DEPARTMENT OF WATER AND SANITATION

NO. 612 **17 JULY 2015**

DEPARTMENT OF WATER AND SANITATION

NATIONAL WATER ACT, 1998
(ACT NO.36 OF 1998)

PROPOSED CLASSES AND RESOURCE QUALITY OBJECTIVES OF WATER RESOURCES FOR CATCHMENTS OF THE MIDDLE VAAL

I, Nomvula Paula Mokonyane, in my capacity as Minister of Water and Sanitation, and duly authorised in terms of section 13(4) of the National Water Act (Act No. 36 of 1998) hereby publishes for public comment the proposed classes of water resources and resource quality objectives for catchments of the Middle Vaal, in the Schedule, to be issued under section 13(4) of the National Water Act (Act No. 36 of 1998).

Any person who wishes to submit written comments with regard to the proposed classes and resource quality objectives should submit the comments within 60 days from the date of publication of this Notice to:

Director: Water Resource Classification
Attention: Ms Shane Naidoo
Department of Water and Sanitation
Zwamadaka Building 185 Francis Baard Street
Private Bag X313
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MRS NP MOKONYANE
MINISTER OF WATER AND SANITATION
DATE: 01.07.15

SCHEDULE

PROPOSED CLASSES AND RESOURCE QUALITY OBJECTIVES OF WATER RESOURCES FOR CATCHMENTS OF THE MIDDLE VAAL IN TERMS OF SECTION 13(1)(A) AND (B) OF THE NATIONAL WATER ACT (ACT NO.36 OF 1998)

1 DESCRIPTION OF WATER RESOURCE

1. The proposed classes and resource quality objectives are determined for all or part of every significant water resource within the catchments of the Middle Vaal as set out below:

Water Management Area:	Vaal
Drainage Region:	C Primary Drainage Region
River(s):	Vaal River System (Vaal, Renoster, Vals, Schoonspruit, Koekemoerspruit, Sand and Vet Systems)

2. The Minister has, in terms of section 12 of the National Water Act, Act No 36 of 1998 (the Act), prescribed a system for classifying water resources by promulgating Regulation 810, Government Gazette 33541 dated 17 September 2010. In terms of section 13(1) of the Act the Minister must, as soon as reasonably practicable after the Minister has prescribed a system for classifying water resources and subject to subsection (4), by notice in the *Gazette*, determine for all or part of every significant water resource, a class in accordance with the prescribed classification system.

3. The Minister, in terms of section 13(1)(a) of the Act, proposes to determine the following classes of each significant water resource for catchments of the Middle Vaal.

4. The Minister, in terms of section 13(1)(b) of the Act, proposes to determine the following resource quality objectives for each significant water resource for catchment of the Middle Vaal.

2. DETERMINATION OF THE CLASS OF WATER RESOURCE AND RESOURCE QUALITY OBJECTIVES IN TERMS OF SECTION 13(1)(A) AND (B) OF THE NATIONAL WATER ACT (ACT NO.36 OF 1998)

1. A summary of the water resource classes for Integrated Units of Analysis (Figure 1) and ecological categories for the Middle Vaal is set out in Table 1.

2. Integrated Units of Analysis (IUA) are classified in terms of their extent of permissible utilization and protection as either Class I: indicating high environmental protection and minimal utilization; or Class II indicating moderate protection and moderate utilization; and Class III indicating sustainable minimal protection and high utilization.

3. Resource Quality Objectives (RQO) are defined for each prioritised resource unit (RU) (Table 2 and Figure 2) for every IUA in terms of water quantity, quality, habitat and biota as shown in Tables 3 – 11 respectively.

4. Where specified, the ecological category or Recommended Ecological Category (REC) means the assigned ecological condition by the Minister to a water resource that reflects the ecological condition of that water resource in terms of the deviation of its biophysical components from a predevelopment condition.

5. RQO are applicable from 1 April 2016.

1. **Water Resource Classes of the Middle Vaal**

Table 1: Water Resource Classes per Integrated Unit of Analysis and Ecological Categories per Biophysical Node

Integrated Unit of Analysis (IUA)	Water Resource Class for IUA	Biophysical Node Name	Quaternary Catchment	Major River Name	Tributary Name	Gross Catchment Area (km²)	Natural MAR (million m³/a)	Present Ecological State	Recommended Ecological Category
Renoster River (MA)	II	MA.1	C70A	Vaal River	Renoster River	613	18.46	C	C
		MA.2	C70B	Renoster River	Renoster River	881	25.55	B/C	B/C
		MA.3	C70C	Renoster River	Leeufonteinspruit	81	2.11	C	C
		MA.4	C70D	Vaal River	Renoster River	2413	63.86	C	C
		MA.5	C70D	Renoster River	Doringspruit	422	7.86	C/D	C/D
		MA.6	C70F	Vaal River	Renoster River	4092	93.14	C	C
		MA.7	C70H	Renoster River	Heuningspruit	1152	17.94	C	C
		MA.8	C70K	Vaal River	Renoster River	5868	120.92	C	C
Vals River (MB)	III	MB.1	C60A	Vaal River	Vals River	860	31.24	C	C
		MB.2	C60C	Vals River	Elandsspruit/Elands	349	8.2	C	C
		MB.3	C60G	Vaal River	Vals River	4898	131.7	C	C
		EWR14	C60J	Vaal River	Vals River	5930	145.79	C/D	C/D
Schoonspruit River (MC)	III	MC.1	C24C	Vaal River	Schoonspruit	1350	60.6	C/D	C/D
		MC.2	C24F	Vaal River	Taaibosspruit	2020	19.5	C	C
		MC.3	C24G	Vaal River	Schoonspruit	2694	105.52	C/D	C/D
		MC.4	C24H	Vaal River	Schoonspruit	3503	117.31	C/D	C/D
		MC.5	C24A	Vaal River	Koekemoerspruit	839	26.19	D/E	D
		MC.6	C24H	Schoonspruit	Jagspruit	499	5.24	D	D
Upper Sand River (MD1)	III	MD1.1	C42D	Vet River	Sand River	2215	66.4	C	C
Lower Sand River (MD2)	III	MD2.1	C42G	Vet River	Sand River	3974	104.16	C	C
		MD2.2	C42F	Sand River	Koolspruit	734	19.26	C	C
		MD2.3	C42L	Vet River	Sand River	7555	180.27	C	C
Upper Vet River (ME1)	II	ME1.1	C41D	Vaal River	Vet River	2113	72.01	C	C
		ME1.2	C41E	Vet River/Erfenis	Klein Vet River	2083	81.86	C	C
		ME1.3	C41E	Klein Vet River	Soutspruit	159	3.87	B/C	B/C
Lower Vet River (ME2)	III	ME2.1	C41H	Vaal River	Vet River	5551	190.94	C	C
		EWR15	C43A	Vaal River	Vet River	16040	413.55	C/D	C/D
Vaal River from Renoster River confluence to Bloemhof Dam (MF)	III	MF.1	C24B	Vaal River		864	4.75	C	C
		EWR12	C24J	Vaal River		62305	2546.42	D	D
		EWR13	C25A	Vaal River	Klipspruit	70809	2714.89	C/D	C/D

Table 2: Resource Units delineated for the Middle Vaal WMA

Resource Unit	Description	Quaternary Catchment
	INTEGRATED UNITS OF ANALYSIS: VAAL RIVER (MF)	
VB1.1	Vaal River mainstem: Vermaasdrift to upstream of the Schoon spruit confluence	C24B
VB1.2	Vaal River mainstem: From the Schoonspruit confluence to just upstream of the Vals River confluence	C24J
VB1.3	Vaal River mainstem: From Vals River confluence to Bloemhof Dam	C25C, C25F
VB2	Tributary catchments (Vierfonteinspruit and C24J –south of Vaal River)	C24B, C24J
VB3	Ysterspruit, Matjiespruit, Klipspruit, Wolwespruit and Makwassiespruit tributary catchments	C24J, C25A, C25C, C25D
VB4	Sandspruit tributary catchment	C25C, C25B, C25F, C43B
VB5	Bamboespruit tributary catchment	C25E
VB6	Bloemhof Dam	C25E, C25F, C43D
	TRIBUTARIES	
	INTEGRATED UNITS OF ANALYSIS: RENOSTER RIVER (MA)	
R2	Downstream Vaalbankspruit tributary confluences to Koppies Dam	C70C
R3	Koppies Dam	C70C
R4	Downstream Koppies Dam to confluence with the Heuningspruit	C70E, C70D, C70F, C70G, C70H
R5	Downstream Heuningspruit confluence to confluence with the Vaal River	C70J, C70K
	INTEGRATED UNITS OF ANALYSIS MB: VALS RIVER	
V2	Downstream Pauciflora Spruit confluence to Kroonstad	C60B, C60C, C60D, C60E, C60F
V3	Serfontein Dam	C60D
V4	Middelspruit tributary catchment	C60H
V5	From the Kroonval weir to the Vaal River confluence	C60G, C60J
	INTEGRATED UNITS OF ANALYSIS: SCHOONSPRUIT (MC)	
SK1	From origin of Koekemoerspruit to confluence with Vaal River	C24A, C24B
SK2	Schoonspruit eye	C24C
SK3	Taaibospruit tributary catchment	C24F
SK4	From Schoonspruit eye to Kaalspruit confluence	C24D, C24E
SK5	Kaalspruit and Buisfonteinspruit tributary catchment	C24G
SK6	Johan Neser Dam (Klerksdorp Dam)	C24G
SK7	From Johan Neser Dam to confluence with the Vaal River	C24H
	INTEGRATED UNITS OF ANALYSIS: UPPER SAND RIVER (MD1)	
US2	Downstream Klipspruit confluence to Allemanskraal Dam	C42D, C42E
US3	Allemanskraal Dam	C42E
	INTEGRATED UNITS OF ANALYSIS: LOWER SAND RIVER (MD2)	
LS1	Allemanskraal Dam to Merriespruit confluence	C42F, C42G, C42H,
LS2	Rietspruit tributary catchment	C42J
LS3	Downstream Rietspruit confluence to confluence with the Vet River	C42K, C42L, C43B
	INTEGRATED UNITS OF ANALYSIS: UPPER VET RIVER (ME1)	
UV1	Klein Vet and Laaispruit tributary catchments	C41A, C41B
UV2	Origin of Vet River and Leeuspruit tributary catchment to Erfenis Dam	C41C, C41D
UV3	Soutspruit tributary catchment	C41E
UV4	Erfenis Dam	C41E
	INTEGRATED UNITS OF ANALYSIS : LOWER VET RIVER (ME2)	
LV1	Erfernis Dam to confluence with Sand River	C41F, C41G, C41H, C41J
LV2	Downstream Sand River confluence to Bloemhof Dam	C43A, C43C, C43D

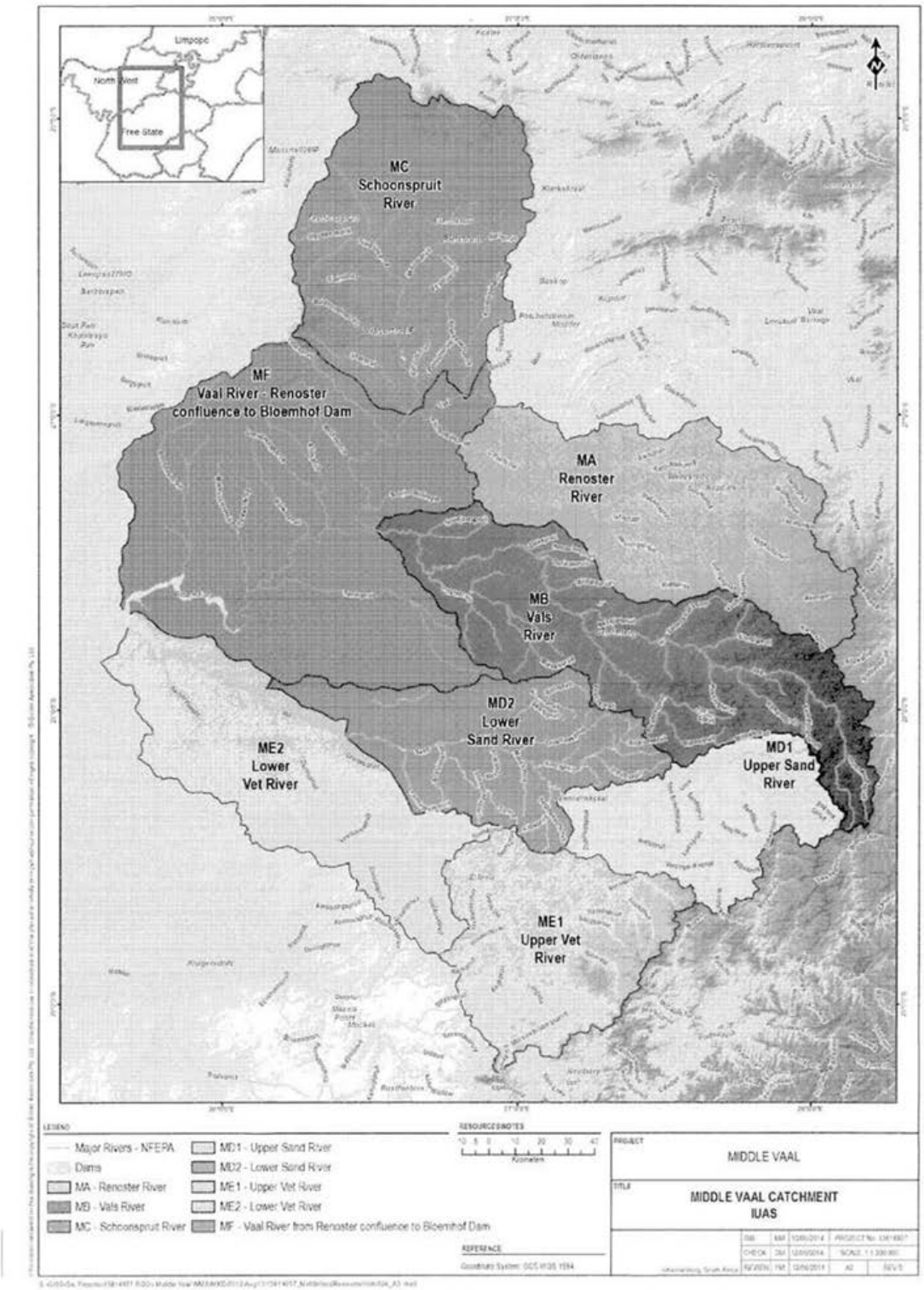

Figure 1: Integrated Units of Analysis defined in the Middle Vaal WMA

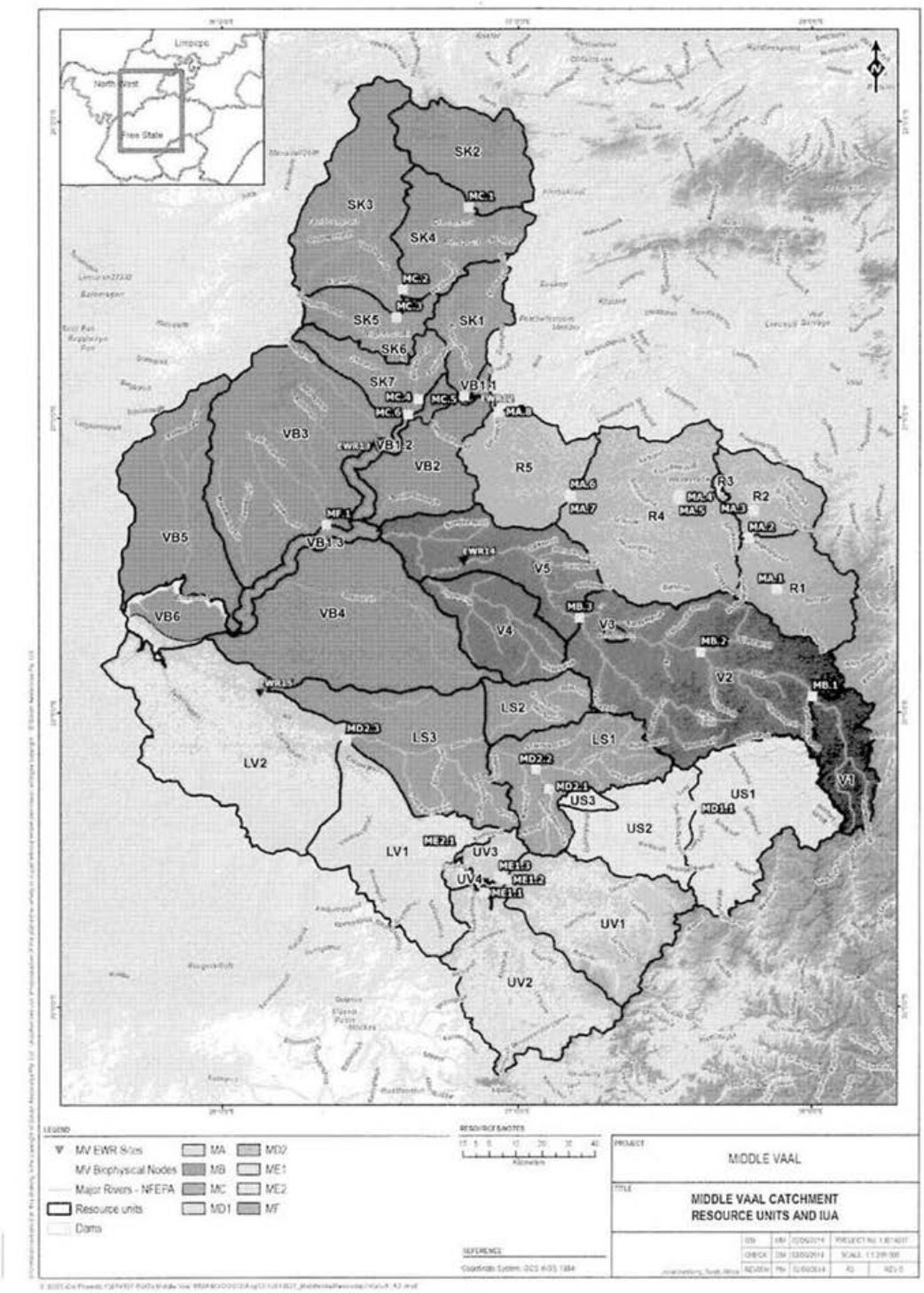

Figure 2: Resource Units and location of Nodes in the Middle Vaal WMA

Table 3: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis (RENOSTER)

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
										Month	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-centile*	*cubic metres/ second*	*Per-centile*
Renoster	II	**Renoster (C70C)** (Tributaries Elandspruit, Leeufontein and Wolwespruit)	**R2**	**MA 3**	**C**	**Quantity**	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MA3) = 1.097 million cubic metres/annum (51.79% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Oct	0.0172	40	0.0000	90
										Nov	0.0428	50	0.0000	99
										Dec	0.0463	60	0.0000	99
										Jan	0.0597	60	0.0037	99
										Feb	0.0616	40	0.0000	99
										Mar	0.0455	40	0.0000	99
										Apr	0.0243	30	0.0000	99
										May	0.0093	30	0.0000	90
										Jun	0.0062	30	0.0000	90
										Jul	0.0049	50	0.0000	99
										Aug	0.0045	50	0.0000	99
										Sep	0.0073	30	0.0000	99
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and to ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as nitrogen	≤ 0.50 milligrams/litre (50th percentile)				
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)				
							Salts	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 55 milliSiemens/metre (95th percentile)				
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)				
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat integrity category ≥ C (≥ 62)				

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						Biota	Fish	Instream biota must be in moderately modified condition or better. The importance of the RU as a refuge habitat and nursery area for fish must be ensured.	A baseline assessment to determine the current integrity and health of the fish community must be undertaken. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
		Renoster (C70C) (Tributaries Elandspruit, Leeufontein and Wolwespruit)	R2	MA 3	C	Biota	Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.
		Koppies Dam (C70C)	R3			Quantity	Low flows	The downstream maintenance low flow requirements of node MA 4 must be met to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MA4) = 18.04 million cubic metres/annum (28.82% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
						Quality	Nutrients	Concentration of nutrients must be maintained to sustain ecosystem health and water quality requirements of water users. The dam should be maintained in a mesotrophic state.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.015 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) 6 milligrams/litre (95th percentile)

Month	Maintenance Low Flows		Drought Flows	
	cubic metres/second	Percentile	cubic metres/second	Percentile
Oct	0.2348	60	0.0299	99
Nov	0.5204	60	0.0231	99
Dec	0.5604	70	0.0336	99
Jan	0.7187	80	0.0672	99
Feb	0.7577	70	0.0248	99
Mar	0.5892	60	0.0448	99
Apr	0.3484	60	0.0309	99
May	0.1613	50	0.0261	99
Jun	0.1181	60	0.0386	99
Jul	0.1001	60	0.0381	99
Aug	0.0900	70	0.0351	99
Sep	0.1246	50	0.0455	99

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
									Phytoplankton	≤ 0.025 milligrams/litre (50^{th} percentile)
							Salts	The salinity in the dam must be maintained in order to support ecosystem health and the water quality requirements of the downstream water users.	Electrical conductivity	≤ 55 milliSiemens/metre (95^{th} percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95^{th} percentile)
	II	Koppies Dam (C70C)	R3			Habitat	Dam habitat	The downstream maintenance low flow requirements of node MA 4 in RU R2 must be met to support a healthy condition for the ecosystem and users. The importance of the Dam as a refuge for aquatic and semi-aquatic biota must be protected. This includes ecologically and recreationally important fish species and birds. The importance of the Dam for recreation, eco-tourism, abstraction and ecological flow releases must be protected.		
						Biota	Fish	Located in the main channel of the Renoster River, the dam provides an important fish refuge area and must be managed to maintain the upstream species.	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Monitoring should be conducted annually.	
							Aquatic birds	The dam supports a variety of aquatic and semi-aquatic bird species. The suitability of the dam as bird habitat must be maintained.	A baseline assessment should be conducted to determine the aquatic bird community around the dam.	
		Renoster (C70D, C70E, C70F, C70G, C70H) (Downstream Koppies Dam to confluence with the Heuningspruit)	R4	MA 6	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MA6) = 25.413 million cubic metres/annum (27.28% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows	

Month	Maintenance Low Flows		Drought Flows	
	cubic metres/second	Percentile	cubic metres/second	Percentile
Oct	0.2808	60	0.0373	99
Nov	0.6065	70	0.0617	99
Dec	0.6758	80	0.0971	99
Jan	0.9039	80	0.0821	99
Feb	1.0206	70	0.0661	99
Mar	0.8789	70	0.0485	99

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit			
									(percentage value of naturalised flow distribution)	Apr	0.5698	70	0.0887	99
										May	0.2830	60	0.0261	99
										Jun	0.1759	60	0.0502	99
										Jul	0.1434	80	0.0709	99
										Aug	0.1307	80	0.0373	99
										Sep	0.1674	50	0.0579	99
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)			
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th percentile)			
									Nitrate & Nitrite as Nitrogen	≤ 0.50 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)			
Renoster	II	Renoster (C70D, C70E, C70F, C70G, C70H) (Downstream Koppies Dam to confluence with the Heuningspruit)	R4	MA 6	C	Quality	Salts	Instream salinity must be maintained at the current state to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 70 milliSiemens/metre (95th percentile)			
							System variables	pH must be maintained at present state.	pH range	7.4 (5th percentile) and 8.6. (95th percentile)			
								A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.			
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)			
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat integrity category ≥ C (≥ 62)			

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						Biota	Fish	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality and limitation of migration barriers for fish.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state. If the current ecological category meets the recommended C category then the baseline integrity and health must be maintained. However if the baseline assessment shows that the current state does not meet the C ecological category then the C category must be met. Fish Response Assessment Index (FRAI) must be utilized.	Instream and Riparian habitat integrity category ≥ C (≥ 62) Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.
Renoster	II	Renoster (C70J, C70K) (Downstream Heuningspruit confluence to confluence with the Vaal River) (includes the Olifantsvlei tributary)	R5	MA8	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MA8) = 31.578 million cubic metres/annum (26.12% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	

Month	*Maintenance Low Flows*		*Drought Flows*	
	cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
Oct	0.3226	60	0.0373	99
Nov	0.6848	50	0.1003	99
Dec	0.7743	80	0.1232	99
Jan	1.0600	90	0.0821	999
Feb	1.2269	80	0.1116	99
Mar	1.0977	70	0.0485	99
Apr	0.7311	70	0.1427	99
May	0.3812	60	0.0261	99
Jun	0.2319	80	0.0502	99
Jul	0.1871	90	0.0709	99

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit			
										Aug	0.1725	90	0.0373	99
										Sep	0.2076	60	0.0579	99
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤1.25 milligrams/litre (50th percentile)				
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 1.0 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)				
							Salts	Instream salinity must be maintained. Salinity levels should not be allowed to deteriorate.	Electrical conductivity	≤ 55 milliSiemens/metre (95th percentile)				
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)				
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)				
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)				
								A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.				
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat integrity category ≥ C (≥ 62)				

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
Renoster	II	Renoster (C70J, C70K) (Downstream Heuningspruit confluence to confluence with the Vaal River) (includes the Olifantsvlei tributary)	R5	MA 8	C	Biota	Fish	Instream biota must be in moderately modified condition or better. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the invertebrate community within the system must be improved, by improving the water quality from a nutrient perspective	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	An ecological category of C must be met. The Average Score Per Taxon value of > 5.0 must be achieved.
							Aquatic birdlife	The habitat requirements of aquatic bird populations must be provided for.	A baseline assessment should be conducted to determine the aquatic bird community and future changes in the bird communities compared to the baseline.	

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Table 4: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis (VALS)

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
											Maintenance Low Flows		Drought Flows	
										Month	cubic metres/ second	Per-cen-tile	cubic metres/ second	Per-cen-tile
MB Vals	III	Vals (C60B, C60C, C60D, C80E, C80F) (from the Pauciflora spruit confluence to the Kroonval weir at Kroonstad) (Major tributaries include the Elandspruit, Liebenberg stroom and Blomspruit)	V2	MB 3	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MB3) = 33.464 million cubic metres/annum (25.41% of the Virgin Mean Annual Runoff)	Oct	0.3200	60	0.0261	99
										Nov	0.6655	70	0.0077	99
										Dec	0.8307	70	0.0000	99
										Jan	1.1537	80	0.0373	99
									Maintenance flows (percentage value of naturalised flow distribution)	Feb	1.2475	70	0.0703	99
										Mar	1.1455	90	0.0523	99
										Apr	0.6917	60	0.0000	99
										May	0.3566	40	0.0373	99
									Drought flows (percentage value of naturalised flow distribution)	Jun	0.1991	60	0.0386	99
										Jul	0.1340	60	0.0075	99
										Aug	0.1568	60	0.0411	99
										Sep	0.2600	30	0.0000	99
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0. 50 milligrams/litre (50^{th} percentile)				
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50^{th} percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)				
							Salts	Instream salinity must be maintained at the present state to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 65 milliSiemens/metre (95^{th} percentile)				
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95^{th} percentile)				
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented	Instream and Riparian habitat integrity category ≥ C (≥ 62)				
						Biota	Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be improved, by improving the water quality from a nutrient perspective.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic	An ecological category of C/D must be met. The Average Score Per Taxon value of > 4.8 must be achieved.				

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
									biomonitoring annually using the South African Scoring System 5 methodology.	
							Diatoms	Water quality improvement is required from a nutrient perspective.	Conduct a diatom assessment annually.	The Specific Pollution Index should be > 9.2 (C category).
MB Vals	III	Vals (C60B, C60C, C60D, C60E, C60F) (from the Pauciflora spruit confluence to the Kroonval weir) (Major tributaries Elandspruit, Liebenberg stroom and Blomspruit)	V2	MB 3	C	Biota	Fish	Instream biota must be in moderately modified condition or better. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for including the limitation of migration barriers.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Instream and Riparian habitat Integrity category ≥ C (≥ 62) Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
MB Vals	III	Serfontein Dam (C60D)	V3			Quantity	Low flows	The downstream maintenance low flow requirements of node MB 3 must be met to support a healthy condition for the ecosystem.	Total Ecological Water Requirement (node MB3) = 33.464 million cubic metres/annum (25.41% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
						Quality	Nutrients	Concentration of nutrients in the dam must be improved to sustain ecosystem health and the water quality requirements of water users. Dam should be maintained in a mesotrophic state.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.015 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)

Month	Maintenance Low Flows: cubic metres/second	Maintenance Low Flows: Percentile	Drought Flows: cubic metres/second	Drought Flows: Percentile
Oct	0.3200	60	0.0261	99
Nov	0.6655	70	0.0077	99
Dec	0.8307	70	0.0000	99
Jan	1.1537	80	0.0373	99
Feb	1.2475	70	0.0703	99
Mar	1.1455	60	0.0523	99
Apr	0.6917	60	0.0000	99
May	0.3566	40	0.0373	99
Jun	0.1991	50	0.0386	99
Jul	0.1340	70	0.0075	99
Aug	0.1568	60	0.0411	99
Sep	0.2600	30	0.0000	99

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MB Vals	III	Serfontein Dam (C60D)	V3		C	Quality			Chlorophyll-*a*	≤ 0.025 milligrams/litre (50th percentile)
							Salts	Salinity in the dam must be maintained to support ecosystem health and water quality requirements of the downstream water users.	Electrical conductivity	≤ 65 milliSiemens/metre (95th percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Biota	Fish	The downstream maintenance low flow requirements of node MB 3 in RU V2 must be met to support a healthy condition for the ecosystem and users. The importance of the Dam as a fish refuge must be protected. This includes ecologically and recreationally important fish species. The importance of the Dam for abstraction and ecological flow releases must be protected.	Maintenance of low flow releases as specified for node MB 3 in RU V2. Habitat requirements and health of specified ecologically and recreationally important fish species as specified. Habitat requirements and health of specified ecologically and recreationally important aquatic and semi-aquatic bird species as specified.	
		Middelspruit (C60H) (Otterspruit tributary)	V4			Quantity	Low flows	Flows must be maintained to support the wetland systems present.	Ecological Water Requirement for maintenance low flows	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th percentile)
							Salts	Instream salinity must be maintained to support the aquatic ecosystem.	Electrical conductivity	≤ 65 milliSiemens/metre (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified	The Rapid Habitat Assessment Method must be implemented	Instream and Riparian habitat Integrity category ≥ C (≥ 62)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
								condition or better.		
						Biota	Fish	Instream biota must be in moderately modified condition or better. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for including the limitation of migration barriers.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.
MB Vals	III	Vals (C60G, C60J) (From Kroonvaal weir to the Vaal River confluence) (Nuwejaar spruit and Skikspruit tributaries)	V5	EWR 14	C/D	Quantity	Low flows	The maintenance low flows and drought flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem and users.	Total Maintenance low flow and drought flow Ecological Water Requirement (EWR 14) = 8.003 million cubic metres/annum (5.49% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
							High Flows	The maintenance high flows must be attained so that the environmental flows	Total Maintenance high flow Ecological Water Requirement (EWR 14) =	

Month	Maintenance Low Flows		Drought Flows	
	cubic metres/ second	Per-cen-tile	cubic metres/ second	Per-cen-tile
Oct	0.153	70	0.003	99
Nov	0.276	80	0.005	99
Dec	0.333	80	0.006	99
Jan	0.447	90	0.008	99
Feb	0.484	80	0.008	99
Mar	0.444	80	0.008	99
Apr	0.285	80	0.000	99
May	0.166	70	0.003	99
Jun	0.112	80	0.002	99
Jul	0.087	90	0.002	99
Aug	0.095	90	0.002	99
Sep	0.133	70	0.000	99

Month	Maintenonce High Flows	
	cubic metres/ second	Percentile

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit	
MB Vals	III	Vals (C60G, C60J) (From Kroonvaal weir to the Vaal River confluence) (Nuwejaar spruit and Skikspruit tributaries	V5	EWR 14	C/D	Quality	Nutrients	requirements are met to support a healthy condition for the ecosystem.	16.969 million cubic metres/annum (11.64% of the Virgin Mean Annual Runoff)	Oct	0.000	99
										Nov	1.653	50
										Dec	0.000	99
										Jan	0.697	90
										Feb	2.7	60
									Maintenance high flows (percentage value of naturalised flow distribution)	Mar	1.6	60
										Apr	0.000	99
										May	0.000	99
										Jun	0.000	99
										Jul	0.000	99
										Aug	0.000	99
										Sep	0.000	99
								Instream concentration of nutrients must sustain aquatic ecosystem health. Concentrations should not be allowed to deteriorate.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 1.50 milligrams/litre (50th percentile)	
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)	
									Nitrate & Nitrite as Nitrogen	≤ 1.35 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)	
									Chlorophyll-*a* concentrations should be monitored as a response indicator against the resource quality objective nutrient concentrations.	Chlorophyll-*a* Periphyton ≤ 1.7 milligrams/square metre (50th percentile) Chlorophyll-*a* Phytoplankton ≤ 0.025 milligrams/litre (50th percentile)	
							Salts	Instream salinity should not deteriorate.	Electrical conductivity	≤ 85 milliSiemens/metre (95th percentile)	
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)	
							System variables	pH must be maintained at present state.	pH range	7.0 (5th percentile) and 8.6 (95th percentile).	
								A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.	

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a better than largely modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)
						Biota	Fish	Instream biota must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for including the limitation of migration barriers. The importance of the RU as a refuge for fish in the Middle Vaal River must be maintained.	Fish Response Assessment Index (FRAI) must be utilized. The ecological specifications and Thresholds of Potential Concern for Ecological Water Requirement site 14 must be adhered to.	Fish ecological category: ≥ C/D (≥ 58) Macro-invertebrate ecological category:≥ C/D (≥ 58) Instream Ecostatus category ≥ C/D (≥ 58) Hydrological category ≥ C/D (≥ 58) With monthly flow requirements as specified. Water Quality category:≥ C/D (≥ 58)
							Aquatic Invertebrates	The Present Ecological State must be improved to a C category.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology. The ecological specifications and Thresholds of Potential Concern for Ecological Water Requirement site 14 must be adhered to.	The South African Scoring System 5 score must be >110 and the Average Score Per Taxon > 5.2.

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Table 5: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis (SCHOONSPRUIT)

IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
										Month	Maintenance Low Flows		Drought Flows	
											cubic metres/second	Percentile	cubic metres/second	Percentile
MC Schoonspruit	III	Koekemoerspruit (C24A)	SK1	MC 5	D	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MC5) = 4.691 million cubic metres/annum (17.91% of the Virgin Mean Annual Runoff)	Oct	0.0202	70	0.0037	99
										Nov	0.0409	80	0.0039	99
										Dec	0.0571	40	0.0112	99
										Jan	0.1038	40	0.0112	99
										Feb	0.1682	40	0.0165	99
										Mar	0.2012	70	0.0149	99
										Apr	0.1246	60	0.0000	99
										May	0.0504	50	0.0037	99
										Jun	0.0243	70	0.0039	99
										Jul	0.0179	70	0.0000	99
										Aug	0.0138	80	0.0000	99
										Sep	0.0104	70	0.0000	99
									Maintenance flows (percentage value of naturalised flow distribution)					
									Drought flows (percentage value of naturalised flow distribution)					
									The mine water and wastewater treatment works discharges in relation to the required instream flows will have to be managed in future to ensure the maintenance low in the river.					
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Dissolved Inorganic Nitrogen as nitrogen	≤ 3.0 milligrams/litre (50th percentile				
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)				
							Salts	Instream salinity must be improved to acceptable levels to support a healthy aquatic ecosystem and the water quality requirements of water users.	Electrical conductivity					
									The salinity needs to be improved significantly from the present state to meet the required limit of 85 milliSiemens/ metre. A phased approach over a twenty year period is to be used to achieve the limit of 85 milliSiemens/metre.	≤ 85 milliSiemens/metre (95th percentile) A numerical limit of 110 milliSiemens/ metre (95th percentile) to be met by the 10th year after publication date of the Government Notice. Resource Quality Objective numerical limit to be achieved by the 20th year after publication date of the Government Notice.				
									Sulphate	≤ 250 milligrams/litre (95th percentile) A numerical limit of 400 milligrams/ litre (95th percentile) to be met by the 10th year after publication date of the Government Notice. Resource Quality Objective				

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
										numerical limit to be achieved by the 20th year after publication date of the Government Notice.
									Magnesium	≤100 milligrams/litre (95th percentile)
MC Schoonspruit	III	Koekemoer-spruit (C24A)	SK1	MC 5	D	Quality	Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Cyanide (free)	≤ 0.050 milligrams/litre (95th percentile)
									Aluminium	≤ 0.1 milligrams/litre (95th percentile)
									Manganese	≤ 0.250 milligrams/litre (95th percentile)
									Iron	≤ 0.25 milligrams/litre (95th percentile)
									Uranium	≤ 0.03 milligrams/litre (95th percentile)
									Ammonia as Nitrogen	≤ 0.1milligrams/litre (95th percentile)
									A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.	
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a largely modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ D (≥ 42)
						Biota	Fish	Instream biota must be in a largely modified condition or better. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ ≥ D (≥ 42) Macro-invertebrate ecological category:≥ D (≥ 42) Instream Ecostatus category≥ D (≥ 42) Hydrological category≥ D (≥ 42) With monthly flow requirements as specified. Water Quality category:≥ D (≥ 42)
							Diatoms	Water quality improvement is required from a nutrient perspective.	Specific Pollution Index. Conduct a diatom assessment annually.	The Specific Pollution Index score should be > 5.0.

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MC Schoonspruit	III	Schoonspruit Eye (C24C)	SK2	MC 1	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	There is depletion of the groundwater resources which is impacting on the flow and water quality of the Schoonspruit Eye water due to irrigation water use. The water quality of the eye is currently good and it is important to maintain this quality as irrigation and domestic water users are dependent on the Schoonspruit eye for water supply.	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
									Ecological Water Requirement for maintenance low flows and drought flows	
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health of the Eye and protect the good water quality present. Concentrations should not be allowed to deteriorate. The current water quality ecological status of the Schoonspruit Eye must be maintained.	Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									Orthophosphate as Phosphorus	≤ 0.020 milligrams/litre (50th percentile)
									Chlorophyll-*a*	≤ 0.010 milligrams/litre (50th percentile)
							Salts	Salinity levels at the Schoonspruit eye are low and must be maintained at the present state. Salinity levels should not deteriorate.	Electrical conductivity	≤ 55 milliSiemens/metre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	6.0 (5th percentile) and 8.5 (95th percentile)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MC Schoonspruit	III	Taalbosspruit (C24F)	SK3	MC 2	C	Habitat	Instream Habitat	Instream and Riparian habitat must be in a largely natural condition or better. The habitat is unique to the catchment area and must be maintained at the prescribed ecological condition. Instream biota must be in a largely natural condition or better. The requirements of species of ecological importance and with particular flow and water quality needs must be provided for.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ B (≥ 82) Fish ecological category:≥ B (≥ 82) Macro-invertebrate ecological category:≥ B (≥ 82) Instream Ecostatus category≥ B (≥ 82) Hydrological category ≥ B (≥ 82) With monthly flow requirements as specified. Water Quality category: A (> 92)
						Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MC2) = 4.147 million cubic metres/annum (21.27% of the Virgin Mean Annual Runoff) Maintenance flows (percentile value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
						Quality	Salts	The instream salinity must be maintained at the present state to support the aquatic ecosystem and the water quality requirements of the water users. Salinity levels should not deteriorate.	Electrical conductivity	≤ 65 milliSiemens/metre (95th percentile)

Month	Maintenance Low Flows		Drought Flows	
	cubic metres/second	Percentile	cubic metres/second	Percentile
Oct	0.0239	60	0.0075	99
Nov	0.0278	70	0.0039	99
Dec	0.0310	70	0.0037	99
Jan	0.0743	70	0.0149	99
Feb	0.1484	60	0.0124	99
Mar	0.1605	60	0.0112	99
Apr	0.1073	70	0.0270	99
May	0.0489	80	0.0224	99
Jun	0.0313	90	0.0201	99
Jul	0.0246	99	0.0153	99
Aug	0.0202	99	0.0119	99
Sep	0.0170	70	0.0096	99

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MC Schoonspruit	III	Schoonspruit (C24D, C24E) (From below eye to the Kaalspruit confluence) (Rietspruit and Strydfontein-loop tributaries)	SK4	MC 3	C/D	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Ecological Water Requirement for maintenance low flows	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 3.0 milligrams/litre (50^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
							Salts	The instream salinity must be maintained at the current state to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 75 milliSiemens/metre (95^{th}percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95^{th} percentile)
		Schoonspruit (C24D, C24E) (From below eye to the Kaalspruit confluence) (Rietspruit and Strydfontein-loop tributaries)	SK4	MC 3	C/D	Habitat	Instream Habitat	Instream and Riparian habitat must be in a better than largely modified condition.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)
						Biota	Fish	Instream biota must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category:≥ C/D (≥ 58) Macro-invertebrate ecological category:≥ C/D (≥ 58) Instream Ecostatus category≥ C/D (≥ 58) Hydrological category≥ C/D (≥ 58) With monthly flow requirements as specified. Water Quality category:≥ C/D (≥ 58)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.
		Schoonspruit (24F) From Kaalspruit confluence to Johan Neser Dam) (includes Buisfontein-spruit)	SK5	MC 3	C/D	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Ecological Water Requirement for maintenance low flows	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Dissolved Inorganic Nitrogen as nitrogen	≤ 1.0 milligrams/litre (50^{th} percentile)
									Orthophosphate as Phosphorus ≤	0.125 milligrams/litre (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
							Salts	The instream salinity must be maintained at the present state to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 70 milliSiemens/metre (95^{th} percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95^{th} percentile)
							System variables	pH must be maintained at present state.	pH range	6.0 (5^{th} percentile) and 8.5 (95^{th} percentile)
MC Schoon spruit	III	Schoonspruit (24F) From Kaalspruit confluence to	SK5	MC 3	C/D	Habitat	Instream Habitat	Instream and Riparian habitat must be in a better than largely modified condition.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
		Johan Neser Dam) (includes Buisfontein-spruit)				Biota	Fish	Instream biota must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category:≥ C/D (≥ 58) Macro-invertebrate ecological category:≥ C/D (≥ 58) Instream Ecostatus category≥ C/D (≥ 58) Hydrological category≥ C/D (≥ 58) With monthly flow requirements as specified. Water Quality category:≥ C/D (≥ 58)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C ecological category by ensuring the Average Score Per Taxon is >5.0.
		Johan Neser (Klerksdorp Dam) (C24G)	SK6			Quality	Nutrients	Concentrations of nutrients must be maintained to sustain ecosystem health and the water quality requirements of water users. Concentrations should not be allowed to deteriorate. Nutrient concentrations must be maintained in a mesotrophic state.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.5 milligrams/litre (50^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.025 milligrams/litre (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
									Chlorophyll-*a*	≤ 0.025 milligrams/litre (50^{th} percentile)
							Salts	Salinity must be maintained to support ecosystem health and the water quality requirements of the water users.	Electrical conductivity	≤ 70 milliSiemens/metre (95^{th} percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95^{th} percentile)
						Biota	Fish	The importance of the Dam as a refuge for upstream aquatic and semi-aquatic biota must be protected. This includes ecologically and	Habitat requirements and health of specified ecologically and recreationally important fish species as specified.	

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MC Schoonspruit	III	Schoonspruit (24H) (From Johan Neser Dam to the confluence of the Vaal River) (includes Jagspruit tributary	SK7	MC 4	C/D			recreationally important fish species. The importance of the Dam for recreation. abstraction and ecological flow releases must be protected.		
						Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Ecological Water Requirement for maintenance and drought low flows.	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements for node MC 4 on the Schoonspruit.
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 3.0 milligrams/litre (50^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
							Salts	The instream salinity must be improved to support the aquatic ecosystem and the water quality requirements ofwater users.	Electrical conductivity	≤ milliSiemens/metre (95^{th}percentile)
									Sulphate	≤ 200 milligrams/litre (95^{th} percentile)
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Cyanide (free)	≤ 0.050 milligrams/litre (95^{th} percentile)
									Aluminium	≤0.1 milligrams/litre (95^{th} percentile)
									Manganese	≤ 0.250 milligrams/litre (95^{th} percentile)
									Uranium	≤ 0.03 milligrams/litre (95^{th} percentile)
									Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95^{th} percentile)
									Iron	≤ 0.25 milligrams/litre (95^{th} percentile)
										A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.

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IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
MC Schoonspruit	III	Schoonspruit (24H) (From Johan Neser Dam to the confluence of the Vaal River) (includes Jagspruit tributary	SK7	MC 4	C/D	Habitat	Instream Habitat	Instream and Riparian habitat must be in a better than largely modified condition.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)
						Biota	Fish	Instream biota must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	A baseline assessment to determine the current integrity and health of the fish community must be undertaken. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category:≥ C/D (≥ 58) Macro-invertebrate ecological category:≥ C/D (≥ 58) Instream Ecostatus category≥ C/D (≥ 58) Hydrological category≥ C/D (≥ 58) With monthly flow requirements as specified at Node MC 4. Water Quality category:≥ C/D (≥ 58)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be improved through the implementation of the water quality objective specified above.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	The current ecological category D/E must be improved to a D ecological category. Aim to reach an Average Score Per Taxon value of > 4.2

Table 6: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis (UPPER SAND)

IUA	Class	River/ Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
										Month	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
MD1 Upper Sand	III	Upper Sand (C42D, C42E) (From Klipspruit confluence to Allemanskraal Dam)	US2	MD 1.1	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MD1.1) = 17.349 million cubic metres/annum (26.13% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Oct	0.2225	60	0.0373	99
										Nov	0.3673	80	0.0193	99
										Dec	0.4066	80	0.0112	99
										Jan	0.5615	80	0.0411	99
										Feb	0.7068	70	0.0496	99
										Mar	0.6213	70	0.0299	99
										Apr	0.4201	70	0.0231	99
										May	0.2640	50	0.0187	99
										Jun	0.1659	50	0.0000	99
										Jul	0.1094	70	0.0299	99
										Aug	0.1057	80	0.0302	99
										Sep	0.1644	60	0.0444	99
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and to ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50^{th} percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)				
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50^{th} percentile)				
							Salts	Instream salinity must be maintained to support the aquatic ecosystem health and the water quality requirements of the water users.	Electrical conductivity	≤ 75 milliSiemens/metre (95^{th} percentile)				
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95^{th} percentile)				
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95^{th} percentile)				

IUA	Class	River/ Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MD1 Upper Sand	III	Upper Sand (C42D, C42E) (From Klipspruit confluence to Allemanskraal Dam)	US2	MD 1.1	C	Biota	Fish	Instream biota must be in moderately modified condition or better. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C ecological category by ensuring that the Average Score Per Taxon is >5.0.
		Allemanskraal Dam (C42E)	US3			Quantity	Low flows	The maintenance low flow requirements of the downstream node MD 2.1 must be met to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MD2.1) = 29.516 million cubic metres/annum (28.34% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
						Quality	Nutrients	Concentration of nutrients must be maintained to sustain ecosystem health and water quality requirements of water users.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)

Month	Maintenance Low Flows		Drought Flows	
	cubic metres/ second	Per-centile	cubic metres/ second	Per-centile
Oct	0.3558	60	0.0523	99
Nov	0.6034	70	0.0270	99
Dec	0.6743	80	0.0187	99
Jan	0.9457	80	0.0709	99
Feb	1.1913	70	0.0827	99
Mar	1.0629	70	0.0523	99
Apr	0.7284	70	0.0424	99
May	0.4529	40	0.0336	99
Jun	0.2662	50	0.0193	99
Jul	0.1635	70	0.0448	99
Aug	0.1591	80	0.0627	99
Sep	0.2600	60	0.0887	99

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IUA	Class	River/ Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MD1 Upper Sand	III	Allemanskraal Dam (C42E)	US3			Quality		Dam should be maintained in a mesotrophic state.	Orthophosphate as Phosphorus	≤ 0.025 milligrams/litre (50th percentile)
									Chlorophyll-*a*	≤ 0.025 milligrams/litre (50th percentile)
							Salts	The salinity in the dam must be maintained in order to support ecosystem health and the water quality requirements of the downstream water users.	Electrical conductivity	≤ 30 milliSiemens/metre (95th percentile).
							System variables	pH must be maintained at present state.	pH range	7.0 (5th percentile) and 8.5 (95th percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Biota	Fish	The importance of the Dam as a refuge for upstream aquatic and semi-aquatic biota must be protected. This includes ecologically and recreationally important fish species and ecologically important aquatic bird species The importance of the Dam for recreation, abstraction and ecological flow releases must be protected.	Habitat requirements and health of specified ecologically and recreationally important fish speciesaquatic bird species as specified.	
							Aquatic birds	The dam supports large numbers of a rich diversity of locally resident and migratory water fowl and associated birds. Of these the Greater Flamingo (*Phoenicopterus roseus*), Lesser Flamingo (*Phoenicopterus minor*), the Caspian Tern (*Sterna caspia*) are of conservation importance. The suitability of the dam for aquatic bird populations must be maintained through proper habitat management.	A baseline assessment should be conducted to determine the aquatic bird community around the dam.	

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Table 7: Resource Quality Objectives for RIVERS in priority Resource Units in the Integrated Unit of Analysis (LOWER SAND)

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
										Month	Maintenance Low Flows		Drought Flows	
											cubic metres/ second	Per-cen-tile	cubic metres/ second	Per-cen-tile
MD 2 Lower Sand	III	Lower Sand (C42F, C42G,C42H) (From Allemanskraal Dam to Merriespruit confluence)	LS1	MD 2.1, MD 2.2	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MD2.2) = 5.989 million cubic metres/annum (31.08% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Oct	0.0459	50	0.0000	99
										Nov	0.1076	60	0.0000	99
										Dec	0.1307	60	0.0000	99
										Jan	0.2106	70	0.0037	99
										Feb	0.2534	60	0.0000	99
										Mar	0.2699	60	0.0000	99
										Apr	0.1956	50	0.0000	99
										May	0.1064	30	0.0000	99
										Jun	0.0444	30	0.0000	99
										Jul	0.0004	50	0.0000	99
										Aug	0.0056	50	0.0000	99
										Sep	0.0343	30	0.0000	99
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50th percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 0.50 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)				
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th percentile)				
							Salts	The instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users. Salinity levels should not deteriorate.	Electrical conductivity	≤ 65 milliSiemens/metre (95th percentile)			
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)				
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)				

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented	Instream and Riparian habitat integrity category ≥ C (≥ 62)
MD 2 Lower Sand	**III**	**Lower Sand (C42F, C42G,C42H)** (From Allemanskraal Dam to Merriespruit confluence)	**LS1**	**MD 2.1, MD 2.2**	**C**	**Biota**	Fish	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality.	Monitor the integrity of the fish community at a downstream point selected within the Resource Unit. A baseline assessment to determine the current integrity and health of the fish community must be undertaken. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C ecological category by ensuring that the Average Score Per Taxon is >5.0.
MD2 Lower Sand	**III**	**Rietspruit tributary (C42J)**	**LS2**		**D**	**Quality**	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 3.0 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)

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IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MD2 Lower Sand	III	Rietspruit tributary (C42J)	LS2		D	Quality	Salts	Instream salinity must be improved to support the aquatic ecosystem and the water quality requirements of the water users and to ensure the prescribed ecological category is met.	Electrical conductivity The salinity needs to be improved significantly from the present state to meet the electrical conductivity required limit of 85 milliSiemens/metre. A phased approach over a twenty year period is to be used to achieve the limit of 85 milliSiemens/metre.	≤ 85 milliSiemens/metre (95th percentile). A numerical limit of 185 milliSiemens/metre (95th percentile) to be met by the 10th year after publication date of the Government Notice. Resource Quality Objective numerical limit to be achieved by the 20th year after publication date of the Government Notice.
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 9.2 (95th percentile).
								A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Cyanide (free)	≤ 0.050 milligrams/litre (95th percentile)
									Aluminium	≤ 0.1 milligrams/litre (95th percentile)
									Manganese	≤0.25 milligrams/litre (95th percentile)
									Iron	≤ 0.25 milligrams/litre (95th percentile)
									Uranium	≤ 0.030 milligrams/litre (95th percentile)
									Ammonia as Nitrogen	≤ 0.1 milligrams/litre (95th percentile)

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IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
									A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.	
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a largely modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ D (≥ 42)
						Biota	Fish	Instream biota must be in largely modified condition or better through maintenance of habitat, flows, water quality.	A baseline assessment to determine the integrity of the fish community should be conducted to determine the current state and localised impacts. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ D (≥ 42) Macro-invertebrate ecological category:≥ D (≥ 42) Instream Ecostatus category≥ D (≥ 42) Hydrological category ≥ D (≥ 42) With monthly flow requirements as specified. Water Quality category: ≥ D (≥ 42)
MD2 Lower Sand	**III**	**Lower Sand (C42J)** (Downstream Rietspruit tributary to confluence with the Vet River)	**LS3**	**MD 2.3**	**C**	**Quantity**	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node MD 2.3) = 43.933 million cubic metres/annum (24.37% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	

Month	Maintenance Low Flows		Drought Flows	
	cubic metres/ second	Per-cen-tile	cubic metres/ second	Per-cen-tile
Oct	0.4014	70	0.0523	99
Nov	0.7481	80	0.0270	99
Dec	0.8658	80	0.0187	99
Jan	1.2769	80	0.1792	99
Feb	1.5828	80	0.1819	99
Mar	1.5177	80	0.1120	99
Apr	1.0849	70	0.0849	99
May	0.6440	40	0.0933	99
Jun	0.3306	50	0.0849	99
Jul	0.1404	80	0.0448	99
Aug	0.1493	90	0.0493	99
Sep	0.2986	60	0.0876	99

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IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MD2 Lower Sand	III	Lower Sand (C42J) (Downstream Rietspruit tributary to confluence with the Vet River)	LS3	MD 2.3	C	Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 1.5 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 6 milligrams/litre (95th percentile)
							Salts	Salinity levels are significantly high. Instream salinity must be improved to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 0.058 milligrams/litre (50th percentile)
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.		≤ 85 milliSiemens/metre (95th percentile)
									Cyanide (free)	≤ 0.045 milligrams/litre (95th percentile)
									Aluminium	≤ 0.1 milligrams/litre (95th percentile)
									Manganese	≤ 0.25 milligrams/litre (95th percentile)
									Iron	≤ 0.3 milligrams/litre (95th percentile)
									Uranium	≤ 0.03 milligrams/litre (95th percentile)
									Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)
									A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.	
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 9.2 (95th percentile)
								A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.

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IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat integrity category ≥ C (≥ 62)
						Biota	Fish	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the D ecological category by ensuring that the Average Score Per Taxon is >5 4.0.

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Table 8: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis (UPPER VET)

IUA	Class	River / Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit				
ME1 Upper Vet	II	Upper Vet (C41A, C41B) (Klein Vet and Laaispruit tributary catchments) (C41C, C41D) (Vet and Leeuspruit tributary catchments to Erfenis Dam)	UV1 and UV2	ME 1.1, ME 1.2	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node ME 1.1) = 18.861 million cubic metres/annum (26.19% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Month	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-centile*
										Oct	0.2180	60	0.0373	99
										Nov	0.3376	70	0.0386	99
										Dec	0.2950	80	0.0187	99
										Jan	0.4719	70	0.0075	99
										Feb	0.6477	70	0.0289	99
										Mar	0.6481	70	0.0261	99
										Apr	0.6320	60	0.0248	99
										May	0.3188	50	0.0336	99
										Jun	0.1917	50	0.0270	99
										Jul	0.1299	70	0.0362	99
										Aug	0.1254	80	0.0351	99
										Sep	0.1539	60	0.0424	99
									Total Ecological Water Requirement (node ME 1.2) = 20.946 million cubic metres/annum (25.59% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Month	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-centile*
										Oct	0.2386	60	0.0448	99
										Nov	0.3684	70	0.0463	99
										Dec	0.3218	80	0.0224	99
										Jan	0.5141	70	0.0075	99
										Feb	0.7056	70	0.0331	99
										Mar	0.7056	70	0.0299	99
										Apr	0.6424	60	0.0231	99
										May	0.3480	50	0.0336	99
										Jun	0.2099	50	0.0309	99
										Jul	0.1426	70	0.0403	99
										Aug	0.1378	80	0.0392	99
										Sep	0.1690	70	0.0471	99
						Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50th percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)				
									Orthophosphate as Phosphorus	≤ 0.020 milligrams/litre (50th percentile)				

IUA	Class	River / Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
ME1 Upper Vet	II	Upper Vet (C41A, C41B) (Klein Vet and Laaispruit tributary catchments) (C41C, C41D) (Vet and Leeuspruit tributary catchments to Erfenis Dam)	UV1 and UV2	ME 1.1, ME 1.2	C	Quality	Salts	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 70 milliSiemens/metre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 8.4 (95th percentile)
								A baseline assessment to determine the present state instream turbidity is required	Turbidity	A 10% variation from background concentration is allowed.
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat integrity category ≥ C (≥ 62)
						Biota	Fish	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality.	A baseline assessment to determine the current integrity and health of the fish community must be undertaken. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)

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IUA	Class	River / Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
ME1 Upper Vet	II	Soutspruit (C41E)	UV3	ME 1.3	B/C	Biota	Aquatic invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current C ecological category by ensuring that the Average Score Per Taxon is > 4.8.
						Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Total Ecological Water Requirement (node ME 1.3) = 2.369 million cubic metres/annum (61.17% of the Virgin Mean Annual Runoff)	
									Maintenance flows (percentage value of naturalised flow distribution)	
									Drought flows (percentage value of naturalised flow distribution)	

Month	Maintenance Low Flows: cubic metres/second	Maintenance Low Flows: Percentile	Drought Flows: cubic metres/second	Drought Flows: Percentile
Oct	0.0310	40	0.0000	99
Nov	0.0563	50	0.0000	99
Dec	0.0474	50	0.0000	99
Jan	0.0859	40	0.0000	99
Feb	0.1228	40	0.0000	99
Mar	0.1247	40	0.0000	99
Apr	0.1115	30	0.0000	99
May	0.0526	20	0.0000	99
Jun	0.0243	20	0.0000	99
Jul	0.0116	40	0.0000	99
Aug	0.0105	50	0.0015	99
Sep	0.0166	40	0.0019	99

						Quality	Salts	Instream salinity must be maintained at the current state to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	≤ 55 milliSiemens/metre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a better than moderately modified condition.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ B/C (≥ 78)

IUA	Class	River / Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
ME1 Upper Vet	II	Erfenis Dam	UV4			Biota	Fish	Instream biota must be in better than moderately modified condition through maintenance of habitat, flows, water quality.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state. Fish Response Assessment Index (FRAI) must be utilized	Fish ecological category: ≥ B/C (≥ 78) Macro-invertebrate ecological category: ≥ B/C (≥ 78) Instream Ecostatus category ≥ B/C (≥ 78) Hydrological category ≥ B/C (≥ 78) With monthly flow requirements as specified. Water Quality category: ≥ B/C (≥ 78)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	Maintain the current B category by ensuring the Average Score Per Taxon is >5.0.
						Quantity	Low flows	The downstream maintenance low flow requirements of node ME 2.1 must be met to support a healthy condition for the ecosystem and users.	Ecological Water Requirement for maintenance low flows.	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
						Quality	Nutrients	Concentration of nutrients must be improved to sustain ecosystem health and water quality requirements of water users. Dam should be maintained in a mesotrophic state.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.025 milligrams/litre (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
									Chlorophyll-*a*	≤ 0.025 milligrams/litre (50^{th} percentile)

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IUA	Class	River / Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
							Salts	The salinity in the dam must be maintained in order to support ecosystem health and the water quality requirements of the downstream water users.	Electrical conductivity	≤ 30 milliSiemens/ metre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Dam	The importance of the Dam as a fish refuge and for semi-aquatic biota in upstream reaches must be protected. This includes ecologically and recreationally important fish species. The importance of the Dam for recreation, eco-torism, abstraction and ecological flow releases must be protected.		
						Biota	Fish	The dam provides an important fish refuge area and must be managed to maintain the upstream recruitment.	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Monitoring should be conducted annually.	

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Table 9: Resource Quality Objectives for RIVERS in priority Resource Units in the Integrated Unit of Analysis (LOWER VET)

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
ME 2 Lower Vet	III	Lower Vet (C41F, C41G, C41H, C41J) (From Erfenis Dam to Sand River confluence) (includes the Taaibosspruit tributary)	LV1	ME 2.1	C	Quantity	Low flows	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Ecological Water Requirement for maintenance low flows (ME 2.1)	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
						Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.50 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									Orthophosphate as Phosphorus	≤ 0.030 milligrams/litre (50th percentile)
							Salts	Instream salinity must be maintained. Salinity levels should not be allowed to deteriorate.	Electrical conductivity	≤ 75 milliSiemens/metre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat Integrity category ≥ C (≥ 62)
						Biota	Fish	Instream biota must be in moderately modified condition or better. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state. Fish Response Assessment Index (FRAI) must be utilized	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥ C (≥ 62)

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
ME 2 Lower Vet	III	Lower Vet (C43A, C43C, C43D) (Downstream Sand River Confluence to Bloemhof Dam)	LV2	EWR 15	C/D	Quantity	Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be improved to the recommended ecological category.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	An ecological category of C must be met. The Average Score Per Taxon value of > 4.8 must be achieved.
							Low flows	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.	Total Maintenance low flow and drought flow Ecological Water Requirement (EWR 15) = 19.765 million cubic metres/annum (7.81% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
							High Flows	The high flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem	Total Maintenance high flow Ecological Water Requirement (EWR 15) = 32.309 million cubic metres/annum (12.76% of the Virgin Mean Annual Runoff) Maintenance high flows (percentage value of naturalised flow distribution)	

	Maintenance Low Flows		Drought Flows	
Month	cubic metres/second	Percentile	cubic metres/second	Percentile
Oct	0.250	99	0.142	99
Nov	0.420	99	0.135	99
Dec	0.446	99	0.071	99
Jan	0.67	99	0.34	99
Feb	0.857	90	0.327	99
Mar	0.849	90	0.213	99
Apr	0.701	90	0.17	99
May	0.403	99	0.269	99
Jun	0.227	99	0.177	99
Jul	0.129	99	0.129	99
Aug	0.130	99	0.13	99
Sep	0.190	99	0.19	99

	Maintenance High Flows	
Month	cubic metres per second	Percentile
Oct	0.00	99
Nov	3.462	30
Dec	0.00	99
Jan	6.358	30
Feb	0.00	99
Mar	2.355	60
Apr	0.00	99

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IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit		
										May	0.00	99
										Jun	0.00	99
										Jul	0.00	99
										Aug	0.00	99
										Sep	0.00	99
ME 2 Lower Vet	III	Lower Vet (C43A, C43C, C43D) (Downstream Sand River Confluence to Bloemhof Dam)	LV2	EWR 15	C/D	Quality	Nutrients	Instream concentration of nutrients must sustain aquatic ecosystem health. Concentrations should not be allowed to deteriorate.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.7 milligrams/litre (50th percentile)		
									Nitrate & Nitrite as Nitrogen	≤ 0.50 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)		
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th percentile)		
									Chlorophyll-a concentrations should be monitored as a response indicator against the resource quality objective nutrient concentrations.	Chlorophyll-a Periphyton should be between ≤ 84 milligrams/square metre (50th percentile) Chlorophyll-a Phytoplankton ≤ 0.025 milligrams/litre (50th percentile)		
							Salts	Salinity levels must be maintained.	Electrical conductivity	≤ 80 milliSiemens/metre (95th percentile)		
									Sulphate	≤ 120 milligrams/litre (95th percentile)		
									Chloride	≤100 milligrams/litre (95th percentile)		
							System variables	pH must be maintained at present state.	pH range	6.5 (5th percentile) and 9.2 (95th percentile)		
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Aluminium	≤ 0.1 milligrams/litre (95th percentile)		
									Manganese	≤ 0.25 milligrams/litre (95th percentile)		
									Iron	≤0.75 milligrams/litre (95th percentile)		
									Uranium	≤ 0.07 milligrams/litre (95th percentile)		

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IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
									Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)
										A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.
ME 2 Lower Vet	III	Lower Vet (C43A, C43C, C43D) (Downstream Sand River Confluence to Bloemhof Dam)	LV2	EWR 15	C/D	Quality	Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a better than largely modified condition.	The Rapid Habitat Assessment Method must be implemented. The ecological specifications for Ecological Water Requirement site 15 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)
							Riparian Habitat	Exotic invasive riparian plant species must be controlled.	The ecological specifications for Ecological Water Requirement site 15 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)
						Biota	Fish	Instream biota must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for. The value of the RU as fish refuge must be maintained and migration barriers limited.	Fish Response Assessment Index (FRAI) must be utilized. The ecological specifications and thresholds of potential concern for Ecological Water Requirement site 15 must be adhered to.	Fish ecological category:≥ C/D (≥ 58) Macro-invertebrate ecological category:≥ C/D (≥ 58) Instream Ecostatus category≥ C/D (≥ 58) Hydrological category≥ C/D (≥ 58) With monthly flow requirements as specified. Water Quality category:≥ C/D (≥ 58)

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology. The ecological specifications and thresholds of potential concern for Ecological Water Requirement site 15 must be adhered to.	Maintain the current C/D ecological category by ensuring the South African Scoring System 5 score must be > 90 and the Average Score Per Taxon is > 4.8.

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Table 10: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis (VAAL RIVER)

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
MF Vaal River	III	Vaal River (C24B) (From Vermaasdrift to upstream Schoonspruit confluence)	VB 1.1	EWR 12	D	Quantity	Low flows	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.	Total Maintenance low flow and drought flow Ecological Water Requirement (EWR 12) = 346.444 million cubic metres/annum (22% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	Month: Maintenance Low Flows (cubic metres/second; Percentile); Drought Flows (cubic metre/second; Percentile) Oct: 5.421; 99; 4.284; 99 Nov: 6.592; 99; 5.21; 99 Dec: 6.783; 99; 5.361; 99 Jan: 7.588; 99; 5.997; 99 Feb: 9.845; 99; 6.486; 99 Mar: 7.72; 99; 6.101; 99 Apr: 6.521; 99; 5.154; 99 May: 5.619; 99; 4.441; 99 Jun: 5.184; 99; 4.097; 99 Jul: 5.035; 99; 3.98; 99 Aug: 3.954; 99; 3.125; 99 Sep: 4.321; 99; 3.415; 99
							High flows	The high flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem	Total Maintenance high flow Ecological Water Requirement (EWR 12) = 250.042 million cubic metres/annum (15.88% of the Virgin Mean Annual Runoff) Maintenance high flows (percentage value of naturalised flow distribution)	Month: Maintenance High Flows (cubic metres per second; Percentile) Oct: 0.00; 99 Nov: 14.6; 90 Dec: 0.00; 99 Jan: 14.129; 90 Feb: 72.071; 20 Mar: 0.00; 99 Apr: 0.00; 99 May: 0.00; 99 Jun: 0.00; 99 Jul: 0.00; 99 Aug: 0.00; 99 Sep: 0.00; 99
						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.	Nitrate & Nitrite as Nitrogen	≤ 1.35 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									Dissolved Inorganic Nitrogen as Nitrogen	≤1.65 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)
									Chlorophyll-*a*	≤ 0.075 milligrams/litre (50th percentile)

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
MF Vaal River	III	Vaal River (C24B) (From Vermaasdrift to upstream Schoonspruit confluence)	VB 1.1	EWR 12	D	Quality	Salts	Instream salinity must be improved to meet the recommended ecological category and the water quality requirements of the water users in the Middle Vaal River. The river must be managed to assimilate the impacts of the land based activities and inflow of the Koekemoerspruit and Schoonspruit.	Electrical conductivity	≤ 70 milliSiemens/metre (95th percentile)
									Sulphate	≤160 milligrams/litre (95th percentile)
									Magnesium	≤ 33 milligrams/litre (95th percentile)
									Total Dissolved Solids	≤ 560 milligrams/litre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	pH range 7.5 (5th percentile) - 9.2 (95th percentile)
							Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Cyanide (free)	≤ 0.050 milligrams/litre (95th percentile)
									Aluminium	≤ 0.1 milligrams/litre (95th percentile)
									Manganese	≤ 0.25 milligrams/litre (95th percentile)
									Iron	≤ 0.25 milligrams/litre (95th percentile)
									Uranium	≤ 0.030 milligrams/litre (95th percentile)
									Ammonia as Nitrogen	≤ 0.1 milligrams/litre (95th percentile)
									A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.	
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
MF Vaal River	III	Vaal River (C24B) (From Vermaasdrift to upstream Schoonspruit confluence)	VB 1.1	EWR 12	D	Habitat	Instream Habitat	Instream and Riparian habitat must be in a largely modified condition or better.	The Rapid Habitat Assessment Method must be implemented. The ecological specifications for Ecological Water Requirement site 12 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	Instream and Riparian habitat integrity category ≥ D (≥ 42)
							Riparian Habitat	Exotic invasive plant species must be controlled.	The ecological specifications for Ecological Water Requirement site 12 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	Instream and Riparian habitat integrity category ≥ D (≥ 42)
						Biota	Fish	Instream biota must be in a largely modified condition or better. The specific requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for. The specific requirements of aquatic bird species of ecological importance must provided for.	Fish Response Assessment Index (FRAI) must be utilized. The ecological specifications and thresholds of potential concern for Ecological Water Requirement site 12 must be adhered to.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ D (≥ 42) Habitat requirements and health of specified ecologically and recreationally important fish species aquatic bird species as specified. Instream Ecostatus category≥ D (≥ 42) Hydrological category≥ D (≥ 42) With monthly flow requirements as specified. Water Quality category:≥ D (≥ 42)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit		
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system and recommended ecological category must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology. The ecological specifications and thresholds of potential concern for Ecological Water Requirement site 12 must be adhered to.	Maintain the current C/D ecological category by ensuring the South African Scoring System 5 score must be >100 and the Average Score Per Taxon value must be > 5.0.		
MF Vaal River	III	Vaal River (C24B)	VB 1.1	EWR12	D	Biota	Aquatic Birds	The area supports more 5000 water fowl and occasionally exceeds the 1% of the bio-geographical population threshold of several water fowl species although no comprehensive data are available. This is one of few sites in South Africa holding a substantial population of a White-backed Night Heron (*Gorsachius leuconotus*) and over twenty pairs of Goliath Heron (*Ardea goliath*). The suitability of this stretch of river for aquatic bird populations must be maintained through proper habitat management.	A baseline assessment should be conducted to determine the aquatic bird community around the dam.			
							Diatoms	Water quality improvement is required from a nutrient perspective.	Conduct a diatom assessment annually.	The Specific Pollution Index should be > 5.0.		
		Vaal River	VB 1.2,	EWR 13	C/D	Quantity	Low flows	The maintenance and	Total Maintenance	*Month*	*Maintenance Low Flows*	*Drought Flows*

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit			
											cubic metres/second	Per-centile	
		(C24J) (From Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam-Quaternary catchment)	VB 1.3					drought flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem and users.	low flow and drought flow Ecological Water Requirement (EWR 13) = 309.184 million cubic metres/annum (11.65% of the Virgin Mean Annual Runoff)	Oct	7.254	90	0.029
										Nov	10.7	99	0.043
										Dec	11.931	99	0.047
									Maintenance flows (percentage value of naturalised flow distribution)	Jan	13.892	99	0.055
										Feb	18.531	99	0.073
										Mar	15.172	99	0.06
										Apr	11.532	90	0.046
									Drought flows (percentage value of naturalised flow distribution)	May	7.732	90	0.031
										Jun	5.863	99	0.024
										Jul	5.278	99	0.022
										Aug	4.78	99	0.02
										Sep	5.177	99	0.022
MF Vaal River	III	Vaal River (C24J) (From Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam-Quaternary catchment)	VB 1.2, VB 1.3	EWR 13	C/D	Quantity	High flows	The high flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem	Total Maintenance high flow Ecological Water Requirement (EWR 13) = 298.797 million cubic metres/annum (11.26% of the Virgin Mean Annual Runoff)	Maintenance High Flows			
										Month	cubic metres per second	Percentile	
										Oct	0.00	99	
										Nov	14.6	90	
										Dec	0.00	99	
										Jan	14.129	99	
										Feb	92.225	50	
										Mar	0.00	99	
									Maintenance high flows (percentage value of naturalised flow distribution)	Apr	0.00	99	
										May	0.00	99	
										Jun	0.00	99	
										Jul	0.00	99	
										Aug	0.00	99	
										Sep	0.00	99	
						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	Nitrate & Nitrite as Nitrogen	≤ 1.35 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)			
									Dissolved Inorganic Nitrogen as Nitrogen	≤ 1.65 milligrams/litre (50th percentile)			

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
								of the water users are met.	Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)
									Chlorophyll-a	≤ 0.075 milligrams/litre (50th percentile)
							Salts	Instream salinity must be improved to meet the recommended ecological category and the water quality requirements of the water users in the Middle Vaal River. The water resource must be managed to assimilate the impacts of the land based activities.	Electrical conductivity	≤ 70 milliSiemens/metre (95th percentile)
									Sulphate	≤160 milligrams/litre (95th percentile)
									Magnesium	≤ 33 milligrams/litre (95th percentile)
									Total Dissolved Solids	≤ 560 milligrams/litre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	7.5 (5th percentile) - 9.2 (95th percentile)
MF Vaal River	III	Vaal River (C24J) (From Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam-Quaternary catchment)	VB 1.2, VB 1.3	EWR 13	C/D	Quality	Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Cyanide (free)	≤ 0.050 milligrams/litre (95th percentile)
									Aluminium	≤ 0.1 milligrams/litre (95th percentile)
									Manganese	≤ 0.25 milligrams/litre (95th percentile)
									Iron	≤ 0.25 milligrams/litre (95th percentile)
									Uranium	≤ 0.030 milligrams/litre (95th percentile)
									Ammonia as Nitrogen	≤ 0.1 milligrams/litre (95th percentile)
										A screening level whole effluent toxicity test should be conducted at four trophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
						Habitat	Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
							Instream Habitat	Instream and Riparian habitat must be in a largely modified condition or better.	The Rapid Habitat Assessment Method must be implemented at prescribed intervals as stated in the ecological specifications to ensure that a 10% increase or decrease in current habitat integrity is avoided as this is undesirable. The ecological specifications for Ecological Water Requirement site 13 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	Instream and Riparian habitat Integrity category ≥ D (≥ 42)
							Riparian Habitat	Exotic invasive plant species must be controlled.	The ecological specifications for Ecological Water Requirement site 13 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	Instream and Riparian habitat Integrity category ≥ D (≥ 42)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
MF Vaal River	III	Vaal River (C24J) (From Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam-Quaternary catchment)	VB 1.2, VB 1.3	EWR 13	C/D	Biota	Fish	Instream biota must be in a largely modified condition or better. The specific requirements of fish species of ecological importance and with particular flow and water quality needs must be provided for. The specific requirements of aquatic bird species of ecological importance must provided for.	Fish Response Assessment index (FRAI) must be utilized. The ecological specifications and thresholds of potential concern for Ecological Water Requirement site 13 must be adhered to.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ D (≥ 42) Habitat requirements and health of specified ecologically and recreationally important fish species aquatic bird species as specified. Instream Ecostatus category≥ D (≥ 42) Hydrological category≥ D (≥ 42) With monthly flow requirements as specified. Water Quality category:≥ D (≥ 42)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology. The ecological specifications and thresholds of potential concern for Ecological Water Requirement site 13 must be adhered to.	An ecological category of C/D must be met. To ensure this the South African Scoring System 5 score must be >100 and the Average Score Per Taxon value must > than 5.0.
		Vierfontein-spruit	VB2		D	Quality	Diatoms	Water quality improvement is required from a nutrient perspective.	Conduct a diatom assessment annually.	The Specific Pollution Index should be > 8.9 (C/D category).
							Salts	Instream salinity must be improved to sustain the aquatic ecosystem.	Electrical conductivity	≤ 85 milliSiemens/metre (95th percentile)
									Sulphate	≤ 300 milligrams/litre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	7.5 (5th percentile) - 9.2 (95th percentile)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
MF Vaal River	III	Ystersprui, Matjiesprui, Klipsprui, Leeudoring-spruit, Wolvespruit, Makwassie-spruit (C24J, C25A, C25C, C25D)	VB3		B and C	Quality	Toxics	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Aluminium	≤ 0.1 milligrams/litre (95th percentile)
									Manganese	≤ 0.25 milligrams/litre (95th percentile)
									Iron	≤ 0.25 milligrams/litre (95th percentile)
						Quantity	Low flows	The maintenance and drought flows must be maintained.	Ecological Water Requirement for maintenance low flows	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.
							Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Nitrate & Nitrite as Nitrogen	≤ 1.35 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									Dissolved Inorganic Nitrogen as Nitrogen	≤ 1.65 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)
									Chlorophyll-a	≤ 0.05 milligrams/litre (50th percentile)
							Salts	Instream salinity must be maintained at the present state to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity	Matjiespruit and Leeudoringspruit: ≤ 55 milliSiemens/metre (95th percentile)
										Ystersprui, Makwassiespruit and Wolvespruit: ≤ 85 milliSiemens/metre (95th percentile)
							System variables	pH must be maintained at present state.	pH range	7.5 (5th percentile) - 9.2 (95th percentile)
								A baseline assessment to determine the present state instream turbidity is required	Turbidity	A 10% variation from background concentration is allowed.
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented. All land use activities impacting on the riparian zone and thus causing an effect on water resources should be authorised and regulated to prevent deterioration of the habitat.	Instream and Riparian habitat Integrity category ≥ C (≥ 62)
MF Vaal River	III	Ystarspruit, Matjiespruit, Klipspruit, Leeudoring-spruit, Wolwespruit, Makwassie-spruit (C24J, C25A, C25C,C25D)	VB3		B and C		Riparian Habitat	Instream and Riparian habitat must be in a largely natural condition. Instream and Riparian habitat must be in a moderately modified condition or better.	All land use activities impacting on riparian zone should be authorised and regulated to prevent deterioration of the habitat.	Instream and Riparian habitat Integrity category ≥ B (≥ 82) Instream and Riparian habitat Integrity category ≥ C (≥ 62)
						Biota	Fish	Instream biota must be in a largely natural condition and contribute to the sustainability of the fish assemblages in the Vaal River Instream biota must be in a moderately modified condition or better and contribute to the sustainability of the fish assemblages in the Vaal River	A baseline assessment to determine the integrity of the fish community should be conducted to determine the current state. Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category:≥ B (≥ 82) Macro-invertebrate ecological category: ≥ B (≥ 82) Instream Ecostatus category ≥ B (≥ 82) Hydrological category ≥ B (≥ 82) With monthly flow requirements as specified. Water Quality category: ≥ B (≥ 82) Fish ecological category:≥ C (≥ 62) Macro-invertebrate ecological category: ≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified. Water Quality category: ≥C (≥ 62)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
							Aquatic Invertebrates	In order to maintain the ecological integrity of the macroinvertebrate community within the Middle Vaal River the tributaries need to be sustainably managed. The Present Ecological State must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology	The Present Ecological State must be maintained.
		Sandspruit (C25C, C25B, C25F, C43B)	VB4		C	Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the present ecological category is maintained.	Orthophosphate as Phosphorus	≤ 0.091 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
							Salts	Instream salinity must be improved to sustain the aquatic ecosystem.	Electrical conductivity	≤ 70 milliSiemens/metre (95th percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a moderately modified condition or better.	The Rapid Habitat Assessment Method must be implemented.	Instream and Riparian habitat integrity category ≥ C (≥ 62)
						Biota	Fish	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality. The importance of the lower reaches as refuge habitat must be sustained.	Fish Response Assessment Index (FRAI) must be utilized.	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category:≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements to be specified. Water Quality category: ≥ C (≥ 62)
							Aquatic Invertebrates	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
									biomonitoring annually using the South African Scoring System 5 methodology.	
MF Vaal River	III	Bamboes-spruit (C25E)	VB5		D	Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 1.62 milligrams/litre (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 1.50 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50^{th} percentile)
							Salts	The instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users. Salinity levels should not deteriorate.	Electrical conductivity	≤ 80 milliSiemens/metre (95^{th} percentile)
									Sulphate	≤160 milligrams/litre (95^{th} percentile)
							System variables	pH must be maintained.	pH range	7.5 (5^{th} percentile) - 9.2 (95^{th} percentile)
						Habitat	Instream Habitat	Instream and Riparian habitat must be in a largely modified condition or better.	Ensure that mining activities impacting on the riparian zone and instream habitats are authorised and regulated to prevent deterioration of the habitat. Rehabilitation management plans must be developed to improve the habitat integrity to obtain a minimum D category. The Rapid Habitat Assessment Method must be implemented	Instream and Riparian habitat integrity category ≥ D (≥ 42)
							Riparian Habitat	Invasive riparian plant species must be controlled.	Rehabilitation must be undertaken which must include the removal of invasive exotic species from the riparian zone.	Instream and Riparian habitat integrity category ≥ D (≥ 42)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
						Biota	Fish	Instream biota must be in largely modified condition or better. The importance of the lower reaches must be maintained as fish refuge and nursery area for species moving in from the Bloemhof Dam.	A baseline assessment to determine the integrity and health of the fish community should be conducted to determine the current state and potential impacts to the population. This assessment should include a fish tissue contamination study to determine heavy metal concentrations. Fish Response Assessment Index (FRAI) must be utilized.	Instream and Riparian habitat Integrity category ≥ D (≥ 42) Fish ecological category: ≥ D (≥ 42) Macro-invertebrate ecological category:≥ D (≥ 42) Instream Ecostatus category≥ D (≥ 42) Hydrological category ≥ D (≥ 42) With monthly flow requirements to be specified. Water Quality category: ≥ D (≥ 42)
MF Vaal River	III	Bloemhof Dam (C25E, C25F, C43D)	VB6			Quantity	Low flows	The downstream maintenance low flow requirements of EWR 16 must be met to support a healthy condition for the ecosystem.	Total Maintenance low flow and drought flow Ecological Water Requirement (EWR 16) = 360.296 million cubic metres/annum (21.2% of the Virgin Mean Annual Runoff) Maintenance flows (percentage value of naturalised flow distribution) Drought flows (percentage value of naturalised flow distribution)	
										Maintenance Low Flows / *Drought Flows*
										Month / cubic metres/second / *Percentile* / cubic metres/second / *Percentile*
										Oct 6.333 99 4.905 99
										Nov 6.794 99 5.262 99
										Dec 6.971 99 5.4 99
										Jan 8.266 99 6.403 99
										Feb 11.052 99 2.646 99
										Mar 8.974 99 6.952 99
										Apr 7.086 99 5.489 99
										May 5.71 99 4.423 99
										Jun 4.717 99 3.654 99
										Jul 4.669 99 3.617 99
										Aug 4.46 99 3.454 99
										Sep 5.632 99 4.363 99
						Quality	Nutrients	Concentration of nutrients in the dam must be improved to sustain ecosystem health	Nitrate & Nitrite as Nitrogen	≤ 0.15 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
MF Vaal River	III	Bloemhof Dam (C25E, C25F, C43D)	VB6					and the water quality requirements of water users. Nutrient levels must not be allowed to deteriorate. Dam has the potential to be hypertrophic.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.25 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.015 milligrams/litre (50th percentile)
								Dam should be maintained in a mesotrophic state.	Chlorophyll - *a*	≤ 0.050 milligrams/litre (50th percentile)
							Salts	The salinity in the dam must be maintained in order to support ecosystem health and the water quality requirements of the downstream water users.	Electrical conductivity	≤ 70 milliSiemens/metre (95th percentile)
									Sulphate	≤150 milligrams/litre (95th percentile)
									Sodium	≤ 80 milligrams/litre (95th percentile)
									Chloride	≤ 75 milligrams/litre (95th percentile)
									Total Dissolved Solids	≤ 560 milligrams/litre (95th percentile)
						Quality	System variables	pH must be maintained.	pH range	7.5 (5th percentile) - 9.2 (95th percentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
						Habitat	Dam Habitat	The importance of the Dam as a fish refuge and for aquatic and semi-aquatic biota must be protected. This includes ecologically and recreationally important fish species. The requirements of ecologically important bird species must provide for. The importance of the Dam for recreation, eco-torism, abstraction and ecological flow releases must be protected.		
						Biota	Fish	The dam provides a refuge area and is important in maintaining the upstream species.	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Monitoring should be conducted annually.	

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IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
						Biota	Aquatic Birds	The dam supports a high number of water fowl, with several mixed heronries supporting a variety of breeding egrets, herons and cormorants. A number of bird species recorded at the dam and in the adjacent terrestrial habitats are listed as threatened species. These include amongst others the Greater Flamingo (*Phoenicopterus roseus*), Lesser Flamingo (*Phoenicopterus minor*), the Caspian Tern (*Sterna caspia*) and African Marsh Harrier (*Circus ranivorus*).The suitability of the dam for aquatic bird populations must be maintained through proper habitat management.	A baseline assessment should be conducted to determine the aquatic bird community around the dam.	

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Table 11: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in the MIDDLE VAAL WMA

IUA	Ground-water unit	Resource Unit	Resource Quality Objective	Indicator/ Measure	Numerical Limit
MC – Schoonspruit	RU G1	SK3	Groundwater flow directions in the non-dolomite aquifer part of the resource unit should not be reversed from it natural flow directions towards the drainage systems (specifically the Schoonspruit and Taaiboschspruit cases).	Water Level - Depth to groundwater level from ground elevation. Time series water level monitoring (Monthly) required to comply with limits.	Dolomite aquifer systems: Saturation levels should not be lowered >6metres below an average water level depth of ~23metres in the dolomite aquifer area. Due to ground stability risks, the water table range limit should remain 100% compliance
			Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods).	Abstraction - Abstraction Volume (Q) Time series water level monitoring (Monthly) required to comply with limits.	Annual abstraction rates should be in balance with recharge rates. Abstraction of groundwater within a 500m zone from the river course should be regulated.
			Nitrate values in the recharge area must be maintained to support domestic water users.	Nutrients - Nitrate	Nitrate < 6 milligrams/litre in recharge area (based on quality dataset). Specified annual trend should not approach the 95th percentile.
			Salinity levels should not increase. Concentrations must be maintained at levels to support water users.	Salts - Electrical Conductivity	Electrical Conductivity ≤ 50milliSiemens/metre; based on typical groundwater quality in dolomite aquifers Specified annual trend should not approach the 95th percentile.
MC - Schoonspruit	RU - G2	SK 2, SK 4		Water Level - Depth to groundwater level Time series water level monitoring (Monthly) required to comply to limits.	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~23 metres in the dolomite aquifer area. Due to ground stability risks, the water table range limit should remain 100% compliance.
			The flow at the Schoonspruit Eye must be maintained at a sustainable volume maintain the Eye and to support downstream users.	Abstraction - Abstraction rate (Q) Continuous Flow measurement at Eye	The allocable volumes in the catchment of the Eye should not be higher than 4Mm^3/m (~48 million cubic metres/annum) – and should be correlated with latest flow data at flow gauge C2H024 and irrigation requirements downstream from the Eye (based on historical flow measurements). Proper irrigation schedules need to be developed and applied at all times (100% compliance). Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry

IUA	Ground-water unit	Resource Unit	Resource Quality Objective	Indicator/ Measure	Numerical Limit
					cycles.
MC - Schoonspruit	RU - G2	SK 2, SK 4	Nitrate values in the recharge area should not increase to > 2 milligrams /litre.	Nutrients - Nitrate Bi-annual monitoring	Nitrate values in the recharge area should not increase to > 2 milligrams /litre.
			Salinity levels should not increase. Concentrations must be maintained at levels to support the catchment of the Eye.	Salts - Electrical Conductivity	Electrical conductivity ≤ 50 milliSiemens/metre in the catchment of the Eye Groundwater criteria for the dolomite aquifer should be based on the groundwater quality criteria of the Schoonspruit dolomite water compartment as observed by the Department of Water and Sanitation. The Schoonspruit Eye catchment area (~5 square kilometre area) must be managed as a protected area in terms of the Department of Water Affair's Dolomitic Guidelines Document (August 2006).
MC – Schoonspruit; MF – Vaal; MA - Renoster	Venters-dorp aquifers	VB 3, VB 5, SK 5, SK 6, SK 7 and R5	Medium to long-term declining water level trends should be managed in a sustainable manner.	Water Level (metres below ground level) Water level (wl) recession rate, dh (metres/day): $dh=(h_0-h_n)/t$; where h_0=wl on day1; h_n=wl on day 30; t=number of days. Water use monitoring dataset	A specific recession rate must be calculated for each licensed water user based on the area, use and compliance status (in cubic metres/square kilometres/annum). Critical rate: <0.25 metres/month.
			The regional groundwater quality criteria should be managed to meet the water use requirements for domestic, agricultural and or industrial users.	Nutrients – Nitrate (as Nitrogen) Annual water quality analysis	Domestic:< 10 milligrams/litre; Stock water:<110 milligrams/litre; Irrigation: <10 milligrams/litre

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IUA	Ground-water unit	Resource Unit	Resource Quality Objective	Indicator/ Measure	Numerical Limit
MC – Schoonspruit; MF – Vaal; MA - Renoster	Venters-dorp aquifers	VB 3, VB 5, SK 5, SK 6, SK 7 and R5			Salinity: Electrical conductivity <150 milliSiemens/metre for domestic use; Total dissolved solids <1000 milligrams/litre for stock watering; Electrical conductivity < 40 milliSiemens/metre for irrigation water Macro elements – Specific levels for fluoride (<1.0 milligrams/litre), sodium (<200 milligrams/litre), chloride (<200 milligrams/litre) and sulphate (<400 milligrams/litre). 100% compliance
				Electrical conductivity and specific macro elements for domestic use; Electrical Conductivity and Sodium Adsorption Ratio for irrigation water use. Annual water quality analysis.	
				Toxics: specific trace metal constituents. Annual water quality analyses must be undertaken.	Domestic Use: Trace metals –Arsenic (<0.05 milligrams/litre), Cadmium (<0.005 milligrams/litre), Copper (<1.0 milligrams/litre), Iron (<0.5 milligrams/litre), manganese (<0.4 milligrams/litre) and zinc (<10 milligrams/litre). For stock and irrigation water: Refer to appropriate guideline.
MA - Renoster, MB - Vals, MD1 - Upper Sand, MD2 - Lower Sand, ME1- Upper Vet, ME2 - Lower Vet, MF - Vaal to Bloemhof Dam	Karoo aquifers	UV1, UV2, UV3, UV4, LV1, LV2, US2, US3, LS1, LS2, LS3, V2, V3, V4, V5, R2, R3, R4, R5, VB4, VB2, VB6	Medium to long-term declining water level trends should remain sustainable	Water Level (m below ground level) Water level (wl) recession rate, dh (metres/day): $dh=(h_0-h_n)/t$; where h_0=wl on day1; h_n=wl on day 30; t=number of days. Water use monitoring dataset	A specific recession rate must be calculated for each licensed water user based on the area and use and compliance (in $m^3/km^2/a$). Critical rate: <0.25metres/month

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IUA	Ground-water unit	Resource Unit	Resource Quality Objective	Indicator/ Measure	Numerical Limit
MA - Renoster, MB - Vals, MD1 - Upper Sand, MD2 - Lower Sand, ME1- Upper Vet, ME2 - Lower Vet, MF - Vaal to Bloemhof Dam	Karoo aquifers	UV1, UV2, UV3, UV4, LV1, LV2, US2, US3, LS1, LS2, LS3, V2, V3, V4, V5, R2, R3, R4, R5, VB4, VB2, VB6	Where water use (m^3/a) is higher than requirements for Reserve, Schedule 1 and General Authorizations, balance between annual recharge and abstraction on specified property area (hectares) must be satisfied.	Water use > Reserve, Schedule 1 and General Authorisations Abstraction rate Q ($mm/km^2/a$) and recharge ($mm/km^2/a$). (Refer to Groundwater Resources Assessment Phase II or more recent updated recharge estimation in $mm/km^2/a$). Estimate local Stress Index, SI(%): SI(%)=Use (Q)/Recharge	Abstraction rate < Average recharge (based on the licensed area average recharge estimation). Stress Index <60% - Category A investigation, Stress Index =60-100% - Category B investigation; and Stress Index >100% - Category C investigation Water Use Registration (million cubic metres/annum)
			The regional groundwater quality criteria should be based on the water use requirement for domestic, agricultural and or industrial limits.	Nutrients: Nitrate (as Nitrogen) Annual water quality analysis	Domestic use:<10 milligrams/litre; Stock water use:<110 milligrams/litre; Irrigation use: <10 milligrams/litre
				Salts: Electrical conductivity and specific macro elements for all domestic use. Electrical Conductivity and Sodium Adsorption Ratio for Irrigation waters. Annual water quality analysis.	Electrical conductivity <150 milliSiemens/metre for domestic use; Total dissolved solids <1000 milligrams/litre for stock watering; Electrical conductivity < 40 milliSiemens/metre for irrigation water Macro elements – Specific levels for fluoride (<1.0 milligrams/litre), sodium (<200 milligrams/litre), chloride (<200 milligrams/litre) and sulphate (<400 milligrams/litre). 100% compliance
				Toxics: Specific trace metal constituents Annual water quality analyses must be undertaken.	Domestic Use: Trace metals –Arsenic (<0.05 milligrams/litre), Cadmium (<0.005 milligrams/litre), Copper (<1.0 milligrams/litre), Iron (<0.5 milligrams/litre), Manganese (<0.4 milligrams/litre) and Zinc (<10 milligrams/litre). For stock and irrigation water: Refer to appropriate guideline.

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