707	N40F	Sandkops		

Lower Sundays

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RESOURCE QUALITY OBJECTIVES: N CATCHMENT

Table with columns: RU No., SQ Reach, Quat, River, Rationale, Quantity (Low Flows, High Flows, Nutrients, Salts, System variables), Quality (Toxicity, Pathogens, Geomorphology, Riparian vegetation), Habitat (RIP, Fish), and Biota (Aquatic macroinvertebrates, Diatoms).

6.4 Lower Sundays and Korhaansdrift Weir

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RESOURCE QUALITY OBJECTIVES: RIVERS AND DAMS

Table with columns: RU No., SQ Reach, Quat, River, Rationale, Quantity (Low Flows, High Flows, Nutrients, Salts, System variables), Quality (Toxicity, Pathogens, Geomorphology, Riparian vegetation), Habitat (RIP), Fish, and Biota (Aquatic macroinvertebrates, Diatoms).

Drill! Groundwater take priority - Thursday

Table with columns: IUA No., RU No., Dams, Dam operation and levels, System (dam) operating rules, Reduction in live storage, Clarity/Secchi Disc Indication, Cyanobacteria, Alien aquatic plant species, In-channel Phytobenthos sp./reeds.

5.34: Darlington Dam

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RESOURCE QUALITY OBJECTIVES: RIVERS AND DAMS

Table with columns: RU No., SQ Reach, Quat, River, Rationale, Quantity (Low Flows, High Flows, Nutrients, Salts, System variables), Quality (Toxicity, Pathogens, Geomorphology, Riparian vegetation), Habitat (RIP), Fish, and Biota (Aquatic macroinvertebrates, Diatoms).

Table with columns: IUA No., RU No., Dams, Dam operation and levels, System (dam) operating rules, Reduction in live storage, Clarity/Secchi Disc Indication, Cyanobacteria, Alien aquatic plant species, In-channel Phytobenthos sp./reeds.

3.2: Kouga and Kouga Dam

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RESOURCE QUALITY OBJECTIVES: LN CATCHMENT



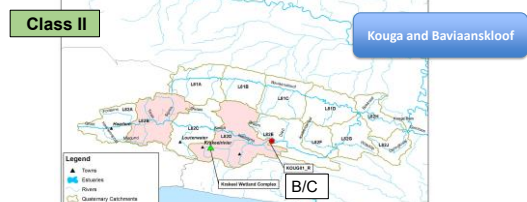
Class II Upper Sundays and Groot

Table with columns: IUA No., IUA Code, RU No., SQ Reach, Quat, River, River, RU No., Dams.

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RESOURCE QUALITY OBJECTIVES: L CATCHMENT



Class II

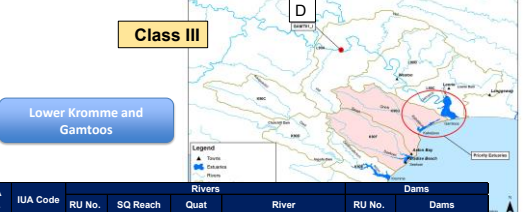
Kouga and Baviaanskloof

Table with columns: IUA No., IUA Code, RU No., SQ Reach, Quat, River, River, RU No., Dams.

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RESOURCE QUALITY OBJECTIVES: K/L CATCHMENT



Class III

Lower Kromme and Gantoots

Table with columns: IUA No., IUA Code, RU No., SQ Reach, Quat, River, River, RU No., Dams.

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**RESOURCE QUALITY OBJECTIVES: RIVERS AND DAMS**

RU No.	SQ Reach	Quat	River	Rationale	Quantity			Quality				Component		Habitat		Biota	
					Low Flow	High Flow	Nutrients	Silt	SO <sub>4</sub>	System variables	Toxicity	Phenolics	Chemistry	Human vegetation	Human		Fish
2.1	K90D-09127	K90D	Kromme (reach downstream of Mpofo Dam)	Down by Kromme Estuary RQOs and also Dam. Dam water users farming and industrial use priority. This is RQOs are													
2.2	K90D-09127	K90D	Kromme	Down by Kromme Estuary RQOs and also Dam. Dam water users farming and industrial use priority. This is RQOs are													
2.3	K90E-09147	K90E	Deelheidsdam	Down according to the RQO indication and RQO via GEM/21	X	X	X	X	X	X	X	X				X	X
2.4	K90F-09116	K90F	Swart	Down by Swart Estuary RQOs													
2.5	K90F-09132	K90F	Swakwe	Down by Swart Estuary RQOs and SW RQOs													
2.6	K90G-09066	K90G	Kubuho	Down by Kubuho Estuary RQOs and SW RQOs													
2.7	K90A-09077	K90A	Quaken	In accordance with RQO (CLASSIC)	X	X	X	X	X	X	X	X	X	X	X	X	X
2.8	K90A-09051	K90A	Kroaga	Dams upstream, same RQOs as Kromme RQ 2.1													
2.9	K90B-09024	K90B	Gamtoos	Dam driven by Gamtoos estuary RQOs													

IUA	RU No.	Dams	Quantity			Quality				Vegetation	
			Dam operation and levels	System (dam) operating rules	Reduction in live storage	Clarity /Secchi Disc Indication	Cyanobacteria	Alien aquatic plant species	In-channel Phragmites sp./reeds		
IUA_KL01	2.1	Mpofo Dam	X	X							X

**WATER IS LIFE - SANITATION IS DIGNITY** 2.7: Gamtoos

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**RESOURCE QUALITY OBJECTIVES: K CATCHMENT**



IUA No.	IUA Code	Rivers				Dams	
		RU No.	SQ Reach	Quat	River	RU No.	Dams
1	IUA_K01	1.1	K90A-09040	K90A	Kromme	1.8	Churchill
		1.2	K80A-09053	K80A	Elandsbos		
		1.3	K80D-09124	K80D	Groot		
		1.4	K80E-09175	K80E	Klasies		
		1.5	K80E-09152	K80E	Tsatsikamma		
		1.6	K80F-09201	K80F	Klipdrift		
		1.7	K80F-09252	K80F	Slang		

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**RESOURCE QUALITY OBJECTIVES: RIVERS AND DAMS**

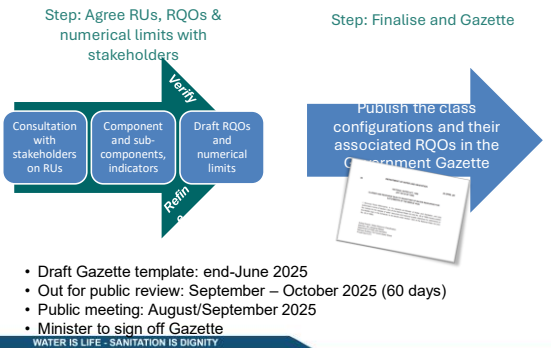
RU No.	SQ Reach	Quat	River	Rationale	Quantity			Quality				Component		Habitat		Biota	
					Low Flow	High Flow	Nutrients	SO <sub>4</sub>	System variables	Toxicity	Phenolics	Chemistry	Human vegetation	Human	Fish		Algae
1.1	K90A-09040	K90A	Kromme	In accordance with RQO (CLASSIC)	X	X	X	X	X	X	X	X	X	X	X	X	X
1.2	K80A-09053	K80A	Elandsbos	Selected according to the RQO indication			X	X	X	X	X						
1.3	K80D-09124	K80D	Groot	Selected and W. Area RQO (CLASSIC)	X												
1.4	K80E-09175	K80E	Klasies	Check estimate flow and quality RQOs													
1.5	K80E-09152	K80E	Tsatsikamma	Check estimate flow and quality RQOs													
1.6	K80F-09201	K80F	Klipdrift	Check estimate flow and quality RQOs													
1.7	K80F-09252	K80F	Slang	Check estimate flow and quality RQOs													

IUA	RU No.	Dams	Quantity			Quality				Vegetation	
			Dam operation and levels	System (dam) operating rules	Reduction in live storage	Clarity /Secchi Disc Indication	Cyanobacteria	Alien aquatic plant species	In-channel Phragmites sp./reeds		
IUA_K01	1.8	Churchill Dam	X								X

**WATER IS LIFE - SANITATION IS DIGNITY** 1.1: Kromme and Churchill (K) and Mpofo Dam (KL)

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**NEXT STEPS:**



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**THANK YOU!**

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All study reports can be accessed from the DWS website: <https://www.dws.gov.za/RDM/WRCRS/>

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