DEPARTMENT OF WATER AND SANITATION

NO. 469 **22 APRIL 2016**

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

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 publish the notices for the 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).

Acting Director: Water Resource Classification
Attention: Ms Lebogang Matlala
Department of Water and Sanitation
Ndinaye Building 178 Francis Baard Street
Private Bag X313
Pretoria
0001

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MRS NP MOKONYANE
MINISTER OF WATER AND SANITATION
DATE: 17 03. 2016

SCHEDULE

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 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, has determined 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, has determined 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 Table 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 upon the date of approval by the Minister, unless otherwise specified.

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 (km^2)	Natural MAR (million m^3/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	III	MF.1	C24B	Vaal River		864	4.75	C	C
		EWR12	C24J	Vaal River		62305	2546.42	D	D

confluence to Bloemhof Dam (MF)		**EWR13**	C25A	Vaal River	Klipspruit	70809	2714.89	C/D	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

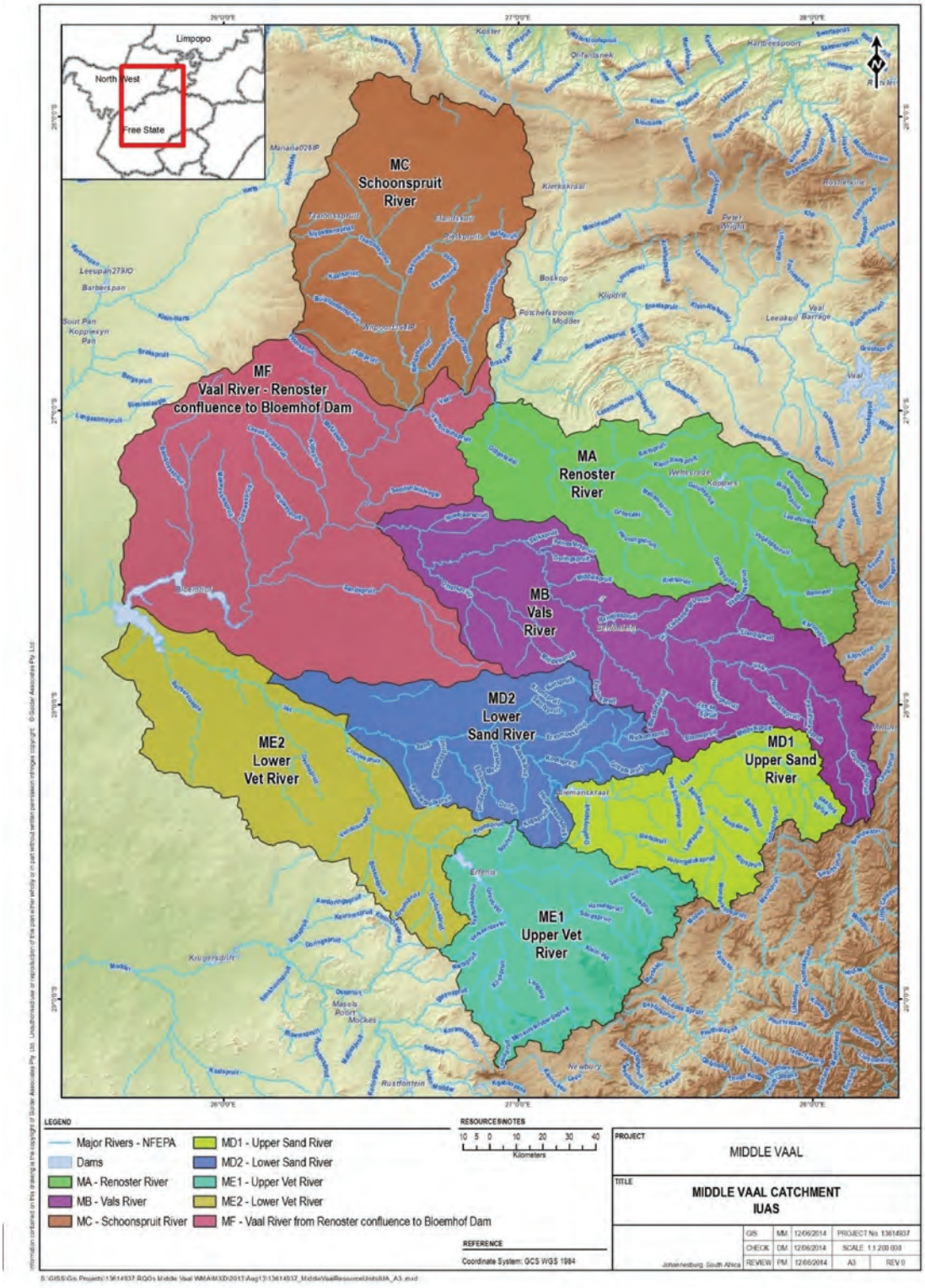

Figure 1: Integrated Units of Analysis defined in the Middle Vaal WMA

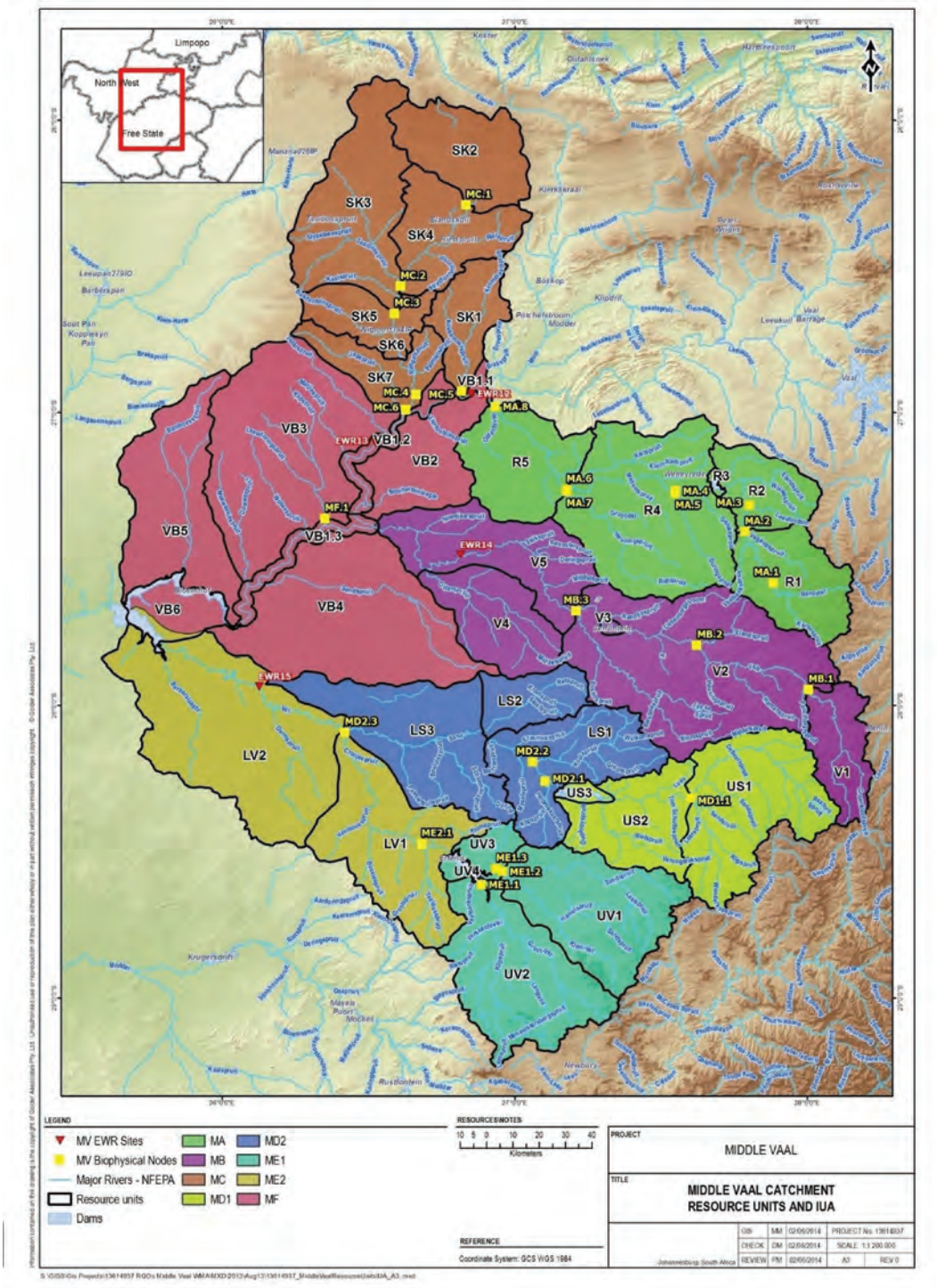

Figure 2: Resource Units and location of Nodes in the Middle Vaal WMA

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				
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)	*Month*	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
										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)				

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th>Numerical limit</th></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td></td><td></td><td></td><td></td><td>Biota</td><td>Fish</td><td>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.</td><td>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.</td><td>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)</td></tr>
<tr><td>Renoster (C70C)
(Tributaries Elandspruit, Leeufontein and Wolwespruit)</td><td>R2</td><td>MA 3</td><td>C</td><td>Biota</td><td>Aquatic Invertebrates</td><td>The integrity of the macroinvertebrate community within the system must be maintained.</td><td>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.</td><td>Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.</td></tr>
<tr><td rowspan="2">Koppies Dam
(C70C)</td><td rowspan="2">R3</td><td rowspan="2"></td><td rowspan="2"></td><td>Quantity</td><td>Low flows</td><td rowspan="2">The downstream maintenance low flow requirements of node MA 4 must be met to support a healthy condition for the ecosystem and users.

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.</td><td>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)</td><td>
<table>
<tr><th rowspan="2">Month</th><th colspan="2">Maintenance Low Flows</th><th colspan="2">Drought Flows</th></tr>
<tr><th>cubic metres/ second</th><th>Per-cen-tile</th><th>cubic metres/ second</th><th>Per-cen-tile</th></tr>
<tr><td>Oct</td><td>0.2348</td><td>60</td><td>0.0299</td><td>99</td></tr>
<tr><td>Nov</td><td>0.5204</td><td>60</td><td>0.0231</td><td>99</td></tr>
<tr><td>Dec</td><td>0.5604</td><td>70</td><td>0.0336</td><td>99</td></tr>
<tr><td>Jan</td><td>0.7187</td><td>80</td><td>0.0672</td><td>99</td></tr>
<tr><td>Feb</td><td>0.7577</td><td>70</td><td>0.0248</td><td>99</td></tr>
<tr><td>Mar</td><td>0.5892</td><td>60</td><td>0.0448</td><td>99</td></tr>
<tr><td>Apr</td><td>0.3484</td><td>60</td><td>0.0309</td><td>99</td></tr>
<tr><td>May</td><td>0.1613</td><td>50</td><td>0.0261</td><td>99</td></tr>
<tr><td>Jun</td><td>0.1181</td><td>60</td><td>0.0386</td><td>99</td></tr>
<tr><td>Jul</td><td>0.1001</td><td>60</td><td>0.0381</td><td>99</td></tr>
<tr><td>Aug</td><td>0.0900</td><td>70</td><td>0.0351</td><td>99</td></tr>
<tr><td>Sep</td><td>0.1246</td><td>50</td><td>0.0455</td><td>99</td></tr>
</table>
</td></tr>
<tr><td>Quality</td><td>Nutrients</td><td>Dissolved Inorganic Nitrogen as Nitrogen

Orthophosphate as Phosphorus

Nitrate & Nitrite as Nitrogen</td><td>≤ 0.50 milligrams/litre (50th percentile)

≤ 0.015 milligrams/litre (50th percentile)

≤ 0.25 milligrams/litre (50th percentile)
6 milligrams/litre (95th percentile)</td></tr>
</table>

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	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
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

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)

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th colspan="5">Numerical limit</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">Biota</td><td>Fish</td><td>Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality and limitation of migration barriers for fish.</td><td>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.</td><td colspan="5">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)</td></tr>
<tr><td>Aquatic Invertebrates</td><td>The integrity of the macroinvertebrate community within the system must be maintained.</td><td>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.</td><td colspan="5">Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.</td></tr>
<tr><td rowspan="13">Renoster</td><td rowspan="13">II</td><td rowspan="13">Renoster (C70J, C70K) (Downstream Heuningspruit confluence to confluence with the Vaal River) (includes the Olifantsvlei tributary)</td><td rowspan="13">R5</td><td rowspan="13">MA8</td><td rowspan="13">C</td><td rowspan="13">Quantity</td><td rowspan="13">Low flows</td><td rowspan="13">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.</td><td rowspan="13">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)</td><td rowspan="2">Month</td><td colspan="2">Maintenance Low Flows</td><td colspan="2">Drought Flows</td></tr>
<tr><td>cubic metres/ second</td><td>Per-cen-tile</td><td>cubic metres/ second</td><td>Per-cen-tile</td></tr>
<tr><td>Oct</td><td>0.3226</td><td>60</td><td>0.0373</td><td>99</td></tr>
<tr><td>Nov</td><td>0.6848</td><td>50</td><td>0.1003</td><td>99</td></tr>
<tr><td>Dec</td><td>0.7743</td><td>80</td><td>0.1232</td><td>99</td></tr>
<tr><td>Jan</td><td>1.0600</td><td>90</td><td>0.0821</td><td>999</td></tr>
<tr><td>Feb</td><td>1.2269</td><td>80</td><td>0.1116</td><td>99</td></tr>
<tr><td>Mar</td><td>1.0977</td><td>70</td><td>0.0485</td><td>99</td></tr>
<tr><td>Apr</td><td>0.7311</td><td>70</td><td>0.1427</td><td>99</td></tr>
<tr><td>May</td><td>0.3812</td><td>60</td><td>0.0261</td><td>99</td></tr>
<tr><td>Jun</td><td>0.2319</td><td>80</td><td>0.0502</td><td>99</td></tr>
<tr><td>Jul</td><td>0.1871</td><td>90</td><td>0.0709</td><td>99</td></tr>
</table>

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)

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.	

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
MB Vals	**III**	**Vals (C60B, C60C, C60D, C60E, C60F)** (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) 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 metres/second*, *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, 90, 0.0523, 99 Apr: 0.6917, 60, 0.0000, 99 May: 0.3566, 40, 0.0373, 99 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.

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th colspan="5">Numerical limit</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>biomonitoring annually using the South African Scoring System 5 methodology.</td><td colspan="5"></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Diatoms</td><td>Water quality improvement is required from a nutrient perspective.</td><td>Conduct a diatom assessment annually.</td><td colspan="5">The Specific Pollution Index should be > 9.2 (C category).</td></tr>
<tr><td>MB Vals</td><td>III</td><td>Vals (C60B, C60C, C60D, C60E, C60F) (from the Pauciflora spruit confluence to the Kroonval weir) (Major tributaries Elandspruit, Liebenberg stroom and Blomspruit)</td><td>V2</td><td>MB 3</td><td>C</td><td>Biota</td><td>Fish</td><td>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.</td><td>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.</td><td colspan="5">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)</td></tr>
<tr><td rowspan="14">MB Vals</td><td rowspan="14">III</td><td rowspan="14">Serfontein Dam (C60D)</td><td rowspan="14">V3</td><td rowspan="14"></td><td rowspan="14"></td><td rowspan="12">Quantity</td><td rowspan="12">Low flows</td><td rowspan="12">The downstream maintenance low flow requirements of node MB 3 must be met to support a healthy condition for the ecosystem.</td><td rowspan="12">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)</td><td rowspan="2">Month</td><td colspan="2">Maintenance Low Flows</td><td colspan="2">Drought Flows</td></tr>
<tr><td>cubic metres/ second</td><td>Per-cen-tile</td><td>cubic metres/ second</td><td>Per-cen-tile</td></tr>
<tr><td>Oct</td><td>0.3200</td><td>60</td><td>0.0261</td><td>99</td></tr>
<tr><td>Nov</td><td>0.6655</td><td>70</td><td>0.0077</td><td>99</td></tr>
<tr><td>Dec</td><td>0.8307</td><td>70</td><td>0.0000</td><td>99</td></tr>
<tr><td>Jan</td><td>1.1537</td><td>80</td><td>0.0373</td><td>99</td></tr>
<tr><td>Feb</td><td>1.2475</td><td>70</td><td>0.0703</td><td>99</td></tr>
<tr><td>Mar</td><td>1.1455</td><td>60</td><td>0.0523</td><td>99</td></tr>
<tr><td>Apr</td><td>0.6917</td><td>60</td><td>0.0000</td><td>99</td></tr>
<tr><td>May</td><td>0.3566</td><td>40</td><td>0.0373</td><td>99</td></tr>
<tr><td>Jun</td><td>0.1991</td><td>50</td><td>0.0386</td><td>99</td></tr>
<tr><td>Jul</td><td>0.1340</td><td>70</td><td>0.0075</td><td>99</td></tr>
<tr><td>Aug</td><td>0.1568</td><td>60</td><td>0.0411</td><td>99</td></tr>
<tr><td>Sep</td><td>0.2600</td><td>30</td><td>0.0000</td><td>99</td></tr>
<tr><td rowspan="2">Quality</td><td rowspan="2">Nutrients</td><td rowspan="2">Concentration of nutrients in the dam must be improved to sustain ecosystem health and the water quality requirements of water users.</td><td>Dissolved Inorganic Nitrogen as Nitrogen</td><td colspan="5">≤ 0.50 milligrams/litre (50^{th} percentile)</td></tr>
<tr><td>Orthophosphate as Phosphorus</td><td colspan="5">≤ 0.015 milligrams/litre (50^{th} percentile)</td></tr>
</table>

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
								Dam should be maintained in a mesotrophic state.	Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50th percentile) ≤ 6 milligrams/litre (95th percentile)
									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)
MB Vals	**III**	**Serfontein Dam (C60D)**	**V3**			**Quality**	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**		**C**	**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)

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th>Numerical limit</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td>Habitat</td><td>Instream Habitat</td><td>Instream and Riparian habitat must be in a moderately modified condition or better.</td><td>The Rapid Habitat Assessment Method must be implemented</td><td>Instream and Riparian habitat Integrity category ≥ C (≥ 62)</td></tr>
<tr><td rowspan="2">Biota</td><td>Fish</td><td>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.</td><td>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.</td><td>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)</td></tr>
<tr><td>Aquatic Invertebrates</td><td>The integrity of the macroinvertebrate community within the system must be maintained.</td><td>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.</td><td>Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.</td></tr>
<tr><td rowspan="2">MB Vals</td><td rowspan="2">III</td><td rowspan="2">Vals (C60G, C60J) (From Kroonvaal weir to the Vaal River confluence) (Nuwejaar spruit and Skikspruit tributaries)</td><td rowspan="2">V5</td><td rowspan="2">EWR 14</td><td rowspan="2">C/D</td><td rowspan="2">Quantity</td><td>Low flows</td><td rowspan="2">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.</td><td rowspan="2">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)</td><td>
<table>
<tr><th rowspan="2">Month</th><th colspan="2">Maintenance Low Flows</th><th colspan="2">Drought Flows</th></tr>
<tr><th>cubic metres/ second</th><th>Per-cen-tile</th><th>cubic metres/ second</th><th>Per-cen-tile</th></tr>
<tr><td>Oct</td><td>0.153</td><td>70</td><td>0.003</td><td>99</td></tr>
<tr><td>Nov</td><td>0.276</td><td>80</td><td>0.005</td><td>99</td></tr>
<tr><td>Dec</td><td>0.333</td><td>80</td><td>0.006</td><td>99</td></tr>
<tr><td>Jan</td><td>0.447</td><td>90</td><td>0.008</td><td>99</td></tr>
<tr><td>Feb</td><td>0.484</td><td>80</td><td>0.008</td><td>99</td></tr>
<tr><td>Mar</td><td>0.444</td><td>80</td><td>0.008</td><td>99</td></tr>
<tr><td>Apr</td><td>0.285</td><td>80</td><td>0.000</td><td>99</td></tr>
<tr><td>May</td><td>0.166</td><td>70</td><td>0.003</td><td>99</td></tr>
<tr><td>Jun</td><td>0.112</td><td>80</td><td>0.002</td><td>99</td></tr>
<tr><td>Jul</td><td>0.087</td><td>90</td><td>0.002</td><td>99</td></tr>
<tr><td>Aug</td><td>0.095</td><td>90</td><td>0.002</td><td>99</td></tr>
<tr><td>Sep</td><td>0.133</td><td>70</td><td>0.000</td><td>99</td></tr>
</table>
</td></tr>
<tr><td>High Flows</td><td>The maintenance high flows must be attained so that the environmental flows</td><td>Total Maintenance high flow Ecological Water Requirement (EWR 14) =</td><td>
<table>
<tr><th rowspan="2">Month</th><th colspan="2">Maintenance High Flows</th></tr>
<tr><th>cubic metres/ second</th><th>Percentile</th></tr>
</table>
</td></tr>
</table>

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit		
								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)			
									Maintenance high flows (percentage value of naturalised flow distribution)	Oct	0.000	99
										Nov	1.653	50
										Dec	0.000	99
										Jan	0.697	90
										Feb	2.7	60
										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
						Quality	Nutrients	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)		
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**	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.		

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.

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				
MC Schoon spruit	III	Koekemoer-spruit (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) 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.	*Month*	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/second	*Per-centile*	*cubic metres/second*	*Per-centile*
										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
						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	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 (95^{th}percentile) A numerical limit of 110 milliSiemens/ metre (95^{th}percentile) to be met by the 10^{th} year after publication date of the Government Notice. Resource Quality Objective numerical limit to be achieved by the 20^{th} year after publication date of the Government Notice.				
									Sulphate	≤ 250 milligrams/litre (95^{th}percentile) A numerical limit of 400 milligrams/ litre (95^{th}percentile) to be met by the 10^{th} year after publication date of the Government Notice. Resource Quality Objective				

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 (95thpercentile)
MC Schoon spruit	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 (95thpercentile)
									Aluminium	≤ 0.1 milligrams/litre (95thpercentile)
									Manganese	≤ 0.250 milligrams/litre (95thpercentile)
									Iron	≤ 0.25 milligrams/litre (95thpercentile)
									Uranium	≤ 0.03 milligrams/litre (95thpercentile)
									Ammonia as Nitrogen	≤ 0.1milligrams/litre (95thpercentile)
									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.

IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
MC Schoon spruit	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 (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.020 milligrams/litre (50^{th} percentile)
									Chlorophyll-*a*	≤ 0.010 milligrams/litre (50^{th} 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 (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)

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th>Numerical limit</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>Habitat</td><td>Instream Habitat</td><td>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.</td><td>The Rapid Habitat Assessment Method must be implemented.</td><td>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)</td></tr>
<tr><td rowspan="2">MC Schoon spruit</td><td rowspan="2">III</td><td rowspan="2">Taaibosspruit (C24F)</td><td rowspan="2">SK3</td><td rowspan="2">MC 2</td><td rowspan="2">C</td><td>Quantity</td><td>Low flows</td><td>The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.</td><td>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)</td><td>
<table>
<tr><th rowspan="2">Month</th><th colspan="2">Maintenance Low Flows</th><th colspan="2">Drought Flows</th></tr>
<tr><th>cubic metre/second</th><th>Per-centile</th><th>cubic metres/second</th><th>Per-centile</th></tr>
<tr><td>Oct</td><td>0.0239</td><td>60</td><td>0.0075</td><td>99</td></tr>
<tr><td>Nov</td><td>0.0278</td><td>70</td><td>0.0039</td><td>99</td></tr>
<tr><td>Dec</td><td>0.0310</td><td>70</td><td>0.0037</td><td>99</td></tr>
<tr><td>Jan</td><td>0.0743</td><td>70</td><td>0.0149</td><td>99</td></tr>
<tr><td>Feb</td><td>0.1484</td><td>60</td><td>0.0124</td><td>99</td></tr>
<tr><td>Mar</td><td>0.1605</td><td>60</td><td>0.0112</td><td>99</td></tr>
<tr><td>Apr</td><td>0.1073</td><td>70</td><td>0.0270</td><td>99</td></tr>
<tr><td>May</td><td>0.0489</td><td>80</td><td>0.0224</td><td>99</td></tr>
<tr><td>Jun</td><td>0.0313</td><td>90</td><td>0.0201</td><td>99</td></tr>
<tr><td>Jul</td><td>0.0246</td><td>99</td><td>0.0153</td><td>99</td></tr>
<tr><td>Aug</td><td>0.0202</td><td>99</td><td>0.0119</td><td>99</td></tr>
<tr><td>Sep</td><td>0.0170</td><td>70</td><td>0.0096</td><td>99</td></tr>
</table>
</td></tr>
<tr><td>Quality</td><td>Salts</td><td>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.</td><td>Electrical conductivity</td><td>≤ 65 milliSiemens/metre (95th percentile)</td></tr>
</table>

IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
		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 (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	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 (95thpercentile)
							Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	≤ 130 counts/100 millilitres (95th percentile)
MC Schoon spruit	**III**	**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)

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 (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	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 (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	6.0 (5th percentile) and 8.5 (95th 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)

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.	

IUA	Class	River/Dam	Resource Unit	Node	Ecological category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
								recreationally important fish species. The importance of the Dam for recreation, abstraction and ecological flow releases must be protected.		
MC Schoon spruit	**III**	**Schoonspruit (24H)** (From Johan Neser Dam to the confluence of the Vaal River) (includes Jagspruit tributary	**SK7**	**MC 4**	**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 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 (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50th percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50h percentile) ≤ 6 milligrams/litre (95th percentile)
							Salts	The instream salinity must be improved to support the aquatic ecosystem and the water quality requirements ofwater users.	Electrical conductivity	≤ milliSiemens/metre (95thpercentile)
									Sulphate	≤ 200 milligrams/litre (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	≤ 0.250 milligrams/litre (95th percentile)
									Uranium	≤ 0.03 milligrams/litre (95th percentile)
									Ammonia as Nitrogen	≤ 0.072 milligrams/litre (95th percentile)
									Iron	≤ 0.25 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.	

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 Schoon spruit	**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				
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)	*Month*	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
										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)				

<table>
<tr><th>IUA</th><th>Class</th><th>River/ Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th colspan="5">Numerical limit</th></tr>
<tr><td rowspan="4">MD1 Upper Sand</td><td rowspan="4">III</td><td rowspan="2">Upper Sand (C42D, C42E)
(From Klipspruit confluence to Allemanskraal Dam)</td><td rowspan="2">US2</td><td rowspan="2">MD 1.1</td><td rowspan="2">C</td><td rowspan="2">Biota</td><td>Fish</td><td>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.</td><td>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.</td><td colspan="5">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)</td></tr>
<tr><td>Aquatic Invertebrates</td><td>The integrity of the macroinvertebrate community within the system must be maintained.</td><td>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.</td><td colspan="5">Maintain the current C ecological category by ensuring that the Average Score Per Taxon is >5.0.</td></tr>
<tr><td rowspan="2">Allemanskraal Dam (C42E)</td><td rowspan="2">US3</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">Quantity</td><td rowspan="2">Low flows</td><td rowspan="2">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.</td><td rowspan="2">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)</td><td colspan="5"><table>
<tr><th rowspan="2">Month</th><th colspan="2">Maintenance Low Flows</th><th colspan="2">Drought Flows</th></tr>
<tr><th>cubic metres/ second</th><th>Per-cen-tile</th><th>cubic metres/ second</th><th>Per-cen-tile</th></tr>
<tr><td>Oct</td><td>0.3558</td><td>60</td><td>0.0523</td><td>99</td></tr>
<tr><td>Nov</td><td>0.6034</td><td>70</td><td>0.0270</td><td>99</td></tr>
<tr><td>Dec</td><td>0.6743</td><td>80</td><td>0.0187</td><td>99</td></tr>
<tr><td>Jan</td><td>0.9457</td><td>80</td><td>0.0709</td><td>99</td></tr>
<tr><td>Feb</td><td>1.1913</td><td>70</td><td>0.0827</td><td>99</td></tr>
<tr><td>Mar</td><td>1.0629</td><td>70</td><td>0.0523</td><td>99</td></tr>
<tr><td>Apr</td><td>0.7284</td><td>70</td><td>0.0424</td><td>99</td></tr>
<tr><td>May</td><td>0.4529</td><td>40</td><td>0.0336</td><td>99</td></tr>
<tr><td>Jun</td><td>0.2662</td><td>50</td><td>0.0193</td><td>99</td></tr>
<tr><td>Jul</td><td>0.1635</td><td>70</td><td>0.0448</td><td>99</td></tr>
<tr><td>Aug</td><td>0.1591</td><td>80</td><td>0.0627</td><td>99</td></tr>
<tr><td>Sep</td><td>0.2600</td><td>60</td><td>0.0887</td><td>99</td></tr>
</table></td></tr>
<tr><td rowspan="2">Quality</td><td rowspan="2">Nutrients</td><td rowspan="2">Concentration of nutrients must be maintained to sustain ecosystem health and water quality requirements of water users.</td><td>Dissolved Inorganic Nitrogen as Nitrogen</td><td colspan="5">≤ 0.5 milligrams/litre (50th percentile)</td></tr>
<tr><td>Nitrate & Nitrite as Nitrogen</td><td colspan="5">≤ 0.25 milligrams/litre (50th percentile)
≤ 6 milligrams/litre (95th percentile)</td></tr>
</table>

IUA	Class	River/ Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
								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)
MD1 Upper Sand	**III**	**Allemanskraal Dam (C42E)**	**US3**			**Quality**	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.	

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				
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)	*Month*	*Maintenance Low Flows*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
										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 (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 2.5 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.125 milligrams/litre (50^{th} percentile)

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
							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 (95thpercentile) 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.
MD2 Lower Sand	**III**	**Rietspruit tributary (C42J)**	**LS2**		**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)

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

IUA	Class	River	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						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) ≤ 6 milligrams/litre (95th percentile)
									Orthophosphate as Phosphorus	≤ 0.058 milligrams/litre (50th 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	≤ 85 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.	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.	
MD2 Lower Sand	**III**	**Lower Sand (C42J)** (Downstream Rietspruit tributary to confluence with the Vet River)	**LS3**	**MD 2.3**	**C**	**Quality**	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.

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.

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 (50^{th} percentile)				
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)				
									Orthophosphate as Phosphorus	≤ 0.020 milligrams/litre (50^{th} 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)

IUA	Class	River / Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical limit
						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.
ME1 Upper Vet	**II**	**Soutspruit (C41E)**	**UV3**	**ME 1.3**	**B/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 1.3) = 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*, *Percentile*) / *Drought Flows* (*cubic metres/second*, *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
						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.
ME1 Upper Vet	**II**	**Erfenis Dam**	**UV4**			**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)

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 (95^{th} percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5^{th} percentile) and 8.5 (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	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.	

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 (50^{th} percentile)
									Nitrate & Nitrite as Nitrogen	≤ 0.25 milligrams/litre (50^{th} percentile) ≤ 6 milligrams/litre (95^{th} percentile)
									Orthophosphate as Phosphorus	≤ 0.030 milligrams/litre (50^{th} percentile)
							Salts	Instream salinity must be maintained. Salinity levels should not be allowed to deteriorate.	Electrical conductivity	≤ 75 milliSiemens/metre (95^{th} percentile)
							System variables	pH must be maintained at present state.	pH range	6.5 (5^{th} percentile) and 8.5 (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 (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
							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.
ME 2 Lower Vet	**III**	**Lower Vet (C43A, C43C, C43D)** (Downstream Sand River Confluence to Bloemhof Dam)	**LV2**	**EWR 15**	**C/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 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*	*Per-cen-tile*	*cubic metres/ second*	*Per-cen-tile*
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

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)		

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 (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.	
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 (95^{th} 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.

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*		*Drought Flows*	
											cubic metres/ second	*Per-cen-tile*	*cubic metre/ second*	*Per-cen-tile*
										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 (95h 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)

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)

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**	**C/D**	**Quantity**	Low flows	The maintenance and	Total Maintenance	*Month* / *Maintenance Low Flows* / *Drought Flows*

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th colspan="5">Numerical Limit</th></tr>
<tr><td rowspan="13"></td><td rowspan="13"></td><td rowspan="13">(C24J) (From Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam-Quaternary catchment)</td><td rowspan="13">VB 1.3</td><td rowspan="13">13</td><td rowspan="13"></td><td rowspan="13"></td><td rowspan="13"></td><td rowspan="13">drought flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem and users.</td><td rowspan="13">low flow and drought flow Ecological Water Requirement (EWR 13) = 309.184 million cubic metres/annum (11.65% of the Virgin Mean Annual Runoff)

Maintenance flows (percentage value of naturalised flow distribution)

Drought flows (percentage value of naturalised flow distribution)</td><td></td><td>cubic metres/ second</td><td>Per-cen-tile</td><td>cubic metres/ second</td><td>Per-cen-tile</td></tr>
<tr><td>Oct</td><td>7.254</td><td>90</td><td>0.029</td><td>99</td></tr>
<tr><td>Nov</td><td>10.7</td><td>99</td><td>0.043</td><td>99</td></tr>
<tr><td>Dec</td><td>11.931</td><td>99</td><td>0.047</td><td>99</td></tr>
<tr><td>Jan</td><td>13.892</td><td>99</td><td>0.055</td><td>99</td></tr>
<tr><td>Feb</td><td>18.531</td><td>99</td><td>0.073</td><td>99</td></tr>
<tr><td>Mar</td><td>15.172</td><td>99</td><td>0.06</td><td>99</td></tr>
<tr><td>Apr</td><td>11.532</td><td>90</td><td>0.046</td><td>80</td></tr>
<tr><td>May</td><td>7.732</td><td>90</td><td>0.031</td><td>90</td></tr>
<tr><td>Jun</td><td>5.863</td><td>99</td><td>0.024</td><td>99</td></tr>
<tr><td>Jul</td><td>5.278</td><td>99</td><td>0.022</td><td>99</td></tr>
<tr><td>Aug</td><td>4.78</td><td>99</td><td>0.02</td><td>99</td></tr>
<tr><td>Sep</td><td>5.177</td><td>99</td><td>0.022</td><td>99</td></tr>
<tr><td rowspan="14">MF Vaal River</td><td rowspan="14">III</td><td rowspan="14">Vaal River (C24J) (From Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam-Quaternary catchment)</td><td rowspan="14">VB 1.2, VB 1.3</td><td rowspan="14">EWR 13</td><td rowspan="14">C/D</td><td rowspan="12">Quantity</td><td rowspan="12">High flows</td><td rowspan="12">The high flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem</td><td rowspan="12">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 (percentage value of naturalised flow distribution)</td><td rowspan="2">Month</td><td colspan="2">Maintenance High Flows</td></tr>
<tr><td>cubic metres per second</td><td>Percentile</td></tr>
<tr><td>Oct</td><td>0.00</td><td>99</td></tr>
<tr><td>Nov</td><td>14.6</td><td>90</td></tr>
<tr><td>Dec</td><td>0.00</td><td>99</td></tr>
<tr><td>Jan</td><td>14.129</td><td>99</td></tr>
<tr><td>Feb</td><td>92.225</td><td>50</td></tr>
<tr><td>Mar</td><td>0.00</td><td>99</td></tr>
<tr><td>Apr</td><td>0.00</td><td>99</td></tr>
<tr><td>May</td><td>0.00</td><td>99</td></tr>
<tr><td>Jun</td><td>0.00</td><td>99</td></tr>
<tr><td>Jul</td><td>0.00</td><td>99</td></tr>
<tr><td>Aug</td><td>0.00</td><td>99</td></tr>
<tr><td>Sep</td><td>0.00</td><td>99</td></tr>
<tr><td rowspan="2">Quality</td><td rowspan="2">Nutrients</td><td rowspan="2">Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category and the water quality requirements</td><td>Nitrate & Nitrite as Nitrogen</td><td colspan="4">≤ 1.35 milligrams/litre (50th percentile)
≤ 6 milligrams/litre (95th percentile)</td></tr>
<tr><td>Dissolved Inorganic Nitrogen as Nitrogen</td><td colspan="4">≤ 1.65 milligrams/litre (50th percentile)</td></tr>
</table>

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 (95h 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.	

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 (95^{th} 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 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)

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.
							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).
		Vierfontein-spruit	**VB2**		**D**	**Quality**	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 (5thpercentile) - 9.2 (95th percentile)

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
							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)
MF Vaal River	**III**	**Ysterspruit, Matjiespruit, Klipspruit, Leeudoring-spruit, Wolwespruit, Makwassie-spruit (C24J, C25A, C25C,C25D)**	**VB3**		**B and C**	**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.
						Quality	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)
										Ysterspruit, Makwassiespruit and Wolwespruit: ≤ 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)

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**	**Ysterspruit, 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)

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 (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 improved to sustain the aquatic ecosystem.	Electrical conductivity	≤ 70 milliSiemens/metre (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	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)

<table>
<tr><th>IUA</th><th>Class</th><th>River/Dam</th><th>Resource Unit</th><th>Node</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>Resource Quality Objective</th><th>Indicator/measure</th><th colspan="5">Numerical Limit</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>Biota</td><td>Fish</td><td>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.</td><td>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.</td><td colspan="5">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)</td></tr>
<tr><td rowspan="14">MF Vaal River</td><td rowspan="14">III</td><td rowspan="14">Bloemhof Dam (C25E, C25F, C43D)</td><td rowspan="14">VB6</td><td rowspan="14"></td><td rowspan="14"></td><td rowspan="13">Quantity</td><td rowspan="13">Low flows</td><td rowspan="13">The downstream maintenance low flow requirements of EWR 16 must be met to support a healthy condition for the ecosystem.</td><td rowspan="13">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)</td><td>Month</td><td colspan="2">Maintenance Low Flows</td><td colspan="2">Drought Flows</td></tr>
<tr><td></td><td>cubic metres/ second</td><td>Per-cen-tile</td><td>cubic metres/ second</td><td>Per-cen-tile</td></tr>
<tr><td>Oct</td><td>6.333</td><td>99</td><td>4.905</td><td>99</td></tr>
<tr><td>Nov</td><td>6.794</td><td>99</td><td>5.262</td><td>99</td></tr>
<tr><td>Dec</td><td>6.971</td><td>99</td><td>5.4</td><td>99</td></tr>
<tr><td>Jan</td><td>8.266</td><td>99</td><td>6.403</td><td>99</td></tr>
<tr><td>Feb</td><td>11.052</td><td>99</td><td>2.646</td><td>99</td></tr>
<tr><td>Mar</td><td>8.974</td><td>99</td><td>6.952</td><td>99</td></tr>
<tr><td>Apr</td><td>7.086</td><td>99</td><td>5.489</td><td>99</td></tr>
<tr><td>May</td><td>5.71</td><td>99</td><td>4.423</td><td>99</td></tr>
<tr><td>Jun</td><td>4.717</td><td>99</td><td>3.654</td><td>99</td></tr>
<tr><td>Jul</td><td>4.669</td><td>99</td><td>3.617</td><td>99</td></tr>
<tr><td>Aug</td><td>4.46</td><td>99</td><td>3.454</td><td>99</td></tr>
<tr><td>Sep</td><td>5.632</td><td>99</td><td>4.363</td><td>99</td></tr>
<tr><td>Quality</td><td>Nutrients</td><td>Concentration of nutrients in the dam must be improved to sustain ecosystem health</td><td>Nitrate & Nitrite as Nitrogen</td><td colspan="5">≤ 0.15 milligrams/litre (50th percentile)
≤ 6 milligrams/litre (95th percentile)</td></tr>
</table>

IUA	Class	River/Dam	Resource Unit	Node	Ecological Category	Component	Sub-component	Resource Quality Objective	Indicator/measure	Numerical Limit
								and the water quality requirements of water users. Nutrient levels must not be allowed to deteriorate. Dam has the potential to be hypertrophic. Dam should be maintained in a mesotrophic state.	Dissolved Inorganic Nitrogen as Nitrogen	≤ 0.25 milligrams/litre (50th percentile)
									Orthophosphate as Phosphorus	≤ 0.015 milligrams/litre (50th percentile)
									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)
MF Vaal River	**III**	**Bloemhof Dam (C25E, C25F, C43D)**	**VB6**			**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.	

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 mino)r*, 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.	

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 kiliometres/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

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**		Electrical conductivity and specific macro elements for domestic use; Electrical Conductivity and Sodium Adsorption Ratio for Irrigation water use. Annual water quality analysis.	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
				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

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.