DEPARTMENT OF WATER AND SANITATION

NO. 1419 **21 DECEMBER 2018**

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

PROPOSED RESERVE DETERMINATION OF WATER RESOURCES FOR THE VAAL CATCHMENT

I, Gugile Nkwinti, Minister of Water and Sanitation, in terms of section 16(3) of the National Water Act, 1998 (Act No. 36 of 1998) hereby publish, for public comment the proposed Reserve of the water resources for the Vaal catchment area, as set out in the Schedule.

Any person who wishes to submit written comments with regard to the proposed Reserve should submit the comments within 60 days from the date of publication of this Notice to:

Acting Director: Reserve Determination
Attention: Mr Kwazi Majola
Department of Water and Sanitation
Ndinaye Building 178 Francis Baard Street
Private Bag X313
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NKWINTI GE (MP)
MINISTER OF WATER AND SANITATION
DATE: 23/10/2018

SCHEDULE

PROPOSED RESERVE OF WATER RESOURCES FOR THE VAAL CATCHMENT IN TERMS OF SECTION 16(1) AND (2) OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

DESCRIPTION OF WATER RESOURCE

1. (1) The Reserve is determined for all or part of every significant water resource within the Vaal catchment as set out below:

Water Management Area: Vaal

Drainage Regions: C Primary Drainage Region:

C11, C12, C13, C21, C22, C23, C81, C82, C83, C24, C25, C41, C42, C43, C60, C70, C31, C32, C33, C91, C92, C41, C42

(excluding the Modder Riet catchment, C51 and C52; and excluding the Molopo catchment, D41 and D42 of the Vaal Water Management Area)

Rivers: Vaal, Wilge, Klip, Klein Vaal, Waterval, Suikerbosrand, Blesbokspruit, Mooi, Vals, Schoonspruit, Sand, Vet, Harts

(2) The Minister has in terms of section 12 of the National Water Act, 1998 (Act No.36 of 1998) ("the Act"), prescribed a system for classifying water resources by issuing Government Notice No. R. 810, published in Government *Gazette* No. 33541 dated 17 September 2010. In terms of section 16(1) of the Act, the Minister must, as soon as reasonably practicable after the class of all or part of a water resource has been determined, by Notice in the *Gazette*, determine the Reserve for all or part of that water resource.

(3) The Minister, in terms of section 16(3) of the Act, proposes, for the purpose of section 16(1) of the Act, the following Reserve determination for the Vaal catchment.

2. ACRONYMS AND DEFINITIONS

2.1 Acronyms

BAS	Best attainable state
BHN	Basic Human Needs
CAWC	Co-ordinated Water Bird Counts
CBA	Critical Biodiversity Areas
EC	Ecological Category
EcoSpecs	Ecological Specifications
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Areas
EWR	Ecological Water Requirement
GRAII	Groundwater Resource Assessment Phase II
GRDM	Groundwater Reserve Determination Methodology
GRUs	Groundwater Resource Units
MAR	Mean Annual Runoff
MCM	Million Cubic Metres
PES	Present Ecological Status
REC	Recommended Ecological Category
TEC	Target Ecological Category
TPCs	Thresholds of Potential Concern
WUL	Water Use Licence

2.2 Definitions

Baseflow is a sustained low flow in rivers during dry or fair weather conditions, but not necessarily all contributed by groundwater; includes contribution from delayed interflow and groundwater discharge.

Ecological Importance and Sensitivity (EIS): Key indicators in the ecological classification of water resources. Ecological importance relates to the presence, representativeness and diversity of species of biota and habitat. Ecological sensitivity relates to the vulnerability of the habitat and biota to modifications that may occur in flows, water levels and physico-chemical conditions.

Ecological Water Requirements (EWR): The flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components.

Ecological Water Requirement (EWR) Sites: Specific points on the river as determined through the site selection process. An EWR site consists of a length of river which may consist of various cross-sections for both hydraulic and ecological purposes. These sites provide sufficient indicators to assess environmental flows and assess the condition of biophysical components (drivers such as hydrology, geomorphology and physico-chemical) and biological responses (viz. fish, invertebrates and riparian vegetation).

Present Ecological State (PES): A category indicating the current health or integrity of various biological attributes of the water resource, compared to the natural or close to natural reference conditions. The results of the process are provided as Ecological Categories (ECs) ranging from A (near natural) to F (completely modified) for the PES.

Recharge is the addition of water to the zone of saturation, either by downward percolation of precipitation or surface water and/ or the lateral migration of groundwater from adjacent aquifers.

Recommended Ecological Category (REC): An ecological category indicating the ecological management target for a water resource based on its ecological classification that should be attained. Categories range from Category A (unmodified, natural) to Category D (largely modified).

River Node (biophysical node): These are modelling point's representative of an upstream reach or area of an aquatic eco-system (rivers, wetlands, estuaries and groundwater) for which a suite of relationships apply.

Sub-quaternary catchments: A finer subdivision of the quaternary catchments (the catchment areas of tributaries of main stem rivers in quaternary catchments).

Target Ecological Category (TEC): Means the assigned ecological condition by the Minister to a water resource that reflects the ecological condition of that water resource in terms of the deviation of its biophysical components from the natural reference condition. The ultimate target to achieve a sustainable system both ecologically and economically taking into account the PES and REC.

PROPOSED RESERVE DETERMINATION AS REQUIRED IN TERMS OF SECTION 16(1) AND (2) OF THE NATIONAL WATER ACT, 1998

3. (1) The proposed Reserve which includes the Ecological Water Requirements (EWRs) and the Basic Human Needs Reserve (BHN) for the Rivers at EWR sites and selected biophysical nodes in the Vaal catchment is set out in section 4. The Vaal catchment locality and EWR sites are indicated in **Figure 1**.

(2) The water quality component of the proposed Reserve for the Rivers at the EWR sites in Vaal catchment in terms of section 16(1) of the Act is set out in section 5.

(3) The proposed Groundwater Reserve for Water Quantity in terms of section 16(1) of the Act for the Vaal catchment is set out in section 6.

(4) The proposed Groundwater Reserve for Water Quality in terms of section 16(1) of the Act for the Vaal catchment is set out in **section 6**.

(5) The proposed ecological specifications for the Wetlands in terms of section 16(1) of the Act for Vaal catchment is set out in **section 7**.

(6) The Reserve will apply from the date signed off as determined in terms of section 16(1) of the Act, unless otherwise specified by the Minister.

4. PROPOSED RESERVE FOR RIVERS

Proposed Reserve determination and ecological categorisation in terms of section 16(1) of the Act for the rivers of the Vaal catchment area, where the Reserve is expressed as a percentage of the NMAR for the respective catchments (cumulative):

Table 4.1: Proposed Reserve for the Rivers at the EWR sites which include the EWRs to protect the aquatic ecosystem and the BHN requirements

Quaternary Catchment	Water Resource	PES	EIS	TEC[5]	MAR (MCM)[1]	Reserve[2] (%MAR)	Ecological Reserve[3] (%MAR)	Basic human needs Reserve[4] (%MAR)
C11J	Vaal River – EWR 1	B/C	High	B/C	332.3*	39.411	39.41	0.001
C11M	Vaal River – EWR 2	C	Moderate	C	457.7#	13.610	13.61	0.00022
C12F	Waterval – EWR WA1	D	Low	D	76.71#	3.501	3.5	0.0007
C12G	Waterval – EWR WA2	D	Low	D	147.43#	6.4003	6.4	0.00027
C12H	Vaal River – EWR 3	C	Moderate	C	858.1#	14.300	14.3	0.00004
C22F	Vaal River – EWR 4	C	High	B/C	1977.3#	21.550	21.55	0.00015
C23L	Vaal River – EWR 5	C/D	High	C	2288•	34.100	34.1	0.00004
C13D	Klip River – EWR 6	B/C	Moderate	B/C	95.3#	26.542	26.54	0.0021
C81A	Wilge River – EWR 7	A/B	High	A/B	23.5#	45.893	45.88	0.0128
C82C	Wilge River – EWR 8	C	Moderate	C	474.3#	11.770	11.77	0.00006
C21C	Suikerbosrand – EWR 9	C	High	B/C	31.3#	41.893	41.89	0.0032
C21G	Suikerbosrand – EWR 10	C/D	Moderate	C/D	149.27*	34.391	34.39	0.0007
C21F	Blesbokspruit – EWR 11	D	Low	D	100.69*	18.145	18.14	0.0050
C11C	Klein Vaal River – RE-EWR 1	C	Moderate	C	26.09#	24.725	24.71	0.0153
C23G	Mooi River – RE-EWR 2	D	Low	D	37.7#	19.061	19.05	0.0106
C24B	Vaal River – EWR 12	D	Moderate	D	1574.64*	28.280	28.28	0.00009
C24J	Vaal River – EWR 13	C/D	Moderate	C/D	1638.37•	35.800	35.8	0.00009
C60J	Vals River – EWR 14	C/D	Moderate	C/D	145.79#	17.050	17.05	0.00034
C43A	Vet River – EWR 15	C/D	Moderate	C/D	253.15*	18.200	18.2	0.00028
C41E	Klein Vet – RE – EWR 3	C	Moderate	C	49.56#	19.540	19.54	0.00028
C42J	Sand – EWR RD1	C/D	Moderate	B/C	140.76#	23.820	23.82	0.00007
C42L	Sand – EWR RD2	C	Moderate	B/C	180.692#	23.490	23.49	0.00011
C24E	Schoonspruit – EWR S1	C	Low	C	59.38#	35.805	35.8	0.0049
C24G	Schoonspruit – EWR S3	C/D	Low	C/D	89.96#	30.902	30.9	0.0018
C24H	Schoonspruit – EWR S4	C/D	Low	C/D	102.09#	31.203	31.2	0.0034
C91A	Vaal – EWR 16	D	Moderate	D	3242.51*	13.020	13.02	0.00007
C33C	Harts – EWR 17	D	Moderate	D	147.85*	51.6034	51.60	0.0034
C92B	Vaal – EWR 18	C	Moderate	C	1177.28*	21.871	21.87	0.00060

1) MAR is the Mean Annual Runoff (# Based on natural flow at the EWR site MAR; * Based on present day flow at the EWR site; • Based on observed flow at the EWR site).
2) The Reserve is the total requirement that accounts for both the Ecological Reserve and the Basic Human Needs Reserve (BHN).
3) Ecological Reserve requirement represents the long term mean based on the MAR. If the MAR changes, this volume will also change.
4) Represents the BHN requirement as a percentage of the MAR. Basic human needs includes the population directly reliant on rivers, streams and springs for water supply (derived from 2011 Census data)
5) Target Ecological Category (TEC): The ultimate target to achieve a sustainable system both ecologically and economically taking into account the PES and REC.

ECOLOGICAL WATER REQUIREMENTS SITE INFORMATION

EWR Site	EWR site name	River	Sub-quaternary river reach	Coordinates		Quaternary catchment
				Latitude	Longitude	
EWR1	Uitkoms	Vaal	C11J-01838	S26.872800	E29.613840	C11J
EWR2	Grootdraai	Vaal	C11M-01894	S26.92110	E29.27929	C11M
EWR WA1	Waterval_1	Waterval	C12F-01722	S26.64608	E29.01857	C12F
EWR WA2	Waterval_2	Waterval	C12G-01896	S26.88543	E28.88357	C12G
EWR3	Gladdedrift	Vaal	C12C-01997	S26.99087	E28.72971	C12H
EWR4	De Neys	Vaal	C22F-01737	S26.84262	E28.11230	C22F
EWR5	Skandinavia	Vaal	C22L-01792	S26.93243	E27.01367	C23L
EWR6	Klip	Klip	C13D-02226	S27.36166	E29.48503	C13D
EWR7	Upper Wilge	Wilge	C81A-02790	S28.20185	E29.55827	C81A
EWR8	Bavaria	Wilge	C82C-2505	S27.80017	E28.76778	C82C
EWR9	Suikerbos Upstream	Suikerbosrand	C21C-01675	S26.64670	E28.38197	C21C
EWR10	Suikerbos Downstream	Suikerbosrand	C21G-01627	S26.68137	E28.16798	C21G
EWR11	Blesbokspruit	Blesbokspruit	C21F-01447	S26.47892	E28.42488	C21F
RE-EWR1	Klein Vaal	Klein Vaal	C11C-01846	S26.912750	E30.174970	C11C
RE-EWR2	Mooi River	Mooi	C23G-01250	S26.258670	E27.159730	C23G
EWR12	Vaal River: Vermaasdrift	Vaal	C24B-01817	S26.93615	E26.85025	C24B
EWR13	Vaal River: Regina bridge	Vaal	C24J-02016	S27.10413	E26.52185	C24J
EWR14	Vals River: Proklameersdrift	Vals	C60J-02262	S27.48685	E26.81320	C60J
EWR15	Vet River: Fisantkraal	Vet	C43A-02561	S27.93482	E26.12569	C43A
RE-EWR 3	Klein-Vet, just downstream of Winburg	Klein Vet	C41E-03132	S28.564708	E26.943946	C41E
EWR RD1	RD1 at Meloding	Sand	C42J-02716	S28.1131994	E26.9080556	C42J
EWR RD2	RD2 at Steel Bridge	Sand	C42L-02635	S28.1228333	E26.5855555	C42L
S1	EWR S1	Schoonspruit	C24E-01164	S26.31172	E26.31172	C24E
S3	EWR S3	Schoonspruit	C24G-01661	S26.67500	E26.586108	C24G
S4	EWR S4	Schoonspruit	C24H-01860	S26.93333	E26.66528	C24H
EWR16	Downstream Bloemhof Dam	Vaal	C91A-02391	S27.65541	E25.59564	C91A
EWR17	Lloyds weir on Harts River	Harts	C33C-02836	S28.37694	E24.30305	C33C
EWR18	Schmidtsdrift	Vaal	C92B-02903	S28.70758	E24.07578	C92B

Table 4.2: The proposed Reserve for the Rivers at the priority biophysical nodes with High Ecological importance

Quaternary catchment	Node	River	Sub-quaternary river reach	PES	Ecological Importance	REC	Ecological Reserve (%NMAR)	BHN Reserve (%NMAR)	Total Reserve (%NMAR)	NMAR (MCM/a)
C11A	UA.1	Vaal	C11A-01460	B/C	High	B/C	44.09	0.053	44.143	13.27
C13C	UB.1	Vaal	C13C-02550	B	High	B	63.86	0.018	63.878	5.67
C13D	UB.2	Vaal	C13D-02416	B/C	High	B/C	38.86	0.004	38.864	54
C13D	UB.3	Vaal	C13D-02284	B/C	High	B	44.26	0.003	44.263	68.04
C13E	UB.6	Klip	C13E-02228	B/C	High	B	50.66	0.006	50.666	33.6
C81A	UC1.1	Wilge	C81A-02790	B	High	B	45.69	0.004	45.694	69.03
C81L	UC1.3	Meul	C81L-02594	B	High	B	57.25	0.008	57.258	26.49
C81G	UC2.3	Klerkspruit	C81G-02882	B	High	B	69.45	0.017	69.467	5.85
C83G	UD.4	Liebenbergsvlei	C83G-02364	B/C	High	B/C	62.48	0.006	62.486	4.74
C23H	UD.5	Liebenbergsvlei	C23H-02395	B/C	High	B	64.50	0.015	64.515	2.66
C12A	UH.1	Suikerbosrant	C12A-01567	B/C	High	B	47.17	0.002	47.172	28.65

5. WATER QUALITY COMPONENT OF THE PROPOSED ECOLOGICAL RESERVE FOR RIVERS

The ecological specifications for water quality for the maintenance of the Reserve target ecological category at each EWR site is detailed in Tables 5.1 to Table 5.18. These are the values of water quality parameters (threshold concentrations) that should not be exceeded in order to meet the water quality attribute of the TEC.

Table 5.1: EWR1: Water Quality Ecological Specifications

River: Vaal		**EWR 1: at Uitkoms**	**Water quality monitoring site/gauge: C1H007/ VS4 GDDC11**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 28 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 38 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 36 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 69 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 243 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	Electrical Conductivity	The 95th percentile of the data must be ≤ 70 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0, and the 95th percentile 8.0 to 8.8	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be < 21 mg/m^2	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.044 mg/L	
	Atrazine	The 95th percentile of the data must be ≤ 0.064 mg/l	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	
	Endosulfan	The 95th percentile of the data must be ≤ 0.13 µg/l	

Table 5.2: EWR2: Water Quality Ecological Specifications

River: Vaal		**EWR 2: Downstream Grootdraai**	**Water quality monitoring site/gauge:** C1H019
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 23 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 33 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 30 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 57 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0, and the 95th percentile 8.0 to 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥7.5mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.25 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤0.025mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be <18 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 16 mg/m^2	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.044 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.3: EWR3: Water Quality Ecological Specifications

River: Vaal		EWR 3: at Gladdedrift	Water quality monitoring site/gauge: C1H012
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 33 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 30 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 57 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.0 to 8.8	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.5 mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.25 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.1 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.4: EWR4: Water Quality Ecological Specifications

River: Vaal		EWR 4: at De Neys	Water quality monitoring site/gauge: C1H012
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 33 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 30 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 57 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.0 to 8.8	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7 mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be <10 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 1.7 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.1 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.5: EWR5: Water Quality Ecological Specifications

River: Vaal		EWR 5: Skandinavia	Water quality monitoring site/gauge: C2H122
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 36 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 105 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.8 to 9.2	
	Temperature	Temperatures should be close to natural range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6 mg/L	

Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 1.0 mg/L
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L
Toxics	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m²
	Ammonia	The 95th percentile of the data must be ≤ 0.1 mg/L
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L
Inorganic ions	Sulphate	The 95th percentile of the data must be ≤ 200 mg/L

Table 5.6: EWR6: Water Quality Ecological Specifications

River: Klip		**EWR 6:** Klip	**Water quality monitoring site/gauge: C1H002** (Downstream site in C13F)
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 28 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 20 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 15 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 21 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 45 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.0 to 8.8	
	Temperature	Temperatures should be close to natural range	
	Dissolved oxygen	Must be between 7 and 8 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range, minor silting of instream habitats acceptable	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.75 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.020 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 15 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be < 12 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.044 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.7: EWR7: Water Quality Ecological Specifications

River: Wilge		**EWR 7: Upper Wilge**	**Water quality monitoring site/gauge:** No weir/WQ site in vicinity of EWR site
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be < 23 mg/L	
	Na_2SO_4	The 95th percentile of the data must be < 33 mg/L	
	$MgCl_2$	The 95th percentile of the data must be < 30 mg/L	
	$CaCl_2$	The 95th percentile of the data must be < 57 mg/L	
	NaCl	The 95th percentile of the data must be < 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be < 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be < 55 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0, and the 95th percentile 8.8 to 9.2	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range, minor silting of instream habitats acceptable	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be between < 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be < 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 15 µgL	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 12 mg/m²	

Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.044 mg/L
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L

Table 5.8: EWR8: Water Quality Ecological Specifications

River: Wilge		**EWR 8: Bavaria**	**Water quality monitoring site/gauge: C8H028**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be < 16 mg/L	
	Na_2SO_4	The 95th percentile of the data must be < 20 mg/L	
	$MgCl_2$	The 95th percentile of the data must be < 15 mg/L	
	$CaCl_2$	The 95th percentile of the data must be < 21 mg/L	
	NaCl	The 95th percentile of the data must be < 45 mg/L	
	$CaSO_4$	The 95th percentile of the data must be < 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be <55 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.0 to 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range, minor silting of instream habitats acceptable	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be between <0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be < 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 20 ug/L	
	Chl-a periphyton	The 50th percentile of the data must be < 21 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.073 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.9: EWR9: Water Quality Ecological Specifications

River: Suikerbosrand		**EWR 9: Upstream**	**Water quality monitoring site/gauge:** C2H131
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be < 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be < 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be < 30 mg/L	
	$CaCl_2$	The 95th percentile of the data must be < 57 mg/L	
	NaCl	The 95th percentile of the data must be < 45 mg/L	
	$CaSO_4$	The 95th percentile of the data must be < 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be < 55 mS/m	
	pH	The 5th percentile of the data must be 6.5 – 8.0 and the 95th percentile 8.0 - 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range, minor silting of instream habitats acceptable	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be < 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be < 0.020 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must < 21 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.073 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.10: EWR10: Water Quality Ecological Specifications

River: Suikerbosrand		**EWR 10: Downstream**	**Water quality monitoring site/gauge**: C2H070
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be < 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be < 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be <51 mg/L	
	$CaCl_2$	The 95th percentile of the data must be <105 mg/L	
	NaCl	The 95th percentile of the data must be < 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be < 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be < 85 mS/m	
	pH	The 5th percentile of the data must be between 6.5 – 8.0 and the 95th percentile 8.0 - 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7 mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be < 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be < 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be < 21 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.100 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.11: EWR11: Water Quality Ecological Specifications

River: Blesbokspruit		**EWR 11: Blesbokspruit**	**Water quality monitoring site/gauge:** C2H185
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be < 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be < 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be < 36 mg/L	
	$CaCl_2$	The 95th percentile of the data must be <105 mg/L	
	NaCl	The 95th percentile of the data must be < 389 mg/L	
	$CaSO_4$	The 95th percentile of the data must be < 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be < 85 mS/m (<111mS/m)	
	pH	The 5th percentile of the data must be 6.5 – 8.0 and the 95th percentile 8.0 - 8.8	
	Temperature	Moderate change from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Initiate baseline monitoring for this variable	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.70 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be < 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m²	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.100 mg/L	
	Atrazine	The 95th percentile of the data must be ≤ 100 ug/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.0 mg/L)	
	Endosulfan	The 95th percentile of the data must be ≤ 0.200 µg/L	

Table 5.12: EWR12: Water Quality Ecological Specifications

River: Vaal		**EWR 12: at Vermaasdrift**	**Water quality monitoring site/gauge**: C2H007
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 5th and 95th percentile of the data must be ≤ 51 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 105 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	

Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m
	pH	The 5th percentile of the data must be 7.5 to 8.0 and the 95th percentile 8.8 to 9.2
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.5 mg/L
	Turbidity	Vary by a small amount from the natural turbidity range
	TDS	The 95th percentile data must be ≤560mg/L
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 1.0 mg/L
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m^2
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.1 mg/L
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L
	Cyanide	The 95th percentile data must be ≤ 0.05 mg/L
	Aluminium	The 95th percentile data must be ≤ 0.1 mg/L
Inorganic ions	Sulphate	The 95th percentile data must be ≤ 160 mg/L
	Magnesium	The 95th percentile data must be ≤ 33 mg/L

Table 5.13: EWR13: Water Quality Ecological Specifications

River: Vaal		**EWR 13: At Regina Bridge**	**Water quality monitoring site/gauge: C2H022**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 51 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 105 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be 85 mS/m	
	pH	The 5th percentile of the data must be 7.5 to 8.0, and the 95th percentile 8.0 to 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range	
	TDS	The 95th percentile data must be ≤ 560 mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 4.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m^2	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.0438 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	
	Aluminium	The 95th percentile data must be ≤ 0.1 mg/L	
	Cyanide	The 95th percentile data must be ≤ 0.05 mg/L	
Inorganic ions	Magnesium	The 95th percentile data must be ≤ 33 mg/L	
	Sulphate	The 95th percentile data must be ≤ 160 mg/L	

Table 5.14: **EWR14: Water Quality Ecological Specifications**

River: Vals		**EWR 14: Proklameersdrift**	**Water quality monitoring site/gauge: C6H007**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 51 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 191mg/L	
	NaCl	The 95th percentile of the data must be ≤ 105 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical	EC	The 95th percentile of the data must be ≤ 85 mS/m	

variables	pH	The 5th percentile of the data must be 5.5 to 6.0 and the 95th percentile 8.8 to 9.2
	Temperature	Small deviation from the natural temperature range
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8 mg/L
	Turbidity	Vary by a 10% from the natural turbidity range
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.7 mg/L
	PO_4-P	The 50th percentile of the data must be ≤ 0.125mg/L
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30ug/L
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m^2
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.073 mg/L
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L

Table 5.15: EWR15: Water Quality Ecological Specifications

River: Vet		**EWR 15: at Fisantkraal**	**Water quality monitoring site/gauge: C4H004**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 36 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 69 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th percentile of the data must be 6.5 – 8.0, and the 95th percentile 8.0 – 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.058 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 25 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m^2	
Toxics	Ammonia	The 95th percentile of the data must be ≤ 0.044 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	
Inorganic ions	Sulphate	The 95th percentile data must be ≤ 120 mg/L	
	Chloride	The 95th percentile data must be ≤ 100 mg/L	

Table 5.16: EWR16: Water Quality Ecological Specifications

River: Vaal		**EWR 16: Downstream Bloemhof Dam**	**Water quality monitoring site/gauge: C9H021**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 28 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 30 mg/L	
	$CaCl_2$	- The 95th percentile of the data must be ≤ 69 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5t^{h} percentile of the data must be between 6.5 to 8.0, and the 95th percentile between 8.0 to 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.25 mg/L	

	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m²
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.073 mg/L
	Fluoride	The 95th percentile of the data must be ≤ 3.0 mg/L
	Atrazine	The 95th percentile data must be ≤ 0.079 mg/L
	Endosulfan	The 95th percentile data must be ≤ 0.15 µg/L

Table 5.17: EWR17: Water Quality Ecological Specifications

River: Harts		**EWR 17: Lloyds weir**	**Water quality monitoring site/gauge**: C3H016
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 37 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 51 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 105 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 389 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.0 to 8.8	
	Temperature	Small deviation from the natural temperature range	
	Dissolved oxygen	5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary by a small amount from the natural turbidity range	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30ug/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m²	
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.073 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.18: EWR18: Water Quality Ecological Specifications

River: Vaal		**EWR 18: at Schmidtsdrift**	**Water quality monitoring site/gauge: C9H024**
Inorganic Salts	$MgSO_4$	The 95th percentile of the data must be ≤ 28 mg/L	
	Na_2SO_4	The 95th percentile of the data must be ≤ 51 mg/L	
	$MgCl_2$	The 95th percentile of the data must be ≤ 30 mg/L	
	$CaCl_2$	The 95th percentile of the data must be ≤ 105 mg/L	
	NaCl	The 95th percentile of the data must be ≤ 191 mg/L	
	$CaSO_4$	The 95th percentile of the data must be ≤ 351 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th percentile of the data must be 6.5 to 8.0 and the 95th percentile 8.0 to 8.8	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 4 mg/L	
	Turbidity	The 5th percentile of the data must be ≥ 4 mg/L	
Nutrients	Total inorganic Nitrogen (TIN)	The 50th percentile of the data must be ≤ 0.7 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m²	
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.073 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.5 mg/L	

Table 5.19: **EWR WA1: Water Quality Ecological Specifications**

River: Waterval		EWR WA1: Waterval_1	Water quality monitoring site/gauge: C1H036
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th percentile of the data must be 5.0 to 5.6 and the 95th percentile 9.2 to 10.0	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.5 mg/L	
Nutrients	Nitrate (NO_3) + Nitrite (NO_2)	The 50th percentile of the data must be ≤ 4.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m^2	
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.1 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.0 mg/L	
	Atrazine	The 95th percentile data must be ≤ 0.1 mg/L	
	Endosulfan	The 95th percentile data must be ≤ 0.20 µg/L	
	Cadmium (hard)	The 95th percentile data must be ≤ 0.005 mg/L	
	Chromium (VI)	The 95th percentile data must be ≤ 0.2 mg/L	
	Copper (hard)	The 95th percentile data must be ≤ 0.008 mg/L	
	Manganese	The 95th percentile data must be ≤ 1.3 mg/L	
	Lead (hard)	The 95th percentile data must be ≤ 0.013 mg/L	
	Mercury	The 95th percentile data must be ≤ 0.0017 mg/L	
	Selenium	The 95th percentile data must be ≤ 0.030 mg/L	
	Zinc	The 95th percentile data must be ≤ 0.036 mg/L	

Table 5.20: **EWR WA2: Water Quality Ecological Specifications**

River: Waterval		EWR WA2: Waterval_2	Water quality monitoring site/gauge: C1H030
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th percentile of the data must be 5.0 to 5.6 and the 95th percentile 9.2 to 10.0	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.5 mg/L	
Nutrients	Nitrate (NO_3) + Nitrite (NO_2)	The 50th percentile of the data must be ≤ 4.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤84 mg/m^2	
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.1 mg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.0 mg/L	
	Atrazine	The 95th percentile data must be ≤ 0.1 mg/L	
	Endosulfan	The 95th percentile data must be ≤ 0.20 µg/L	
	Cadmium (hard)	The 95th percentile data must be ≤ 0.005 mg/L	
	Chromium (VI)	The 95th percentile data must be ≤ 0.2 mg/L	
	Copper (hard)	The 95th percentile data must be ≤ 0.008 mg/L	
	Manganese	The 95th percentile data must be ≤ 1.3 mg/L	
	Lead (hard)	The 95th percentile data must be ≤ 0.013 mg/L	
	Mercury	The 95th percentile data must be ≤ 0.0017 mg/L	
	Selenium	The 95th percentile data must be ≤ 0.030 mg/L	
	Zinc	The 95th percentile data must be ≤ 0.036 mg/L	

Table 5.21: EWR S1: Water Quality Ecological Specifications

River: Schoonspruit		**EWR S1: downstream Schoonspruit Eye**	**Water quality monitoring site/gauge**: No site in vicinity
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th percentile of the data must be 5.6 to 5.9 and the 95th percentile 8.5 to 8.8	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
Nutrients	Nitrate (NO_3) + Nitrite (NO_2)	The 50th percentile of the data must be ≤ 2.5 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.02 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 10 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 12 mg/m^2	

Table 5.22: EWR S3: Water Quality Ecological Specifications

River: Schoonspruit		**EWR S3: downstream Taaibosspruit and Rietspruit confluence**	**Water quality monitoring site/gauge**: No active site
Physical variables	EC	The 95th percentile of the data must be ≤ 70 mS/m	
	pH	The 5th percentile of the data must be 5.2 to 5.4 and the 95th percentile 9.3 to 9.6	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.5 mg/L	
Nutrients	Nitrate (NO_3) + Nitrite (NO_2)	The 50th percentile of the data must be ≤ 2.5 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	

Table 5.22: EWR S4: Water Quality Ecological Specifications

River: Schoonspruit		**EWR S4: downstream Johan Neser Dam**	**Water quality monitoring site/gauge: C2H073**
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th percentile of the data must be 5.2 to 5.4 and the 95th percentile 9.3 to 9.6	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.5 mg/L	
Nutrients	Nitrate (NO_3) + Nitrite (NO_2)	The 50th percentile of the data must be ≤ 2.5 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
Inorganic ions	Sulphate	The 95th percentile of the data must be ≤ 200 mg/L	
Toxics	Ammonia as Nitrogen	The 95th percentile of the data must be ≤ 0.073 mg/L	
	Aluminium	The 95th percentile of the data must be ≤ 0.1 mg/L	
	Manganese	The 95th percentile of the data must be ≤0.250 mg/L	
	Uranium	The 95th percentile of the data must be ≤0.03 mg/L	
	Iron	The 95th percentile of the data must be ≤0.25 mg/L	
	Chromium (VI)	The 95th percentile data must be ≤ 0.2 mg/L	
	Copper (hard)	The 95th percentile data must be ≤ 0.008 mg/L	
	Cyanide (free)	The 95th percentile data must be ≤ 0.050 mg/L	

6. PROPOSED RESERVE FOR GROUNDWATER

Table 6.1 below presents the Groundwater Reserve for the Vaal Catchment area derived using the Groundwater Resources Directed Measures (GRDM) methodology.

A groundwater quantity ranking approach was applied using the stress index (SI) principle. The stress index provides a measure of the groundwater balance in a groundwater unit (in this case the quaternary catchment) indicating the fraction of how much of the groundwater recharge [volume] is used, *i.e.* (i) amount required for BHN (25 l/c/d), (ii) the volume of groundwater supporting the base flow (i.e. the baseflow requirement of the quaternary catchment), and (iii) the actual groundwater use/abstraction. When the SI is =/> 1.00 it means that all the recharged groundwater is "allocated". The "safe" cut off is 0.65 of 65% of the groundwater recharge. SI is an indicator of the groundwater use impact.

The prescribed GRDM algorithm was used and an "allocable groundwater" volume (MCM/a) was calculated. The potential impact of groundwater abstraction on the surface water component in the quaternary catchments is listed. According to the GRDM algorithm for calculating the "groundwater component" of a water resource unit (*i.e.* in this case it's the quaternary catchment). This algorithm is explained in the GRDM protocols, and it indicates the component of the annual recharge that is still available after BHN, baseflow requirements and the current water use is subtracted from the calculated groundwater recharge. SI is used as an indicator in a table format to sort and rank the dataset to highlight quaternary catchments where the groundwater balance is approaching over utilisation.

The groundwater quality for each quaternary catchment, where available in a data count of >9, was applied and the ranking of the groundwater quality is according to the guideline: "Quality of domestic water supplies Volume 1: Assessment Guide". 1998. Water Research Commission, the Department of Water Affairs and Forestry & the Department of Health.

NOTE:

Class 0 This is ideal water quality, suitable for lifetime use, with no adverse health effects on the user. This class is essentially the same as the target water quality range in the 2nd edition of the South African Water Quality Guidelines for Domestic Use (DWAF, 1996).

Class I Water in this class is safe for lifetime use, but falls short of the ideal water quality in that there may be instances of adverse health effects, but these are usually mild, and overt health effects are almost sub-clinical and difficult to demonstrate. Water in Class I does not cause health effects under normal circumstances. Aesthetic effects may, however, be apparent.

Class II Water in this class is defined as that where adverse health effects are unusual for limited short-term use. Adverse health effects may become more common particularly with prolonged use over many years, or with lifetime use. This class represents water suitable for short-term or emergency use only, but not necessarily suitable for continuous use over a lifetime.

Class III This water has constituents in a concentration range where serious health effects might be anticipated, particularly in infants or elderly people with short-term use, and even more so with longer term use. The water in this class is not suitable for use as drinking water without adequate treatment to shift the water into a lower and safer class.

Table 6.1: Groundwater Resource Directed Measures (GRDM) for the Vaal River Catchment

Quaternary Catchment	Area (km²)	MAP (mm)	Recharge (Mm³/a)	% MAP	Population	Basic Human Needs (Mm³/a)	Groundwater Component of Baseflow (Mm³/a)	Total Reserve (Mm³/a)	Groundwater Use (Mm³/a)	Groundwater Balance (Mm³/a)	Exploitation Factor[1]	Allocable Groundwater Total (Mm³/a)	GRDM Classification[#]	Impact of groundwater abstraction on surface water[♦]	Groundwater Water Quality Reserve specification: Class*
	Area	RECHARGE (Average Annual)			RESERVE				USE & BALANCE & ALLOCABLE						WATER QUALITY
UPPER VAAL															
C11A	719.4	743	38.93	7.3	1955	0.02	23.54	23.56	0.00	15.37	0.32	4.93	Moderate to High	Low	Limited hydrochemistry data.
C11B	534.7	705	26.49	7.0	2142	0.02	14.45	14.47	0.09	11.93	0.30	3.53	Moderate to High	Low	Limited hydrochemistry data.
C11C	448.8	765	22.16	6.5	1277	0.01	11.92	11.93	0.14	10.09	0.31	3.16	Moderate to High	Low	Limited hydrochemistry data.
C11D	371.7	702	17.05	6.5	965	0.01	8.12	8.13	0.17	8.75	0.30	2.64	Moderate to High	Low	Limited hydrochemistry data.
C11E	1154.7	697	46.63	5.8	23889	0.22	18.56	18.78	1.26	26.59	0.31	8.31	Moderate to High	Low	Limited hydrochemistry data.
C11F	929.1	705	39.67	6.1	31634	0.29	15.61	15.90	0.39	23.38	0.26	6.14	Moderate to High	Low	Limited hydrochemistry data.
C11G	431.7	659	17.01	6.0	1460	0.01	6.29	6.30	0.22	10.49	0.27	2.84	Moderate to High	Low	Limited hydrochemistry data.
C11H	1102.8	664	40.16	5.5	33924	0.31	13.57	13.88	1.38	24.90	0.31	7.73	Moderate to High	Low	Class 2
C11J	1000.6	658	36.15	5.5	3106	0.03	11.06	11.09	0.48	24.58	0.32	7.78	Moderate	Low	Limited hydrochemistry data
C11K	340.0	633	11.47	5.3	2970	0.03	3.28	3.31	0.31	7.85	0.33	2.55	Moderate	Low	No hydrochemistry data.
C11L	946.9	675	32.74	5.1	6416	0.06	10.02	10.08	0.49	22.17	0.33	7.21	Moderate	Low	No hydrochemistry data.
C11M	795.2	637	23.38	4.6	38506	0.35	4.54	4.89	0.43	18.06	0.33	5.87	Moderate	Low	Limited hydrochemistry data
C12A	484.1	614	12.10	4.1	758	0.01	1.59	1.60	0.00	10.50	0.32	3.39	Low	Low	No hydrochemistry data.
C12B	478.4	631	14.40	4.8	2461	0.02	3.51	3.53	0.13	10.74	0.33	3.49	Moderate	Low	No hydrochemistry data.
C12C	665.6	605	18.66	4.6	4257	0.04	7.29	7.33	0.17	11.16	0.31	3.51	Moderate to High	Low	No hydrochemistry data.
C12D	898.4	667	32.75	5.5	53555	0.49	9.37	9.86	3.78	19.11	0.30	5.79	Moderate to High	Low	Class 2
C12E	497.3	641	16.87	5.3	1960	0.02	5.01	5.03	0.26	11.58	0.32	3.65	Moderate	Low	Limited hydrochemistry data
C12F	834.1	635	29.46	5.6	3241	0.03	10.02	10.05	0.36	19.05	0.30	5.63	Moderate to High	Low	No hydrochemistry data.
C12G	570.4	640	21.20	5.8	6797	0.06	8.04	8.10	0.20	12.90	0.34	4.44	Moderate to High	Low	Limited hydrochemistry data
C12H	355.1	618	11.26	5.1	16104	0.15	8.86	9.01	0.08	2.17	0.33	0.72	High	Low	No hydrochemistry data.
C12J	344.3	615	9.67	4.6	627	0.01	0.58	0.59	0.17	8.91	0.31	2.75	Low	Low	Nohydrochemistry data.
C12K	478.7	657	19.93	6.3	2739	0.02	7.55	7.57	0.09	12.27	0.34	4.14	Moderate to High	Low	Limited hydrochemistry data
C12L	886.5	648	31.99	5.6	2116	0.02	11.57	11.59	3.77	16.63	0.33	5.57	Moderate to High	Low	No hydrochemistry data.
C13A	593.5	779	27.18	5.9	2807	0.03	11.85	11.88	0.21	15.09	0.33	4.90	Moderate to High	Low	Limited hydrochemistry data
C13B	615.0	683	21.93	5.2	2395	0.02	6.29	6.31	0.27	15.35	0.33	4.99	Moderate	Low	No hydrochemistry data.
C13C	836.2	724	35.96	5.9	5970	0.05	14.54	14.59	0.04	21.33	0.33	6.97	Moderate to High	Low	Limited hydrochemistry data
C13D	894.6	698	32.67	5.2	1742	0.02	9.80	9.82	0.11	22.74	0.33	7.39	Moderate	Low	No hydrochemistry data.
C13E	602.1	699	21.94	5.2	1130	0.01	6.31	6.32	0.01	15.61	0.33	5.07	Moderate	Low	No hydrochemistry data.
C13F	610.6	692	19.25	4.6	1525	0.01	5.01	5.02	0.03	14.20	0.33	4.62	Modarate	Low	No hydrochemistry data.
C13G	434.0	674	14.14	4.8	15885	0.14	3.02	3.16	0.01	10.97	0.29	3.21	Moderate	Low	Limited hydrochemistry data
C13H	588.4	628	15.36	4.2	1688	0.02	2.18	2.20	0.02	13.14	0.32	4.21	Low	Low	Limited hydrochemistry data
C21A	706.6	674	26.89	5.6	4853	0.04	9.77	9.81	0.06	17.02	0.33	5.68	Low	Low	Limited hydrochemistry data
C21B	430.6	697	9.70	3.2	19019	0.17	7.97	8.14	0.23	1.33	0.34	0.46	High	Low	Limited hydrochemistry data
C21C	437.9	674	9.85	3.3	8820	0.08	7.75	7.83	0.13	1.89	0.33	0.63	High	Low	Class 0
C21D	445.8	698	8.56	2.8	180660	1.65	5.78	7.43	0.84	0.29	0.44	0.13	Critical	Low	Class 0◆
C21E	628.2	691	9.21	2.1	40363	0.37	7.69	8.06	0.22	0.93	0.41	0.38	High	Low	Class 1◆
C21F	426.6	704	9.49	3.2	71170	0.65	8.26	8.91	0.59	0.01	0.35	0.00	Critical	Low	Class 0
C21G	462.4	667	9.38	3.0	2339	0.02	8.07	8.09	0.03	1.26	0.36	0.45	High	Low	Class 0◆
C22A	548.4	695	19.56	5.4	517617	4.73	7.04	11.77	1.41	6.38	0.42	2.68	High	Low	Class 1
C22B	391.4	691	11.22	4.7	237009	2.16	3.11	5.27	1.47	4.48	0.42	1.89	Moderate to High	Low	Class 2◆
C22C	465.3	684	14.72	4.5	96073	0.88	10.17	11.05	0.03	3.64	0.41	1.49	High	Low	Class 1
C22D	345.2	701	12.24	9.2	30823	0.28	7.55	7.83	2.34	4.61	0.47	2.15	High	Low	Class 1◆
C22E	532.1	669	12.13	3.4	13549	0.12	10.47	10.59	0.91	0.63	0.44	0.28	High	Low	Class 0◆
C22F	440.2	655	7.01	2.4	109440	1.00	7.48	8.48	0.05	1.52	0.35	0.53	Critical	Low	Class 1◆

Quaternary Catchment	Area (km^2)	MAP (mm)	Recharge (Mm^3/a)	% MAP	Population	Basic Human Needs (Mm^3/a)	Ground-water Component of Baseflow (Mm^3/a)	Total Reserve (Mm^3/a)	Ground-water Use (Mm^3/a)	Ground-water Balance (Mm^3/a)	Exploi-tation Factor[1]	Allocable Ground-water Total (Mm^3/a)	GRDM Classification[#]	Impact of groundwater abstraction on surface water[+]	Groundwater Water Quality Reserve specification: Class*
C22G	830.4	613	25.77	5.1	2596	0.02	0.00	0.02	0.47	25.28	0.33	8.23	Natural	Low	Limited hydrochemistry data.
C22H	454.2	639	9.35	3.2	282162	2.57	4.81	7.38	0.07	1.90	0.43	0.81	High	Moderate	Class 0◆: None
C22J	668.7	633	15.25	3.6	14856	0.14	10.89	11.03	0.24	3.98	0.42	1.68	High	Moderate	Class 1◆: None
C22K	433.8	644	18.27	6.5	58152	0.53	7.86	8.39	0.34	9.54	0.34	3.22	Moderate to High	Low	Class 0◆: None
C23A	258.0	612	7.39	4.7	1028	0.01	1.04	1.05	0.12	6.22	0.33	2.02	Low	Low	No hydrochemistry data.
C23B	701.1	619	27.63	6.4	2152	0.02	8.14	8.16	0.40	19.07	0.34	6.49	Moderate	Low	Class 0◆
C23C	1068.7	609	23.13	3.6	42653	0.39	14.95	15.34	0.60	7.19	0.32	2.28	High	Low	Class 1
C23D	510.1	664	25.79	7.6	99677	0.91	6.53	7.44	4.93	13.42	0.49	6.54	Moderate to High	Low	Class 0◆
C23E	850.0	631	35.84	6.7	64933	0.59	11.34	11.93	34.23	10.32	0.49	5.06	Critical	Low	Class 1◆
C23F	1323.6	605	47.38	5.9	2373	0.01	15.87	15.89	0.28	31.21	0.44	13.78	Low	Moderate	Class 0◆
C23G	613.1	597	27.18	7.4	1605	0.01	9.01	9.02	2.32	15.84	0.48	7.67	Moderate	Low	Class 2
C23H	451.2	604	12.43	4.6	8385	0.08	6.96	7.04	0.27	5.12	0.48	2.45	Moderate to High	Moderate	Class 1
C23J	890.3	620	19.05	3.5	25528	0.23	12.12	12.35	0.63	6.07	0.44	2.69	High	Low	Class 1◆
C23K	395.9	607	10.76	4.5	1605	0.01	6.86	6.87	0.26	3.63	0.49	1.79	High	Low	Class 1◆
C23L	1211.0	612	24.44	3.3	40749	0.37	16.70	17.07	0.73	6.64	0.44	2.93	High	Low	Class 0◆
C81A	381.9	882	22.72	6.7	323	0.00	15.86	15.86	0.05	6.81	0.38	2.55	High	Low	Limited hydrochemistry data
C81B	575.5	763	26.44	6.0	1374	0.01	13.14	13.15	0.08	13.21	0.35	4.69	Moderate to High	Low	Limited hydrochemistry data
C81C	249.7	730	9.88	5.4	230	0.00	3.76	3.76	0.03	6.09	0.30	1.83	Moderate to High	Low	No hydrochemistry data.
C81D	194.8	735	8.31	5.8	216	0.00	3.38	3.38	0.03	4.90	0.32	1.59	Moderate to High	Low	No hydrochemistry data.
C81E	642.4	658	22.34	5.3	21029	0.19	8.27	8.46	0.10	13.78	0.30	4.17	Moderate to High	Low	No hydrochemistry data.
C81F	688.0	892	46.15	7.5	236987	2.16	42.98	45.14	0.35	0.66	0.31	0.21	Critical	Moderate	Class 0◆
C81G	434.5	722	19.86	6.3	3855	0.04	9.12	9.16	0.09	10.61	0.32	3.38	Moderate to High	Low	No hydrochemistry data.
C81H	357.8	638	12.37	5.4	1227	0.01	5.89	5.90	0.04	6.43	0.31	1.96	Moderate to High	Low	No hydrochemistry data.
C81J	391.6	612	12.88	5.4	1496	0.01	1.38	1.39	0.06	11.43	0.30	3.43	Low	Low	Limited hydrochemistry data
C81K	359.1	623	12.34	5.5	793	0.01	4.99	5.00	0.05	7.29	0.30	2.20	Moderate to High	Low	No hydrochemistry data.
C81L	793.4	740	35.97	6.1	689	0.01	16.93	16.94	0.11	18.92	0.37	7.08	Moderate to High	Low	No hydrochemistry data.
C81M	1091.7	662	38.82	5.4	2936	0.03	12.34	12.37	0.16	26.29	0.37	9.66	Moderate	Low	Limited hydrochemistry data
C82A	581.7	670	21.75	5.6	1303	0.01	0.00	0.01	0.08	21.66	0.3	7.55	Natural	Low	Limited hydrochemistry data
C82B	493.0	660	16.88	5.2	4736	0.04	0.00	0.04	0.07	16.77	0.3	5.25	Natural	Low	Class 0
C82C	353.1	646	12.39	5.4	978	0.01	5.27	5.28	0.07	7.04	0.3	1.85	Moderate to High	Low	No hydrochemistry data.
C82D	571.6	623	19.50	5.5	1849	0.02	5.35	5.37	0.16	13.97	0.2	3.48	Moderate	Low	No hydrochemistry data.
C82E	622.1	666	20.73	5.0	1725	0.02	5.34	5.36	0.04	15.33	0.3	4.31	Moderate	Low	No hydrochemistry data.
C82F	483.1	639	14.02	4.5	827	0.01	2.67	2.68	0.01	11.33	0.3	3.27	Moderate	Low	No hydrochemistry data.
C82G	580.3	655	18.14	4.8	1086	0.01	5.16	5.17	0.09	12.88	0.2	3.16	Moderate	Low	No hydrochemistry data.
C82H	782.1	614	20.70	4.3	1537	0.01	3.29	3.30	0.19	17.21	0.3	5.11	Moderate	Low	Class 2
C83A	745.5	692	31.27	6.1	3635	0.03	12.06	12.09	0.07	19.11	0.35	6.76	Moderate	Low	Limited hydrochemistry data
C83B	250.5	668	9.95	5.9	2141	0.02	2.91	2.93	0.03	6.99	0.40	2.76	Moderate	Low	Class 1
C83C	827.5	663	30.60	5.6	39056	0.36	9.91	10.27	0.10	20.23	0.31	6.26	Moderate	Low	No hydrochemistry data.
C83D	464.6	650	17.05	5.6	1761	0.02	4.54	4.56	0.05	12.44	0.31	3.90	Moderate	Low	No hydrochemistry data.
C83E	426.0	654	15.46	5.6	1918	0.02	4.72	4.74	0.11	10.61	0.30	3.16	Moderate	Low	No hydrochemistry data.
C83F	874.8	637	32.35	5.8	2266	0.02	10.93	10.95	11.23	10.17	0.28	2.86	high	Low	No hydrochemistry data.
C83G	694.9	647	24.23	5.4	14040	0.13	7.26	7.39	0.21	16.63	0.26	4.25	Moderate	Low	No hydrochemistry data.
C83H	546.7	646	16.23	4.6	4173	0.04	3.42	3.46	0.24	12.53	0.25	3.13	Moderate	Low	No hydrochemistry data.
C83J	221.5	641	6.68	4.7	18257	0.17	1.52	1.69	0.11	4.88	0.25	1.24	Moderate to High	Low	No hydrochemistry data.
C83K	547.6	635	16.63	4.8	943	0.01	3.55	3.56	0.24	12.83	0.30	3.82	Moderate	Low	No hydrochemistry data.
C83L	825.4	641	23.21	4.4	2014	0.02	3.97	3.99	0.05	19.17	0.33	6.23	Moderate	Low	No hydrochemistry data.
C83M	1100.0	639	31.72	4.5	9691	0.09	6.91	7.00	0.39	24.33	0.32	7.90	Moderate	Low	No hydrochemistry data.
MIDDLE VAAL															
C24A	839.0	582.6	18.6	4.18	5 017	0.1		0.10	0.3	18.3	0.41	7.46	Natural	Low	Class 2

Quaternary Catchment	Area (km^2)	MAP (mm)	Recharge (Mm^3/a)	% MAP	Population	Basic Human Needs (Mm^3/a)	Ground-water Component of Baseflow (Mm^3/a)	Total Reserve (Mm^3/a)	Ground-water Use (Mm^3/a)	Ground-water Balance (Mm^3/a)	Exploi-tation Factor[1]	Allocable Ground-water Total (Mm^3/a)	GRDM Classification[#]	Impact of groundwater abstraction on surface water[*]	Groundwater Water Quality Reserve specification: Class[*]
C24B	529.6	561.0	16.31	5.49	31 256	0.29	3.55	3.84	5.1	7.4	0.45	3.33	Moderate to High	Low	Class 3◆
C24C	1349.8	586.9	96.98	12.24	25 663	0.23	13.09	13.3	14.9	68.76	0.48	33.24	Low	Moderate	Class 1
C24D	364.3	584.3	3.99	1.88	3 079	0.03	3.94	3.97	0.2	0.2	0.43	0.08	Critical	Low	Class 0
C24E	925.1	560.0	21.87	6.23	51389	0.47	10.17	10.64	7.51	9.14	0.45	4.14	High	Low	Class 1
C24F	2019.8	577.5	55.91	5.52	29827.00	0.27	13.63	13.90	1.30	40.71	0.46	18.87	Moderate	Low	Class 1
C24G	985.2	581.6	11.75	2.05	20 852	0.19	9.01	9.20	0.3	2.3	0.45	1.01	High	Low	Class 0
C24H	839.8	574.9	10.81	2.24	5 225	0.05	3.64	3.69	1.4	5.7	0.42	2.41	Moderate to High	Negligible	Class 1◆
C24J	2109.4	550.9	22.31	1.88	17403.00	0.16	10.15	10.31	0.80	11.20	0.41	4.57	Moderate to High	Negligible	Class 0
C25A	863.4	542.8	12.49	2.67	2 998	0.03	2.88	2.91	0.5	9.1	0.38	3.49	Moderate	Negligible	Class 0◆
C25B	1887.6	510.0	18.16	1.89	63 942	0.58	4.45	5.03	0.6	12.5	0.35	4.34	Moderate	Negligible	Class 3
C25C	1209.7	523.0	7.02	1.84	5004.00	0.09	5.76	5.85	0.80	0.37	0.38	0.14	Critical	Negligible	Class 2
C25D	1202.4	526.1	8.74	1.21	60167.00	0.67	1.74	2.41	0.60	5.73	0.39	2.26	Moderate	Negligible	Limited hydrochemistry data
C25E	1536.1	510.7	8.3	1.01	10597.00	0.1	1.2	1.3	1.9	5.1	0.34	1.76	Moderate to High	Negligible	Class 2
C25F	2218.2	481.9	10.48	0.96	3706.00	0.06	3.24	3.30	0.60	6.58	0.34	2.22	Moderate to High	Negligible	Class 0◆
C41A	1077.8	598.2	9.04	1.41	54136.00	0.74	2.66	3.40	1.10	4.54	0.35	1.60	Moderate to High	Low	Class 2
C41B	1004.8	598.2	9.51	1.58	20033.00	0.27	3.06	3.33	0.40	5.78	0.37	2.15	Moderate to High	Low	Limited hydrochemistry data
C41C	1094.6	594.7	10.09	1.55	21 292	0.19	3.05	3.24	0.3	6.6	0.42	2.74	Moderate to High	Low	Limited hydrochemistry data
C41D	1154.5	549.5	4.94	0.78	29 024	0.26	2.09	2.35	0.3	2.3	0.41	0.93	High	Negligible	Class 1◆
C41E	391.3	519.0	0.62	0.30	2 629	0.02	2.75	2.77	0.1	2.3	0.38	0.84	High	Negligible	Limited hydrochemistry data
C41F	555.5	494.9	0.56	0.20	8 630	0.08	0.01	0.09	0.2	0.3	0.37	0.10	Critical	Negligible	No hydrochemistry data
C41G	271.8	516.8	0.29	0.21	130.00	0.00	0.24	0.24	0.1	0.1	0.37	0.02	Critical	Negligible	No hydrochemistry data
C41H	887.4	499.2	2.32	0.52	8 669	0.08	0.78	0.86	0.2	1.3	0.33	0.42	Critical	Negligible	No hydrochemistry data
C41J	555.5	494.6	2.16	0.79	11 390	0.10	0.90	1.00	0.1	1.1	0.34	0.36	Critical	Negligible	No hydrochemistry data
C42A	694.7	632.0	8.77	2.00	5 110	0.05	7.24	7.29	0.3	1.2	0.37	0.44	Critical	Low	Limited hydrochemistry data
C42B	726.5	581.0	5.10	1.21	1 903	0.02	4.06	4.08	0.3	0.7	0.35	0.25	Critical	Low	Limited hydrochemistry data
C42C	793.3	625.6	6.27	1.26	8 731	0.08	4.76	4.84	0.3	1.1	0.34	0.38	Critical	Low	No hydrochemistry data
C42D	662.5	555.5	1.71	0.46	21 992	0.20	2.45	2.65	0.3	1.2	0.31	0.38	Critical	Low	No hydrochemistry data
C42E	750.4	564.0	2.93	0.69	6 150	0.06	2.19	2.25	0.3	0.4	0.33	0.13	Critical	Low	No hydrochemistry data
C42F	733.7	568.2	1.42	0.34	39 809	0.36	0.25	0.61	0.2	0.6	0.33	0.20	Critical	Low	No hydrochemistry data
C42G	555.0	550.4	0.82	0.27	6 876	0.06	1.64	1.70	0.2	1.1	0.35	0.38	Critical	Low	No hydrochemistry data
C42H	445.0	541.1	0.53	0.22	41 319	0.38	0.53	0.91	1.1	1.5	0.32	0.47	Critical	Low	No hydrochemistry data.
C42J	1013.9	530.8	1.99	0.37	12 391	0.11	1.29	1.40	0.4	0.2	0.34	0.06	Critical	Low	Limited hydrochemistry data
C42K	668.0	522.1	0.67	0.19	587.00	0.01	0.16	0.17	0.9	0.4	0.37	0.15	Critical	Low	Limited hydrochemistry data
C42L	510.8	505.2	0.96	0.37	1 182	0.01	0.70	0.71	0.1	0.2	0.35	0.05	Critical	Low	Limited hydrochemistry data
C43A	1490.7	482.2	3.37	0.47	26 707	0.24	1.98	2.22	0.3	0.9	0.32	0.27	Critical	Negligible	Limited hydrochemistry data
C43B	723.3	494.0	1.26	0.35	1 854	0.02	0.05	0.07	0.2	1.0	0.33	0.32	Critical	Negligible	Class 2◆
C43C	912.5	469.0	3.17	0.74	9 364	0.09	1.04	1.13	0.3	1.7	0.30	0.51	High	Negligible	No hydrochemistry data
C43D	1475.4	464.0	3.95	0.58	24 645	0.22	0.58	0.80	0.4	2.8	0.30	0.83	High	Negligible	No hydrochemistry data
C60A	859.4	632.8	10.01	1.84	2 340	0.02	7.68	7.70	0.2	2.1	0.35	0.75	High	Low	No hydrochemistry data
C60B	1021.6	617.8	10.11	1.60	10 790	0.10	8.26	8.36	0.5	1.3	0.33	0.42	Critical	Low	Limited hydrochemistry data
C60C	1047.4	578.4	5.51	0.91	8 469	0.08	3.64	3.72	0.4	1.4	0.40	0.55	High	Low	Limited hydrochemistry data
C60D	644.7	552.7	2.53	0.71	2 567	0.02	0.85	0.87	0.2	1.5	0.42	0.62	High	Low	Limited hydrochemistry data
C60E	663.9	563.9	2.76	0.74	7 788	0.07	1.12	1.19	0.6	1.0	0.40	0.39	Critical	Low	Class 0◆
C60F	659.1	558.2	1.94	0.53	96 217	0.88	1.29	2.17	0.2	0.4	0.40	0.17	Critical	Low	Limited hydrochemistry data
C60G	781.6	539.2	2.28	0.54	1 300	0.01	2.34	2.35	2.1	2.2	0.36	0.78	High	Low	Limited hydrochemistry data
C60H	1232.0	514.8	2.69	0.42	6 274	0.06	0.25	0.31	0.3	2.1	0.34	0.71	High	Negligible	Limited hydrochemistry data
C60J	958.9	550.6	10.02	1.90	6 169	0.06	3.84	3.90	0.8	5.3	0.37	1.98	Moderate to High	Negligible	No hydrochemistry data
C70A	612.5	628.1	7.02	1.82	2 218	0.02	5.28	5.30	0.5	1.2	0.34	0.41	Critical	Low	Limited hydrochemistry data
C70B	659.7	612.6	4.74	1.17	6 715	0.06	3.53	3.59	0.4	0.8	0.34	0.26	Critical	Low	No hydrochemistry data

Quaternary Catchment	Area (km^2)	MAP (mm)	Recharge (Mm^3/a)	% MAP	Population	Basic Human Needs (Mm^3/a)	Ground-water Component of Baseflow (Mm^3/a)	Total Reserve (Mm^3/a)	Ground-water Use (Mm^3/a)	Ground-water Balance (Mm^3/a)	Exploi-tation Factor[1]	Allocable Ground-water Total (Mm^3/a)	GRDM Classification#	Impact of groundwater abstraction on surface water*	Groundwater Water Quality Reserve specification: Class*
C70C	886.9	616.0	5.92	1.08	4 114	0.04	4.14	4.18	0.4	1.3	0.32	0.43	Critical	Low	No hydrochemistry dat.
C70D	674.6	586.6	3.82	0.96	2 012	0.02	2.30	2.32	0.6	0.9	0.32	0.28	Critical	Low	Class 1
C70E	692.8	580.4	7.67	1.91	13 034	0.12	4.67	4.79	0.2	2.7	0.31	0.83	Moderate to High	Low	No hydrochemistry data
C70F	564.3	576.4	4.95	1.52	2 141	0.02	3.98	4.00	0.2	0.8	0.29	0.22	Critical	Low	No hydrochemistry data
C70G	901.2	579.1	7.15	1.37	2 745	0.03	3.91	3.94	0.3	2.9	0.33	0.97	High	Low	No hydrochemistry data
C70H	250.6	570.4	1.92	1.34	3 081	0.03	1.59	1.62	0.1	0.2	0.33	0.07	Critical	Low	No hydrochemistry data
C70J	520.6	577.3	6.45	2.14	3 602	0.03	3.99	4.02	0.2	2.2	0.39	0.86	High	Low	No hydrochemistry data
C70K	890.6	567.4	9.39	1.86	3 050	0.03	5.14	5.17	0.7	3.5	0.39	1.38	Moderate to High	Low	Limited hydrochemistry data
LOWER VAAL															
C31A	1402	330.00	32.68	7.00	28400	0.71	3.93	4.64	0.80	27.33	0.47	12.87	Low	Negligible	Class 2
C31B	1743	230.00	20.59	5.00	4400	0.11	9.10	9.21	1.10	11.27	0.41	4.60	Moderate to High	Negligible	Class 2◆
C31C	1635	280.00	21.79	5.00	800	0.02	7.92	7.94	1.40	13.83	0.40	5.58	Moderate to High	Negligible	Class 2◆
C31D	1493	300.00	22.95	5.00	30400	0.76	5.34	6.10	0.60	16.09	0.31	5.06	Moderate	Negligible	Class 2◆
C31E	2958	270.00	37.91	5.00	65600	1.64	17.35	18.99	2.30	17.28	0.37	6.40	Moderate to High	Negligible	Class 2◆
C31F	1787	205.00	12.92	3.00	63600	1.59	5.75	7.34	1.40	3.99	0.33	1.32	High	Negligible	Class 2◆
C32A	1403	165.00	8.62	3.50	25200	0.63	4.55	5.18	1.10	2.81	0.36	1.01	High	Negligible	Class 2◆
C32B	2997	225.00	31.22	5.00	123200	3.08	10.50	13.58	2.50	17.64	0.47	8.30	Moderate to High	Negligible	Class 2
C32C	1657	245.00	15.24	3.50	<1000	0.00	6.49	6.49	0.80	8.75	0.35	3.03	Moderate to High	Negligible	Class 2
C32D	4134	240.00	60.26	6.00	40000	1.00	10.65	11.65	3.30	47.61	0.49	23.41	Moderate	Negligible	Class 2
C33A	2855	245.00	35.29	5.00	57600	1.44	7.84	9.28	1.10	24.57	0.43	10.67	Moderate	Negligible	Class 2◆
C33B	2830	230.00	36.55	5.00	17600	0.44	3.47	3.91	0.80	32.20	0.49	15.71	Low	Negligible	Class 2◆
C33C	4141	190.00	35.06	4.50	2400	0.06	3.43	3.49	0.97	31.51	0.41	12.99	Low	Negligible	Class 2◆
C91A	2545	170.00	16.81	3.50	11200	0.28	6.07	6.35	0.80	10.18	0.32	3.31	Moderate	Negligible	Class 1◆
C91B	4675	270.00	59.66	4.50	2600	0.07	20.10	20.17	1.10	39.42	0.33	13.19	Moderate	Negligible	Class 2◆
C91C	3133	240.00	33.55	4.00	10400	0.26	6.83	7.09	0.18	26.20	0.38	9.91	Moderate	Negligible	Class 2
C91D	2694	265.00	27.83	4.00	22000	0.55	1.70	2.25	0.50	25.03	0.35	8.65	Low	Negligible	Class 2◆
C91E	1506	190.00	9.32	3.00	36400	0.91	2.08	2.99	0.40	5.42	0.34	1.85	Moderate to High	Negligible	Class 2◆
C92A	3913	180.00	27.50	4.00	24000	0.60	4.07	4.67	2.03	22.23	0.39	8.74	Moderate to High	Negligible	Class 1◆
C92B (68%)[2]	1341	190.00	9.00	3.50	<1000	0.00	0.30	0.30	2.70	8.70	0.36	3.14	Moderate	Negligible	Class 2◆
C92C (67%)[2]	1332	185.00	10.00	4.00	6600	0.17	0.35	0.52	4.70	9.31	0.41	3.82	Moderate to high	Negligible	Class 2◆

Limited hydrochemistry data: Number of water quality analyses is less than 9 per quaternary catchment (Limit of population number required for statistical analyses)
Class ◆ implies groundwater quality classification range where the median value of the quaternary catchment analyses range falls is pre-1995.
NA - Unknown
*Surface water – Groundwater Interaction (Based on potential Stream Flow Reduction Factor): Moderate = <10% to 5%, Low = <5% to 1%, and Negligible = <1%.
[1]Exploitation Factor = That part of the recharge that can be abstracted over time from an aquifer system due to the hydraulic nature of the water bearing formation.
[2]Only the upper parts (indicated as percentages of the total quaternary catchment area) falls in the Lower Vaal catchment area.
*In terms of Water Research Commission: Quality of Domestic Water Supplies – Volume 1. Report No. TT 101/98, Second Edition, 1998.
Grey shading: Dolomite water areas (Significant aquifer systems) - At least 25% of quaternary catchment contains dolomite rocks.

#GRDM Classification System:	
0.20 - 0.40	Moderate
0.40 - 0.65	Moderate to High
0.65 - 0.95	High
> 0.95	Critical

PROPOSED GROUNDWATER RESERVE – WATER QUALITY COMPONENT

The groundwater quality of quaternary catchments with available hydrochemistry data was assessed against the domestic water target water quality ranges as shown in Table 6.2 and Table 6.3. A summary of the results for the groundwater quality classification at quaternary level in terms of the basic human needs requirement is included in the tables that follow (Tables 6.4 – 6.73).

Table 6.2: Chemical water quality

Chemical Parameter	Water Quality Ranges[1]				
	Units	Class 0	Class I	Class II	Class III
Calcium as Ca	mg/l	0 - 80	80 - 150	150 - 300	> 300
Magnesium as Mg	mg/l	0 - 30	30 - 70	70 - 100	> 100
Potassium as K	mg/l	0 - 25	25 - 50	50 - 100	> 100
Sodium as Na	mg/l	0 - 100	100 - 200	200 - 400	> 400
Chloride as Cl	mg/l	0 - 100	100 - 200	200 - 600	> 600
Sulphate as SO_4	mg/l	0 - 200	200 - 400	400 - 600	> 600
Nitrate as NO_x- N	mg/l	0 - 6	6 - 10	10 - 20	> 20
Fluoride as F	mg/l	< 0.7	0.7 - 1.0	1.0 - 1.5	> 1.5
Total hardness as $CaCO_3$	mg/l	0 - 200	200 - 300	300 - 600	> 600

1) Reference: Classification System in terms of - Water Research Commission: Quality of Domestic Water Supplies – Volume 1. Report No. TT 101/98, Second Edition, 1998.

Table 6.3: Physical water quality

Physical Parameter	Water Quality Ranges[2]				
	Units	Class 0	Class I	Class II	Class III
pH (pH Units)		6 - 9	5 - 6 & 9 - 9.5	4.5 – 5 & 9.5 - 10	< 4 or > 10
Total Dissolved Solids	mg/l	0 - 450	450 - 1000	1000 - 2400	> 2400
Electrical Conductivity	mS/m	0 - 70	70 - 150	150 - 370	> 370

2) Reference: Classification System in terms of - Water Research Commission: Quality of Domestic Water Supplies – Volume 1. Report No. TT 101/98, Second Edition, 1998.

The water quality for the following quaternary catchments were not assessed due to insufficient information (lack of representable groundwater quality data):

- C11A; C11B; C11C; C11D; C11E; C11F; C11G; C11J; C11K; C11L; C11M
- C12A; C12B; C12C; C12E; C12F; C12G; C12H; C12J; C12K; C12L
- C13A; C13B; C13C; C13D; C13E; C13F; C13G
- C21A; C21B
- C22G
- C23A; C23C
- C25D
- C41B; C41C; C41E; C41F; C41G; C41H; C41J
- C42A; C42B; C42C; C42D; C42E; C42F; C42G; C42H; C42J; C42K; C42L
- C43C; C43D
- C60A; C60B; C60C; C60D; C60F; C60G; C60H; C60J
- C70A;C70B; C70C; C70E; C70F; C70G; C70H; C70J; C70K
- C81A; C81B; C81C; C81D; C81E; C81G; C81H; C81J; C81K; C81L; C81M
- C82A; C82C; C82D; C82E; C82F; C82G
- C83A; C83C; C83D; C83E; C83F; C83G; C83H; C83JC83K; C83L; C83M

Table 6.4: Groundwater Quality Reserve – Quaternary catchment C11H

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C11H			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		37	8.20	9.5 – 5.0 (±0.05)	9.0
Electrical Conductivity	mS/m	37	79.70	<150	88
Calcium as Ca	mg/l	37	78.65	<150	87
Magnesium as Mg	mg/l	37	36.28	<70	39
Sodium as Na	mg/l	37	48.76	<200	54
Potassium as K	mg/l	37	4.24	<50	4.7
Total Hardness as $CaCO_3$	mg/l	37	345.8	<300	380
Chloride as Cl	mg/l	37	32.32	<200	36
Sulphate as SO_4	mg/l	37	61.58	<400	68
Nitrate as NO_x-N	mg/l	37	4.75	<10	5.2
Fluoride as F	mg/l	37	0.35	<1.0	0.39
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC *et al.* 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used.

Table 6.5: Groundwater Quality Reserve – Quaternary catchment C12D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C12D			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		34	8.13	9.5 – 5.0 (±0.05)	9.0
Electrical Conductivity	mS/m	34	89.25	<150	98
Calcium as Ca	mg/l	34	84.75	<150	93
Magnesium as Mg	mg/l	34	48.91	<70	54
Sodium as Na	mg/l	34	29.33	<200	32
Potassium as K	mg/l	34	8.34	<50	9
Total Hardness as $CaCO_3$	mg/l	34	413	<300	454
Chloride as Cl	mg/l	34	44.61	<200	49
Sulphate as SO_4	mg/l	34	96.36	<400	106
Nitrate as NO_x-N	mg/l	34	3.63	<10	4
Fluoride as F	mg/l	34	0.28	<1.0	0.3
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC *et al.* 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used

Table 6.6: Groundwater Quality Reserve – Quaternary catchment C21C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C21C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		67	7.65	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	67	57.20	<150	63
Calcium as Ca	mg/l	67	40.10	<150	44
Magnesium as Mg	mg/l	67	19.40	<70	21
Sodium as Na	mg/l	67	39.10	<200	43
Potassium as K	mg/l	67	4.98	<50	5
Total Hardness as $CaCO_3$	mg/l	67	180	<300	198
Chloride as Cl	mg/l	67	43.40	<200	48
Sulphate as SO_4	mg/l	67	31.60	<400	35
Nitrate as NO_x-N	mg/l	67	0.10	<10	0.11
Fluoride as F	mg/l	67	0.71	<1.0	0.78
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.7: Groundwater Quality Reserve – Quaternary catchment C21D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C21D♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		17	7.37	9.5 – 5.0 (±0.05)	8.1
Electrical Conductivity	mS/m	17	27.50	<150	30
Calcium as Ca	mg/l	17	19.10	<150	21
Magnesium as Mg	mg/l	17	11	<70	12
Sodium as Na	mg/l	17	13.40	<200	15
Potassium as K	mg/l	17	2.20	<50	2.4
Total Hardness as $CaCO_3$	mg/l	17	101.60	<300	112
Chloride as Cl	mg/l	17	8.50	<200	9
Sulphate as SO_4	mg/l	17	6.10	<400	7
Nitrate as NO_x-N	mg/l	17	0.23	<10	0.25
Fluoride as F	mg/l	17	0.12	<1.0	0.13
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.8: Groundwater Quality Reserve – Quaternary catchment C21E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C21E♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		11	7.52	9.5 – 5.0 (±0.05)	8.3
Electrical Conductivity	mS/m	11	51.90	<150	57
Calcium as Ca	mg/l	11	39.70	<150	44
Magnesium as Mg	mg/l	11	20.90	<70	23
Sodium as Na	mg/l	11	26.00	<200	29
Potassium as K	mg/l	11	10.43	<50	11
Total Hardness as $CaCO_3$	mg/l	11	185.2	<300	203
Chloride as Cl	mg/l	11	29.50	<200	32
Sulphate as SO_4	mg/l	11	32.30	<400	36
Nitrate as NO_x-N	mg/l	11	1.73	<10	1.9
Fluoride as F	mg/l	11	0.17	<1.0	0.19
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.9: Groundwater Quality Reserve – Quaternary catchment C21F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C21F			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		31	7.92	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	31	41.80	<150	46
Calcium as Ca	mg/l	31	39.34	<150	43
Magnesium as Mg	mg/l	31	19.71	<70	22
Sodium as Na	mg/l	31	10.72	<200	12
Potassium as K	mg/l	31	0.50	<50	1
Total Hardness as $CaCO_3$	mg/l	31	179.5	<300	198
Chloride as Cl	mg/l	31	25.60	<200	28
Sulphate as SO_4	mg/l	31	12.87	<400	14
Nitrate as NO_x-N	mg/l	31	2.88	<10	3.21
Fluoride as F	mg/l	31	0.13	<1.0	0.15
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used

Table 6.10: Groundwater Quality Reserve – Quaternary catchment C21G

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C21G♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		15	7.58	9.5 – 5.0 (±0.05)	8.3
Electrical Conductivity	mS/m	15	48.30	<150	53
Calcium as Ca	mg/l	15	32	<150	35
Magnesium as Mg	mg/l	15	20.80	<70	23
Sodium as Na	mg/l	15	23.80	<200	26
Potassium as K	mg/l	15	3.23	<50	4
Total Hardness as $CaCO_3$	mg/l	15	165.6	<300	182
Chloride as Cl	mg/l	15	12.409	<200	14
Sulphate as SO_4	mg/l	15	12.40	<400	14
Nitrate as NO_x-N	mg/l	15	1.52	<10	2
Fluoride as F	mg/l	15	0.21	<1.0	0.23
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.11: Groundwater Quality Reserve – Quaternary catchment C22A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22A			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		45	8.00	9.5 – 5.0 (±0.05)	8.1
Electrical Conductivity	mS/m	45	46.5	<150	51
Calcium as Ca	mg/l	45	38.6	<150	43
Magnesium as Mg	mg/l	45	29.0	<70	32
Sodium as Na	mg/l	45	8.00	<200	8.8
Potassium as K	mg/l	45	0.96	<50	1.1
Total Hardness as $CaCO_3$	mg/l	45	215.8	<300	237
Chloride as Cl	mg/l	45	5.8	<200	6.4
Sulphate as SO_4	mg/l	45	90.0	<400	99
Nitrate as NO_x-N	mg/l	45	4.07	<10	4.5
Fluoride as F	mg/l	45	0.10	<1.0	0.11
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.12: Groundwater Quality Reserve – Quaternary catchment C22B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		53	7.70	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	53	134.10	<150	148
Calcium as Ca	mg/l	53	106.45	<150	117
Magnesium as Mg	mg/l	53	58.70	<70	65
Sodium as Na	mg/l	53	46.25	<200	51
Potassium as K	mg/l	53	3.75	<50	4
Total Hardness as $CaCO_3$	mg/l	53	507.5	<300	558
Chloride as Cl	mg/l	53	55.10	<200	61
Sulphate as SO_4	mg/l	53	308.70	<400	340
Nitrate as NO_x-N	mg/l	53	2.40	<10	2.6
Fluoride as F	mg/l	53	0.15	<1.0	0.17
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.13: Groundwater Quality Reserve – Quaternary catchment C22C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		123	7.79	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	123	57	<150	63
Calcium as Ca	mg/l	123	44.0	<150	50
Magnesium as Mg	mg/l	123	32.0	<70	35
Sodium as Na	mg/l	123	14.8	<200	16
Potassium as K	mg/l	123	1.84	<50	2
Total Hardness as $CaCO_3$	mg/l	123	241.6	<300	266
Chloride as Cl	mg/l	123	16.8	<200	19
Sulphate as SO_4	mg/l	123	23.2	<400	26
Nitrate as NO_x-N	mg/l	123	2.38	<10	2.6
Fluoride as F	mg/l	123	0.10	<1.0	0.11
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.14: Groundwater Quality Reserve – Quaternary catchment C22D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22D♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		182	7.60	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	182	38.15	<150	42
Calcium as Ca	mg/l	182	35.90	<150	39
Magnesium as Mg	mg/l	182	22.85	<70	25
Sodium as Na	mg/l	182	6.30	<200	7
Potassium as K	mg/l	182	0.84	<50	1
Total Hardness as $CaCO_3$	mg/l	182	183.7	<300	202
Chloride as Cl	mg/l	182	6.25	<200	7
Sulphate as SO_4	mg/l	182	9	<400	10
Nitrate as NO_x-N	mg/l	182	1.20	<10	1.3
Fluoride as F	mg/l	182	0.10	<1.0	0.11
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.15: Groundwater Quality Reserve – Quaternary catchment C22E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22E♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		181	7.68	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	181	38.70	<150	43
Calcium as Ca	mg/l	181	33.80	<150	37
Magnesium as Mg	mg/l	181	22.90	<70	25
Sodium as Na	mg/l	181	10.10	<200	11
Potassium as K	mg/l	181	0.94	<50	1
Total Hardness as $CaCO_3$	mg/l	181	178.70	<300	197
Chloride as Cl	mg/l	181	7.10	<200	8
Sulphate as SO_4	mg/l	181	9.70	<400	11
Nitrate as NO_x-N	mg/l	181	1.05	<10	1.2
Fluoride as F	mg/l	181	0.13	<1.0	0.14
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.16: Groundwater Quality Reserve – Quaternary catchment C22F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22F♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		39	7.60	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	39	48.30	<150	53
Calcium as Ca	mg/l	39	42.70	<150	47
Magnesium as Mg	mg/l	39	22.30	<70	25
Sodium as Na	mg/l	39	18	<200	20
Potassium as K	mg/l	39	1.61	<50	2
Total Hardness as $CaCO_3$	mg/l	39	198.5	<300	218
Chloride as Cl	mg/l	39	14.40	<200	16
Sulphate as SO_4	mg/l	39	10.30	<400	11
Nitrate as NO_x-N	mg/l	39	0.50	<10	0.55
Fluoride as F	mg/l	39	0.20	<1.0	0.22
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.17: The results of the Groundwater Component – QC C22H

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22H♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		30	7.21	9.5 – 5.0 (±0.05)	7.9
Electrical Conductivity	mS/m	30	18.30	<150	20
Calcium as Ca	mg/l	30	14.50	<150	16
Magnesium as Mg	mg/l	30	6	<70	7
Sodium as Na	mg/l	30	7.05	<200	8
Potassium as K	mg/l	30	0.91	<50	1
Total Hardness as $CaCO_3$	mg/l	30	60.9	<300	67
Chloride as Cl	mg/l	30	4.45	<200	5
Sulphate as SO_4	mg/l	30	4.70	<400	5
Nitrate as NO_x-N	mg/l	30	0.11	<10	0.12
Fluoride as F	mg/l	30	0.14	<1.0	0.15
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.18: Groundwater Quality Reserve – Quaternary catchment C22J

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22J♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		30	7.40	9.5 – 5.0 (±0.05)	8.1
Electrical Conductivity	mS/m	30	56.10	<150	62
Calcium as Ca	mg/l	30	47.70	<150	52
Magnesium as Mg	mg/l	30	27.65	<70	30
Sodium as Na	mg/l	30	23.75	<200	26
Potassium as K	mg/l	30	1.17	<50	1.3
Total Hardness as $CaCO_3$	mg/l	30	233.0	<300	256
Chloride as Cl	mg/l	30	17.35	<200	19
Sulphate as SO_4	mg/l	30	21.85	<400	24
Nitrate as NO_x-N	mg/l	30	4.29	<10	5
Fluoride as F	mg/l	30	0.21	<1.0	0.23
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.19: Groundwater Quality Reserve – Quaternary catchment C22K

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C22K♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		9	7.71	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	9	50.60	<150	56
Calcium as Ca	mg/l	9	40.20	<150	44
Magnesium as Mg	mg/l	9	13	<70	14
Sodium as Na	mg/l	9	33.60	<200	37
Potassium as K	mg/l	9	2.73	<50	3
Total Hardness as $CaCO_3$	mg/l	9	153.9	<300	169
Chloride as Cl	mg/l	9	17.80	<200	20
Sulphate as SO_4	mg/l	9	3.10	<400	3.4
Nitrate as NO_x-N	mg/l	9	0.20	<10	0.22
Fluoride as F	mg/l	9	0.28	<1.0	0.31
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.20: Groundwater Quality Reserve – Quaternary catchment C23B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		16	7.64	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	16	43.10	<150	47
Calcium as Ca	mg/l	16	31.05	<150	34
Magnesium as Mg	mg/l	16	20.45	<70	23
Sodium as Na	mg/l	16	15.95	<200	18
Potassium as K	mg/l	16	2.37	<50	3
Total Hardness as $CaCO_3$	mg/l	16	161.7	>300	178
Chloride as Cl	mg/l	16	13.30	<200	15
Sulphate as SO_4	mg/l	16	10.25	<400	11
Nitrate as NO_x-N	mg/l	16	2.44	<10	3
Fluoride as F	mg/l	16	0.23	<1.0	0.25
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.21: Groundwater Quality Reserve – Quaternary catchment C23C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C23C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		35	7.92	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	35	64.80	<150	71
Calcium as Ca	mg/l	35	42.45	<150	47
Magnesium as Mg	mg/l	35	27.76	<70	31
Sodium as Na	mg/l	35	53.10	<200	58
Potassium as K	mg/l	35	4.61	<50	5
Total Hardness as $CaCO_3$	mg/l	35	220.3	<300	242
Chloride as Cl	mg/l	35	24.50	<200	26
Sulphate as SO_4	mg/l	35	19.40	<400	21
Nitrate as NO_x-N	mg/l	35	4.07	<10	5
Fluoride as F	mg/l	35	0.42	<1.0	0.46
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used.

Table 6.22: The results of the Groundwater Component – QC C23D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23D♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		74	7.08	9.5 – 5.0 (±0.05)	7.8
Electrical Conductivity	mS/m	74	20.40	<150	22
Calcium as Ca	mg/l	74	16	<150	18
Magnesium as Mg	mg/l	74	10.70	<70	12
Sodium as Na	mg/l	74	3.80	<200	4
Potassium as K	mg/l	74	0.78	<50	1
Total Hardness as $CaCO_3$	mg/l	74	84.0	<300	92
Chloride as Cl	mg/l	74	2.25	<200	2.5
Sulphate as SO_4	mg/l	74	12.90	<400	14
Nitrate as NO_x-N	mg/l	74	0.53	<10	1
Fluoride as F	mg/l	74	0.05	<1.0	0.06
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.23: Groundwater Quality Reserve – Quaternary catchment C23E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23E♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		34	7.56	9.5 – 5.0 (±0.05)	8.3
Electrical Conductivity	mS/m	34	50.4	<150	55
Calcium as Ca	mg/l	34	51.1	<150	56
Magnesium as Mg	mg/l	34	33.7	<70	37
Sodium as Na	mg/l	34	9.9	<200	11
Potassium as K	mg/l	34	1.29	<50	1.4
Total Hardness as $CaCO_3$	mg/l	34	266.4	<300	293
Chloride as Cl	mg/l	34	5.15	<200	6
Sulphate as SO_4	mg/l	34	24.6	<400	27
Nitrate as NO_x-N	mg/l	34	1.96	<10	2
Fluoride as F	mg/l	34	0.05	<1.0	0.06
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.24: Groundwater Quality Reserve – Quaternary catchment C23F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23F♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		14	7.72	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	14	31.20	<150	34
Calcium as Ca	mg/l	14	30.90	<150	34
Magnesium as Mg	mg/l	14	16.75	<70	18
Sodium as Na	mg/l	14	3.40	<200	4
Potassium as K	mg/l	14	0.90	<50	1
Total Hardness as $CaCO_3$	mg/l	14	146.1	<300	161
Chloride as Cl	mg/l	14	3.35	<200	3.7
Sulphate as SO_4	mg/l	14	2	<400	2.2
Nitrate as NO_x-N	mg/l	14	1	<10	1.1
Fluoride as F	mg/l	14	0.12	<1.0	0.13
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.25: Groundwater Quality Reserve – Quaternary catchment C23G

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23G♣			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		196	7.78	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	196	88.95	<150	98
Calcium as Ca	mg/l	196	79.95	<150	88
Magnesium as Mg	mg/l	196	44.55	<70	49
Sodium as Na	mg/l	196	44.35	<200	48
Potassium as K	mg/l	196	1.88	<50	2
Total Hardness as $CaCO_3$	mg/l	196	383.1	<300	421
Chloride as Cl	mg/l	196	45.40	<200	50
Sulphate as SO_4	mg/l	196	228.05	<400	251
Nitrate as NO_x-N	mg/l	196	2.11	<10	2.3
Fluoride as F	mg/l	196	0.11	<1.0	0.12
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♣ Based on long-term hydrochemistry dataset from only one monitoring (spring/eye) site in the quaternary catchment

Table 6.26: Groundwater Quality Reserve – Quaternary catchment C23H

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23H			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		19	7.91	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	19	43.70	<150	48
Calcium as Ca	mg/l	19	44	<150	48
Magnesium as Mg	mg/l	19	24.60	<70	27
Sodium as Na	mg/l	19	11.40	<200	13
Potassium as K	mg/l	19	1.14	<50	1.25
Total Hardness as $CaCO_3$	mg/l	19	211.3	<300	232
Chloride as Cl	mg/l	19	7.20	<200	8
Sulphate as SO_4	mg/l	19	5.20	<400	6
Nitrate as NO_x-N	mg/l	19	3.11	<10	3.4
Fluoride as F	mg/l	19	0.13	<1.0	0.14
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.27: Groundwater Quality Reserve – Quaternary catchment C23J

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23J♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		20	7.73	9.5 – 5.0 (±0.05)	8.50
Electrical Conductivity	mS/m	20	44.2	<150	49
Calcium as Ca	mg/l	20	28.3	<150	31
Magnesium as Mg	mg/l	20	31.0	<70	34
Sodium as Na	mg/l	20	14.3	<200	16
Potassium as K	mg/l	20	1.50	<50	1.65
Total Hardness as $CaCO_3$	mg/l	20	198.3	<300	218
Chloride as Cl	mg/l	20	8.40	<200	9.0
Sulphate as SO_4	mg/l	20	7.45	<400	8.20
Nitrate as NO_x-N	mg/l	20	0.79	<10	0.87
Fluoride as F	mg/l	20	0.22	<1.0	0.24
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.28: Groundwater Quality Reserve – Quaternary catchment C23K

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23K♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		9	7.76	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	9	39.50	<150	43
Calcium as Ca	mg/l	9	44.50	<150	49
Magnesium as Mg	mg/l	9	19.20	<70	21
Sodium as Na	mg/l	9	15.70	<200	17
Potassium as K	mg/l	9	1.07	<50	1.1
Total Hardness as $CaCO_3$	mg/l	9	190.2	<300	209
Chloride as Cl	mg/l	9	6.10	<200	7
Sulphate as SO_4	mg/l	9	4	<400	4.5
Nitrate as NO_x-N	mg/l	9	2.32	<10	3
Fluoride as F	mg/l	9	0.18	<1.0	0.2
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.29: Groundwater Quality Reserve – Quaternary catchment C23L

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C23L♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		26	7.20	9.5 – 5.0 (±0.05)	7.9
Electrical Conductivity	mS/m	26	34.70	<150	38
Calcium as Ca	mg/l	26	33.55	<150	37
Magnesium as Mg	mg/l	26	16.80	<70	18
Sodium as Na	mg/l	26	10.25	<200	11
Potassium as K	mg/l	26	1.47	<50	2
Total Hardness as $CaCO_3$	mg/l	26	153	<300	168
Chloride as Cl	mg/l	26	5.90	<200	6
Sulphate as SO_4	mg/l	26	2	<400	2.2
Nitrate as NO_x-N	mg/l	26	0.87	<10	1
Fluoride as F	mg/l	26	0.13	<1.0	0.14
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.30 Groundwater Quality Reserve – Quaternary catchment C24A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24A			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		112	7.40	9.5 – 5.0 (±0.05)	8.1
Electrical Conductivity	mS/m	112	108.05	<150	119
Calcium as Ca	mg/l	112	89.95	<150	99
Magnesium as Mg	mg/l	112	74.30	<70	82
Sodium as Na	mg/l	112	70.35	<200	77
Potassium as K	mg/l	112	7.74	<50	9
Total Hardness as $CaCO_3$	mg/l	112	529.3	<300	582
Chloride as Cl	mg/l	112	67.05	<200	74
Sulphate as SO_4	mg/l	112	323.45	<400	356
Nitrate as NO_x-N	mg/l	112	1.99	<10	2
Fluoride as F	mg/l	112	0.16	<1.0	0.18
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.31: Groundwater Quality Reserve – Quaternary catchment C24B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		13	7.17	9.5 – 5.0 (±0.05)	7.9
Electrical Conductivity	mS/m	13	361.20	<150	397
Calcium as Ca	mg/l	13	458.60	<150	504
Magnesium as Mg	mg/l	13	225.40	<70	248
Sodium as Na	mg/l	13	118.90	<200	131
Potassium as K	mg/l	13	20.14	<50	22
Total Hardness as $CaCO_3$	mg/l	13	2073.3	<300	2281
Chloride as Cl	mg/l	13	143.40	<200	158
Sulphate as SO_4	mg/l	13	2109.90	<400	2321
Nitrate as NO_x-N	mg/l	13	4.82	<10	5.3
Fluoride as F	mg/l	13	0.22	<1.0	0.24
				Water Quality Class	Class 3

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset

Table 6.32: Groundwater Quality Reserve – Quaternary catchment C24C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		161	7.95	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	161	40.70	<150	45
Calcium as Ca	mg/l	161	34	<150	37
Magnesium as Mg	mg/l	161	29.20	<70	32
Sodium as Na	mg/l	161	4.60	<200	5
Potassium as K	mg/l	161	1.43	<50	2
Total Hardness as $CaCO_3$	mg/l	161	205.1	<300	226
Chloride as Cl	mg/l	161	5.70	<200	6
Sulphate as SO_4	mg/l	161	2	<400	2.2
Nitrate as NO_x-N	mg/l	161	1.97	<10	2.2
Fluoride as F	mg/l	161	0.05	<1.0	0.06
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.33: Groundwater Quality Reserve – Quaternary catchment C24D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24D			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		10	7.70	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	10	24.30	<150	27
Calcium as Ca	mg/l	10	16.95	<150	19
Magnesium as Mg	mg/l	10	10.10	<70	11
Sodium as Na	mg/l	10	13.90	<200	15
Potassium as K	mg/l	10	3.03	<50	3.3
Total Hardness as $CaCO_3$	mg/l	10	83.9	<300	92
Chloride as Cl	mg/l	10	5.05	<200	6
Sulphate as SO_4	mg/l	10	7.05	<400	8
Nitrate as NO_x-N	mg/l	10	3.46	<10	3.8
Fluoride as F	mg/l	10	0.13	<1.0	0.15
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.34: Groundwater Quality Reserve – Quaternary catchment C24E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24E			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		48	7.89	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	48	48.80	<150	54
Calcium as Ca	mg/l	48	35.45	<150	39
Magnesium as Mg	mg/l	48	35.75	<70	39
Sodium as Na	mg/l	48	7.20	<200	8
Potassium as K	mg/l	48	1.37	<50	2
Total Hardness as $CaCO_3$	mg/l	48	235.7	<300	259
Chloride as Cl	mg/l	48	12.15	<200	13
Sulphate as SO_4	mg/l	48	2	<400	2.2
Nitrate as NO_x-N	mg/l	48	5.21	<10	6
Fluoride as F	mg/l	48	0.13	<1.0	0.14
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.35: Groundwater Quality Reserve – Quaternary catchment C24F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24F			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		175	7.84	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	175	46.30	<150	51
Calcium as Ca	mg/l	175	40	<150	44
Magnesium as Mg	mg/l	175	26.90	<70	30
Sodium as Na	mg/l	175	7.70	<200	8
Potassium as K	mg/l	175	1.80	<50	2
Total Hardness as $CaCO_3$	mg/l	175	211	<300	232
Chloride as Cl	mg/l	175	30.50	<200	34
Sulphate as SO_4	mg/l	175	2	<400	2.2
Nitrate as NO_x-N	mg/l	175	6.62	<10	7
Fluoride as F	mg/l	175	0.05	<1.0	0.06
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.36: Groundwater Quality Reserve – Quaternary catchment C24G

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24G			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		23	7.80	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	23	38	<150	42
Calcium as Ca	mg/l	23	33.70	<150	37
Magnesium as Mg	mg/l	23	15.70	<70	17
Sodium as Na	mg/l	23	14.70	<200	16
Potassium as K	mg/l	23	1.99	<50	2.2
Total Hardness as $CaCO_3$	mg/l	23	148.8	<300	164
Chloride as Cl	mg/l	23	7.60	<200	8.4
Sulphate as SO_4	mg/l	23	11.80	<400	13
Nitrate as NO_x-N	mg/l	23	3.21	<10	3.5
Fluoride as F	mg/l	23	0.31	<1.0	0.34
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.37: Groundwater Quality Reserve – Quaternary catchment C24H

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24H♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		42	7.80	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	42	51.40	<150	57
Calcium as Ca	mg/l	42	46.10	<150	51
Magnesium as Mg	mg/l	42	25.80	<70	28
Sodium as Na	mg/l	42	14.85	<200	16
Potassium as K	mg/l	42	1.59	<50	1.75
Total Hardness as $CaCO_3$	mg/l	42	221.4	<300	244
Chloride as Cl	mg/l	42	15.40	<200	17
Sulphate as SO_4	mg/l	42	11.55	<400	13
Nitrate as NO_x-N	mg/l	42	3.67	<10	4.0
Fluoride as F	mg/l	42	0.27	<1.0	0.29
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.38: Groundwater Quality Reserve – Quaternary catchment C24J

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C24J			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		22	7.64	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	22	42.60	<150	43
Calcium as Ca	mg/l	22	36.30	<150	37
Magnesium as Mg	mg/l	22	16.30	<70	17
Sodium as Na	mg/l	22	24.85	<200	26
Potassium as K	mg/l	22	1.06	<50	2
Total Hardness as $CaCO_3$	mg/l	22	157.3	<300	173.5
Chloride as Cl	mg/l	22	10.45	<200	11
Sulphate as SO_4	mg/l	22	7.55	<400	8
Nitrate as NO_x-N	mg/l	22	1.62	<10	2
Fluoride as F	mg/l	22	0.22	<1.0	0.24
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.39: Groundwater Quality Reserve – Quaternary catchment C25A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C25A♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		9	7.84	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	9	53.60	<150	59
Calcium as Ca	mg/l	9	30	<150	33
Magnesium as Mg	mg/l	9	24.90	<70	27
Sodium as Na	mg/l	9	33.40	<200	37
Potassium as K	mg/l	9	1.37	<50	2
Total Hardness as $CaCO_3$	mg/l	9	177.4	<300	195
Chloride as Cl	mg/l	9	17	<200	19
Sulphate as SO_4	mg/l	9	14.20	<400	16
Nitrate as NO_x-N	mg/l	9	3.10	<10	3.4
Fluoride as F	mg/l	9	0.82	<1.0	0.9
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.40: Groundwater Quality Reserve – Quaternary catchment QC C25B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C25B			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		16	8.29	9.5 – 5.0 (±0.05)	9.1
Electrical Conductivity	mS/m	16	136.95	<150	151
Calcium as Ca	mg/l	16	27.32	<150	30
Magnesium as Mg	mg/l	16	15.25	<70	17
Sodium as Na	mg/l	16	267.18	<200	294
Potassium as K	mg/l	16	5.03	<50	6.0
Total Hardness as $CaCO_3$	mg/l	16	131.0	<300	144
Chloride as Cl	mg/l	16	117.83	<200	130
Sulphate as SO_4	mg/l	16	33.93	<400	37
Nitrate as NO_x-N	mg/l	16	0.35	<10	0.4
Fluoride as F	mg/l	16	2.38	<1.0	2.62
				Water Quality Class	Class 3

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used.

Table 6.41: Groundwater Quality Reserve – Quaternary catchment C25C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C25C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		28	8.13	9.5 – 5.0 (±0.05)	8.9
Electrical Conductivity	mS/m	28	50.45	<150	56
Calcium as Ca	mg/l	28	46.63	<150	51
Magnesium as Mg	mg/l	28	27.52	<70	30
Sodium as Na	mg/l	28	14.95	<200	16
Potassium as K	mg/l	28	1.93	<50	2
Total Hardness as $CaCO_3$	mg/l	28	229.8	<300	253
Chloride as Cl	mg/l	28	8.77	<200	10
Sulphate as SO_4	mg/l	28	4.32	<400	5
Nitrate as NO_x-N	mg/l	28	9.57	<10	11
Fluoride as F	mg/l	28	0.13	<1.0	0.15
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.42: Groundwater Quality Reserve – Quaternary catchment C25E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C25E			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		11	7.99	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	11	67.70	<150	74
Calcium as Ca	mg/l	11	48.30	<150	53
Magnesium as Mg	mg/l	11	20.70	<70	23
Sodium as Na	mg/l	11	19.80	<200	22
Potassium as K	mg/l	11	2.75	<50	3
Total Hardness as $CaCO_3$	mg/l	11	205.8	<300	226
Chloride as Cl	mg/l	11	17.80	<200	20
Sulphate as SO_4	mg/l	11	8.90	<400	10
Nitrate as NO_x-N	mg/l	11	13.07	<10	14
Fluoride as F	mg/l	11	0.18	<1.0	0.2
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.43: Groundwater Quality Reserve – Quaternary catchment C25F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C25F♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		22	7.75	9.5 – 5.0 (±0.05)	8.5
Electrical Conductivity	mS/m	22	27.20	<150	30
Calcium as Ca	mg/l	22	20.92	<150	23
Magnesium as Mg	mg/l	22	12.30	<70	14
Sodium as Na	mg/l	22	4.10	<200	5
Potassium as K	mg/l	22	1	<50	1.1
Total Hardness as $CaCO_3$	mg/l	22	102.9	<300	113
Chloride as Cl	mg/l	22	1.50	<200	2
Sulphate as SO_4	mg/l	22	11.45	<400	13
Nitrate as NO_x-N	mg/l	22	0.84	<10	1.0
Fluoride as F	mg/l	22	0.05	<1.0	0.06
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.44: Groundwater Quality Reserve – Quaternary catchment QC C31A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C31A			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		187	7.82	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	187	60.90	<150	67
Calcium as Ca	mg/l	187	59	<150	65
Magnesium as Mg	mg/l	187	34.30	<70	38
Sodium as Na	mg/l	187	13.10	<200	14
Potassium as K	mg/l	187	2.19	<50	2.4
Total Hardness as $CaCO_3$	mg/l	187	288.6	<300	317
Chloride as Cl	mg/l	187	27	<200	30
Sulphate as SO_4	mg/l	187	2	<400	2.2
Nitrate as NO_x-N	mg/l	187	4.96	<10	5.5
Fluoride as F	mg/l	187	0.12	<1.0	0.13
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.45: Groundwater Quality Reserve – Quaternary catchment C31B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C31B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		69	7.87	9.5 – 5.0 (±0.05)	8.6
Electrical Conductivity	mS/m	69	74.80	<150	82
Calcium as Ca	mg/l	69	80.80	<150	89
Magnesium as Mg	mg/l	69	36.90	<70	41
Sodium as Na	mg/l	69	23.30	<200	26
Potassium as K	mg/l	69	3.10	<50	3.3
Total Hardness as $CaCO_3$	mg/l	69	353.7	<300	389
Chloride as Cl	mg/l	69	35.70	<200	39
Sulphate as SO_4	mg/l	69	11.30	<400	12
Nitrate as NO_x-N	mg/l	69	14.05	<10	15
Fluoride as F	mg/l	69	0.23	<1.0	0.25
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.46: Groundwater Quality Reserve – Quaternary catchment C31C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C31C♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		41	7.61	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	41	42.90	<150	47
Calcium as Ca	mg/l	41	31.90	<150	35
Magnesium as Mg	mg/l	41	18.10	<70	20
Sodium as Na	mg/l	41	24.80	<200	27
Potassium as K	mg/l	41	2.73	<50	3
Total Hardness as $CaCO_3$	mg/l	41	154.2	<300	169
Chloride as Cl	mg/l	41	11.60	<200	13
Sulphate as SO_4	mg/l	41	10.10	<400	11
Nitrate as NO_x-N	mg/l	41	9.76	<10	11
Fluoride as F	mg/l	41	0.25	<1.0	0.28
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.47: Groundwater Quality Reserve – Quaternary catchment C31D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C31D♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		23	8.05	9.5 – 5.0 (±0.05)	8.9
Electrical Conductivity	mS/m	23	83	<150	91
Calcium as Ca	mg/l	23	83.20	<150	92
Magnesium as Mg	mg/l	23	41.30	<70	45
Sodium as Na	mg/l	23	49.60	<200	55
Potassium as K	mg/l	23	4.43	<50	5
Total Hardness as $CaCO_3$	mg/l	23	377.8	<300	416
Chloride as Cl	mg/l	23	56.20	<200	62
Sulphate as SO_4	mg/l	23	19	<400	21
Nitrate as NO_x-N	mg/l	23	10.56	<10	12
Fluoride as F	mg/l	23	0.42	<1.0	0.46
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.48: Groundwater Quality Reserve – Quaternary catchment C31E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C31E♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		82	7.88	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	82	74.85	<150	82
Calcium as Ca	mg/l	82	70.85	<150	78
Magnesium as Mg	mg/l	82	30.50	<70	34
Sodium as Na	mg/l	82	44.50	<200	49
Potassium as K	mg/l	82	3.57	<50	4
Total Hardness as $CaCO_3$	mg/l	82	302.5	<300	333
Chloride as Cl	mg/l	82	42.95	<200	47
Sulphate as SO_4	mg/l	82	18.95	<400	21
Nitrate as NO_x-N	mg/l	82	14.37	<10	16
Fluoride as F	mg/l	82	0.34	<1.0	0.37
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.49: Groundwater Quality Reserve – Quaternary catchment C31F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C31F♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		35	7.28	9.5 – 5.0 (±0.05)	8
Electrical Conductivity	mS/m	35	57.20	<150	63
Calcium as Ca	mg/l	35	43.30	<150	48
Magnesium as Mg	mg/l	35	21.90	<70	24
Sodium as Na	mg/l	35	43.20	<200	48
Potassium as K	mg/l	35	2.97	<50	3.3
Total Hardness as $CaCO_3$	mg/l	35	198.3	<300	218
Chloride as Cl	mg/l	35	26.90	<200	30
Sulphate as SO_4	mg/l	35	23.60	<400	26
Nitrate as NO_x-N	mg/l	35	13.28	<10	15
Fluoride as F	mg/l	35	0.35	<1.0	0.39
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.50: Groundwater Quality Reserve – Quaternary catchment C32A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C32A♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		135	7.92	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	135	88.30	<150	97
Calcium as Ca	mg/l	135	69.90	<150	77
Magnesium as Mg	mg/l	135	34.60	<70	38
Sodium as Na	mg/l	135	71.70	<200	79
Potassium as K	mg/l	135	3.10	<50	3.4
Total Hardness as $CaCO_3$	mg/l	135	316.00	<300	349
Chloride as Cl	mg/l	135	45.20	<200	50
Sulphate as SO_4	mg/l	135	18.80	<400	21
Nitrate as NO_x-N	mg/l	135	15.87	<10	17
Fluoride as F	mg/l	135	0.55	<1.0	0.61
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.51: Groundwater Quality Reserve – Quaternary catchment C32B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C32B			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		896	7.91	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	896	80.95	<150	89
Calcium as Ca	mg/l	896	56	<150	62
Magnesium as Mg	mg/l	896	44.60	<70	49
Sodium as Na	mg/l	896	39.70	<200	44
Potassium as K	mg/l	896	3.18	<50	3.5
Total Hardness as $CaCO_3$	mg/l	896	323.5	<300	356
Chloride as Cl	mg/l	896	43.90	<200	48
Sulphate as SO_4	mg/l	896	18.40	<400	20
Nitrate as NO_x-N	mg/l	896	7.05	<10	7.8
Fluoride as F	mg/l	896	0.40	<1.0	0.44
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.52: Groundwater Quality Reserve – Quaternary catchment C32C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C32C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		98	7.94	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	98	71.80	<150	79
Calcium as Ca	mg/l	98	58	<150	64
Magnesium as Mg	mg/l	98	43.35	<70	48
Sodium as Na	mg/l	98	37.35	<200	41
Potassium as K	mg/l	98	2.70	<50	3.0
Total Hardness as $CaCO_3$	mg/l	98	323.3	<300	356
Chloride as Cl	mg/l	98	29.30	<200	32
Sulphate as SO_4	mg/l	98	22.70	<400	25
Nitrate as NO_x-N	mg/l	98	5.90	<10	6.5
Fluoride as F	mg/l	98	0.40	<1.0	0.44
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.53: Groundwater Quality Reserve – Quaternary catchment C32D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C32D			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		148	8.14	9.5 – 5.0 (±0.05)	8.95
Electrical Conductivity	mS/m	148	85.65	<150	94
Calcium as Ca	mg/l	148	76.09	<150	84
Magnesium as Mg	mg/l	148	64.45	<70	71
Sodium as Na	mg/l	148	13.30	<200	15
Potassium as K	mg/l	148	0.67	<50	0.74
Total Hardness as $CaCO_3$	mg/l	148	455.4	<300	501
Chloride as Cl	mg/l	148	33.08	<200	36
Sulphate as SO_4	mg/l	148	44.35	<400	49
Nitrate as NO_x-N	mg/l	148	7.51	<10	8.3
Fluoride as F	mg/l	148	0.29	<1.0	0.32
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.54: Groundwater Quality Reserve – Quaternary catchment C33A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C33A♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		264	8	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	264	85.95	<150	95
Calcium as Ca	mg/l	264	69.05	<150	76
Magnesium as Mg	mg/l	264	69.20	<70	76
Sodium as Na	mg/l	264	13.40	<200	15
Potassium as K	mg/l	264	0.95	<50	1.1
Total Hardness as $CaCO_3$	mg/l	264	457.4	<300	503
Chloride as Cl	mg/l	264	36	<200	40
Sulphate as SO_4	mg/l	264	31.30	<400	34
Nitrate as NO_x-N	mg/l	264	5.80	<10	6.4
Fluoride as F	mg/l	264	0.33	<1.0	0.36
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.55: Groundwater Quality Reserve – Quaternary catchment C33B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C33B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		388	7.97	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	388	80.15	<150	88
Calcium as Ca	mg/l	388	59.60	<150	66
Magnesium as Mg	mg/l	388	62.45	<70	69
Sodium as Na	mg/l	388	14.40	<200	16
Potassium as K	mg/l	388	1.21	<50	1.3
Total Hardness as $CaCO_3$	mg/l	388	406.0	<300	447
Chloride as Cl	mg/l	388	31.40	<200	35
Sulphate as SO_4	mg/l	388	21.30	<400	23
Nitrate as NO_x-N	mg/l	388	5.67	<10	6.2
Fluoride as F	mg/l	388	0.24	<1.0	0.26
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.56: Groundwater Quality Reserve – Quaternary catchment C33C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C33C♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		290	7.99	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	290	71.80	<150	79
Calcium as Ca	mg/l	290	65.10	<150	72
Magnesium as Mg	mg/l	290	44.30	<70	49
Sodium as Na	mg/l	290	13	<200	14
Potassium as K	mg/l	290	2.07	<50	2.3
Total Hardness as $CaCO_3$	mg/l	290	345.0	<300	380
Chloride as Cl	mg/l	290	30.65	<200	34
Sulphate as SO_4	mg/l	290	16.35	<400	18
Nitrate as NO_x-N	mg/l	290	3.99	<10	4.4
Fluoride as F	mg/l	290	0.21	<1.0	0.23
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.57: Groundwater Quality Reserve – Quaternary catchment C41A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C41A			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		17	7.97	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	17	71.50	<150	79
Calcium as Ca	mg/l	17	74.90	<150	82
Magnesium as Mg	mg/l	17	29.20	<70	32
Sodium as Na	mg/l	17	56.10	<200	62
Potassium as K	mg/l	17	2.62	<50	2.9
Total Hardness as $CaCO_3$	mg/l	17	307.3	<300	338
Chloride as Cl	mg/l	17	11.80	<200	13
Sulphate as SO_4	mg/l	17	25.18	<400	28
Nitrate as NO_x-N	mg/l	17	2.51	<10	2.8
Fluoride as F	mg/l	17	0.28	<1.0	0.31
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.58: Groundwater Quality Reserve – Quaternary catchment C41D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C41D♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		14	8.18	9.5 – 5.0 (±0.05)	9.0
Electrical Conductivity	mS/m	14	82.35	<150	91
Calcium as Ca	mg/l	14	65	<150	72
Magnesium as Mg	mg/l	14	26.50	<70	29
Sodium as Na	mg/l	14	65.15	<200	72
Potassium as K	mg/l	14	2.30	<50	2.5
Total Hardness as $CaCO_3$	mg/l	14	271.4	<300	299
Chloride as Cl	mg/l	14	30.05	<200	33
Sulphate as SO_4	mg/l	14	21.40	<400	24
Nitrate as NO_x-N	mg/l	14	4.50	<10	5.0
Fluoride as F	mg/l	14	0.40	<1.0	0.43
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.59: Groundwater Quality Reserve – Quaternary catchment C43B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C43B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		15	7.60	9.5 – 5.0 (±0.05)	8.4
Electrical Conductivity	mS/m	15	70	<150	77
Calcium as Ca	mg/l	15	69.30	<150	76
Magnesium as Mg	mg/l	15	39.90	<70	44
Sodium as Na	mg/l	15	22.70	<200	25
Potassium as K	mg/l	15	2.32	<50	2.6
Total Hardness as $CaCO_3$	mg/l	15	337.4	<300	371
Chloride as Cl	mg/l	15	25.50	<200	28
Sulphate as SO_4	mg/l	15	41.90	<400	46
Nitrate as NO_x-N	mg/l	15	0.07	<10	0.08
Fluoride as F	mg/l	15	0.20	<1.0	0.22
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.60: Groundwater Quality Reserve – Quaternary catchment C60E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C60E			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		12	7.90	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	12	64.30	<150	71
Calcium as Ca	mg/l	12	43.90	<150	48
Magnesium as Mg	mg/l	12	15.80	<70	17
Sodium as Na	mg/l	12	42.30	<200	47
Potassium as K	mg/l	12	1.01	<50	1.1
Total Hardness as $CaCO_3$	mg/l	12	174.7	<300	192
Chloride as Cl	mg/l	12	20.50	<200	23
Sulphate as SO_4	mg/l	12	12	<400	13.2
Nitrate as NO_x-N	mg/l	12	1.91	<10	2.10
Fluoride as F	mg/l	12	0.24	<1.0	0.26
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.61: Groundwater Quality Reserve – Quaternary catchment C70D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: * C70D			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		21	8.11	9.5 – 5.0 (±0.05)	8.9
Electrical Conductivity	mS/m	21	77.50	<150	85
Calcium as Ca	mg/l	21	62.72	<150	69
Magnesium as Mg	mg/l	21	23.75	<70	26
Sodium as Na	mg/l	21	70.50	<200	78
Potassium as K	mg/l	21	4.93	<50	5
Total Hardness as $CaCO_3$	mg/l	21	254.4	<300	280
Chloride as Cl	mg/l	21	29.17	<200	32
Sulphate as SO_4	mg/l	21	68.34	<400	75
Nitrate as NO_x-N	mg/l	21	1.76	<10	1.9
Fluoride as F	mg/l	21	0.60	<1.0	0.66
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used.

Table 6.62: Groundwater Quality Reserve – Quaternary catchment C81F

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C81F♣			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		18	7.25	9.5 – 5.0 (±0.05)	8.0
Electrical Conductivity	mS/m	18	28.90	<150	32
Calcium as Ca	mg/l	18	24.75	<150	27
Magnesium as Mg	mg/l	18	6.30	<70	6.9
Sodium as Na	mg/l	18	20	<200	22
Potassium as K	mg/l	18	1.30	<50	1.4
Total Hardness as $CaCO_3$	mg/l	18	87.7	<300	97
Chloride as Cl	mg/l	18	1.50	<200	1.7
Sulphate as SO_4	mg/l	18	2	<400	2.2
Nitrate as NO_x-N	mg/l	18	0.31	<10	0.34
Fluoride as F	mg/l	18	0.21	<1.0	0.23
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♣ Samples only from monitoring done in 1976.

Table 6.63: Groundwater Quality Reserve – Quaternary catchment C82B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C82B			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		29	8.21	9.5 – 5.0 (±0.05)	9.0
Electrical Conductivity	mS/m	29	39.90	<150	44
Calcium as Ca	mg/l	29	32.23	<150	35
Magnesium as Mg	mg/l	29	13.98	<70	15
Sodium as Na	mg/l	29	27.60	<200	30
Potassium as K	mg/l	29	3.39	<50	3.7
Total Hardness as $CaCO_3$	mg/l	29	138.0	<300	152
Chloride as Cl	mg/l	29	25.24	<200	28
Sulphate as SO_4	mg/l	29	22.16	<400	24
Nitrate as NO_x-N	mg/l	29	0.17	<10	0.19
Fluoride as F	mg/l	29	0.32	<1.0	0.35
				Water Quality Class	Class 0

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used.

Table 6.64: Groundwater Quality Reserve – Quaternary catchment C82H

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C82H			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		18	8.07	9.5 – 5.0 (±0.05)	8.9
Electrical Conductivity	mS/m	18	85.15	<150	94
Calcium as Ca	mg/l	18	65.77	<150	72
Magnesium as Mg	mg/l	18	27.34	<100	30
Sodium as Na	mg/l	18	89.79	<200	99
Potassium as K	mg/l	18	1.08	<50	1.2
Total Hardness as $CaCO_3$	mg/l	18	276.8	<300	305
Chloride as Cl	mg/l	18	20.71	<200	23
Sulphate as SO_4	mg/l	18	22.56	<400	25
Nitrate as NO_x-N	mg/l	18	0.38	<10	0.41
Fluoride as F	mg/l	18	0.78	<1.0	0.85
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.65: Groundwater Quality Reserve – Quaternary catchment C83B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: *C83B			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		33	7.98	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	33	60	<150	66
Calcium as Ca	mg/l	33	52.12	<150	57
Magnesium as Mg	mg/l	33	27.20	<70	30
Sodium as Na	mg/l	33	33.50	<200	37
Potassium as K	mg/l	33	0.85	<50	0.9
Total Hardness as $CaCO_3$	mg/l	33	242.82	<300	267
Chloride as Cl	mg/l	33	28.89	<200	32
Sulphate as SO_4	mg/l	33	35.06	<400	39
Nitrate as NO_x-N	mg/l	33	0.79	<10	0.9
Fluoride as F	mg/l	33	0.29	<1.0	0.32
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
* Indicates that only post-1995 hydrochemical datasets for the specific quaternary catchment were used.

Table 6.66: Groundwater Quality Reserve – Quaternary catchment C91A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C91A♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		14	8.41	9.5 – 5.0 (±0.05)	9.3
Electrical Conductivity	mS/m	14	70.10	<150	77
Calcium as Ca	mg/l	14	27.45	<150	30
Magnesium as Mg	mg/l	14	36.85	<70	41
Sodium as Na	mg/l	14	59.70	<200	66
Potassium as K	mg/l	14	4.02	<50	4.4
Total Hardness as $CaCO_3$	mg/l	14	220.3	<300	242
Chloride as Cl	mg/l	14	44.40	<200	49
Sulphate as SO_4	mg/l	14	60.20	<400	66
Nitrate as NO_x-N	mg/l	14	3.05	<10	3.4
Fluoride as F	mg/l	14	0.28	<1.0	0.30
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.67: Groundwater Quality Reserve – Quaternary catchment C91B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C91B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		41	7.90	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	41	96.00	<150	106
Calcium as Ca	mg/l	41	50.50	<150	56
Magnesium as Mg	mg/l	41	46.40	<70	51
Sodium as Na	mg/l	41	70.40	<200	77
Potassium as K	mg/l	41	2.30	<50	2.5
Total Hardness as $CaCO_3$	mg/l	41	317.2	<300	349
Chloride as Cl	mg/l	41	68.50	<200	75
Sulphate as SO_4	mg/l	41	60.20	<400	66
Nitrate as NO_x-N	mg/l	41	7.02	<10	7.7
Fluoride as F	mg/l	41	0.56	<1.0	0.62
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.68: Groundwater Quality Reserve – Quaternary catchment C91C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C91C			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		33	8.12	9.5 – 5.0 (±0.05)	8.9
Electrical Conductivity	mS/m	33	98.90	<150	109
Calcium as Ca	mg/l	33	82.90	<150	91
Magnesium as Mg	mg/l	33	62.57	<70	69
Sodium as Na	mg/l	33	25.81	<200	28
Potassium as K	mg/l	33	3.33	<50	3.7
Total Hardness as $CaCO_3$	mg/l	33	464.7	<300	511
Chloride as Cl	mg/l	33	92.36	<200	102
Sulphate as SO_4	mg/l	33	54.36	<400	60
Nitrate as NO_x-N	mg/l	33	14.42	<10	16
Fluoride as F	mg/l	33	0.41	<1.0	0.45
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.

Table 6.69: Groundwater Quality Reserve – Quaternary catchment C91D

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C91D♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		15	7.90	9.5 – 5.0 (±0.05)	8.7
Electrical Conductivity	mS/m	15	71.30	<150	78
Calcium as Ca	mg/l	15	49.60	<150	55
Magnesium as Mg	mg/l	15	38.80	<70	43
Sodium as Na	mg/l	15	30.30	<200	33
Potassium as K	mg/l	15	2.91	<50	3.2
Total Hardness as $CaCO_3$	mg/l	15	283.6	<300	312
Chloride as Cl	mg/l	15	35.00	<200	39
Sulphate as SO_4	mg/l	15	36.50	<400	40
Nitrate as NO_x-N	mg/l	15	2.55	<10	2.8
Fluoride as F	mg/l	15	0.64	<1.0	0.7
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.70: Groundwater Quality Reserve – Quaternary catchment C91E

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C91E♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		29	8.00	9.5 – 5.0 (±0.05)	8.8
Electrical Conductivity	mS/m	29	113.20	<150	125
Calcium as Ca	mg/l	29	78.20	<150	86
Magnesium as Mg	mg/l	29	61.10	<70	67
Sodium as Na	mg/l	29	53.90	<200	59
Potassium as K	mg/l	29	1.80	<50	2.0
Total Hardness as $CaCO_3$	mg/l	29	446.9	<300	492
Chloride as Cl	mg/l	29	69.50	<200	76
Sulphate as SO_4	mg/l	29	116.80	<400	128
Nitrate as NO_x-N	mg/l	29	7.45	<10	8.2
Fluoride as F	mg/l	29	0.58	<1.0	0.64
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.71: Groundwater Quality Reserve – Quaternary catchment C92A

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C92A♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		298	8.09	9.5 – 5.0 (±0.05)	8.9
Electrical Conductivity	mS/m	298	49.10	<150	54
Calcium as Ca	mg/l	298	51.35	<150	56
Magnesium as Mg	mg/l	298	19.20	<70	21
Sodium as Na	mg/l	298	10.58	<200	12
Potassium as K	mg/l	298	2.29	<50	2.5
Total Hardness as $CaCO_3$	mg/l	298	207.3	<300	228
Chloride as Cl	mg/l	298	20.35	<200	22
Sulphate as SO_4	mg/l	298	20.45	<400	23
Nitrate as NO_x-N	mg/l	298	2.31	<10	2.5
Fluoride as F	mg/l	298	0.17	<1.0	0.19
				Water Quality Class	Class 1

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.72: Groundwater Quality Reserve – Quaternary catchment C92B

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C92B♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		46	8.22	9.5 – 5.0 (±0.05)	9.0
Electrical Conductivity	mS/m	46	100.20	<150	110
Calcium as Ca	mg/l	46	82.85	<150	91
Magnesium as Mg	mg/l	46	73.40	<70	81
Sodium as Na	mg/l	46	29.05	<200	32
Potassium as K	mg/l	46	3.28	<50	3.6
Total Hardness as $CaCO_3$	mg/l	46	509.1	<300	560
Chloride as Cl	mg/l	46	55.55	<200	61
Sulphate as SO_4	mg/l	46	42.25	<400	46
Nitrate as NO_x-N	mg/l	46	6.14	<10	6.8
Fluoride as F	mg/l	46	0.31	<1.0	0.34
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

Table 6.73: Groundwater Quality Reserve – Quaternary catchment C92C

Chemical Parameter	Unit	Vaal WMA – Quaternary catchment: C92C♦			
		[A]	[B]	[C]	[D]
		No. of Samples	GW quality (median value)[1]	BHN Limit[2]	Groundwater Quality Reserve[3]
pH		100	8.27	9.5 – 5.0 (±0.05)	9.1
Electrical Conductivity	mS/m	100	87.60	<150	96
Calcium as Ca	mg/l	100	83.55	<150	92
Magnesium as Mg	mg/l	100	56.10	<70	62
Sodium as Na	mg/l	100	20.95	<200	23
Potassium as K	mg/l	100	4.13	<50	4.5
Total Hardness as $CaCO_3$	mg/l	100	439.6	<300	484
Chloride as Cl	mg/l	100	50.85	<200	56
Sulphate as SO_4	mg/l	100	32.30	<400	36
Nitrate as NO_x-N	mg/l	100	4.29	<10	4.7
Fluoride as F	mg/l	100	0.33	<1.0	0.36
				Water Quality Class	Class 2

[1] Based on long-term groundwater quality datasets (DWS Water Management System). Minimum number of analyses used for the statistical evaluation is nine (9);
[2] Upper limit of Class I water quality [Drinking] (WRC et al. 2nd Edition, 1998, Volume 1: Assessment Guide);and
[3] Median value plus 10%.
♦ Based on pre-1995 hydrochemistry dataset (most representative spatial dataset)

7. PROPOSED PROTECTION AND MONITORING MEASURES FOR PRIORITY WETLANDS

Priority wetlands in the Vaal River catchment area includes those wetlands which display an ecological sensitivity of a High or Very High. Additional priority wetlands were identified taking cognisance of inter alia unique features, red data species and peat wetlands. Proposed recommended ecological categories (REC) and ecological specifications for the priority wetlands in the Vaal catchment area is presented in Table 7.1. The Present Ecological State (PES), Importance and Sensitivity (IS) for the identified priority wetlands are also presented.

Table 7.1: Ecological specfifications for priority wetlands in the Vaal catchment area

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
UA	C11H	Headwaters of the Blesbokspruit (Upper Vaal)	Unchannelled Valley Bottom	C	High	B/C	C	Diffuse water distribution is required to optimise the water quality enhancement functions. The unchannelled nature of sections of the wetland must be maintained. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of an Environmental Impact Asessment (EIA) and/or Water Use Licence (WUL) applications, and strict licensing conditions including monitoring of the systems should apply. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC.
UB	C13C	Vanger	Unchannelled Valley Bottom	A	Very High	A	A	Diffuse water distribution is required to optimise hydrological and biodiversity support functions. Maintain in natural or near-natural ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the Critically Biodiversity Areas 1 and Ecological Support Areas 2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain the existing flow distribution and retention patterns in the system to maintain the existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.

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IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
UB	C13C	Seekoeivlei	Floodplain	E[1]	Very High	D	D	Diffuse water distribution is required to optimise hydrological and biodiversity support functions. Implement measures to improve the state of the wetland towards a more natural ecological condition and manage per the protected area management plan objectives. Protect the wetland and its catchment for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the Critically Biodiversity Areas 1, Ecological Support Areas 1 and 2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem type and its associated biodiversity. Improve the existing flow distribution and retention patterns in the system to restore the some of the lost ecological and hydrological functionality of the system and improve vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Monitor effluent originating from the upstream urban areas which are known to cause frequent sewage spill, as well as runoff from the solid waste site. Identify and prioritise wetland rehabilitation requirements to be implemented by the already engaged Working for Wetlands programme.
UC1	C81B	Murphy's Rust	Unchannelled and Channelled Valley Bottom	C	Very High	B	B/C	Implement measures to improve or at least maintain the ecological condition of the system for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the Critically Biodiversity Areas 1 and Ecological Support Areas 2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition as well as low disturbance levels for continued support of threatened biodiversity. Currently unchannelled wetlands must be maintained as unchannelled systems. Flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Apply the precautionary principle for disturbance of unknown impact. Any application for development that is likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC.

[1] The system is in a PES category of E (Seriously Modified) but has a Very High IS as it is a Ramsar Site (Designated as a Wetland of International Importance in terms of the Ramsar Convention). A PES category of E is not sustainable so the TEC is recommended to be the same as the REC and is set one category higher than the PES. Rehabilitation intervention would be required to improve the PES. Achieving an improvement in the PES of this system should thus be prioritised.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
UC1	C81A	Ingula (Bedford wetland complex)	Unchannelled Valley Bottom	C	Very High	B	B/C	Maintain the naturally simulated water release from the Ingula Dam to ensure unaltered hydrological regime. Diffuse water distribution is required to optimise hydrological and biodiversity support functions. Maintain the near-natural ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA1 and ESA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain the existing flow distribution and retention patterns in the system. Maintain existing vegetation structure and composition as well as low disturbance levels for continued support of threatened biodiversity. Currently unchannelled wetlands must be maintained as unchannelled systems. No erosion gullies (no incision of channels or headcuts) can be permitted to develop within the wetland. This is an unchannelled wetland and is very sensitive to erosion and incision. Flow releases from the Ingula dam must simulate the natural hydrological regime required to maintain the wetland in its existing state. The approved Reserve for the wetland recommends both baseflow and flood releases for the wetland. The baseflows are required to ensure shallow inundation of the valley floor, particularly within those parts of the valley floor supporting mixed sedge marsh. This is required not only to provide potentially suitable habitat for the critically endangered White winged flufftail, and breeding habitat for Wattled cranes, but to ensure saturation of the peat in the system. This will also create favourable conditions for the functioning of the wetland and the provision of ecosystem services through maximizing contact between the water column and the wetland sediments. The function of these higher flows helps to achieve a level of wetland habitat maintenance (for the smaller inundation events) and to allow for some scour of the weakly developed channels (in the case of the larger, more infrequent flushing events). Monitoring should be aimed at determining whether or not the recommended baseflow and flood releases are achieving the desired objectives for the wetland and the REC. It should also be for detecting change, especially changes related to the hydrological regime to inform future water releases. Future potential impact of development applications must be determined as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Apply the precautionary principle for disturbance of unknown impact. Monitoring of existing wetland rehabilitation structures is required to ensure the continued performance of the structures.
UC1	C81A	Upper Wilge	Floodplain	B	High	A/B	B	Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation that are dependent on flooding for their life cycles.

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IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
								Maintain in natural or near-natural ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA1 and ESA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain the existing flow distribution and retention patterns in the system to maintain the existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.
UC1	C81L	Meul	Floodplain	B	High	A/B	B	Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation that are dependent on flooding for their life cycles Maintain in natural or near-natural ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the ESA1 and ESA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain the existing flow distribution and retention patterns in the system to maintain the existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.
UI	C21E	Blesbokspruit[2]	Flooded Valley Bottom (artificially supported)	D	High	C/D	D	In order to improve the state of the wetland, the following should beconsidered: • Management interventions to re-establish certain habitat types necessary for certain bird species; • Improved treatment of mine water, waste water and effluent discharges at source prior to release in to the wetland areas; • Engineering of some sections of the wetland to create oxidation zones to effect improved water quality. This will also recreate some of the open water habitats that were associated with high waterfowl numbers in the 1970s and 1980's; • Prioritisation and protection of the few reaches where the species rich, seasonally wet grassland still occurs; and • Monitoring to ensure that the specified water quality standards in terms of discharge are adhered to and enforced.

[2] The system is a Ramsar Site (Designated as a Wetland of International Importance in terms of the Ramsar Convention) and is regarded as being important from both a birdlife and hydro-functional perspective

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
								Furthermore these previous studies recommended further work to understand the effects of changing the flows through the system. There has been concern that introducing variability in flow to the system could result in some of the sediments undergoing chemical changes resulting in the mobilization of certain heavy metals and uranium, thereby creating health risks. More clarity on this issue would be required before any recommendation related to changing the flows through the system could be made with any confidence that it would not result in health risks. Liaise with interested and affected parties to develop and implement a collaborative Management, Rehabilitation and Monitoring Plan for the wetland
UI	C22D	Klip River wetland	Unchannelled and Channelled Valley Bottom	D/E	Moderate	D	D	Historically the flows in this system were much lower than present day, but due to the altered channel geometry – the incision of the channel in to the wetland – larger flows are now required to inundate the floodplain than would have been necessary under the Reference channel condition. Even so, the present day flows are much higher than the estimated ecological water requirements for the reach. The present day wet season baseflows even exceed the estimated annual flood requirement for the D REC. If the TEC is to be improved from the current D/E to a D or higher, then baseflows need to be reduced. If the flows cannot be reduced then it is very unlikely that the improved D condition of the wetland reach will be achieved. If the flows are reduced then this would open up opportunities for some rehabilitation actions, such as small weirs that could be used to reinstate local baselevels to counteract the impacts of the incised channels. These sorts of structures in the mainstem would be able to raise the water and rewet the valley bottom and associated peat substrates. Rehabilitation actions in the Klip River catchment should focus on: • Attenuating urban stormwater peaks (in the smaller tributaries); • Stabilising headcuts in the mainstem and larger tributaries; and • Raising the watertable and rewetting the valley bottom peats of the main tributaries. Liaise with interested and affected parties to develop and implement a collaborative Management, Rehabilitation and Monitoring Plan for the wetland.
UI	C22B	Natalspruit	Unchannelled and Channelled Valley Bottom	D	High	C/D	D	Diffuse water distribution is required to optimise the water quality enhancement functions. Therefore it is important to maintain and if possible enhance the existing flow distribution and retention patterns in the system. Unchannelled sections of the wetland must be maintained as unchannelled and existing vegetation structure and composition should at least be retained or improved. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state and the functions it is performing.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
								Liaise with interested and affected parties to develop and implement a collaborative Management, Rehabilitation and Monitoring Plan for the wetland.
UK	C23B	Kromelmboog-spruit	Floodplain and Channelled Valley Bottom	C	High	B/C	C	Maintain in natural or near-natural ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the ESA1 and ESA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and enhance the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state.
UL	C23F	Boovenste Oog	Peat wetland (dolomitic eye)	B/C	High	B	B	Maintaining the perennial nature of the system and a diffuse water distribution pattern across the system are key features which determine it's ecological as well as functional importance. Maintain in natural or near-natural ecological condition for the purpose of the long-term protection of important biodiversity, flow regulation function, and as an important and unique landscape feature. Maintain good water quality normally associated with dolomitic aquifers and associated eyes/springs. Prevent over-abstraction form the associated dolomitic aquifer. Maintain the natural fish and macro-invertebrate diversity of the system and prevent the introduction of exotic taxa. A management plan should be developed and implemented for the system. It has previously been suggested that reclaiming peripheral shallow open water habitats with adequate reed corridors left between the open water areas would enhance the biodiversity of the system. It was also suggested that infilling of some of the excavated canals in the system would allow for an improvement in the PES. In developing the management plan, these suggestions should be investigated further. Determine a Preliminary Wetland and Groundwater Reserve for the system as well as protection and management requirements for the groundwater to protect the associated dolomitic aquifer and flows into the system.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
UL	C23F	Mooi	Unchannelled Valley Bottom	D	High	C/D	C/D	Diffuse water distribution is required to optimise hydrological and biodiversity support functions. Maintain and where possible improve the ecological condition for the purpose of the long-term protection of hydrological functions, biodiversity and as an important landscape feature. Maintain a viable representative sample of this ecosystem type and its associated biodiversity. Implement measures to improve the existing flow distribution and retention patterns in the system to maintain the existing vegetation structure and composition.
UL	C23G	Gerhard Minnebron	Peat wetland	C	High	B/C	C	Maintaining the perennial nature of the system and a diffuse water distribution pattern across the system are key features which determine it's ecological as well as functional importance. Maintain the current ecological condition for the purpose of the long-term protection of the remaining peat, important biodiversity, flow regulation and water quality enhancement functions, and as an important and unique landscape feature. Maintain and where possible improve the natural flow distribution and retention patterns in the system. Maintain good water quality normally associated with dolomitic aquifers and associated peat wetlands. Since peatlands require low energy flow with permanent saturation and anaerobic conditions for peat to be able to accumulate or at least not decompose, it is important that these conditions are met in order to maintain the system. At worst, maintaining the system based on a TEC of C would mean that it would be important to maintain a daily flow as recommended in the Preliminary Reserve in order to constantly replenished the peat and keep it saturated, thus preventing any chance of it drying out, oxidizing and decomposing or burning. On the other hand, improving the system based on an REC of B/C would mean that it would be important to increase the daily flow into the peatland as indicated in the Preliminary Reserve. This would allow inundation of the system thus facilitating the accretion or accumulation of peat via the creation of anaerobic conditions within the rhizomatous zone, thus creating conditions favourable for accumulation of organic matter derived from the seasonal die off of rhizomes. This would result in an improvement in the system via the re-wetting of lateral habitats, the inundation of currently exposed peat, and the re-establishment of the natural peat accumulation process, particularly in those areas where peat has previously been mined. Prevent over-abstraction form the associated dolomitic aquifer. Ensure implementation of the rehabilitation measures recommended for the peat mining that has taken place in the system. A management and rehabilitation plan should be developed and implemented for the system. Update the existing Preliminary Wetland Reserve and determine a Preliminary Groundwater Reserve for the system as well as protection and management requirements for the groundwater to protect the associated dolomitic aquifer and flows into the system.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
UL	C23E	Abe Bailey Nature Reserve Wetlands	Unchannelled and Channelled Valley Bottom	D[3]	High	C	C	Implement measures to improve the ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA and ESA landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and where possible enhance the existing flow distribution and retention patterns in the system. Excessive nutrient inputs should be identified and addressed.
UL	C23H and C23L	O.P.M. Prozesky Bird Sanctuary	Floodplain	E[4]	High	D	D	Implement measures to improve the current ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and enhance the existing flow distribution and retention patterns in the system. Excessive nutrient inputs should be identified and addressed.
MA	C70K	Witpan	Pan	F[5]	High	D	D	Implement measures to improve the current state (ecological condition) of the system for it to continue to provide existing services. Excessive nutrient inputs to the system should be identified and addressed.
MC	C24C	Pan and wetland complex - Leliefontein	Pan, Seeps and Unchannelled Valley Bottom	C	High	B/C	C	Maintain in the current ecological condition for the purpose of the long-term protection of the biodiversity and as an important landscape feature. Maintain or improve existing ecological diversity and interconnectivity of the pan and associated wetland system. Water quantity and quality impacts must be managed so as not to undermine the ecological value of the pan and its associated wetland.

[3] As this system is associated with a Nature Reserve, the TEC is recommended to be the same as the REC and is set one category higher than the PES

[4] The system is in a PES category of E (Seriously Modified) but has a High IS as it is regarded as an important sanctuary for birdlife. A PES category of E is not sustainable so the TEC is recommended to be the same as the REC and is set one category higher than the PES

[5] The system is in a PES category of F (Critically Modified) but has a High IS as it is regarded as an important sanctuary for birdlife. A PES category of F is not sustainable so the TEC is recommended to be the same as the REC and is set two categories higher than the PES

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
MC	C24C	Vetpan	Pan	C	High	B/C	C	Maintain in the current ecological condition for the purpose of the long-term protection of the biodiversity and as an important landscape feature. Maintain or improve existing ecological diversity and interconnectivity of the pan and associated drainage system and surrounding natural habitats. Water quantity and quality impacts must be managed so as not to undermine the ecological value of the pan and its associated wetland.
MC	C24C	Klippan and wetland system associated with Klippan	Pan and Unchannelled Valley Bottom	C	High	B/C	C	Maintain in current ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA and ESA landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Water quantity and quality impacts must be managed so as not to undermine the ecological value of the pan and its associated wetland. Maintain and enhance the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state.
MC	C24C	Upper section of the Schoonspruit peatland and the Schoonspruit eye	Peat wetland and dolomitic eye	B	Very High	A	B	Maintaining the perennial nature of the system and a diffuse water distribution pattern across the system are key features which determine it's ecological as well as functional importance. Maintain in natural or near-natural ecological condition for the purpose of the long-term protection of important biodiversity, peat, flow regulation function, and as an important and unique landscape feature. Maintain the natural flow distribution and retention patterns in the system. Maintain good water quality normally associated with dolomitic aquifers and associated eyes/springs. Prevent over-abstraction form the associated dolomitic aquifer. Maintain the natural fish and macro-invertebrate diversity of the system and prevent the introduction of exotic taxa. A management plan should be developed and implemented for the system in consultation with interested and affected parties. Determine a Preliminary Wetland and Groundwater Reserve for the system as well as protection and management requirements for the groundwater to protect the associated dolomitic aquifer and flows into the system.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
MC	C24F	Floodplain and lower section of the Taaibosspruit	Floodplain and Unchannelled Valley Bottom	C	High	B/C	C	Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation that are dependent on flooding for their life cycles. The lower section of the wetland is unchannelled and should remain as such as it is likely to provide water quality enhancement functions and habitat that is different from the rest of the system. This enhances the biodiversity of the wetland. Maintain in the current ecological condition and where possible improve the condition of the system for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Maintain the existing flow distribution and retention patterns in the system to maintain the existing vegetation structure and composition. Unchannelled sections of the wetland must be maintained as unchannelled and existing vegetation structure and composition should at least be retained or improved. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state and the functions it is performing.
MC	C24G	Floodplain of the Schoonspruit including Mahemsvlei	Floodplain	C	High	B/C	C	Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation that are dependent on flooding for their life cycles. Maintain in the current ecological condition and where possible improve the condition of the system for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Maintain the existing flow distribution and retention patterns in the system to maintain the existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state and the functions it is performing.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
MC	C24C and C24E	Lower section of the Schoonspruit peatland	Peat wetland	D	Very High	C	C	Maintaining the perennial nature of the system and a diffuse water distribution pattern across the system are key features which determine it's ecological as well as functional importance. Improve the ecological condition of the system for the purpose of the long-term protection of important biodiversity, peat, flow regulation function, and as an important and unique landscape feature. Maintain the natural flow distribution and retention patterns in the system. Maintain good water quality normally associated with dolomitic aquifers and associated eyes/springs. Prevent over-abstraction form the associated dolomitic aquifer. Prevent and manage over-abstraction/diversion of flows/water from the peatland. Maintain the natural fish and macro-invertebrate diversity of the system and prevent the introduction of exotic taxa. A management plan should be developed and implemented for the system in consultation with interested and affected parties. Determine a Preliminary Wetland and Groundwater Reserve for the system as well as protection and management requirements for the groundwater to protect the associated dolomitic aquifer and flows into the system.
MA	C70G	Grootvlei in a tributary of the Heuningspruit and on the Heuningspruit	Unchannelled and Channelled Valley Bottom	D	High	C/D	D	Maintain and where possible improve the current ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA1, ESA1 and ESA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and enhance the existing flow distribution and retention patterns in the system. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state.
MA	C70K	Wetland system adjacent to Viljoenskroon	Unchannelled and Channelled Valley Bottom	E[6]	High	D	D	Maintain and enhance the existing flow distribution and retention patterns in the system. Pressure from sewage spills, physical obstruction, informal settlements and other in upstream area needs to be attended to.

[6] The system is in a PES category of E (Seriously Modified) but has a High IS due to its hydro-functional importance. A PES category of E is not sustainable so the TEC is recommended to be the same as the REC and is set one category higher than the PES

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
								Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain or improve existing vegetation structure and composition. The wetland should be assessed to identify potential rehabilitation measures that will improve its current state and ability to improve water quality.
MA	C70K	Groot Rietpan	Pan	D	High	C/D	C/D	Implement measures to improve the current ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contribute towards the CBA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and enhance the existing flow distribution and retention patterns in the system. Monitor nutrient and sediment inputs from immediate catchments area. The wetland should be assessed to identify potential rehabilitation measures to restore the hydrology to a more natural state.
MF	C25B	Upper reaches of the Sandspruit (immediately north of Kutloanong)	Unchannelled and Channelled Valley Bottom	D	High	C/D	D	Maintain and where possible improve the current ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA1 and ESA1 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and where possible enhance the existing flow distribution and retention patterns in the system. Pressure from sewage spills, physical obstruction, informal settlements and other in upstream area needs to be attended to. Currently unchannelled wetlands must be maintained as unchannelled systems. Maintain or improve existing vegetation structure and composition. Lateral flow inputs to the wetland must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. The wetland should be assessed to identify potential rehabilitation measures that will improve its ability to enhance water quality.
MF and MD2	C25B, C25F and C43B	Pan cluster around Wesselbron including Volstruispan to the north	Pan cluster	C	High	B/C	B/C	Maintain in near-natural ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the ESA1 and ESA2 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity.

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
								Protect the water quality and ecological characteristics of the different pans associated with the cluster to ensure that they continue to provide the biodiversity support functions typically associated with the different pan types present. Maintain or improve existing ecological diversity and interconnectivity of individual depression wetlands (pans).
MD2	C43B	Flamingo Pan	Pan	F[7]	High	D	D	Implement measures to improve the current state of the pan for it to continue to provide existing services. Excessive nutrient and pollution inputs should be identified and addressed. Propose and implement physical and management interventions where required.
ME2	C43A	Bultfontein Pan	Pan	D	High	C/D	C/D	In consultation with interested and affected parties explore and where feasible implement measures to improve the hydrological regime towards a more natural state. Prevent sewage effluent from flowing into the wetland system. Assess and monitor the impact of salt works and other activities on the hydrology and the biodiversity support function of the wetland. Propose and implement physical and management interventions where required.
MD2	C43B	Toronto Pan	Pan	F[8]	High	D	D	Implement measures to improve the current state of the pan for it to continue to provide existing services. Excessive nutrient and pollution inputs should be identified and addressed. Propose and implement physical and management interventions where required.
LA1	C31D	Barberspan[9]	Pan	C	Very High	B	B/C	Maintain and if possible improve the current ecological condition for the purpose of the long-term protection of important biodiversity and as an important wetland and landscape feature. Excessive nutrient and sediment inputs should be identified and addressed. Liaise with interested and affected parties to develop a collaborative management and monitoring plan together with that for Leeupan.

[7] The system is in a PES category of F (Critically Modified) but has a High IS as it is regarded as an important sanctuary for birdlife. A PES category of F is not sustainable so the TEC is recommended to be the same as the REC and is set two categories higher than the PES

[8] The system is in a PES category of F (Critically Modified) but has a High IS as it is regarded as an important sanctuary for birdlife. A PES category of F is not sustainable so the TEC is recommended to be the same as the REC and is set two categories higher than the PES

[9] The system is a Ramsar Site (Designated as a Wetland of International Importance in terms of the Ramsar Convention)

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
LA1	C31D	Leeupan	Pan	C[10]	High	B/C	B/C	Implement measures to improve the ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Excessive nutrient and/or sediment inputs should be identified and addressed. Liaise with interested and affected parties to develop a collaborative management and monitoring plan together with that for Barberspan.
LA2	C31E	Harts River Floodplain	Floodplain	C	High	B/C	B/C	Erosion and channel incision threaten to undermine the flood attenuation functions of the wetland. It is also important to ensure the protection and maintenance of the floodplain habitats which support biodiversity. Implement measures to improve the current condition of the wetland for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Maintain a viable representative sample of this ecosystem types and its associated biodiversity. Maintain and enhance the existing flow distribution and retention patterns in the system and maintain the hydrological and ecological link to Barberspan. Maintain existing vegetation structure and composition.
LB	C91E	Kamferpan[11]	Pan	C	Very High	B	B/C	Maintain and where possible improve the state of thepan for it to continue to provide existing hydrological and biodiversity support services. Excessive nutrient and pollution inputs should be identified and addressed. Continuation of existing efforts to prevent sewage input and managing of water levels to prevent flooding of breeding areas. Monitor threats such as eutrophication and reed encroachment. Liaise with interested and affected parties to develop a collaborative management and monitoring plan for the pan.
LB	C91B	Gannapan	Pan	C	High	B/C	B/C	Maintain and where possible improve the current ecological condition for the purpose of the long-term protection of important biodiversity and as an important landscape feature. Ensure that the site and its catchment contributes towards the CBA1, CBA2 and ESA1 landscape level purpose for the site to represent and maintain a viable representative sample of this ecosystem types and its associated biodiversity.

[10] As this system is associated with the Barberspan Ramsar Site, the TEC is recommended to be the same as the REC and is set half a category higher than the PES

[11] Although largely artificially maintained, this system is a critical breeding site for Lesser Flamingo and strict protection requirements should be applied to ensure it remains a successful breeding site for this species

IUA	Quaternary Catchment	Wetland Name	Wetland Type	PES	IS	REC	TEC	Ecological Specifications Protection, Maintenance and Management Requirements
LB	C92A	Silverstreams Pan (The Great Pan) and associated Wetland Complex	Pans, Unchannelled Valley Bottom and Springs	B	High	A/B	B	Maintain existing hydrological regime and ecological processes to protect the pans and springs and associated wetland habitats in current ecological state. Maintain the natural flow distribution and retention patterns in the system. Maintain good water quality normally associated with dolomitic aquifers and associated eyes/springs. Prevent over-abstraction form the associated dolomitic aquifer. A management plan should be developed and implemented for the system in consultation with interested and affected parties. Determine a Preliminary Wetland and Groundwater Reserve for the system as well as protection and management requirements for the groundwater to protect the associated dolomitic aquifer, associated springs and flows into the system.

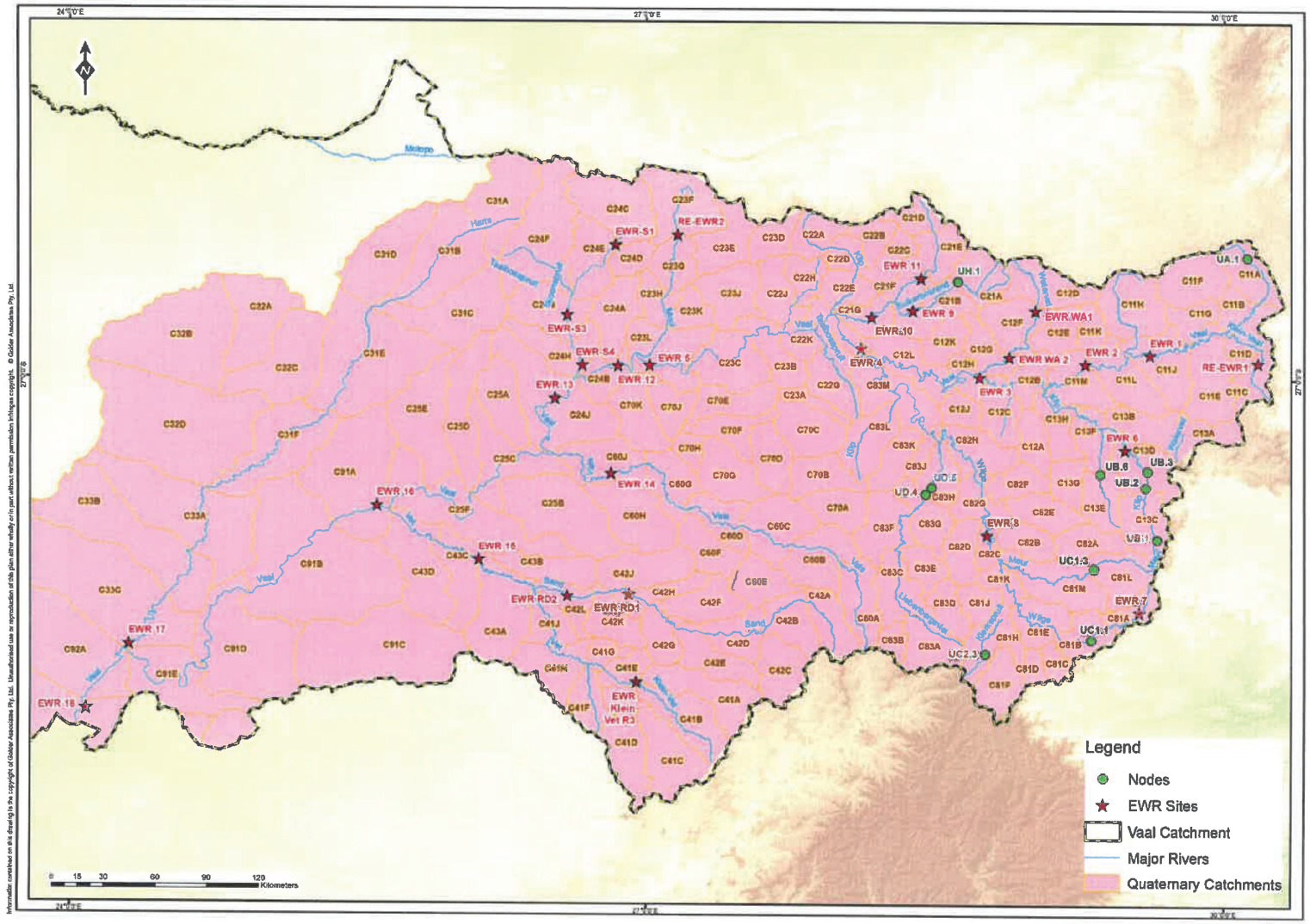

Figure 1: Map of the Vaal Catchment illustrating the quaternary catchments and EWR and node sites