#### **DEPARTMENT OF WATER AND SANITATION**

NO. 612 17 JULY 2015

### DEPARTMENT OF WATER AND SANITATION

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

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

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

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

Director: Water Resource Classification Attention: Ms Shane Naidoo Department of Water and Sanitation Zwamadaka Building 185 Francis Baard Street Private Bag X313 **Pretoria** 

Pretoria 0001

E-mail: naidooshane@dwa.gov.za Facsimile: 012 336 6712

MRS NP MOKONYANE

MINISTER OF WATER AND SANITATION

DATE: 61.67-15

### SCHEDULE

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

## 1 DESCRIPTION OF WATER RESOURCE

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

Water Management Area:

Vaal

Drainage Region:

C Primary Drainage Region

River(s):

Vaal River System ( Vaal, Renoster, Vals, Schoonspruit,

Koekemoerspruit, Sand and Vet Systems)

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

- 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)
- 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.
- 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.
- Resource Quality Objectives (RQO) are defined for each prioritised resource unit (RU)
  (Table 2 and Figure 2) for every IUA in terms of water quantity, quality, habitat and biota
  as shown in Tables 3 11 respectively.
- 4. Where specified, the ecological category or Recommended Ecological Category (REC) means the assigned ecological condition by the Minister to a water resource that reflects the ecological condition of that water resource in terms of the deviation of its biophysical components from a predevelopment condition.
- 5. RQO are applicable from 1 April 2016.

Water Resource Classes of the Middle Vaal

Recommended Ecological Category CVD 9 8008 8808800 O O ۵ Present Ecological State 000000808 200 00 Table 1: Water Resource Classes per Integrated Unit of Analysis and Ecological Categories per Biophysical Node Natural MAR (million m<sup>3</sup>/a) 2546.42 2714.89 25.55 25.55 2.11 2.11 63.86 63.86 63.86 17.94 8.2 31.24 8.2 8.2 1131.7 1145.79 60.6 60.6 117.31 117.31 126.52 117.31 126.52 66.4 104.16 19.26 72.01 72.01 81.86 3.87 413.55 4.75 Catchment Area (km²) 70809 2215 3974 734 7555 2113 2083 159 159 16040 62305 811 811 2413 422 4092 11152 5868 860 349 4898 5930 1350 2020 2020 2030 499 499 864 **Tributary Name** Elandsspruit/Elands
Vals River
Vals River
Schoonspruit
Taalbosspruit
Schoonspruit
Schoonspruit
Schoonspruit Renoster River
Leeufonteinspruit
Renoster River
Doringspruit
Renoster River Heuningspruit Renoster River Sand River
Sand River
Koolspruit
Sand River
Vet River
Klein Vet River
Soutspruit Vals River Vet River Klipspruit Vet River
Vet River
Sand River
Vat River
Vat River
Klein Vet River
Vat River
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Vat River
Vat River
Vat River Renoster River Vaal River Renoster River Renoster River Renoster River Major River Name Vaal River Vaal River Vaal River Schoonspruit Vaal River Vaal River Vals River Vaal River Quaternary C42D C42F C42F C41D C41D C41E C41H C25A C24J Biophysi cal Node Name EWR15 EWR13 MD2.2 MD2.2 MD2.3 ME1.1 ME1.2 ME1.3 EWR12 MD1.1 MF.1 Resource Class for INA ≡ ≡ ⊨ ≡ = = = River River River Jpper Sand River Lower Sand River River Integrated Unit of Analysis (IUA) from Vals River (MB) Schoonspruit River (MC) Vet Lower Vet confluence Bloemhof (MF) Vaal River Renoster (MA) Renoster Upper (ME1) (MD1) (MD2) (ME2)

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)	00
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

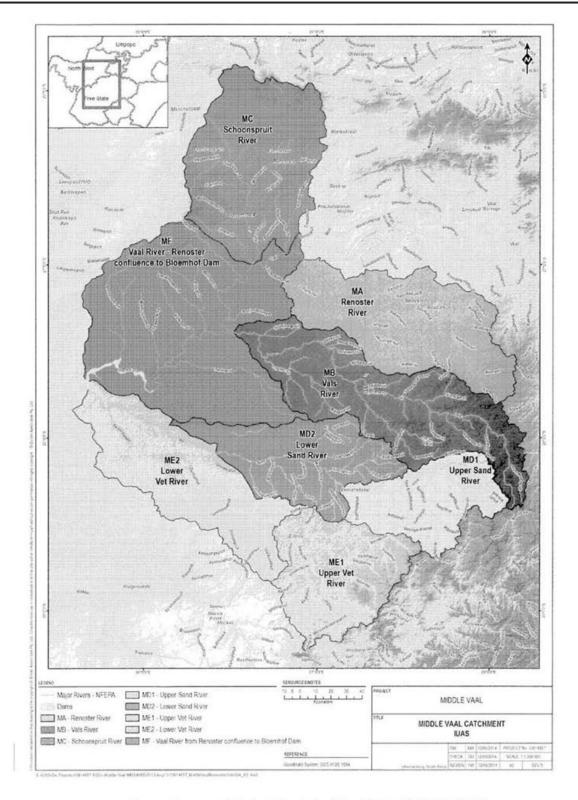


Figure 1: Integrated Units of Analysis defined in the Middle Vaal WMA

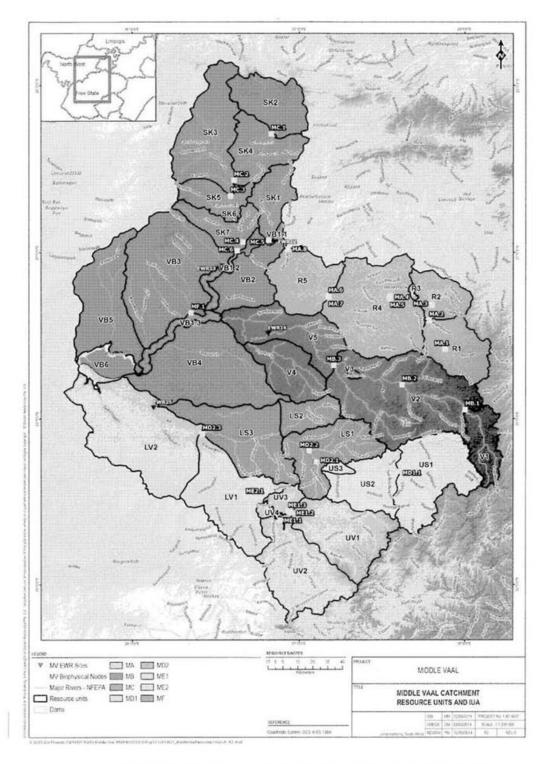


Figure 2: Resource Units and location of Nodes in the Middle Vaal WMA

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

naintena	The maintenance low	The maintena	The maintena
and dro	flows and drought flows	flows and dro	flows and dro
ort a he	support a healthy	Support a he	Low flows support a be-
tion for	condition for the	condition for	
ystem a	ecosystem and users.	ecosystem a	ecosystema
		_	
		_	
sam	Instream concentration of nutrients must be	Instream of nutrien	Instream of nutrien
tice	maintained to sustain aquatic ecosystem	aquatic	Nutrients aquatic e
2 5	nearm and to ensure the prescribed ecological category is met.	prescrib categor	prescrib prescrib categor
ain	Instream salinity must be maintained to support	Instream be main	Instream be main
26	the aquatic ecosystem and the water quality	the aqui	Salts the aqui
rem us	requirements of the water users.	requirem water us	requirem water us
Sauc	The presence of	The pres	The pres
ris Tris	pathogens should pose a low risk to human health.	a fow ris health.	Pathogens a low ris
at r	Instream and Riparian habitat must be in a moderately modified		Instream Habitat moderal
tion	moderately modified condition or better.		

S

IUA Class	s River/Dam	Unit	Node	Category	Component	Sub-component	Objective	Indicator/measure		Numerical limit	limit		
									Fish ecologi	Fish ecological category: ≥ C (≥ 62)	≥ C (≥ 6	2)	
								A baseline assessment		of the same	Plant and		4
							in moderately modified	integrity and health of	Macro-inver 62)	macro-invertebrate ecological category.∠ ∪ (< 62)	gicai can	egory.<	y v
							condition or better. The	the fish community must					
					Biota	Fish	importance of the RU as	be undertaken.	Instream Ec	Instream Ecostatus category ≥ C (≥ 62)	ory ≥ C	(≥ 62)	
							a reruge nabilial and	Fish Response	Hydrological	Hydrological category > C (> 62)	(5 62)		
							must be ensured.	Assessment Index	With month!	With monthly flow requirements as specified.	ments a	s specific	pq.
								(FRAI) must be utilized.	Water Quali	Water Quality category: ≥ C (≥ 62)	C (≥ 62	_	
								The integrity of the					
								invertebrate community					
	(C10C)						The integrity of the	using the					
	(Tributaries	1		,	i	Aguatic	macroinvertebrate	Macroinvertebrate	Maintain the	Maintain the current C category by ensuring	tegory by	v ensurir	00
	Leeufontein	<b>K</b> 2	MA 3	υ	Biota	Invertebrates	system must be	Response Assessment Index. Conduct aquatic	the Average	the Average Score Per Taxon is >5.0.	axon is >	5.0.	0
	and Wolwespruit)						maintained.	biomonitoring annually using the South African Scoring System 5					
								methodology.					T
								Total Ecological Water		Maintenance Low Flows	- 20	Drought Flows	OWS
								Requirement (node	Month	-	-	-	Per-
								MA4) = 18.04 million		second c	rile s	metres/	cen-
							The downstraam	(28.82% of the Virgin	Oct			0.0299	66
							maintenance low flow	Mean Annual Runoff)	Nov	0.5204	0 09	0.0231	66
							requirements of node		Dec	0.5604		0.0336	66
					Ousnith	I our flower	MA 4 must be met to	Maintenance flows	Jan			0.0672	66
					Common of the Co		condition for the	(percentage value of	Feb			0.0248	66
							ecosystem and users.	distribution)	Mar	-	-	0.0448	66
									Apr			0.0309	66
	Koppies Dam	R3						Drought flows	May	-	$\dashv$	0.0261	66
	(2012)							(percentage value of	Jun			0.0386	66
								distribution)	Jul	$\dashv$		0.0381	66
									Aug	00600	70 0	0.0351	66
									Sep	0.1246	20 0	0.0455	66
							Concentration of nutrients must be maintained to enstain	Dissolved Inorganic Nitrogen as Nitrogen	s 0.50 millig	< 0.50 milligrams/litre (50th percentile)	P percen	(elile)	
							eccevelem health and						T
					Quality	Nutrients	water quality requirements of water	Orthophosphate as Phosphorus	s 0.015 milligrams/litre (50" percentile)	grams/litre tile)			
							users. The dam should be maintained in a mesotrophic state.	Nitrate & Nitrite as Nitrogen	s 0.25 millig 6 milligrams	s 0.25 milligrams/litre (50" percentile) 6 milligrams/litre (95" percentile)	P percen rcentile)	tile)	

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Patricial Conduction   Patricial Conduction	IUA	Class	River/Dam	Resource	Node	Ecological	Component	Sub-component	Resource Quality Objective	Indicator/measure		Numerical Ilmit	al limit		П
The saling in the dam must be maintained in didden outside to support a codystem health and coder to support a codystem health and the water quality in the dam with the dam provides and a low risk to human health. Commistreem water the confident for the exponence of the Dam habitat (C70C.)    Reneater   R										Phytoplankton	s 0.025 millig (50" percentil	rams/litre le)			
Pathogens   Pathogens   Pathogens   Pathogens   Pathogens should bose								Saits	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	s 55 milliSien percentile)	nens/metre		99	69
Habitat   Dam habitat   Dam habitat   The downstream maintenang								Pathogens	The presence of pathogens should pose a low risk to human health.	Escherichia coli	s 130 counts/ (95" percentil	/100 mililitr	se		
Ranoster (C70C)   Ranoster (									The downstream maintena a healthy condition for the	ince low flow requirements of ecosystem and users.	of node MA 4 in	RU R2 mu	ust be me	t to supp	T.
The importance of the Dam							Habitat	Dam habitat	The importance of the Dan includes ecologically and re	n as a refuge for aquatic and ecreationally important fish a	d semi-aquatic t species and bin	biota must ds.	be prote	sted. This	75,90
Continuence									The importance of the Dan be protected.	n for recreation, eco-tourism	n, abstraction an	nd ecologic	al flow re	leases m	nst
Renoster (C70D, C70E, C70E) C70F, C70G, C70H) (Downstream R4 MA 6 C Quantity Low flows and drought flows must be attained to confluence with the Heuningspruit)  Heuningspruit)  The dam supports a The dam support a death and semi-aquatic bird species. The suitability of the dam as bird habitat must be maintenance low flows and drought flows and drought flows and drought flows confluence with the ecosystem and users.			Koppies Dam (C70C)	22				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 t studies. Suitable abundan be conducted annually.	be monitored thr	rough healt	th assess Monito	ment ring shou	P
Total Ecological Water   Requirement (node   Month   Low Flows   And drought flows and drought flows		=					5000	Aquatic birds	The dam supports a warefy of aquatic and semi-aquatic bird species. The suitability of the dam as bird habitat must be maintained.	A baseline assessment sh community around the dar	m.	ted to dete	rmine th	e aquatic	pid
MA6   C   Quantity   Low flows and drought flow and drought flows and drought flows and drought flows and drought flow and										Total Ecological Water Requirement (node		Mointena Low Flor	18)	Drought Fi	SMC
The maintenance low (27.28% of the Vrgin lows and drought flows are drought flows and drought flows and drought flows are drought flows are drought flows and drought flows are drought flows and drought flows are drought flows and drought flows are drought flows			Renoster							MA6) = 25.413 million	Month	cubic		cubic	Per-
The control of the			(C70D, C70E,						The maintenance low	Cubic metres/annum		second second	20	recond .	cen-
R4         MA 6         C         Quantity         Low flows         must be attained to a matter of a must be attained to a must be attained to a must be a consistent and users.         Maintenance flows per condition for the advantage value of maturalised flow distribution)         Nov         0.6065         70         0.0617           Condition for the ecosystem and users.         Reconstitution for the advantage value of maturalised flow distribution)         Jan         0.9039         80         0.0821           Drought flows         Mar         0.8789         70         0.0648			C70F, C70G, C70H)	2000		Î			flows and drought flows	Mean Annual Runoff)	Oct	0.2808		0.0373	66
condition for the ecosystem and users.         Maintenance flows construction for the ecosystem and users.         0.9039 construction for the ecosystem and users.         0.9039 construction for the ecosystem and users.         0.0061 co			(Downstream	8	MA6	υ	Quantity	Low flows	must be attained to support a healthy		Nov	0.6065		71900	66
Occupate the control of the contro			to confluence						condition for the	Maintenance flows	Dec	0.6758		17600	66
distribution)         Feb         1.0206         70         0.0661           Drought flows         Mar         0.8789         70         0.0485			with the Heuningspruit)						cooperation and decision	naturalised flow	Jan	0.9039		0.0821	66
Mar 0.8789 70 0.0485										distribution)	Feb	1.0206	Н	0.0661	66
										Drought flows	Mar	0.8789		0.0485	66

Г	66	66	66	66	66	66								
	0.0887	0.0261	0.0502	60200	0.0373	0.0579	entile)		rcentile)			pun		Integrity
Numerical limit	20	9	9	80	80	20	0" pero		(50" pe	9	18.6.	ackgrou d.	350	habitat
Numeri	0.5698	0.2830	0.1759	0.1434	0.1307	0.1674	ams/litre (5	igrams/litre tile)	rams/litre	mens/metr	centile) and tile)	tion from b n is allowe	grams/litre tile)	d Riparian (z 62)
	Apr	May	Jun	Jul	Aug	Sep	s 0.5 milligrams/litre (50° percentile)	s 0.058 milligrams/litre (50° percentile)	s 0.50 milligrams/fitre (50th percentile) s 6 milligrams/fitre (95th percentile)	s 70 milliSiemens/metre (95th percentile)	7.4 (5th percentile) and 8.6. (95th percentile)	A 10% variation from background concentration is allowed.	s 0.072 milligrams/litre (95th percentile)	Instream and Riparian habitat Integrity category z C (z 62)
Indicator/measure	(percentage value of	distribution)					Dissolved Inorganic Nitrogen as Nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Electrical conductivity	pH range	Turbidity	Ammonia as Nitrogen	The Rapid Habitat Assessment Method must be implemented.
Resource Quality Objective							Instream concentration	improved to sustain aquatic ecosystem health and ensure the	prescribed ecological category is met.	Instream salinity must be maintained at the current state to support the aqualic coosystem and the water quality requirements of the water users.	pH must be maintained at present state.	A baseline assessment to determine the present state instream turbidity is required.	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	Instream and Riparian habitat must be in a moderately modified condition or better
Sub-component								Nutrients		Salts		System variables	Toxics	Instream Habitat
Component								Quality			- Harris	Congress of the Congress of th		Habitat
Ecological Category												υ		
Node												MA6		
Resource Unit												ž		
River/Dam											Renoster (C70D, C70E,	C70F, C70G, C70H) (Downstream Koppies Dam to confluence	with the Heuningspruit)	
Class												=		
IUA												Renoster		

Biota Fish Aquatic Invertebrates Low flows	Sio Barro	Component sup-component	Objective	Indicator/measure	Numer	Numerical limit	
Renoster (C704, C70K) (C704, C7		Fish .	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality and limitation of migration barriers for fish.	A baseline assessment to determine the integrity and heath of the fish connutually should be conducted to determine the current state. If the current state, if the current state, if the current state, if the current state, if the category meets the recommended Category then the baseline integrity and health must be maintained. However if the baseline assessment shows that the current shows that the category then the C category must be met.	instream and Riparian habitat integrify 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)	habitat integrit y; ≥ C (≥ 62) logical catego logical catego egory ≥ C (≥ 62) ≥ C (≥ 62) irements as sp	/ y.≥ C (≥ 2) ecified.
Renoster (C704, C70K) (Downstream Heuningspruit confluence to confluence to confluence to with the Vaal Kneer) (includes the Oilfantsviel Inbutany)		Aquatic	The integrity of the macroinvertebrate community within the system must be maintained.	The integrity of the invertebrate community ashould be determined using the Macroinvertebrate Response Assessment Index Conduct aquatic biomonitoring annually using the South African Social System 5 methodology.	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.	category by en Taxon is >5.0	suring
(C70J, C70K) (Downstream Heuminsspruit Confluence to confluence to with the Vaal River) (includes the Olifantswiel tributary)				Total Ecological Water Requirement (node MAB) 31.578 million	Month cubic Fer		Cought Flows cubic Per-
Heuningspruit confluence to R5 MA8 C Quantity Low flows with the Vaal Raver) (includes the Oilfantsviel Inbutary)			The maintenance low flows and drought flows	(26.12% of the Virgin Mean Annual Runoff)	second 0.3226	-	_
Il confluence R5 MA8 C Quantity Low flows with the Vaal Raver) (includes the Olifantsviel Inbutary)			must be attained so that the environmental flows		Ħ	Н	$\vdash$
with the Vaal River) (includes the Oildantsviel Inbutary)	υ		requirements are met to	Maintenance flows		$\dashv$	$\rightarrow$
			support a healthy	(percentage value of	T	$\dashv$	
			ecosystem and users.	naturalised flow	1	+	$\rightarrow$
(ributary)				distribution)		+	-
				Drought flows	1	+	-
	_			(percentage value of	1	$\forall$	-
				naturalised flow	1	-	-
				distribution)	Jul 0.1871	90 0.0709	66 6

	ě	5	
	4	5	
		2	
		2	

	66	66				(85)			(e)		
	0.0373	0.0579	centile)		entile) ntile)	6)			5 <sup>th</sup> percentil	pur	integrity
Numerical limit	06	9	50" per		50" perc	e.		litres	d 8.5 (9	backgrot ed.	habitat
Numer	0.1725	0.2076	s1.25 milligrams/litre (50th percentile)	< 0.058 milligrams/litre (50" percentile)	4.0 milligrams/litre (50 <sup>th</sup> percentile) \$6 milligrams/litre (95 <sup>th</sup> percentile)	s 55 milliSiemens/metre percentile)	s 0.072 milligrams/fitre (95" percentile)	s 130 counts/100 millilitres (95" percentile)	6.5 (5" percentile) and 8.5 (95" percentile)	A 10% variation from background concentration is allowed.	Instream and Riparian habitat integrity category ≥ C (≥ 62)
	Aug	Sep	s1.25 mi	< 0.058 milligrar (50th percentile)	s 1.0 mil	s 55 milliS percentile)	s 0.072 r (95" per	s 130 counts/10 (95th percentile)	6.5 (5"	A 10% v	Instream
Indicator/measure			Dissolved Inorganic Nitrogen as Nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Electrical conductivity	Ammonia as Nitrogen	Escherichia coll	pH range	Turbidity	The Rapid Habilat Assessment Method must be implemented.
Resource Quality Objective			Instream concentration of nutrients must be	improved to sustain aquatic ecosystem	prescribed ecological category is met.	Instream salinity must be maintained. Salinity levels should not be allowed to deteriorate.	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	The presence of pathogens should pose a low risk to human health.	pH must be maintained at present state.	A baseline assessment to determine the present state instream turbidity is required.	Instream and Riparian habitat must be in a moderately modified condition or better.
Sub-component				Nutrients		Salts	Toxics	Pathogens		System variables	Instream Habitat
Component							Quality				Habitat
Ecological											
Node											
Resource											
River/Dam											
Class											
IUA											

Numerical limit	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)	An ecological category of C must be met. The Average Score Per Taxon value of > 5.0 must be achieved.	A baseline assessment should be conducted to determine the aquatic bird community and future changes in the bird communities compared to the baseline.
Indicator/measure	Fish Response Assesment Index (FRAI) must be utilized.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scroing System 5 methodology.	A baseline assessment she community and future char baseline.
Resource Quality Objective	Instream blots must be im 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.	The integrity of the invertebrate community within the system must be improved, by improving the water quality from a nutrient perspective	The habitat requirements of aquatic bird populations must be provided for.
Sub-component	Fish	Aquatic Invertebrates	Aquatic birdlife
Component		note	
Ecological Category	. (	٥	
Node		o C	
Resource		£	
River/Dam	Renoster (CTOJ, CZOK) (Downstream Heuningspruit	connuence with the Vaal River) (includes the Olifartsviei tributary)	
Class			
IUA		Jan Soulan	

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

	lows	Per-	-uao	tile	66	66	66	66	66	66	66	66	66	66	66	66			(e)			ığı.	8_
limit	Drought Flows	cubic	/saxtam	puoses	0.0261	0.0077	0.0000	0.0373	0.0703	0.0523	0.0000	0.0373	0.0386	0.0075	0.0411	0.0000			< 0.25 milligrams/litre (50" percentile) < 6 milligrams/litre (95" percentile)		res	Instream and Riparian habitat integrity category ≥ C (≥ 62)	An ecological category of C/D must be met. The Average Score Per Taxon value of > 4.8 must be achieved.
Numerical limit	Maintenance Low Flows	c Per-	-	4	00 00	55 70	07 70	37 80	75 70	$\vdash$	$\dashv$	$\dashv$	$\dashv$	$\rightarrow$	$\dashv$	00 30	ams/litre e)	rams/litre e)	ms/litre (	ens/metra	100 millife e)	Riparian ( 2 62)	category rage Sco must be
z	3.00	Month cubic	metres/	second	Oct 0.3200	Nov 0.6655	Dec 0.8307	Jan 1.1537	Feb 1.2475	Mar 1.1455	Apr 0.6917	May 0.3566	$\forall$	Jul 0.1340	Aug 0.1568	Sep 0.2600	s 0. 50 milligrams/litre (50° percentile)	s 0.058 milligrams/litre (50th percentile)	25 milligrams	s 65 milliSiemens/metre (95" percentile)	s 130 counts/100 millilitres (95th percentile)	Instream and Ripar category ≥ C (≥ 62)	An ecological category of C/D mmet. The Average Score Per Tavalue of > 4.8 must be achieved.
Indicator/measure	Total Ecolopical Water	121	= 33 464 million cubic	matras/annum	Virgin		ă	Maintenance flows	of o	flow	distribution) Ap	Drought flows (percentage	Ц	distribution) Jr.	A	Se	Dissolved Inorganic s 0 Nitrogen as Nitrogen (50	Orthophosphate as s ( S0 Phosphorus (50	Nitrate & Nitrite as s0 Nitrogen s6	s 6 Electrical conductivity (95)	Escherichia coli (95	The Rapid Habitat Assessment Method must cate	The integrity of the invertebrate community An should be determined An using the Macroinvertebrate valid Response Assessment
Resource Quanty Objective							The maintenance low flows	and drought flows must be	condition for the ecosystem	and users.							Instream concentration of	to sustain aquatic	ensure the prescribed ecological category is met.	instream salinity must be maintained at the present state to support the aquatic ecosystem and the water quality requirements of the water users.	The presence of pathogens should pose a low risk to human health.	Instream and Riparian habitat must be in a moderately modified condition or better.	The integrity of the macroinvertebrate community within the system must be improved, by improving the water quality from a nuthent perspective.
Sub-component								low fowe										Nutrients		Salts	Pathogens	Instream Habitat	Aquatic Invertebrates
Component								Ousofite	-											Quality		Habitat	Biota
Category																		υ					
Node																		MB 3					
Resour ce Unit																		72					
River/Dam													Vals (C60B,	C60C, C60D,	C60E, C60F)	(from the	spruit confluence to	the Kroonval weir at	Kroonstad) (Major tributaries	include the Elandspruit, Liebenberg stroom and Blomspruit)			
Class																		≡					
IUA																		MB					

		^ ac	ίξ			62)			ows	Per-	cen-	66	66	66	66	66	66	66	66	66	66	66	66			(e)
mit		The Specific Pollution Index should be > 9.2 (C category).	Instream and Riparian habitat Integrity category ≥ C (≥ 62)	Fish ecological category: ≥ C (≥ 62)	gical	instream Ecostatus category ≥ C (≥ 62)	Hydrological category ≥ C (≥ 62) With monthly flow requirements as specified.	C (2 62)	Drought Flows	cubic	metres/	0.0261	0.0077	0.0000	0.0373	0.0703	0.0523	0.0000	0.0373	0.0386	0.0075	0.0411	0.0000			< 0.25 milligrams/litre (50th percentile)
Numerical limit		ition Ind	arian ha 2)	legory:	e ecolo	is categ	gory ≥ require	egory: 2	ance	Per-	-uao	9	20	70	80	70	8	9	40	20	02	9	30	litre	s/litre	litre (50
Num		ific Pollt.	and Rip	ogical ca	ertebrat ≥ C (≥ 6	Ecostatu	cal cate thly flow	ality cat	Maintenance Low Flows	cubic	metres/	0.3200	0.6655	0.8307	1.1537	1.2475	1.1455	0.6917	0.3566	0.1991	0.1340	0.1568	0.2600	ligrams/ entile)	illigram: entile)	ligrams/
		The Specific Poll 9.2 (C category).	Instream and Ripar category ≥ C (≥ 62)	Fish ecok	Macro-invertebrate ecological category:≥ C (≥ 62)	Instream	Hydrologi With mon specified.	Water Quality category: ≥ C (≥ 62)		Month		Oct	+	Dec	Jan	Н	1	$\rightarrow$	+	+	$\forall$	Aug	Sep	s 0.50 milligrams/litre (50° percentile)	s 0.015 milligrams/litre (50° percentile)	s 0.25 milligrams/litre (50" percenti
Indicator/measure	biomonitoring annually using the South African Scoring System 5 methodology.	Conduct a diatom assessment annually.	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.		Total Englanded Mistor	Requirement (node MR3)	= 33.464 million cubic	metres/annum	Mean Annual Runoff)		Maintenance flower	(percentage value of	naturalised flow	distribution)	Drought flows (percentage	value of naturalised flow	distribution)			Dissolved Inorganic Nitrogen as Nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as
Resource Quality Objective		Water quality improvement is required from a nutrient perspective.		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.						The downstream	requirements of node MB 3	must be met to support a	healthy condition for the	ecosystem.				E			Concentration of nutrients in the dam must be improved	to sustain ecosystem health and the water quality	Dam should be maintained in a mesotrophic state.
Sub-component		Diatoms			ì	Fish									I can floure	COM HOMS									Nutrients	
Component					i	Biota									Ousselle	Committee									Quality	
Ecological Category					ĵ	υ																				
Node						MB 3																				
Resour ce Unit						72												5	2							
River/Dam			Vals (C60B, C60C, C60D,	(from the	spruit confluence to	the Kroonval weir)	(Major tributaries Elandspruit, Liebenberg stroom and	Blomspruit)										Serfontein	Dam (C60D)							
Class					1	=													=							
IUA					MB	Vals												MB	Vals							

_												
Numerical limit	< 0.025 milligrams/litre (50" percentile)	s 65 millslemens/metre (95" percentile)	s 130 counts/100 millilitres (95" percentile)	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.		Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.	< 0.50 milligrams/litre (50th percentile)	s 0.25 milligrams/litre (50th percentile) s 6 milligrams/litre (95th percentile)	s 0.058 milligrams/litre (50th percentile)	s 65 mill/Siemens/metre (95th percentile)	Instream and Riparian habitat Integrity category ≥ C (≥ 62)
Indicator/measure	Chlorophyll-a	Electrical conductivity	Escherichia coli	Maintenance of low flow rele V2.	Habitat requirements and health of specified eco recreationally important fish species as specified. Habitat requirements and health of specified eco recreationally important aquatic and semi-aquatic specified.		Ecological Water Requirement for maintenance low flows	Dissolved Inorganic Nitrogen as Nitrogen	Nitrate & Nitrite as Nitrogen	Orthophosphate as Phosphorus	Electrical conductivity	The Rapid Habitat Assessment Method must be implemented
Resource Quality Objective		Salinity in the dam must be maintained to support ecosystem health and water quality requirements of the downstream water users.	The presence of pathogens should pose a low risk to human health.	The downstream maintenance low flow maintenance low flow requirements of node MB3 in RU VZ 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.	Flows must be maintained to support the wetland systems present.	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.	Instream salinity must be maintained to support the aquatic ecosystem.	Instream and Riparian habitat must be in a moderately modified
Sub-component		Salts	Pathogens		Fish		Low flows		Nutrients		Salts	Instream Habitat
Component			Quality		Biota		Quantity			Quality		Habitat
Category										o		
Node												
Resour ce Unit					\$					*		
River/Dam				Confession	Dam (C60D)				Middelspruit	(Otterspruit tributary)		
Class												
IUA						MB	Vals					
_												_

		95)	E C	SWG	Per-	tile	66	8 8	66	66	66	66	66	66	66	66	66	MS tile
ıt		ish ecological category: ≥ C (≥ 62)  Alacro-invertebrate ecological  ategory:≥ C (≥ 62)  nstream Ecostatus category ≥ C (≥ 62)  N/th monthly flow requirements as specified.  Nater Quality category: ≥ C (≥ 62)	gory by e Per Tax	Drought Flows	cubic /	-	+	+	9000	800.0	800.0		0.003	-	0.002	0.002	0.000	Maintenance High Flows subic metres/ second
Numerical limit		ecologic categor categor categor categor categor	ge Score		Per-		+	+	08 06	80	80		70		06	06	70	Maintenance cubic metres/ second
Numer		gical cata ertebrate c C (≥ 62) Ecostatus cal categ hly flow r	he currer	Maintenance Low Flows	cubic metres/	-	0.153	0.276	0.447	0.484	0.444	0.285	0.166	0.112	0.087	0.095	0.133	Mo
		Fish ecological category: $\geq C (\geq 62)$ Macro-invertebrate ecological category: $\geq C (\geq 62)$ Instream Ecostatus category $\geq C (\geq 62)$ With monthly flow requirements as specified.	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.		Month	$\neg$	+	+	Jan	Feb (	Mar (	Apr (	May (		Jul	Aug (	Sep (	Month
Indicator/measure		A baseline assessment to determine the integrity and death 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.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic blomonitoring annually using the South African Scoring System 5 methodology.	Total Majoranana Jour	flow and drought flow	Requirement (EWR 14) =	8.003 million cubic	the Virgin Mean Annual	Runoff)		Maintenance flows	naturalised flow	distribution)	Drought flows (percentage	value of naturalised flow	distribution)		Total Maintenance high flow Ecological Water Requirement (EWR 14) =
Resource Quality Objective	condition or better.	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.	The integrity of the macroinvertebrate community within the system must be maintained.				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.						The maintenance high flows must be attained so that the environmental flows
Sub-component		Fish	Aquatic Invertebrates						14	Low flows								High Flows
Component		no en									Quantity							
Ecological Category											CID							
Node										FWR	4							
Resour ce Unit											<b>^2</b>							
River/Dam								(C60G, C60J)	(From Kroonvaal weir	to the Vaal	River	(Nuwejaar	spruit and	Skikspruit fributaries)				
Class										1	=							
IUA										MB	Vals							

	_	_	_	_	_	_	_	_	_	_											
=	66	20	66	06	09	09	66	66	66	66	66	66	(50th percentile)	P percentile)	percentile)	1.7	n s 0.025 tile)				hound
Numerical limit	0000	1.653	0.000	0.697	2.7	1.6	0000	00000	00000	0000	0.000	0.000		< 0.125 milligrams/litre (50th percentile)	< 1.35 milligrams/litre (50" percentile) < 6 milligrams/litre (95" percentile)	Chlorophyll-a Periphyton s 1.7 milligrams/square metre (50 <sup>m</sup>	percentile) Chlorophyll-a Phytoplankton ≤ 0.025 milligrams/litre (50 <sup>th</sup> percentile)	nens/metre le)	130 counts/100 millilitres (95" percentile)	7.0 (5th percentile) and 8.6 (95th percentile).	A 10% variation from background concentration is allowed.
z	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	< 1.50 milligrams/litre	s 0.125 millig	s 1.35 milligrams	Chlorophyll-a milligrams/sq	percentile) Chlorophyll-a milligrams/litr	s 85 milliSiemens/metre (95th percentile)	s 130 counts/10 (95" percentile)	7.0 (5" perce (95" percenti	A 10% variation from bar concentration is allowed
Indicator/measure	16.969 million cubic	metres/annum	Mean Annual Runoff)			Maintenance high flows	(percentage value of	naturalised flow	distribution)				Dissolved Inorganic Nitrogen as Nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Chlorophyll-a concentrations should be	indicator against the resource quality objective nutrient concentrations.	Electrical conductivity	Escherichia coll	pH range	Turbidity
Resource Quality Objective	requirements are met to	support a healthy condition	ioi ule ecosystem.												nutrients must sustain	Concentrations should not be allowed to deteriorate.		Instream salinity should not deteriorate.	The presence of pathogens should pose a low risk to human health.	pH must be maintained at present state.	A baseline assessment to determine the present state instream turbidity is required.
Sub-component															Mutripote			Salts	Pathogens		System variables
Component															C Stiller	Î				Quality	
Ecological Category																				g	
Node																			9	4	
Resour ce Unit																				\$	
River/Dam																		Vals	(From Kroonvaal weir to the Vaal	River confluence) (Nuwejaar	spruit and Skikspruit tributaries
Class																				=	
IUA																			2	Vals	

Sub-component
Instream and Riparian habitat must be in a better than largely modified condition or better.
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 Fish quality needs must be
provided for including the impartance of the Republic Application of migration barriers. The importance of the RU as a retigue for fish in the Middle Vaal Briese must he Middle Vaal Briese must he Middle Vaal Briese must
be maintained.
State must be improved to a C category.

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

	iht	8	Per-	cen-	ard	86	66	66	66	66	66	66	66	66	66	66	66					ile)	tre year
	Drought	Flows	copic	metres/	second	0.0037	0.0039	0.0112	0.0112	0.0165	0.0149	0.0000	0.0037	0.0039	0.0000	0.0000	0.0000			rcentile) centile)		Siemens Siemens met by th tte of the rce Quali se achiev	grams/ li the 10th Governm bjective
al limit	ance	WS	Per-	-uao	Dille	20	80	40	40	40	20	9	20	20	70	80	20		9	50° pe		tre (95) 10 milli 10 be r stion da Resour imit to t publica	(95° pe 00 milli- met by of the of the
Numerical limit	Maintenance	Low Flows	cubic	metres/s	econd	0.0202	0.0409	0.0571	0.1038	0.1682	0.2012	0.1246	0.0504	0.0243	0.0179	0.0138	0.0104	s 3.0 milligrams/litre (50" percentile	s 0.125 milligrams/litre (50th percentile)	≤ 2.5 milligrams/litre (50 <sup>th</sup> percentile) ≤ 6 milligrams/litre (95 <sup>th</sup> percentile)		s 85 milliSiemens/metre (95"/percentile) A numerical linit of 110 milliSiemens/ metre (95"/percentile) to be met by the 10" year after publication date of the Government Notice. Resource Quality Objective numerical limit to be achieved by the 20" year after publication date of the Government Notice.	\$ 250 milligrams/litre (95°percentile) A numerical limit of 400 milligrams/ litre (95°percentile) to be met by the 10° year after publication date of the Government Notice. Resource Quality Objective
		1	Month			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	lot	Aug	Sep	s 3.0 milligrams (50 <sup>th</sup> percentile	s 0.125 milligrar (50 <sup>m</sup> percentile)	s 2.5 millign s 6 millign		s 85 mills A numeric metre (95 10" year 6 Governme Objective by the 20"	s 250 milli A numeric (95"perce after publi Notice. R
Indicator/measure		Total Ecological Water	Requirement (node MC5)	= 4.691 million cubic	menes/amom (17.31% of	the Virgin Mean Annual	Runoff)	Maintenance floure	(percentage value of	naturalised flow	distribution)	Ominht flows (normentane	value of naturalised flow	distribution)	The section was a section of the	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.	Dissolved Inorganic Nitrogen as nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Electrical conductivity	The salinity needs to be improved significantly from the present state to meet the required limit of 85 milliSiemens/ mete. A phased approach over a twenty year period is to be used to achieve the limit of 85 milliSiemens/mete.	Sulphate
Resource Quality Objective									1	The maintenance low	must be attained to	support a healthy	condition for the	ecosystem and users.				Instream concentration of nutrients must be	aquatic ecosystem health and ensure the prescribed	ecological category is met. Concentrations should not be allowed to deteriorate.		Instream salinity must be improved to acceptable levels to support a healthy aquatic ecosystem and the water quality requirements	of water users.
Sub- component												Low flows							Nutrients			Salts	
Component												Quantity										Quality	
Ecological	۵																						
Node																	MC 5						
Resource																	SK1						
River/Dam																	Koekemoer- spruit	(C24A)					
Class																							
IUA																	MC	¥					

Quality P	Quality	Alleno	Unit Node category Component	Unit Component C	Resource Node category Component Unit Category Component Outlify
D Habitat		٥	SK1 MC 5 D	MC 55	SK1 MC 5 D
Biota	Biota	Biota	Biota	Biota	Biota

Numerical limit	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.		s 2.5 milligrams/litre (50" percentile) s 6 milligrams/litre (95" percentile)	s 0.020 milligrams/litre (50° percentile)	\$ 0.010 miligrams/litre (50" percentile)	≤ 55 miliSiemens/metre (95° percentile)	6.0 (5th percentile) and 8.5 (95th percentile)
Indicator/measure	There is depletion of the groundwater resources which is impacting on the flow and water quality of the Schoonspruit Eye water due to infigation water use. The water quality of the eye is currently good and it is important to manitain this quality as irrigation and domestic water users are dependent on the Schoonspruit eye for water usplay.	Ecological Water Requirement for maintenance low flows and drought flows	Nitrate & Nitrite as Nitrogen	Orthophosphate as Phosphorus	Chlorophyll-a	Electrical conductivity	pH range
Resource Quality Objective	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.		Instream concentration of nutrients must be maintained to sustain an article proceeds an earth	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.	Salinity levels at the Schoonspruit eye are low and must be maintained at the present state. Salinity levels should not deteriorate.	pH must be maintained at present state.
Sub- component	Low flows			Nutrients		Salts	System variables
Component	Quantity					Quality	
Ecological			υ				
Node			MC 1				
Resource			SK2				
River/Dam			Schoonspruit Eye (C24C)				
Class			I				
IUA			MC Schoon spruit				

П				Ņ	100			Т		Per-	pile	66	66	66	66	66	66	66	66	66	66	66	66	
	Instream and Riparian habitat Integrity calegory ≥ 8 (≥ 82)	821	(20)	Macro-invertebrate ecological category:2 B (2 82)	Instream Ecostatus category≥ B (≥ 82)	82) s as	5)	Drought	Flows	cubic Pe			0.0039 9	$\rightarrow$	-	_	4	_	0.0224 9	_	0.0153 9		0.0096	
I limit	habitat	V S R (V	1	ological	egoryz	z B (z 8 irement	A > 9	92		Per- cu			70 0.0								99 0.0		70 0.0	9
Numerical limit	Riparian 2 82)	Fish ecological category > R (> 82)	offeren.	vrate eco	tatus cat	Hydrological category ≥ B (≥ 82) With monthly flow requirements as specified.	Water Quality category: A (> 92)	Maintenance	Low Flows	cubic Pr	-	$\vdash$	0.0278	$\vdash$	-	-	-	-	-	_	0.0246 9	_	0.0100	s 65 milliSlemens/metre (95° percentile)
ž	Instream and Ripar category ≥ B (≥ 82)	ological	and and	inverteb ?)	m Ecost	ogical c ionthly fl	Quality	M	_		909	0.0			0.0		T	П	T	0.0	0.0			illiSieme
	Instrea	Fish or		Macro-ir B (≥ 82)	Instrea	Hydrologi With mon specified	Water			Month		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	s 65 п д #36)
nre				-						MC2)	ò		≘ €	<b>.</b>					entage	flow				Aj.
Indicator/measure				The Rapid Habitat	anted.					Total Ecological Water Requirement (node MC2)	= 4.147 million cubic	mn	Z1.Z7% of the virgin	out were	se flows	(percentile value of			Drought flows (percentage	value of naturalised flow	_			Electrical conductivity
Indicat				The Rapid Habitat	be implemented.					tal Ecolo quireme	4.147 m	metres/annum	10 06/12	2011	Maintenance flows	(percentile value	distribution)		ought flo	ue of na	distribution)			odrical o
Н	Jo			£ 4		c		╀	1	- 8 - 8	11	E S	22	200	Ma	<u>a</u> ?	dis	5	D	· va	dis	_		
tuality ve	Instream and Riparian habitat must be in a largely natural condition or better. The habitat is unique to the catchment	9 4	gical		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.	l					to four	ht flows	10	^	Spece	5						The instream salinity must be maintained at the present state to support the aquatic ecosystem and the water quality requirements of the water press; Salinity levels
Resource Quality Objective	Instream and Riparian habitat must be in a largely natural conditio better. The habitat is unique to the catchme	area and must be	prescribed ecological	ď	n biota n	a largely natural conor or better. The requirements of	species of ecological importance and with particular flow and wat quality needs must be provided for.	l					The maintenance four	flows and drought flows	must be attained to	support a healthy	ecosystem and users	2						The instream salinity mu be maintained at the present state to support the aquatic cosystem is the water quality requirements of the wat users. Salinity levels
Res	Instrean habitat r largely r better.T	area an	prescrib	condition.	Instream	a largely or better. The requ	species of ec importance a particular flov quality needs provided for.						Thomas	flows ar	must be	support	PCOSVST	e feeds						The inst be main present the aqui the wate requiren requiren. S
- nent								T								,								
Sub- component				Instream	Habitat										I ow flows									Salts
Component					1										2	ì								<b>A</b>
Comp				1				L							Ousnitt	,								Quality
Ecological																		(	v					
Ecc								L	_			_	_			_			_					
Node																			MCZ					
Resource						7												***	SK3					
Res		_						L	_		_	_	_		_	_	_			_	_	_	_	
River/Dam																		bosspru	(C24F)					
								_					_		_		_	Taail	٤	2				
Class																		1	•					
IUA																	0	WC.	Schoon					
																	-8	- 6	מ מ	5				

	data to		(50m	tile)	entile)		grity	58) egory:2 C (2 58) s				
Numerical limit	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.	s 3.0 milligrams/litre (50th percentile)	s 0.125 milligrams/litre percentile)	s 2.5 milligrams/litre (50th percentile) s 6 milligrams/litre (95th percentile)	s 75 millSiemens/metre (95"percentile)	s 130 counts/100 millilitres (95th percentile)	instream and Riparian habitat Integrify category $\geq$ C/D ( $\geq$ 58)	Fish ecological category: 2 C/D (z 58) Macro-invertebrate ecological category: 2 C/D (z 58) Instream Ecostatus category: 2 C/D (z 58) Hydrological category: 2 C/D (z 58) With monthly flow requirements as specified.				
Indicator/measure	Ecological Water Requirement for maintenance low flows	Dissolved Inorganic Nitrogen as Nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Electrical conductivity	Escherichia coli	The Rapid Habitat Assessment Method must be implemented.	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 (FRA)				
Resource Quality Objective	The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Instream concentration of	maintained to sustain aquatic ecosystem health and ensure the prescribed	ecological category is met.	The instream salinity must be maintained at the current state to support the aqualic ecosystem and the water quality requirements of the water users.	The presence of pathogens should pose a low risk to human health.	Instream and Riparian habitat must be in a better than largely modified condition.	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.				
Sub- component	Low flows		Nutrients		Salts	Pathogens	Instream Habitat	Fish				
Component	Quantity				Quality		Habitat	Biota				
Ecological			3	9				95				
Node				MC 3				MC 3				
Resource				SK4				SK4				
River/Dam		Schoonspruit	(From below eye to the	confluence) (Rietspruit and	tributaries)		Schoonspruit	(C24b, C24E) (From below eye to the Kaalspruit confluence) (Retspruit and Shydfontein- loop tributaries)				
Class								=				
IUA					(40)			MC Schoon spruit				

Numerical limit	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.	Use Desktop Reserve Model and updated Present Ecological State data to determine low flow requirements.	s 1.0 milligrams/litre (50" percentile)	0.125 milligrams/litre (50" percentile)	s 2.5 milligrams/litre (50th percentile) s 6 milligrams/litre (95th percentile)	s 70 miliSlemens/metre (95° percentile)	≤ 130 counts/100 millilitres (95th percentile)	6.0 (5" percentile) and 8.5 (95" percentile)	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)
Indicator/measure	The integrity of the inventebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic blomonitoring annually using the South African Scoring System 5 methodology.	Ecological Water Requirement for maintenance low flows	Dissolved Inorganic Nitrogen as nitrogen	Orthophosphate as Phosphorus s	Nitrate & Nitrite as Nitrogen	Electrical conductivity	Escherichia coli	pH range	The Rapid Habitat Assessment Method must be implemented.
Resource Quality Objective	The integrity of the macroinvertebrate community within the system must be maintained.	The maintenance low flows and drought flows must be aftained to support a healthy condition for the ecosystem and users.	Instream concentration of nutrients must be	aquatic ecosystem health and ensure the prescribed	ecological category is met. Concentrations should not be allowed to deteriorate.	The instream salinity must be maintained at the present state to support the aquabic ecosystem and the water quality requirements of the water users.	The presence of pathogens should pose a low risk to human health.	pH must be maintained at present state.	Instream and Riparian habitat must be in a better than largely modified condition.
Sub- component	Aquatic Invertebrates	Low flows		Nutrients		Salts	Pathogens	System variables	Instream Habitat
Component		Quantity				Quality			Habitat
Ecological category					C/D				C/D
Node					MC 3				MC 3
Resource		4			SKS				SKS
River/Dam	9)		2	Schoonspruit (24F)	Kaalspruit confluence to	Dam) (includes Buisfontein- spruit)			Schoonspruit (24F) From Kaalspruit confluence to
Class									Ħ
IUA									MC Schoon spruit

Fish ecological category:2 C/D (2 58)  Macro-invertebrate ecological category:2 C/D (2 58)	Instream Ecostatus categoryz C/D (2 58)	Hydrological category≥ C/D (≥ 58) With monthly flow requirements as	specified.	Water Quality category:≥ C/D (≥ 58)	Maintain the current C ecological category by ensuring the Average Score Per Taxon is >5.0.	s 0.5 milligrams/litre (50th percentile)	s 0.025 milligrams/litre (50th percentile)	s 2.5 milligrams/fitre (50th percentile) s 6 milligrams/fitre (95th percentile)	s 0.025 milligrams/litre (50th percentile)	s 70 miliSlemens/metre (95" percentile)	s 130 counts/100 milliitres (95th percentile)	Habitat requirements and health of specified ecologically and recreationally important fish species as specified.
A baseline assessment to determine the integrity and health of the fish community should be	the current state and	population.	Fish Response Assessment Index (FRAI)	must be utilized.	The integrity of the investebrate community should be determined using the Marccinvesteate Response Assessment Index. Conduct aquatic blomonitoring annually using the South African Scoring System 5 methodology.	Dissolved Inorganic Nitrogen as Nitrogen	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Chlorophyll-a	Electrical conductivity	Escherichia coli	Habitat requirements and health of specified ecol recreationally important fish species as specified
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 integrity of the macroinvertebrate community within the system must be maintained.	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.	Salinity must be maintained to support ecosystem health and the water quality requirements of the water users.	The presence of pathogens should pose a low risk to human health.	The importance of the Dam as a refuge for upstream aquatic and semi-aquatic biota must be protected. This includes ecologically and
	Fish				Aquatic Invertebrates			Nutrients		Salts	Pathogens	Fish
			65	Biota					Quality		V	Biota
										SK6		
Johan Neser Dam) (includes Buisfontein-	(in the								Johan Neser	(Klerksdorp Dam) (C24G)		
	A baseline assessment to instream blots must be in a better than largely community should be modified condition. The	A baseline assessment to instream biota must be in a better than largely modified condition. The requirements of fish species of ecological and species of ecological must be in the answers and a conducted to determine the current state and properties of ecological must be interested and properties of ecolog	Instream blota must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and water	Instream biota must be in a better mine the integrity and health of the fish modified condition. The requirements of fish species of ecological importance and witter quality needs must be provided for.  A baseline assessment to hearmine the integrity and health of the fish modified ondition. The current state and importance and water quality needs must be in a better integrity and health oppulation.	A baseline assessment to instream blots must be in a better than largely modified condition. The requirements of fish species of ecological importance and with particular flow and with particular flow and with population.  Biota  A baseline assessment to determine the integrity and determine the integrity and health of the fish modified to determine the integrity and health of the fish and condition. The community should be conducted to determine the integrity and health of the fish and community should be community should be required to determine the integrity and the fish and the firsh are required to determine the integrity and the firsh are required to determine the integrity and the firsh assessment to determine the integrity and the firsh are required to determine the integrity and the f	Biota  Biota  Apuatic  Aquatic  Aquatic	Biota  Biota  Biota  Aquatic Aquatic Aquatic Aquatic Aquatic Aquatic Invertebrates System must be in a better than langing and health of the fish modified condition. The integrity of the particular flow and water quality needs must be provided for.  Biota  Biota  Biota  Aquatic Aquatic Aquatic Aquatic Aquatic Invertebrate System must be integrity of the macroinvertebrate Aquatic	Biota  Biota  Biota  Apuatic  Community within the invertebrates community within the macroinvertebrate community and the macroinvertebrate community within the macroinvertebrate community and the macroinvertebrate community and the macroinvertebrate community and the macroinvertebrate comm	Biota  Biota  Apuatic  Concentrations of the macroinvertebrate  Aquatic  Concentrations of the macroinvertebrate  Aquatic  Concentrations of the macroinvertebrate  Aquatic  Concentrations of the macroinvertebrate  Multients  Outhophosphate as seessement to determine the integrity and the current state and water quality needs must be invertebrate community within the requirement of the fish Response to the provided for.  The integrity of the invertebrate community within the reconstruction and water duality and the macroinvertebrate community within the reconstruction and the determined using the determined to system for maintained to sustain the maintained to sustain the correct advanced invertebrate community within the reconstructions and the maintained to sustain the phosphorus  Nutrients of water quality requirements  Nutrients of water users.  Nutrients of water users.  Nutrients of water users.  Nutrients conducted a seesance of the population.  Nutrients of water users.  Occoncentrations of mitrate & Nitrie as the propertical program of the prosphorus of the propertical program of the program of the propertical program of the program of the program of the propertical program of the propertical program of the propertical program of the pr	Biota  Bi	Blota  Aquatic  Community whin the Inhebrity of the Inhebrity of the Inhebrotae Community With the Camporae Community With the Camporae Assessment Index (FRA)  Inherity the Camporae Community With the Inhebrotae Community With the Camporae Community With the Inhebrotae  Community while the Inhebrotae Community With the Inhebrotae Community With the Camporae Community With the Inhebrotae  Community while the Inhebrotae Community With the Inhebrotae Community With the Camporae Community With the Inhebrotae  Concentrations of Walcone as Nitrogen in Microgen as Nitrogen in Walcon Concentrations of Inhebrotae Should not Comportations of Inhebrotae Should Nitrogen  Concentrations of Walcone Community With the Inhebrotae Should not Allocae  Concentrations of Walcone Should not Should Nitrogen  Concentrations of Walcone Should not Should Nitrogen  Concentrations of Walcone Should not Should Nitrogen  Concentrations  Advance Allege Should Nitrogen  Blota  Blota  Blota  Aquatic  Concentrations  Concentrations  August quality requirements  Concentrations  Blota  Blota  Blota  Blota  Aguatic  Concentrations  August quality requirements  Concentrations  Blota  Blota  Blota  Blota  Aguatic  Concentrations  August quality requirements  Concentrations  Blota  Blota  Blota  Blota  Absessment  Concentrations  August quality requirements  Concentrations  Blota  Blota  Blota  Blota  Appendix  Blota  Blota  Blota  Blota  Blota  Appendix  Blota  Blo	Blots  Blots  Blots  Aquatic  Concentrations of lish  Aquatic  Aqu

IUA Class	River/Dam	Resource	Node	Ecological	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.			
					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 fow flow requirements for node MC 4 on the Schoonspruit.	a to
							Instream concentration of nutrients must be	Dissolved Inorganic Nitrogen as Nitrogen	s 3.0 milligrams/litre (50" percentile)	
						Nutrients	improved to sustain aquatic ecosystem health and ensure the prescribed	Orthophosphate as Phosphorus	s 0.125 milligrams/litre (5 percentile)	(50m
							ecological category is met. Concentrations should not be allowed to deteriorate.	Nitrate & Nitrite as Nitrogen	s 2.5 milligrams/litre (50° percentile) s 6 milligrams/litre (95° percentile)	
	Schoonspruit (24H) (From Johan						The instream salinity must be improved to support the	Electrical conductivity	s milliSiemens/metre (95%percentile)	
MC Schoon	Neser Dam to the confluence	SK7	MC 4	CO		Salts	aquatic ecosystem and the water quality requirements ofwater users.	Sulphate	s 200 milligrams/litre (9 percentile)	#S6)
	River) (includes				Onality			Cyanide (free)	s 0.050 miligrams/litre (9 percentile)	"S6)
	tributary				Ì			Aluminium	s0.1 milligrams/litre (95th percentile)	
							The proceedinglane of	Manganese	s 0.250 milligrams/litre (95th percentile)	
						Toxics	toxins should not be at a level that is toxic to	Uranium	≤ 0.03 milligrams/litre (99 percentile)	(95#
							threat to human health.	Ammonia as Nitrogen	≤ 0.072 milligrams/litre (94 percentile)	"56)
								Iron	s 0.25 milligrams/litre (95" percentile)	
								A screening level whole efflu four trophic levels and shoul (limited to not acutely toxic) i	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.	
1000						25				1

IUA

Numerical limit	s 130 counts/100 millilitres (95° percentile)	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)	Fish ecological category:≥ C/D (≥ 58)	Macro-invertebrate ecological category:≥ C/D (≥ 58)	Instream Ecostatus category≥ C/D (≥ 58)	Hydrological category2 C/D (2.58) With monthly flow requirements as specified at Node MC 4.	Water Quality category:≥ C/D (≥ 58)	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
Indicator/measure	Escherichia coli	The Rapid Habitat Assessment Method must be implemented.		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.		The integrity of the westebate community should be determined using the Macroinvertebrate Macroinvertebrate Index. Conduct aquatic blomonitoring annually using the South African Scoring System 5 methodoloov.
Resource Quality Objective	The presence of pathogens should pose a low risk to human health.	Instream and Riparian habitat must be in a better than largely modified condition.		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 integrity of the macroinvertebrate community within the system must be improved through the implementation of the water quality objective specified above.
Sub- component	Pathogens	Instream Habitat			Fish			Aquatic
Component		Habitat					Biota	
Ecological						C/D		
Node						MC 4		
Resource Unit						SK7		
River/Dam				9	Schoonspruit (24H)	(From Johan Neser Dam to the confluence of the Vaal	(included	daggerini tributary
lass						=		

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

	· ·				Т	Т	Т	_													
ılt	Drought Flows	-	metres/ cen-	+	+	+	+	0.0496 99	0.0299 99	0.0231 99			0.0299 99	0.0302 99	0.0444 99		s 0.25 milligrams/litre (50" percentile) s 6 milligrams/litre (95" percentile)			s 0.072 milligrams/litre (95% percentile)	
ical lim		-	ceu-	+	+	t	+	1	20	20			20	80	09	e	re (50' (95" p	Aitre	netre	litre (95	nilliitres
Numerical limit	Maintenance Low Flows		metres/	0.2225	+	0.4066	+	0.7068	0.6213	0.4201			0.1094	0.1057	0.1644	s 0.50 milligrams/litre (50th percentile)	s 0.25 milligrams/litre (50" percenti s 6 milligrams/litre (95" percentile)	s 0.058 milligrams/litre (50 <sup>th</sup> percentile)	575 mili(Siemens/metre (95 <sup>th</sup> percentile)	milligrams/	s 130 counts/100 millilitres (95" percentile)
		Month		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	s 0.50 m (50° per	\$ 0.25 m \$ 6 millig	s 0.058 (50th per	s 75 mill (95° per	s 0.072	s 130 counts/10 (95" percentile)
Indicator/measure		Poculation of American	MD1 1) = 17 349 million	cubic metres/annum	(26.13% of the Virgin	Mean Annual Kunoff)	Maintenance flows	(percentage value of	naturalised flow	distribution)	Drought flows	(percentage value of	naturalised flow	distribution)		Dissolved Inorganic Nitrogen as Nitrogen	Nitrate & Nitrite as Nitrogen	Orthophosphate as Phosphorus	Electrical conductivity	Ammonia as Nitrogen	Escherichia coli
Resource Quality Objective					7	The maintenance low flows	and drought flows must be	attained to support a healthy	and users.							Instream concentration of	maintained to sustain aquatic ecosystem health and to ensure the prescribed	ecological category is met.	Instream salinity must be maintained to support the aquatic ecosystem health and the water quality requirements of the water users.	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	The presence of pathogens should pose a low risk to human health.
Sub- component								Low flows									Nutrients		Saits	Toxics	Pathogens
Component								Quantity											Quality		
Ecological Category															149	v	i i				
Node																QW	5				
Resource																US2					
River/ Dam																Upper Sand (C42D, C42E) (From Kilpspruit	confluence to Allemanskraal Dam )				
Class																=					
NA						36										MD1 Upper	Sand				

IUA	Class	River/ Dam	Resource	Node	Ecological Category	Component	Sub- component	Resource Quality Objective	Indicator/measure		Numerical limit	al limit		
							Fish	Instream blota must be in moderately modified condition or better. The requirements of fish species of ecological importance and with particular flow and whater quality needs.	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 eco Macro-in category Instream Hydrolog	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	jory: ≥ C ( cological category ≥ ry ≥ C (≥ l	(2 62) 2 C (2 6 62) 15 35	ଥି
		Upper Sand (C42D, C42E) (From Klipspruit confluence to	US2	OM 1	U	Biota		water quality increas illust ce provided for.	Fish Response Assessment Index (FRAI) must be utilized.	specified.	was mountily now requirements as specified.  Water Quality category: ≥ C (≥ 62)	yor.≥C(2	£ 62)	
		Allemanskraal Dam )					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 category Score P	Maintain the current C ecological category by ensuring that the Average Score Per Taxon is >5.0.	C ecologi that the 5.0.	ical Average	0
Upper	=										Maintenance Low Flows		Drought Flows	ws
Sand									Total Ecological Water Requirement (node	Month	cubic Pe metres/ ce second ti	Per- cubic cen- metres/ tile second		Per- cen- tile
									cubic metres/annum	Oct	0.3558 6	60 0.0523		66
								The maintenance low flow	(28.34% of the Virgin	Nov				66
								requirements of the	Mean Annual Runoff)	Dec		$\neg$		66
						Quantity	Low flows	downstream node MD 2.1	Maintenance flows	Jan	-	$\neg$	-	66
								healthy condition for the	(percentage value of	Heb	1.0629 7	70 0.0827	+	66
		Allemanskraai Dam (C42E)	US3					ecosystem and users.	distribution)	Apr	+		-	66
		()							Decumpt floure	May	0.4529 4	40 0.0336		66
									(percentage value of	unr	Ш	П	ш	66
									naturalised flow	Jul		70 0.0448		66
									distribution)	Aug	0.1591 8	80 0.0627		66
										Sep	0.2600 6	60 0.0887	Н	66
						Ouality	Nutrients	Concentration of nutrients must be maintained to sustain ecosystem health	Dissolved Inorganic Nitrogen as Nitrogen	s 0.5 mil	s 0.5 milligrams/litre (50 <sup>th</sup> percentile)	(50° perc	centile)	
								and water quality requirements of water users.	Nitrate & Nitrite as Nitrogen	s 0.25 rr s 6 millig	s 0.25 milligrams/litre (50" percentile) s 6 milligrams/litre (95" percentile)	e (50° pe 95° perce	arcentile antile)	<u>@</u>

Numerical limit	s 0.025 milligrams/litre (50th percentile)	s 0.025 milligrams/litre (50th percentile)	s 30 milliSlemens/metre (95° percentile).	7.0 (5th percentile) and 8.5 (95th percentile)	s 130 counts/100 milihitres (95 <sup>th</sup> percentile)	Habitat requirements and health of specified ecologically and recreationally important fish speciesaquatic bird species as specified.		A baseline assessment should be conducted to determine the aquatic bird community around the dam.
Indicator/measure	Orthophosphate as Phosphorus	Chlorophyll-a	Electrical conductivity	pH range	Escherichia coli	Habitat requirements and he recreationally important fish specified.		A baseline assessment should be condu aquatic bird community around the dam
Resource Quality Objective	Dam should be maintained in a mesotrophic state.		The salinity in the dam must be maintained in order to support ecosystem health and the water quality requirements of the downstream water users.	pH must be maintained at present state.	The presence of pathogens should pose a low risk to human health.	The importance of the Dam aga a refuge for upstream aguatic 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.	The dam supports large mumbers of a rich diversity of locally resident and migratory water fowl and massociated brians, Of these the Greater Flamingo (Phoenicopterus minor), the Casplan Tern (Sterna Casplan) Tern (Sterna Casplan) Tern (Sterna Casplan) Tern (Sterna Indinoctance. The suitability of the dam for aquatic bird populations must be maintained through moper habitat management.
Sub- component			Salts	System variables	Pathogens	Fish		Aquatic birds
Component				Quality				Biota
Ecological Category								
Node								
Resource						US3		
River/ Dam						Allemanskraal Dam (C42E)		
Class						=		
IUA						MD1 Upper Sand		

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

	SANS	Per-	cen-	66	66	66	66	66	66	66	66	66	66	66	66		_	2			
	Drought Flows	cubic	second c	-	_	0.0000	0.0037	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		arcentile)	ercentile		Sth	28
al limit		Per-	cen-	۲		90 09	70 0.0	09	09	20 00	30 00	30 0.0	50 0.	50 0.0	30 0.0		(50" perce	e (50°° p	tre	d 8.5 (95	litres (9)
Numerical limit	Maintenance Low Flows	cubic	second .	-	0.1076	0.1307 6	0.2106 7	0.2534 6	0.2699	0.1956 5	0.1064	0.0444	0.0004	9500'0	0.0343 3	s 0.50 milligrams/litre (50" percentile)	s 0.50 milligrams/litre (50th percentile) s 6 milligrams/litre (95th percentile)	s 0.058 milligrams/litre (50" percentille)	s 65 milliSiemens/metre (95° percentile)	6.5 (5" percentile) and 8.5 (95" percentile)	< 130 counts/100 millilitres (95 <sup>th</sup>
		Month		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jol	Aug	Sep	s 0.50 milligram (50° percentile)	s 0.50 mill s 6 milligra	s 0.058 m	s 65 milliSieme (95° percentile)	6.5 (5° per percentile)	s 130 coun
Indicator/measure	Total Engineeral Mates	Deguirement (node	MD2.2) = 5.989 million	cubic metres/annum	Mean Annual Runoff		Majorana Barre	(narrantana valua of	naturalised flow	distribution)	December Server	Crought flows	naturalised flow	distribution)		Dissolved Inorganic Nitrogen as Nitrogen	Nitrate & Nitrite as Nitrogen	Orthophosphate as Phosphorus	Electrical conductivity	pH range	Escharichia coll
Resource Quality Objective						The maintenance low flows	and drought flows must be	attained to support a nealthy	and users.							Instream concentration of	numents must be maintained to sustain aquatic ecosystem health	and ensure the prescribed ecological category is met.	The instream salinity must be maintained to support the aqualic ecceystem and the water quality requirements of the water users. Salinity levels should not deteniorate.	pH must be maintained at present state.	The presence of pathogens
Sub- component								LOW HOWS									Nutrients		Salts	System variables	Dollhouses
Component								Quantity											Quality	900 - 2	
Ecological Category																v					
Node														5	2.1	MD 2.2					
Resource Unit																[2]					
River													Lower Sand	C42F,	(From	Allemanskraal Dam to	Merriespruit confluence)				
Class																<b>=</b>					
IUA															MD 2	Sand					

Numerical limit	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) Specified. Water Quality category: ≥ C (≥ 62)	Maintain the current C ecological category by ensuring that the Average Score Per Taxon is >5.0.	\$ 3.0 miligrams/fitre (50" percentile) \$ 2.5 miligrams/fitre (50" percentile) \$ 6 miligrams/fitre (95" percentile) \$ 0.125 miligrams/fitre (95" (50" percentile)
Indicator/measure	The Rapid Habitat Assessment Method must be implemented	Monitor the integrity of the fish community at a downstream point a 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.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Macroinvertebrate Response Assessment Index. Conduct aquatic biomonilloring annually using the South African Soring System 5 methodology.	Dissolved Inorganic Nitrogen as Nitrogen Nitrate & Nitrite as Nitrogen Orthophosphate as Phosphorus
Resource Quality Objective	Instream and Riparian habitat must be in a moderately modified condition or better.	Instream biota must be in moderately modified condition or better through maintenance of habitat, flows, water quality.	The integrity of the macroinvertebrate community within the system must be maintained.	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.
Sub- component	instream Habitat	Fish	Aquatic Invertebrates	Nutrients
Component	Habitat	Biota		Quality
Ecological Category		O		۵
Node		MD MD	2.2	
Resource		F31		rs2
River		Lower Sand (C42F, C42G,C42H) (From Allemanskraal	Dam to Merriespruit confluence)	Rietspruit tributary (C42J)
Class				=
IUA		MD 2 Lower Sand		MD2 Lower Sand

Numerical limit		(95" percentile).  A numerical limit of 185 milliSiemens/ metre (95"-percentile) to be met by the 10" year after publication date of the Government Notice. Resource Quality Dijective numerical limit to be achieved by the 20" year after publication date of the Government Notice.	6.5 (5" percentile) and 9.2 (95" percentile).	A 10% variation from background concentration is allowed.	< 0.050 milligrams/litre (95 <sup>th</sup> percentile)	≤ 0.1 milligrams/fitre (95™ percentile)	s0.25 milligrams/litre (95" percentile)	≤ 0.25 milligrams/litre (95th percentile)	<ul> <li>0.030 milligrams/litre</li> <li>(95° percentile)</li> </ul>	s 0.1 milligrams/litre (95" percentile)
Indicator/measure	Electrical conductivity	The salinity needs to be improved significantly from the present state to meet the electrical conductivity required limit of 85 milliStemens/ metre. A phased approach over a twenty year period is to be used to achieve the limit of 85 an milliStemens and the achieve the milliStemens/milliSte	pH range	Turbidity	Cyanide (free)	Aluminium	Manganese	Iron	Uranium	Ammonia as Nitrogen
Resource Quality Objective		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.	pH must be maintained at present state.	A baseline assessment to determine the present state instream turbidity is required.			The concentrations of toxins should not be at a level that is toxic to aquatic organisms	and a threat to numan health.		
Sub- component		Salts		System			Toxics			
Component							Quality			
Ecological Category							٥			
Node										
Resource Unit				,			LS2			
River							Rietspruit tributary (C42J)			
Class							=			
IUA							MD2	Dusc		

П	d at		≥	Τ	4.6		5)				240	Per	cen-	66	66	66	66	66	66	66	66	66	66	66	66
aft	be conducte by greater the are required	s (95°	bitat Integri	≥ D (≥ 42)	pical catego		oryz D (z 4	) (≥ 42)	ments as	D (2 42)	Drought Flows	Н	second second		0.0270	0.0187		0.1819		0.0849			4	4	9280.0
Numerical limit	should b w toxicit re tests a	millitre	arian hal 2)	tegory:	e ecolog		us categ	gony ≥ [	rednirer	egory: ≥	auce	į,	cen-	70	80	80		80			40	$\neg$	$\neg$	+	09
Num	toxicity test is results shot ther definitive	s 130 counts/100 millilitres (95° percentile)	Instream and Riparían habitat integrity category ≥ D (≥ 42)	Fish ecological category: ≥ D (≥ 42)	Macro-invertebrate ecological category:2	12)	Instream Ecostatus category≥ D (≥ 42)	Hydrological category ≥ D (≥ 42)	vvin monthly now requirements as specified.	Water Quality category: ≥ D (≥ 42)	Maintenance Low Flows	8	metres/	0.4014	0.7481	0.8658	1.2769	1.5828	1.5177	1.0849	0.6440	0.3306	-	-	0.2986
	effluent hould the toxic) fur	s 130 coun percentile)	Instre	Fish	Macro	7 ₹) Q	-	Hydro	specified.	Water		Month		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jol	Aug	Sep
Indicator/measure	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.	Escherichia coli	The Rapid Habitat Assessment Method must be implemented.		A baseline assessment to determine the	integrity of the fish	conducted to determine	the current state and localised impacts.	Fish Response	(FRAI) must be utilized.	Total Ecological Water	Requirement (node	MD 2.3) = 43.933	metres/annum	(24.37% of the Virgin	Mean Annual Runoff)		Maintenance flows	(percentage value of	distribution)	distribution)	Drought flows	(percentage value of	distribution)	
Resource Quality Objective		The presence of pathogens should pose a low risk to human health.	Instream and Riparian habitat must be in a largely modified condition or better.			Instream biota must be in	largely modified condition or better through maintenance	of habitat, flows, water quality.								The maintenance low flows	and drought flows must be	attained to support a healthy	and users.						
Sub- component		Pathogens	Instream Habitat				Fish											Low flows							
Component			Habitat				Biota										-	Quantity							
Ecological Category																	(	0							
Node																	MD	2.3							
Resource Unit			K															L83							
River															Lower Sand	(C423)	(Downstream	reetspruit tributary	the Vet River)						
Class																	=	=							
IUA																	MD2	Sand	Odillo						

Numerical limit	s 1.5 milligrams/litre (50° percentile)	s 1.0 milligrams/litre (50" percentile) s 6 milligrams/litre (95" percentile)	s 0.058 milligrams/litre (50th percentile)	≤ 85 milliSiemens/metre (95™ percentile)	≤ 0.045 milligrams/litre (95" percentile)	s 0.1 milligrams/fitre (95th percentile)	s 0.25 milligrams/litre (95th percentile)	s 0.3 milligrams/litre (95th percentile)	s 0.03 milligrams/litre (95th percentile)	s 0.072 milligrams/litre (95 <sup>th</sup> 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.	≤ 130 counts/100 millilitres (95° percentile)	6.5 (5" percentile) and 9.2 (95" percentile)	A 10% variation from background concentration is allowed.
Indicator/measure	Dissolved Inorganic	Nitrate & Nitrite as Nitrogen	Orthophosphate as Phosphorus	Electrical conductivity	Cyanide (free)	Aluminium	Manganese	Iron	Uranium	Ammonia as Nitrogen	A screening level whole efflicur trophic levels and should fulfillmited to not acutely toxic	Eschenchia coli	pH range	Turbidity
Resource Quality Objective	Instream concentration of	to sustain aquatic ecosystem health and	ensure the prescribed ecological category is met.	Salinity levels are salinity must be improved to support the aquatic ecosystem and the water quality requirements of the water users.				The concentrations of toxins should not be at a level that	is toxic to aquatic organisms and a threat to human health			The presence of pathogens should pose a low risk to human health.	pH must be maintained at present state.	A baseline assessment to determine the present state instream turbidity is required.
Sub- component		Nutrients		Salts					OXICS			Pathogens		System
Component					o diam'n	, and a							Quality	
Ecological Category													U	
Node													MD 2.3	
Resource													183	
River												Lower Sand	(Downstream Rietspruit tributary to confluence with	חופ אפן ניאפו
Class													=	
NA													MD2 Lower Sand	

NA	Class	River	Resource	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)
								Instream biota must be in	A baseline assessment to determine the integrity and health of the fish community should be conducted to	Fish ecological category: 2 C (2 62)  Macro-invertebrate ecological category:2 C (2 62)
							Fish	moderately modified condition or better through maintenance of habitat, flows, water quality.	determine the current state and potential impacts to the population,	Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) With monthly flow requirements as
						Biota			Fish Response Assessment Index (FRAI) must be utilized.	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	Maintain the D ecological category by ensuring that the Average Score Per Taxon is >5

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

_	_	_	_	_	_	_	_	_	_	_	_	_	_,	_	_	_	_	_	_	_	_	_	_	_	_	_		_	_	_		_	_
	Drought Flows	Per-	centile	66	66	66	66	66				66	66	66	66	Drought Flows		Centile	1	5	88	66	66	66	66	66	66	66	66	66		ntile)	(entile)
mit	Drough	cubic	second	0.0373	0.0386	0.0187	0.0075	0.0289	0.0261	0.0248	0.0336	0.0270	0.0362	0.0351	0.0424	Drough	cubic	metres/	puopas	0.0440	0.0463	0.0224	0.0331	0.0299	0.0231	0.0336	0.0309	0.0403	0.0392	0.0471		orcentile	s 0.020 milligrams/litre (50th percentile)
Numerical limit	ows	Per-	tile	09	20	80	70	20	70	9	20	80	70	80	09	ows	Per-	-uao	Dile	Т	T	80	Т	70	09		П	╗	80	70	/litre	/litre (50 e (95° p	ns/litre (
Nun	Maintenance Low Flows	cubic	second	0.2180	0.3376	0.2950	0.4719	0.6477	0.6481	0.6320	0.3188	0.1917	0.1299	0.1254	0.1539	Mointenance Low Flows	cubic	metres/	second	0.2380	0.3584	0.3218	0.7056	0.7056	0.6424	0.3480	0.2099	0.1426	0.1378	0.1690	s 0.50 milligrams/litre (50° percentile)	< 0.25 milligrams/litre (50th percentile) < 6 milligrams/litre (95th percentile)	milligran
		Month		Oct	Nov	Dec	Jan	Н	Mar	$\neg$	$\neg$	7	$\dashv$	Aug	Sep		Month		+	+	$^{+}$	Dec	+	Mar	Apr	May	$\neg$	$\dashv$	Aug	Sep	s 0.50 milligram (50° percentile)	≤ 0.25 m ≤ 6 millig	s 0.020
Indicator/measure	Total Ecological Water	Requirement (node ME	1.1) = 18.861 million	(26.19% of the Virgin	Mean Annual Runoff)		Maintenance flows	(percentage value of	naturalised flow	distribution)	Drought flows	(percentage value of	naturalised flow	distribution)		Total Ecological Water	Requirement (node MF	1.2) = 20.946 million	cubic metres/annum	Mean Against Brings	weart Amidal Runon)		(percentage value of	naturalised flow	distribution)	Drought flows	(percentage value of	naturalised flow	distribution)		Dissolved Inorganic Nitrogen as Nitrogen	Nitrate & Nitrite as Nitrogen	Orthophosphate as
Resource Quality Objective														The maintenance low flows	and drought flows must be	condition for the ecosystem	arid users.										Y				Instream concentration of nutrients must be	maintained to sustain aquatic ecosystem health	and ensure the prescribed ecological category is met.
Sub- component															Tour Barre	LOW HOWS																Nutrients	
Component	Quantity															Quality																	
Ecological																		υ															
Node																0.100.10	W	- 1	12														
Resource																	10000	UV1 and	•														
River / Dam														Hanne Vat	CA1A CA1B)	(Klein Vet and	calchments)	(C41C, C41D)	(Vet and	Leeuspruit	catchments to	Erfenis Dam)											
Class					0													=															
IUA																	ME1	Upper	Vet														

							A.						
Numerical limit	s 70 milliSlemens/metre (95° percentile)	6.5 (5" percentile) and 8.4 (95" percentile)	A 10% variation from background concentration is allowed.	s 0.072 milligrams/litre (95" percentile)	s 130 counts/100 millilitres (95° percentile)	Instream and Riparian habitat Integrity category ≥ G (≥ 62)	Fish ecological category: $z \in (z \in 2)$ Macro-invertebrate ecological category: $z \in (z \in 2)$ instream Ecostatus category $z \in (z \in 2)$ Hydrological category $z \in (z \in 2)$ With monthly flow requirements as specified.						
Indicator/measure	Electrical conductivity	pH range	Turbidity	Ammonia as Nitrogen	Escherichia coli	The Rapid Habitat Assessment Method must be implemented.	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.						
Resource Quality Objective	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	pH must be maintained at present state.	A baseline assessment to determine the present state instream turbidity is required	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.	The presence of pathogens should pose a low risk to human health.	Instream and Riparian habitat must be in a moderately modified condition or better.	Instream biote must be in moderately modified condition or better through maintenance of habitat, flows, water quality.						
Sub- component	Salts		System	Toxics	Pathogens	Instream Habitat	Fish						
Component	Quality Habitat												
Ecological Category					υ								
Node					ME 1.1, ME 1.2								
Resource Unit					UV1 and UV2								
River / Dam				Upper Vet (C41A, C41B) (Klein Vet and	catchments) (C41C, C41D) (Vet and Leeuspruit	tributary catchments to Erfenis Dam)							
Class					=								
IUA					ME1 Upper Vet								

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ì	ė	۲

	ade	Flows	Per- centile	66	66	66	66	66	66	66	66	66	66	66	66			duß
nit	ological the Aver	Drought Flows	cubic metres/ second	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0019	m56)	2 (95 <sup>m</sup>	bitat Integ
Numerical limit	ent C econing that is > 4.8.	nance	Per- cen- tile	40	20	50	40	40	40	30	20	20	40	$\neg$	40	s/metre	and 8.	arian hal 2 78)
Nun	Maintain the current C ecological category by ensuring that the Average Score Per Taxon is > 4.8.	Maintenance Low Flows	cubic metres/ second	0.0310	0.0563	0.0474	0.0859	0.1228	0.1247	0.1115	0.0526	0.0243	0.0116	0.0105	0.0166	s 55 mill/Siemens/metre (95 <sup>m</sup> percentile)	6.5 (5" percentile) and 8.5 (95" percentile)	Instream and Riparian habitat Integrity category ≥ B/C (≥ 78)
	Mainta catego Score		Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	lut	Aug	Sep	s 55 milliSi percentile)	6.5 (5" per percentile)	instrea
Indicator/measure	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.		Total Ecological Water Requirement (node ME 1.3) = 2.369 million	cubic metres/annum	(61.17% of the Virgin Mean Annual Runoff)		Majaranana Baus	(percentage value of	naturalised flow	distribution)	Drought flows	(percentage value of	distribution)			Electrical conductivity	pH range	The Rapid Habitat Assessment Method must be implemented.
Resource Quality Objective	The integrity of the macroinvertebrate community within the system must be maintained.					The maintenance low flows	and drought flows must be	attained to support a healthy condition for the ecosystem	and users.							Instream salinity must be maintained at the current state to support the aquatic eccsystem and the water quality requirements of the water users.	pH must be maintained at present state.	Instream and Riparian habitat must be in a better than moderately modified
Sub- component	Aquatic Invertebrates							Low flows								Salts	System variables	Instream Habitat
Component	Biota							Quantity								Quality		Habitat
Ecological Category												B/C						
Node											W.	WE .	3					
Resource Unit												200						
River / Dam												Soutspruit	(0415)					
Class												=						
IUA											ME1	Upper	Vet					

Resource Quality Indicator/measure Numerical limit Objective	A baseline assessment to determine the instream bota must be in registry and health of maintenance of habitat, state.  Fish ecological category: ≥ B/C (≥ 78)  Abseline through through through through through through the current flows, water quality.  Fish Resessment Index (FRAI) must be utilized Water Quality category: ≥ B/C (≥ 78)  Hydrotogical category: ≥ B/C (≥ 78)  Appropriate through through through through through through through through the current state.  Hydrotogical category: ≥ B/C (≥ 78)  Appropriate through t	The integrity of the invertebrate community invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology.	The downstream maintenance low flow Ecological Water Use Desktop Reserve Model and Ecological Water Use Desktop Reserve Model and Use Desktop Reserve Model	Dissolved Inorganic s 0.50 milligrams/litre Nitrogen as Nitrogen (50" percentile)	Concentration of nutrients Onthophosphate as a 0.025 milligrams/litre must be improved to sustain Phosphorus (50" percentile)	yearly sequirements of water users. Dam should be Nitrate & Nitrite as safe.    Solution   Solution	
	instream biota must better than moderals modified condition the maintenance of hab flows, water quality.	The integrity of the macroinvertebrate community within th must be maintained	The downstream maintenance low requirements of r 2.1 must be met healthy condition ecosystem and u		Concentrat must be im ecosystem	water user maintained state.	
Sub- component	Fish	Aquatic	Low flows			Not remain	
Component	Blota		Quantity			, and a second	
Ecological Category			·				
Node							
Resource Unit					<b>1</b> 074		_
River / Dam					Erfenis Dam		
Class				8	=		
IUA				ME1	Upper		

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

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

8	+	+
9 9 Em	the acosystem for its factorial and its factoria	Low flows and drought flows must be and drought flows must be Rec attained to support a healthy ma condition for the ecosystem and users.
Dissolved Inorganic Nitrogen as Nitrogen		Instream concentration of nutrients must be improved
Nitrate & Nitrite as Nitrogen		
Orthophosphate as Phosphorus		ensure the prescribed C ecological category is met.
8	n sainfily must be ned. Salinity levels not be allowed to ste.	Instream salinity must be maintained. Salinity levels should not be allowed to deteriorate.
pH range		System pH must be maintained at present state.
Ammonia as Nitrogen	centrations of toxins tot be at a level that o aquatic organisms reat to human	The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human health.
Escherichia coli	sence of pathogens tose a low risk to realth.	The presence of pathogens should pose a low risk to human health.
The Rapid Habitat Assessment Method must be implemented	n and Riparian must be in a ely modified	Instream and Riparian habitat must be in a habitat moderately modified condition or better.
A haseline assessment		
to determine the integrity and health of the fish	n biota must be in	Instream biota must be in moderately moderately
community should be	n or better. The	condition or better. The
conducted to determine	nents of fish species	requirements of fish species
Deu	gical importance and	or econgical importance and
Fish Response	-	needs must be
Assessment Index	for.	provided for.
5		

Г	9 C	iows	Per-	66	66	66	66	66	66	66	66	66	66	66	66		ie				9 3			П
nit	C must b Per Taxo hieved.	Drought Flows	cubic metres/	0.142	0.135	0.071	0.34	0.327	0.213	0.17	0.269	0.177	0.129	0.13	0.19	tigh Flows	Percentile	66	30	66	30	66	09	66
Numerical limit	tegory of ge Score ust be acl		Per-	+	66	66	66	06	06	06	66	66	66	66	66	Maintenance High Flows	p per		~				10	
Num	An ecological category of C must be met. The Average Score Per Taxon value of > 4.8 must be achieved.	Maintenance Low Flows	cubic metres/	0.250	0.420	0.446	29'0	0.857	0.849	0.701	0.403	0.227	0.129	0.130	0.190	Mair	cubic metres per second	0.00	3.462	00.00	6.358	0.00	2.355	0.00
	An ecol met. Ti value o		Won	oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Inf	Aug	Sep	-	43	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Indicator/measure	The integrity of the invertebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aquatic blomonitoring annually using the South African Scoring System 5 methodology.		Total Maintenance low flow and drought flow Ecological Water	Requirement (EWR 15) = 19.765 million cubic	metres/annum (7.81%	Annual Runoff)		Maintenance flows	(percentage value of	distribution)	Denischt flouie	(percentage value of	naturalised flow	distribution)		100	fotal maintenance right flow Ecological Water Requirement (EWR 15)	= 32.309 million cubic	(12.76% of the Virgin	Mean Annual Runoff)		(percentage value of	naturalised flow	distribution
Resource Quality Objective	The integrity of the macroinvertebrate community within the system must be improved to the recommended ecological category.			0.000	The maintenance and	attained so that the	environmental flows	support a healthy condition	for the ecosystem and	,600.0							ú	The high flows must be	attained so that the	requirements are met to	support a healthy condition for the ecosystem			
Sub- component	Aquatic Invertebrates						Date Bours	COM HOMS												High Flows				
Component													Quantity											
Ecological Category													C/D											
Node												FWB	15										Ī	
Resource													LV2											
River											CA3A CA3C	C43D)	(Downstream	Confluence to	Bloemhof Dam)									
Class													=											
IUA												ME 2	Lower	:										

									. 841	Т	Т								
Ilmit	66	66	66	66	66		(50th percentile) the percentile)		on should be is/square metre nkton s 0.025	9			9.2 (95h						
Numerical limit	0.00	0.00	0.00	0.00	0.00	s 0.7 milligrams/litre (50th percentile)	s 0.50 milligrams/litre (50th percentile) s 6 milligrams/litre (95th percentile)	s 0.058 milligrams/litre (50° percentile)	Chlorophyli-a Periphyton should be between s 84 milligrams/square metre (50° percentile) Chlorophyli-a Phytoplankton s 0.025 milligrams/litre	s 80 milliSiemens/metre	s 120 milligrams/litre (95th percentile)	≤100 milligrams/litre (95° percentile)	6.5 (5" percentile) and 9.2 (95" percentile)	s 0.1 milligrams/litre (95º percentile)	s 0.25 milligrams/litre (95th percentile)	s0.75 milligrams/litre (95th percentile)	s 0.07 milligrams/litre (95th percentile)		
	May	Jun	Þ	Aug	Sep	\$ 0.7 (50°	s 0.5	s 0.0 (50°	Chlor (50° Chlor millig	S 80	s 120 (95th	\$100 (95°	6.5 (5 perce	s 0.1 (95°	s 0.2 (95°	\$0.75 (95th	s 0.0 (95 <sup>th</sup>		
Indicator/measure						Dissolved Inorganic Nitrogen as Nitrogen	Nitrate & Nitrite as Nitrogen	Orthophosphate as Phosphorus	Chlorophyli-a concentrations should be monitored as a response indicator against the resource quality objective nutrient	Electrical conductivity	Sulphate	Chloride	pH range	Aluminium	Manganese	Iron	Uranium		
Resource Quality Objective							Instream concentration of	nutrients must sustain aquatic ecosystem health. Concentrations should not	be allowed to deteriorate.		Salinity levels must be maintained.		pH must be maintained at present state.	į.	The concentrations of toxins should not be at a level that	is toxic to aquatic organisms and a threat to human health.			
Sub- component						-	5	Nutrients			Salts		System variables			loxics			
Component											Quality								
Ecological							90												
Node											EWR 15								
Resource							2.				LV2								
River										Lower Vet (C43A, C43C,	(Downstream Sand River	Bloemhof Dam)							
Class											=			O. Ey					
IUA											Lower Vet								

s 0.072 miligrams/litre (95th percentile)	fluent toxicity test should be conducted at uid the results show toxicity greater than dic) further definitive tests are required.	s 130 counts/100 millilitres (95" percentile)		Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)	Instream and Riparian habitat Integrity category ≥ C/D (≥ 58)	Fish ecological category:≥ C/D (≥ 58)	Macro-invertebrate ecological category:≥ C/D (≥ 58)	Instream Ecostatus categoryz C/D (2 58)	Hydrological categoryz C/D (z 58) With monthly flow requirements as specified.	Water Quality category:≥ C/D (≥ 58)
Ammonia as Nitrogen	A screening level whole eff four trophic levels and sho fimited to not acutely tox	Escherichia coli	The Rapid Habitat Assessment Method must be implemented.	The ecological specifications for Ecological Water Ecological Water Requirement site 15 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be involvemented.	The ecological specifications for Ecological Water Requirement site 15 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	0 4-1	Assessment Index (FRAI) must be utilized.	The ecological specifications and	thresholds of potential concern for Ecological Water Requirement site 15 must be adhered to.	
		The presence of pathogens should pose a low risk to human health.		Instream and Riparian habitat must be in a better than largely modified condition.	Exotic invasive riparian plant species must be confrolled.	and the state of t	better than largely modified condition. The requirements	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.
		Pathogens		instream Habitat	Riparian Habitat			Fish	,	
		Quality		Habitat				Biota		
					Q					
					EWR 15					
					<b>LV2</b>					
				Lower Vet	(C430) (Downstream Sand River Confluence to Bloemhof Dam)					
					=					
					ME 2 Lower Vet					
		le effli	The presence of pathogens should pose a low risk to human health.	The presence of pathogens should pose a low risk to human health.	Quality Pathogens Should pose a low risk to human health.  Instream and Riparian Instream and Riparian Instream habitat must be in a better Habitat condition.	Lower Vet (C43A, C43C, C	Lower Vet (C43A, C43C)  III (Characteran Sand River San	Lower Vet (C43A, C43C, C43D)  III (Coverstream Confident	Lower Vet (C43A, C43C, C43D)  Lower Net (C43A, C43C, C43C, C43C, C43C, C43D)  Lower Net (C43A, C43C, C	Couality Pathogens should pose a low risk to human health.  Lower Vet (C43A, C43C, C43D)  (C43A)  (C43

Numerical limit	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.	
Indicator/measure	The integrity of the invertebrate community should be determined using the daxonivertebrate Response Assessment Index. Conduct aquatic Index. Conduct aquatic big on 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.
Resource Quality Objective	The integrity of the macroinvertebrate community within the system must be maintained.	
Sub- component	Aquatic Invertebrates	
Component		
Ecological Category		
Node		
Resource Unit		
River		
Class		
IUA		

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	Resourc e Unit	Node	Ecological Category	Component	Sub- component	Resource Quality Objective	Indicator/measure		Numerical	Numerical Limit		
										Low Flows	200	Drought Flows	2462
								low flow and drought	Month	cubic metres/	Per-	cubic metre/	Per-
								flow Ecological Water		second			tile
								Requirement (EWR	Oct	5.421	66	4.284	66
_							The maintenance and	cubic metres/annum	Nov	6.592	66	5.21	66
							drought flows must be	(22% of the Virgin	Dec	6.783	66	5.361	66
							attained so that the	wean Annual Runon)	Jan	7.588	66	5.997	66
						Low flows	requirements are met to	7.00	Feb	9.845	66	6.486	66
_							support a healthy condition	(percentage value of	Mar	7.72	66	6.101	66
							for the ecosystem and users.	naturalised flow	Apr	6.521	66	5.154	66
								distribution)	May	5.619	66	4,441	66
								Drought flows	Jun	5.184	66	4.097	66
								(percentage value of naturalised flow	lul	5:035	66	3.98	66
					Quantity			distribution)	Aug	3.954	66	3.125	66
	Vaal River								Sep	4.321	66	3.415	66
_	(C24B) (From	777.0							1	W	aintenanc	Maintenance High Flows	WS
Vaal River	to upstream	VB 1.1	EWR 12	٥				Total Maintenance	Month	onp	cubic metres per second	Percentile	app
_	Schoonspruit							high flow Ecological	Oct		0.00	66	10.50
_	columnes (ce)							Water Requirement	Nov		14.6	06	224
_							The high flows must be	million cubic	Dec	0	00'0	66	i i
							attained so that the	metres/annum	Jan	1	14.129	06	900 P
_						High flows	environmental flows	(15.88% of the Virgin	Feb	7	72.071	20	
_							requirements are met to	Mean Annual Runoff)	Mar		0.00	66	
							for the ecosystem		Apr		0.00	66	
_								Maintenance high	May		00'0	66	) Vas
_								flows (percentage	unf		00'0	66	723
							7	flow distribution)	Jul		0.00	66	
_									Aug		0.00	66	
_									Sep		0.00	66	
_							Instream concentration of nutrients must be improved	Nitrate & Nitrite as Nitrogen	\$ 1.35 milligrams/litre (50" percentile) \$ 6 milligrams/litre (95" percentile)	igrams/litre ims/litre (9	35" perce	ercentile)	
					Ouality	Nutrients	to sustain aquatic ecosystem health and	Dissolved Inorganic Nitrogen as Nitrogen	s1.65 milligrams/litre (50" percentile)	grams/litre ntile)			
					ì		ensure the prescribed ecological category and the	Orthophosphate as Phosphorus	s 0.125 milligrams/litre (50th percentile)	lligrams/lit	re (50° p	ercentile)	
							of the water users are met.	Chiorophyll-a	< 0.075 milligrams/litre (50" percentile)	Iligrams/lib	re (50° p	ercentile)	

Numerical Limit	s 70 milliSiemens/metre (95" percentile)	s160 milligrams/litre (95th percentile)	s 33 milligrams/litre (95° percentile)	s 560 milligrams/litre (95° percentile)	pH range 7.5 (5th percentile) - 9.2 (95th percentile)	s 0.050 milligrams/litre (95th percentile)	s 0.1 milligrams/litre (95th percentile)	s 0.25 milligrams/litre (95" percentile)	s 0.25 milligrams/litre (95" percentile)	s 0.030 milligrams/litre (95th percentile)	s 0.1 milligrams/litre (95th percentile)	A screening level whole effluent toxicity test should be conducted at four tophic levels and should the results show toxicity greater than 1 (limited to not acutely toxic) further definitive tests are required.	s 130 counts/100 millilitres (95th percentile)
Indicator/measure	Electrical conductivity	Sulphate	Magnesium	Total Dissolved Solids	pH range	Cyanide (free)	Aluminium	Manganese	Iron	Uranium	Ammonia as Nitrogen	A screening level whole four trophic levels and st (limited to not acutely to	Escherichia coli
Resource Quality Objective	Instream salinity must be improved to meet the	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.	pH must be maintained at present state.				The concentrations of toxins should not be at a level that is toxic to aquatic organisms and a threat to human	health.			The presence of pathogens should pose a low risk to human health.
Sub- component			Salts		System variables				Toxics				Pathogens
Component								Knamy					
Ecological Category								<b>.</b>					
Node							SA CANO	7					
Resourc e Unit								2					
River/Dam							Vaal River (C24B) (From Vermaasdrift	to upstream Schoonspruit confluence)					
Class							-						
IUA							MF	Vaal River					

INA

Numerical Limit	Instream and Riparian habitat I category ≥ D (≥ 42)	instream and Riparian habitat l category ≥ D (≥ 42)	Fish ecological category: ≥ C (2 42) Macro-invertebrate ecological or (2 42) Habitat requirements and healt specified ecologically and recre important fish species aquatic 1 as specified. Instream Ecostatus category≥ I hydrological category≥ With monthly flow requirements specified. Water Quality category:≥ D (≥ 4/2)
Indicator/measure	The Rapid Habitat Assessment Method must be implemented. The ecological specifications for Ecological Water Ecological Water Ecological Water Ecological Water Comprehensive Reacurement site 12 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.	The ecological specifications for Ecological Water Ecological Water Requirement site 12 as as determined in serve Comprehensive Reserve Reserve Determination Study (2010) must be implemented.	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.
Resource Quality Objective	Instream and Riparian habitat must be in a largely modified condition or better.	Exotic invasive plant species must be controlled.	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 species of ecological importance must provided for the specific species of ecological importance must provided for.
Sub- component	Instream Habitat	Riparian Habitat	Fish
Component	Habítat		Biota
Ecological Category		۵	
Node		EWR 12	
Resourc e Unit		VB 1.1	
River/Dam		Vaal River (C24B) (From Vermaasdrift to upstream Schoonsprut confluence)	
Class		=	

River/Dam	Resourc e 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 and recological category must be maintained.	The integral of the invertebrate community should be determined using the Macroinvertebrate Response Response Response Phomonitoring annually using the South African Scoring System 5.  The ecological specifications and thresholds of potential concern for Ecological concern for Ecological was predictations and thresholds of potential concern for Ecological Water Requirement site 12 must be	Maintain the current C/ID 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.	ical African alue must
	VB 1.1	EWR12	۵	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-boding a substantial population of a White-boding a substantial population of a White-boding of Substantial population of a White-boding of Substantial population of this stretch of river for aquatic bird populations must be maintained through proper habital management.	A baseline assessment should be condu- aquatic bird community around the dam.	A baseline assessment should be conducted to determine the aquatic bird community around the dam.	e the
					Diatoms	Water quality improvement is required from a nutrient perspective.	Conduct a diatom assessment annually.	The Specific Pollution Index should be > 5.0.	ould be >
-	VB 1.2,	EWR 13	C/D	Quantity	Low flows	The maintenance and	Total Maintenance	Month Maintenance On	Drought Flows

	Per-	-wao	tile	66	66	66	66	66	66	80	90	66	66	66	66	_	*	Г	Г										П			
3				-												Maintenance High Flows	Percentile	66	06	66	66	20	66	66	66	66	66	66	66	intile)	(e)	
Limit	cubic	- metres/	second	0.029	0.043	0.047	0.055	0.073	90.0	0.046	0.031	0.024	0.022	0.02	0.022	mance H	tres				6					2				) <sup>th</sup> perce	percent	
Numerical Limit			d tile	96	66	1 99	2 99	1 99	2 99	2 90	96	66	66	66	66	Mainte	cubic metres	0.00	14.6	0.00	14.129	92.225	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Vitre (50	(82 <sub>m</sub>	/litre
N	cubic	metres/	second	7.254	10.7	11.931	13.892	18.531	15.172	11.532	7.732	5.863	5.278	4.78	5.177	-	5						_		,					s 1.35 milligrams/litre (50th percentile)	s 6 milligrams/litre (95" percentile)	s 1.65 milligrams/litre (50th percentile)
				Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		Month	000	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	s 1.35 n	s 6 mills	s 1.65 n (50" per
Indicator/measure	low flow and drought	flow Ecological Water	Requirement (EWR	cubic metres/annum	(11.65% of the Virgin	Mean Annual Kunon)	Maintenance flows	(percentage value of	distribution)	Drought flows	(percentage value of	naturalised flow distribution)						high flow Ecological	Water Requirement	(EWR 13) = 298.797	million cubic	(11.26% of the Virgin	Mean Annual Runoff)	***************************************	Maintenance high	value of naturalised	flow distribution)			Nitrate & Nitrite as	Nitrogen	Dissolved Inorganic Nitrogen as Nitrogen
Resource Quality Objective	drought flows must be	attained so that the	environmental flows	support a healthy condition	for the ecosystem and	users.														The high flows must be	attained so that the	environmental flows	requirements are met to	for the ecosystem						Instream concentration of	to sustain aquatic	ensure the prescribed ecological category and the water quality requirements
Sub- component																						High flows									Muleinate	
Component																						Quantity									O	ć ingr
Ecological Category																									C/D							
Node																									<b>EWR 13</b>							
Resourc e Unit	VB 1.3																							0.000000	VB 1.2,	VB 1.3						
River/Dam	(C24J)	(From	Schoonspruit	upstream Vals	River	(C25C, C25F)	(From Vals River	confluence to	Dam-	Quatemary	(1)							2.0000000000000000000000000000000000000	Vaal River	(C24J)	Schoonspruit	confluence to	upstream Vals	Confinence	(C25C, C25F)	(From Vals	River	Rinemhof	Dam-	Quaternary	9	
Class																									=							
IUA																									MF	Vaai River						

Numerical Limit	< 0.125 milligrams/litre (50 <sup>th</sup> percentile)	< 0.075 milligrams/litre (50 <sup>th</sup> percentile)	< 70 milliSiemens/metre (95% percentile)	s160 miligrams/litre (95% percentile)	s 33 milligrams/fitre (95° percentile)	s 560 milligrams/litre (95" percentile)	7.5 (5 <sup>m</sup> percentile) - 9.2 (95 <sup>m</sup> percentile)	< 0.050 milligrams/litre (95" percentile)	< 0.1 miligrams/litre (95" percentile)	< 0.25 milligrams/litre (95th percentile)	< 0.25 milligrams/litre (95" percentile)	< 0.030 milligrams/litre (95% percentile)	s 0.1 miligrams/litre (95" 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.
Indicator/measure	Orthophosphate as Phosphorus	Chlorophyll-a	Electrical conductivity	Sulphate	Magnesium	Total Dissolved Solids	pH range	Cyanide (free)	Aluminium	Manganese	Iron	Uranium	Ammonia as Nitrogen	A screening level whole four trophic levels and s (limited to not acutely to
Resource Quality Objective	of the water users are met.		Instream salinity must be	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.	pH must be maintained at present state.				should not be at a level that is toxic to aquatic organisms and a threat to human	health,		
Sub- component				4	Salts		System variables				Toxics			
Component											Quality			
Ecological Category											C/D			
Node											EWR 13			
Resourc e Unit											VB 1.2, VB 1.3			
River/Dam									Vaal River (C24J)	Schoonspruit confluence to	River confluence) (C25C, C25F)	(From Vals River confluence to	Dam- Quatemary catchment)	
Class											=			
IUA											MF Vaal River			

	T	
s 130 counts/100 millilitres (95th percentile)	instream and Riparian habitat integrity category ≥ D (≥ 42)	Instream and Riparian habitat integrity category $\geq D$ ( $\geq 42$ )
Escherichia coli	Assessment Method must be implemented at prescribed intervals as stated in the ecological 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.	The ecological specifications for Ecological Water Ecological Water Requirement site 13 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be inclemented
The presence of pathogens should pose a low risk to human health.	Instream and Riparian habitat must be in a largely modified condition or better.	Exotic invasive plant species must be controlled.
Pathogens	Instream Habitat	Riparian Habitat
	Habitat	
	The presence of pathogens should pose a low risk to human health.	The presence of pathogens should pose a low risk to human health.  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 must be in a largely increase or decrease in current habitat integrity is avoided as this is undesirable. The ecological specifications for Ecological Visiter Requirement site 13 as determined in terms of the Comprehensive Reserve Determination Study (2010) must be implemented.

Fish ecological category: 2 C (2 62) Macro-invertebrate ecological category: 2 D (2 42) Habitat requirements and health of specified ecologically and recreationally important fish species aquatic bird species as specified.  Instream Ecostatus category: D (2 42) Hydrological category: D (2 42) With monthly flow requirements as specified. Water Quality category: D (2 42)	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.	The Specific Pollution Index should be > 8.9 (C/D category).	s 85 milliSiemens/metre (95th percentile)	s 300 miligrams/fitre (95" percentile) 7.5 (5"percentile) - 9.2 (95" percentile)
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.	The integrity of the invertebrate community should be determined using the Macroinvertebrate Macroinvertebrate Assessment index. Conduct aquatic blomonitoring annually using the South African Scoring System 5 methodology.  The ecological speeding of potential concern for Ecological concern for Ecological size Assessment and thresholds of potential concern for Ecological size 13 must be adhered to.	Conduct a diatom assessment annually.	Electrical conductivity	Sulphate pH range
instream biota must be in a largely modified condition or better. The specific requirements of itsh species of ecological importance and with particular flow and water quality needs must be provided for. The specific requirements of aqualc bird species of ecological importance must provided for.	The integrity of the macroinvertebrate community within the system must be maintained.	Water quality improvement is required from a nutrient perspective.	Instream salinity must be improved to sustain the	aquairc ecosystem. pH must be maintained at present state.
Fish	Aquatic Invertebrates	Diatoms	Salts	System variables
	Biota			Quality
	9			Q
	EWR 13			
	VB 1.2, VB 1.3			VB2
Vaal River (C24.) (From	Schoonspruit confluence to upstream Vals River confluence) (C25C, C25F) (From Vals River confluence to Bloemhof Dam Cuaternary catchment)		Vierfontein-	spruit
	<b>=</b>	,		
	MF Vaal River			
	Insteam biota must be in a largely modified condition or better. The specific requirements of fish species of ecological importance and water quality needs must be provided for. The specific requirements of quality needs must provided for. The specific concern for Ecological importance must provided for.	Assessment Index   Assessment	Vail River   Cachun	Val Rher  (CCA.1)  (CCA.2)  (CCA.2)  (CCA.2)  (CCA.3)  (CCA.3)  (CCA.3)  (CCA.3)  (CCA.3)  (CCA.4)  (C

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

Numerical Limit	Instream and Riparian habitat Integrity category ≥ C (≥ 62)	Instream and Riparian habitat Integrity category ≥ B (≥ 82) Instream and Riparian habitat integrity category ≥ C (≥ 62)	Fish ecological category.≥ B (2 82)  Macro-invertebrate ecological category: ≥ B (2 82)  Instream Ecostatus category ≥ B (2 82)  Hydrological category ≥ B (2 82)  With monthly flow requirements as specified.  Water Quality category: ≥ B (2 82)  Fish ecological category: ≥ C (2 62)  Macro-invertebrate ecological category: ≥ C (2 62)  Hydrological category ≥ C (2 62)  Hydrological category ≥ C (2 62)  With monthly flow requirements as specified.  Water Quality category: ≥ C (2 62)
Indicator/measure	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 detenioration of the habitat.	All land use activities impacting on riparian zone should be authorized and regulated to prevent deterioration of the habitat.	A baseline to 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.
Resource Quality Objective	Instream and Riparian habitat must be in a moderately modified condition or better.	Instream and Riparian habitar must be in a largely natural condition.  Instream and Riparian habitat must be in a moderately modified condition or better.	instream blota must be in a contribute to the contribute to the standard sassemblages in the Vaal River moderately modified condition or better and condition or better and assemblages in the Sassemblages in the Sassemblages in the Sassemblages in the Vaal River
Sub- component	Instream Habitat	Riparian Habitat	Fish
Component	Habitat		Biota
Ecological Category			B and C
Node			
Resourc e Unit			VB3
River/Dam			Ysterspruit, Matjiespruit, Klipspruit, Leeudoring- spruit, Wolvespruit, Makwassie- spruit (C24J, C25A, C25C, C25D)
Class			=
NUI			MF Vaal River

Numerical Limit	The Present Ecological State must be maintained.	s 0.091 milligrams/litre (50th percentile)	s 0.25 milligrams/fitre (50" percentile) s 6 milligrams/fitre (95" percentile)	s 70 milliSiemens/metre (95th percentile)	Instream and Ripanian 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 to be specified.	Water Quality category: ≥ C (≥ 62)	Maintain the current C category by ensuring the Average Score Per Taxon is >5.0.	
Indicator/measure	The integrity of the invertebrate community should be determined using the Marcrioirvertebrate Response Assessment Index. Conduct aquatic biomonitoring annually using the South African Scoring System 5 methodology	Orthophosphate as Phosphorus	Nitrate & Nitrite as Nitrogen	Electrical conductivity	The Rapid Habitat Assessment Method must be implemented.			Assessment Index	(FRAI) must be utilized.		The integrity of the investebrate community should be determined using the Macroinvertebrate Response Assessment Index. Conduct aqualic	
Resource Quality Objective	In order to maintain the ecological integrity of the marcoinventebrate community within the Middle Vaal River the tributaries managed. The Present Ecological State must be maintained.	Instream concentration of nutrients must be improved to sustain acutalic	ecosystem health and ensure the present ecological category is maintained.	Instream salinity must be improved to sustain the aquatic ecosystem.	Instream and Riparian habitat must be in a moderately modified condition or better.	instream blota must be in moderately modified condition or better through mantlenance of habitat. Hows, water quality. The importance of the lower reaches as refuge habitat must be sustained.  The integrity of the marcoinverlebrate community within the system must be maintained.						
Sub- component	Aquatic Invertebrates		Salts Salts Instream Habitat Aquatic Invertebrates									
Component		Quality Habitat										
Ecological Category		O										
Node												
Resourc e Unit		¥										
River/Dam		Sandspruit (0256, 0258, C25F, C438)										
Class												
IUA												

Numerical Limit		s 1.62 milligrams/litre (50th percentile)	≤ 1.50 milligrams/litre (50" percentile) ≤ 6 milligrams/litre (95" percentile)	5 0.125 milligrams/litre (50 <sup>th</sup> percentile)	s 80 milliSiemens/metre (95" percentile)	5160 milligrams/litre (95th percentile)	7.5 (5th percentile) - 9.2 (95th percentile)	Instream and Riparian habitat integrify category ≥ D (≥ 42)	Instream and Riparian habitat integrity category ≥ D (≥ 42)				
Indicator/measure	biomonitoring annually using the South African Scoring System 5 methodology.	o %	Nitrate & Nitrite as s1 Nitrogen s6	sphate as rus	Electrical conductivity (95	Sulphate (95	pH range 7.5	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	Rehabilitation must be undertaken which must include the removal of invasive cat exotic species from the riparian zone.				
Resource Quality Objective		Instream concentration of	nutrients must be improved to sustain aquatic	ecosystem health.	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.	pH must be maintained.	Instream and Riparian habitat must be in a largely modified condition or better.	Invasive riparian plant species must be controlled.				
Sub- component			Nutrients		Collec	Salts	System	Instream Habitat Riparian Habitat					
Component					Quality			Habitat					
Ecological Category								۵					
Node													
Resourc e Unit		VB5											
River/Dam		Bamboes- spruit (C25E)											
Class								=					
IUA								MF Vaal River					

	Instream and Riparian habitat Integrity category ≥ D (≥ 42) Fish ecological category: ≥ D (≥ 42) Macro-invertebrate ecological category:≥ D (≥ 42) Instream Ecostatus category ≥ D (≥ 42) With monthly flow requirements to be specified. Water Quality category: ≥ D (≥ 42)	Drought Flows	1	cubic Per- metres/ cen- second tile	4.905 99	5.262 99	5.4 99	6.403 99	2.646 99	6.952 99	5.489 99	4,423 99	3.654 99	117 99	3.454 99	4.363 99	entile) tile)
Il Limit	habitat in habitat in y; z D (z ylogical cylogical cylog		+											3.617			50" percent
Numerical Limit	Fiparian (≥ 42) al categor ebrate eccebrate ecc estatus cal category flow requ	Maintenance Low	Swo	cubic Per- metres/ cen- second tile	6.333 99	6.794 99	6.971 99	8.266 99	11.052 99	8.974 99	7.086 99	5.71 99	4,717 99	4.669 99	4.46 99	5.632 99	ams/litre ( s/litre (95
	Instream and Riparian habitat Integrity category ≥ D (≥ 42) Fish ecological category: ≥ D (≥ 42) Macro-invertebrate ecological category (≥ 42) Instream Ecostatus category ≥ D (≥ 42) With monthly flow requirements to be specified. Water Quality category. ≥ D (≥ 42)	Mo	Month	1200	Oct 6.3	Nov 6.7	Dec 6.9	Jan 8.2	Feb 11.	Mar 8.5	Apr 7.0	May 5.	Jun 4,7	Jul 4.6	Aug 4.	Sep 5.6	s 0.15 milligrams/litre (50th percentile) s 6 milligrams/litre (95th percentile)
Indicator/measure	A baseline to determine the integrity and health of the fish for community should be conducted to determine the current state and potential impacts to the population. This assessment should impacts to the population. This assessment should include a fish tissue contamination study to determine heavy the metal concentrations. We have seen that the determine heavy the determinations.		Total Maintenance	-	16) = 360.296 million	cubic metres/annum	Mean Annual Runoff)		Maintenance flows	(percentage value of	distribution)	Decurate forms	(percentage value of	naturalised flow	distribution)		Nitrate & Nitrite as Nitrogen
Resource Quality Objective	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.						The downstream	requirements of EWR 16	must be met to support a	ecosystem.							Concentration of nutrients in the dam must be improved to sustain ecosystem health
Sub- component	Fish							Jour Bouse	CON HOMS								Nutrients
Component	Biota							Ouspelle	- Common								Quality
Ecological Category																	
Node																	
Resourc e Unit										VB6							
River/Dam									Bloemhof	Dam (C25E,	C43F, C43D)						
Class										=							
NA									ME	Vaal River					71:-		

IUA	Class	River/Dam	Resourc e 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	Dissolved Inorganic Nitrogen as Nitrogen	s 0.25 milligrams/litre (50th percentile)
								allowed to detendrate. Dam has the potential to be hypertrophic.	Orthophosphate as Phosphorus	s 0.015 milligrams/litre (50" percentile)
								Dam should be maintained in a mesotrophic state.	Chlorophyll - a	s 0.050 miligrams/litre (50" percentile)
									Electrical conductivity	s 70 miliSiemens/metre (95 <sup>th</sup> percentile)
								The salinity in the dam must be maintained in order to	Sulphate	s150 milligrams/litre (95th percentile)
							Salts	support ecosystem health and the water quality	Sodium	s 80 milligrams/litre (95th percentile)
								downstream water users.	Chloride	s 75 milligrams/litre (95" percentile)
									Total Dissolved Solids	s 560 milligrams/litre (95th percentile)
							System variables	pH must be maintained.	pH range	7.5 (5th percentile) - 9.2 (95th percentile)
						Quality	Pathogens	The presence of pathogens should pose a low risk to human health.	Escherichia coli	s 130 counts/100 millilitres (95th percentile)
MF Vaal River	=	Bloemhof Dam (C25E, C25F, C43D)	VB6			Habitat	Dam Habitat	The importance of the Dam as a fish refuge and for protected. This includes ecologically and recreation: ecologically important bird species must provide for	a fish refuge and for ag gically and recreationally i icies must provide for.	The importance of the Dam as a fish refuge and for aquatic and semi-aquatic blota 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 be protected.	r recreation, eco-torism, a	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 m studies. Suitable abundances : should be conducted annually.	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Monitoring should be conducted annually.

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Numerical Limit	A baseline assessment should be conducted to determine the aquatic bird community around the dam.
Indicator/measure	A baseline assessment should be condu aquatic bird community around the dam.
Resource Quality Objective	The dam supports a high number of water fowl, with several mixed heronries supporting a variety of breeding egrets, herons and comorants. A number of bird species recorded at the dam and in the adjacent terrestrial habitals are listed as threatened species. These include amongst others the Greater Flamingo (Phoenicopteurs roseus). Lesser Flamino, the Caspian Tem (Sterna Lesser Flamino), the Caspian Tem (Sterna Caspia) and African Marsh Harrier (Grous mino), the Caspian Tem (Sterna Caspia) and African Marsh Harrier (Grous mino), the propulations must be maintained through proper maintained through proper
Sub- component	Aquatic Birds
Component	Biota
Ecological Category	
Node	
Resourc e Unit	
River/Dam	
Class	
IUA	

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
			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 Taalboschspruit 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
		7.	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.
MC Schoonspruit	RU G1	SK3	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 95° percentile.
			Salinity levels should not increase. Concentrations must be maintained at levels to support water users.	Salts - Electrical Conductivity	Electrical Conductivity s 50milliSiemens/metre; based on typical groundwater quality in dolomite aquifers Specified annual trend should not approach the 95 <sup>m</sup> percentile.
				Water Level - Depth to groundwater level 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.
MC - Schoonspruit	RU - G2	SK 2, SK 4	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/m (-46 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 can be an irrigation and applied at all times (100% compliance).

Indicator/ Measure Numerical Limit	cycles.	Nutrients - Nitrate Natrate values in the recharge area should not increase Bi-annual monitoring to > 2 miligrams //itre.	Electrical conductivity s 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 based on the groundwater quality criteria of the based on the groundwater quality criteria of the based on 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).	Water Level (metres below ground level) Water level (wl) recession rate, dh licensed water user based on the area, use and (metres/day): Water level (wl) recession rate, dh licensed water user based on the area, use and (metres/day): Whater level (wl) recession rate, dh licensed water user based on the area, use and compliance status (in cubic metres/square killometres/annum). Critical rate: <0.25 metres/month. Critical rate: <0.25 metres/month.	Paramantina 45 millioname (films)			
Resource Quality Objective		Nitrate values in the recharge area should not increase to > 2 milligrams ////////////////////////////////////	Salinity levels should not increase. Concentrations must be maintained at levels to support the catchment of the Eye.	Medium to long-term declining water level trends should be managed in a sustainable manner.	40			
Resource			SK 2, SK 4	VB 3, VB 6, SK 6, SK 6, SK 7 and R5				
Ground-water unit			RU - G2	Venters-dorp aquifers				
IUA			MC - Schoonspruit	MC - Schoonspruit; Ven MF - Vaal; aa				

Numerical Limit	Abstraction rate < Average recharge (based on the literased area average 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)	Domestic use:<10 milligrams/litre; Stock water use:<10 milligrams/litre; Irrigation use:<10 milligrams/litre	Electrical conductivity <150 milliSiemens/metre for domestic use,  Total dissolved solids <1000 milligrams/fitte for stock watering.  Electrical conductivity < 40 milliSiemens/metre for irrigation water  Macro elements – Specific levels for fluoride (<1.0 milligrams/fitre), sodium (<200 milligrams/fitre), chloride (<200 milligrams/fitre), 100% compliance  Domestic Use:	Trace metals —Arsenic (<0.05 milligrams/litre), Cadmium (<0.005 milligrams/litre), Copper (<1.00 milligrams/litre), Iron (<0.05 milligrams/litre), Manganese (<0.4 milligrams/litre) and Zinc (<10 milligrams/litre).  For stock and irrigation water: Refer to appropriate guideline.				
Indicator/ Measure	Water use > Reserve. Schedule 1 and General Authorisations. Abstraction rate Q (mm/km²/a) and recharge (mm/km²/a). (Refer to Groundwarter Resources Assessment Phase II or more recent updated recharge estimation in mm/km²/a). Estimate local Stress index, Si(%): Si(%)=Use (Q)/Recharge	Nutrients: Nitrate (as Nitrogen) Annual water quality analysis	Salts: Electrical conductivity and specific macro elements for all domestic use. Electrical Conductivity and Sodium Adsorption Ratio for Irrigation waters. Annual water quality analysis.	Toxics: Specific trace metal constituents Annual wafer quality analyses must be undertaken.				
Resource Quality Objective	Where water use (m³/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.		The regional groundwater quality criteria should be based on the water use requirement for domestic, agricultural and or industrial limits.					
Resource Unit	UV1, UV2, UV3, UV4, UV1, UV2, UV3, UV4, UV2, UV3, UV4, UV3, UV3, VV4, VV6, R2, VV8, VV8, VV8, VV8, VV8, VV8, VV8, VV							
Ground-water unit			Karoo aquifers					
IUA			MA - Kenoster, MB - Vals, MD1 - Upper Sand, MD2 - Lower Sand, ME1- Upper Vet, ME - Vaal to Bloemhof Dam					