DEPARTMENT OF WATER AND SANITATION

NO. 610 **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 UPPER 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 Upper Vaal, in the Schedule, to be issued under section 13(4) of the National Water 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
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Private Bag X313
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MRS NP MOKONYANE
MINISTER OF WATER AND SANITATION
DATE: 01-07-15

SCHEDULE

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

1. DESCRIPTION OF WATER RESOURCE

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

Water Management Area:	Vaal
Drainage Region:	C Primary Drainage Region
River(s):	Vaal and Wilge River Systems

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

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

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

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

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

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

3. Resource Quality Objectives (RQO) are defined for each prioritised resource unit (RU) or hydrological node (Figure 2 and Table 2) for every IUA in terms of water quantity, quality, habitat and biota as shown in Tables 3 – 9 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.

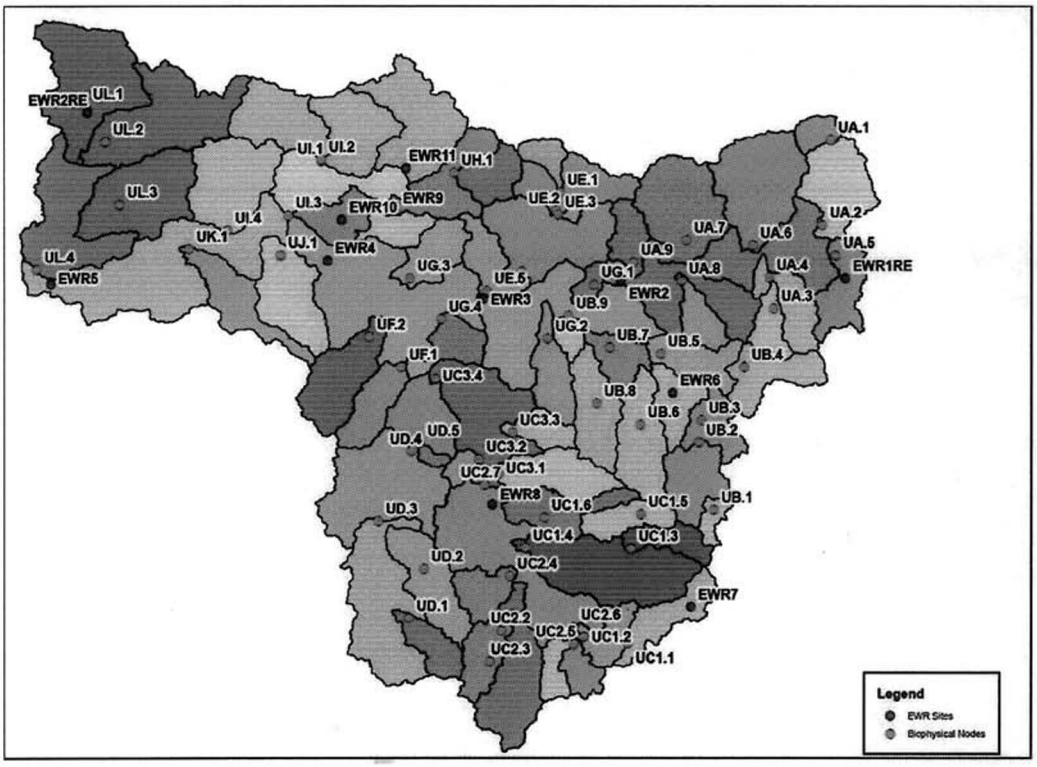

Figure 2: Resource Units (Hydro Nodes) in the Upper Vaal

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

Integrated Unit of Analysis (IUA)	Water Resource Class for IUA	Biophysical Node Name	Quaternary Catchment	Major River Name	Tributary Name	Gross Catchment Area (km²)	Natural MAR (million m³/a)	Present Ecological State	Recommended Ecological Category
Vaal River upstream of Grootdraai Dam (UA)	II	UA.1	C11A	Vaal		197	13.27	B/C	B
		UA.2	C11B	Vaal		1073	69.33	C	C
		UA.3	C11E	Rietspruit	Skulpspruit	215	12.03	C	C
		UA.4	C11E	Vaal	Rietspruit	746	41.73	C	C
		UA.5	C11D	Vaal	Klein Vaal	533	41.66	C/D	C/D
		UA.6	C11G	Vaal	Drinkwaterspruit	1331	66.07	C/D	C/D
		UA.7	C11H	Vaal	Blesbokspruit	1084	70.66	C/D	C/D
		UA.8	C11K	Vaal	Kaalspruit	355	18.62	B/C	B/C
		UA.9	C11K	Vaal	Leeuspruit	340	18.07	C	C
		EWR1RE	C11C	Vaal	Klein Vaal	318	26.09	C	C
		EWR1	C11J	Vaal		4984	288.8	B/C	B/C
Klip River (Free State) (UB)	II	UB.1	C13C	Vaal	Klip	88	5.67	B	B
		UB.2	C13C	Vaal	Klip	837	54	B/C	B
		UB.3	C13D	Vaal	Klip (Grootdraai)	1090	68.04	B/C	B
		UB.4	C13A	Klip	Sandspruit	595	51.37	C	C
		UB.5	C13B	Klip	Sandspruit	1139	78.84	C	C
		UB.6	C13E	Klip	Komandospruit	603	33.6	B/C	B
		UB.7	C13F	Vaal	Klip (Grootdraai)	4129	248.05	C/D	C/D
		UB.8	C13G	Klip	Spruitsonderdrif	435	20.8	C	C
		UB.9	C13H	Vaal	Klip	589	19.22	C/D	C/D
		EWR6	C13D	Vaal	Klip	1583	95.31	B/C	B/C
Upper Wilge River (UC1)	II	UC1.1	C81B	Vaal	Wilge	591	69.03	B	B
		UC1.2	C81B	Vaal	Wilge	932	81.11	C	C
		UC1.3	C81L	Wilge	Meul	364	26.49	B	B
		UC1.4	C81M	Wilge	Meul	1831	104.03	C	C
		UC1.5	C82A	Wilge	Cornelius	156	7.82	C	C
		UC1.6	C82B	Wilge	Cornelis	812	39.63	C	C
		EWR7	C81A	Vaal	Wilge	170	23.47	A/B	A/B
Wilge River and tributaries (UC2)	II	UC2.1	C81F	Vaal	Elands	1405	114.76	C/D	C/D
		UC2.2	C81G	Elands	Klerkspruit	435	22.13	C	C
		UC2.3	C81G			115	5.85	B	B
		UC2.4	C81J	Wilge	Vaalbanksspruit	392	12	C	C
		UC2.5	C81C	Nuwejaarspruit	Fraser/Modder	250	18.41	B/C	B/C
		UC2.6	C81E	Wilge	Nuwejaarspruit	527	39.87	C	C
		UC2.7	C82D	Wilge	Rus-se-spruit	572	19.6	C	C
		EWR8	C82C	Vaal	Wilge	7503	474.25	C	C

Integrated Unit of Analysis (IUA)	Water Resource Class for IUA	Biophysical Node Name	Quaternary Catchment	Major River Name	Tributary Name	Gross Catchment Area (km²)	Natural MAR (million m³/a)	Present Ecological State	Recommended Ecological Category
Lower Wilge River (UC3)	II	UC3.1	C82G	Wilge	Holspruit	729	32.9	C	C
		UC3.2	C82G	Wilge	Wilge Trib	152	6.34	B/C	B/C
		UC3.3	C82F	Wilge	Grootspruit	296	11.08	C	C
		UC3.4	C82H	Vaal	Wilge	10633	591.39	C/D	C/D
Liebenbergsvlei River (UD)	III	UD.1	C83A	Liebenbergsvlei		375	14.36	C	C
		UD.2	C83D	Liebenbergsvlei	Tierkloof	465	12.42	C	C
		UD.3	C83E	Liebenbergsvlei	Tierkloof	891	23.31	C	C
		UD.4	C83G	Liebenbergsvlei	Unnamed tributary	139	4.74	B/C	B
		UD.5	C83H	Liebenbergsvlei	Unnamed tributary	76	2.66	B/C	B
Waterval River (UE)	III	UE.1	C12D	Vaal	Waterval	695	59.33	C	C
		UE.2	C12F	Vaal	Waterval	970	80.37	D	D
		UE.3	C12F	Waterval	Unnamed tributary	41	2.12	C	C
		UE.4	C12F	Vaal	Waterval	2278	149.84	D	D
		UE.5	C12G	Vaal	Waterval	2787	177.67	D	D
Kromspruit and Skulpspruit (UF)	II	UF.1	C83K	Wilge	Kromspruit	546	25.7	C	C
		UF.2	C83L	Vaal	Klip (flows into Vaal Dam from FS)	765	35.59	C	C
Vaal River from Grootdraai Dam to Vaal Dam (UG)	II	UG.1	C11M	Vaal	Brakspruit	75	3.36	C	C
		UG.2	C12A	Vaal	Venterspruit	485	21	C	C
		UG.3	C12K	Vaal	Molspruit	479	22	C	C
		UG.4	C12J	Vaal	Bankplaasspruit	344	12.43	C	C
		EWR2	C11M	Vaal		7995	457.68	C	C
		EWR3	C12H	Vaal		15638	852.13	C	C
Suikerbosrand River (UH)	II	UH.1	C21A	Vaal	Suikerbosrand	707	28.65	B/C	B
		EWR9	C21C	Vaal	Suikerbosrand	1175	31.31	C	B/C
Klip River (Gauteng) (UI)	III	UI.1	C22C	Klip River	Rietspruit	857	36.6	E	D
		UI.2	C22D	Vaal	Klip River	893	39.21	E	D
		UI.3	C22E	Vaal	Klip River	2309	96.98	E	D
		UI.4	C22J	Vaal	Rietspruit	926	22.1	D/E	D
		EWR10	C21G	Vaal	Suikerbosrand	3271	86.97	C/D	C/D
		EWR11	C21F	Suikerbosrand	Blesbokspruit	1098	29.14	D	D
Taaibosspruit (UJ)	III	UJ.1	C22G	Vaal	Taaibosspruit	831	18.4	D	D
Kromelmboog-spruit (UK)	III	UK.1	C23B	Vaal	Kromelmboogspruit	724	14.3	C	C

Integrated Unit of Analysis (IUA)	Water Resource Class for IUA	Biophysical Node Name	Quaternary Catchment	Major River Name	Tributary Name	Gross Catchment Area (km²)	Natural MAR (million m³/a)	Present Ecological State	Recommended Ecological Category
Mooi River (UL)	III	UL.1	C23F	Vaal	Mooi River	1324	37.69	C/D	C/D
		UL.2	C23E	Mooi	Mooirivierloop	1360	25.96	E	D
		UL.3	C23K	Mooi	Loopspruit	890	20.26	E	D
		UL.4	C23L	Vaal	Mooi	5535	132.21	D	D
		EWR2RE	C23G	Vaal	Mooi	1324	37.69	D	D
Vaal River reach from Vaal Dam to C23L (UM)	III	EWR4	C22F	Vaal		38638	1977.26	C	B/C
		EWR5	C23L	Vaal		49739	2288.01	C/D	C

Table 2: Prioritised Resource Units (RU) delineated for the Upper Vaal

IUA Name	RU	Hydro Node	River Name
UA. Vaal River upstream of Grootdraai Dam	1	UA.1	Vaal
	2	UA.2	Vaal
	3	EWR1RE	Vaal
	4	UA.3	Rietspruit
	5	UA.4	Vaal
	6	UA.5	Vaal
	7	UA.6	Vaal
	8	EWR1	Vaal
	9	UA.7	Vaal
	10	UA.8	Vaal
	11	UA.9	Vaal
UB. Klip River (Free State)	12	UB.1	Vaal
	13	UB.2	Vaal
	14	UB.3	Vaal
	15	EWR6	Vaal
	16	UB.4	Klip
	17	UB.5	Klip
	18	UB.6	Klip
	19	UB.7	Vaal
	20	UB.8	Klip
	21	UB.9	Vaal
UC1. Upper Wilge River	22	EWR7	Vaal
	23	UC1.1	Vaal
	24	UC1.2	Vaal
	25	UC1.3	Wilge
	26	UC1.4	Wilge
	27	UC1.5	Wilge
	28	UC1.6	Wilge
UC2. Wilge River and tributaries	29	UC2.1	Vaal
	30	UC2.2	Elands
	31	UC2.3	
	32	UC2.4	Wilge
	33	UC2.5	Nuwejaarspruit
	34	UC2.6	Wilge
	35	EWR8	Vaal
	36	UC2.7	Wilge
UC3. Lower Wilge River	37	UC3.1	Wilge
	38	UC3.2	Wilge
	39	UC3.3	Wilge
	40	UC3.4	Vaal
UD. Liebenbergsvlei River	41	UD.1	Liebenbergsvlei
	42	UD.2	Liebenbergsvlei
	43	UD.3	Liebenbergsvlei
	44	UD.4	Liebenbergsvlei
	45	UD.5	Liebenbergsvlei
UE. Waterval River	46	UE.1	Vaal
	47	UE.2	Vaal
	48	UE.3	Waterval
	49	UE.4	Vaal
	50	UE.5	Vaal
UF. Kromspruit and Skulpspruit	51	UF.1	Wilge
	52	UF.2	Vaal
UG. Vaal River from Grootdraai Dam to Vaal Dam	53	EWR2	Vaal
	54	UG.1	Vaal
	55	UG.2	Vaal
	56	EWR3	Vaal
	57	UG.3	Vaal
	58	UG.4	Vaal

IUA Name	RU	Hydro Node	River Name
IUA Name	RU	Hydro Node	River Name
UH. Suikerbosrand River	59	UH.1	Vaal
	60	EWR9	Suikerbosrand
	61	EWR10	Blesbokspruit
	62	EWR11	Blesbokspruit
UI. Klip River (Gauteng)	63	UI.1	NatalSpruit
	64	UI.2	Klip
	65	UI.3	Klip
	66	UI.4	Riet
UJ. Taaibosspruit	67	UJ.1	Vaal
UK. Kromelmboogspruit	68	UK.1	Vaal
UL. Mooi River	69	UL.1	Vaal
	70	EWR2RE	Vaal
	71	UL.2	Mooi
	72	UL.3	Mooi
	73	UL.4	Vaal
	74	EWR4	Vaal
UM. Vaal River reach from Vaal Dam to C23L	75	EWR5	Vaal

Table 3: Resource Quality Objectives for RIVER WATER QUANTITY in priority RUs in the Upper Vaal

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits		
										Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
UA	II	Vaal	RU8	EWR1	B/C (B)	Quantity	Low Flows	Low flows need to be maintained in a healthy condition for the ecosystem and for users.	EWR maintenance low and drought flows: Vaal EWR1 in C11J VMAR = 332.3x10^{6}m3 REC=B/C category (equivalent to EcoClassification score 70-80)*	Oct	2.9 (50)	0.2 (99)
										Nov	3.7 (70)	0.22 (99)
										Dec	4 (50)	0.25 (99)
										Jan	4.3 (50)	0.26 (99)
										Feb	5.2 (50)	0.265 (99)
										Mar	3.7 (30)	0.04 (99)
										Apr	3 (40)	0.08 (99)
										May	2.6 (50)	0.03 (90)
										Jun	2.5 (50)	0.15 (99)
										Jul	2.4 (50)	0.15 (99)
										Aug	2.4 (50)	0.15 (99)
										Sep	2.6 (50)	0.16 (99)
UB	II	Vaal	RU21	UB.9	C/D	Quantity	Low Flows	Low flows: Low flows at this site need to improve to maintain the FEPA status of this important ecosystem. Low flows to be improved to a C category.	EWR maintenance low and drought flows: EWR for C category, Klip in B13H, VMAR = 39.776x106m3	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
										Oct	0.310 (40)	0.000
										Nov	0.358 (40)	0.000
										Dec	0.366 (40)	0.000
										Jan	0.401 (40)	0.000
										Feb	0.594 (40)	0.000
										Mar	0.341 (40)	0.000
										Apr	0.199 (50)	0.000
										May	0.102 (50)	0.000
										Jun	0.054 (50)	0.000
										Jul	0.077 (40)	0.000
										Aug	0.071 (50)	0.015 (99)
										Sep	0.092 (50)	0.000
UC2	II	Vaal	RU35	EWR8	C	Quantity	Low Flows	Low flows need to be maintained to support the ecosystem.	EWR maintenance low and drought flows: Wilge EWR8 in C82C, VMAR = 474.3x10^{6}m3, REC=C category*	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
										Oct	0.053 (99)	0.011 (99)
										Nov	0.083 (99)	0.236 (99)
										Dec	0.97 (60)	0.274 (99)
										Jan	1.1(60)	0.316 (99)
										Feb	1.4 (60)	0.422 (99)
										Mar	1.25 (60)	0.355 (99)

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits		
										Apr	1 (60)	0.27 (99)
										May	0.65 (50)	0.06 (99)
										Jun	0.45 (50)	0.031 (99)
										Jul	0.4 (50)	0.011 (99)
										Aug	0.33 (50)	0.015 (99)
										Sep	0.4 (50)	0.118 (99)
UC3	II	Vaal	RU40	UC3.4	C/D	Quantity	Low Flows	Low flow: There is potential for the low flows in this RU to be negatively impacted by unnatural releases from Sterkfontein Dam. Low flows should be improved to a C/D category	1. EWR maintenance low and drought flows: EWR for C category, Wilge in C82H, VMAR = 591.36x106m3	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
										Oct	1.358 (70)	0.011 (99)
										Nov	1.977 (99)	0.829 (99)
										Dec	2.246 (99)	0.992 (99)
										Jan	2.538 (99)	1.112 (99)
										Feb	3.297 (99)	1.431 (99)
										Mar	2.817 (99)	1.226 (99)
										Apr	2.226 (80)	0.621(99)
										May	1.606 (70)	0.060 (99)
										Jun	1.206 (70)	0.031 (99)
										Jul	1.042 (70)	0.007 (99)
										Aug	0.974 (70)	0.015 (99)
										Sep	1.102 (80)	0.321(99)
UG	II	Vaal	RU58	UG.4	C	Quantity	Low Flows	Low flows need to be improved to support the ecosystem and provide for irrigation and other users.	EWR maintenance low and drought flows: Vaal in C12H, PES = B/C category (equivalent to EcoClassification score 70-80)*	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
										Oct	1.775 (60)	0.1 (99)
										Nov	3.591 (60)	0.3 (99)
										Dec	4.54 (60)	0.4 (99)
										Jan	5.229 (70)	0.5 (99)
										Feb	7.501 (70)	0.8 (99)
										Mar	5.002 (70)	0.5 (99)
										Apr	3.204 (60)	0.3 (99)
										May	1.559 (60)	0.1 (99)
										Jun	0.776 (60)	0.05 (00)
										Jul	0.687 (60)	0.00
										Aug	0.4 (60)	0.00
										Sep	0.554 (60)	0.00
UH	II	Vaal	RU60	EWR9	B/C	Quantity	Low Flows	Low flows need to be improved to support the ecosystem and provide for users.	EWR maintenance low and high flows and drought flows: Suikerbosrant EWR9 in C21C, VMAR=31.31x10^{6}m3, REC = C category*	Maintenance low flows (m3/s) (Percentile)	Drought flows (m3/s) (Percentile)	High flows (m3/s)
										Oct	0.12 (60)	0.05 (99)	1.5 for 3 days
										Nov	0.177 (60)	0.066 (99)	1.5 for 3 days
										Dec	0.147 (60)	0.06 (99)	1.5 for 3 days
										Jan	0.182 (60)	0.066 (99)	5 for 4 days

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO		Indicator/ measure	Numerical Limits		
											Feb	0.231 (60)	0.079 (99)	1.5 for 3 days
											Mar	0.18 (60)	0.066 (99)	1.5 for 3 days
											Apr	0.16 (60)	0.064 (99)	
											May	0.143 (60)	0.059 (99)	
											Jun	0.123 (60)	0.057 (99)	
											Jul	0.08 (70)	0.05 (99)	
											Aug	0.065 (70)	0.04 (99)	
											Sep	0.075 (70)	0.04 (99)	
UI	III	Suikerbosrand	RU62	EWR11	D	Quantity	Low Flows	Low flows should be capped to protect the ecosystem.	High flows need to be maintained to support the ecosystem especially fish	EWR maintenance and drought flows: Blesbokspruit EWR11 in C21F, VMAR=100.69x10^{6}m3, REC = D category*	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
											Oct	0.034 99()	0.034
											Nov	0.3 (99)	0.3
											Dec	0.3 (99)	0.3
											Jan	0.34 (99)	0.34
											Feb	0.37 (99)	0.37
											Mar	0.34 (99)	0.34
											Apr	0.34 (99)	0.34
											May	0.32 (99)	0.32
											Jun	0.3 (99)	0.3
											Jul	0.3 (99)	0.3
											Aug	0.3 (99)	0.3
											Sep	0.3 (99)	0.3
UM	III	Vaal	RU75	EWR5	C	Quantity	High Flows	High flows in the river reach upstream of the confluence with the Mooi River need to be provided to support the ecosystem.		EWR high flows: Vaal EWR5 in C23L, MAR=2288.0x10^{6}m3, REC = C category*	Maintenance high flows (m3/s)		
											Nov	50 for 3 days	
											Dec	50 for 3 days	
											Jan	50 for 3 days	
											Feb	180-260 for 3-5 days	
											Mar	400-570 for 3-5 days	

Table 4: Resource Quality Objectives for RIVER WATER QUALITY in the Upper Vaal

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits	95th Percentile
UA	II	Vaal	RU8	EWR1	B/C (B)	Quality	Nutrients	The nutrient condition must be improved to provide for users and the ecosystem.	Phosphate(PO_4) *	≤ 0.020 mg/L P	0.121
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 0.85 mg/L N	0.858
			RU10	UA.8	B/C				Phosphate(PO_4) *	≤ 0.020 mg/L P	0.0085
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 0.85 mg/L N	0.099
UC3	II	Vaal	RU40	UC3.4	C/D	Quality	Nutrients	The nutrient condition must be maintained to provide for users and the ecosystem.	Phosphate(PO_4) *	≤ 0.075 mg/L P	0.08
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 2.50 mg/L N	1.008
UE	III	Vaal	RU47 RU50	UE.2 UE.5	D	Quality	Nutrients	The nutrient condition must be improved to an acceptable level for the ecosystem.	Phosphate(PO_4) *	≤ 0.125 mg/L P	0.08
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 4.00 mg/L N	1.008
UH	II	Vaal	RU60	EWR9	B/C	Quality	Nutrients	The nutrient condition must be improved to an acceptable level for the ecosystem.	Phosphate(PO_4)*	≤ 0.020 mg/L P	0.6
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 0.85 mg/L N	1.62
UL	III	Mooi	RU71	UL.2	D	Quality	Nutrients	The nutrients should be improved to an acceptable state.	Phosphate(PO_4) *	≤ 0.125 mg/L P	0.4
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 4.00 mg/L N	1.94
		Vaal	RU73	UL.4				The nutrients should be improved to an acceptable state	Phosphates (RWQO limits 0.4 mg/l) *	≤ 0.125 mg/L P	1.40
UM	III	Vaal	RU75	EWR5	C	Quality	Nutrients	The nutrients should be improved to an acceptable state	Phosphate(PO_4)*	≤ 0.025 mg/L P	0.2
									Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.25
									Total Ammonia*	≤ 73 µg/L N	1.5
UA	II	Vaal	RU8	EWR1	B/C (B)	Quality	Salts	Salt concentrations need to be maintained to meet quality requirements for agriculture and to maintain the ecosystem wellbeing..	Electrical conductivity*	≤ 70 mS/m	51.
			RU10	UA.8	B/C	Quality	Salts	Salts need to be improved to levels that do not threaten the ecosystem and to provide for users.	Electrical conductivity*	≤ 70 mS/m	29.4.
UE	III	Vaal	RU47	UE.2	D	Quality	Salts	Salts need to be improved to levels that do not threaten the ecosystem and to provide for users.	Electrical conductivity*	≤ 111 mS/m	79.1
UI	III	Suikerbosrant	RU62	EWR11	D	Quality	Salts	Salts need to be improved to levels that do not threaten the ecosystem and to provide for users.	Electrical conductivity*	≤ 111 mS/m	135
		Vaal	RU65	UI.3							90.6
			RU66	UI.4							98.1

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits	95th Percentile
UL	III	Mooi	RU71	UL.2	D	Quality	Salts	Salts need to be improved to levels that do not threaten the ecosystem and to provide for users.	Electrical conductivity*	≤ 111 mS/m	87
		Vaal	RU73	UL.4				Salts need to be improved to levels that do not threaten the ecosystem and to provide for users.	Electrical conductivity*	≤ 111 mS/m	90.5
									Sulphates *	≤ 500 mg/L	132
UM	III	Vaal	RU75	EWR5	C	Quality	Salts	Salts need to be improved to levels that do not threaten the ecosystem especially fish and to provide for users.	Electrical conductivity *	≤ 85 mS/m	84
									Sulphates *	≤ 200 mg/L	173
UA	II	Vaal	RU8	EWR1	B/C (B)	Quality	System Variables	Temperature and oxygen should be improved to support the ecosystem.	Temperature *	≤ abs(dev from ambient) abs(dev from ambient) 1 deg C	No data
									Dissolved oxygen *	≥ 7 mg/L O_2	No data
			RU10	UA.8	B/C				Temperature *	≤ abs(dev from ambient) abs(dev from ambient) 1 deg C	No data
									Dissolved oxygen *	≥ 7 mg/L O_2	No data
UE	III	Vaal	RU47	UE.2	D	Quality	System Variables	Oxygen levels must be improved to support the ecosystem.	Dissolved oxygen *	≥ 4 mg/L O_2	No data
UG	II	Vaal	RU58	UG.4	C	Quality	System Variables	Temperatures and oxygen concentrations must not threaten the viability of local aquatic species.	Temperature *	≤ abs(dev from ambient) abs(dev from ambient) 2 deg C	No data
									Dissolved oxygen *	≥ 6 mg/L O_2	No data
									Dissolved oxygen *	≥ 7 mg/L O_2	No data
UA	II	Vaal	RU8	EWR1	B/C (B)	Quality	Toxins	Toxics need to be maintained at levels which are non-toxic to the ecosystem.	Endosulfan *	≤ 0.103 µg/L	No data
			RU10	UA.8	B/C			Toxics need to be maintained at levels which are non-toxic to the ecosystem.	Atrazine *	≤ 64 µg/L	No data
									Endosulfan *	≤ 0.103 µg/L	No data
UB	II	Vaal	RU21	UB.9	C/D	Quality	Toxins	Ammonia toxicity must be limited for the sake of the ecosystem.	Total Ammonia *	≤ 86 µg/L N	2.9
UE	III	Vaal	RU47 RU50	UE.2 UE.5	D	Quality	Toxins	The river water should not be toxic to aquatic organisms or be a threat to human health.	F *	≤ 3.0 mg/L	0.39
									Al *	≤ 150 µg/L	No data
									As *	≤ 130 µg/L	No data
									Cd hard *	≤ 5.0 µg/L	No data
									Cr(VI) *	≤ 200 µg/L	No data
									Cu hard *	≤ 8.0 µg/L	No data
									Hg *	≤ 1.70 µg/L	No data
									Mn *	≤ 1300 µg/L	No data
									Pb hard *	≤ 13.00 µg/L	No data
									Se *	≤ 30 µg/L	No data

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits	95th Percentile
									Zn *	≤ 36 µg/L	No data
									Chlorine *	≤ 5.0 µg/L free Cl	No data
									Endosulfan *	≤ 0.200 µg/L	No data
									Atrazine *	≤ 100 µg/L	No data
UG	II	Vaal	RU58	UG.4	C	Quality	Toxins	The river water should not be toxic to aquatic organisms or be a threat to human health.	F *	≤ 2.5 mg/L	0.50
									Al *	≤ 105 µg/L	No data
									As *	≤ 95 µg/L	No data
									Cd hard *	≤ 3.0 µg/L	No data
									Cr(VI) *	≤ 121 µg/L	No data
									Cu hard *	≤ 6.0 µg/L	No data
									Hg *	≤ 0.97 µg/L	No data
									Mn *	≤ 990 µg/L	No data
									Pb hard *	≤ 9.50 µg/L	No data
									Se *	≤ 22 µg/L	No data
									Zn *	≤ 25 µg/L	No data
									Chlorine *	≤ 3.1 µg/L free Cl	No data
									Endosulfan *	≤ 0.130 µg/L	No data
									Atrazine *	≤ 79 µg/L	No data
UI	III	Suikerbosrant and Vaal	RU62 RU65 RU66	EWR11 UI.3 UI.4	D	Quality	Toxins	The river water should not be toxic to aquatic organisms or be a threat to human health.	F *	≤ 3.0 mg/L	0.465
									Al *	≤ 150 µg/L	No data
									As *	≤ 130 µg/L	No data
									Cd hard *	≤ 5.0 µg/L	No data
									Cr(VI) *	≤ 200 µg/L	No data
									Cu hard *	≤ 8.0 µg/L	No data
									Hg *	≤ 1.70 µg/L	No data
									Mn *	≤ 1300 µg/L	No data
									Pb hard *	≤ 13.00 µg/L	No data
									Se *	≤ 30 µg/L	No data
									Zn *	≤ 36 µg/L	No data
									Chorine *	≤ 5.0 µg/L free Cl	No data
									Endosulfan *	≤ 0.200 µg/L	No data
									Atrazine *	≤ 100 µg/L	No data
UL	III	Mooi	RU71	UL.2	D	Quality	Toxins	The river water should not be toxic to aquatic organisms or be a threat to human health. Uranium concentrations need to be at acceptable levels.	F *	≤ 3.0 mg/L	0.05
									Al *	≤ 150 µg/L	No data
									As *	≤ 130 µg/L	No data
									Cd hard *	≤ 5.0 µg/L	No data
									Cr(VI) *	≤ 200 µg/L	No data
									Cu hard *	≤ 8.0 µg/L	No data
									Hg *	≤ 1.70 µg/L	No data
									Mn *	≤ 1300 µg/L	No data
									Pb hard *	≤ 13.00 µg/L	No data
									Se *	≤ 30 µg/L	No data
									Zn *	≤ 36 µg/L	No data

IUA	Class	River	RU	Node	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits	95th Percentile
									Chorine *	≤ 5.0 µg/L free Cl	No data
									Endosulfan *	≤ 0.200 µg/L	No data
									Atrazine *	≤ 100 µg/L	No data
									Uranium *	≤ 15 µg/L	No data
UE	III	Vaal	RU47 RU50	UE.2 UE.5	D	Quality	Pathogens	Pathogens should be maintained at levels safe for human use (excluding for direct consumption).	*E.coli* *	≤ 130 counts/100 ml	No data
UI	III	Suikerbosrant	RU62	EWR11	D	Quality	Pathogens	Pathogens should be maintained at levels safe for human use (excluding for direct consumption).	*E.coli* *	≤ 130 counts/100 ml	No data
		Vaal	RU65	UI.3						≤ 130 counts/100 ml	No data
			RU66	UI.4						≤ 130 counts/100 ml	No data
UM	III	Vaal	RU75	EWRS5	C	Quality	Pathogens	Pathogens should be maintained at levels safe for human use (excluding for direct consumption).	*E.coli* *	≤ 130 counts/100 ml	No data

Table 5: Resource Quality Objectives for RIVER INSTREAM HABITAT and BIOTA in the Upper Vaal catchment

IUA	Class	River	RU	REC	RQO	Numerical Limits
UA. Vaal River upstream of Grootdraai Dam	II	VAAL	1	B	Instream habitat must be in a largely natural condition to support the ecosystem. Instream biota must be in a largely condition and at sustainable levels. Low and high flows must be suitable to maintain the river habitat for ecosystem condition. Water quality: Salt concentrations must be maintained to meet quality requirements for agriculture and to maintain the ecosystem wellbeing.	Instream Habitat Integrity category ≥ B (≥ 82) Fish ecological category: ≥ B (≥ 82) Macro-invertebrate ecological category: ≥ B (≥ 82) Instream Ecostatus category ≥ B (≥ 82) Hydrological category ≥ B (≥ 82) Water Quality category: ≥ B (≥ 82)
UA. Vaal River upstream of Grootdraai Dam	II	VAAL	8	B/C	Instream habitat must be in a better than moderately modified condition to support the ecosystem and for property values and recreation Instream biota must be in a better than moderately modified condition and at sustainable levels. The requirements of ecologically important fish species must be provided for. Low and high flows must be suitable to maintain the river habitat for ecosystem condition. Water quality: The nutrient concentrations must be decreased for ecosystem condition and other users.	Instream Habitat Integrity category ≥ B/C (≥ 78) Fish ecological category: ≥ B/C (≥ 78) Macro-invertebrate ecological category: ≥ B/C (≥ 78) Instream Ecostatus category ≥ B/C (≥ 78) Hydrological category ≥ B/C (≥ 78) Water Quality category:≥ B/C (≥ 78)
UA. Vaal River upstream of Grootdraai Dam	II	VAAL	10	B/C	Instream habitat must be in a better than moderately modified condition to support the ecosystem and for property values and recreation Instream biota must be in a better than moderately modified condition and at sustainable levels. The requirements of ecologically important fish species must be provided for. Low and high flows must be suitable to maintain the river habitat for ecosystem condition. Water quality: The nutrient concentrations must be decreased for ecosystem condition and other users.	Instream Habitat Integrity category ≥ B/C (≥ 78) Fish ecological category: ≥ B/C (≥ 78) Macro-invertebrate ecological category: ≥ B/C (≥ 78) Instream Ecostatus category ≥ B/C (≥ 78) Hydrological category ≥ B/C (≥ 78) Water Quality category:≥ B/C (≥ 78)
UB. Klip River (Free State)	II	KLIP	21	C/D	Instream habitat must be in a better than largely modified condition to support the ecosystem.Instream biota must be in a better than largely modified condition and at sustainable levels to support biodiversity.Flows must be	Instream Habitat Integrity category ≥ C/D (≥ 58)Fish ecological category: ≥ C/D (≥ 58)Macro-invertebrate ecological category: ≥ C/D (≥ 58)Instream Ecostatus

IUA	Class	River	RU	REC	RQO	Numerical Limits
					suitable to maintain the river habitat for ecosystem condition. Low flows must be suitable to maintain the FEPA status.Water quality: Ammonia toxicity must be limited to protect the ecosystem.	category ≥ C/D (≥ 58)Hydrological category ≥ C/D (≥ 58)FEPA required low flows: ≥ C (≥ 62)Water Quality category:≥ C/D (≥ 58)
UC2. Wilge River and tributaries	II	WILGE	35	C	Instream habitat must be in a moderately modified or better condition to support the ecosystem. Instream biota must be in a moderately modified condition or better. The habitat conditions needed for the protecion of the genetic integrity of fish species of ecological importance must be provided for. Flows must be suitable to maintain the river habitat for ecosystem condition. Water quality: Nutrient concentrations must be suitable for users and to protect the ecosystem. Pathogens must be maintained at levels safe for human use (excluding for direct consumption).	Instream 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) Water Quality category:≥ C (≥ 62)
UC3. Lower Wilge River	II	LOWER WILGE	40	C/D	Instream habitat must be in a better than largely modified condition to support the ecosystem. Instream biota must be in a better than largely modified condition and at sustainable levels. Flows must be suitable to maintain the river habitat for ecosystem condition. Low flows must mimic the the natural flow patterns Water quality: Nutrient concentrations must be suitable for users and to protect the ecosystem.	Instream 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 category ≥ C/D (≥ 58) Water Quality category:≥ C/D (≥ 58)
UD. Liebenbergsvlei River	III	Liebenbergsvlei River	45	B	Instream habitat must be in a largely natural condition to support the ecosystem.Instream biota must be in a largely condition and at sustainable levels.Low and high flows must be suitable to maintain the river habitat for ecosystem condition. Flows must reflect the flow regime of the region.Water quality: Water quality should be in a close to natural condition.	Instream Habitat Integrity category ≥ B (≥ 82)Fish ecological category: ≥ B (≥ 82)Macro-invertebrate ecological category: ≥ B (≥ 82)Instream Ecostatus category ≥ B (≥ 82)Hydrological category ≥ B (≥ 82)Water Quality category: ≥ B (≥ 82)
UE. Waterval River	III	Waterval River	47	D	Instream habitat must be in a largely modified or better condition to support the ecosystem. Instream biota must be in largely modified or better condition. Flows must be in largely modified or better condition. Water quality:	Instream Habitat Integrity category ≥ D (≥ 42) Fish ecological category:≥ D (≥ 42) Macro-invertebrate ecological category: ≥ D (≥ 42) Instream Ecostatus category ≥ D (≥ 42)

IUA	Class	River	RU	REC	RQO	Numerical Limits
					The nutrient concentrations must be improved to an acceptable level for the ecosystem. Salt concentrations must to be improved to levels that do not threaten the ecosystem and to provide for users. Oxygen levels must be improved to support the ecosystem. The river water must not be toxic to aquatic organisms or be a threat to human health. Pathogens must be at levels safe for human use (excluding for direct consumption).	Hydrological category ≥ D (≥ 42) Water Quality category:≥ D (≥ 42)
UE. Waterval River	III	Waterval River	50	D	Instream habitat must be in a largely modified or better condition to support the ecosystem.Instream biota must be in largely modified or better condition. The requirements of fish species of ecological importance must be provided for.Flows must be in largely modified or better condition.Water quality: The nutrient concentrations must be improved to an acceptable level for the ecosystem and to limit filamentous algal growth. The river water must not be toxic to aquatic organisms or be a threat to human health. Pathogens must be at levels safe for human use (excluding for direct consumption).	Instream Habitat Integrity category ≥ D (≥ 42)Fish ecological category:≥ D (≥ 42)Macro-invertebrate ecological category: ≥ D (≥ 42)Instream Ecostatus category ≥ D (≥ 42)Hydrological category ≥ D (≥ 42)Water Quality category:≥ D (≥ 42)
UG. Vaal River from Grootdraai Dam to Vaal Dam	II	VAAL	58	C	Instream habitat must be in a moderately modified or better condition to support the ecosystem. Instream biota must be in a moderately modified or better condition. The requirements of fish species of ecological importance must be provided for. Flows must be suitable to maintain the river habitat for ecosystem condition. Low flows must be sufficient to support the ecosystem and to provide for the requirements of irrigation and other users. Water quality: Temperatures and oxygen concentrations must not threaten the viability of aquatic biota. The river water must not be toxic to aquatic organisms or be a threat to human health.	Instream 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) Water Quality category:≥ C (≥ 62)
UH. Suikerbosrand River	II	Suikerbosrand River	60	B/C	Instream habitat must be in a better than moderately modified condition to support the ecosystem.Instream biota must be in a better than moderately modified condition and at sustainable levels.Low and high flows must be suitable to maintain the river habitat for ecosystem condition. Low flows must be sufficient for users.Water quality: The nutrient concentrations must be decreased for ecosystem condition and other users. Temperature and oxygen	Instream Habitat Integrity category ≥ B/C (≥ 78)Fish ecological category: ≥ B/C (≥ 78)Macro-invertebrate ecological category: ≥ B/C (≥ 78)Instream Ecostatus category ≥ B/C (≥ 78)Hydrological category ≥ B/C (≥ 78)Water Quality category:≥ B/C (≥ 78)

IUA	Class	River	RU	REC	RQO	Numerical Limits
					must be suitable to support the ecosystem in a good condition.	
UH. Suikerbosrand River	II	Blesbokspruit	62	D	Instream habitat must be in a largely modified or better condition to support the ecosystem. Instream biota must be in largely modified or better condition. Flows must be in largely modified or better condition. Low flows must be suitable to support the ecosystems functions. Water quality: The nutrient concentrations must be decreased to an acceptable mesotrophic state. Salt concentrations must be at levels that do not threaten the ecosystem and are suitable for users. The river water must not be toxic to aquatic organisms or be a threat to human health. Pathogens must be at levels safe for human use (excluding for direct consumption).	Instream Habitat Integrity category ≥ D (≥ 42) Fish ecological category:≥ D (≥ 42) Macro-invertebrate ecological category: ≥ D (≥ 42) Instream Ecostatus category ≥ D (≥ 42) Hydrological category ≥ D (≥ 42) Water Quality category:≥ D (≥ 42)
UI. Klip River (Gauteng)	III	Klip River	65	D	Instream habitat must be in a largely modified or better condition to support the ecosystem.Instream biota must be in largely modified or better condition.Flows must be in largely modified or better condition. Low flows must be suitable to support the ecosystem functions.Water quality: Salt concentrations must be at levels that do not threaten the ecosystem and are suitable for users.The river water must not be toxic to aquatic organisms or be a threat to human health. Pathogens must be at levels safe for human use (excluding for direct consumption).	Instream Habitat Integrity category ≥ D (≥ 42)Fish ecological category:≥ D (≥ 42)Macro-invertebrate ecological category: ≥ D (≥ 42)Instream Ecostatus category ≥ D (≥ 42)Hydrological category ≥ D (≥ 42)Water Quality category:≥ D (≥ 42)
UI. Klip River (Gauteng)	III	Riet	66	D	Instream habitat must be in a largely modified or better condition to support the ecosystem. Instream biota must be in largely modified or better condition. Flows must be in largely modified or better condition. Low flows must be suitable to support the ecosystem functions. Water quality: Salt concentrations must be at levels that do not threaten the ecosystem and are suitable for users. Dissolved organic carbon concentrations must not cause the ecosystem to	Instream Habitat Integrity category ≥ D (≥ 42) Fish ecological category:≥ D (≥ 42) Macro-invertebrate ecological category: ≥ D (≥ 42) Instream Ecostatus category ≥ D (≥ 42) Hydrological category ≥ D (≥ 42) Water Quality category:≥ D (≥ 42)

IUA	Class	River	RU	REC	RQO	Numerical Limits
					become unsustainable. The river water must not be toxic to aquatic organisms or be a threat to human health. Pathogens must be at levels safe for human use (excluding for direct consumption).	
UJ. Taaibosspruit	III	Taaibosspruit	67	D	Instream habitat must be in a largely modified or better condition to support the ecosystem.Instream biota must be in largely modified or better condition.Flows must be in largely modified or better condition. Low flows must be suitable to support the ecosystem functions.Water quality: Salt concentrations must be at levels that do not threaten the ecosystem and are suitable for users.The river water must not be toxic to aquatic organisms or be a threat to human health.	Instream Habitat Integrity category ≥ D (≥ 42)Fish ecological category:≥ D (≥ 42)Macro-invertebrate ecological category: ≥ D (≥ 42)Instream Ecostatus category ≥ D (≥ 42)Hydrological category ≥ D (≥ 42)Water Quality category:≥ D (≥ 42)
UL. Mooi River	III	Mooi River	71	D	Instream habitat must be in a largely modified or better condition to support the ecosystem. Instream biota must be in largely modified or better condition. Flows must be in largely modified or better condition. Low flows must be suitable to support the ecosystem functions. Water quality: The nutrient concentrations must be decreased for ecosystem condition and other users. Salt concentrations must be at levels that do not threaten the ecosystem and are suitable for users. The river water must not be toxic to aquatic organisms or be a threat to human health. Uranium must be at acceptable levels	Instream Habitat Integrity category ≥ D (≥ 42) Fish ecological category:≥ D (≥ 42) Macro-invertebrate ecological category: ≥ D (≥ 42) Instream Ecostatus category ≥ D (≥ 42) Hydrological category ≥ D (≥ 42) Water Quality category:≥ D (≥ 42)
UL. Mooi River	III	Mooi River	73	D	Instream habitat must be in a largely modified or better condition to support the ecosystem.Instream biota must be in largely modified or better condition.Flows must be in largely modified or better condition. Low flows must be suitable to support the ecosystem functions.Water quality: The nutrient concentrations must be decreased for ecosystem condition and other users. Salt concentrations must be at levels that do not threaten the ecosystem and are suitable for users.	Instream Habitat Integrity category ≥ D (≥ 42)Fish ecological category:≥ D (≥ 42)Macro-invertebrate ecological category: ≥ D (≥ 42)Instream Ecostatus category ≥ D (≥ 42)Hydrological category ≥ D (≥ 42)Water Quality category:≥ D (≥ 42)
UM. Vaal River reach from Vaal Dam to C23L	III	VAAL	75	C	Instream habitat must be in a moderately modified or better condition to support the ecosystem. Water hyacinth should be at levels that do not lower instream habitat conditions to less than moderately modified. Instream biota must be in moderately modified or better condition. The	Instream Habitat Integrity category ≥ C (≥ 62) Water hyacinth distribution and water surface coverage should be aligned to the Instream Habitat Integrity category.

IUA	Class	River	RU	REC	RQO	Numerical Limits
					requirements of fish species of ecological importance should be provided for. Flows must be in moderately modified or better condition. High flows must be sufficient to support ecosystem functions. <u>Water quality:</u> The nutrient concentrations must be decreased for ecosystem condition and other users. Salt concentrations must be at levels that do not threaten the ecosystem function and are detrimental to fish species and are suitable for users. Pathogens must be at levels safe for human use (excluding for direct consumption).	Fish ecological category: ≥ C (≥ 62) Macro-invertebrate ecological category: ≥ C (≥ 62) Instream Ecostatus category ≥ C (≥ 62) Hydrological category ≥ C (≥ 62) Water Quality category: ≥ C (≥ 62)

Table 6: Resource Quality Objectives for RIVER RIPARIAN ZONE HABITAT in the Upper Vaal

IUA	Class	River	RU	REC	RQO	Numerical Limits
UA. Vaal River upstream of Grootdraai Dam	II	VAAL	1	B	The riparian zone must be in a largely natural condition. Riparian vegetation must be in a largely natural condition. The requirements of plant species of ecological importance must be provided for. Low and high flows must be suitable to maintain the riparian zone habitat for ecosystem condition.	Riparian Zone Habitat Integrity category ≥ B (≥ 82) Riparian ecostatus category: ≥ B (≥ 82) Hydrological category ≥ B (≥ 82)
UA. Vaal River upstream of Grootdraai Dam	II	VAAL	8	B/C	The riparian zone must be in a better than moderately modified condition and must support property and recreational values. Riparian vegetation must be in a better than moderately modified condition. The requirements of plant species of ecological importance must be provided for. Low and high flows must be suitable to maintain the riparian zone habitat for ecosystem condition.	Riparian Zone Habitat Integrity category ≥ B/C (≥ 78) Riparian ecostatus category:≥ B/C (≥ 78) Hydrological category≥ B/C (≥ 78)
UA. Vaal River upstream of Grootdraai Dam	II	VAAL	10	B/C	The riparian zone must be in a better than moderately modified condition. Riparian vegetation must be in a better than moderately modified condition. The requirements of plant species of ecological importance must be provided for. Low and high flows must be suitable to maintain the riparian zone habitat for ecosystem condition.	Riparian Zone Habitat Integrity category ≥ B/C (≥ 78) Riparian ecostatus category:≥ B/C (≥ 78) Hydrological category≥ B/C (≥ 78)
UB. Klip River (Free State)	II	KLIP	21	C/D	The riparian zone must be in a better than largely modified condition to control negative influences on the river system. Riparian vegetation must be in better than largely modified condition. Low and high flows must be in a a better than largely modified condition.	Riparian Zone Habitat Integrity category ≥ C/D (≥ 58) Riparian ecostatus category: ≥ C/D (≥ 58) Hydrological category ≥ C/D (≥ 58)
UC2. Wilge River and tributaries	II	WILGE	35	C	The riparian zone must be in a moderately modified condition or better. Riparian vegetation must be in a moderately modified condition or better. Low and high flows must be in a moderately modified condition or better.	Riparian Zone Habitat Integrity category ≥ C (≥ 62) Riparian ecostatus category: ≥ C (≥ 62) Hydrological category ≥ C (≥ 62)

IUA	Class	River	RU	REC	RQO	Numerical Limits
UC3. Lower Wilge River	II	LOWER WILGE	40	C/D	The riparian zone must be in a better than largely modified condition to control negative influences on the river system. Riparian vegetation must be in better than largely modified condition. Flows must be suitable to maintain the riparian zone habitat for ecosystem condition. Low flows must mimic the the natural flow patterns	Riparian Zone Habitat Integrity category ≥ C/D (≥ 58) Riparian ecostatus category: ≥ C/D (≥ 58) Hydrological category ≥ C/D (≥ 58)
UD. Liebenbergsvlei River	III	Liebenbergsvlei River	45	B	The riparian zone must be in a largely natural condition. Riparian vegetation must be in a largely natural condition. The requirements of plant species and assemblages of ecological importance must be provided for. Low and high flows must be suitable to maintain the riparian zone habitat for ecosystem condition.	Riparian Zone Habitat Integrity category ≥ B (≥ 82) Riparian ecostatus category: ≥ B (≥ 82) Hydrological category ≥ B (≥ 82)
UE. Waterval River	III	Waterval River	47	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition. .	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UE. Waterval River	III	Waterval River	50	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition. .	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UG. Vaal River from Grootdraai Dam to Vaal Dam	II	VAAL	58	C	The riparian zone must be in a moderately modified condition or better. Riparian vegetation must be in a moderately modified condition or better. Low and high flows must be in a moderately modified condition or better.	Riparian Zone Habitat Integrity category ≥ C (≥ 62) Riparian ecostatus category: ≥ C (≥ 62) Hydrological category ≥ C (≥ 62)
UH. Suikerbosrand River	II	Suikerbosrand River	60	B/C	The riparian zone must be in a better than moderately modified condition. Riparian vegetation must be in a better than moderately modified condition. The requirements of plant species of ecological importance must be provided for. Low and high flows must be suitable to maintain the riparian zone habitat for ecosystem condition.	Riparian Zone Habitat Integrity category ≥ B/C (≥ 78) Riparian ecostatus category:≥ B/C (≥ 78) Hydrological category≥ B/C (≥ 78)

IUA	Class	River	RU	REC	RQO	Numerical Limits
UH. Suikerbosrand River	II	Blesbokspruit	62	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition.	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UI. Klip River (Gauteng)	III	Klip River	65	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition.	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UI. Klip River (Gauteng)	III	Riet	66	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition.	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UJ. Taaibosspruit	III	Taaibosspruit	67	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition.	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UL. Mooi River	III	Mooi River	71	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition.	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)
UL. Mooi River	III	Mooi River	73	D	The riparian zone must be in a largely modified or better condition. Riparian vegetation must be in a largely modified or better condition. Low and high flows must be in a largely modified or better condition.	Riparian Zone Habitat Integrity category ≥ D (≥ 42) Riparian ecostatus category: ≥ D (≥ 42) Hydrological category ≥ D (≥ 42)

IUA	Class	River	RU	REC	RQO	Numerical Limits
UM. Vaal River reach from Vaal Dam to C23L	III	VAAL	75	C	The riparian zone must be in a moderately modified condition or better. Riparian vegetation must be in a moderately modified condition or better. Low and high flows must be in a moderately modified condition or better.	Riparian Zone Habitat Integrity category ≥ C (≥ 62) Riparian ecostatus category: ≥ C (≥ 62) Hydrological category ≥ C (≥ 62)

Table 7: Resource Quality Objectives for DAM WATER QUANTITY in the Upper Vaal

IUA	Dams	RU	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits		
UA	Amersfoort Dam (27°4'1"S; 29°53'1"E)	RU4	Quantity	Low Flows	Dam levels must be sufficient for release for domestic supply to Amersfoort and the surrounding small irrigation areas	Flow releases: Skulpspruit in C11E, VMAR = 12.035x10^{6}m^3, PES=C	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
							Oct	0.049 (50)	0.007 (99)
							Nov	0.099 (40)	0.015 (99)
							Dec	0.130 (50)	0.030 (99)
							Jan	0.143 (40)	0.045 (99)
							Feb	0.196 (40)	0.041 (99)
							Mar	0.131 (40)	0.015 (99)
							Apr	0.087 (40)	0.012 (99)
							May	0.051 (40)	0.000
							Jun	0.035 (40)	0.000
							Jul	0.031 (40)	0.000
							Aug	0.024 (50)	0.000
							Sep	0.027 (50)	0.008 (99)
	Groodraai Dam (26°55'9.2"S; 29°17'41.6"E)	RU10			Dam levels must remain sufficient to provide for municipal and industrial use, as well as releases for ecosystem function downstream.	Flow releases: Vaal EWR2 in C11M VMAR = 457.7x10^{6}m3 REC=C category*. (Releases from C1R002)	Maintenance low flows (m3/s) (Percentile)		Drought flows (m3/s) (Percentile)
							Oct	0.7 (50)	0.116 (99)
							Nov	1 (50)	0.219 (99)
							Dec	1.2 (50)	0.281 (99)
							Jan	1.35 (50)	0.309 (99)
							Feb	1.75 (50)	0.422 (99)
							Mar	1.3 (50)	0.285 (99)
							Apr	1 (50)	0.194 (99)
							May	0.8 (50)	0.00
							Jun	0.7 (50)	0.00
							Jul	0.6 (60)	0.00
							Aug	0.55 (60)	0.00
							Sep	0.6 (60)	0.071 (99)
	Sterkfontein Dam (28°23'15"S; 29°1'1"E)	RU33 and 34		Flows	Dam levels must be sufficient for releases to protect ecosystem function and for municipal and industrial use downstream. The dam is filled from the Thukela catchment, the increased dam levels from the transfer must be maintained such that they support the protection of ecosystem function within the dam.	Flow releases: Nuwejaarspruit in C81D, VMAR == 40.089x10^{6}m^3, REC=C/D	Maintenance low flows (m^3/s) (Percentile)	Drought flows (/m^{3}s) (Percentile)	Maintenance high flows (m^3/s) (Percentile)
							Oct	0.125 (50)	0.011 (99)	0.114 (99)
							Nov	0.215 (50)	0.042 (99)	0.238 (40)
							Dec	0.252 (40)	0.045 (99)	0.115 (60)
							Jan	0.324 (50)	0.134 (99)	0.115 (99)
							Feb	0.412 (50)	0.098 (99)	0.585 (30)
							Mar	0.368 (50)	0.146 (99)	0.206 (70)
							Apr	0.246 (50)	0.042 (99)	0.056 (90)
							May	0.139 (50)	0.045 (99)	0.00
							Jun	0.075 (50)	0.031 (99)	0.00
							Jul	0.053 (50)	0.007 (99)	0.00

IUA	Dams	RU	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits		
							Aug	0.048 (50)	0.015 (99)	0.00
							Sep	0.083 (50)	0.035 (99)	0.070 (60)
UH	Balfour Dam (26°34'25"S; 28°30'37"E)	RU60	Quantity	Flows	Dam levels must be maintained at sufficient levels to provide releases for municipal and industrial use as well as protection of ecosystem function downstream.	Flow releases: Vaal EWR9 in C21C VMAR = 31.31x10^{6}m3 REC=C category*. (Daily - no flow gauge close by)	Maintenance low flows (m3/s) (Percentile)			Drought flows (m3/s) (Percentile)
							Oct	0.12 (60)		0.05 (99)
							Nov	0.177 (60)		0.066 (99)
							Dec	0.147 (60)		0.06 (99)
							Jan	0.182 (60)		0.066 (99)
							Feb	0.231 (60)		0.079 (99)
							Mar	0.18 (60)		0.066 (99)
							Apr	0.16 (60)		0.064 (99)
							May	0.143 (60)		0.059 (99)
							Jun	0.123 (60)		0.057 (99)
							Jul	0.08 (70)		0.05 (99)
							Aug	0.065 (70)		0.04 (99)
							Sep	0.075 (70)		0.04 (99)
UL	Klerkskraal Dam (26°15'9"S; 27°9'40"E)	RU69	Quantity	Flows	Dam levels must therefore be maintained at levels sufficient for irrigation releases as well as for protection of ecosystem function downstream.	Flow releases: Vaal RE-EWR2 in C23G VMAR = 37.7x106m3 REC=D*. (Releases from Klerkskraal Dam monitored by C2H006.)	Maintenance low flows (m3/s) (Percentile)			Drought flows (m3/s) (Percentile)
							Oct	0.12 (70)		0.106 (99)
							Nov	0.12 (70)		0.109 (99)
							Dec	0.12 (70)		0.106 (99)
							Jan	0.128 (60)		0.108 (99)
							Feb	0.155 (60)		0.124 (99)
							Mar	0.153 (50)		0.115 (99)
							Apr	0.16 (60)		0.12 (99)
							May	0.154 (60)		0.116 (99)
							Jun	0.154 (60)		0.118 (99)
							Jul	0.146 (60)		0.113 (99)
							Aug	0.143 (60)		0.112 (99)
							Sep	0.137 (70)		0.113 (99)
UM	Vaal Barrage (26°45'53"S; 27°41'3"E)	RU75	Quantity	Flows	Levels must be maintained at sufficient levels for municipal and industrial releases as well as to provide releases for the protection of ecosystem function downstream.	Flow releases: Vaal River in C23B, VMAR = 2 253.9x10^{6}m^3, REC=C	Maintenance low flows (m^3/s) (Percentile)			Drought flows (m^3/s) (Percentile)
							Oct	6.16 (95)		2.55 (99)
							Nov	8.56 (90)		3.59 (99)
							Dec	9.36 (95)		4.30 (99)
							Jan	10.51 (95)		4.79 (99)
							Feb	13.61 (85)		6.15 (99)
							Mar	10.97 (90)		4.99 (99)
							Apr	8.67 (85)		3.76 (99)
							May	6.19 (85)		2.96 (99)
							Jun	4.98 (90)		2.45 (99)
							Jul	4.58 (90)		2.27 (99)
							Aug	4.29 (95)		2.15 (99)

IUA	Dams	RU	Component	Sub Component	RQO		Indicator/ measure		Numerical Limits		
								Sep	4.69 (95)	2.33 (99)	
	Vaal Dam (26°52'57"S; 28°6'58"E)	RU74			Dam levels must be maintained such that they are sufficient for municipal, industrial and irrigation releases as well as protection of ecosystem function downstream.		Flow releases: Vaal EWR4 in C22F downstream Vaal Dam MAR = 1977x10^{6}m3 REC=C category*. (Releases from Vaal Dam monitored by C1H122.)	Maintenance low flows (m^3/s) (Percentile)		Drought flows (m^3/s) (Percentile)	High flows (m3/s)
								Oct	13.05 (70)	3.44 (99)	
								Nov	16.02 (50)	5.04 (99)	15 - 25
								Dec	17.65 (50)	5.58 (99)	15 – 25
								Jan	18.23 (50)	5.98 (90)	15 – 25
								Feb	17.38 (50)	6.63 (95)	40 - 96
								Mar	16.6 (50)	5.58 (95)	15 - 25
					During the wet season dam inflows and levels must be maintained such that they are sufficient for releases for intended use, and release for the protection of ecosystem function downstream.			Apr	13.95 (40)	4.72 (99)	
								May	11.01 (60)	4.14 (99)	
								Jun	10.03 (70)	4.14 (99)	
								Jul	9.54 (95)	3.98 (99)	
								Aug	9.37 (95)	3.98 (99)	
								Sep	9.37 (95)	3.98 (99)	

Table 8: Resource Quality Objectives for DAM WATER QUALITY in the Upper Vaal

IUA	Dams	RU	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits	95th Percentile
UA	Grootdraai Dam (26°55'9.2"S; 29°17'41.6"E)	RU10	Quality	Nutrients	The system must be maintained in a mesotrophic state or better.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.0085
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.099
UB	Vrede/Thembalihle Dam (27°26'21.8"S; 29°11'45.1"E)	RU20	Quality	Nutrients	The system must be maintained in a mesotrophic state or better.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.2
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.4
UD	Gerrands Dam (28°16'55.3"S; 28°17'30.6"E)	RU43	Quality	Nutrients	Nutrients must be maintained at mesotrophic levels.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.006
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.025
	Loch Athlone Dam (28°15'0.9"S; 28°18'31.4"E)				Nutrients must be maintained at mesotrophic levels so as to retain the recreational value of the dam.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.024
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.05
	Saulspoort Dam (Sol Plaatjie Dam) (28°13'1.5"S; 28°21'46.9"E)	RU41			Nutrients must be maintained at mesotrophic levels to protect the ecosystem and also the fitness for use.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.022
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.2
UL	Klipdrift Dam (26°37'0"S; 27°17'52"E)	RU72	Quality	Nutrients	The system is currently in a eutrophic state and must be improved and maintained in a mesotrophic state.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.031
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.11
	Boskop Dam (26°33'42"S; 27°6'41"E)	RU73			Nutrient concentrations must be maintained such that the system is in a mesotrophic state	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.006
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.3
UM	Vaal Barrage (26°45'53"S; 27°41'3"E)	RU75	Quality	Nutrients	The system is currently eutrophic and must be improved and maintained in a mesotrophic state.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.295
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	2.4
	Vaal Dam (26°52'57"S; 28°6'58"E)				The system must be improved and managed in a mesotrophic state.	Phosphate(PO_4) *	≤ 0.025 mg/L P	0.021
						Nitrate (NO_3) & Nitrite (NO_2) *	≤ 1.00 mg/L N	0.2

IUA	Dams	RU	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits	95th Percentile
UB	Vrede/Thembalihle Dam (27°26'21.8"S; 29°11'45.1"E)	RU 20	Quality	Salts	Salt levels must be maintained at concentrations where they do not impact negatively on the ecosystem.	Electrical Conductivity*	≤ 85 mS/m	84.8
UL	Klipdrift Dam (26°37'0"S; 27°17'52"E)	RU 72	Quality	Salts	Salt levels must be maintained at concentrations where they do not impact negatively on the ecosystem.	Electrical Conductivity*	≤ 85 mS/m	102
UM	Vaal Barrage (26°45'53"S; 27°41'3"E)	RU 75	Quality	Salts	Salt levels must be maintained at concentrations where they do not impact negatively on the ecosystem.	Electrical Conductivity*	≤ 85 mS/m	80.4
UL	Boskop Dam (26°33'42"S; 27°6'41"E)	RU 73	Quality	System Variables	The pH of the water in the dam should not negatively impact on ecosystem function.	pH_max *	≥ 8.8	8.7
						pH_min *	≤ 5.9	8.1
UA	Grootdraai Dam (26°55'9.2"S; 29°17'41.6"E)	RU10	Quality	Toxins	Toxicity must be maintained better than concentrations that would pose a threat to human health. The dam must be maintained in a mesotrophic state to avoid cyanobacterial blooms and the associated algal toxins.	Chl-a: phytoplankton*	≤ 20 µg/L	No data
UD	Gerrands Dam (28°16'55.3"S; 28°17'30.6"E)	RU 43	Quality	Toxins	The system must be maintained in a mesotrophic condition to avoid cyanobacteria and the associated algal toxins.	Chl-a: phytoplankton*	≤ 20 µg/L	No data
	Loch Athlone Dam (28°15'0.9"S; 28°18'31.4"E)							
	Saulspoort Dam (Sol Plaatjie Dam) (28°13'1.5"S; 28°21'46.9"E)	RU 41 & 43						
UL	Klipdrift Dam (26°37'0"S; 27°17'52"E)	RU 72	Quality	Toxins	To avoid cyanobacteria blooms, the dam must be maintained in a mesotrophic state.	Chl-a: phytoplankton*	≤ 20 µg/L	No data
UM	Vaal Barrage (26°45'53"S; 27°41'3"E)	RU 75	Quality	Toxins	The system must be maintained in a mesotrophic state to prevent build-up of cyanobacteria blooms and associated algal toxins. The water in the Barrage should not contain toxins including metals at levels that pose a threat to human health.	Chl-a: phytoplankton*	≤ 20 µg/L	No data
	Vaal Dam (26°52'57"S; 28°6'58"E)	RU 74			The system must be maintained in a mesotrophic state to avoid cyanobacterial blooms and associated algal toxins.	Chl-a: phytoplankton*	≤ 20 µg/L	No data

Table 9: Resource Quality Objectives for GROUNDWATER in the Upper Vaal

IUA	RU	Component	RQO	Indicator/ measure	Numerical Limits
All	All Prioritised RUs	Quantity	Where water use is higher than requirements for Reserve, Schedule 1 and General Authorizations, abstraction rates should not exceed the average recharge values of the aquifer based on the area.	Abstraction Volume (Q) per hectare > Reserve, Schedule and General Authorizations.	Q < Average recharge per hectare
All	RU1 RU2 RU3 RU5 RU6 RU7 RU10 RU11 RU33 RU35 RU40 RU42 RU44 RU43 RU46 RU47 RU59 RU60 RU74	Aquifer	Medium to long-term water trends should not show negative decline or deviation from the natural trend	Depth to Groundwater Level according to Groundwater Monitoring Guidelines.	At least one NGwQI MP monitoring site that is representative of the aquifer. Water level fluctuations in Dolomitic aquifers[6] should not exceed 6m.
	RU69				Water level fluctuations around the average site water level should not exceed 4.05 m
	RU63				Water level fluctuations around the average site water level should not exceed 15.3 m
	RU71				Water level fluctuations around the average site water level should not exceed 13.8 m
	RU64				Water level fluctuations around the average site water level should not exceed 14.8 m
	RU66				Water level fluctuations around the average site water level should not exceed 23.6 m
	RU75				Water level fluctuations around the average site water level should not exceed 9.8 m
	RU70				Water level fluctuations around the average site water level should not exceed 15.4 m
	RU62				Water level fluctuations around the average site water level should not exceed 11.8 m
	RU73				Water level fluctuations around the average site water level should not exceed 4.2 m
	RU65				Water level fluctuations around the average site water level should not exceed 22.9 m
	RU72				Water level fluctuations around the average site water level should not exceed 7.16 m