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DEPARTMENT OF WATER AND SANITATION

NO. 1388 **08 DECEMBER 2017**

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

PROPOSED CLASSES OF WATER RESOURCE AND RESOURCE QUALITY OBJECTIVES FOR MOKOLO, MATLABAS, CROCODILE (WEST) AND MARICO CATCHMENTS

I, Sifiso Mkhize, in my capacity as Director-General (Acting) of Water and Sanitation, and duly authorised in terms of section 13(4) and 63(1)(a) of the National Water Act, 1998 (Act No. 36 of 1998) hereby publish, for public comment, the proposed classes of water resources and the proposed resource quality objectives for the Mokolo, Matlabas, Crocodile (West) and Marico catchments, in the Schedule, to be determined under S13(1) of the Act.

Any person who wishes to submit written comments with regard to the proposed classes of water resources and the proposed 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 Lebogang Matlala
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Private Bag x 313
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MR SIFISO MKHIZE
DIRECTOR-GENERAL (ACTING) OF THE DEPARTMENT OF WATER AND SANITATION
DATE: 08/11/2017

SCHEDULE

DESCRIPTION OF THE WATER RESOURCE

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

Water Management Area:	Limpopo North West
Drainage Region:	A10, A21 to A24, A31, A32, A41 and A42 Tertiary Drainage Region
River(s):	Mokolo, Matlabas, Crocodile (West) and Marico river systems

Water Management Area:	Vaal Water Management Area
Drainage Region:	D41A Quaternary Drainage Region
River(s):	Molopo River system

A. PROPOSED WATER RESOURCE CLASSES AS REQUIRED IN TERMS OF SECTION 13(4)(a)(i)(aa) OF THE NATIONAL WATER ACT, 1998

i. The proposed water resource classes for Mokolo, Matlabas, Crocodile (West) and Marico catchments are listed in Table 1 according to the overall class per integrated unit of analysis (IUA), indicated in Figure 1.

ii. IUAs are classified in terms of their extent of permissible utilisation and protection as either Class I: indicating high environmental protection and minimal utilisation; Class II indicating moderate protection and moderate utilisation; and Class III indicating sustainable minimal protection and high utilisation.

iii. Table 1 provides the IUA, its water resource class and its respective catchment configuration. The catchment configuration consists of a number of biophysical nodes representing river reaches or resource units (RUs). The ecological category to be maintained for each RU in the IUA is provided.

B. RESOURCE QUALITY OBJECTIVES OF WATER RESOURCES AS REQUIRED IN TERMS OF SECTION 13(4)(a)(i)(bb) OF THE NATIONAL WATER ACT, 1998

i. Resource Quality Objectives (RQOs) are defined for each prioritised RU for every IUA in terms of water quantity, habitat and biota, and water quality.

ii. Figure 2 represents the RU boundaries of the Crocodile (West), Marico, Mokolo and Matlabas catchments.

iii. Table 2 to Table 21 provide the RQOs for RIVERS AND DAMS in priority RUs.

iv. Table 22 represents the RQOs for PRIORITY WETLAND CLUSTERS AND SYSTEMS in selected Resource Units.

v. Table 23 to Table 33 represent Regional and RU specific RQOs for GROUNDWATER in priority RUs.

vi. RQOs will apply from the date signed off as determined in terms of Section 13(1) of the National Water Act, 1998, unless otherwise specified by the Minister.

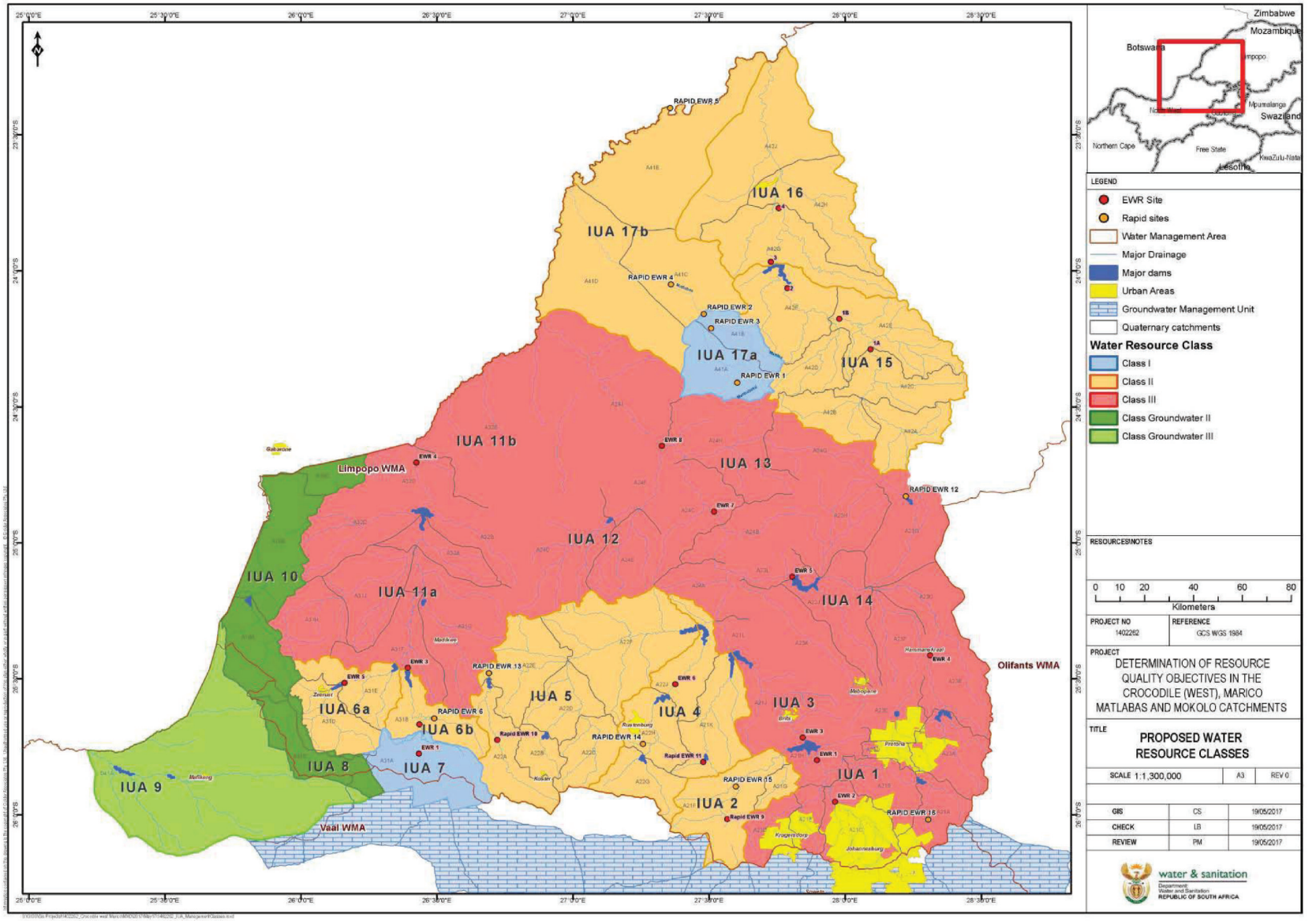

Figure 1: Proposed Water Resource Classes for the Crocodile (West), Marico, Mokolo and Matlabas catchments

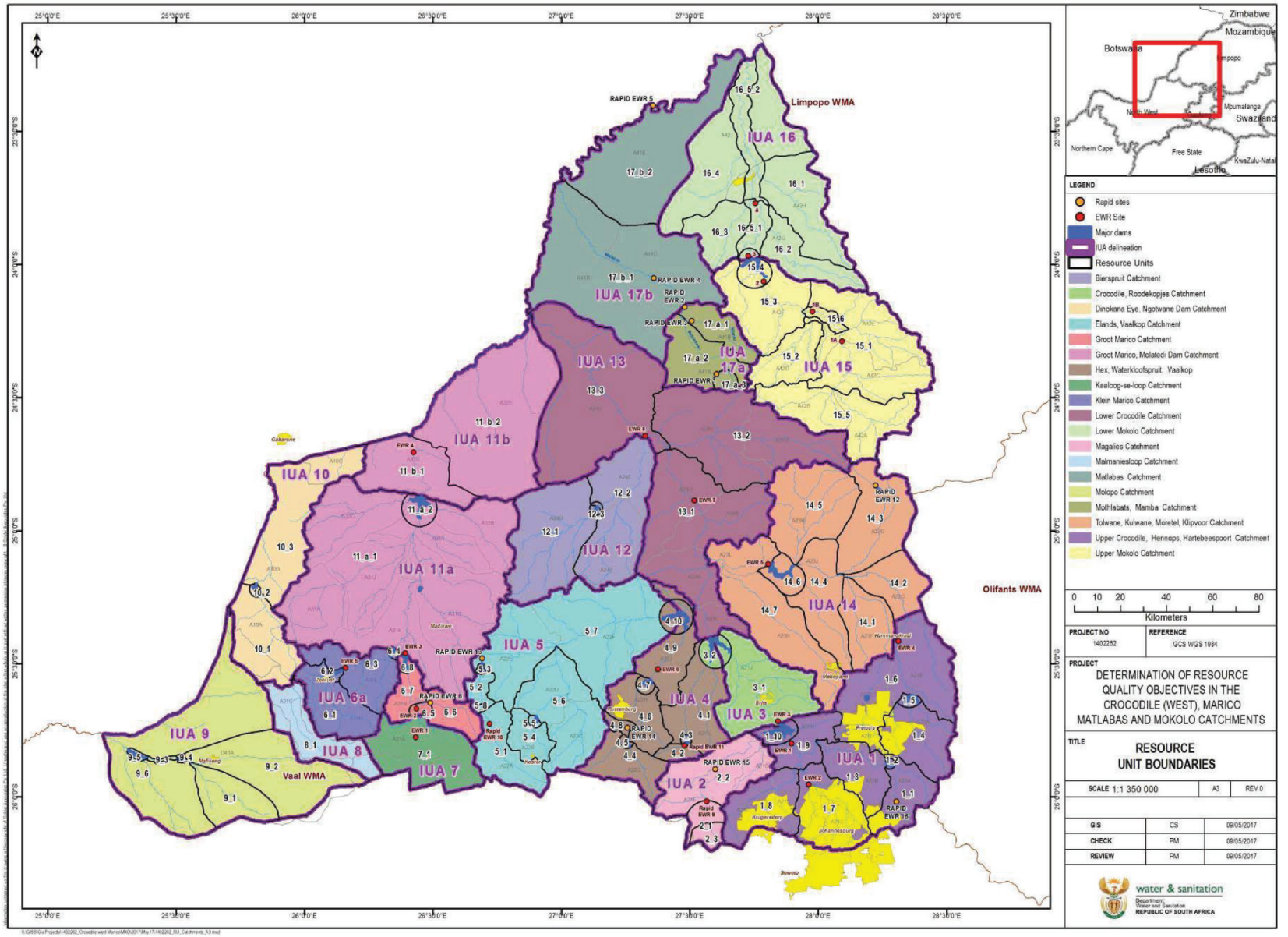

Figure 2: Resource Units of the Crocodile (West), Marico, Mokolo and Matlabas catchments

Table 1: Summary of Water Resource Classes per Integrated Unit of Analysis and Ecological Categories – Crocodile (West), Marico, Mokolo and Matlabas catchments

IUA	Proposed Water Resource Class	Node Name	Quaternary Catchment	Resource Unit	River Name	Ecological Category to be maintained	Mean Annual Runoff (million m^3/a)	EWR as % of natural Mean annual runoff
1 Upper Crocodile/ Hennops/ Hartbeespoort	**III**	**CROC Rapid EWR_16**	A21A	1_1	Rietvlei (source)	C	4.788	27.83
		HN1	A21A	1_1	Hennops River upstream Rietvlei Dam	C	11.66	27.83
		HN2	A21B	1_3	Sesmylspruit with its' tributaries to confluence with Hennops	D	-	-
		HN3	A21C	1_7	Modderfonteinspruit to confluence with Jukskei	D	-	-
		HN4	A21C	1_7	Klein Jukskei at confluence with Jukskei	D	-	-
		EWR site CROC_ EWR2	A21C	1_7	Jukskei River	D	139.9	29.19
		HN6	A21D	1_8	Bloubankspruit and tributaries (outlet of quaternary/confluence with Crocodile)	D	-	-
		HN8	A21H	1_9	Swartspruit to Hartbeespoort Dam	D	-	-
		EWR CROC_EWR1	A21 H	1_9	Crocodile River from Jukskei confluence to inflow Hartbeespoort Dam	D	231.05	24.07
		HN11	A23A	1_4	Upper Pienaars River, Edendalespruit and Moretlele Rivers to Roodeplaat Dam	D	-	-
		EWR site CROC_EWR4	A23B	1_6	Pienaars from Roodeplaat Dam to outlet of quaternary catchment (outlet of IUA1)	C	28.2	30.81
		HN13	A23B	1_6	Boekenhoutspruit to confluence with Pienaars	C	-	-
		HN14	A23D	1_6	Skinnerspruit (source) to confluence with Apies	D	-	-
		HN15	A23D, E	1_6	Apies (source) to Bon Accord Dam, below the dam at outlet of IUA1	D	-	-
2 Magalies	**II**	**CROC Rapid _EWR9**	A21F	2_1	Magalies below Maloney's Eye	B	14.7	45.93
		CROC Rapid _EWR15	A21G	2_2	Magalies, Klein Magalies, Bloubank	C/D	21.9	21.18
		HN18	A21G, F	2_2	Skeerpoort at outlet of IUA2	C/D	-	-
3 Crocodile/ Roodekopjes	**III**	HN19	A21J	3_1	Rosespruit at confluence with Crocodile	C/D	-	-
		EWR site CROC_EWR3	A21J	3_1	Crocodile from Hartbeespoort Dam to upstream Roodekopjes Dam	C/D	143.3	25.02
4 Hex/ Waterkloof-spruit/ Vaalkop	**II**	**CROC Rapid_EWR11**	A21K	4_2	Upper reaches of Sterkstroom (source) to inflow Buffelspoort Dam	C	13.95	28.21
		HN22	A21K	4_1	Sterkstroom from Buffelskloof Dam to Roodekopjes Dam	C	-	-

IUA	Proposed Water Resource Class	Node Name	Quaternary Catchment	Resource Unit	River Name	Ecological Category to be maintained	Mean Annual Runoff (million m^3/a)	EWR as % of natural Mean annual runoff
		HN23	A22G	4_4	Upper Hex (source) to Olifantsnek Dam, Rooikloofspruit	C	-	-
		CROC Rapid_EWR14	A22H	4_8	Waterkloofspruit to confluence with Hex	B/C	5.469	28.27
		HN25	A22H	4_6	Hex from Olifantsnek Dam to Bospoort Dam, Sandspruit	D	12.11	15.26
		EWR site CROC_EWR6	A22J	4_9	Hex from Bospoort Dam to inflow Vaalkop Dam	D	26.9	14.96
5 Elands/ Vaalkop	**II**	**CROC Rapid_EWR10**	A22A	5_1	Upper reaches of Elands (source) to Swartruggens Dam	B/C	10.1	30.48
		HN29	A22A	5_2	Elands from Swartruggens Dam to Lindleyspoort Dam	C	12.87	23.99
		HN30	A22B	5_4	Upper Koster (source) to Koster Dam	C	2.54	22.77
		HN31	A22C, A22D	5_6	Selons River, Koedoespruit, Dwarsspruit, lower Koster River	C	-	-
		CROC Rapid_EWR13	A22E, A22F	5_7	Elands from Lindleyspoort Dam to Vaalkop Dam	C	18.77	21.90
6b Groot Marico	**II**	**MAR Rapid_EWR6**	A31B	6_6	Polkadraaispruit to confluence with Marico	B	9.87	49.27
		EWR Site MAR_EWR2	A31B	6_5	Groot Marico main stem upstream to Polkadraaispruit confluence	B	42.08	50.26
		HN63	A31B	6_7	Groot Marico from Polkadraaispruit confluence to Marico Bosveld Dam	B	56.92	50.61
6a Klein Marico	**II**	HN64	A31D	6_1	Malmaniesloop to confluence with Klein Marico	C/D	-	-
		HN35	A31D	6_1	Klein Marico and tributaries upstream of Zeerust	C/D	-	-
		HN65	A31E	6_1	Klein Marico from Zeerust to Klein Maricopoort Dam	C/D	16.25	14.26
		EWR Site MAR_EWR5	A31E	6_3	Klein Marico from Klein Maricopoort Dam to Kromellemboog Dam	C	16.25	11.70
7 Kaaloog-se-Loop	**I**	**EWR site MAR_EWR1**	A31A	7_1	Marico Eye, Kaaloog-se-Loop, Bokkraal-se-Loop, Ribbokfontein-se-Loop, Rietspruit (southern eye), Kuilsfontein, Syferfontein, Bronkhorstfontein	B	10.539	76.32
		HN38	A31A	7_1	Vanstraatenvlei and tributaries at confluence with Kaaloog-se-Loop, outlet of IUA7	B	-	-
8 Malmaniesloop	**II***	-	A31C	8_1	Dolomite water area	B	-	-
9 Molopo	**II***	HN66	D41A	9_3	Molopo River main stem only from Modimola Dam to Disaneng Dam	D	-	-

IUA	Proposed Water Resource Class	Node Name	Quaternary Catchment	Resource Unit	River Name	Ecological Category to be maintained	Mean Annual Runoff (million m^3/a)	EWR as % of natural Mean annual runoff
		HN67	D41A	9_2	Molopo headwaters to inflow Setumo (Modimola) dam (dolomite water area)	D	-	-
		HN39	D41A	9_6	Molopo at outlet of IUA9	D	-	-
10 Dinokana Eye/Ngotwane Dam	**III***	HN68	A10A	10_1	Ngotwane from Dinokana to Ngotwane Dam	D	-	-
11a Groot Marico/ Molatedi Dam	**III**	**EWR Site MAR_EWR3**	A31F, A31G, A32A	11a_1	Marico Groot Marico from outflow Marico Bosveld Dam to Molatedi Dam, all tributaries	C/D	65.083	23.62
11b Groot Marico/ seasonal tributaries	**III**	**EWR Site MAR_EWR4**	A32D, E	11b_1	Marico from Molatedi Dam to confluence with Limpopo, Rasweu, Maselaje rivers; outlet of IUA11b	C	153.25	7.96
12 Bierspruit	**III**	-	A24D	12_1	Wilgespruit, Bofule, Kolobeng, Magoditshane, Motlhabe	C		
		HN42	A24E, F	12_2	Bierspruit to confluence with Crocodile River, Brakspruit, Phufane, Sefatlhane, Lesobeng, lower reach Bofule; outlet of IUA12.	D	-	-
13 Lower Crocodile	**III**	HN43	A24G, A24H	13_2	Sand to confluence with Crocodile	B	-	-
		EWR Sites CROC_EWR7	A21L, A24A-C, A24H	13_1	Crocodile River outflow Roodekopjes Dam to upstream Sand River confluence, Sleepfonteinspruit, Klipspruit tributaries	D	463.4	13.9
		EWR Site CROC_EWR8	A24J	13_3	Lower Crocodile from Bierspruit confluence to confluence with Limpopo, outlet of IUA13	D	565.16	7.48
14 Tolwane/ Kulwane/ Moretele/ Klipvoor	**III**	**CROC Rapid_EWR12**	A23G	14_3	Plat River	C/D	4.864	23.08
		-	A23F	14_1	Apies River, Tshwane tributary	D		
		-	A23C	14_2	Pienaars River from Boekenshout confluence to Apies River confluence	C		
			A23J	14_4	Moretele (Pienaars) River from Plat River confluence to Klipvoor Dam, Kutswane to Klipvoor Dam	C		
		EWR Site CROC_EWR5	A23J A23J, A23L	14_7	Moretele (Pienaars) to confluence with Crocodile, outlet of IUA14	D	113.0	11.82
		HN49	A23K	14_7	Tolwane to confluence with Moretele	C/D	-	-
15	**II**	HN50	A42A	15_5	Sand (source) to confluence with Grootspruit	C	-	-

IUA	Proposed Water Resource Class	Node Name	Quaternary Catchment	Resource Unit	River Name	Ecological Category to be maintained	Mean Annual Runoff (million m^3/a)	EWR as % of natural Mean annual runoff
Upper Mokolo		HN51	A42B	15_5	Grootspruit (source) to confluence with Sand	D	27.8	21.73
		EWR Site MOK_EWR1a	A42C	15_1	Mokolo to confluence with Dwars	C/D	84.84	16.79
		EWR Site MOK_EWR1b	A42E	15_6	Mokolo to confluence with Sterkstroom	B/C	135.03	13.6
		HN54	A42D	15_2	Sterkstroom (source) to confluence with Mokolo,	B	43.45	52.63
		EWR Site MOK_EWR2	A42F	15_4	Mokolo River in A42F to inflow Mokolo Dam,	B/C	196.2	11.7
		EWR Site MOK_EWR3	A42G	15_4	Mokolo Dam to upper portion of A42G (10km downstream of dam)	B/C	213.99	8.65
16 Lower Mokolo	**II**	**-**	A42H (eastern portion	16_1	Tambotie River	B		
		-	A42G	16_2	Poer-se-Loop	B		
		-	A42J and remaining of A42H	16_4	Sandloop	C		
		EWR Site MOK_EWR4	A42G	16_5_1	Mokolo main stem - Mokolo from below EWR3 to the Tambotie confluence	C	253.3	12.3
		HN58	A42H, A42J	16_5_2	Mokolo main stem - from Tambotie confluence to Limpopo	C	-	-
17a Mothlabatsi/ Mamba	**I**	HN59	A41A	17a_3	Headwaters Mothlabatsi (Matlabas-Zyn-Kloof, peatlands)	A	5.23	57.07
		MAT Rapid_EWR3	A41B	17a_1	Mamba to confluence with Mothlabatsi	B/C	9.54	35.49
		MAT Rapid_EWR2	A41B	17a_2	Matlabas/Motlhabatsi confluence (outlet of IUA)	B/C	32.80	33.23
17b Matlabas	**II**	**MAT Rapid_EWR4**	A41C	17b_1	Matlabas	B	35.58	33.42
		HN62	A41C, D	17b_1	Matlabas to confluence with Limpopo, outlet of IUA17b	B	-	-

Groundwater** **Zone

Table 2: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 1: UPPER CROCODILE/HENNOPS/HARTEBEESPOORT

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit		
1: UPPER CROCODILE/HENNOPS/HARTEBEESPOORT	III	Upper Hennops and Rietvlei Rivers (inflow into Rietvlei Dam) (A21A)	1_1	D	Quantity	Low flows	EWR maintenance low and drought flows: Hennops River at A2H090 in A21A NMAR = $11.66 \times 10^6 m^3$ REC=C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows - specifically required after confluence of Rietvlei and Hennops Rivers Maintenance flows and drought flows Monitoring of Hennops River with surveys of biota at A2H090)		Maintenance Low flows (m^3/s)	Drought Low flows (m^3/s)
									Oct	0.041	0.007
									Nov	0.054	0.007
									Dec	0.056	0.010
									Jan	0.078	0.017
									Feb	0.100	0.015
									Mar	0.087	0.017
									Apr	0.072	0.014
									May	0.065	0.013
									Jun	0.064	0.017
									Jul	0.059	0.016
									Aug	0.054	0.013
									Sep	0.048	0.007
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Application of the concentration limits must be undertaken in conjunction with a nutrient load balance for the catchment.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.060 milligrams/litre (mg/l) (50^{th} percentile)		
								Dissolved Inorganic Nitrogen (DIN) as Nitrogen	≤1.25 milligrams/litre (mg/l) (50^{th} percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50^{th} percentile)		
						Salts	Instream salinity must be maintained or improved upon to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity (EC)	≤ 55 milliSiemens/metre (mS/m) (95^{th} percentile) Hennops above confluence with Rietvlei		
									≤ 70 milliSiemens/metre (mS/m) (95^{th} percentile) below confluence		
								Sulphate (SO_4)	≤ 80 milligrams/litre (mg/l) 95^{th} percentile)		
								Sodium (Na)	≤ 70 milligrams/litre (mg/l) (95^{th} percentile)		
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)		
						System Variables	pH must be maintained at present state.	pH range	6.5 (5^{th} percentile) and 9.0 (95^{th} percentile)		
							A baseline assessment to determine the present state	Turbidity	A 10% variation from background concentration is allowed.		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							instream turbidity is required.		
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	6-7 milligrams/litre (mg/l)
						Toxics	The concentrations of toxins should not be toxic to aquatic organisms and a threat to human health. (Pesticides to be confirmed)	Ammonia as N	≤ 0.0725 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.105 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
								Oil and grease	2.5 mg/l
								Hormone driven Pharmaceuticals	17ß-oestradiol: ≤ 0.001 mglℓ
					Habitat	Instream	Sufficient velocity depth for flow sensitive species must be attained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model Method and Model (RHAMM)	Instream Habitat Integrity ecological category = C ≥ 62%
						Riparian habitat	Alien invasive control should be implemented. Riparian vegetation should be maintained at a C ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI ecological category = C ≥ 62% Riparian IHI = C ≥ 62%
					Biota	Fish	Fish community should be maintained at a C ecological category. Flow velocity linked to seasonal requirements needed for *BMAR*, *AURA* and *CPRE*	Fish Response Assessment Index (FRAI). Seasonality must be noted.	Fish ecology category = C FRAI ≥ 62%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a moderately modified	Macroinvertebrate Response Assessment Index and the South African Scoring System	MIRAI C ecological category ≥ 62% SASS ≥ 80 ASPT ≥ 4.8

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							condition or improved upon.	Version 5 (SASS5).	
						Semi-aquatic biota	The suitability of this stretch of river to serve as a habitat and migration corridor for aquatic bird and mammal populations must be maintained through proper habitat management.	Aquatic birds/Indicator mammal species	Determine representative bird species (types and population numbers to serve as indicators). There is a need to set a numerical limits for density of animals/birds based on the available/collected data.
		Rietvlei Dam (A21A)	**1_2**		Quantity	Dam levels	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained.	Minimum operating level required in dam	Operation rules as applicable. Minimum level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system or better.	Orthophosphate	≤ 0.025 mg/ℓ 50th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total phosphorous	≤ 0.130 mg/ℓ 50th percentile
							Concentration of total Ammonia as Nmust be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total Ammonia as N	≤ 0.0725 mg/L N 95th percentile
							Concentration of total nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic	Nitrite& Nitrate	≤ 1.00 mg/L N 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							system or better.		
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 70 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sulphate	≤ 80 mg/ℓ 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sodium	≤ 70 mg/ℓ 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli*	≤ 130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreation use.	pH	6.5 – 9.0 95th percentile
							Increased clarity with reading ≥0.4 m	Turbidity	Minimum 95th percentile
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/L O_2 95th percentile
						Toxics	The dam must be managed to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominance with Chl *a* concentration higher than 30µg/ℓ must be kept at less than 20% of the time.
							The river water should not be toxic to aquatic organisms or be a threat to human health.	Pesticides	Cyanide:≤ 110 µg/ℓ Endosulfan:≤ 20 µg/ℓ Atrazine:≤ 100 µg/ℓ 95th percentile
							The impoundment water should not be a threat to animal or human sustainability.	Hormone driven Pharmaceuticals	17ß-oestradiol: ≤ 1 µg/ℓ
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic and semi-aquatic species, riparian zones). Conserve, maintain,	Riparian vegetation Health	80% riparian vegetation cover

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.		
					Biota	Fish	Ensure that the diversity and quantities are maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl a concentrations must be maintained in a eutrophic state.	Chl *a*	20-30µg/ℓ 50th percentile
		Hennops from outflow Rietvlei Dam to A21H Sesmylspruit, Kaalspruit and Olifantspruit (A21B)	**1_3**		Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category and the water quality requirements of the water users are met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50th percentile)
								Dissolved Inorganic Nitrogen	≤ 3.0 milligrams/litre (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)
						Salts Pathogens	Instream salinity must be improved to meet the recommended ecological category and the water quality requirements of the water users. Land based impacts and wastewater discharges must be controlled and managed to protect the resource.	Electrical conductivity (EC)	≤ 85 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 70 milligrams/litre (95th percentile)
								Sodium	≤ 70 milligrams/litre (mg/l) (95th percentile)
							The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	130 counts/100 millilitres (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	pH range 7.5 (5th percentile) - 9.2 (95th percentile)
						Toxics	A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
							The concentrations of toxins should not be toxic to	Ammonia as N	≤ 0.1 milligrams/litre (mg/l) 95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							aquatic organisms and a threat to human health	Aluminium (Al)	≤ 0.150 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.013 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0075 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
					Habitat	Instream	Habitat diversity should be maintained in a D Ecological Category or improved upon. Velocity depth for flow sensitive species (*AURA* and *CPRE)* and taxa is required.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model Method and Model (RHAMM)	Instream Habitat Integrity category ≥ D ≥ 42%
						Riparian habitat	Alien invasive control required. Riparian vegetation should be improved from an E ecological category to a D category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI ecology category = D ≥ 42% Riparian IHI = D ≥ 42%
					Biota	Fish	Fish community should be improved from the current E ecological category to a D category. Flow velocity linked to seasonal requirements needed for *BMAR* and *BMAT*.	Fish Response Assessment Index (FRAI)	FRAI should be conducted annually to monitor against the prescribed D ecological category. FRAI ≥ 42%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 55 ASPT ≥ 4.2
		Upper Pienaars River, Edendalespruit and Moretele Rivers to	**1_4**		Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50^{th} percentile)
								Dissolved Inorganic Nitrogen (DIN) as Nitrogen	≤1.25 milligrams/litre (mg/l) (50^{th} percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
		Roodeplaat (A23A)					ecological category and the water quality requirements of the water users are met. Control of nutrients required to improve instream water quality status.	Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)
						Salts	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity (EC)	≤ 65 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate (SO_4)	≤ 50 milligrams/litre (mg/l) (95th percentile)
								Chloride (Cl)	≤ 50 milligrams/litre (mg/l) (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli*	130 counts/100 millilitres (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 9.0 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxins should not be toxic to aquatic organisms and a threat to human health. (Dissolved)	Ammonia as N	≤ 0.0725 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.007 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0075 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Fluoride (F)	≤ 2.54 milligrams/litre (mg/l) (95th percentile)
								Benzene	≤0.01 milligrams/litre (mg/l) (95th percentile)
								Toluene	≤0.7 milligrams/litre (mg/l) (95th percentile)
								Hormone driven Pharmaceuticals	17ß-oestradiol: ≤ 0.001 mglℓ

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
					Habitat	Instream	Habitat availability for fish and macroinvertebrates must be maintained, to sustain biotope diversity. Marginal vegetation required to support *BANO.*	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model Method and Model (RHAMM)	Instream Habitat Integrity ecological category = D ≥ 42% (A2HART-KAMEE and A2PIEN-BAVIA)
						Riparian habitat	Alien invasive control required. Riparian vegetation should be improved from E ecological category to a D category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI ecological category = D ≥ 42% Riparian IHI = D ≥ 42% (A2HART-KAMEE and A2PIEN-BAVIA)
					Biota	Diatoms	Diatom assemblage must be maintained within a largely modified condition or improved upon.	Specific Pollution Index	Diatom ecological category = D ≥ 42% (for both REMP sites A2HART-KAMEE and A2PIEN-BAVIA)
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI ecological category = D ≥ 42% REMP Site At A2PIEN-BAVIA: SASS ≥ 60 ASPT ≥ 3.8 REMP Site A2HART-KAMEE: SASS ≥ 60 ASPT ≥ 3.8
		Roodeplaat Dam	**1_5**		Quantity	Dam levels	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic state. Hyacinth growth must be managed. Management	Orthophosphate	≤ 0.025 mg/ℓ 50th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							strategy to address load in sediments required.		
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total phosphorous	≤ 0.130 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Nitrite & Nitrate	≤ 1.00 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sulphate	≤ 80 mg/ℓ 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sodium	≤ 70 mg/ℓ 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli*	≤ 130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity with reading ≥0.4 m	Turbidity	Minimum 95th percentile
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/L O_2 95th percentile
						Toxics	The dam must be managed to minimize the	Cyanobacteria	Cyanobacterial dominance with Chl a concentration higher than 30µg/ℓ

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit		
							development of toxic cyanobacterial blooms		must be kept at less than 20% of the time.		
							The impoundment water should not be a threat to animal or human sustainability.	Hormone driven Pharmaceuticals	17ß-oestradiol: ≤ 1 µg/ℓ		
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	70% riparian vegetation cover		
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.		
						Periphyton/ Phytoplankton	The Chl *a* concentrations must be maintained in a eutrophic state.	Chl *a*	20-30µg/ℓ 50th percentile		
		Upper reaches_ Apies, Skinner-spruit and Pienaars River outflow from Roodeplaat Dam (A23B, A23D, A23E)	**1_6**		Quantity	Low flows	EWR maintenance low and drought flows: Pienaars River at CROC_EWR4 in A23B NMAR = 28.20x10^{6}m^3 REC=C category 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.	Base flows Maintenance flows and drought flows. Intermediate EWR site 4 on Pienaars River (monitoring at A2H006)		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.104	0.063
									Nov	0.136	0.081
									Dec	0.146	0.086
									Jan	0.211	0.122
									Feb	0.242	0.140
									Mar	0.208	0.119
									Apr	0.174	0.102
									May	0.144	0.085
									Jun	0.133	0.080
									Jul	0.120	0.072
									Aug	0.111	0.067
									Sep	0.103	0.063
									Oct	0.104	0.063

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
									Nov 0.136 0.081
						High flows	EWR high flows: Pienaars River at CROC_EWR4 in A23B NMAR = 28.20x10^{6}m^3 REC=C category The high flows must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem	Floods (See Appendix A for detail on flood requirements) Intermediate EWR site 4 on Pienaars River (monitoring at A2H006)	High flows (m^3/s) Oct 0 Nov 0.210 Dec 0.339 Jan 0.203 Feb 0.56 Mar 0.203 Apr 0 May 0 Jun 0 Jul 0 Aug 0 Sep 0
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.5 milligrams/litre (mg/l) (50th percentile) Apies
									≤ 0.09 milligrams/litre (mg/l) (50th percentile) Pienaars
									≤ 0.05 milligrams/litre (mg/l) (50th percentile) Skinnerspruit
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 3.0 milligrams/litre (50th percentile) Skinnerspruit and Apies
									≤ 1.0 milligrams/litre (mg/l) (50th percentile) Pienaars
						Salts	Instream salinity must be maintained at acceptable levels to support a healthy aquatic ecosystem and the water quality requirements of water users.	Electrical conductivity (EC)	≤ 55 milliSiemens/metre (mS/m) (95thpercentile) Pienaars River
									≤ 70 milliSiemens/metre (mS/m) (95thpercentile) Apies River
								Sulphate (SO_4)	≤ 70 milligrams/litre (95th percentile)
								Sodium (Na)	≤ 50 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 9.0 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							must be improved to support the aquatic ecosystem.		
						Toxics	The concentrations of toxins must not be at a level that is toxic to aquatic organisms and a threat to human health	Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
					Habitat	Instream	Habitat availability for fish and macroinvertebrates must be maintained, to sustain biotope diversity, especially maintaining marginal vegetation to support fish species *MBRE* and *BANO.*	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity ecological category = C ≥ 62%
						Riparian habitat	Alien invasive control required. Rparian vegetation should be maintained at an ecological category of C.	Index of Habitat Integrity, Vegetation Response Assessment Index (VEGRAI)	VEGRAI ecological category = C ≥ 62%
					Biota	Fish	Fish community should be improved from the current E ecological category to a D category.	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42% (Apies/Skinnerspruit Rivers)
							An assessment of the fish community should be conducted annually to monitor against present state C ecological category. Maintain the species diversity present. Flow should be maintained to accommodate species *LCYL, LMOL* and *BMAR*	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% (Pienaars River at REMP site A2PIEN-DINOK (d/s EWR 4)
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 50 ASPT ≥ 3.4 (Apies and Skinner at REMP site A2APIE-BOSCH (A23D & A23E)
							Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 5.0 (REMP site A2PIEN-DINOK (d/s EWR 4)
						Diatoms	Pienaars downstream of Roodeplaat Dam to Boekenhoutspruit	Specific Pollution Index	Diatom EC = D ≥ 42%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							confluence (A23B): Diatom assemblage must be maintained within a largely modified condition or improved upon.		
		Jukskei, Klein Jukskei, Modderfonteinspruit (A21C)	**1_7**		Quantity	Low flows	EWR maintenance low and drought flows: Jukskei River at CROC_EWR2 in A21C PMAR = 139.9x10^{6} m^{3} REC=D category Ecological water requirements (Reserve) must be attained so that the environmental flows requirements are met to support a healthy condition for the ecosystem and users.	Base Flows Maintenance flows and drought flows Intermediate EWR site 2 on Jukskei River (monitoring at A2H023/ A2H044)	Maintenance Low flows (m^3/s) / Drought flows (m^3/s) Oct 0.725 / 0.725 Nov 0.775 / 0.775 Dec 0.770 / 0.770 Jan 0.814 / 0.814 Feb 0.936 / 0.936 Mar 0.845 / 0.845 Apr 0.839 / 0.839 May 0.795 / 0.795 Jun 0.815 / 0.815 Jul 0.785 / 0.785 Aug 0.774 / 0.774 Sep 0.762 / 0.762
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category and the water quality requirements of the water users are met. Nutrient management required to improve current state and ensure sustainability of the system.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.5 milligrams/litre (mg/l) (50th percentile) (interim numeric limit) ≤ 0.125 milligrams/litre (mg/l) (50th percentile) (long term numeric limit)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)
						Salts	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity (EC)	≤ 65 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate (SO_4)	≤ 70 milligrams/litre (mg/l) (95th percentile)
								Sodium (Na)	≤ 70 milligrams/litre (mg/l) (95th percentile)
								Chloride	≤ 60 milligrams/litre (mg/l) (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the	pH range	6.5 (5th percentile) and 9.0 (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							aquatic ecosystem and water user requirements.		
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxins should not be toxic to aquatic organisms and a threat to human health	Ammonia as N	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤0.013 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤0.0075 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤0.07 milligrams/litre (mg/l) (95th percentile)
								Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
					Habitat	Instream	Habitat diversity should be improved from an E ecological category to a D category. Ecological integrity of system must improve.	Index of Habitat Integrity	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Riparian vegetation must be maintained at a C ecological category. Control of alien invasive vegetation required.	Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	Fish community should be improved from the current E ecological category to a D category. Ensure presence of species *BMAR* and *BMOT* (flow dependent species). Flow depth must be present to support habitat availability for *TSPA,*	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42%

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IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							CGAR, BANO, BMAR and *BMOT*		
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI ecological category = D ≥ 42% SASS ≥ 50 ASPT ≥ 3.8 (EWR2, A2JUKS-DIENR)
						Diatoms	Diatom assemblage must be maintained within a D ecological category or improved upon.	Specific Pollution Index	Diatom EC ≥ 42% A2JUKS-DIENR
		Upper reaches of the Crocodile River and Bloubank spruit (A21D, A21E)	**1_8**		Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and to ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)
						Salts	Instream salinity must be maintained at present state quality. Control impacts and future development.	Electrical conductivity (EC)	Crocodile upstream Bloubankspruit confluence: ≤ 45 milliSiemens/metre (mS/m) (95th percentile)
							Salinity levels are significantly high. Instream salinity must be improved to maintain the aquatic ecosystem in a sustainable state and support the water quality requirements of the water users		Bloubankspruit: ≤ 85 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate (SO_4)	Crocodile upstream Bloubankspruit confluence ≤ 40 milligrams/litre (mg/l) (95th percentile)
									Bloubankspruit: ≤ 200 milligrams/litre (mg/l) (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
						Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health.	Cyanide	≤ 0.110 milligrams/litre (95th percentile)
								Uranium (U) (238)	≤ 0.03 milligrams/litre (95th percentile
								Arsenic (As)	≤ 0.130 milligrams/litre (95th percentile
								Gross α	0.42 Bq/litres
								Gross β	0.42 Bq/litres

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
								Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0075 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity must be improved to maintain a D ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Riparian vegetation should be maintained at D ecological category. Marginal vegetation must be improved. Alien invasive control and rehabilitation of marginal zone is required. Limited habitat is available. Rehabilitation of riparian zone required to support semi-aquatic species (birdlife).	Index of Habitat Integrity, Vegetation Response Assessment Index (VEGRAI)	VEGRAI EC = D ≥ 42%
					Biota	Fish	The fish community should be managed to the prescribed ecological category D ecological category or improved upon. Habitat requirements for *BMOT* (vegetation) and substrate and flow for *CPRE* must be met	Fish Response Assessment Index (FRAI)	Ecological category = D FRAI ≥ 42%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI ecological category = D ≥ 42% SASS ≥ 60 ASPT ≥ 4.0 (A2CROC-ELAND)
		Crocodile River from Jukskei confluence to Hartbeespoort Dam (A21H)	**1_9**		Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category and the	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.20 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 2.0 milligrams/litre (50^{th} percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							water quality requirements of the water users are met. Nutrient management required to improve current state and ensure sustainability of the system.		
						Salts	Instream salinity must be maintained to support the aquatic ecosystem and the water quality requirements of the water users.	Electrical conductivity (EC)	≤ 75 milliSiemens/metre (mS/m) (95th percentile)
								Sodium	≤ 60 milligrams/litre (mg/l) (95th percentile)
								Chloride	≤ 60 milligrams/litre (mg/l) (95th percentile)
								Sulphate	≤ 75 milligrams/litre (mg/l) (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
						Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health.	Cyanide	≤ 0.110 milligrams/litre (95th percentile)
								Uranium (U) (238)	≤ 0.03 milligrams/litre (95th percentile)
								Gross α	0.42 Bq/litres
								Gross β	0.42 Bq/litres
								Aluminium (Al)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.013 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0075 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
					Habitat	Instream	No further degradation of the instream habitat should occur Habitat diversity should be improved from an E ecological category to a D category.	Index of Habitat Integrity, Geomorphic Assessment Index	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Conserve, maintain, rehabiliate and add artificial functional systems in shoreline and riparian zone. Alien invasive control required. Riparian vegetation should be maintained at an ecological category D or improved upon.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = D ≥ 42%
					Biota	Fish	Fish community should be maintained at a D ecological category or improved upon. Habitat and water quality improvement required for *CFLA* and flow should be adequate for flow dependant spp. *BMAR, BPOL, CPRE*	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a largely modified condition or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 50 ASPT ≥ 3.8 (at EWR1 = A2CROC-HARTB)
						Semi aquatic biota	The suitability of this stretch of river to serve as a habitat and migration corridor for aquatic bird and mammal populations must be maintained through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Diatoms	Diatom assemblage must be maintained within a largely modified condition or improved upon.	Specific Pollution Index	Diatom EC = D ≥ 42% (at EWR1 = A2CROC-HARTB)
		Hartbeespoort Dam	**1_10**		Quantity	Dam levels	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.		
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic state.	Orthophosphate	≤ 0.050 mg/ℓ 95th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total phosphorous	≤ 0.130 mg/ℓ 50th percentile
							Concentration of total Ammonia as Nmust be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total Ammonia	≤ 00725 mg/L N 95th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Nitrite& Nitrate	≤ 1.00 mg/L N 95th percentile
						Aesthetic quality	The aesthetic quality of the dam must be managed to support recreational use and tourism	Litter, debris, algae, aquatic weeds	To be determined
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 85 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the	Sulphate	≤ 100 mg/L 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							water quality requirements of the downstream users.		
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Chloride	≤ 50 mg/ℓ 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreation use.	pH	6.5 – 9.0 95th percentile
							Increased clarity	Turbidity	≥0.4 m 5th percentile
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/L O_2 95th percentile
						Toxics	The dam must be managed to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominance with Chl *a* concentration higher than 30µg/ℓ must be kept at less than 20% of the time.
							The impoundment water should not be toxic to aquatic organisms or be a threat to human health.	Pesticides	Cyanide: ≤ 110 µg/ℓ Endosulfan: ≤ 20 µg/ℓ Atrazine: ≤ 100 µg/ℓ 95th percentile
							The impoundment water should not be a threat to animal or human sustainability.	Hormone driven Pharmaceuticals	17ß-oestradiol: ≤ 1 µg/ℓ
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat. The aesthetic and visual quality of the dam must be maintained in good state (free of litter, and limited	Riparian vegetation Health	50% riparian vegetation cover

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	Narrative RQO	Indicator	Numerical Limit
							hyacinth growth)		
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentrations must be maintained in a eutrophic state or improved upon.	Chl a	20-30µg/ℓ 50th percentile

Table 3: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 2: MAGALIES

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
2: MAGALIES	II	Maloneys Eye (A21F)	2_1	C	Quantity	Low flows	EWR maintenance low and drought flows: Magalies River at CROC_EWR9 in A21F NMAR = 14.68x10^{6} m^{3} REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows (Rapid EWR site 9 on Magalies River Monitoring at A2H010)		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.211	0.211
									Nov	0.216	0.216
									Dec	0.211	0.211
									Jan	0.212	0.212
									Feb	0.224	0.224
									Mar	0.206	0.206
									Apr	0.212	0.212
									May	0.208	0.208
									Jun	0.214	0.214
									Jul	0.210	0.210
									Aug	0.211	0.211
									Sep	0.217	0.217
					Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.020 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Salts	Instream salinity must be maintained at current status to ensure protection of good ecological integrity or resource.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 10 milligrams/litre (95th percentile)
								Sodium	≤ 10 milligrams/litre (95th percentile)
								Chloride	≤ 10 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.0 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
					Habitat	Instream	Habitat diversity and suitability should be maintained at prescribed B ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82% (Rapid EWR 9)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
						Riparian habitat	Riparian vegetation should be maintained at prescribed B ecological category.	Vegetation Response Assessment Index Index of Habitat Integrity	VEGRAI EC = B ≥ 82% (Rapid EWR 9)		
					Biota	Fish	The fish community should be managed to the prescribed B ecological category Ensure presence of species *Yellow fish (BPOL), AURA, CPRE, BMOT*	Fish Response Assessment Index (FRAI)	Fish ecology category = B FRAI ≥ 82% Collect at least 10 species in 20min survey effort In 20min sample effort a minimum of 50+ CPRE and 5 BMOT (Rapid EWR site 9 = REMP site A2MAGA-MALON)		
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a largely natural condition or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System, Version 5 (SASS5).	MIRAI EC = B ≥ 82% SASS ≥ 200 ASPT ≥ 6.5 (Rapid EWR site 9 = REMP site A2MAGA-MALON)		
						Semi aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.		
		Magalies River, Klein Magalies, Bloubank, Skeerpoort Rivers (A21F)	**2_2**		Quantity	Low flows	EWR maintenance low and drought flows: Magalies River at CROC_EWR15 in A21F NMAR = 21.899x10^{6}m^{3} REC=C/D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows (Rapid site CROC_EWR 15 on Magalies River Monitoring of discharge during biological surveys		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.042	0.015
									Nov	0.044	0.016
									Dec	0.052	0.019
									Jan	0.100	0.035
									Feb	0.163	0.031
									Mar	0.151	0.045
									Apr	0.111	0.039
									May	0.080	0.028
									Jun	0.066	0.023
									Jul	0.057	0.020
									Aug	0.051	0.018
									Sep	0.045	0.016

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.090 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity must be maintained at current status to ensure protection of the water resource.	Electrical Conductivity (EC)	≤ 40 milliSiemens/metre (mS/m) (95^{th} percentile)
								Sulphate	≤ 15 milligrams/litre (95^{th} percentile)
								Sodium	≤ 10 milligrams/litre (95^{th} percentile)
								Chloride	≤ 15 milligrams/litre (95^{th} percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.5 (95^{th} percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health	Ammonia as N	≤ 0.072 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.006 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
					Habitat	Instream	Habitat diversity must be maintained at the C/D ecological category. Good marginal vegetation and low silt load in riffles must be maintained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Riparian vegetation should be maintained at the C/D ecological category. Alien invasive control must be undertaken and protection of riparian zone must improve. Encroachment must be managed. Exotic invasive plant species must be controlled.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C/D ≥ 58%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Fish	Fish community should be maintained at the prescribed C/D ecological category. Ensure presence of indicator species. Flow should be maintained to accommodate species.	Fish Response Assessment Index (FRAI).	Fish ecology category = C/D FRAI ≥ 58% Collect at least 8 spp. in a 20min sample effort. Indicator species *Yellow fish (BPOL), AURA, CPRE , BMOT* (Lower Skeerpoort site A2SKEE-R560B – proposed new; Magalies Rapid EWR 15 – reach A21F-01168)
						Aquatic macroinvertebrates	Upper Skeerpoort (A2SKEE-UITKO): Macroinvertebrate assemblage must be maintained within a largely natural condition or improved upon (B ecological category). Lower Skeerpoort (A2SKEE-R560B): and Magalies River (CROC_ EWR 15): Macroinvertebrate assemblage must be maintained within a moderately modified condition or improved upon (C ecological category).	Macroinvertebrate Response Assessment Index and the South African Scoring System, Version 5 (SASS5).	Upper Skeerpoort site: A2SKEE-UITKO; MIRAI EC = B ≥ 82% SASS ≥ 200 ASPT ≥ 6.5 Lower Skeerpoort A2SKEE-R560B proposed new site and Magalies River Rapid EWR 15 – reach A21F-01168; MIRAI EC = C ≥ 62% SASS ≥ 150 ASPT ≥ 6.0
						Semi aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Diatoms	Diatom assemblage must be maintained within a moderately modified condition or improved upon.	Specific Pollution Index	Diatom EC = C ≥ 62%
		Rietspruit catchment area **South eastern**	**2_3**		Quantity	Low flows	Refer to Groundwater RQOs	Base Flows	Groundwater driven system (dolomites) Steenkoppies compartment over abstraction. Stress index should not be <65%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
		portion of A21F			Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.010 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.05 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity must be maintained at current status to ensure protection of resource.	Electrical Conductivity (EC)	≤ 20 milliSiemens/metre (mS/m) (95^{th} percentile)
								Sulphate	≤ 10 milligrams/litre (95^{th} percentile)
								Sodium	≤ 10 milligrams/litre (95^{th} percentile)
								Chloride	≤ 10 milligrams/litre (95^{th} percentile)

Table 4: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 3: CROCODILE / ROODEKOPJES

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
3: CROCODILE/ROODEKOPJES	III	Crocodile River from outflow Hartebeespoort Dam to inflow Roodekopjes Dam, Rosespruit, Ramogatla and Kareespruit **(A21J)**	3_1	C/D	Quantity	Low flows	EWR maintenance low and drought flows: Crocodile River at CROC_EWR3 in A21J NMAR = 143.3x10^{6}m^3 REC=C/D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows (Intermediate EWR site on Crocodile River Monitoring at A2H083)		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	1.425	1.446
									Nov	1.591	1.607
									Dec	1.690	1.703
									Jan	1.993	1.995
									Feb	2.276	2.267
									Mar	2.290	2.279
									Apr	2.022	2.024
									May	1.870	1.878
									Jun	1.765	1.776
									Jul	1.679	1.690
									Aug	1.564	1.580
									Sep	1.441	1.462
						High flows	EWR high flows: Crocodile River at CROC_EWR3 in A21J NMAR = 143.3x10^{6}m^3 REC=C/D category	Floods High flow also specified as individual flood requirements in terms of size and duration (see Appendix A)		High flows (m^3/s)	
									Oct	0	
									Nov	1.717	
									Dec	2.942	
									Jan	0	
									Feb	6.191	
									Mar	1.668	
									Apr	0	
									May	0	
									Jun	0	
									Jul	0	
									Aug	0	
									Sep	1.729	
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Salts	Instream salinity must be maintained at current status to ensure protection of resource and sustainability of the resource.	Electrical Conductivity (EC)	≤ 75 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 90 milligrams/litre (95th percentile)
								Sodium	≤ 60 milligrams/litre (95th percentile)
								Chloride	≤ 70 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Ammonia as N	≤ 0.0725 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.105 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.005 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Atrazine	≤0.078 milligrams/litre (mg/l)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
					Habitat	Instream	Habitat diversity should be improved from a D ecological category to a C/D category. Flow variation concern for flow and habitat dependant biota. Flow should be adequate for flow dependent taxa.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM), Geomorphic Assessment Index	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Riparian vegetation should be maintained at a C/D ecological category or improved upon. Alien vegetation infestation must be controlled and developments into the riparian zone should be prohibited.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C/D ≥ 58%. Prohibit any further development into riparian zone.
					Biota	Fish	Fish community should be improved from a D ecological category to a C/D category. Regulated seasonality required to accommodate flow sensitive fish species.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Indicator species in *(Crocodile River): AJOH,* and flow dependant *BMAR, CPRE*
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 60 ASPT ≥ 4.0

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Semi aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management. Riparian zone habitat must be improved.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Diatoms	Diatom assemblage must be maintained within a D ecological category or improved upon.	Specific Pollution Index	Diatom EC = D ≥ 42%
		Roodekopjes Dam (A21J)	**3_2**		Quantity	Dam levels	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphate	≤ 0.050 mg/ℓ 95th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.130 mg/ℓ 50th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 70 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sulphate	≤ 85 mg/L 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sodium	≤ 70 mg/ℓ 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity	Turbidity	≥0.4 m 5th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/L O2 95th percentile
						Toxics	The dam must be managed to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominance with Chl *a* concentration higher than 30µg/ℓ must be kept at less than 20% of the time.
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	70% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl a concentrations must be maintained in a eutrophic state.	Chl *a*	20-30µg/ℓ 50th percentile

Table 5: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 4: HEX / WATERKLOOFSPRUIT / VAALKOP

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
4: HEX/WATERKLOOFSPRUIT/VAALKOP	II	Sterkstroom from outflow Buffelspoort Dam to inflow Roodekopjes Dam, Maretwane, Tshukutswe - Quaternary catchment A21K middle and lower catchment below dam	4_1	C	Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity (EC)	≤ 70 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 70 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
						Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health	Ammonia as N	≤ 0.0725 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)
								Chromium (IV)	≤ 0.0675 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Lead (Pb) hard	≤0.005 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤0.07 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained in an ecological category C. The integrity of the habitat, water quality and flow conditions must be maintained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM), Geomorphic Assessment Index	Instream Habitat Integrity E= C ≥ 62%
						Riparian habitat	Vegetation control must be maintained in a C ecological category. Alien infestation control must be implemented.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	The fish community must be maintained in a C/D ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI).	Fish ecology category= C/D FRAI ≥ 58% Collect 6 species in 20min sampling effort. Indicator species *BMOT* (site A2STER-MAMOG)
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 70 ASPT ≥ 4.2
						Diatoms	Diatom assemblage must be maintained within a largely modified condition or improved upon	Specific Pollution Index	Diatom EC = D ≥ 42%
		Upper reaches of Sterkstroom to inflow Buffelspoort	**4_2**		Quantity	Low Flows	EWR maintenance low and drought flows: Sterkstroom at CROC_EWR11 in A21K	Base Flows Maintenance flows and drought flows	Maintenance Low flows (m^3/s) / Drought flows (m^3/s) Oct: 0.078 / 0.033

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
		Dam (A21K middle and upper catchment above dam)					NMAR = 14.0x10^{6}m^{3} REC=C category Adequate protection of instream flows required (must be maintained to support biota). Management of land based activites required.	Rapid EWR site 11 on Sterkstroom (monitoring at A2H053)	Nov	0.083	0.035
									Dec	0.086	0.036
									Jan	0.094	0.039
									Feb	0.113	0.047
									Mar	0.104	0.043
									Apr	0.101	0.042
									May	0.09	0.038
									Jun	0.09	0.038
									Jul	0.085	0.036
									Aug	0.082	0.035
									Sep	0.082	0.035
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.010 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity (EC)	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 70 milligrams/litre (95th percentile)		
					Habitat	Instream	Habitat diversity should be maintained within a B/C ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B/C ≥ 78%		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Riparian habitat	Riparian vegetation should be maintained within a B/C ecological category. Alien infestation must be controlled and managed.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = B/C ≥ 78%
					Biota	Fish	The fish community must be maintained in a C ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Collect 6 species in 20min sampling effort Indicator species – flow sensitive species, *AURA, BMOT* (Sterkstroom at CROC_EWR11 in A21K)
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 100 ASPT ≥ 5.7 (Sterkstroom at CROC_EWR11 in A21K)
		Buffelspoort Dam (A21K)	**4_3**		Quantity	Dam levels	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Orthophosphate	≤ 0.015 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.50 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Birds	Habitat availability	Indicator species Birdlife.	Health assessment studies
		Upper Hex river to Olifantsnek Dam, Rooikloofspruit (A22G)	**4_4**		Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.015 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)
								Sodium	≤ 70 milligrams/litre (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Chloride	≤ 40 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained within a C ecological category. Flow must be adequate to support species and taxa and habitat.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained within a C ecological category. Alien infestation must be controlled and managed.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	An assessment of the fish community should be conducted annually to monitor against the prescribed C ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Collect at least 20 BMOT in 20min sampling effort.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	Macroinvertebrate EC= C ≥ 62% SASS ≥ 140 ASPT ≥ 5.8
		Olifantsnek Dam (A22G)	**4_5**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphate	≤ 0.015 mg/ℓ 95th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.50 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation	50% riparian vegetation cover
		Hex river from Olifantsnek Dam, to inflow Bospoort Dam, Sandspruit (A22H)	**4_6**		Quantity	Low Flows	EWR maintenance low and drought flows: Hex River (at new W-component) in A22H NMAR = 12.11x10^{6}m^3 REC=D category 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.	Base flows Maintenance flows and drought flows (Node on Hex River downstream Olifantsnek Dam. Monitoring at new W-component of the dam	

	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
Oct	0.013	0.011
Nov	0.014	0.012
Dec	0.015	0.013
Jan	0.019	0.016
Feb	0.028	0.023
Mar	0.026	0.022
Apr	0.020	0.017
May	0.017	0.015

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
									Jun	0.017	0.014
									Jul	0.015	0.013
									Aug	0.014	0.012
									Sep	0.014	0.012
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and the water quality requirements of the water users are met. Nutrient management required to ensure sustainability of the system. Water quality must be improved to improve present ecological state from E to D ecological category.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50^{th} percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50^{th} percentile)		
						Salts	Salinity levels are significantly high. Instream salinity must be improved to support the aquatic ecosystem and the water quality requirements of the water users. Water quality must be improved to improve present ecological state from E to D ecological category.	Electrical Conductivity	≤ 85 milliSiemens/metre (mS/m) (95^{th} percentile)		
								Sulphate	≤ 120 milligrams/litre (95^{th} percentile)		
								Chloride	≤ 120 milligrams/litre (95^{th} percentile)		
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.5 (95^{th} percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
						Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health	Ammonia as N	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤0.07 milligrams/litre (mg/l) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
					Habitat	Instream	Habitat diversity should be improved from a D ecological category to a C category to support the overall ecological integrity of the system.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained at a D ecological category.	Index of Habitat Integrity	VEGRAI EC = D ≥ 42%
					Biota	Fish	Fish community should be maintained at a D ecological category or improved upon. Flow should be adequate for flow dependant species.	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Semi aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management. Riparian zone habitat must be improved.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 70 ASPT ≥ 4.2 (SiteA2HEX-PAARD)
		Bospoort Dam (A22H)	**4_7**		Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Orthophosphate	≤ 0.5 mg/ℓ 50th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total phosphorous	≤ 0.130 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Nitrite& Nitrate	≤ 1.00 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 85 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sodium	≤ 100 mg/ℓ 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity with reading.	Turbidity	≥0.4 m 5th percentile
						Toxics	The dam must be managed to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominance with Chl a concentration higher than 30µg/ℓ must be kept at less than 20% of the time.
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	50% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish assemblage should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentrations must be maintained in as eutrophic system. Aesthetic quality of the dam must be managed by control of phytoplankton/periphyton growth.	Chl *a*	20-30µg/ℓ 50th percentile
		Waterkloofspruit (A22H)	**4_8**		Quantity	Low Flows	EWR maintenance low and drought flows: Waterkloofspruit at CROC_EWR14 in	Base flows Maintenance flows and drought flows	Maintenance Low flows (m^3/s) / Drought flows (m^3/s)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
							A22H NMAR = 5.469x10^{6}m^{3} REC=B/C category 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.	Rapid EWR site 14 on Waterkloofspruit (monitoring at A2H038)	Oct	0.028	0.010
									Nov	0.027	0.010
									Dec	0.028	0.010
									Jan	0.035	0.013
									Feb	0.039	0.014
									Mar	0.038	0.014
									Apr	0.035	0.013
									May	0.033	0.012
									Jun	0.033	0.012
									Jul	0.031	0.011
									Aug	0.03	0.011
									Sep	0.03	0.010
					Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.25 milligrams/litre (50th percentile)		
						Salts	Instream salinity must be maintained at current status to ensure protection of good ecological integrity or resource.	Electrical Conductivity	≤ 20 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 10 milligrams/litre (95th percentile)		
								Chloride	≤ 10 milligrams/litre (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
					Habitat	Instream	Habitat diversity should be maintained in the B ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation should be maintained at a B ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	Fish community should be maintained at a B/C ecological category. Area above the waterfall must be protected due to presence of *TSPA* upstream of waterfall. FRAI should be conducted to monitor against current category	Fish Response Assessment Index (FRAI)	Fish ecology category = B/C FRAI ≥ 78% Sample 20 BMOT in 20min sample effort
						Semi-Aquatic species	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management. Riparian zone habitat must be improved.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC =C ≥ 62% SASS ≥ 150 ASPT ≥ 6.0
		Hex River outflow Bospoort Dam to inflow Vaalkop Dam (A22J)	**4_9**		Quantity	Low Flows	EWR maintenance low and drought flows: Hex River at CROC_EWR6 in A22J NMAR = 26.9x10^{6}m^{3} REC=D category The maintenance low flows and drought flows must be attained to support a healthy condition for the ecosystem and users.	Base flows Maintenance flows and drought flows Intermediate EWR site 6 on Hex River (monitoring at A2H094)	Maintenance Low flows (m^3/s) / Drought flows (m^3/s) Oct 0.024 / 0.015 Nov 0.026 / 0.023 Dec 0.035 / 0.022 Jan 0.052 / 0.022 Feb 0.093 / 0.070 Mar 0.084 / 0.067 Apr 0.055 / 0.054 May 0.039 / 0.039 Jun 0.035 / 0.035 Jul 0.030 / 0.030 Aug 0.028 / 0.028 Sep 0.025 / 0.023
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and the water quality requirements of the water users are met. Nutrient management required to ensure sustainability of the system. Water quality must be improved to improve present ecological state from E to D ecological category.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 2.0 milligrams/litre (50th percentile)
						Salts	Salinity levels are significantly high. Instream salinity must be improved to support the aquatic ecosystem and the water quality requirements of the water users. Water quality must be improved to improve present ecological state from E to D ecological category.	Electrical Conductivity	≤ 85 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 120 milligrams/litre (95th percentile)
								Chloride	≤ 120 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
						Toxics	The concentrations of toxins must be maintained at levels that are not toxic to aquatic organisms and a threat to human health	Ammonia	≤ 0.007 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤0.07 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained within a D ecological category or improved upon. Habitat diversity for flow and marginal vegetation sensitive species and taxa must be attained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Riparian vegetation should be maintained at a C ecological category or better condition. Habitat protection required. Developments into riparian zone must be controlled.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	An assessment of the fish community should be conducted annually to monitor against the prescribed D ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 70 ASPT ≥ 4.2 REMP site A2HEXR-ROOIW
						Diatoms	Diatom assemblage must be maintained within a D ecological category or improved upon	Specific Pollution Index	Diatom EC = D ≥ 42%
		Vaalkop Dam **and lower reach of Elands before confluence with Crocodile (A22J)**	**4_10**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphate	≤ 0.05 mg/ℓ 50th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.055 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Sulphate,	≤ 100 mg/ℓ 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Chloride	≤ 100 mg/ℓ 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity	Turbidity	≥0.4 m 5th percentile
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/L O2 95th percentile
						Toxics	The dam must be managed to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominate with Chl *a* concentration higher than 30µg/ℓ must be kept at less than 20% of the time.
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	70% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl a concentrations must be maintained in a mesotrophic state.	Chl *a*	11-20µg/ℓ 50th percentile

Table 6: Resource Quality Objectives for RIVERS in priority Resource Units in the Integrated Unit of Analysis 5: ELANDS / VAALKOP

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
5: ELANDS/VAALKOP	II	Upper reaches of Elands to Swartruggens Dam A22A south eastern portion	5_1	C	Quantity	Low flows	EWR maintenance low and drought flows: Elands River at CROC_EWR10 in A22A NMAR = 10.1x10^{6}m^{3} REC=B/C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Rapid EWR site 10 on Elands River (monitoring during biological surveys)		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.038	0.015
									Nov	0.045	0.012
									Dec	0.050	0.011
									Jan	0.070	0.026
									Feb	0.094	0.031
									Mar	0.091	0.019
									Apr	0.073	0.015
									May	0.056	0.015
									Jun	0.051	0.019
									Jul	0.046	0.017
									Aug	0.042	0.016
									Sep	0.039	0.015
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 30 milligrams/litre (95th percentile)		
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 9.0 (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							A baseline assessment to determine the present state instream turbidity is required. Limits must be defined to control the impacts of slate mining on the resource.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	6-7 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity should be maintained for C ecological category.Habitat diversity for flow and marginal vegetation sensitive species must be maintained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained at a C ecological category. Protection of riparian habitat is required. Developments into riparian zone must be controlled and managed.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	The fish community must be maintained in a C ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecological category = C FRAI ≥ 62% Sample 20 BMOT in 20min sample effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C category ecological condition or improved upon.	Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 155 ASPT ≥ 5.5

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
						Diatoms	Diatom assemblage must be maintained within a C ecological category or improved upon	Specific Pollution Index	Diatom EC ≥ 62%		
		Elands downstream Swartruggens Dam to Lindleyspoort Dam (A22A)	**5_2**		Quantity	Low flows	EWR maintenance low and drought flows: Elands River at A2H107 in A22A NMAR = 12.87x10^{6}m^3 REC=C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows Monitoring of Elands River at A2H107		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.030	0.016
									Nov	0.037	0.014
									Dec	0.044	0.013
									Jan	0.063	0.028
									Feb	0.083	0.009
									Mar	0.081	0.018
									Apr	0.064	0.016
									May	0.047	0.018
									Jun	0.042	0.019
									Jul	0.036	0.018
									Aug	0.033	0.018
									Sep	0.030	0.016
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Control of wastewater treatment works discharges discharges is required.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Control of land based impacts and WWTW discharges is required.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 80 milligrams/litre (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Chloride	≤ 40 milligrams/litre (95th percentile)
								Sodium	≤ 70 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 9.0 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	6-7 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity should be maintained for C ecological category or improved upon.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained at C ecological category or better condition.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Semi aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C category ecological condition or improved upon.	Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	Macroinvertebrate EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 5.3
						Diatoms	Diatom assemblage must be maintained within a C/D ecological category or improved upon	Specific Pollution Index	Diatom EC ≥ 58%
		Lindleyspoort Dam (A22A)	**5_3**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphates,	≤ 0.015 mg/ℓ 50th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.055 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity	Turbidity	≥0.4 m 5th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	90% riparian vegetation cover
					Biota	Periphyton/ Phytoplankton	The Chl *a* concentrations must be maintained in a mesotrophic state.	Chl *a*	11-20µg/ℓ 50th percentile
		Upper Koster River to Koster Dam (A22B)	**5_4**		Quantity	Low flows	EWR maintenance low and drought flows: Koster River at A2H036 in A22B NMAR = 2.54x10^{6}m^{3} REC=C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows Monitoring of Koster River at A2H036	See table below
					Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.05 milligrams/litre (50th percentile)

	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
Oct	0.006	0.002
Nov	0.004	0.002
Dec	0.006	0.001
Jan	0.009	0.004
Feb	0.020	0.005
Mar	0.032	0.006
Apr	0.031	0.007
May	0.018	0.006
Jun	0.015	0.006
Jul	0.012	0.005
Aug	0.010	0.004
Sep	0.008	0.003

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Salts	Instream salinity must be maintained at current status to ensure protection of good ecological integrity or resource.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)
								Sodium	≤ 20 milligrams/litre (95th percentile)
								Sulphate	≤ 20 milligrams/litre (95th percentile)
								Chloride	≤ 20 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.0 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	6-7 milligrams/litre (mg/l)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Toxics	The concentrations of toxins must not toxic to aquatic organisms and a threat to human health	Hormone driven Pharmaceuticals	17ß-oestradiol: ≤ 0.001 mglℓ
					Biota	Fish	Fish community should be maintained at the prescribed C ecological category. Flow should adequate to support representative species.	Fish Response Assessment Index (FRAI).	Fish ecology category = C FRAI ≥ 62% Sample 20 BMOT in 20min sample effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C category ecological condition or improved upon.	Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 70 ASPT ≥ 4.2
		Selons River, Koedoespruit, Dwarsspruit, lower Koster River (A22C, A22D)	**5_6**		Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
						Salts	Instream concentration of salinity must be maintained to preserve present state and to sustain aquatic ecosystem health in the prescribed ecological category is met.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)
								Sodium	≤ 20 milligrams/litre (95th percentile)
								Sulphate	≤ 20 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.0 (5th percentile) and 8.5 (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		
		Elands River outflow Lindleyspoort Dam to inflow Vaalkop Dam, Brakkloofspruit, Roosspruit, Sandspruit Mankwe. Leragane, Molapongwamongana (A22E, A22F)	**5_7**		Quantity			Chloride	≤ 20 milligrams/litre (95th percentile)	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
										0.038	0.011
									Nov	0.048	0.014
									Dec	0.057	0.016
									Jan	0.081	0.023
									Feb	0.107	0.012
									Mar	0.105	0.027
									Apr	0.082	0.023
									May	0.06	0.017
									Jun	0.054	0.016
									Jul	0.047	0.014
									Aug	0.042	0.012
									Sep	0.038	0.011
					Quality	Nutrients	Nutrient levels are high and must be reduced to meet the requirements of the aquatic ecosystem. Concentrations must be reduced to meet the prescribed C ecological category.	Orthophosphate (PO_4^-) as Phosphorus			
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 2.0 milligrams/litre (50th percentile)		
						Salts	Salinity levels are significantly high. Instream salinity must be improved to support the aquatic ecosystem and the water quality requirements of the water users. Water quality must be improved to a C ecological category.	Electrical Conductivity	≤ 85 milliSiemens/metre (mS/m) (95th percentile)		
								Sodium	≤ 100 milligrams/litre (95th percentile)		
								Sulphate	≤ 120 milligrams/litre (95th percentile)		
								Chloride	≤ 120 milligrams/litre (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.0 (5th percentile) and 9.0 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained in a C ecological category or better. Important to maintain marginal vegetation and in-stream substrate (flow depth classes) for fish and macroinvertebrate diversity.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model, Geomorphic Assessment Index	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained at a C ecological category. Alien vegetation control is required. Riparian zone development must be limited.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 70%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Fish	The fish community must be maintained in a D ecological category or better. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI).	Fish ecology category = D FRAI ≥ 42% Sample minimum of 4 species per 20min sample effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C category ecological condition or improved upon.	Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 110 ASPT ≥ 4.5
						Diatoms	Diatom assemblage must be maintained within a C ecological category or improved upon.	Specific Pollution Index	Diatom EC ≥ 62%
						Semi-aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.

Table 7: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 6a: KLEIN MARICO / KROMELLEMBOOG

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
6a: KLEIN MARICO/KROMELLEMBOOG	II	Upper Klein Marico to inflow, Klein Maricopoort Dam, Rhenosterspruit, Malmaniesloop, Kareespruit (A31D)	6_1	B/C	Quantity	Low flows	EWR maintenance low and drought flows: Klein Marico River just upstream of Klein Maricopoort Dam in A31D NMAR = 16.25x10^{6}m^3 REC=C/D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows Monitoring of Klein Marico River with biological surveys		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.038	0.035
									Nov	0.039	0.036
									Dec	0.039	0.036
									Jan	0.041	0.038
									Feb	0.048	0.045
									Mar	0.044	0.040
									Apr	0.045	0.041
									May	0.042	0.039
									Jun	0.043	0.039
									Jul	0.041	0.038
									Aug	0.040	0.037
									Sep	0.041	0.037
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 80 milligrams/litre (95th percentile)		
								Chloride	≤ 40 milligrams/litre (95th percentile)		
								Sodium	≤ 70 milligrams/litre (95th percentile)		
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.0 (5th percentile) and 9.0 (95th percentile)		

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IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Fluoride	≤ 2.5 milligrams/litre (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained in a C/D ecological category. Maintain marginal vegetation and in-stream substrate (velocity depth classes) for fish and macroinvertebrate diversity.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Riparian vegetation should be improved from a D ecological category to a C/D ecological category. Alien vegetation control must be implemented. Riparian zone development must be limited and controlled.	Vegetation Response Assessment Index	VEGRAI EC = C/D ≥ 58%
		Klein Maricopoort Dam (A31D)	**6_2**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphates	≤ 0.025 mg/ℓ 50th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.050 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/L N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 65 mS/m 95th percentile
								Chloride	≤ 40 mg/ℓ 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli*	≤ 10 counts/100µℓ 95th percentile
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity with reading	Turbidity	≥0.4 m 5th percentile
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	50% riparian vegetation cover

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Periphyton/ Phytoplankton	The Chl a concentrations must be maintained in a mesotrophic state.	Chl *a*	11-20µg/ℓ 50th percentile
		Klein Marico downstream Klein Maricopoort Dam to Kromellenboog Dam, Wilgeboomspruit (A31E)	**6_3**		Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 65 milliSiemens/metre (mS/m) (95^{th} percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 9.0 (95^{th} percentile)
							Sedimentation must be controlled through management of land use practices. A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
					Habitat	Instream	Habitat diversity should be maintained in a C ecological category or better condition. Maintain marginal vegetation and in-stream substrate (velocity depth classes) for fish and macroinvertebrate diversity.	Index of Habitat Integrity	Instream Habitat Integrity EC =C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained in a C ecological category or better condition.	Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Fish	Fish community must be maintained within a C ecological condition or improved upon.	Fish Response Assessment Index (FRAI)	Fish ecological category = C FRAI ≥ 62% Collect 5 species in 20min sampling effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological condition or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	Macroinvertebrate EC = C ≥ 62% SASS ≥ 130 ASPT ≥ 5.0
		Kromellenboog Dam (A31E)	**6_4**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphates	≤ 0.015 mg/ℓ 50th percentile
							Concentration of total phosphorous must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.025 mg/ℓ 50 th percentile
							Concentration of nitrate & nitrite must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/ℓ N 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile
						Pathogens	Pathogens should be maintained at levels safe for human use.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained at within limits specified to support the aquatic ecosystem in the dam.	pH	6.5 – 9.0 95th percentile
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	50% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentrations must be maintained in a mesotrophic state.	Chl *a*	11-20µg/ℓ 50th percentile

Table 8: Resource Quality Objectives for RIVERS in priority Resource Units in the Integrated Unit of Analysis 6b: GROOT MARICO / MARICO BOSVELD DAM

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
6b: GROOT MARICO/MARICO BOSVELD DAM	II	Groot Marico main stem upstream to Polkadraaispruit confluence (A31B)	6_5	B	Quantity	Low flows	EWR maintenance low and drought flows: Groot Marico River at MAR_EWR2 in A31B NMAR = 42.08x10^{6}m^{3} REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows Monitoring of Groot Marico River at planned new weir close to EWR2		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.510	0.268
									Nov	0.540	0.283
									Dec	0.560	0.291
									Jan	0.620	0.319
									Feb	0.710	0.364
									Mar	0.637	0.327
									Apr	0.628	0.324
									May	0.584	0.302
									Jun	0.588	0.305
									Jul	0.557	0.290
									Aug	0.547	0.285
									Sep	0.546	0.285
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.020 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 10 milligrams/litre (95th percentile)		
								Chloride	≤ 10 milligrams/litre (95th percentile)		
								Sodium	≤ 10 milligrams/litre (95th percentile)		
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.8 (95th percentile)		
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	≥ 7 milligrams/litre (mg/l)
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0057 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0048 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity must be maintained in a B ecological category or better condition. Maintain marginal vegetation and in-stream substrate (velocity depth classes) for fish and macroinvertebrate diversity.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation must be maintained in a B ecological category or better condition.	Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	The fish community must be maintained in a B ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.Habitat and flow must be adequate for flow dependent species.	Fish Response Assessment Index (FRAI).	Fish ecology category = B FRAI ≥ 82% Sample 20 *BMOT*, 30 *CPRE* and 15 *AURA* in 20min sample effort.

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within current state at the A/B ecological category.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = A/B ≥ 88% SASS ≥ 220 ASPT ≥ 6.5 (Site EWR 2 = A3GMAR-KOEDO)
						Diatoms	Diatom assemblage must be maintained within a largely natural to natural condition.	Specific Pollution Index	Diatom EC ≥ 88%
		Polkadraaispruit (A31B)	**6_6**		Quantity	Low flows	EWR maintenance low and drought flows: Polkadraaispruit at MAR_EWR6 in A31B NMAR = 9.866x10^{6}m^{3} REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows Monitoring of discharge of the Polkadraaispruit during biological surveys	See table below
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.020 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 10 milligrams/litre (95th percentile)
								Chloride	≤ 10 milligrams/litre (95th percentile)
								Sodium	≤ 10 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)

	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
Oct	0.088	0.000
Nov	0.099	0.003
Dec	0.113	0.003
Jan	0.138	0.024
Feb	0.157	0.010
Mar	0.130	0.007
Apr	0.118	0.005
May	0.104	0.003
Jun	0.105	0.002
Jul	0.098	0.000
Aug	0.095	0.000
Sep	0.095	0.000

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.8 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	≥ 7 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity must be improved from a B/C ecological category to a B category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation should be improved from a B/C ecological category to a B ecological category. Protection of riparian habitat is required.	Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	The fish community must be maintained in a B/C ecological category or better condition. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = B/C FRAI ≥ 78%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within current state at the B/C ecological category.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = B/C ≥ 78% SASS ≥ 155 ASPT ≥ 6.0
		Groot Marico from Polkadraaispruit confluence to N4 bridge (A31B)	**6_7**		Quantity	Low flows	EWR maintenance low and drought flows: Groot Marico River at N4 road bridge in A31B NMAR = 56.92x10^{6}m^3 REC=B category The maintenance low flows and drought flows must be attained to	Base Flows Maintenance flows and drought flows. Monitoring of discharge of Groot Marico River during biological surveys	Maintenance Low flows (m^3/s) / Drought flows (m^3/s) Oct 0.649 / 0.345 Nov 0.704 / 0.372 Dec 0.762 / 0.398 Jan 0.890 / 0.458 Feb 1.030 / 0.513 Mar 0.908 / 0.466

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
							support the aquatic ecosystem and the downstream users.		Apr	0.864	0.447
									May	0.783	0.408
									Jun	0.779	0.407
									Jul	0.730	0.383
									Aug	0.709	0.373
									Sep	0.701	0.370
					Quality	Nutrients	Instream concentration of nutrients as specified must be improved to sustain aquatic ecosystem health in the prescribed ecological category and to support downstream users. Wastewater discharges must be controlled to protect the ecological integrity of the system.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as must be improved to sustain aquatic ecosystem health in the prescribed ecological category and to support downstream users. Wastewater discharges and land use impacts must be controlled to protect the ecological integrity of the system.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 50 milligrams/litre (95th percentile)		
								Chloride	≤ 40 milligrams/litre (95th percentile)		
								Sodium	≤ 50 milligrams/litre (95th percentile)		
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)		
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		
							Dissolved oxygen levels must be improved to support the aquatic ecosystem.	Dissolved oxygen	≥ 7 milligrams/litre (mg/l)		
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)		
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0057 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0048 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be improved improved from a D ecological category to a C ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be improved from a D ecological category to a C ecological category.	Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	The fish community must be maintained in a C/D ecological category or better condition. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Indicator species *certain BMOT, AURA, CPRE, AMOS*
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within current state at a B ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = B ≥ 82% SASS ≥ 210 ASPT ≥ 6.2 (Site A3GMAR-WONDE)
						Diatoms	Diatom assemblage must be maintained within a natural to largely natural condition.	Specific Pollution Index	Diatom EC = A/B ≥ 88% (Site A3GMAR-WONDE)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
		Marico Bosveld Dam (A31B)	**6_8**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphates	≤ 0.015 mg/ℓ 50th percentile
							Concentration of total phosphorous must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.025 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 35 mS/m 95th percentile
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	50% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentrations must be maintained in a mesotrophic state.	Chl *a*	11-20µg/ℓ 50th percentile

Table 9: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 7: KAALOOG-SE-LOOP

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
7: KAALOOG-SE-LOOP	I	**Marico Eye,** **Kaaloog-se-Loop,** **Bokkraal se Loop** **Rietspruit** **Ribbokfontein-se-Loop** **Rietfontein** **Bronkhorstfontein** **Zyferfontein (Kuilfontein) Syferfontein**	7_1	B	Quantity	Low flows	EWR maintenance low and drought flows: Kaaloog-se-Loop at MAR_EWR1 in A31A NMAR = 10.539x10^{6}m^{3} REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base flows Maintenance flows and drought flows. Monitoring of discharge at EWR site during biological surveys and downstream at the new planned weir.		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.244	0.159
									Nov	0.252	0.164
									Dec	0.245	0.160
									Jan	0.250	0.162
									Feb	0.280	0.182
									Mar	0.254	0.165
									Apr	0.262	0.170
									May	0.253	0.164
									Jun	0.261	0.170
									Jul	0.252	0.164
									Aug	0.252	0.163
									Sep	0.257	0.167

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
		(A31A)			Quality	Salts	Pristine water quality status must be maintained. No deterioration in water quality should be permitted. Instream salinity must be maintained to ensure the ecological integrity of the resource unit remains intact.	Electrical Conductivity	≤ 50 milliSiemens/metre (mS/m) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained within a B ecological category or better condition.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model	Instream Habitat Integrity EC = B ≥ 25%
						Riparian habitat	Riparian vegetation should be maintained within a B ecological category or better condition.	Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	The fish community must be maintained in a B ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI).	Fish ecology category = B FRAI ≥ 82%
						Aquatic invertebrates	Macroinvertebrate assemblage must be maintained within the current state at a A/B ecological category.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = A/B ≥ 88% SASS ≥ 220 ASPT ≥ 6.4 (Site A3KAAL-RIETS)
						Diatoms	Diatom assemblage must be maintained within a largely natural to natural condition.	Specific Pollution Index	Diatom EC ≥ 88%

Table 10: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 8: MALMANIESLOOP

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
8: MALMANIESLOOP	III	Malmanies-loop (A31C)	8_1	-	Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and to maintain the water quality present ecological state.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity must be maintained to support the aquatic ecosystem and maintain the water quality present ecological state.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95^{th} percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem nd use requirements of water users.	pH range	6.5 (5^{th} percentile) and 8.5 (95^{th} percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
					Habitat	Wetland Vegetation	Refer to wetland RQOs, habitat is part of the wetland system.		
					Biota	Fish	The fish community must be maintained in a C ecological category or better condition. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Control and remove alien invasive fish species MSAL. Prevent spreading of the alien species.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Sample 10 *BMOT* in 20min sample effort

Table 11: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 9: MOLOPO

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
9: MOLOPO	II	**Bodibe eye** **D41A (Polfonteinspruit and Lotlhakane tributary catchment area)**	**9_1**	**C**	Refer to Groundwater RQOs				
		Molopo Eye, Grootfontein Eye, Molopo headwaters to inflow Setumo/Modimola Dam **D41A**	**9_2**		Quantity	Flows	Groundwater related (Molopo and Grootfontein Eye)		
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and to support downstream users. Improvement in salinity concentrations is required.	Electrical Conductivity	≤ 75 milliSiemens/metre (mS/m) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem nd use requirements of water users.	pH range	6.5 (5^{th} percentile) and 8.8 (95^{th} percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
					Habitat	Instream	Refer to wetland RQOs, habitat is part of the wetland system.		
						Wetland Vegetation			
					Biota	Fish	Fish community should be improved from an E ecological category to a D category.	Fish Response Assessment Index (FRAI).	Fish ecology category = D FRAI ≥ 42% Sample 3 species, including *BBRI* in 20min survey. Sample 15 *PPHI* in 20min
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category (largely modified condition) or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = D ≥ 42% SASS ≥ 80 ASPT ≥ 4.0
		Molopo River main stem from Modimola Dam to Disaneng Dam D41A (main stem)	**9_3**		Habitat	Instream	Habitat diversity must be improved from an E ecological category to a D category. Improve runoff water into the system to improve to D ecological category. Control siltation and organic material.	Index of Habitat Integrity	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Riparian vegetation must be improved from an E ecological category to a D category. Alien invasive species must be	Vegetation Response Assessment Index	VEGRAI EC = D ≥ 42%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							controlled. Riparian zone must be rehabilitated.		
		Modimola (Setumo) Dam (D41A)	**9_4**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system. Improvement required from hypertrophic state.	Orthophosphates	≤ 0.050 mg/ℓ 50th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total phosphorous	≤ 0.055 mg/ℓ 50th percentile
							Concentration nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Nitrite& Nitrate	≤ 0.70 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 85 mS/m 95th percentile
							The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Chloride	≤ 100 mg/ℓ 95th percentile
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity with reading ≥0.4 m	Turbidity	Minimum 95th percentile
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/L O_2 95th percentile
						Toxics	The dam must be managed within a eutrophic state to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominance with Chl a concentration higher than 30µg/ℓ must be kept at less than 20% of the time.

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	50% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentration must be maintained in a eutrophic state.	Chl *a*	20-30µg/ℓ 50th percentile
		Disaneng Dam (D41A)	**9_5**		Quantity	Dam levels	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphates	≤ 0.010 mg/ℓ 50th percentile
							Concentration of total phosphorous must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.025 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Nitrite& Nitrate	≤ 0.70 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 75 mS/m 95th percentile
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-	Riparian vegetation Health	70% riparian vegetation cover

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.		
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/Phytoplankton	The Chl *a* concentration must be maintained in a mesotrophic state.	Chl *a*	11-20µg/ℓ 50th percentile

Table 12: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 10: DINOKANA EYE / NGOTWANE DAM

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
10: DINOKANA EYE/NGOTWANE DAM	**III**	**Upper Ngotwane, Dinokana Eye (A10A)**	**10_1**	**-**	Habitat	Instream	Ensure recommended "low flows" maintained to sustain the ecosystem in a B/C ecological category. Flow should be adequate to ensure habitats for flow dependent species and taxa.	Index of Habitat Integrity	Instream Habitat Integrity EC = B/C ≥ 82%
					Biota	Fish	Fish community should be improved from a D ecological category to a C/D category.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Sample at least 8 species in 20min sample effort. Sample 10 *AJOH*, 10 *CFLA* and 15 *BMOT* in 20min sample effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within B/C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC= B/C ≥ 78% SASS ≥ 180 ASPT ≥ 6.2 (Site A1NGOT-DINOK)
						Diatoms	Diatom assemblage must be maintained within a natural to largely natural condition.	Specific Pollution Index	Diatom EC ≥ 88%

Table 13: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 11a: GROOT MARICO / MOLATEDI DAM

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
11a: GROOT MARICO / MOLATEDI DAM	III	Groot Marico from outflow Marico Bosveld Dam to Molatedi Dam, All tributaries (A31G, A31H, A31F, A31J, A32A, A32B, A32C)	11a_1	C/D	Quantity	Low flows	EWR maintenance low and drought flows: Groot Marico River at MAR_EWR3 in A31F NMAR = 65.0839x10^{6}m^3 REC=C/D category The maintenance low flows and drought flows must be attained to support the ecological requirement and downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of Groot Marico River at A3H029		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.248	0.196
									Nov	0.262	0.206
									Dec	0.266	0.209
									Jan	0.284	0.223
									Feb	0.318	0.250
									Mar	0.281	0.221
									Apr	0.278	0.219
									May	0.262	0.207
									Jun	0.268	0.211
									Jul	0.258	0.203
									Aug	0.256	0.202
									Sep	0.260	0.205
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.090 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 50 milligrams/litre (95th percentile)		
								Chloride	≤ 40 milligrams/litre (95th percentile)		
								Sodium	≤ 50 milligrams/litre (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements. A baseline assessment to determine the present state instream turbidity is required.	pH range	6.5 (5th percentile) and 8.8 (95th percentile)		
								Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Habitat	Instream	Habitat diversity should be maintained in a C/D ecological category. Runoff resulting in organic pollution and bacterial pollution of the resource must be managed.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Riparian vegetation should be maintained in a C/D ecological category. Alien invasive vegetation must be controlled and development into the riparian zone must be limited.	Vegetation Response Assessment Index	VEGRAI EC = C/D ≥ 58%
					Biota	Fish	The fish community must be maintained in a D ecological category or improved upon. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42% Collect 10+ species in 20min sampling effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 5.5
						Diatoms	Diatom assemblage must be maintained within a natural to largely natural condition.	Specific Pollution Index	Diatom EC = A/B ≥ 88%
						Semi-Aquatic Biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management. Riparian zone habitat must be improved.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
		Molatedi Dam (A32A, A32B, A32C)	**11a_2**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Orthophosphates	≤ 0.015 mg/ℓ 50th percentile
							Concentration of total phosphorous must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Total phosphorous	≤ 0.055 mg/ℓ 50th percentile
							Concentration of nitrate & nitrite must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a mesotrophic system.	Nitrite& Nitrate	≤ 0.70 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 55 mS/m 95th percentile
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/ℓ O2 95th percentile
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	50% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentration must be maintained in a mesotrophic state.	Chl a	11-20µg/ℓ 50th percentile

Table 14: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 11b: GROOT MARICO / SEASONAL TRIBUTARIES

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
11b: GROOT MARICO / SEASONAL TRIBUTARIES	III	Groot Marico, Rasweu, Maselaje (A32D)	11b_1	C	Quantity	Low flows	EWR maintenance low and drought flows: Groot Marico River at MAR_EWR4 in A32D NMAR = 153.25x10^{6}m^3 REC=C category 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.	Base Flows Maintenance flows and drought flows Monitoring of Groor Marico River at A3H007		Maintenance High flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.214	0.173
									Nov	0.230	0.185
									Dec	0.239	0.191
									Jan	0.264	0.209
									Feb	0.306	0.242
									Mar	0.267	0.211
									Apr	0.258	0.206
									May	0.234	0.187
									Jun	0.236	0.189
									Jul	0.227	0.182
									Aug	0.224	0.180
									Sep	0.226	0.182
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.090 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)		
					Habitat	Instream	Habitat diversity should be maintained within a C ecological category. A natural flow pattern must be maintained. Improve instream habitat and velocity/depth for aquatic biota diversity. Connectivity to downstream to (11b_2) must be achieved,	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%		

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IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Riparian habitat	Riparian vegetation should be maintained within a C ecological category. Impacts including grazing/trampling of riparian zone must be controlled. Management of siltation required.	Index of Habitat Integrity	VEGRAI EC = C ≥ 62%
					Biota	Fish	The fish community must be maintained in a C/D ecological category or better. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Fishways must be built for migratory species as currently there is no connectivity over numerous weirs.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Sample 8+ species per sample survey Indicator species: *BMAR, LMOL, SZAM*
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 4.8
						Diatoms	Diatom assemblage must be maintained within a moderately modified condition or improved upon.	Specific Pollution Index	Diatom EC ≥ 62%
		Elandslaagtespruit, Lengope la Kgamanyane, Lenkwane (A32E)	**11b_2**		Wetland RQOs applicable				

Table 15: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 12: BIERSPRUIT

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
12: BIERSPRUIT	III	Wilgespruit, Bofule, Kolobeng, Magoditshane, Motlhabe (A24D)	12_1	D	Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.090 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95^{th} percentile)
								Sulphate	≤ 80 milligrams/litre (95^{th} percentile)
								Chloride	≤ 40 milligrams/litre (95^{th} percentile)
								Sodium	≤ 70 milligrams/litre (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.0 (5^{th} percentile) and 8.5 (95^{th} percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.105 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)
					Habitat	Instream	Habitat diversity should be improved from a D ecological category to a C ecological category. Maintain natural flow regime. Improve instream habitat and velocity/depth for fish diversity.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be improved from a D ecological category to a C ecological category. Improve riparian zone. Remove alien vegetation.	Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	Fish community should be improved from a D ecological category to a C/D category. Maintain natural flow regime. Improve instream habitat and velocity/depth for fish diversity.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Sample at least 10+ species in 20min effort Indicator species: *AJOH, LCYL, BMAR, MBRE*
		Bierspruit outflow Bierspruit Dam to confluence with the Crocodile River, Brakspruit, Phufane, Sefatlhane, Lesobeng (A24E, A24F)	**12_2**		Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.125 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)
						Salts	Instream salinity must be maintained at acceptable levels to support a healthy aquatic ecosystem and the water quality requirements of water users. Concentrations should not be allowed to deteriorate.	Electrical conductivity (EC)	≤ 85 milliSiemens/metre (mS/m) (95thpercentile)
								Sulphate (SO_4)	≤ 100 milligrams/litre (95th percentile)
								Sodium (Na)	≤ 100 milligrams/litre (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Chloride (Cl)	≤ 100 milligrams/litre (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.0 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
						Pathogens	The presence of pathogens should pose a low risk to human health.	*Escherichia coli* (*E. coli*)	130 counts/100 millilitres (ml) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Habitat	Instream	Habitat diversity should be maintained within a D ecological category. Maintain natural flow regime. Improve instream habitat and velocity/depth for fish and macroinvertebrate diversity.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Riparian vegetation should be maintained within a D ecological category. Development into the riparian zone must be controlled and limited. Siltation impacts must be managed.	Vegetation Response Assessment Index	VEGRAI EC = D ≥ 42%
					Biota	Fish	Fish community should be maintained within a D ecological category or improved upon. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42% Collect 4+ species in 20min sampling effort.

Table 16: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 13: LOWER CROCODILE

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
13: LOWER CROCODILE	III	Crocodile outflow Roodekopjes Dam to Sand river confluence, Sleepfontein-spruit, Klipspruit tributaries (A21L, A24A, A24B, A24C)	13_1	C/D	Quantity	Low flows	EWR maintenance low and drought flows: Crocodile River at CROC_EWR7 in A24C NMAR = 463.4x10^{6}m^3 REC=D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of Crocodile River at A2H132		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	1.134	1.134
									Nov	1.362	1.362
									Dec	1.481	1.481
									Jan	1.938	1.938
									Feb	2.638	2.488
									Mar	2.481	2.481
									Apr	2.118	2.118
									May	1.745	1.745
									Jun	1.574	1.574
									Jul	1.389	1.389
									Aug	1.262	1.262
									Sep	1.172	1.172
						High flows	EWR high flows: Crocodile River at CROC_EWR7 in A24C NMAR = 463.4x10^{6}m^3 REC=D category High flows must be attained as specified to support aquatic ecostem requirements.	Floods High flow also specified as individual flood requirements in terms of size and duration (See Appendix A)		High flows (m^3/s)	
									Oct	0	
									Nov	0.790	
									Dec	1.529	
									Jan	0	
									Feb	1.270	
									Mar	0	
									Apr	0.790	
									May	0	

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit	
								Monitoring of Crocodile River at A2H132	Jun	0
									Jul	0
									Aug	0
									Sep	0
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.060 milligrams/litre (mg/l) (50th percentile)	
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)	
						Salts	Instream salinity must be maintained at the levels specified to support a healthy aquatic ecosystem and the water quality requirements of water users. Concentrations should not be allowed to deteriorate.	Electrical conductivity (EC)	≤ 85 milliSiemens/metre (mS/m) (95thpercentile)	
								Sulphate (SO_4)	≤ 100 milligrams/litre (95th percentile)	
								Sodium (Na)	≤ 80 milligrams/litre (95th percentile)	
								Chloride (Cl)	≤ 80 milligrams/litre (95th percentile)	
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)	
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)	
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.	
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)	

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
								Metolachlor	≤0.30 milligrams/litre (mg/l)
								Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.3 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0073 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
								Aluminium (Al)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained within a D ecological category or better condition. Maintain good low flows to sustain habitat for substrate and habitat sensitive species and taxa.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = D ≥ 42%
						Riparian habitat	Rehabilitation/remediation required. Indigenous vegetation must be protected (unique *Acacia galpinii* (Monkey thorn). Riparian vegetation should be maintained within a D ecological category or better condition. Maintain riparian zone in cultivated areas. Control development.	Vegetation Response Assessment Index	VEGRAI EC = D ≥ 42%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Fish	Fish community should be maintained within a D ecological category or better condition. Flow velocity/depth must be adequate for flow sensitive species *CPRE* and *LMOL* and habitat sensitive species – *AJOH.*	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42% Sample 6+ species per sample effort Indicator species *Sensitive fish species. Course substrate, CPRE, LMOL*
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5)	MIRAI EC = D ≥ 42% SASS ≥ 60 ASPT ≥ 4.5 (Site A2CROC-KOEDO)
		Sand River to confluence with Crocodile River (A24G, A24H)	**13_2**		Quantity	Lows flows	EWR maintenance low and drought flows: Sand River upstream of Sondags River confluence at S24.6289, E27.6223 in A24H NMAR = 26.56x10^{6}m^3 REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base flows Maintenance flows and drought flows. Monitoring of discharge of the Sand River during biological surveys	
						High flows	EWR high flows: Sand River Monitoring of discharge of the Sand River during biological surveys at S24.6289, E27.6223 in A24H NMAR = 26.56x10^{6}m^3 REC=B category High flows must be attained to ensure freshets for fish communities.	Freshets for fish High flow also specified as individual flood requirements in terms of size and duration (see Appendix A)	

	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
Oct	0.085	0.042
Nov	0.104	0.024
Dec	0.120	0.021
Jan	0.196	0.063
Feb	0.263	0.105
Mar	0.199	0.055
Apr	0.158	0.071
May	0.127	0.059
Jun	0.119	0.056
Jul	0.108	0.051
Aug	0.098	0.047
Sep	0.089	0.044

	High flows (m^3/s)
Oct	0.009
Nov	0.056
Dec	0.090
Jan	0.181
Feb	0.500
Mar	0.181
Apr	0.093
May	0
Jun	0
Jul	0
Aug	0
Sep	0

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Quality	Nutrients Salts	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.020 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50^{th} percentile)
								Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95^{th} percentile)
								Sulphate	≤ 20 milligrams/litre (95^{th} percentile)
								Chloride	≤ 20 milligrams/litre (95^{th} percentile)
					Habitat	Instream	Habitat diversity should be maintained within a B ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation should be maintained within a B ecological category or better condition.	Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	The fish community must be maintained in a B ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.Habitat and flow must be adequate for *seasonal* flow dependent species, *CPAR*.	Fish Response Assessment Index (FRAI)	Fish ecology category = B FRAI ≥ 82%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 100 ASPT ≥ 5.5 (Site A2SUND-WATER)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
		Lower Crocodile from Bierspruit to the Botswana border (Limpopo River) (A24J)	**13_3**		Quantity	Low flows	EWR maintenance low and drought flows: Crocodile River at A2H128 in A24J NMAR = 565.16x10^{6}m^3 REC=C/D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of Crocodile River at A2H128		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	1.246	1.057
									Nov	1.454	1.228
									Dec	1.536	1.294
									Jan	1.932	1.616
									Feb	2.488	2.074
									Mar	2.128	1.776
									Apr	1.791	1.503
									May	1.548	1.303
									Jun	1.524	1.285
									Jul	1.425	1.203
									Aug	1.345	1.138
									Sep	1.287	1.091
						High flows	EWR high flows: Crocodile River at A2H128 in A24J NMAR = 565.16x10^{6}m^3 REC=C/D category High flows must be attained to ensure flood requirements for fish communities.	Floods High flow also specified as individual flood requirements in terms of size and duration (see Appendix A). Monitoring of Crocodile River at A2H128		High flows (m^3/s)	
									Oct	0	
									Nov	0.395	
									Dec	2.829	
									Jan	0	
									Feb	0.423	
									Mar	0	
									Apr	0	
									May	0	
									Jun	0	
									Jul	0	
									Aug	0	
									Sep	0	
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Concentrations should not be allowed to deteriorate.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.06 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50th percentile)		
						Salts	Instream salinity must be maintained at the levels specified to support a healthy aquatic ecosystem and the water quality requirements of water users. Concentrations should not be allowed to deteriorate.	Electrical conductivity (EC)	≤ 85 milliSiemens/metre (mS/m) (95thpercentile)		
								Sulphate (SO_4)	≤ 100 milligrams/litre (95th percentile)		
								Sodium (Na)	≤ 80 milligrams/litre (95th percentile)		
								Chloride (Cl)	≤ 100 milligrams/litre (95th percentile)		
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health	Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity should be improved from D ecological category to C/D ecological category. Maintain good low flows to sustain habitat for substrate and habitat sensitive species and taxa.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Indigenous vegetation must be protected (unique *Acacia galpinii* (Monkey thorn). Riparian vegetation should be improved from D ecological category to C/D ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C/D ≥ 58%
					Biota	Fish	Fish community should be maintained within a D ecological category. Flow velocity/depth must be maintained for *CPAR, MACU* and *LMOL*, and habitat sensitive species – *MMAC, BANN*.	Fish Response Assessment Index (FRAI)	Fish ecology category = D FRAI ≥ 42% Sample 6+ species per sample effort
						Semi-aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management. Maintain good riparian cover for otters.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Aquatic invertebrates	Macroinvertebrate assemblage must be maintained within a C/D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C/D ≥ 58% SASS ≥ 120 ASPT ≥ 5.0
						Diatoms	Diatom assemblage must be maintained within a largely modified condition or improved upon.	Specific Pollution Index	Diatom EC ≥ 42%

Table 17: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 14: TOLWANE / KULWANE / MORETELE / KLIPVOOR

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
14: TOLWANE / KULWANE / MORETELE / KLIPVOOR	III	Apies River, Tshwane tributary (A23F)	14_1	D	Quantity	Flows	A management strategy to manage the excesss water present (return flows) in the system must be developed. Suitable management options must be assessed. The benefits of reducing the flow must be determined.	Low flows	To be determined once the management strategy is developed
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.5 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 3.0 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical conductivity (EC)	≤ 80 milliSiemens/metre (mS/m) (95^{th}percentile)
								Sulphate (SO_4)	≤ 70 milligrams/litre (95^{th} percentile)
								Chloride (Cl)	≤ 75 milligrams/litre (95^{th} percentile)
								Sodium (Na)	≤ 80 milligrams/litre (95^{th} percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.5 (95^{th} percentile)

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IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
								Glyphosate	0.7 milligrams/litre (mg/l)
								Endosulfan	0.13 micrograms/litre (ug/l)
								Chromium (VI)	≤ 0.2 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0013 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Cb)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be improved to a D ecological category. Maintain good low flows to sustain habitat for substrate sensitive species (*BMAR, BUNI)* and taxa.	Index of Habitat Integrity	Instream Habitat Integrity EC = D ≥ 42% (site below confluence of Apies and Tshwane)
						Riparian habitat	Riparian vegetation should be maintained within a D ecological category or better condition. Maintain riparian zone in cultivated (subsistence) areas.	Vegetation Response Assessment Index	VEGRAI EC = D ≥ 42%
		Pienaars River from Boekenshout confluence to Apies River confluence (A23C)	**14_2**		Quantity	Flows	A management strategy to manage the excess water present (return flows) in the system must be developed. Suitable management options must be assessed. The benefits of reducing the flow must be determined.	Low flows	To be determined once the management strategy is developed
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.090 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50^{th} percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 50 milligrams/litre (95th percentile)
								Chloride	≤ 50 milligrams/litre (95th percentile)
								Sodium	≤ 70 milligrams/litre (95th percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0095 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.00735 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity should be maintained within a C ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be maintained within a C ecological category. Remediation of riparian zone along Boekenshout required. Sand mining must be controlled.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Fish	The fish community must be maintained in a C ecological category or better. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Flow velocity/depth must be maintained for fish species – *CPAR* and *LMOL* and habitat sensitive species – *AKAT* that are likely to be present in the wetlands.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Sample 10 *CPAR* and 10 *LMOL* in 20min effort
						Semi-Aquatic Biota	Habitat in Moretele Floodplain must be maintained. The stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management. Maintain good riparian cover for otters. Maintain riparian zone as important bird habitat.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
		Plat River (A23G)	**14_3**		Quantity	Low flows	EWR maintenance low and drought flows: Plat River at A2H064 in A23G NMAR = 9.64x10^{6}m^3 REC=C/D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows Monitoring of Plat River at A2H064	
									Maintenance Low flows (m^3/s) / Drought flows (m^3/s)
									Oct 0.021 / 0.012
									Nov 0.023 / 0.012
									Dec 0.023 / 0.013
									Jan 0.025 / 0.014
									Feb 0.030 / 0.016
									Mar 0.027 / 0.015
									Apr 0.027 / 0.014
									May 0.025 / 0.013
									Jun 0.025 / 0.014
									Jul 0.024 / 0.013
									Aug 0.024 / 0.013
									Sep 0.023 / 0.012
					Habitat	Instream	Habitat diversity should be improved from a D ecological category to a C/D category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Riparian vegetation should be improved from a D ecological category to a C/D category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C/D ≥ 58%
					Biota	Fish	Fish community should be improved from a D ecological category to a C/D category. Maintain flow velocity/depth for fish species *LCYL* and *LMOL* and habitat sensitive species, *MBRE* and *BBR*. Isolated populations of *CTHE* in upper reaches of river must also be maintained.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Sample 2 or 3 *CTHE* and 10 *LMOL* in 20min effort (Site A2PLAT-KOMAN)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 6.0 (Site A2PLAT-KOMAN)
		Moretele (Pienaars) River from Plat River confluence to Klipvoor Dam, Kutswane to Klipvoor Dam (A23J)	**14_4**		Quantity	Flows	A management strategy to manage the excesss water present (return flows) in the system must be developed. Suitable management options must be assessed. The benefits of reducing the flow must be determined.	Low flows	To be determined once the management strategy is developed
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.5 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 3.0 milligrams/litre (50^{th} percentile)
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 85 milliSiemens/metre (mS/m) (95^{th} percentile)
								Sulphate (SO_4)	≤ 70 milligrams/litre (95^{th} percentile)
								Chloride (Cl)	≤ 75 milligrams/litre (95^{th} percentile)
								Sodium (Na)	≤ 80 milligrams/litre (95^{th} percentile)
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.5 (95^{th} percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
		Klipvoor Dam (A23J)	**14_6**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Quality	Nutrients	Concentration of orthophosphate must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Orthophosphate	≤ 0.05 mg/ℓ 50th percentile
							Concentration of total phosphorous must be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total phosphorous	≤ 0.130 mg/ℓ 50th percentile
							Concentration of total Ammonia as Nmust be improved to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as a eutrophic system.	Total Ammonia	≤ 0.072 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 75 mS/m 95th percentile
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity	Turbidity	≥0.4 m 5th percentile
							Moderate change	Temperature	No more than 2 °C increasing change in both minimum and maximum
							The oxygen levels in the system must maintain the ecological system.	Dissolved Oxygen	≥ 7.0 mg/ℓ O_2 95th percentile
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)
						Toxics	The dam must be managed to minimize the development of toxic cyanobacterial blooms	Cyanobacteria	Cyanobacterial dominate with Chl *a* concentration higher than 30µg/ℓ must be kept at less than 20% of the time.
							The river water should not be toxic to aquatic organisms or be a threat to human health.	Pesticides	Cyanide: ≤ 110 µg/ℓ Endosulfan: ≤ 20 µg/ℓ Atrazine: ≤ 100 µg/ℓ 95th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic and semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	90% riparian vegetation cover		
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.		
						Periphyton/ Phytoplankton	The Chl a concentration must be maintained in a eutrophic state.	Chl a	20-30µg/ℓ 50th percentile		
		Moretele River from Klipvoor Dam to Crocodile River , Tolwane (A23K, A23L)	**14_7**		Quantity	Low Flows	EWR maintenance low and drought flows: Moretele/ Pienaars River at CROC_EWR5 in A23J NMAR = 113.0x$10^6$$m^3$ REC=D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base flows Maintenance flows and drought flows Monitoring of Pienaars River at A2H106		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.162	0.159
									Nov	0.210	0.206
									Dec	0.230	0.226
									Jan	0.303	0.298
									Feb	0.356	0.351
									Mar	0.309	0.304
									Apr	0.260	0.256
									May	0.220	0.216
									Jun	0.208	0.205
									Jul	0.188	0.185
									Aug	0.174	0.171
									Sep	0.160	0.158
					Quality	Nutrients	Instream concentration of nutrients must be improved to sustain aquatic ecosystem health and ensure the prescribed ecological category is met. Nutrient concentrations must be reduced.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.060 milligrams/litre (mg/l) (50^{th} percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 1.0 milligrams/litre (50^{th} percentile)		
						Salts	Instream salinity must be maintained to support the aquatic ecosystem and sustain present ecological state. No further deterioration should occur. Land based activities and WWTW discharges must be controlled.	Electrical Conductivity	≤ 75 milliSiemens/metre (mS/m) (95^{th} percentile)		
								Sulphate	≤ 60 milligrams/litre (95^{th} percentile)		
								Chloride	≤ 70 milligrams/litre (95^{th} percentile)		
								Sodium	≤ 100 milligrams/litre (95^{th} percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Pathogens	The presence of pathogens should pose no risk to human health. Microbial pollution must be minimised.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
								Metolachlor	≤0.30 milligrams/litre (mg/l)
								Mancozeb	0.009 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity should be improved from a D ecological category to a C category. Maintain good low flows to sustain habitat for substrate and habitat sensitive species and taxa.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%
						Riparian habitat	Riparian vegetation should be improved from a D ecological category to a C category. Sand mining in riparian zone must be limited.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	The fish community must be maintained in a C/D ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Maintain flow velocity/depth species *LMOL LCYL* and *CPAR* and habitat sensitive species, *MBRE*.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Sample 10+ species per sample effort Sample 20 *BMAR* in 20min effort
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D ecological category or improved upon.	Macroinvertebrate Response Assessment Index, and the South African Scoring System Version 5 (SASS5).	MIRAI EC = C ≥ 62% SASS ≥ 100 ASPT ≥ 5.0 (REMP site A2PIEN – BUFFE or EWR5)
						Semi aquatic biota	The river reach to serve as a habitat for aquatic bird populations must be maintained through proper habitat management. Maintain the riparian zone to provide suitable habitats.	Aquatic birds Indicator species	A baseline assessment should be conducted to determine the aquatic bird species along the river reach. There is a need to set a numerical RQO for density of birds based on the available/collected data.

IUA	Class	River	Resource Unit	Ecological Category	Compone nt	Sub-component	RQO	Indicator	Numerical Limit
						Diatoms	Diatom assemblage must be maintained within a largely modified condition or improved upon.	Specific Pollution Index	Diatom EC = D ≥ 42%

Table 18: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 15: UPPER MOKOLO

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
15: UPPER MOKOLO	II	**Moloko River, Klein Sand, Sondagsloop, Heuningspruit, Dwars, Jim se loop tributaries (A42C, A42E)**	**15_1**	**B/C**	Quantity	Low flows	EWR maintenance low and drought flows: Mokolo River at MOK_EWR1a in A42C NMAR = 84.84x10^{6}m^3 PES=C/D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of Mokolo River at A4H002		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.110	0.005
									Nov	0.120	0.005
									Dec	0.200	0.020
									Jan	0.550	0.040
									Feb	0.850	0.060
									Mar	0.700	0.050
									Apr	0.500	0.040
									May	0.350	0.030
									Jun	0.270	0.020
									Jul	0.230	0.015
									Aug	0.180	0.010
									Sep	0.100	0.005
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50th percentile) Monitoring data – regional		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)		
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.0 (95th percentile)		
							A baseline assessment to determine the present state instream turbidity is required. Limits must be	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							defined to control the impacts of slate mining on the resource.		
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
								Bromoxynil	≤0.010 milligrams/litre (mg/l)
					Habitat	Instream	Habitat condition should be improved from a C/D ecological to a B/C category. Good low flows must be maintained to sustain habitat for substrate and habitat sensitive species. Return flows and abstraction in resource unit must be monitored and controlled to protect the instream habitat.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B/C ≥ 78%
						Riparian habitat	Riparian vegetation must be improved from C/D to a C category. Riparian zones must remain in cultivated areas. Cultivation must be managed to prevent loss of riparian zone.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 62%
					Biota	Fish	Fish community should be improved from a C/D ecological category to a C category. Flow velocity/depth must be maintained for species, *LMOL, BMAR* and *CPRE* and habitat sensitive species, *BRAD, BVIV*.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Sample 15+ species per sample effort Sample 25 *CPRE* and 15 *AURA* in 20min effort (Site EWR1a Dwars)
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macromacroinvertebrates assemblage must be maintained within a C	Macroinvertebrate Response Assessment Index, and the South	Sites: EWR 1a = A4MOKO-VAALW MIRAI EC = C ≥ 62%

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							ecological category condition or improved upon.	African Scoring System Version 5 (SASS5).	SASS ≥ 120 ASPT ≥ 5.5 A4SAND-TOPBR: MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 6.0 Site DWARS 1a = Rapid EWR site: MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 5.5
						Diatoms	Diatom assemblage must be maintained within B ecological category or better condition.	Specific Pollution Index	Diatom EC ≥ 82%
		Sterkstroom, Frikkie se Loop (A42D)	**15_2**		Quantity	Low flows	EWR maintenance low and drought flows: Sterkstroom in A42D NMAR = 43.43x10^{6}m^3 REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of Sterkstroom at A4H008	
									Maintenance Low flows (m^3/s) / Drought flows (m^3/s)
									Oct: 0.382 / 0.060
									Nov: 0.517 / 0.110
									Dec: 0.972 / 0.130
									Jan: 1.778 / 0.210
									Feb: 2.842 / 0.070
									Mar: 2.996 / 0.110
									Apr: 2.529 / 0.020
									May: 1.908 / 0.020
									Jun: 1.390 / 0.050
									Jul: 1.090 / 0.110
									Aug: 0.758 / 0.080
									Sep: 0.426 / 0.060
					Quality	Nutrients	Instream concentration of nutrients as specified maintained to protect the aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.015 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
						Salts	Instream salinity levels as specified must be maintained to protect the aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 20 milliSiemens/metre (mS/m) (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.0 (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		
					Habitat	Instream	Habitat diversity should be maintained within a B/C ecological category. Maintain low flows to sustain habitat for substrate and habitat sensitive species and taxa.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC B/C ≥ 78%		
						Riparian habitat	Riparian vegetation should be maintained within a B/C ecological category or better condition.	Vegetation Response Assessment Index	VEGRAI EC = B/C ≥ 78%		
					Biota	Fish	The fish community must be maintained in a B/C ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Maintain flow velocity/depth for species, *LMOL, BMAR, AURA* and *CPRE* and habitat sensitive species – *CTHE*. Presence of new species: *B. waterbergensis* must be confirmed.	Fish Response Assessment Index (FRAI)	Fish ecology category = B/C FRAI ≥ 78% Sample 9+ species per sample effort Sample 10 *AJOH* and 2 *CTHE* in 20min effort		
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.		
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a B ecological category or improved upon. .	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	Macroinvertebrates EC ≥ 82% (Site A4STER-WELGE)		
		Mokolo River A42F, inflow Mokolo Dam, Taaibosspruit, Malmanies and	**15_3**		Quantity	Low flows	EWR maintenance low and drought flows: Mokolo River at MOK_EWR2 in A42F NMAR = 195.69x10^{6}m^3	Base Flows Maintenance flows and drought flows.		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.230	0.008
									Nov	0.240	0.110

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
		Bulspruit (A42F)					PES=B/C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Monitoring of Mokolo River at A4H005	Dec	0.370	0.146
									Jan	0.602	0.201
									Feb	1.064	0.318
									Mar	0.953	0.285
									Apr	0.808	0.252
									May	0.627	0.207
									Jun	0.512	0.181
									Jul	0.400	0.120
									Aug	0.320	0.008
									Sep	0.230	0.005
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.025 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)		
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.0 (95th percentile)		
							A baseline assessment to determine the present state instream turbidity is required. Limits must be defined to control the impacts of slate mining on the resource.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Metolachlor	≤0.30 milligrams/litre (mg/l)		
					Habitat	Instream	Habitat diversity should be improved from B/C ecological category to a B category. Return flows into habitat must be controlled.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Riparian habitat	Riparian vegetation should be improved from B/C ecological category to a B category Maintain riparian zone in cultivated areas, and control cultivation onto riparian zone.	Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	The fish community must be maintained in a C ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Maintain flow velocity/depth species *CPRE* and habitat sensitive species, *MMAC* and *AJOH*.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Sample 10+ species per sample effort Sample 10 *AJOH* in 20min effort
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 130 ASPT ≥ 6.0 (Site MOK_EWR2)
						Diatoms	Diatom assemblage must be maintained within a largely natural condition or improved upon.	Specific Pollution Index	Diatom EC ≥ 82%
		Mokolo Dam to upper portion of A42G (10km downstream of dam)	**15_4**		Quantity	Low flows	EWR maintenance low and drought flows: Mokolo River at MOK_EWR3 in A42G NMAR = 215.995x10^{6}m^3 PES=B/C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of Mokolo River at A4H010	

	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
Oct	0.383	0.005
Nov	0.399	0.005
Dec	0.406	0.005
Jan	0.444	0.015
Feb	0.559	0.020
Mar	0.504	0.018
Apr	0.493	0.015
May	0.450	0.010
Jun	0.441	0.008

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
									Jul	0.413	0.006
									Aug	0.399	0.005
									Sep	0.396	0.005
						High flows	EWR maintenance high flows: Mokolo River at MOK_EWR3 in A42G NMAR = 215.995x$10^6$$m^3$ PES=B/C category High flows must be attained as specified to support aquatic ecostem requirements.	Floods High flow also specified as individual flood requirements in terms of size and duration. Monitoring of Mokolo River at A4H010	As per operating rule in Reserve template, section 3.		
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.010 milligrams/litre (mg/l) (50^{th} percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50^{th} percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95^{th} percentile)		
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95^{th} percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.0 (95^{th} percentile)		
							A baseline assessment to determine the present state instream turbidity is required. Limits must be defined to control the impacts of slate mining on the resource.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		
					Habitat	Instream	Habitat diversity should be improved from a B/C ecological category to a B category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%		
						Riparian habitat	Riparian vegetation should be maintained within the B/C ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index.	VEGRAI EC = B/C ≥ 78%		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							Maintain riparian zone with regard to *Syzygium cordatum*		
					Biota	Fish	Fish community should be maintained within the B/C ecological category. Maintain flow velocity/depth for species *CPRE*.	Fish Response Assessment Index (FRAI)	Fish ecology category = B/C FRAI ≥ 78%
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 130 ASPT ≥ 6.0
		Mokolo Dam	**15_4**		Quantity	Dam level	The dam must be managed to protect ecosystem function as well as downstream users. Develop and update operational rules for the dam to sustain optimum dam levels in order to ensure that aquatic ecosystem diversity is maintained. Dam releases are required to meet downstream flows for ecological flow requirements.	Minimum operating level required in dam	Operation rules as applicable. Minimal level to sustain aquatic ecosystem (15-18%).
					Quality	Nutrients	Concentration of orthophosphate must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as an oligotrophic system.	Orthophosphates	≤ 0.010 mg/ℓ 50th percentile
							Concentration of total phosphorous must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam	Total phosphorous	≤ 0.025 mg/ℓ 50th percentile

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							must be maintained as an oligotrophic system.		
							Concentration of nitrate & nitrite must be maintained to sustain ecosystem health and the water quality requirements of water users. The dam must be maintained as an oligotrophic system.	Nitrite& Nitrate	≤ 0.50 mg/ℓ N 95th percentile
						Salts	The salinity in the dam must be maintained to support ecosystem health and the water quality requirements of the downstream users.	Electrical Conductivity	≤ 20 mS/m 95th percentile
						Pathogens	The presence of pathogens should pose no risk to human health.	*Escherichia coli* (*E.coli*)	130 counts/100 millilitres (ml) (95th percentile)
						System Variables	The water must be acceptable for recreational use.	pH	6.5 – 9.0 95th percentile
							Increased clarity with reading	Turbidity	≥0.4 m 5th percentile
					Habitat	Dam Habitat	To manage the water resource for maintenance of aquatic ecosystem diversity (instream, biotic aqnd semi-aquatic species, riparian zones). Conserve, maintain, rehabilitate and establish artificial shoreline and riparian zones. The natural riparian zone should be preserved as far as possible to ensure necessary habitat.	Riparian vegetation Health	70% riparian vegetation cover
					Biota	Fish	The fish diversity and quantities must be maintained.	Fish diversity and quantity	The fish population must be monitored through health assessment studies. Suitable abundances should be determined. Target fish stocks should be determined.
						Periphyton/ Phytoplankton	The Chl *a* concentration must be maintained in an oligotrophic state.	Chl a	≤10µg/ℓ 50th percentile
		Grootspruit and Sandspruit tributaries	**15_5**		Quantity	Low flows	EWR maintenance low and drought flows: Grootspruit in A42B	Baseflows Maintenance flows and	Maintenance Low flows (m^3/s) | Drought flows (m^3/s)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
		(Mokolo headwater catchment) (A42A, A42B)					NMAR = 27.8 x$10^6$$m^3$ REC= D category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users	drought flows. Monitoring of discharge during biological surveys.	Oct	0.271	0.136
									Nov	0.269	0.135
									Dec	0.291	0.148
									Jan	0.345	0.180
									Feb	0.401	0.213
									Mar	0.384	0.203
									Apr	0.338	0.160
									May	0.320	0.120
									Jun	0.311	0.160
									Jul	0.304	0.156
									Aug	0.299	0.152
									Sep	0.286	0.145
					Quality	Nutrients	Instream concentration of nutrients as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.05 milligrams/litre (mg/l) (50^{th} percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.7 milligrams/litre (50^{th} percentile)		
						Salts	Instream salinity levels as specified must be attained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95^{th} percentile)		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.0 (95^{th} percentile)		
							A baseline assessment to determine the present state instream turbidity is required. Limits must be defined to control the impacts of slate mining on the resource.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.		
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)		
					Habitat	Instream	Habitat diversity should be maintained within a C ecological category. Connectivity for migratory species must be maintained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C ≥ 62%		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Riparian habitat	Riparian vegetation should be maintained in a C ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = C ≥ 70%
					Biota	Fish	Fish community should be maintained within the C ecological category. Maintain flow velocity/depth for species *CPRE, AURA, LCYL* and habitat sensitive species *MMAC* and *AJOH*.	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62% Sample 10+ species per sample effort
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat and migration corridor for aquatic bird populations through proper habitat management. Manage riparian zone – remove alien vegetation, rehabilitate with indigenous species.	Aquatic birds species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a D category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	MIRAI EC = D ≥ 42% SASS ≥ 80 ASPT ≥ 5.5 (site A4GROO-GROOT)
		Mokolo River from Dwars River to confluence with Sterkstroom, Klein Vaalwaterspruit (A42E)	**15_6**		Quantity	Low flows	EWR maintenance low and drought flows: Mokolo River at MOK_EWR1b in A42E NMAR = 135.03x10^{6}m^3 PES=B/C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users	Base Flows Maintenance flows and drought flows. Monitoring of discharge of Mokolo River during biological surveys	
									Maintenance Low flows (m^3/s) / Drought flows (m^3/s)
									Oct 0.120 / 0.005
									Nov 0.120 / 0.005
									Dec 0.320 / 0.020
									Jan 0.700 / 0.050
									Feb 1.400 / 0.080
									Mar 1.150 / 0.065
									Apr 0.850 / 0.050
									May 0.600 / 0.040
									Jun 0.450 / 0.020
									Jul 0.320 / 0.015
									Aug 0.250 / 0.010
					Quality	Nutrients	Instream concentration of nutrients as specified must maintained to protect the aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.020 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.5 milligrams/litre (50th percentile)
						Salts	Instream concentration of salinity must be maintained	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							to protect present ecological state and the aquatic ecosystem health.		
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.0 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required. Limits must be defined to control the impacts of slate mining on the resource.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity should improve from a B/C ecological category to a B category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation should be maintained within a B/C ecological category or better condition.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = B/C ≥ 78%
					Biota	Fish	Fish community should be maintained within a B/C ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = B/C FRAI ≥ 78%
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within B/C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System 5 (SASS5)	MIRAI EC = B/C ≥ 78% SASS ≥ 140 ASPT ≥ 6.0 (MOK_EWR1b in A42E)

Table 19: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 16: LOWER MOKOLO

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
16: LOWER MOKOLO	II	Tambotie River A42H (major portion-eastern)	16_1	B/C	Habitat	Instream	Habitat diversity should be maintained in a B ecological category.	Index of Habitat Integrity	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation should be maintained within B ecological category. Maintain state of riparian zone.	Index of Habitat Integrity	VEGRAI EC = B ≥ 82%
					Biota	Fish	Fish community should be maintained within a B ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Maintain flow velocity/depth for species *CPRE, CPAR, LCYL, LRUD* and habitat sensitive species *MMAC* and *AJOH*.	Fish Response Assessment Index (FRAI)	Fish ecology category = B FRAI ≥ 82% Sample 20+ species per sample effort Sample 5 *BBRI* and 3 *PCAT* in 20min effort
		Poer-se-Loop (upper catchment) (A42G)	16_2		Habitat	Instream	Habitat diversity must be maintained in a B ecological category. Monitor abstraction and flow regime.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation must be maintained within B ecological category. Maintain state of riparian zone.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%

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IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Biota	Fish	Fish community should be maintained within a B ecological category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Maintain flow velocity/depth for flow dependent and habitat sensitive species. (upper catchment)	Fish Response Assessment Index (FRAI)	Fish ecology category B FRAI ≥ 82% Sample 25+ species per sample effort Sample 5 *BBRI* and 3 *PCAT* in 20min effort
		Sandloop A42J and remaining portion of A42H	**16_4**		Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health and ensure the prescribed ecological category is met.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.05 milligrams/litre (mg/l) (50^{th} percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.1 milligrams/litre (50^{th} percentile
						Salts	Instream concentration of salinity must be maintained to protect present ecological state and the aquatic ecosystem health.	Electrical Conductivity	≤ 55 milliSiemens/metre (mS/m) (95^{th} percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5^{th} percentile) and 8.5 (95^{th} percentile)
							A baseline assessment to determine the present state instream turbidity is required. Limits must be defined to control the impacts of slate mining on the resource.	Turbidity	A 10% variation from background concentration is allowed. Limits must be determined.

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
								Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0057 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0048 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)

<table>
<tr><th>IUA</th><th>Class</th><th>River</th><th>Resource Unit</th><th>Ecological Category</th><th>Component</th><th>Sub-component</th><th>RQO</th><th>Indicator</th><th colspan="3">Numerical Limit</th></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="4"></td><td rowspan="2"></td><td></td><td></td><td>Zinc (Zn)</td><td colspan="3">≤ 0.002 milligrams/litre (mg/l) (95th percentile)</td></tr>
<tr><td rowspan="2">Habitat</td><td>Instream</td><td>Habitat diversity should be maintained in a B ecological category.</td><td>Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)</td><td colspan="3">Instream Habitat Integrity EC = B ≥ 82%</td></tr>
<tr><td>Riparian habitat</td><td>Riparian vegetation should be maintained within B ecological category.</td><td>Index of Habitat Integrity, Vegetation Response Assessment Index</td><td colspan="3">VEGRAI EC = B ≥ 82%</td></tr>
<tr><td rowspan="13">Mokolo main stem to Tambotie confluence below (bedrock reach (sand deposit to, wider portion of river)

A42G along main stem river</td><td rowspan="13">16_5_1</td><td rowspan="13">Quantity</td><td rowspan="12">Low flows</td><td rowspan="12">EWR maintenance low and drought flows:
Mokolo River at MOK_EWR4 in A42G
NMAR = 253.5x10^{6}m^{3}
PES=C category

The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.</td><td rowspan="12">Base Flows
Maintenance flows and drought flows.

Monitoring of Mokolo River at A4H013</td><td></td><td>Maintenance Low flows (m^{3}/s)</td><td>Drought flows (m^{3}/s)</td></tr>
<tr><td>Oct</td><td>0.489</td><td>0</td></tr>
<tr><td>Nov</td><td>0.508</td><td>0</td></tr>
<tr><td>Dec</td><td>0.508</td><td>0</td></tr>
<tr><td>Jan</td><td>0.540</td><td>0</td></tr>
<tr><td>Feb</td><td>0.657</td><td>0</td></tr>
<tr><td>Mar</td><td>0.595</td><td>0</td></tr>
<tr><td>Apr</td><td>0.589</td><td>0</td></tr>
<tr><td>May</td><td>0.547</td><td>0</td></tr>
<tr><td>Jun</td><td>0.543</td><td>0</td></tr>
<tr><td>Jul</td><td>0.512</td><td>0</td></tr>
<tr><td>Aug</td><td>0.500</td><td>0</td></tr>
<tr><td>Sep</td><td>0.504</td><td>0</td></tr>
<tr><td>High flows</td><td>EWR high flows:
Mokolo River at MOK_EWR4 in A42G
NMAR = 253.5x10^{6}m^{3}
REC=C category

High flows must be met as specified to support aquatic ecosystem requirements.</td><td>Floods

Monitoring of Mokolo River at A4H013</td><td colspan="3"></td></tr>
</table>

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
					Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health, and maintain ecological status.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.02 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.05 milligrams/litre (50th percentile)
						Salts	Instream concentration of salinity must be maintained to protect present ecological state and the aquatic ecosystem health.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 20 milligrams/litre (95th percentile)
								Sodium	≤ 20 milligrams/litre (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Atrazine	≤0.078 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity must be improved from a B/C ecological category to a B category. Monitor abstraction and flow regime.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation must be improved from a C ecological category to a B/C category. Ensure undergrowth maintained to allow for recruitment of *Xanthocercis zambesiaca* during VEGRAI assessments. Maintain riparian zone	Index of Habitat Integrity, Vegetation Response Assessment Index.	VEGRAI EC = B/C ≥ 80%
					Biota	Fish	Fish community must be improved from a C ecological category to a B category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category. Maintain flow velocity/depth for flow dependent and habitat sensitive species.	Fish Response Assessment Index (FRAI)	Fish ecology category = B/C FRAI ≥ 78% Sample 25+ species per sample effort Sample 5 *BBRI* and 3 *PCAT* in 20min effort
						Semi-Aquatic biota	The suitability of this stretch of river to serve as a habitat for aquatic bird and mammal populations must be maintained through proper habitat management	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	MIRAI macroinvertebrates EC = C ≥ 62% SASS ≥ 80 ASPT ≥ 5.2

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
		Mokolo main stem from Tambotie confluence to Limpopo A42H, A42J along main stem river	**16_5_2**		Quantity	Low flows	Maintain flows in river to support wetland requirements at in A42J	Base Flows	Wetland requirements for the flood plain – Monitor flows at new weir (was A4H014)
					Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health, and maintain ecological status.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.01 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.05 milligrams/litre (50th percentile)
						Salts	Instream concentration of salinity must be maintained to protect present ecological state and the aquatic ecosystem health.	Electrical Conductivity	≤ 30 milliSiemens/metre (mS/m) (95th percentile)
								Sulphate	≤ 20 milligrams/litre (95th percentile)
								Sodium	≤ 20 milligrams/litre (95th percentile)
						System Variables	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)
						Toxics	The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)
								Lead (Pb) hard	≤ 0.0057 milligrams/litre (mg/l) (95th percentile)

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Copper (Cu) hard	≤ 0.0048 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
								Atrazine	≤0.078 milligrams/litre (mg/l)
					Habitat	Instream	Habitat diversity must be improved from a D ecological category to a C/D category. Monitor abstraction and flow regime Maintain good connectivity to upstream areas (16_5_1).	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = C/D ≥ 58%
						Riparian habitat	Riparian vegetation must be improved from a D ecological category to a C/D category. Ensure undergrowth maintained to allow for recruitment of *Xanthocercis zambesiaca* during VEGRAI assessment.	Index of Habitat Integrity, Vegetation Response Assessment Index.	VEGRAI EC = C/D ≥ 58%
					Biota	Fish	Fish community must be improved from a D ecological category to a C/D category. An assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.	Fish Response Assessment Index (FRAI)	Fish ecology category = C/D FRAI ≥ 58% Sample 12+ species per sample effort
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management. Maintain riparian zone.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.

Table 20: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 17a: MOTHLABATSI / MAMBA

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
17a: MOTHLABATSI / MAMBA	I	Mamba River (A41B)	17a_1	B/C	Quantity	Low flows	EWR maintenance low and drought flows: Mamba River at MAT_EWR3 in A41B NMAR = 9.54x10^{6}m^3 REC=B/C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem and the downstream users.	Base Flows Maintenance flows and drought flows. Monitoring of discharge of Mamba River during biological surveys		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.034	0.004
									Nov	0.047	0.007
									Dec	0.072	0.014
									Jan	0.104	0.021
									Feb	0.149	0.016
									Mar	0.129	0.011
									Apr	0.090	0.011
									May	0.058	0.004
									Jun	0.045	0.011
									Jul	0.039	0.011
									Aug	0.035	0.011
									Sep	0.030	0.007
					Quality	Nutrients	Instream concentration of nutrients as specified maintained to protect the aquatic ecosystem health and the ecological integrity of the system.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.015 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.25 milligrams/litre (50th percentile)		
						Salts	Instream salinity levels as specified must be maintained to protect the aquatic ecosystem health and ecological integrity of the system.	Electrical Conductivity	≤ 20 milliSiemens/metre (mS/m) (95th percentile)		
					Habitat	Instream	Habitat diversity must be maintained in a B/C ecological category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model Method and Model (RHAMM)	Instream Habitat Integrity EC= B/C ≥ 78%		
						Riparian habitat	Riparian vegetation must be maintained in a B/C ecological category. Ensure no development into riparian zone.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = B/C ≥ 78%		
					Biota	Fish	Fish community must be maintained within a C ecological category. Maintain low flow regime to accommodate flow velocity and depth classes for flow dependent species.	Fish Response Assessment Index (FRAI).	Fish ecology category = C FRAI ≥ 62% Sample 7+ species per sample effort. Sample 8 *AURA* and 2 *CTHE* during sampling effort		
						Semi-aquatic biota	This river reach must be maintained to serve as a	Aquatic birds species	A baseline assessment should be conducted to determine the aquatic		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							habitat and migration corridor for aquatic bird populations through proper habitat management. Protected riparian zone – no encroachment into riparian.		bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 130 ASPT ≥ 5.5
		Mothlabatsi/ Matlabas River (A41A, A41B)	**17a_2**		Quantity	Low flows	EWR maintenance low and drought flows: Matlabas at MAT_EWR2 in A41C NMAR = 32.80x10^{6}m^3 REC=B/C category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem.	Base Flows Maintenance flows and drought flows. Monitoring of discharge of Matlabas River at A4H004	See table below
					Quality	Nutrients	Instream concentration of nutrients as specified maintained to protect the aquatic ecosystem health and the ecological integrity of the system.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.015 milligrams/litre (mg/l) (50th percentile)
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.25 milligrams/litre (50th percentile)
						Salts	Instream salinity levels as specified must be maintained to protect the aquatic ecosystem health and ecological integrity of the system.	Electrical Conductivity	≤ 20 milliSiemens/metre (mS/m) (95th percentile)
					Habitat	Instream	Habitat diversity must be improved from a C ecological category to a B/C category.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B/C ≥ 78%
						Riparian habitat	Riparian vegetation must be maintained in a C ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index.	VEGRAI EC = C ≥ 62%
					Biota	Fish	Fish community must be maintained within a C ecological category. An	Fish Response Assessment Index (FRAI)	Fish ecology category = C FRAI ≥ 62%

	Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
Oct	0.153	0.007
Nov	0.178	0.012
Dec	0.220	0.080
Jan	0.280	0.101
Feb	0.373	0.095
Mar	0.330	0.116
Apr	0.265	0.077
May	0.208	0.071
Jun	0.193	0.070
Jul	0.179	0.065
Aug	0.168	0.034
Sep	0.154	0.008

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
							assessment of the fish community should be conducted annually to monitor against the prescribed ecological category.		
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management. Maintain riparian zone.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 140 ASPT ≥ 5.5
		Headwaters Mothlabatsi (Matlabas-Zyn-Kloof, peatlands) (A41A)	**17a_3**		Quantity	Low flows	EWR maintenance low and drought flows: Matlabas Zyn Kloof at MAT_EWR1 in A41A NMAR = 5.23x10^{6}m^3 REC=A category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem	Base Flows Maintenance flows and drought flows. Monitoring of discharge of Matlabas Zyn Kloof during biological surveys	Maintenance Low flows (m^3/s) / Drought flows (m^3/s) Oct 0.053 / 0.022 Nov 0.057 / 0.027 Dec 0.063 / 0.030 Jan 0.075 / 0.037 Feb 0.094 / 0.041 Mar 0.086 / 0.037 Apr 0.076 / 0.031 May 0.065 / 0.030 Jun 0.065 / 0.033 Jul 0.061 / 0.032 Aug 0.060 / 0.031 Sep 0.056 / 0.030
					Habitat	Instream	Habitat diversity must be improved from a B ecological category to an A category.	Index of Habitat Integrity	Instream Habitat Integrity EC = A ≥ 90%
						Riparian habitat	Riparian vegetation must be maintained in a B ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index.	VEGRAI EC = B ≥ 82%
					Biota	Fish	Fish community must be maintained within a B ecological category. Maintain low flow regime to accommodate flow velocity and depth classes for flow dependent species.	Fish Response Assessment Index (FRAI).	Fish ecology category = B FRAI ≥ 82% Sample 5+ species per sample effort. Sample 8 *AURA* during sampling effort

Table 21: Resource Quality Objectives for RIVERS AND DAMS in priority Resource Units in the Integrated Unit of Analysis 17b: MATLABAS / LIMPOPO

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit		
17b: MATLABAS	II	Matlabas (A41D, A41C)	17b_1	B/C	Quantity	Low flows	EWR maintenance low and drought flows: Matlabas at MAT_EWR4 in A41C NMAR = 35.58x10^{6}m^3 REC=B category The maintenance low flows and drought flows must be attained to support the aquatic ecosystem	Base Flows Maintenance flows and drought flows. Monitoring of discharge of Matlabas River during biological surveys		Maintenance Low flows (m^3/s)	Drought flows (m^3/s)
									Oct	0.151	0.007
									Nov	0.178	0.016
									Dec	0.225	0.072
									Jan	0.285	0.092
									Feb	0.398	0.100
									Mar	0.339	0.110
									Apr	0.266	0.077
									May	0.208	0.066
									Jun	0.192	0.061
									Jul	0.178	0.056
									Aug	0.166	0.034
									Sep	0.151	0.008
					Quality	Nutrients	Instream concentration of nutrients must be maintained to sustain aquatic ecosystem health, and maintain ecological status.	Orthophosphate (PO_4^-) as Phosphorus	≤ 0.050 milligrams/litre (mg/l) (50th percentile)		
								Nitrate (NO_3^-) & Nitrite (NO_2^-) as Nitrogen	≤ 0.07 milligrams/litre (50th percentile)		
						Salts	Instream concentration of salinity must be maintained to protect present ecological state and the aquatic ecosystem health.	Electrical Conductivity	≤ 40 milliSiemens/metre (mS/m) (95th percentile)		
								Sulphate	≤ 20 milligrams/litre (50th percentile)		
						System Variables Toxics	pH range must be maintained within limits specified to support the aquatic ecosystem and water user requirements.	pH range	6.5 (5th percentile) and 8.5 (95th percentile)		
							A baseline assessment to determine the present state instream turbidity is required.	Turbidity	A 10% variation from background concentration is allowed.		
							Dissolved oxygen levels must be attained to support the aquatic ecosystem.	Dissolved oxygen	≥ 6 milligrams/litre (mg/l)		
							The concentrations of toxicants must pose no risk to aquatic organisms and to human health.	Aluminium (Al)	≤ 0.062 milligrams/litre (mg/l) (95th percentile)		
								Manganese (Mn)	≤ 0.15 milligrams/litre (mg/l) (95th percentile)		
								Iron (Fe)	≤ 0.1 milligrams/litre (mg/l) (95th percentile)		

IUA	Class	River	Resource Unit	Ecological Category	Component	Sub-component	RQO	Indicator	Numerical Limit
								Lead (Pb) hard	≤ 0.0057 milligrams/litre (mg/l) (95th percentile)
								Copper (Cu) hard	≤ 0.0048 milligrams/litre (mg/l) (95th percentile)
								Nickel (Ni)	≤ 0.07 milligrams/litre (mg/l) (95th percentile)
								Cobalt (Co)	≤ 0.05 milligrams/litre (mg/l) (95th percentile)
								Zinc (Zn)	≤ 0.002 milligrams/litre (mg/l) (95th percentile)
					Habitat	Instream	Habitat diversity must be maintained in a B ecological category. Protect instream integrity by controlling land based impacts. Connectivity to Limpopo River must be maintained.	Index of Habitat Integrity, Rapid Habitat Assessment Method and Model (RHAMM)	Instream Habitat Integrity EC = B ≥ 82%
						Riparian habitat	Riparian vegetation must be maintained in a B ecological category.	Index of Habitat Integrity, Vegetation Response Assessment Index	VEGRAI EC = B ≥ 82%
					Biota	Fish	Fish community must be maintained within a B ecological category. Maintain flow velocity and depth class protection for sensitive species (flow sensitive: *LMOL, BIMB* and habitat sensitive: *PCAT*)	Fish Response Assessment Index (FRAI)	Fish ecology category = B FRAI ≥ 82% Sample 13+ species during sample effort
						Semi-aquatic biota	This river reach must be maintained to serve as a habitat for aquatic bird and mammal populations through proper habitat management. Maintain riparian zone.	Aquatic birds/Indicator mammal species	A baseline assessment should be conducted to determine the aquatic bird community and representative mammal species along the river reach. There is a need to set a numerical RQO for density of animals/birds based on the available/collected data.
						Aquatic macroinvertebrates	Macroinvertebrate assemblage must be maintained within a C ecological category or improved upon.	Macroinvertebrate Response Assessment Index and the South African Scoring System Version 5 (SASS5)	MIRAI EC = C ≥ 62% SASS ≥ 120 ASPT ≥ 5.0

Table 22: Resource Quality Objectives for PRIORITY WETLAND CLUSTERS AND SYSTEMS in selected Resource Units in the Mokolo, Matlabas, Crocodile (West) and Marico WMA

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
1: UPPER CROCODILE / HENNOPS / HARTEBEESPOORT	1_1	Bronkhorstfontein Pan Complex (Depresion/Pan)	Quantity	Pan wetted perimeter as measured from desktop mapping in relation to antecedent rainfall.	Water quantity impacts must be managed so as not to undermine the ecological value of these pan systems. In particular, abstraction or artificial water inputs should be limited in the pans so that the depth and duration of inundation is maintained within the normal range for high, average and low rainfall years.	Compile an accurate desktop basemap for the systems prior to the start of monitoring using the most recent available remote imagery and determine the wetted perimeter in relation to antecedent rainfall for selected pans. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there have been any measurable changes in the relationship between wetted perimeter and antecedent rainfall in the pans selected.
			Quality	pH, Electrical Conductivity, TDS, Total Alkalinity as $CaCO_3$, Sodium, Calcium, Magnesium, Sulphate, Iron, Chloride, Potassium, Magnesium, Manganese, Aluminium, Phosphorous, Silica, Fluoride, Ammonia and Nitrate.	Water quality impacts to the pan systems must be restricted to ensure that the water and sediment chemistry remain within the baseline range (anion and cation concentration to pan volume relationship) for this particular water chemistry pan type.	For selected pans, sample every 3 to 5 years.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all the pans units in the wetland complex	Area based weighted Average PES category of C/D must be maintained.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	1_1 1_2	Rietvlei Wetland Complex Channelled and Unchannelled valley bottom (peatland	Quantity	Permanent saturation.	Permanent saturation is required to maintain the peat. The flows should also be such that they do not pose a threat to the unchannelled structure/geomorphology of the wetland system.	During the habitat assessment determine whether the system is saturated and peat is still present.
			Habitat	Desktop PES Category (based on a semi-quantitative score for the wetland. The extent and distribution of peat and populations of peat forming	Wetland vegetation and geomorphology must be maintained to protect the unchannelled character of the system. Viable populations of peat forming plant species must be	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
				plants species in the wetland.	maintained. Area based weighted Average PES category of B although the likely best attainable state Category is B/C. Peat distribution and extent should remain at least unchanged/stable or be increasing.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	1_3	Glen Austin Pan (Depression / Pan)	Quantity	Pan wetted perimeter as measured from desktop mapping in relation to antecedent rainfall.	Water quantity impacts must be managed so as not to undermine the ecological value of the pan. In particular, abstraction or artificial water inputs should be limited in the pans so that the depth and duration of inundation is maintained within the normal range for high, average and low rainfall years.	Compile an accurate desktop basemap for the pan prior to the start of monitoring using the most recent available remote imagery and determine the wetted perimeter in relation to antecedent rainfall for the pan. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there have been any measurable changes in the relationship between wetted perimeter and antecedent rainfall in the pan.
			Quality	pH, Electrical Conductivity, TDS, Total Alkalinity as $CaCO_3$, Sodium, Calcium, Magnesium, Sulphate, Iron, Chloride, Potassium, Magnesium, Manganese, Aluminium, Phosphorous, Silica, Fluoride Ammonia, Nitrate and Fluoride.	Water quality impacts to the pan systems must be restricted to ensure that the water and sediment chemistry remain within an acceptable normal range (anion and cation concentration to pan volume relationship) for this particular water chemistry pan type.	Sample every 3 to 5 years.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the pan – see the method of Kotze, 2016a and 2016b).	Area based weighted Average PES category of C/D although the likely BAS Category is D.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Breeding population of Giant Bullfrogs.	Maintain a viable breeding population of Giant Bullfrogs in the pan.	Verify from monitoring records and recorded sightings adult bullfrogs and recorded breeding events. Report on this every 3 to 5 years.
	1_4	Colbyn Valley Wetland Channelled and Unchannelled valley bottom (peatland)	Quantity	Permanent saturation.	Permanent saturation is required to maintain the peat. The flows should also be such that they do not pose a threat to the unchannelled structure/geomorphology of	Determine whether the system is saturated and peat is still present.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
					sections of the wetland system.	
			Habitat	Desktop PES Category (based on a semi-quantitative score for the wetland) . The extent and distribution of peat and populations of peat forming plants species in the wetland.	Wetland vegetation and geomorphology must be maintained to protect the system and overall biodiversity must be maintained including viable populations of peat forming plant species. Area based weighted Average PES category of B/C although the likely BAS Category is C. Peat distribution and extent should remain at least unchanged/stable or be increasing.	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system. Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
4: HEX / WATERKLOOFSPRUIT / VAALKOP	**4_6**	Waterkloofspruit Wetland Unchannelled valley bottom	Quantity	Permanent saturation.	Permanent saturation is required to maintain the peat. The flows should also be such that they do not pose a threat to the unchannelled structure/geomorphology of the wetland system.	During the habitat assessment determine whether the system is saturated and peat is still present.
			Habitat	Desktop PES Category (based on a semi-quantitative score for the wetland. The extent and distribution of peat and populations of peat forming plants species in the wetland.	Wetland vegetation and geomorphology must be maintained to protect the unchannelled character of the system and overall biodiversity must be maintained including viable populations of peat forming plant species. Area based weighted Average PES category of A although the likely BAS Category is A/B. Peat distribution and extent should remain at least unchanged/stable or be increasing.	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system. Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
5: ELANDS / VAALKOP	**5_1**	Koster Pan Complex Depressions / Pans	Quantity	Pan wetted perimeter as measured from desktop mapping in relation to antecedent rainfall.	Water quantity impacts must be managed so as not to undermine the ecological value of these pan systems. In particular, abstraction	Compile an accurate desktop basemap for the systems prior to the start of monitoring using the most recent available remote imagery and determine the wetted perimeter in relation to antecedent rainfall for selected

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
					or artificial water inputs should be limited in the pans so that the depth and duration of inundation is maintained within the normal range for high, average and low rainfall years.	pans. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there have been any measurable changes in the relationship between wetted perimeter and antecedent rainfall in the pans selected.
			Quality	pH, Electrical Conductivity, TDS, Total Alkalinity as $CaCO_3$, Sodium, Calcium, Magnesium, Sulphate, Iron, Chloride, Potassium, Magnesium, Manganese, Aluminium, Phosphorous, Silica, Fluoride Ammonia, Nitrate and Fluoride.	Water quality impacts to the pan systems must be restricted to ensure that the water and sediment chemistry remain within an acceptable normal range (anion and cation concentration to pan volume relationship) for this particular water chemistry pan type.	For selected pans, sample every 3 to 5 years.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all the pans units in the wetland complex).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
6a: KLEIN MARICO / KROMELLEMBOOG 8: MALMANIESLOOP	**6_1 8_1**	Buffelshoek Wetland Complex Channelled and Unchannelled valley bottom	Quantity	Groundwater indicators apply (see groundwater indicators RU 6_1 and 8_1)). Surface flow indicators need to be determined.	A constant baseflow must be maintained to ensure that the system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply (see groundwater numerical limits). Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQO's.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply (see river and groundwater numerical limits). Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C although the likely BAS Category is C/D.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
	6_1 8_1	Paardenvallei Wetland Complex	Quantity	Groundwater indicators apply (see groundwater indicators).	A constant baseflow must be maintained to ensure that the	Groundwater numerical limits apply.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
		(Malmaniesloop) Channelled and Unchannelled valley bottom		Surface flow indicators need to be determined.	system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQOs.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply (see river and groundwater numerical limits). Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C/D although the likely BAS Category is D.	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system. Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply (see groundwater numerical limits).
7: KAALOOG-SE-LOOP	**7_1**	Marico Eye Wetland (Kaaloog se Loop) Unchannelled valley bottom (peatland)	Quantity	Groundwater indicators apply (see groundwater indicators). Surface flow indicators need to be determined.	A constant baseflow must be maintained that ensure that the system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply (see groundwater numerical limits). Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQO's.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply (see river and groundwater numerical limits). Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland – see the method of Kotze, 2016a and 2016b).	Area based weighted Average PES category of A/B although the likely BAS Category is B.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
						this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
	7_1	Rietspruit Wetland Channelled and Unchannelled valley bottom	Quantity	Groundwater indicators apply (see groundwater indicators).	A constant baseflow must be maintained to ensure that the system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES Category of C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
	7_1	Tufa Waterfall (Tufa)	Quantity	Groundwater indicators apply (see groundwater indicators).	A constant baseflow must be maintained that ensure that the system remains perennial and the waterfall has a constant water supply. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
			Quality	pH, Electrical Conductivity, TDS, Total Alkalinity as $CaCO_3$, Sodium, Calcium, Magnesium, Sulphate, Iron, Chloride, Potassium, Magnesium, Manganese, Aluminium, Phosphorous, Silica, Fluoride Ammonia, Nitrate and Fluoride.	Salinity levels should not increase. Concentrations must be maintained at levels to secure an Ideal/Good water quality status rich in calcium carbonate.	Electrical Conductivity: ≤ 50 mS/m Annual long-term trend should not approach the 95th percentile (55 mS/m). Bi-annual monitoring of major constituents (macro elements).
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
8: MALMANIESLOOP	8_1	Malmanieloop Wetland Complex Channelled and Unchannelled valley bottom (peatland)	Quantity	Groundwater indicators apply (see groundwater indicators). Surface flow indicators need to be determined.	A constant baseflow must be maintained to ensure that the system remains perennial and that most of the marginal and instream vegetation remains inundated throughout the summer growing season and that the rooting zone is saturated throughout the year. This is a requirement for enabling perennial obligate hydrophytes to complete their life cycle and reproduce and in order to maintain the peat in the system. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply. Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQOs.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits. Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex_. The extent and distribution of peat and populations of peat forming plants species in the wetland.	Wetland vegetation and geomorphology must be maintained to protect the unchannelled character of the system and overall biodiversity must be maintained including viable populations of peat forming plant species. Area based weighted Average PES category of B although the likely BAS Category is C. Peat distribution and extent should remain at least unchanged/stable or be increasing.	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system. Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
8: MALMANIESLOOP 9: MOLOPO	8_1 9_2	Upper Molopo River Wetland Complex Channelled and Unchannelled valley bottom (peatland	Quantity	Groundwater indicators apply. Surface flow indicators need to be determined.	A constant baseflow must be maintained to ensure that the system remains perennial and that most of the marginal and instream vegetation remains inundated throughout the summer growing season and that the rooting zone is saturated throughout the year. This is a requirement for enabling perennial obligate hydrophytes to complete their life cycle and reproduce and in order to maintain the peat in the system.	Groundwater numerical limits apply. Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQOs.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply. Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex). The extent and distribution of peat and populations of peat forming plants species in the wetland.	Wetland vegetation and geomorphology must be maintained to protect the unchannelled character of the system and overall biodiversity must be maintained including viable populations of peat forming plant species. Area based weighted Average PES category of B although the likely BAS Category is C/D. Peat distribution and extent should remain at least unchanged/stable or be increasing.	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system. Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
8: MALMANIESLOOP	8_1	Vergenoegd Wetland Channelled and Unchannelled valley bottom	Quantity	Groundwater indicators apply (see groundwater indicators). Surface flow indicators need to be determined.	A constant baseflow must be maintained to ensure that the system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply. Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQOs.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply. Update these based on the findings of the water quality component of the preliminary wetland Reserve.

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Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply.
9: MOLOPO	**9_2**	Middle Molopo River Wetland Complex Channelled valley bottom	Quantity	Groundwater indicators apply (see groundwater indicators). Surface flow indicators need to be determined.	A constant baseflow must be maintained to ensure that the system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply. Undertake a preliminary wetland Reserve linked to the one for Upper Molopo River Wetland and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQOs.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply (see river and groundwater numerical limits). Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland – see the method of Kotze, 2016a and 2016b). The extent and distribution of peat and populations of peat forming plants species in the wetland.	Wetland vegetation and geomorphology must be maintained to protect the unchannelled character of the system and overall biodiversity must be maintained including viable populations of peat forming plant species. Area based weighted Average PES category of C/D although the likely BAS Category is D. Peat distribution and extent should remain at least unchanged/stable or be increasing.	Compile an accurate desktop basemap for the system prior to the start of monitoring using the most recent available remote imagery and determine/estimate and map the extent of peat and peat forming plant species in the system. Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. During the habitat assessment determine/estimate whether the extent of peat in the system has changed. Estimate the extent of peat forming plant species. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	9_3 **9_5**	Lower Molopo River Wetland Complex Channelled valley bottom	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of D.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
10: DINOKANA EYE / NGOTWANE DAM	10_1	Dinokana Wetland Unchannelled and Channelled valley bottom and Hillslope seepage wetlands	Quantity	Groundwater indicators apply (see groundwater indicators). Surface flow indicators need to be determined.	A constant baseflow must be maintained to ensure that the system remains perennial. Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply. Undertake a preliminary wetland Reserve for the system and determine the ecological flow requirements of the wetland. Use these to set the numerical criteria for the water quantity component of the RQOs.
			Quality	River and groundwater indicators apply (see river and groundwater indicators).	River and groundwater RQO's apply (see river and groundwater RQO's).	River and groundwater numerical limits apply. Update these based on the findings of the water quality component of the preliminary wetland Reserve.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Protection zone	Groundwater indicators apply (see groundwater indicators).	Groundwater RQO's apply (see groundwater RQO's).	Groundwater numerical limits apply (see groundwater numerical limits).
	10_1	Ngotwane Wetland Unchannelled valley bottom	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland complex).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
11b: GROOT MARICO / SEASONAL TRIBUTARIES	11_b_2	Lower Lenkwane River Wetland Unchannelled valley bottom linked to Floodplain	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
12: BIERSPRUIT	12_1	Kolobeng Wetland Complex Channelled valley bottom and floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the catchment.	• Floods are necessary to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Using available remote imagery, estimate the extent and frequency of inundation/flooding in relation to rainfall for the wetland. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
						Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
13: LOWER CROCODILE 17b: MATLABAS / LIMPOPO	**13_3 17_b_1**	Lower Crocodile River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the catchment.	Floods are necessary to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the wetland. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
			Quality	River indicators apply (see river indicators).	River RQO's apply (see river RQO's).	River numerical limits apply (see river numerical limits).
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Maintenance of a structurally and species diverse riparian zone.	The overall structural and species diversity of the riparian zone must be maintained.	Using a rapid field-based assessment monitor the structure and species diversity of the riparian zone at selected sites along the floodplain. Take fixed point photographs of key features. Report on this every 3 to 5 years.
14: TOLWANE / KULWANE / MORETELE / KLIPVOOR	**14_1**	Apies River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the catchment.	Floods are necessary to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the wetland. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
			Quality	River indicators apply	River RQO's apply	River numerical limits apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	14_1 14_2	Moretele River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the	Floods are necessary to inundate the floodplain thereby providing	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
	14_3 **14_4**			catchment.	the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	wetland. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
			Quality	River indicators apply.		
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Reporting rates for aquatic/wetland dependent bird species.	Overall diversity and populations of aquatic/wetland dependent bird species must be maintained.	Verify from monitoring records and recorded sightings from available avifaunal reporting data. Report on this every 3 to 5 years.
	14_3	Plat River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the catchment.	Floods are necessary to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the wetland. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
			Quality	River indicators apply.	River RQO's apply.	River numerical limits apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Reporting rates for aquatic/wetland dependent bird species.	Overall diversity and populations of aquatic/wetland dependent bird species must be maintained.	Verify from monitoring records and recorded sightings from available avifaunal reporting data. Report on this every 3 to 5 years.
	14_4	Tswaing Crator Pan Depression / Pan	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of A although the likely BAS Category is B.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	15_1	Upper Mokolo River	Habitat	Desktop PES Category (based on	Area based weighted Average	Undertake a desktop PES assessment and determine

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
		Wetland Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands		a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	PES category of C although the likely BAS Category is C/D.	the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	The continued presence of Blue Cranes within the pentads (5x5 minute squares - the mapping unit used in SABAP2) covering the wetlands.	The continued presence of Blue Cranes must be maintained.	Using the data generated by the South African Bird Atlas Project 2 (SABAP2), the continued presence of Blue Cranes within the pentads must be confirmed by ensuring that a reporting rate higher than 5 % is maintained for the affected pentad (2425_2800 and 2425_2805).
	15_1	Klein Sand River Wetland Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	The continued presence of Blue Cranes within the pentad (5x5 minute squares - the mapping unit used in SABAP2) covering the wetlands.	The continued presence of Blue Cranes must be maintained.	Using the data generated by the South African Bird Atlas Project 2 (SABAP2), the continued presence of Blue Cranes within the pentad must be confirmed by ensuring that a reporting rate higher than 5 % is maintained for the affected pentad (2425_2805).
	15_2	Frikkiesloon River Wetland Complex Channelled and Unchannelled valley bottom	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	15_2	Grootfonteinspruit Wetland Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	The continued presence of Blue Cranes within the pentad (5x5 minute squares - the mapping unit used in SABAP2) covering the wetlands.	The continued presence of Blue Cranes must be maintained.	Using the data generated by the South African Bird Atlas Project 2 (SABAP2), the continued presence of Blue Cranes within the pentad must be confirmed by ensuring that a reporting rate higher than 5 % is maintained for the affected pentad.
	15_5	Grootspruit Wetland	Habitat	Desktop PES Category (based on	Area based weighted Average	Undertake a desktop PES assessment and determine

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
		Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands		a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	PES category of B/C although the likely BAS Category is C.	the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	The continued presence of Blue Cranes within the pentad (5x5 minute squares - the mapping unit used in SABAP2) covering the wetlands.	The continued presence of Blue Cranes must be maintained.	Using the data generated by the South African Bird Atlas Project 2 (SABAP2), the continued presence of Blue Cranes within the pentad must be confirmed by ensuring that a reporting rate higher than 5 % is maintained for the affected pentad (2425_2800).
	15_5	Sandspruit Wetland Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C/D although the likely BAS Category is D.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	The continued presence of Blue Cranes within the pentad (5x5 minute squares - the mapping unit used in SABAP2) covering the wetlands.	The continued presence of Blue Cranes must be maintained.	Using the data generated by the South African Bird Atlas Project 2 (SABAP2), the continued presence of Blue Cranes within the pentad must be confirmed by ensuring that a reporting rate higher than 5 % is maintained for the affected pentad (2430_2800).
	15_5	Sand River Wetland Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C/D although the likely BAS Category is D.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system. Verify by undertaking a rapid field-based PES assessment of the wetland and take fixed point photographs of key features.
			Biota	The continued presence of Blue Cranes within the pentads (5x5 minute squares - the mapping unit used in SABAP2) covering the wetlands.	The continued presence of Blue Cranes must be maintained.	Using the data generated by the South African Bird Atlas Project 2 (SABAP2), the continued presence of Blue Cranes within the pentads must be confirmed by ensuring that a reporting rate higher than 5 % is maintained for the affected pentad (2425_2800 and 2425_2805).
	15_5	Sand River Tributary Wetland Complex Channelled and Unchannelled valley bottom and Hillslope seepage wetlands	Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for all wetland units in the wetland complex).	Area based weighted Average PES category of C although the likely BAS Category is C/D.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
16: LOWER MOKOLO	16_1 16_5_2	Tambotie River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the catchment.	Floods are necessary to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the wetland. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
				River indicators for RU 16_5_2 and groundwater indicators as per the floodplain alluvial aquifer for RU 16_4 also apply.	River RQO's for RU 16_5_2 and groundwater RQO's as per the floodplain alluvial aquifer for RU 16_4 also apply.	River numerical limits for RU 16_5_2 and groundwater numerical limits as per the floodplain alluvial aquifer for RU 16_4 also apply.
			Quality	River indicators for RU 16_5_2 and groundwater indicators as per the floodplain alluvial aquifer for RU 16_4 apply.	River RQO's for RU 16_5_2 and groundwater RQO's as per the floodplain alluvial aquifer for RU 16_4 apply.	River numerical limits for RU 16_5_2 and groundwater numerical limits as per the floodplain alluvial aquifer for RU 16_4 apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of A/B although the likely BAS Category is B/C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Reporting rates (RR) for aquatic/wetland dependent Red Data bird species. Maintenance of a structurally and species diverse riparian zone.	Overall biodiversity and populations of floodplain dependent Red Data bird species must be maintained. The overall structural and species diversity of the riparian zone must be maintained.	Verify from monitoring records and recorded sightings from available avifaunal reporting rate data. Using a rapid field-based assessment monitor the structure and species diversity of the riparian zone at selected sites along the floodplain. Take fixed point photographs of key features. Report on the above every 3 to 5 years.
	16_3	Rietspruit Wetland 2 Channelled and Unchannelled valley bottom	Quantity	River indicators apply.	River RQO's apply.	River numerical limits apply.
			Quality	River indicators apply.	River RQO's apply.	River numerical limits apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland complex).	Area based weighted Average PES category of C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
	16_5_2	Mokolo River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the	Floods are necessary to inundate the floodplain thereby providing	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
		Floodplain, Depressions, backwaters and Seepage wetlands		catchment.	the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Flooding together with water in the alluvial aquifer also supports the riparian trees along edges of the floodplain.	floodplain. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding extent and rainfall events.
				River indicators for RU 16_5_2 and groundwater indicators as per the floodplain alluvial aquifer for RU 16_4 also apply.	River RQO's for RU 16_5_2 and groundwater RQO's as per the floodplain alluvial aquifer for RU 16_4 also apply.	River numerical limits for RU 16_5_2 and groundwater numerical limits as per the floodplain alluvial aquifer for RU 16_4 also apply.
			Quality	River indicators for RU 16_5_2 and groundwater indicators as per the floodplain alluvial aquifer for RU 16_4 apply.	River RQO's for RU 16_5_2 and groundwater RQO's as per the floodplain alluvial aquifer for RU 16_4 apply.	River numerical limits for RU 16_5_2 and groundwater numerical limits as per the floodplain alluvial aquifer for RU 16_4 apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of B/C although the likely BAS Category is C.	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland complex. Verify by undertaking a rapid field-based PES assessment of selected pans and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Reporting rates (RR) for aquatic/wetland dependent Red Data bird species. Maintenance of a structurally and species diverse riparian zone.	Overall biodiversity and populations of floodplain dependent Red Data bird species must be maintained. The overall structural and species diversity of the riparian zone must be maintained.	Verify from monitoring records and recorded sightings from available avifaunal reporting rate data. Using a rapid field-based assessment monitor the structure and species diversity of the riparian zone at selected sites along the floodplain. Take fixed point photographs of key features. Report on the above every 3 to 5 years.
			Protection zone	Groundwater indicators as per the floodplain alluvial aquifer for RU 16_4 apply.	Groundwater RQO's as per the floodplain alluvial aquifer for RU 16_4 apply.	Groundwater numerical limits as per the floodplain alluvial aquifer for RU 16_4 apply.
17a: MOTHLABATSI / MAMBA	**17_a_2**	Matlabas Wetland (Peatland) Channelled and Unchannelled valley bottom and Hillslope seepage wetlands	Quantity	Permanent saturation.	Permanent saturation is required to maintain the peat. The flows should also be such that they do not pose a threat to the unchannelled structure/geomorphology of the wetland system.	During the habitat assessment determine whether the system is saturated and peat is still present.
			Habitat	Desktop PES Category (based on a semi-quantitative score for the wetland).	Wetland vegetation and geomorphology must be maintained to protect the	Undertake a desktop PES assessment and determine the area based weighted average score for the wetland. Verify by undertaking a rapid field-based PES

Integrated Units of Analysis	RU	Wetland/Site	Component prioritised	Indicator	RQO	Numerical Criteria
					unchannelled character of the system and overall biodiversity must be maintained including viable populations of peat forming plant species. Area based weighted Average PES category of A although the likely BAS Category is A/B.	assessment of the wetland. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
17b: MATLABAS / LIMPOPO	**17_b_1**	Lower Matlabas River Floodplain	Quantity	Extent and frequency of flooding in relation to rainfall in the catchment.	Floods are necessary to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Using available remote imagery, estimate the extent and frequency of flooding in relation to rainfall for the floodplain. Repeat the above every 3 to 5 years and assess and report on this with a view to assess if there are any measurable changes in the relationship between flooding and rainfall events.
			Quality	River indicators apply.	River RQO's apply.	River numerical limits apply.
			Habitat	Desktop PES Category (based on a semi-quantitative area based weighted average score for the wetland).	Area based weighted Average PES category of A/B although the likely BAS Category is B.	Undertake a desktop PES assessment and determine the area based weighted average score for the floodplain. Verify by undertaking a rapid field-based PES assessment of the system and take fixed point photographs of key features. Repeat every 3 to 5 years and assess and report on this with a view to assess if there have been any changes in the state of the system.
			Biota	Maintenance of a structurally and species diverse riparian zone.	The overall structural and species diversity of the riparian zone must be maintained.	Using a rapid field-based assessment monitor the structure and species diversity of the riparian zone at selected sites along the floodplain. Take fixed point photographs of key features. Report on this every 3 to 5 years.

Table 23: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 1: UPPER CROCODILE / HENNOPS / HARTEBEESPOORT

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
IUA1: Upper Crocodile/Hennops/Hartbeespoort	RU - G1	1_1, 1_2, 1_3, 1_8 and 1_9.	Quantity	Groundwater flow patterns based on piezometric elevations in aquifer units should not be reversed from its natural flow directions toward the local drainages (Hennops, Rietvlei and Bloubankspruit systems).	Groundwater level depths (piezometric levels to show flow regime wrt surface water sources). Time series water level monitoring (Monthly) vs abstractions and rainfall input Abstraction of groundwater within prescribed zones from the river course/wetland/eye)	Dolomite aquifer systems: Saturation levels should not be lowered **>6 m** below an average water level depth of **~**22 m (1_1 – 1_2), ~20 m (1_3), ~15 m (1_9), and ~34 m (1_8) in the dolomite aquifer area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated within a 1000 m radius from flowing eye's.
				Sustainable abstractions at Grootfontein-Rietvlei and Pretoria Eyes. Groundwater balance (aquifer recharge and abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods).	Calculation of Stress Indexes (Aquifer Unit Use divided by Aquifer Unit Recharge) expressed as a percentage.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%);
			Quality	Aquifer water quality maintained to support ideal/good quality domestic water supply.	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual monitoring of major constituents (macro elements).	Nitrate: Less than 1.0 mg/l. Annual long-term trend should not approach the 50th percentile (*i.e*. 0.9 NO^3–N mg/l).
					Salts - Electrical Conductivity (TDS), mg/l). Bi-annual monitoring of major constituents (macro elements).	Electrical Conductivity ≤30 mS/m; Annual long-term trend should not approach the 95th percentile (*i.e*. 60 mS/m).

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
				Background water quality status in dolomite aquifer system downstream from Tweelopies Spruit and Bloubank Spruit must be maintained. (Currently impacted EC=220 mS/m, SO_4=965 mg/l, and NO_3–N=3.3 mg/l, median values).	EC, Sulphates and nitrates (origin AMD) in head water area (Tweelopies Spruit) Monthly water quality monitoring at source (TCTA WTW discharges).	Tweelopiespruit (RU 1_8): Limit long-term water quality indicators: EC level = 220 mS/m; SO_4 concentration = 200 mg/l; and NO_3–N concentration = 3.3 mg/l.
				Maintain good water quality status at Grootfontein-Rietvlei and Pretoria Dolomite Eye's.	EC, pH, SO_4 and NO_3–N to be used was quality indicators.	Limit long-term–Annual long-term: EC: 25 mS/m–27 mS/m (95^{th} percentile); SO_4: <4.5 mg/l–6.4 mg/l SO_4 (95^{th} percentile); NO_3–N: 0.9 mg/l–1.0 mg/l (95^{th} percentile).
			Protection Zone	Specifically dolomite aquifer systems (Hennops and Bloubankspruit, Rietvlei wet lands, Grootfontein-Rietvlei and Pretoria Eyes): Specific water resource protection requirements should become audit conditions in WUL.	Limit radius of influence (r) due to abstractions	Water level drawdown limited to dolomite sub-compartment unit.
					Distance from river (L)	Activity should be >500 m.
					Distance from wetland (L)	Activity should be >1000 m.
					Distance from Dolomite Eye (L)	Activity should be >1000 m.
					Ground stability (draw down limit, L, to protect buildings/roads /infrastructures)	Limited to 6 m in sub-compartment unit, unless specifically authorised.

Table 14: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 2: MAGALIES

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
MALONEY'S EYE	**RU - G2**	**2_1; 2_3**	**Quantity**	Maloney's Eye – Continuous flow at eye discharge (head waters of the Magalies River System).	Groundwater Levels (boreholes) in the eye's catchment, i.e. depth to groundwater level from ground elevation; Flow volumes at Maloney's Eye (compared with rainfall input, water level trends and abstractions in catchment of the eye (i.e. Steenkoppies Compartment); Abstraction of groundwater within prescribed protection zones at the Maloney's Eye (pool and downstream course as per monitor programme).	Dolomite aquifer saturation levels should not be lowered more than 6 m below an average water level depth of **~65** m in the Maloney's Eye catchment area; Flow volume at Maloney's Eye must not be lower than ~4 Mm^3/a (i.e. the pre 1974 long-term yield since 1908 – 1973). Abstraction zoning: to be regulated with the flow at the eye in a radius of 1000 m from the eye pool area.
				Groundwater balance (aquifer recharge and irrigation abstraction)	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages. Only 65% of recharge value	Limitation of SI value (</=65%); and Flow stage heights at discharge area (eye): <-0.50 m/a) between annual

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
					should be abstracted.	recharge events.
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users.	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring.	Nitrate: Less than 0.5 mg/l. Annual long-term trend should not approach the 95th Percentile (0.5 mg/l)
				Remain Ideal Water Quality status at Maloney's Eye and lower Magalies River.	Sulphates (origin AMD) in head water area in the Randfontein Spruit and Bloubank Spruit with possible link across A21D and A21F boundary (fractured Tarlton dyke)	SO_4: Less than 5 mg/l. Annual long-term trend should not approach the 95th percentile (7.5 mg/l)
				Salinity levels should not increase. Concentrations must be maintained at levels to secure an Ideal/Good water quality status.	Salinity - Electrical Conductivity (TDS), mg/l). Bi-annual monitoring of major constituents (macro elements).	Electrical Conductivity ≤26 mS/m; Annual long-term trend should not approach the 95th percentile (30 mS/m).
			Protection Zone	Demarcated protection zones to be introduced, i.e. distances between activity and eye/pool. Specifically for dolomite aquifer systems (Maloney's Eye and Magalies River downstream).	Stream Depletion Factor	Limit to </=5% of wetland/surface water resource
					Distance from river (L).	Activity regulated if <500 m from downstream drainage
					Distance from Dolomite Eye (L).	Activity regulated if <1000 m from downstream drainage.
					Distance from wetland (L).	Activity regulated if <1000 m from downstream drainage.
					Ground stability (DCU drawdown limit, L) (Buildings/roads/infrastructures).	Limited to 6 m sub-compartment unit, unless specifically authorised.

Table 25: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 3: CROCODILE / ROODEKOPJES

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
IUA3: (Upper) Crocodile River (Alluvial Aquifers)	**RU – G3 Alluvial River Section**	**3_1 and 3_2**	**Quantity**	Time series water level monitoring (L) across local intergranular and fractured aquifer to establish aquifer-river water interaction; Water level observations (local piezometric status).	Water Level - Depth to groundwater level on alluvial aquifer system. Groundwater level trends; and Gwater level gradient in drainage valley.	Reverse groundwater gradient in a 500 m zone along main stem not allowed. Water level recession rate must be less than 1.0 m/a.
				Water balance (interception of Swater).	Positive/Negative water balance estimations, Volume (Q); Flow depletion at downstream gauging weirs.	Swater losses at gauging stations must equal authorised abstractions from river.

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IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
				Groundwater balance status in intergranular and fractured aquifer system	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	Limitation of SI value (</=65%).
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users.	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring.	Nitrate: less than 6.0 mg/l; Annual long-term trend should not approach the 95th percentile.
				Manage irrigation return flows from alluvial aquifer system. Salinity levels should not increase. Concentrations must be maintained at levels to secure an Ideal - Good water quality status.	Salts - Electrical Conductivity Monthly monitoring To monitor quality of return flows from alluvial area. SAR for alluvial aquifer water	Electrical Conductivity ≤75 mS/m; (95th percentile)
			Protection Zone	Protect Intergranular (alluvial) and fractured aquifer system along central Crocodile and Rose Spruit segments in terms of Sw-Gw Interaction	Stream Depletion Factor (manage distance between surface water source and well fields).	Limit impact to <5% of abstraction yield supported by surface water sources.
				Land use activities that may impact on the intergranular aquifer.	Specify all land use activities on floodplain area and intergranular aquifer system.	Limit activities according to 50 day (microbial) and 365 (dilution) day water quality protection zoning (L).

Table 26: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 6a: KLEIN MARICO / KROMELLEMBOOG

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
6a: Klein Marico Eyes	RU – G6	6_1,	Quantity	Groundwater flow patterns based on piezometric elevations in aquifer units should not be reversed from its natural flow directions toward the local drainages (Upper Klein Marico River, Rhenosterfontein Spruit, and Lower Malmani Loop).	Water Levels - Depth to groundwater level from ground elevation. Time series water level monitoring (Monthly) vs abstractions and rainfall input	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~**21** m in the dolomite aquifer area. Water level recession rate must be less than 0.75 m/a.
				Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods).	Calculation of Stress Index (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%);
			Quality	Nitrate values must be maintained to support domestic water users (Ideal –Good water quality).	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring.	Nitrate: ~0.3 mg/l Long-term trend should not approach 95th percentile (1.2 mg/l)
				Flouride – impact on users – elevated fluoride levels	Fluoride (F, mg/l)	Fluoride: ~0.2 mg/l. Annual long-term trend should not approach the 50th percentile (0.2 mg/l).
				Salinity levels should not increase. Concentrations must be maintained at levels to secure an Ideal-Good water quality status.	Salts - Electrical Conductivity (TDS), mg/l). Bi-annual monitoring of major constituents (macro elements).	Electrical Conductivity: ≤ 50 mS/m Annual long-term trend should not approach the 95th percentile (60 mS/m)
					Na-Cl concentrations from mining activities in local eye catchments	
			Protection Zone	Specifically dolomite aquifer systems (Irrigation area); Specific water resource protection requirements should become audit conditions in WUL;	Map catchment (hectares) of the Eye and include a bulk water supply abstraction limitation.	Restriction of abstraction based on application of the Stress Index approach.
					Waterlevel drawdown limit in dolomite compartment unit.	Maximum 6 m (unless specifically authorised)
					Limitation of irrigation area on property size (ha's).	Limit to 9% of deed area (ha's)
					Distance from local river system	Activity should be >500 m.
					Distance from Dolomite Eye (L)	Activity should be >1000 m, unless specifically authorised.
					Ground stability (DCU drawdown limit, L) (buildings/roads/infrastructures).	Limited to 6 m sub-compartment unit.

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Table 27: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 7: KAALOOG-SE-LOOP

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
MARICO EYE (ref. Kaaloog Se Loop, Rietspruit and Bokkraal Eyes)	RU – G6	7_1,	Quantity	Continuous Flow measurement at selected dolomite eyes, i.e. Bokkraal Nr. 1 via the Vanstratensvlei River (only flow data from 1907 to 1943!). (Other important eye discharging into the upper Groot Marico River is Rietspruit (via the Vanstratensvlei River)); (Note: there are several other dolomite eyes in the area, but no information are available, except Rhenosterfontein, which falls in the A31D QC).	Demarcation of eye catchment area (southern boundary not clear); Water Levels - Depth to groundwater level from ground elevation; Time series water level monitoring (Monthly) vs abstractions and rainfall input; and Abstraction of groundwater within prescribed zones from the river course/wetland/eye-spring)	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~21 m in the eye catchment area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated with flow of the eye in a radius of 1000 m from the Bokkraal and Rietspruit Eye pool areas.
				Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods).	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%);
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users.	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual monitoring.	Nitrate: ≤ 0.5 mg/l; Annual long-term trend should not approach the 75th percentile (0.5 mg/l)
				Flouride – impact on users – elevated fluoride levels	Fluoride (F, mg/l) Bi-annual monitoring.	Fluoride: ~0.1 mg/l Annual long-term trend should not approach the 95th percentile (1.0 mg/l).
				Salinity levels should not increase. Concentrations must be maintained at levels to secure an Ideal/Good water quality status.	Salts - Electrical Conductivity (TDS), mg/l). Bi-annual monitoring of major constituents (macro elements).	Electrical Conductivity: ≤ 50 mS/m Annual long-term trend should not approach the 95th percentile (55 mS/m)
			Protection Zone	Demarcated protection zones to be introduced, i.e. distances between activity and eye/pool. Specifically for dolomite aquifer systems (Marico Eye's and Klein Marico River downstream).	Map catchment (hectares) of the Eye and include a bulk water supply abstraction limitation.	Restriction of abstraction based on application of the Stress Index approach.
					Limitation of irrigation area on property size (ha's).	Limit to 9% of deed area (ha's)
					Distance from local river system	Activity regulated if <500 m from downstream drainage
					Distance from Dolomite Eye (L)	Activity regulated if <1000 m from downstream drainage.

IUA	Groundwater unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
					Distance from wetland (L).	Activity regulated if <1000 m from downstream drainage.
					Waterlevel drawdown limit in dolomite compartment unit.	Limited to 6 m sub-compartment unit.

Table 28: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 8: MALMANIESLOOP

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objectives	Indicator/ Measure	Numerical Limit
8: Malmanie Se Loop	RU – G8	8_1	Quantity	Groundwater flow patterns based on piezometric elevations in aquifer units should not be reversed from its natural flow directions toward the local drainages (Malmani Eye Se Loop). Discharge areas (i.e. Malmani Eye, Malmani-Noupoort, Doornplaat Eye, Rietpoort Eye and Doornfontein Eye) should be protected against total depletion of water table).	Water Levels - Depth to groundwater level from ground elevation. Time series water level monitoring (Monthly) vs abstractions and rainfall input Abstraction of groundwater within prescribed zones from the river course/wetland/eye-spring);	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~**21** m in the dolomite aquifer area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated (1000 m for eye pools).
				Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods). Proper irrigation schedules need to be developed and applied at all times (100% compliance).	Abstraction - Volume (Q).Time series of abstraction-rainfall-water level of aquifer system. Annual groundwater balance (aquifer recharge and irrigation abstraction) needs to be for wet and dry cycles.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%);
				Water balance Status	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users (95th percentile = 18 mg/l).	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring.	Nitrate: Less than 1.0 mg/l; Annual long-term trend should not approach the 75th percentile (i.e. 3.5 mg/l)
				Salinity levels should not increase. Concentrations must be maintained at levels to secure a healthy water quality status.	Salts - Electrical Conductivity Monthly monitoring at discharge	Electrical Conductivity: ≤ 50 mS/m; Annual long-term trend should not approach the 95th percentile (i.e. 85 mS/m)
				Flouride – impact on users – elevated fluoride levels	Fluoride (F, mg/l) Bi-annual monitoring.	Fluoride ~0.1 mg/l; Annual long-term trend should not approach the 95th percentile (1.0 mg/l).

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objectives	Indicator/ Measure	Numerical Limit
			Protection Zone	Specifically dolomite aquifer systems (i.e. Malmani Eye, Malmani-Noupoort, Doornplaat Eye, Rietpoort Eye and Doornfontein Eye); Specific water resource protection requirements should become audit conditions in WUL;	Waterlevel drawdown limit in dolomite compartment unit.	Maximum 6 m (unless specifically authorised)
					Stream Depletion Factor	Limit to </=5% of wetland/surface water resource
					Limitation of irrigation area on property size (ha's).	Limit to 9% of deed area (ha's)
					Distance from Dolomite Eye and wetland zone (L)	Should be >1000 m, unless specifically authorised for bulk water supplies.

Table 29: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 9: MOLOPO

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
9: Upper Molopo River	**RU – G9**	**9_1 and 9_2**	**Quantity**	Groundwater flow patterns based on piezometric elevations in aquifer units should not be reversed from its natural flow directions toward the local drainages Discharge areas (i.e. Malapo Eye) should be protected against total depletion of water table (i.e. as the case is for Grootfontein Eye and Bodibe Eye.	Water Levels - Depth to groundwater level from ground elevation. Time series water level monitoring (Monthly) vs abstractions and rainfall input Abstraction of groundwater within prescribed zones from the river course/wetland/eye-spring)	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~**19** m in the dolomite water area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated (1000 m for karst aquifer systems.
				Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods). Proper irrigation schedules need to be developed and applied at all times (100% compliance).	Abstraction - Volume (Q).Time series of abstraction-rainfall-water level of aquifer system. Annual groundwater balance (aquifer recharge and irrigation abstraction) needs to be for wet and dry cycles.	Annual abstraction should not be larger than 65% of average annual recharge (*i.e*. SI of 65%);
				Water balance Status	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users. (Agricultural sources for nitrate)	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring Monthly monitoring at DWS gauging stations.	Nitrate: Less than 1.0 mg/l; Annual long-term trend should not approach the 95th percentile (3.0 mg/l).

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
				Salinity levels should not increase. Concentrations must be maintained at levels to secure a healthy water quality status.	Salts - Electrical Conductivity. Monthly monitoring at DWS gauging stations.	Electrical Conductivity: ≤ 50 mS/m; Annual long-term trend should not approach the 95th percentile (80 mS/m).
				Industrial/agricultural pollutants for Molopo, Grootfontein, Itsoseng (Bodibe) Eyes.	Sulphates SO_4 concentrations) Monthly water quality monitoring at source areas (eye's and well fields)	SO_4: Less than 5.0 mg/l; Annual long-term trend should not approach the 95th percentile (30 mg/l).
			Protection Zone	Protection of Intergranular and Fractured Aquifers: Protect lower sections of Madibe, Polfontein Spruit and Molopo River against industrial/agricultural/microbial pollution.	Distance from drainage valley: based on 50 Day travel time (microbial) and 365 day dilution period (inorganic constituents)	<1000 m Protection zoning (DLMT aquifers) <500 m Protection zoning (hard rock aquifers).
					Distance from discharge area of dolomite eyes: based on 50 Day travel time (microbial) and 365 day dilution period (inorganic constituents)	<1000 m Protection zoning (hard rock aquifers)

Table 30: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 10: DINOKANA EYE / NGOTWANE DAM

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objectives	Indicator/ Measure	Numerical Limit
IUA10: Dinokana Eye	**RU – G10**	**10_1**	**Quantity**	Discharge areas (i.e. Eyes/springs) should be protected against total depletion of water table)	Water levels: Time series water level monitoring (Monthly) vs abstractions and rainfall input.	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of **~24** m in the dolomite aquifer area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated (1000 m radius from eye pool)
				Water balance Status (Water use regulation in recharge area)	Flow gauging at Eye discharge. Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%).
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users.	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring.	Nitrate: ~1.0 mg/l; Annual long-term trend should not approach the 95th percentile (1.1 mg/l).

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objectives	Indicator/ Measure	Numerical Limit
				Flouride – impact on users – elevated fluoride levels	Fluoride (F, mg/l) Bi-annual monitoring.	Fluoride ~0.15 mg/l; Annual long-term trend should not approach the 95th percentile (0.5 mg/l).
				Salts: Concentrations must be maintained at levels to secure a healthy water quality status.	Salinity - Electrical Conductivity Monthly monitoring at discharge area.	Electrical Conductivity: ≤ 45 mS/m; Annual long-term trend should not approach the 95th percentile (55 mS/m).
			Protection Zone	Specifically dolomite aquifer systems ; Specific water resource protection requirements should become audit conditions in WUL.	Map catchment (hectares) of the eye and include a bulk water supply abstraction limitation.	Restriction of abstraction based on application of the Stress Index approach.
					Waterlevel drawdown limit in dolomite compartment unit.	Maximum 6 m (unless specifically authorised).
				Additional wellfields in the catchment area of the DMLT Eyes.	Limitation of irrigation area on property size (ha's).	Limit to 9% of deed area (ha's).
					Distance from Dolomite Eye (L).	Should be >1000 m, unless specifically authorised for bulk water supplies.

Table 31: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 13: LOWER CROCODILE

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
13: Lower Crocodile River	**RU – G13 Alluvial River Section**	**13_1 and 13_3**	**Quantity**	Limit capturing of surface water when abstracting water via boreholes in the flood plain alluvial aquifer systems (there should be a distance limit).	Groundwater level gradient across intergranular aquifer system; and Groundwater level trends on intergranular aquifer systems.	Reverse groundwater gradient (river towards borehole/well field in a 500 m zone along main stem not allowed. Water level recession rate must be less than 1.0 m/a.
					Stream/river flow gauging: Positive/Negative water balance estimations: Volume (Q); Flow depletion at downstream gauging weirs.	Surface water losses must be equal to authorised abstractions from river (incl. evapotranspiration losses).
				Groundwater balance status in intergranular and fractured aquifer system	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%).
			Quality	Nitrate values in the recharge area must be maintained to support domestic water users.	Nutrients - Nitrate (NO^3–N, mg/l). Bi-annual Monitoring.	Nitrate: ≤ 1.0 mg/l (95th percentile)
				Dissolved salts in groundwater resource: Manage irrigation return flow quality from intergranular (alluvial) aquifer system.	Salinity - Electrical Conductivity Weekly/Monthly monitoring.	Electrical Conductivity: ≤ 85 mS/m (95th percentile)

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
				Concentrations must be maintained at levels to secure an Ideal - Good water quality status.	Quality of intergranular (alluvial) aquifer system. SAR for alluvial aquifer water	SAR: Within appropriate limit for irrigation water.
			Protection Zone	Minimum distance from surface water resource where groundwater may be abstracted (based on the hydraulic characteristics of the intergranular (alluvial) aquifer system.	Stream Depletion Factor.	Limit borehole/well field abstraction yield to less than 5% of flow in surface water resources (at specific abstraction point).
				Land use activities that may impact on the alluvial aquifer. Specify protection zoning (i.e. distance from surface water resources) on intergranular (alluvial) aquifer system in terms of microbial and industrial/agricultural pollution migration.	Water quality measure (microbial migration towards surface water source); Water quantity measure (impact on surface water whilst abstracting from intergranular (alluvial) aquifer system.	Water quality limit (1): A 50 day (microbial) zoning, distance between activity and surface water source. Water quantity limit (2): A 365 (dilution) day water quality protection zoning (L).

Table 22: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 16: LOWER MOKOLO

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
16: Sandloop & Mokolo	**RU – G16_4**	**16_4**	**Quantity**	Limit depletion (lowering) of aquifer saturations levels (water levels).	Time series aquifer water level in a surrounding **Reference Area** which represent a background zone around a particular development, i.e. mining area, industrial area and agricultural development).	Water level recession rate must be less than 0.5 m/a in reference area of specific activity.
				Groundwater balance status in aquifer system (Inflow vs outflow).	Stress Index (Aquifer Unit Use/ Aquifer Unit Recharge), outside Area of Activity	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%) in Reference Area.
			Quality (Note that elevated background values for critical hydro-chemical	Acidity of groundwater with regard to acid rock drainage potential (high in areas of coal mining and UCG's)	pH-value of groundwater in specified Reference Area.	pH value between 6.1 and 8.2 in Reference Area.
				Nutrition's in groundwater impacting on consumer's health.	Nitrate (NO_3-N) concentration in groundwater in specified Reference Area (T3)	Nitrate: ≤35 mg/l in Reference Area Annual long-term trend should not approach the 50th percentile + 10% (~40 mS/m) – Based on local studies.

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
			elements may be a natural phenomenon and should be acknowledged, i.e. EC, NO_3-N, Cl, SO_4 and F).	Dissolved salts in groundwater resources - Monitoring Medupi/ Grootegeluk and other impact related monitoring networks.	Salinity: Electrical Conductivity (EC) of groundwater in specified Reference Area (T3).	Electrical Conductivity ≤200 mS/m in Reference Area. Annual long-term trend should not approach the 50th percentile + 10% (~220 mS/m) – Based on local studies.
				Macro chemical element of concern dissolved in groundwater.	Chloride (Cl) concentration in groundwater in specified Reference Area (T3).	Chloride: ≤300 mg/l in Reference Area. Annual long-term trend should not approach the 50th percentile + 10% (~330mS/m) – Based on local studies.
				Acid Mine Water (or ARD) and decanting into surface water resources.	Sulphates (SO_4) concentration in groundwater in specified Reference Area. (T3)	SO_4: ≤200mg/l in Reference Area. Annual long-term trend should not approach the 50th percentile + 10% (~220 mg/l) – Based on local studies.
				Fluoride concentrations in groundwater supplied to domestic users.	Fluoride (F) concentration in groundwater in specified Reference Area. (T3)	Fluoride: ≤2.5 mg/l in Reference Area. Annual long-term trend should not approach the 50th percentile + 10% (~2.7 mg/l) – Based on local studies.
			Protection Zone	Aquifer saturation levels	Water level set for a three (3) tier zoning area.	T1–Area of activity: Water level depletion required for activity. T2–Buffer Area: Water level recession rate must be less than 1.0 m/a. T3–Background or Reference Area: Water level recession rate must be less than 0.5 m/a.
				As per water quality specifications.	Water quality parameters set for a three (3) tier zoning area.	T1–Area of activity, concentration levels due to impact (95th Percentile of water quality in QC): pH: 5.0 to 9.5; NO_3–N: 60 mg/l; Salinity EC: 600 mS/m; Chloride: 1500 mg/l; Sulphates: 800 mg/l; and Fluoride: 6.4 mg/l. T2–Buffer Area: Allow up to 75th Percentile supported by a buffer area background study – actual values in observed in QC A42J: pH: 6.7 to 8.1; NO_3–N: 35 mg/l; Salinity EC: 340 mg/l; Chloride: 650 mg/l; Sulphates: 250 mg/l; and Fluoride: 2.5 mg/l.

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
						T3–Background or Reference Area: Allow up to 50th Percentile + 10% in key constituents as indicated above (Quality).
16: Mokolo Mainstem	**RU – G16**	**16_5_2**	**Quantity**	Limit capturing of surface water when abstracting water via boreholes in the flood plain alluvial aquifer systems (there should be a distance limit).	Water levels in aquifer: Groundwater level gradient across intergranular aquifer system; and Groundwater level trends on intergranular aquifer systems.	Reverse groundwater gradient in a 500 m zone along main stem not allowed. Water level trends not <-1.0 m/a
				Interaction status between Swater and Gwater resources.	Positive/Negative water balance estimations: Volume (Q); Flow depletion at downstream gauging weirs.	Surface water losses must be equal to authorised abstractions from river (incl. evapotranspiration losses).
				Groundwater balance status in intergranular and fractured aquifer system	Calculation of Stress Index (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%).
			Quality (Note that elevated background values for critical hydro-chemical elements may be a natural phenomenon and should be acknowledged, i.e. EC, NO_3-N, Cl, SO_4, and F).	Nutrients - Nitrate	Monthly monitoring at DWS gauging stations. Establish background "natural" nitrate concentration in water resource.	Nitrate: ≤ 0.5 mg/l (95th percentile)
				Dissolved salts in groundwater resources -	Salinity - Electrical Conductivity Establish background "natural" salinity concentration in water resource.	Electrical Conductivity: ≤ 55 mS/m (95th percentile)
				Acid Mine Water (or AMD) of nearby potential acidic underground rock types	Sulphates (SO_4) concentration levels in groundwater. Establish background "natural" sulphate concentration in water resource.	SO_4: ≤ 80 mg/l. (95th percentile)
			Protection Zone	Limit capturing of surface water when abstracting water via boreholes in the flood plain alluvial aquifer systems (there should be a distance limit).	Stream Depletion Factor for Mokolo alluvial aquifer system, (L).	Limit borehole/well field abstraction yield to less than 5% of flow in surface water resources (at specific abstraction point).
				Land use activities that may impact on the intergranular (alluvial) aquifer	Water quality measure (microbial migration towards surface water	Water quality limit (1): A 50 day (microbial) zoning, distance

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IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
				system.	source); Water quantity measure (impact on surface water whilst abstracting from intergranular (alluvial) aquifer system.	between activity and surface water source. Water quantity limit (2): A 365 (dilution) day water quality protection zoning (L).

Table 33: Regional and Resource Unit specific Resource Quality Objectives for GROUNDWATER in priority Resource Units in the Integrated Unit of Analysis 17b: MATLABAS / LIMPOPO

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
IUA 17: MATALBAS	RU – G17_b_2	17_b_2	**Quantity**	Limit depletion (lowering) of aquifer saturations levels (water levels).	Water levels in aquifer system; Groundwater level trends.	Water level recession rate must be less than 0.5 m/a.
				Groundwater balance status in aquifer system; Calculation of Stress Index (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	A Positive/Negative water balance.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%).
			Quality (Note that elevated background values for critical hydro-chemical elements may be a natural phenomenon and should be acknowledged, i.e. EC, NO_3-N, Cl, SO_4, and F).	Nutrition's in groundwater impacting on consumer's health.	Nitrate (NO_3-N) concentration in groundwater in specified reference area.	Nitrate: ≤3.0 mg/l; Annual long-term trend should not approach the 75th percentile (~3.3 mg/l).
				Dissolved salts in groundwater resources -	Salinity: Electrical Conductivity (EC) of groundwater.	Electrical Conductivity ≤140 mS/m Annual long-term trend should not approach the 75th percentile +10% (~155 mS/m).
				Macro chemical element of concern dissolved in groundwater.	Chloride (Cl) concentration in groundwater in specified reference area.	Chloride: ≤145 mg/l in Reference Area. Annual long-term trend should not approach the 75th percentile +10% (~160 mg/l).
				Generation of acid mine water from underlying potential acidic rocks; and Prevent future decanting of underground mine water into surface water resources.	Sulphates (SO_4) concentration in groundwater in specified reference area.	SO_4: ≤85 mg/l. Annual long-term trend should not approach the 75^{h} percentile +10% (~94 mg/l).
				Fluoride concentrations in groundwater supplied to domestic users.	Fluoride (F) concentration in groundwater in specified reference area.	Fluoride: ≤1.3 mg/l; Annual long-term trend should not approach the 75th percentile +10% (~1.4 mg/l).
				Aquifer saturation levels	Water level set for a three (3) tier zoning area.	T1–Area of activity: Water level depletion required for activity. T2–Buffer Area: Water level recession rate must be less than 1.0 m/a.

IUA	Ground-water unit	RU	Sub-component	Resource Quality Objective	Indicator/ Measure	Numerical Limit
						T3–Background or Reference Area: Water level recession rate must be less than 0.5 m/a.
			Protection zoning	As per water quality specifications.	Water quality parameters set for a three (3) tier zoning area.	T1–Area of activity, maximum concentration levels due to impact (based on dataset in impacted area): pH:; pH: 5.0 to 9.5; NO_3–N: 60 mg/l; Salinity EC: 600 mS/m; Chloride: 1500 mg/l; Sulphates: 800 mg/l; and Fluoride: 6.4 mg/l. T2–Buffer Area: Allow up to 75th Percentile of actual background values in QC A41E: pH: 7.2 – 7.8; NO_3–N: 8.0 mg/l; Salinity EC: 200 mg/l; Chloride: 300 mg/l; Sulphates: 170 mg/l; and Fluoride: 1.8 mg/l. T3–Background or Reference Area: Allow up to 50th Percentile + 10% in key constituents as indicated above (see Quality above).