DEPARTMENT OF WATER AND SANITATION

NO. 700 **6 August 2021**

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

PROPOSED RESERVE DETERMINATION FOR WATER RESOURCES OF THE BREEDE-GOURITZ WATER MANAGEMENT AREA

I, Lindiwe Sisulu, in my capacity as Minister of Human Settlements, Water and Sanitation, having complied with section 13 of the National Water Act, 1998 (Act No. 36 of 1998) ("the Act") and regulation 3 of the Regulations for the Establishment of Water Resource Classification System (No. R. 810 Government *Gazette* No. 33541, 17 September 2010), and duly authorised in terms of section 16(1) of the Act, hereby publish, for public comment in accordance with section 16(3) of the Act, the proposed Reserve for water resources of the Breede-Gouritz Water Management Area, as set out in the Schedule to this Notice.

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

Director: Reserve Determination
Attention: Mr Yakeen Atwaru
Department of Human Settlements, Water and Sanitation
Ndinaye Building 185 Francis Baard Street
Private Bag X313
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0001
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MS LINDIWE SISULU
MINISTER OF HUMAN SETTLEMENTS, WATER AND SANITATION
DATE: 26/05/2021

PROPOSED RESERVE FOR WATER RESOURCES OF THE BREEDE-GOURITZ WATER MANAGEMENT AREA IN TERMS OF SECTION 16(1) AND (2) OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

SCHEDULE

1. DESCRIPTION OF WATER RESOURCE

1.1. The Reserve is determined for all or part of every significant water resource within the Breede-Gouritz Water Management Area as set out below:

Water Management Area:	Breede-Gouritz
Drainage Regions:	G40-G50, H10- H90, J11-J40, K10-K70 Tertiary Drainage Region
Rivers:	Breede Overberg Area: Breede River, Rivieronderend River, Overberg River, as well as other smaller coastal rivers. Gouritz Coastal Area: Gouritz River, Buffels River, Touws River, Groot River, Gamka River, Olifants River, Kammanassie River, and smaller coastal rivers.

1.2. 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.

1.3. 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 Breede-Gouritz Water Management Area.

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

2.1. 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 Breede-Gouritz Water Management Area is set out in **Section 4**. The Gouritz and Breede-Overberg Catchments and EWR sites are indicated in **Figure 1 and 2 respectively.**

2.2. The Water Quality component of the proposed Reserve for the Rivers at the EWR sites in Breede-Gouritz Water Management Area in terms of section 16(1) of the Act is set out in **Section 5**.

2.3. The proposed Groundwater Reserve for Water Quantity and Quality in terms of section 16(1) of the Act for the Breede-Gouritz Water Management Area is set out in **Section 6.**

2.4. The proposed Estuarine Reserve in terms of section 16(1) of the Act for the Breede-Gouritz Water Management Area is set out in **Section 7**.

2.5. The proposed Wetland Reserve in terms of section 16(1) of the Act for the Breede-Gouritz Water Management Area catchment is set out in **Section 8**.

2.6. 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.

3. ACRONYMS AND DEFINITIONS

3.1 Acronyms

BHN	Basic Human Needs
EC	Ecological Category
EcoSpecs	Ecological Specifications
EIS	Ecological Importance and Sensitivity
ER	Ecological Reserve
EWR	Ecological Water Requirement
MAR	Mean Annual Runoff
MCM	Million Cubic Metres
PES	Present Ecological Status
RC	Reference conditions
REC	Recommended Ecological Category
TPCs	Thresholds of Potential Concern
WQSU	Water quality sub-unit

3.2 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).

Reserve: is the quantity and quality of the water required to satisfy the basic human needs by securing a basic water supply and to protect the aquatic ecosystem in order to secure ecologically sustainable development and use of the relevant water resource.

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).

4. SURFACE WATER QUANTITY COMPONENT FOR RIVERS AT SELECTED EWR SITES AND NODES

The Reserve consists of two parts – the Basic Human Need (BHN) Reserve and the Ecological Reserve (ER). The BHN Reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, food preparation and for personal hygiene. The ER relates to the water required to protect the aquatic ecosystems of the water resource. The Reserve refers to both the **quantity** and **quality** of the water in the resource, and will vary depending on the class of the resource (Class I, II and III).

BREEDE-OVERBERG AREA (ECOLOGICAL RESERVE)

Table 4.1: Summary of the data for Nodes and EWR sites. EWR Sites are indicated in bold.

Quaternary Catchment	Node/ EWR site	Water Resource	PES	EIS	REC	nMAR (MCM)	EWR (% nMAR)
G40C	Piii1	Palmiet	B	High	B	39.9	19.1
G40C	Piv10	Witklippiesskloof	D	High	D	15.1	21.5
G40C	Piv9	Palmiet	D	High	B	78.8	21.5
G40C	Piv8	Klipdrift	D	High	D	13.6	21.5
G40D	Piv4	Klein-Palmiet	D	High	D	13.7	21.5
G40D	Piv7	Krom/Ribbok	D	Very High	A	27.5	21.5
G40D	Piii2	Palmiet	C	Very High	B/C	206.6	31.2
G40D	Piv12	Dwars/Louws	C	Very High	C	25.2	100.0
G40D	Piii3	Palmiet	C	Very High	B	250.4	34.5
G40G	Niii5	Bot	C	Very High	A	31.9	21.3
G40H	Nx6	Onrus	E	High	B	5.1	13.4
G40F	Niv43	Swart	E	High	B	42.1	13.3
G40K	Niv45	Steenbok	E	Very High	A	10.8	12.2
G40J	Nii4	Hartebees	D	Very High	B	18.4	12.5
G40K	Nv23	Klein	D	Moderate	C	43.0	19.3
G40M	Nx8	Uilkraal	C	Very High	A	2.4	19.2
G50B	Ni4	Nuwejaar	D	Moderate	D	12.5	13.0
G50C	Nvii15	Heuninges	D	-	D	17.8	13.1
G50C	Niv44	Heuninges	D	Very High	B	18.8	13.1
G50C	Nii5	Kars	E	Very High	B	21.6	20.4
G50E	Nv24	Kars	C	Moderate	B	15.4	30.3
G50H	Nii7	DeHoop Vlei	B	High	B	27.1	30.0
G50H	Nii6	Sout	D	-	B	4.2	12.6
H10B	Nvii3	Rooikloof	B	High	B	6.807	37.95
H10B	Niv3	Titus	C	Moderate	C	26.2	22.0
H10C	Niv1	Koekedou	D	Very High	A	18.8	14.2
H10C	Niv2	Dwars	C	High	B	74.9	22.0
H10D	Nvi4	Breede	D	Moderate	D	175.509	17.51
H10D	Niv4	Witels	A	Very High	A	84.3	43.3
H10D	Nvi3	Breede	C	High	B	252.8	31.7
H10E	Nvi2	Wit	A	Very High	A	42.6	46.6
H10F	Niv6	Wabooms	D	High	B	7.4	14.4
H10F	**Nviii1/ EWR1**	**Breede**	**D/E**	**High**	**D**	**434.90**	**31.7**
H10G	Niv7	Slanghoek	D	High	B	32.6	14.5
H10G	Niii1	Breede	D	High	B	497.6	25.4
H10J	Niv40	Elands	B	Very High	A	58.1	50.8
H10J	Niv41	Krom	B	Very High	A	9.0	50.8
H10J	**Nvii2/ EWR2**	**Molenaars**	**C**	**Very High**	**B**	**105.6**	**35.0**
H10J	Niv42	Molenaars (Smalblaar)	E	High	B	191.2	17.4

Quaternary Catchment	Node/ EWR site	Water Resource	PES	EIS	REC	nMAR (MCM)	EWR (% nMAR)
H10K	Niv12	Holsloot	C	High	B	119.5	35.0
H10H	Nvii6	Hartbees	D	Very High	A	4.0	14.4
H10H	Niv9	Hartbees/ de Wetskloof	D	Very High	A	10.2	14.4
H10L	Nv3	Breede	C	High	B	850.9	31.7
H20G	Nvii7	Hex	C	Moderate	C	102.8	22.3
H20H	Niv10	Hex	D	High	B	107.1	22.3
H40B	Nvii5	Koo	D	High	B	0.9	13.1
H40C	Niv11	Nuy	E	High	B	29.4	13.2
H40D	Niv13	Doring	E	High	B	47.4	12.9
H40F	**Nvii8/ EWR3**	**Breede**	**C/D**	**Moderate**	**C/D**	**1042.8**	**45.5**
H40G	Nvii11	Poesnels	D	High	B	16.1	12.8
H40K	Niv14	Keisers	D	Very High	A	12.6	12.5
H40H	Niv15	Vink	D	Very High	A	15.6	12.4
H30C	Niv20	Pietersfontein	D	Moderate	C	17.3	12.0
H30B	Niv18	Kingna	D	High	B	27.1	12.3
H30D	Nvii9	Keisie	D	High	B	21.5	11.9
H30E	Nii2	Kogmanskloof	D	Very High	B	52.0	18.9
H50B	Ni2	Breede	D	High	B	1170.1	17.3
H60B	Nvii10	Du Toits	B	Very High	A	43.9	50.8
H60D	Nv7	Riviersonderend	C	Very High	A	370.2	30.1
H60E	**Niv28/ EWR6**	**Baviaans**	**B**	**High**	**B**	**7.9**	**70.90**
H60E	Niv29	Sersants	D	High	B	4.6	29.9
H60F	Niv30	Gobos	C	Very High	A	12.4	48.1
H60F	**Nv9/EWR5**	**Riviersonderend**	**D**	**High**	**D**	**413.7**	**24.5**
H60G	Niv31	Kwartel	D	High	B	10.7	13.4
H60H	Niv33	Soetmelksvlei	D	Very High	A	4.0	29.9
H60H	Niv34	Slang	D	Very High	A	2.1	29.9
H60H	Nv10	Riviersonderend	D	Very High	A	442.9	24.5
H60K	Niv35	Kwassadie	E	Very High	A	5.9	17.3
H60L	Ni3	Riviersonderend	D	High	B	483.8	24.5
H70A	Niv24	Leeu	E	Very High	A	5.8	12.6
H70B	Nv2	Breede	C	High	B	1701.4	26.4
H70D	Nii3	Tradouw	B	Very High	A	19.4	29.9
H70F	Niv25	Buffeljags	E	High	B	119.4	14.1
H70G	**Niii4/ EWR4**	**Breede**	**C**	**Very High**	**B/C**	**1832.7**	**40.1**
H70J	Niv26	Slang	E	High	B	10.0	14.2

GOURITZ COASTAL AREA (ECOLOGICAL RESERVE)
Table 4.2: Summary of the data for Nodes and EWR sites. EWR sites are indicated in bold.

Quaternary Catchment	Node/ EWR site	Water Resource	PES	EIS	REC	nMAR (MCM)	EWR (% nMAR)
J11C	giv34	Buffels	B	High	B	13.1	26.5
J11F	gv25	Buffels	B	High	B	24.2	17.8
J11H	**J1BUFF-EWR5**	**Buffels**	**C**	**Moderate**	**C**	**27.4**	**17.9**
J11K	giv32	Groot	D	High	B	30.5	17.9
J12D	giv28	Touws	D	High	B	16.4	11.3
J12H	giv27	Touws	B	Moderate	C	26.4	26.8
J12K	giv26	Brak	C	High	B	2.9	17.7
J12L	**J1DORI-EWR7**	**Doring**	**C/D**	**Low**	**C/D**	**2.9**	**12.0**
J12L	J12L Modelled	Huis	D		D	1.56	40.3
J12M	**J1TOUW-EWR3**	**Touws**	**B/C**	**High**	**B/C**	**33.5**	**17.8**
J13B	gv7	Groot	C	High	B	72.7	18.0
J13C	gii3	Groot	B	High	B	78.1	27.0
J21D	giv3	Gamka	B	High	A	31.9	27.1
J22F	giv1	Koekemoers	C	Very High	A	7.4	17.9
J22K	giv2	Leeu	C	Very High	A	17.1	17.9
J23F	gv17	Gamka	B	High	B	58.1	27.0
J23J	gv27	Gamka	C	High	B	69.6	18.3
J24E	gv14	Dwyka	A	High	B	4.0	39.1
J25A	**J2GAMK-EWR4**	**Gamka**	**C/D**	**High**	**C**	**79.8**	**14.9**
J25E	gii2	Gamka	C	High	B	111.8	15.2
J31D	**J3OLIF-EWR9**	**Olifants**	**C**	**Moderate**	**C**	**11.8**	**17.8**
J32E	giv15	Traka	C	High	C	2.7	17.9
J33B	gv33	Olifants	D	High	B	25.0	11.9
J33E	gv21	Meirings	C	Very High	A	21.4	19.1
J33F	giv11	Olifants	E	High	B	80.0	12.4
J34C	**J3KAMM-EWR10**	**Kammanassie**	**C/D**	**Low**	**C/D**	**41.2**	**15.3**
J34F	giv10	Leeu	E	Very High	A	59.2	12.1
J35E	gv19	Olifants	E	High	B	224.5	12.9
J35F	giv17	Olifants	D	High	B	253.4	12.9
J40B	**J4GOUR-EWR6**	**Gouritz**	**C**	**Moderate**	**C**	**489.1**	**14.8**
J40E	gv9	Gouritz	C	High	B	571.8	14.8
H80B	giii5	Duiwenhoks	E	Very High	A	62.5	20.1
H80E	**H8DUIW-EWR1**	**Duiwenhoks**	**D**	**Low**	**D**	**83.2**	**20.9**
H90C	giv27	Korinte	D	High	B	34.1	14.5
H90C	**H9GOUK-EWR2**	**Goukou**	**C/D**	**Moderate**	**C/D**	**50.9**	**24.2**
H90E	gv41	Goukou	C	High	B	105.0	28.2
K10D	giv25	Brandwag	D	High	B	17.9	9.9
K20A	gvii7	Groot-Brak	B/C	Very High	A	27.0	26.5
K20A	**gviii2- EWR GB1-BC**	**Groot-Brak**	**B/C**	**Very High**	**B/C**	**15.3**	**26.5**
K20A	**gvii3-EWR Var 3**	**Varing**	**D**	**High**	**C/D**	**8.4**	**20.9**
K20A	**gviii12- EWR Var2**	**Varing**	**D**	**High**	**C/D**	**6.0**	**20.9**
K30A	**gviii4-EWR**	**Maalgate**	**B**	**Very High**	**A**	**15.3**	**46.0**

Quaternary Catchment	Node/ EWR site	Water Resource	PES	EIS	REC	nMAR (MCM)	EWR (% nMAR)
K30A	gvii8	Maalgate	B	High	D	30.1	16.4
K30B	gvii9	Malgas	C	Very High	C	17.3	31.6
K30B	**gviii6 EWR Gwa1 -D**	**Gwaing**	**E**	**High**	**D**	**34.1**	**16.4**
K30C	**gviii7 EWR Sw1 - D**	**Swart**	**D**	**High**	**D**	**16.1**	**14.5**
K30C	**gvii11 EWR Ka1 - D**	**Kaaimans**	**B**	**High**	**B**	**18.6**	**50.2**
K30C	**gviii8 EWR Si1 -B**	**Silver**	**B**	**Very High**	**B**	**14.9**	**50.2**
K30D	gvii12	Touws	B	Very High	A	16.7	30.3
K30D	gx8	Klein Keurbooms	D	Very High	B	2.5	14.1
K40A	**giii10 EWR 2 Diep -B**	**Diep**	**B**	**Very High**	**B**	**12.4**	**30.3**
K40B	giii13	Hoekraal	B	Very High	A	27.9	30.3
K40C	**gvii13 EWR 4 Karatara-AB**	**Karatara**	**B**	**Very High**	**A/B**	**11.2**	**40.2**
K40C	giii11	Karatara	A/B	Very High	A	33.8	40,2
K40E	**Gou 1**	**Goukamma**	**B/C**	**Very High**	**B/C**	**30.4**	**38.5**
K50A	**EWR 1**	**Knysna**	**B**	**High**	**B**	**26.5**	**32.1**
K50A	**Kny 2**	**Knysna**	**B**	**-**	**B**	**46.5**	**32.1**
K50B	**EWR 2**	**Gouna**	**A/B**	**Very High**	**A/B**	**27.6**	**53.4**
K60C	**K6KEUR-EWR8**	**Keurbooms**	**C**	**Very High**	**B/C**	**46.1**	**34.9**
K60D	giv5	Palmiet	A	Very High	A	42.1	48.3
K60F	giv4	Bitou	C	Very High	A	23.6	22.8
K60G	**Noe 1**	**Noetsie**	**B**	**Very High**	**A/B**	**4.8**	**63.4**
K60G	gx3	Piesang	D	Very High	A	7.3	28.5
K60E	gx9	Keurbooms	C	Very High	A	91.3	34.9
K70A	gx4	Buffels	B	Very High	B	1.8	34.3
K70A	gx5	Sout	B	Very High	B	3.8	34.3
K70B	gvii15	Bloukrans	B	Very High	B	31.2	33.9

Table 4.3: Basic Human Needs for the Breede-Gouritz WMA

Quaternary Catchment	Water Resource	BHN (%NMAR)	Quaternary Catchment	Water Resource	BHN (%NMAR)
G40C	Palmiet	0.008	J11C	Buffels	0.02
G40D	Palmiet	0	J11F	Buffels	0.03
G40G	Bot	0.50	J11H	Buffels	0.03
G40H	Onrus	5.88	J11K	Groot	0.36
G40F	Swart	0.17	J12D	Touws	0.03
G40K	Steenbok	0	J12H	Touws	0
G40J	Hartebees	0.08	J12K	Brak	0
G40K	Klein	0	J12L	Doring	0.21
G40M	Uilkraal	0.125	J12M	Touws	0
G50B	Nuwejaar	1.12	J13B	Groot	0.01
G50C	Heuninges	0	J13C	Groot	0
G50E	Kars	0.84	J21D	Gamka	0
G50G	DeHoop Vlei	0.03	J22F	Koekemoers	0.14
G50H	Sout	0.04	J22K	Leeu	0
H10B	Rooikloof	0	J23F	Gamka	0.10
H10C	Dwars	0.70	J23J	Gamka	0
H10D	Breede	0	J24E	Dwyka	0
H10E	Wit	0	J25A	Gamka	0.003
H10F	**Breede**	**0.04**	J25E	Gamka	**0.03**
H10G	Slanghoek	0	J31D	Olifants	0.02
H10J	Elands	0.02	J32E	Traka	0.03
H10K	Holsloot	0	J33B	Olifants	0.02
H10H	Breede	**0**	J33E	Meirings	**0.56**
H10L	Breede	0.005	J34C	Olifants	0.01
H20G	Hex	0.01	J34F	Kammanassie	0.05
H20H	Hex	1.20	J35E	Leeu	0.004
H40B	Koo	2.22	J35F	Olifants	0.01
H40C	Nuy	0.07	J40B	Olifants	0
H40D	Doring	0	J40E	Gouritz	0.003
H40F	Breede	0.002	H80B	Gouritz	0
H40G	Poesnels	0	H80E	Duiwenhoks	0.005
H40K	Keisers	0.32	H90C	Goukou	0.33
H40H	Vink	0.06	H90E	Goukou	0.06
H30C	Pietersfontein	0.07	K10D	Brandwag	0.06
H30B	Kingna	1.33	K20A	Varing	1.50
H30D	Keisie	0.04	K30A	Maalgate	0.39
H30E	Kogmanskloof	0.17	K30B	Malgas	0.18
H50B	Breede	0.004	K30C	Swart	8.99
H60B	Du Toits	0	K30D	Touws	0.54
H60D	Riviersonderend	0.001	K40A	Diep	0.04
H60E	Baviaans	1.14	K40B	Hoekraal	0
H60F	Gobos	0.007	K40C	Karatara	0.54
H60G	Kwartel	0	K40E	Goukamma	0.39
H60H	Soetmelksvlei	0	K50A	Knysna	0.002
H60K	Kwassadie	0	K50B	Gouna	0.47
H60L	Riviersonderend	0	K60C	Keurbooms	0.03
H70A	Leeu	0	K60D	Palmiet	25.26
H70B	Breede	0.01	K60F	Bitou	0.38
H70D	Tradouw	0	K60G	Piesang	4.34
H70F	Buffeljags	0.02	K60E	Keurbooms	0.02
H70G	Breede	0	K70A	Buffels	1.32
H70J	Slang	0.40	K70B	Bloukrans	0.03

5.SURFACE WATER QUALITY COMPONENT FOR RIVERS AT EWR SITES

BREEDE-OVERBERG

Table 5.1: PES categories and overall site assessment for Breede River at Node Nviii1 (represented by EWR Site 1)

RIVER	Breede River	**WATER QUALITY MONITORING POINTS**		
WQRU	1(Upper Breede River to Wit River confluence)	**RC**	DWA monitoring station @ Koekedou River in Ceres (H1H013Q01) (1998 -2002, n=38)	
EWR SITE	EWR Site 1	**PES**	DWA monitoring station @ Witbrug (H1H006Q01) (1998 -2002, n=143)	
Confidence assessment	Medium. EWR site is further downstream of DWA monitoring station.			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L) 1:95th Percentile values	$MgSO_4$	7	21	Category B
	Na_2SO_4	8	4	Category A
	$MgCl_2$	5	6	Category A
	$CaCl_2$	12	24	Category B
	NaCl	6	27	Category A
	$CaSO_4$	0	0	Category A
Nutrients (mg/L)	SRP	-	-	No data
	TIN	2.8011	0.318	Category B
	TDS	21.8-50.6	< 45	*B Category.* Increased TDS during Winter months
	TSS	-	< 5	Acceptable
	$P0_4$	0.024	0.042	*C Category.*
Physical Variables	pH (5th – 95th %)	6.2-7.5	6.9 – 7.8	*A Category.*
	Temperature	-	-	No data but no concerns noted about DO concentrations
	Dissolved oxygen	-	-	
	Turbidity (NTU)	-	2	
	Electrical conductivity (mS/m)	-	-	No data
Response variables	Chl a: periphyton	-	-	No data
	Chl a: phytoplankton	-	-	No data
	Macroinvertebrates	SASS score = >110 and an ASPT score >7	SASS score = 69 and ASPT score = 5.3	*D/E Category.* Largely modified. Loss of habitat area through infilling.
	Fish community score			*D/E Category.* Introductions of alien fish species, i.e., bass, trout and blue gills.
Toxics		-	No data but pesticide residues are the concern due to intensive agriculture in Ceres	
OVERALL SITE CLASSIFICATION		***A/B Category***		

Table 5.2: PES categories and overall site assessment for Molenaars River at Node Nvii2 (represented by EWR Site 2)

RIVER	Molenaars River	**WATER QUALITY MONITORING POINTS**	
WQRU	2 (Complete Molenaars River)	**RC**	The Molenaars River @ Hawequas Forest Reserve (H1H018Q01) (1998 -1992, n=93)
EWR SITE	EWR Site 2	**PES**	The Molenaars River @ Hawequas Forest Reserve (H1H018Q01) (1998 -2002, n=141)
Confidence assessment	High. Monitoring point is very close to the EWR site. Historic data shows no trends and hence PES data was used for Reference conditions.		

Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L) 1:95th % values	$MgSO_4$	6	6	Category A
	Na_2SO_4	9	9	Category A
	$MgCl_2$	4	4	Category A
	$CaCl_2$	6	6	Category A
	NaCl	9	9	Category A
	$CaSO_4$	0	0	Category A
Nutrients (mg/L)	SRP		-	
	TIN (1:50th %)	0.151	0.151	Category A
	TDS	22	22	Category A
	TSS	< 5	< 5	Category A
	$P0_4$ (1:50th %)	0.025	0.025	Category C
	NH_3-N	<0.015.	<0.015.	Within range
Physical Variables	pH (5th – 95th %)	5.5 – 7.3	5.5 – 7.3	*A Category.* Typical acidic Western Cape river
	Temperature			Within range, Category A
	Dissolved oxygen	80 - 120% saturation.	80 - 120% saturation.	
	Turbidity (NTU)	-	0	
	Electrical conductivity (mS/m)	-	-	No data
Response variables	Chl a: periphyton	-	-	No data
	Chl a: phytoplankton	-	-	No data
	Macroinvertebrates	SASS score ≥140 and an ASPT score >8	SASS score = 175 and ASPT score = 7.9	*A/B Category.* Catchment is relatively pristine
	Fish community score			*E Category.* No indigenous fish were recorded during the study
Toxics		-	-	No toxic substance concerns
OVERALL SITE CLASSIFICATION		***A Category***		

Table 5.3: PES categories and overall site assessment for Breede River at Node Nvii8 (represented by EWR Site 3)

RIVER	Breede River	**WATER QUALITY MONITORING POINTS**		
WQRU	3 (Middle Breede from Molenaars confluence to Kogmanskloof confluence)	**RC**	None. No WQ monitoring station could provide reference data for this Resource Unit.	
EWR SITE	EWR Site 3	**PES**	Breede River at Le Chasseur (H4H017Q01) (1995 -1999, n=214)	
Confidence assessment	Moderate			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L) (1:95th %)	$MgSO_4$	-	39	Category D
	Na_2SO_4	-	5	Category A
	$MgCl_2$	-	12	Category A
	$CaCl_2$	-	32	Category B
	NaCl	-	95	Category B
	$CaSO_4$	-	0	Category A
Nutrients (mg/L)	SRP	-		
	TIN (1:50th %)	-	0.242	Category A
	TDS	-	< 45	*B Category.* High TDS loads. Irrigation return flows in tributaries and main stem between Brandvlei Dam and EWR Site 3.
	TSS	-	< 5	High TSS loads. Releases from Brandvlei to alleviate high TDS.
	$P0_4$ (1:50th %)	-	0.032	C Category
Physical Variables	pH (5th – 95th %)	-	6.9 – 7.8	A Category
	Temperature (°C)	-	22.4	Summer temperature
	Dissolved oxygen	-	-	No observed data
	Turbidity (NTU)	-	-	No data. Low sediment production area
	Electrical conductivity (mS/m)	-	-	No data
Response variables	Chl a: periphyton	-	-	No data
	Chl a: phytoplankton	-	-	No data
	Macroinvertebrates	SASS score ≥110 and an ASPT score >7	SASS score = 91 and ASPT score = 7	*A Category.* Suggest there is no significant impact to community structure.
	Fish community score	-		*D Category.* Only 2 of the 7 indigenous freshwater species expected to occur there were sampled.
Toxics		-	-	No data but Pesticides are a concern as a result of intensive agriculture
OVERALL SITE CLASSIFICATION		***D Category.*** *Mainly due to increased summer low flows and increased sediment load.*		

Table 5.4: PES categories and overall site assessment for Breede River at Node Niii4 (represented by EWR Site 4)

RIVER	Breede River	**WATER QUALITY MONITORING POINTS**		
WQRU	6 (Breede River from Buffelsjags River to Estuary)	**RC**	None. No WQ monitoring station could provide reference data for this Resource Unit.	
EWR SITE	EWR Site 4	**PES**	Lower Breede River @ Swellendam (H7H006Q01) (1995 -1999, n=214)	
Confidence assessment	Moderate (There were no observed hydrological data for this reach of the river and flow in the river during field visits was often too high to allow for discharge readings to be taken; Monitoring point quite far upstream)			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L) (1:95th %)	$MgSO_4$	-	83	Category E/F
	Na_2SO_4	-	3	Category A
	$MgCl_2$	-	49	Category D
	$CaCl_2$	-	62	Category C
	NaCl	-	318	Category D
	$CaSO_4$	-	0	Category A
Nutrients (mg/L)	SRP	-	-	No data
	TIN (1:50th %)	-	0.23	Category A
	TDS	-	-	*C Category.* High TDS loads due to Irrigation return flows in tributaries and main
	TSS	-	-	No data
	$P0_4$ (1:50th %)	-	0.024	*C Category*
	NH_3-N	-	0.3 (Median)	No historic data
	NO_2NO_3-N	-	<1	Recommended winter concentrations but summer can be as low as < 0.3 mg/l
Physical Variables	pH (5th – 95th %)	-	6.9 – 8.1	Category A/B. No significant change.
	Temperature (°C)	-	-	No observed data. Some concerns about short-term fluctuation in DO levels.
	Dissolved oxygen	-	-	
	Turbidity (NTU)	-	-	
	Electrical conductivity (mS/m)	-	-	No data
Response variables	Chl a: periphyton	-	-	No data
	Chl a: phytoplankton	-	-	No data
	Macroinvertebrates	SASS score ≥110 and an ASPT score >7	SASS score = 87 and ASPT score = 6.9	*B Category.* Moderately impacted.
	Fish community score	10 indigenous fish species		*C Category.* Presence of carp and bass.
Toxics		-		No data but pesticide residues are the concern due to intensive agriculture.
OVERALL SITE CLASSIFICATION		***D Category.*** *Dependent on high quality inflow from Buffelsjags River to ensure acceptable WQ in the lower Breede Resource Unit & Estuary*		

Table 5.5: PES categories and overall site assessment for Riviersonderend at Node Nv7 (represented by EWR site 5)

RIVER	Riviersonderend River	**WATER QUALITY MONITORING POINTS**	
WQRU	7 (Middle Riviersonderend River from Theewaterskloof Dam to Bok River	**RC**	Riviersonderend at Swart River/Nuweberg Forest Reserve (H6H008Q01) (1990 -1992, n=34)
EWR SITE	EWR Site 5	**PES**	Riviersonderend at Theewaterskloof Dam (H6H012Q01) (1998 -2002, n=39) Riviersonderend at Reenen (H6H009Q01) (1995 -1999, n=56)
Confidence assessment	High		

Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L) 1:95th % value	$MgSO_4$	7	12	Category A
	Na_2SO_4	7	13	Category A
	$MgCl_2$	4	14	Category A
	$CaCl_2$	5	14	Category A
	NaCl	11	99	Category B
	$CaSO_4$	0	0	Category A
Nutrients (mg/L)	SRP	-	-	No data
	TIN (1:50th %)	0.068	0.154	Category A.
	TDS	13.6-32	Summer: <100 and winter: < 150	*B Category*. High TDS loads due to agricultural return flows in winter
	TSS	< 5	-	No data
	$P0_4$ (1:50th %)	<0.0165	0.013	Category B. Slightly higher.
	NO_2NO_3-N	0.02	<0.25	Recommended winter concentrations but summer can be as low as < 0.2 mg/l
Physical Variables	pH (5th – 95th %)	6.5 – 7.5	6.4 - 7.4	*A/B Category*.
	Temperature (°C)	+-4 °C	-	No data
	Dissolved oxygen	80 - 120% saturation	-	
	Turbidity (NTU)	-	4	
	Electrical conductivity (mS/m)	-	-	No data
Response variables	Chl a: periphyton	-	-	No data
	Chl a: phytoplankton	-	-	No data
	Macroinvertebrates	SASS score ≥110 and an ASPT score >7	SASS score = 95 and ASPT score = 6.8	*C/D Category*. Most of the reach has good water quality but poor habitat quality.
	Fish community score	Six indigenous fish species		*E Category*. Dominated by large and small mouth bass. Reduction of indigenous fish species.
Toxics		-	-	No data but pesticide residues are the concern due to intensive agriculture upstream of EWR site
OVERALL SITE CLASSIFICATION		***A/B Category*** (The presence of Theewaterskloof Dam has slightly reduced the water quality in the downstream river)		

Table 5.6: PES categories and overall site assessment for Baviaans River at Node Niv28 (represented by EWR Site 6)

RIVER	Baviaans River	**WATER QUALITY MONITORING POINTS**		
WQRU	9 (Complete Baviaans River)	**RC**	Baviaans River at Genadendal Mission Station (H6H005Q01) (1972 -1994, n=346)	
EWR SITE	EWR Site 6	**PES**	Baviaans River at Genadendal Mission Station (H6H005Q01) (1998 -2002, n=42)	
Confidence assessment	High. Good data record to assess both reference and PES. Historic data shows no trends and hence PES data was used for Reference conditions			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L) 1:95th % value	$MgSO_4$	9	9	Category A
	Na_2SO_4	9	9	Category A
	$MgCl_2$	4	4	Category A
	$CaCl_2$	10	10	Category A
	NaCl	25	25	Category A
	$CaSO_4$	0	0	Category A
Nutrients (mg/L)	SRP	-	-	No data
	TIN (1:50th % value)	0.04	0.040	Category A
	TDS	41	41	Category A
	TSS	-	-	No data
	PO_4 (1:50th % value)	0.022	0.022	Category A
Physical Variables	pH (5th – 95th %)	4.7 – 7.1	4.7 – 7.0	*A Category*. Regarded as natural for low pH Western Cape Rivers
	Temperature (°C)	-	-	No data but no DO concerns
	Dissolved oxygen	-	-	
	Turbidity (NTU)	-	-	
	Electrical conductivity (mS/m)	-	-	No data
Response variables	Chl a: periphyton	-	-	No data
	Chl a: phytoplankton	-	-	No data
	Macroinvertebrates	SASS score ≥140 and an ASPT score >8	SASS score = 109 and ASPT score = 8.38	*A Category*. Reduced habitat.
	Fish community score	Three indigenous fish species		*A/B Category*. All species expected to occur here historically, were recorded
Toxics		-	-	No data but no toxic substance concerns noted
OVERALL SITE CLASSIFICATION		***A Category***		

GOURITZ

Table 5.7: PES categories and overall site assessment for Duiwenhoks River at H8DUIW-EWR1

RIVER	Duiwenhoks River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	DWS gauging weir H8H001Q01 (1967 – 1979; number of samples (n) = 66 - 71, Electrical Conductivity: n = 110).
EWR SITE	H8DUIW-EWR1	**PES**	DWS gauging weir H8H001Q01 (2007 – 2013; n = 69, Fluorine (F) = 48).
Confidence assessment	Confidence: 3.5		
Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	N/A	-
	Na	382.2	Exceeds the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation.
	Mg	67.4	No guideline.
	Ca	55.0	No guideline.
	Cl	805.4	Exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
	K	9.25	No guideline.
Nutrients (mg/L)	SRP	0.014	A
	TIN	0.118	A
Physical Variables	pH (5^{th} – 95^{th} %)	6.6 and 8.1	B
	Temperature (°C)	N/A	A/B. Impacts expected at low flows.
	Dissolved oxygen	N/A	B. Impacts expected at low flows.
	Turbidity (NTU)	N/A	B. Changes in turbidity appear to be largely related to natural with minor man-made modifications, e.g. gravel mining upstream
	Electrical conductivity (mS/m)	272	80 mS/m
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	50.7% SASS score = 78 ASPT score = 56	D
	Diatoms	11.1	C/D (n = 1, Jan 2014)
	Fish community score	51.6%	D (all estuarine spp. that moved into the freshwater zone and aliens).
Toxics	Ammonia (as N)	0.003	A
	Fluoride (as F)	0.33	A
OVERALL SITE CLASSIFICATION		***C Category***	

Table 5.8: Water quality EcoSpecs and TPCs (C category) for Duiwenhoks River at H8DUIW-EWR1

Metrics	EcoSpecs	TPCs
Inorganic salt ions		
Sulphate as SO_4	N/A	N/A
Sodium as Na	The 95th percentile of the data must be ≤ 380 mg/L.	The 95th percentile of the data must be 300 - 380 mg/L.
Magnesium as Mg	The 95th percentile of the data must be ≤ 67 mg/L.	The 95th percentile of the data must be 53.5 - 67 mg/L.
Calcium as Ca	The 95th percentile of the data must be ≤ 55 mg/L.	The 95th percentile of the data must be 44 - 55 mg/L.
Chloride as Cl	The 95th percentile of the data must be ≤ 800 mg/L.	The 95th percentile of the data must be 640 - 800 mg/L.
Potassium as K	The 95th percentile of the data must be ≤ 9 mg/L.	The 95th percentile of the data must be 7 - 9 mg/L.
Physical Variables		
Electrical conductivity (mS/m)	The 95th percentile of the data must be ≤ 270 mS/m.	The 95th percentile of the data must be 210 - 270 mS/m.
pH	The 5th percentile of the data must be 6.5. – 8.0, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 6.3 and the 95th percentile is ≥ 8.6.
Temperature[a]	Natural temperature range.	Initiate baseline monitoring for this variable.
Dissolved oxygen[a](DO)	The 5th percentile of the data must be ≥ 7.0 mg/L.	The 5th percentile of the data must be 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity[a]	Changes in turbidity are related to minor man-made modifications (e.g. gravel mining upstream). Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN	The 50th percentile of the data must be ≤ 0.25 mg/L.	The 50th percentile of the data must be 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data must be ≤ 0.015 mg/L.	The 50th percentile of the data must be 0.012 - 0.015 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data must be < 15 µg/L.	The 50th percentile of the data must be 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data must be ≤ 12 mg/m^2.	The 50th percentile of the data must be 10 - 12 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data must be ≤ 1.5 mg/L.	The 50th percentile of the data must be 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data must be ≤ 0.015 mg/L.	The 50th percentile of the data must be 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A- No data were available for this assessment.

Table 5.9: PES categories and overall site assessment for Goukou River at H9GOUK-EWR2

RIVER	Goukou River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	Reference Condition (RC) was represented by the A Category benchmark tables in DWAF (2008), as no other data were available to describe natural state.
EWR SITE	H9GOUK-EWR2	**PES**	DWS gauging weir H9H005Q01 (2007 – 2014; n = 63 - 71, F = 52).
Confidence assessment	Confidence: 3		
Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	N/A	N/A
	Na	650.4	Exceeds the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation.
	Mg	79.0	No guideline.
	Ca	57.1	No guideline.
	Cl	1081.3	Exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
	K	20.4	No guideline.
Nutrients (mg/L)	SRP	0.085	D
	TIN	0.055	A
Physical Variables	pH (5^{th} – 95^{th} %)	6.6 and 8.35	B
	Temperature (°C)	N/A	A/B. Impacts expected at low flows.
	Dissolved oxygen	N/A	B. Impacts expected at low flows.
	Turbidity (NTU)	N/A	A/B. Changes in turbidity appear to be largely related to natural.
	Electrical conductivity (mS/m)	408.4	E/F
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	51.2% SASS score =113 ASPT score = 6.6	D
	Diatoms	14.4 and 11.0	C/D (n = 2; Jan and July 2014)
	Fish community score	47.4%	D
Toxics	Ammonia (as N)	0.01	A
	Fluoride (as F)	0.59	A
OVERALL SITE CLASSIFICATION		***C/D Category***	

Table 5.10: Water quality EcoSpecs and TPCs (Category: C/D) for Goukou River at GOUK-EWR2

Metrics	EcoSpecs	TPCs
Inorganic salt ions		
Sulphate as SO_4	N/A	N/A
Sodium as Na	The 95th percentile of the data is between ≤ 650 mg/L.	The 95th percentile of the data is between 520 - 650 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 80 mg/L.	The 95th percentile of the data is between 64 - 80 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 55 mg/L.	The 95th percentile of the data is between 44 - 55 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 1 000 mg/L.	The 95th percentile of the data is between 800 - 1 000 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 20 mg/L.	The 95th percentile of the data is between 16 - 20 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 400 mS/m.	The 95th percentile of the data is between 320 - 400 mS/m.
pH	The 5th percentile of the data must be 6.5. – 8.0, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 6.3 and the 95th percentile is ≥ 8.6.
Temperature[(a)]	Natural temperature range.	Initiate baseline monitoring for this variable.
Dissolved oxygen[(a)]	The 5th percentile of the data is between ≥ 7.0 mg/L.	The 5th percentile of the data is between 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity[(a)]	Changes in turbidity are related to minor man-made modifications. Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.25 mg/L.	The 50th percentile of the data is between 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.125 mg/L.	The 50th percentile of the data is between 0.1 - 0.125 mg/L.
Response variables[(a)]		
Chl-a phytoplankton	The 50th percentile of the data is between < 15 µg/L.	The 50th percentile of the data is between 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 21 mg/m^2.	The 50th percentile of the data is between 17 - 21 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A: No data were available for this assessment.

Table 5.11: PES categories and overall site assessment for Touws River at J1TOUW-EWR3

RIVER	Touws River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	N/A
EWR SITE	J1TOUW-EWR3	**PES**	J1H018Q01 (Water Management System (WMS) code 102147), located upstream of the EWR site. (Data record: 2000 – 2014; number of samples (n) = ± 128).
Confidence assessment	2.5		

Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	N/A	All guidelines exceeded due to high saline geology of the area. It is assumed that some increase in salinity may be expected due to irrigation return flows. No large urban centers are situated in this area.
	Na	2 016.9	
	Mg	370.1	
	Ca	258.2	
	Cl	3 494.6	
	K	37.06	
Nutrients (mg/L)	SRP	0.033	D
	TIN	0.079	A
Physical Variables	pH (5^{th} – 95^{th} %)	7.6 and 8.6	B
	Temperature (°C)	N/A	B. Impacts expected at low flows. B. Impacts expected at low flows, although on-site data still shows high levels. B. Changes in turbidity appear to be largely related to natural with minor man-made modifications.
	Dissolved oxygen	N/A	
	Turbidity (NTU)	N/A	
	Electrical conductivity (mS/m)	1181.8	
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	74.0%	C
	Diatoms	8.6 (average)	D
	Fish community score	56.8%	D
Toxics	Ammonia (as N)	0.034	A
	Fluoride (as F)	0.43	A
OVERALL SITE CLASSIFICATION		***B/C Category***	

Note:
RC: Information available to the water quality specialist on water quality conditions and land-use were used as no RC data were available and the A Category benchmarks tables in DWAF (2008) were considered unsuitable due to the high geology-based salinities in the area.

Table 5.12: Water quality EcoSpecs and TPCs (Category B/C) for Touws River at J1TOUW-EWR3

Metrics	EcoSpecs	TPCs
Inorganic salt ions		
Sulphate as SO_4	N/A	
Sodium as Na	The 95th percentile of the data is between ≤ 2000 mg/L.	The 95th percentile of the data is between 1600 - 2000 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 370 mg/L.	The 95th percentile of the data is between 300 - 370 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 260 mg/L.	The 95th percentile of the data is between 200 - 260 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 3500 mg/L.	The 95th percentile of the data is between 2800 - 3500 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 37 mg/L.	The 95th percentile of the data is between 30 - 37 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 1100 mS/m.	The 95th percentile of the data is between 880 - 1100 mS/m.
pH	The 5th percentile of the data is between 6.5 – 8.0, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 6.3 and the 95th percentile is ≥ 8.6.
Temperature	Natural temperature range.	Initiate baseline monitoring for this variable.
Dissolved oxygen	The 5th percentile of the data is between ≥ 7.0 mg/L.	The 5th percentile of the data is between 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity	Changes in turbidity are related to minor man-made modifications. Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.25 mg/L.	The 50th percentile of the data is between 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.075 mg/L.	The 50th percentile of the data is between 0.06 - 0.075 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data is between < 15 µg/L.	The 50th percentile of the data is between 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 21 mg/m^2.	The 50th percentile of the data is between 17 - 21 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A: No data were available for this assessment.

Table 5.13: PES categories and overall site assessment for Gamka River at J2GAMK-EWR4

RIVER	Gamka River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	A category benchmark tables from DWAF (2008) were used.
EWR SITE	J2GAMK-EWR4	**PES**	Data were sourced from DWS gauging weir J2H016Q01 (WMS code 102173), located downstream Gamkapoort Dam and upstream of the EWR site. (Data record: 2007 – 2014; n = 127).
Confidence assessment	3.0		
Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	N/A	
	Na	114.0	Exceeds the 70mg/l (TWQR) for Agricultural Use: Irrigation
	Mg	20.5	No guideline
	Ca	57.6	No guideline
	Cl	155.5	Exceeds the 100mg/l (TWQR) for Agricultural Use: Irrigation
	K	7.9	No guideline
Nutrients (mg/L)	SRP	0.07	D
	TIN	0.523	B
Physical Variables	pH (5^{th} – 95^{th} %)	7.4 and 8.6	
	Temperature (°C)	N/A	Impact expected as the site is downstream of the Gamkapoort Dam (constructed in 1970)
	Dissolved oxygen	N/A	
	Turbidity (NTU)	N/A	
	Electrical conductivity (mS/m)	97.5	C. Natural salinity expected to be higher than the 30Ms/m A category benchmark value in DWAF (2008)
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	61.4%	C/D
	Diatoms	9.9	D
	Fish community score	60.4%	*C/D*
Toxics	Ammonia (as N)	0.015	A
	Fluoride (as F)	0.53	A
OVERALL SITE CLASSIFICATION		***B/C Category***	

Table 5.14: Water quality EcoSpecs and TPCs (PES: B/C) for Gamka River at J2GAMK-EWR4

Metrics	EcoSpecs: PES	TPCs: PES
Inorganic salt ions		
Sulphate as SO_4	N/A	N/A
Sodium as Na	The 95th percentile of the data is between ≤ 114 mg/L.	The 95th percentile of the data is between 90 - 114 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 20 mg/L.	The 95th percentile of the data is between 16 - 20 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 58 mg/L.	The 95th percentile of the data is between 47 - 58 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 155 mg/L.	The 95th percentile of the data is between 124 - 155 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 8 mg/L.	The 95th percentile of the data is between 6.5 - 8.0 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 100 mS/m.	The 95th percentile of the data is between 80 - 100 mS/m.
pH	The 5th percentile of the data is between 5.9 - 6.5, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 5.7 and the 95th percentile is ≥ 8.6.
Temperature[(a)]	Moderate change to temperature due to upstream Gamkapoort Dam.	Initiate baseline monitoring for this variable.
Dissolved oxygen[(a)]	The 5th percentile of the data is between ≥ 7.0 mg/L. Although some impacts are expected due to the upstream Gamkapoort Dam, the size of the river will mitigate the effects.	The 5th percentile of the data is between 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity[(a)]	Changes in turbidity are related to minor man-made modifications. Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.7 mg/L.	The 50th percentile of the data is between 0.56 - 0.7 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.125 mg/L.	The 50th percentile of the data is between 0.1 - 0.125 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data is between < 15 µg/L.	The 50th percentile of the data is between 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 21 mg/m^2.	The 50th percentile of the data is between 17 - 21 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A: No data were available for this assessment.

Table 5.15: PES categories and overall site assessment for Buffels River at J1BUFF-EWR5

RIVER	Buffels	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	Data were sourced from DWS gauging weir J1H028Q01 (WMS code 102152), located downstream Floriskraal Dam and upstream of the EWR site. Note that the monitoring point is not in the same Level II EcoRegion as the EWR site; however, this was the only data point between the dam and the site. (Data record: 1972 – 1977; n = 54, Conductivity: n = 33).
EWR SITE	J1BUFF-EWR5	**PES**	Data were sourced from DWS gauging weir J1H028Q01 (WMS code 102152) (Data record: 2010 – 2014; n = 44).
Confidence assessment	Confidence: 2.5		

Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	61.42	No guideline
	Na	81.44	Exceeds the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation.
	Mg	25.2	No guideline.
	Ca	48.68	No guideline.
	Cl	124.0	Exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
	K	6.11	No guideline.
Nutrients (mg/L)	SRP	0.015	B. Levels have decreased since the 1970s.
	TIN	0.26	A/B. No change from the 1970s.
Physical Variables	pH (5^{th} – 95^{th} %)	7.5 and 8.5	B. No change from the 1970s.
	Temperature (°C)	N/A	Impact expected as the site is downstream the large Floriskraal Dam (constructed in 1965).
	Dissolved oxygen	N/A	
	Turbidity (NTU)	N/A	
	Electrical conductivity (mS/m)	78.1	No change from the 1970s.
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	72.0%	C
	Diatoms	11.2 (average)	C/D
	Fish community score	83.7%	B
Toxics	Ammonia (as N)	0.017	A
	Fluoride (as F)	0.66	A. No change from the 1970s.
OVERALL SITE CLASSIFICATION		***B/C Category***	

Table 5.16: Water quality EcoSpecs and TPCs (Category B/C) for Buffels River at J1BUFF-EWR5

Metrics	EcoSpecs: PES	TPCs: PES
Inorganic salt ions		
Sulphate as SO_4	The 95th percentile of the data is between ≤ 60 mg/L.	The 95th percentile of the data is between 48 - 60 mg/L.
Sodium as Na	The 95th percentile of the data is between ≤ 80 mg/L.	The 95th percentile of the data is between 64 - 80 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 25 mg/L.	The 95th percentile of the data is between 20 - 25 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 50 mg/L.	The 95th percentile of the data is between 40 - 50 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 125 mg/L.	The 95th percentile of the data is between 100 – 125 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 6.0 mg/L.	The 95th percentile of the data is between 4.8 - 6.0 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 85 mS/m.	The 95th percentile of the data is between 68 - 85 mS/m.
pH	The 5th percentile of the data is between 5.9 - 6.5, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 5.7 and the 95th percentile is ≥ 8.6.
Temperature	Moderate change to temperature expected due to upstream Floriskraal Dam.	Initiate baseline monitoring for this variable.
Dissolved oxygen	The 5th percentile of the data is between ≥ 7.0 mg/L. Although some impacts are expected due to the upstream Floriskraal Dam, the size of the river should mitigate the effects.	The 5th percentile of the data is between 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity	Changes in turbidity are related to minor man-made modifications. Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.48 mg/L.	The 50th percentile of the data is between 0.38 - 0.48 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data is between < 10 µg/L.	The 50th percentile of the data is between 8 - 10 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 12 mg/m^2.	The 50th percentile of the data is between 10 - 12 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A: No data were available for this assessment.

Table 5.17: PES categories and overall site assessment for Gouritz River at J4GOUR-EWR6

RIVER	Gouritz River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	Data were sourced from DWS gauging weir J4H002Q01 (WMS code 102201), located upstream of the EWR site. (Data record: 1965 – 1967; n = 29)
EWR SITE	J4GOUR-EWR6	**PES**	Data were sourced from DWS gauging weir J4H002Q01 (Data record: 2010 – 2014; n = 85).
Confidence assessment	Confidence 3		
Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	693.0	No guideline, but a reduction over time.
	Na	964.0	Exceeds the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation. *Significant increase over time.*
	Mg	127.0	No guideline.
	Ca	123.3	No guideline.
	Cl	1 289.3	Exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
	K	9.81	No guideline.
Nutrients (mg/L)	SRP	0.015	B/C
	TIN	0.05	A
Physical Variables	pH (5^{th} – 95^{th} %)	7.8 and 8.65	B
	Temperature (°C)	N/A	Impact expected at low flows.
	Dissolved oxygen	N/A	
	Turbidity (NTU)	N/A	
	Electrical conductivity (mS/m)	542.5	No change from the 1970s.
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	75.0%	C
	Diatoms	10.2 (average)	C/D
	Fish community score	50.1%	D
Toxics	Ammonia (as N)	0.015	A
	Fluoride (as F)	1.082	A. Substantial increase from the 1960s.
OVERALL SITE CLASSIFICATION		**B/C *Category***	

Table 5.18: Water quality) EcoSpecs and TPCs (Category B/C) for Gouritz River at J4GOUR-EWR6

Metrics	EcoSpecs	TPCs
Inorganic salt ions		
Sulphate as SO_4	The 95th percentile of the data is between ≤ 690 mg/L.	The 95th percentile of the data is between 550 - 690 mg/L.
Sodium as Na	The 95th percentile of the data is between ≤ 960 mg/L.	The 95th percentile of the data is between 770 - 960 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 130 mg/L.	The 95th percentile of the data is between 105 - 130 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 120 mg/L.	The 95th percentile of the data is between 95 - 120 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 1300 mg/L.	The 95th percentile of the data is between 1050 - 1300 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 10 mg/L.	The 95th percentile of the data is between 8 - 10 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 550 mS/m.	The 95th percentile of the data is between 450 - 550 mS/m.
pH	The 5th percentile of the data is between 5.9 - 6.5, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 5.7 and the 95th percentile is ≥ 8.6.
Temperature	Natural temperature range.	Initiate baseline monitoring for this variable.
Dissolved oxygen	The 5th percentile of the data is between ≥ 7.0 mg/L.	The 5th percentile of the data is between 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity	Changes in turbidity are related to minor man-made modifications. Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.25 mg/L.	The 50th percentile of the data is between 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data is between < 10 µg/L.	The 50th percentile of the data is between 8 - 10 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 12 mg/m^2.	The 50th percentile of the data is between 10 - 12 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A: No data were available for this assessment.

Table 5.19: PES categories and overall site assessment for Keurbooms River at K6KEUR-EWR8

RIVER	Keurbooms River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	A Category benchmark tables from DWAF (2008) were used.
EWR SITE	K6KEUR-EWR8	**PES**	Data were sourced from DWS gauging weir K6H001Q01 (WMS code 102295), located far (about 20 km) upstream of the EWR site. (Data record: 2007 – 2014; n = 121; Fluorine (F) = 107)
Confidence assessment	Confidence 3		

Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	27.90	No guideline.
	Na	70.24	Just outside the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation.
	Mg	11.25	No guideline.
	Ca	12.08	No guideline.
	Cl	129.02	Just exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
	K	2.76	No guideline.
Nutrients (mg/L)	SRP	0.012	B
	TIN	0.06	A
Physical Variables	pH (5^{th} – 95^{th} %)	6.6 and 7.8	B
	Temperature (°C)	N/A	B. Some impacts expected at low flows, although on-site data still shows high levels. B. Changes in turbidity appear to be largely related to natural with minor man-made modifications.
	Dissolved oxygen	N/A	
	Turbidity (NTU)	N/A	
	Electrical conductivity (mS/m)	54.6	B
Response variables	Chl a: phytoplankton	N/A	
	Macroinvertebrates	64.0%	C
	Diatoms	9.9 (average)	C/D
	Fish community score	76.4%	C
Toxics	Ammonia (as N)	0.001	A
	Fluoride (as F)	0.26	A
OVERALL SITE CLASSIFICATION		***B Category***	

Table 5.20: Water quality EcoSpecs and TPCs (Category B) for Keurbooms River at K6KEUR-EWR8

Metrics	Eco Specs	TPCs
Inorganic salt ions		
Sulphate as SO_4	The 95th percentile of the data is between ≤ 28 mg/L.	The 95th percentile of the data is between 22 - 28 mg/L.
Sodium as Na	The 95th percentile of the data is between ≤ 70 mg/L.	The 95th percentile of the data is between 56 - 70 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 12 mg/L.	The 95th percentile of the data is between 10 - 12 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 12 mg/L.	The 95th percentile of the data is between 10 - 12 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 130 mg/L.	The 95th percentile of the data is between 104 - 130 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 3 mg/L.	The 95th percentile of the data is between 2.4 - 3.0 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 55 mS/m.	The 95th percentile of the data is between 45 - 55 mS/m.
pH	The 5th and 95th percentile of the data is between 6.5 - 8.0.	The 5th and 95th percentile of the data is ≥ 6.3 and ≤ 8.2.
Temperature	Natural temperature range.	Initiate baseline monitoring for this variable.
Dissolved oxygen	The 5th percentile of the data is between ≥ 7.0 mg/L.	The 5th percentile of the data is between 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity	Changes in turbidity are related to minor man-made modifications. Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.25 mg/L.	The 50th percentile of the data is between 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.0715 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data is between < 10 µg/L.	The 50th percentile of the data is between 8 - 10 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 12 mg/m^2.	The 50th percentile of the data is between 9.6 - 12.0 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.015 mg/L.	The 50th percentile of the data is between 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A: No data were available for this assessment.

Table 5.21: PES categories and overall site assessment for Olifants River at J3OLIF-EWR9

RIVER	Olifants River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	Information available to the water quality specialist on water quality conditions and land-use were available and the A Category benchmark tables in DWAF (2008) were considered unsuitable.
EWR SITE	J3OLIF-EWR9	**PES**	Data were sourced from DWS gauging weir J3H021Q01 (WMS code 102192) was used for the present state assessment located downstream of the EWR site and upstream of Stompdrift Dam. (Data record: 1982 – 1993; n = 127).
Confidence assessment	**Confidence: 2.5**		

Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	1 353.4	No guideline but concentrations are high.
	Na	1 774.5	Exceeds the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation.
	Mg	336.0	No guideline
	Ca	284.4	No guideline
	Cl	3 113	Exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
	K	30.16	No guideline.
Nutrients (mg/L)	SRP	0.019	B/C
	TIN	0.11	A
Physical Variables	pH (5^{th} – 95^{th} %)	7.3 and 9.0	B/C but assumed to be linked to the groundwater signature.
	Temperature (°C)	N/A	C. Impact expected when little surface flow.
	Dissolved oxygen	N/A	
	Turbidity (NTU)	N/A	B/C. Impact expected due to extensive livestock farming and erosion in the area.
	Electrical conductivity (mS/m)	1 078.7	Natural salinity expected to be high due to the geology of the area
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	69.0%	C
	Diatoms	6.0 (average)	D/E
	Fish community score	N/A	
Toxics	Ammonia (as N)	0.038	B
	Fluoride (as F)	0.678	A
OVERALL SITE CLASSIFICATION		***C Category***	

(a) N/A: No data were available for this assessment.

Table 5.22: Water quality EcoSpecs and TPCs (Category C) for Olifants River at J3OLIF-EWR9

Metrics	Eco Specs	TPCs
Inorganic salt ions		
Sulphate as SO_4	The 95th percentile of the data is between ≤ 1350 mg/L.	The 95th percentile of the data is between 1080 - 1350 mg/L.
Sodium as Na	The 95th percentile of the data is between ≤ 1775 mg/L.	The 95th percentile of the data is between 1420 - 1775 mg/L.
Magnesium as Mg	The 95th percentile of the data is between ≤ 335 mg/L.	The 95th percentile of the data is between 270 - 335 mg/L.
Calcium as Ca	The 95th percentile of the data is between ≤ 285 mg/L.	The 95th percentile of the data is between 230 - 285 mg/L.
Chloride as Cl	The 95th percentile of the data is between ≤ 3000 mg/L.	The 95th percentile of the data is between 2400 - 3000 mg/L.
Potassium as K	The 95th percentile of the data is between ≤ 30 mg/L.	The 95th percentile of the data is between 24 - 30 mg/L.
Physical variables		
Electrical conductivity (mS/m)	The 95th percentile of the data is between ≤ 1100 mS/m.	The 95th percentile of the data is between 880 - 1100 mS/m.
pH	The 5th percentile of the data is between 5.9 - 6.5, and the 95th percentile 8.8 - 9.2.	The 5th percentile of the data is ≤ 5.7 and the 95th percentile is ≥ 9.0.
Temperature	The upper Olifants mostly runs underground, with water appearing in places. This is not groundwater from a deep aquifer, but water from the vadose zone. Elevated temperatures and low DO levels would be expected under these conditions. EcoSpecs and TPCs are therefore difficult to set for these variables, and should rather be linked to meeting biotic requirements and monitoring biotic responses.	Initiate baseline monitoring for this variable.
Dissolved oxygen		Initiate baseline monitoring for this variable where and if possible.
Turbidity	Changes in turbidity are related to minor man-made modifications. Some silting of habitats and temporary high turbidity levels are expected.	Initiate baseline monitoring for this variable.
Nutrients		
TIN-N	The 50th percentile of the data is between ≤ 0.25 mg/L.	The 50th percentile of the data is between 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data is between ≤ 0.025 mg/L.	The 50th percentile of the data is between 0.02 - 0.025 mg/L.
Response variables[(a)]		
Chl-a phytoplankton	The 50th percentile of the data is between < 15 µg/L.	The 50th percentile of the data is between 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data is between ≤ 21 mg/m^2.	The 50th percentile of the data is between 17 - 21 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data is between ≤ 1.5 mg/L.	The 50th percentile of the data is between 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data is between ≤ 0.044 mg/L.	The 50th percentile of the data is between 0.035 - 0.044 mg/L.
Other toxics	The 95th percentile of the data is between within the TWQR as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

Table 5.23: PES categories and overall site assessment for Kammanassie River at J3KAMM-EWR10

RIVER	Kammanassie River	**WATER QUALITY MONITORING POINTS**	
WQRU		**RC**	No data were available for the water quality assessment. Land use and available information, diatom data, *in situ* water quality data and survey notes were used to provide an expert opinion and generate a PAI model and integrated water quality category for the site.
EWR SITE	J3KAMM-EWR10	**PES**	N/A
Confidence assessment	Confidence: 2		
Water Quality Constituents		**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	SO_4	N/A	N/A
	Na	N/A	N/A
	Mg	N/A	N/A
	Ca	N/A	N/A
	Cl	N/A	N/A
	K	N/A	N/A
Nutrients (mg/L)	SRP	N/A	N/A
	TIN	N/A	N/A
Physical Variables	pH (5^{th} – 95^{th} %)	N/A	N/A
	Temperature (°C)	N/A	N/A
	Dissolved oxygen	N/A	N/A
	Turbidity (NTU)	N/A	N/A
	Electrical conductivity (mS/m)	N/A	N/A
Response variables	Chl a: phytoplankton	N/A	N/A
	Macroinvertebrates	C/D	
	Diatoms	C/D	The biological water quality at this site was Moderate. Nutrient levels, organic pollution and salinity were elevated with salinity and organic pollution levels becoming problematic. The improvement in diatom-based water quality could mainly be ascribed to higher flows during July 2014 which allowed for the flushing of pollutants as diatom species associated with elevated flows were abundant.
	Fish community score	D	
Toxics	Ammonia (as N)		
	Fluoride (as F)		
OVERALL SITE CLASSIFICATION		***C Category***	

a) N/A: No data were available for this assessment.
Note that limited water quality data exists for the Kammanassie River system. The water quality assessment is therefore based on available information and expert judgement.

Table 5.24: PES categories and overall site assessment for Groot Brak WQSU 1 & 2. (expert judgment)

RIVER	Groot Brak River	**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 1 + 2	**RC**	Default boundary tables for "A" category river
EWR SITE	None	**PES**	Groot Brak R. at Ernest Robertson dam - K2H005-Q01 (1983 – 1996; n = 29)
Confidence assessment	Very low because extrapolated from outflow from a dam, and not current data.		
Water Quality Constituents		**Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$		No data
	Na_2SO_4		
	$MgCl_2$		
	$CaCl_2$		
	NaCl		
	$CaSO_4$		
Nutrients (mg/L)	SRP (mg/l)	0.042	Unreliable data used
	TIN (mg/l)	<0.25	A category
Physical Variables	pH (5^{th} – 95^{th} %)	4.62	Naturally acidic
	Temperature		No data
	Dissolved oxygen		Expected to be high
	Turbidity (NTU)		Expected to be low
	Electrical conductivity (mS/m)	<30	A category
Response variables	Chl a: periphyton		No data
	Chl a: phytoplankton		No data
	Macroinvertebrates (ASPT)		No data
	Fish community score		No data
Toxics			No data – expected to be minimal
OVERALL SITE CLASSIFICATION		**A/B** (from expert judgment)	

Table 5.25: Water quality Ecospecs and TPC's (Category A/B) for Groot Brak River at WQSU 1&2

RIVER		Groot Brak River	**WATER QUALITY MONITORING POINTS**			
WQSU		WQSU 1&2	**DWAF WQ WMS**	Currently, no monitoring station		
EWR SITE		GB 1	**RHP**	Currently, no monitoring site		
Confidence in PES assessment		Very Low because extrapolated from WQSU 3				
Water Quality Constituents		**PES Category**	**WQ Ecospecs**	**Improvement required?**	**TPC**	**Monitoring frequency**
Inorganic salts (mg/L)	$MgSO_4$	Not available	≤23 mg/L	N/A	95th percentile to be < 23 mg/L	Monthly
	Na_2SO_4		≤33 mg/L		95th percentile to be < 33 mg/L	
	$MgCl_2$		≤30 mg/L		95th percentile to be < 30 mg/L	
	$CaCl_2$		≤57 mg/L		95th percentile to be < 57 mg/L	
	NaCl		≤191 mg/L		95th percentile to be < 191 mg/L	
Nutrients (mg/L)	SRP	Category = C.	≤0.012 mg/L	Yes to A	50th percentile to be < 0.012 mg/L	Monthly
	TIN	Category = A	≤0.25 mg/L	No	50th percentile to be < 0.25 mg/L	Monthly
Physical Variables	pH	Naturally acidic river	< 7.9	No	95th percentile to be < 7.9	Monthly
	Temperature	No data, but not considered to be problem in this river.	Maintain range	N/A	Maintain natural range	Monthly
	Dissolved oxygen		7 – 8 mg/L	N/A	5th percentile to be > 7 mg/L	Monthly
	Turbidity (NTU)		Moderate change	N/A	Moderate change allowed	Monthly
	Electrical conductivity (mS/m)	Category = A	≤30 mS/m	No	95th percentile to be < 30 mS/m	Monthly
Response variables	Chl a: periphyton	No data. Visual inspection March & June. No obvious sign of algae.	≤12 mg/m² (B category)	N/A	50th percentile to be < 12 mg/ m²	Quarterly
	Chl a: phytoplankton		≤ 15 µg/L (B category)		50th percentile to be < 15 µg/L	
	Macroinvertebrates (ASPT)	A (this study)	See Ecospecs for fish and invertebrates respectively			
	Fish community score	C (this study				
	Instream toxicity	No data	Assess only if the biomonitoring results indicate that there is a serious problem and the cause is unknown.			
Toxics		No data. Possibly some pesticides				

Table 5.26: PES categories and overall site assessment for Groot Brak Water at WQSU 3

RIVER		Groot Brak River	**1.1.1 WATER QUALITY MONITORING POINTS**	
WQSU		WQSU 3	**RC**	Moordkuil R. at Banff - K1H005 (1979 – 1982 n = 91)
EWR SITE		GB 1	**PES**	K1H005 (2002 – 2006 n = 51)
Confidence assessment		Medium. NB: Because extrapolated from another catchment. Biological data support inferred water quality		
Water Quality Constituents		**RC value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$			No data
	Na_2SO_4			
	$MgCl_2$			
	$CaCl_2$			
	NaCl			
	$CaSO_4$			
Nutrients (mg/L)	SRP	0.006*	0.029	Category = C. Increase in trend
	TIN	0.04	0.06	Category = A. Trend stable
Physical Variables	pH (5^{th} – 95^{th} %)	Not calculated	6.6 – 7.9	
	Temperature			No data, but not considered to be problem variables, as not downstream of a major dam.
	Dissolved oxygen			
	Turbidity (NTU)			Slightly turbid on site visits in March and June 2007 (but after heavy rains).
	Electrical conductivity (mS/m)	40	30	Slight decrease in trend
Response variables	Chl a: periphyton			No data. Visual inspection March and June – no obvious signs of algae.
	Chl a: phytoplankton			
	Macroinvertebrates (ASPT)	-	A	Natural; ASPT = 8.0; SASS = 192 (this study)
	Fish community score	-	C	This study
Toxics				No data. Possibly some pesticides from agriculture.
OVERALL SITE CLASSIFICATION		**B** (from PAI model)		

Table 5.27: Water quality Ecospecs and TPC's (Category B) for Groot Brak River at WQSU 3

RIVER		Groot Brak River	**WATER QUALITY MONITORING POINTS**			
WQSU		3	**DWAF WQ WMS**	Currently, no monitoring station		
EWR SITE		GB 1	**RHP**	Currently, no monitoring site		
Confidence in PES assessment		Low – medium, because extrapolated from Moordkuil R. Biological data supports inferred PES for water quality.				
Water Quality Constituents		**PES Category**	**WQ Ecospecs**	**Improvement required?**	**TPC**	**Monitoring frequency**
Inorganic salts (mg/L)	$MgSO_4$	Not available	≤23 mg/L	N/A	95th percentile to be < 23 mg/L	Monthly
	Na_2SO_4		≤33 mg/L		95th percentile to be < 33 mg/L	
	$MgCl_2$		≤30 mg/L		95th percentile to be < 30 mg/L	
	$CaCl_2$		≤57 mg/L		95th percentile to be < 57 mg/L	
	NaCl		≤191 mg/L		95th percentile to be < 191 mg/L	
Nutrients (mg/L)	SRP	Category = C.	≤0.02 mg/L	Yes to B	50th percentile to be < 0.02 mg/L	Monthly
	TIN	Category = A	≤0.25 mg/L	No	50th percentile to be < 0.25 mg/L	Monthly
Physical Variables	pH	Naturally acidic river	< 7.9	No	95th percentile to be < 7.9	Monthly
	Temperature	No data, but not considered to be problem in this river.	Maintain range	N/A	Maintain natural range	Monthly
	Dissolved oxygen		7 – 8 mg/L	N/A	5th percentile to be > 7 mg/L	Monthly
	Turbidity (NTU)		Moderate change	N/A	Moderate change allowed	Monthly
	Electrical conductivity (mS/m)	Category = A	≤30 mS/m	No	95th percentile to be < 30 mS/m	Monthly
Response variables	Chl a: periphyton	No data. Visual inspection March & June. No obvious sign of algae.	≤12 mg/m² (B category)	N/A	50th percentile to be < 12 mg/ m²	Quarterly
	Chl a: phytoplankton		≤ 15 µg/L (B category)		50th percentile to be < 15 µg/L	
	Macroinvertebrates (ASPT)	A (this study)	See Ecospecs for fish and invertebrates respectively			
	Fish community score	C (this study				
	Instream toxicity	No data	Assess only if the biomonitoring results indicate that there is a serious problem and the cause is unknown.			
Toxics		No data. Possibly some pesticides				

Table 5.28: PES categories and overall site assessment for Groot Brak WQSU 4 (*boundary value recalibrated) (expert judgment)

RIVER	Groot Brak		**WATER QUALITY MONITORING POINTS**	
WQSU	4		**RC**	Groot Brak R. at Wolwedans - K2H002-Q01 (1976 – 1978; n = 68)
EWR SITE	None		**PES**	K2H002 (2002 – 2006; n = 57)
Confidence assessment	**Very good. Monitoring station located in WQSU, above point source of village. Data collected from > 15 years before dam construction**			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$			No data
	Na_2SO_4			
	$MgCl_2$			
	$CaCl_2$			
	NaCl			
	$CaSO_4$			
Nutrients (mg/L)	SRP	0.016*	0.037	Category = C. Trend increasing
	TIN	0.04	0.075	Category = A. Trend increasing
Physical Variables	pH (5^{th} – 95^{th} %)		6.8 – 8.1	Based on Monitoring station located in WQSU, above point source of village
	Temperature		No data	May be a problem considering downstream of dam. Requires monitoring
	Dissolved oxygen		No data	
	Turbidity (NTU)		No data	
	Electrical conductivity (mS/m)	30	52	Category = B. Trend increasing
Response variables	Chl a: periphyton			No data
	Chl a: phytoplankton			No data
	Macroinvertebrates (ASPT)			No data
	Fish community score			No data
Toxics				No data
OVERALL SITE CLASSIFICATION		**B/C** (expert judgment)		

Table 5.29: Water quality Ecospecs and TPC's (Category B/C) for Groot Brak River at WQSU 4

RIVER		Groot Brak River	**WATER QUALITY MONITORING POINTS**			
WQSU		4	**DWAF WQ WMS**	Currently, no monitoring station		
EWR SITE		GB 1	**RHP**	Currently, no monitoring site		
Confidence in PES assessment		Very Low, because extrapolated from WQSU 3.				
Water Quality Constituents		**PES Category**	**WQ Ecospecs**	**Improvement required?**	**TPC**	**Monitoring frequency**
Inorganic salts (mg/L)	$MgSO_4$	Not available	≤23 mg/L	N/A	95th percentile to be < 23 mg/L	Monthly
	Na_2SO_4		≤33 mg/L		95th percentile to be < 33 mg/L	
	$MgCl_2$		≤30 mg/L		95th percentile to be < 30 mg/L	
	$CaCl_2$		≤57 mg/L		95th percentile to be < 57 mg/L	
	NaCl		≤191 mg/L		95th percentile to be < 191 mg/L	
Nutrients (mg/L)	SRP	Category = C.	≤0.025 mg/L	Yes to B/C	50th percentile to be < 0.025 mg/L	Monthly
	TIN	Category = A	≤0.25 mg/L	No	50th percentile to be < 0.25 mg/L	Monthly
Physical Variables	pH	Naturally acidic river	< 7.9	No	95th percentile to be < 7.9	Monthly
	Temperature	No data, but not considered to be problem in this river.	Maintain range	N/A	Maintain natural range	Monthly
	Dissolved oxygen		7 – 8 mg/L	N/A	5th percentile to be > 7 mg/L	Monthly
	Turbidity (NTU)		Moderate change	N/A	Moderate change allowed	Monthly
	Electrical conductivity (mS/m)	Category = A	≤30 mS/m	No	95th percentile to be < 30 mS/m	Monthly
Response variables	Chl a: periphyton	No data. Visual inspection March & June. No obvious sign of algae.	≤12 mg/m^2 (B category)	N/A	50th percentile to be < 12 mg/ m^2	Quarterly
	Chl a: phytoplankton		≤ 15 µg/L (B category)		50th percentile to be < 15 µg/L	
	Macroinvertebrates (ASPT)	A (this study)	See Ecospecs for fish and invertebrates respectively			
	Fish community score	C (this study				
	Instream toxicity	No data	Assess only if the biomonitoring results indicate that there is a serious problem and the cause is unknown.			
Toxics		No data. Possibly some pesticides				

Table 5.30: Water quality Ecospecs and TPC's for Malgas River at WQSU2

RIVER	Malgas River	**WATER QUALITY MONITORING POINTS**			
WQSU	WQSU 2	**RC**	Default values		
EWR SITE	Mal 1	**PES**	Malgas R. at Blanco - K3H004-Q01 ('01 – '06 n = 53)		
Confidence assessment	Good for the overall WQSU. Low for the EWR Site.				
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**	**G-power (Confidence)**
Inorganic salts (mg/L)	$MgSO_4$				No data
	Na_2SO_4				
	$MgCl_2$				
	$CaCl_2$				
	NaCl				
	$CaSO_4$				
Nutrients (mg/L)	SRP	≤0.005	0.038	Category = C. Trend increasing.	0.116 (Low)
	TIN	≤0.25	0.413	Category = A/B. Trend increasing	
Physical Variables	pH (5^{th} + 95^{th} %ile)		4.3 + 7.2	Naturally acidic.	0.84 (High)
	Temperature	16.3 (50%ile)	-	No PES data. Not expected to be a problem since no dam upstream	
	Dissolved oxygen				
	Turbidity (NTU)			No data. Could be a problem due to quarry	
	Electrical conductivity (mS/m)	<30	15	Category = A. Trend = slight increase	0.64 (Medium)
Response variables	Chl a: periphyton			No data	No data (but visual inspection at EWR site indicated localised problem).
	Chl a: phytoplankton			No data	
	Macroinvertebrates			**A** category; ASPT = 8.2, SASS = 164 (this study)	
	Fish community score			**C/D** (this study)	
Toxics				No data. Possible toxicity from quarry/cement/asphalt works, outflows from village and agricultural return flows	
OVERALL SITE CLASSIFICATION		**B Category** (from PAI model)			

Table 5.31: PES categories and overall site assessment for Maalgate River

RIVER	Moeras/Maalgate River	**WATER QUALITY MONITORING POINTS**	
WQSU	N/A	RC	Default boundary tables for A category river
EWR SITE	Moe 1 & Maa 2	PES	Maalgate R. @ Noetze Kamma K3H003 ('02 – '06; n = 52)
Confidence assessment	Good.		

Water Quality Constituents		**Value**	**Category/Comment**
Nutrients (mg/L)	SRP	0.019	Category = B (TP = 0.015 mg/L)
	TIN	0.1	Category = A
Physical Variables	pH (5^{th} – 95^{th} %)	5.7 – 7.7	Naturally acidic
	Temperature		No data. May be impacted (by abstraction)
	Dissolved oxygen		No data. May be impacted (due to excessive abstraction)
	Turbidity (NTU)		No data. Site visit indicated not elevated.
	Electrical conductivity (mS/m)	63	Category = C
Response variables	Chl a: periphyton		No data. Site visit indicated extensive periphyton
	Chl a: phytoplankton		No data
	Macroinvertebrates (ASPT)		D (present study) Fair (RHP)
	Fish community score		D (present study)
Toxics			No data – expected to be pesticides from intensive agricultural activity
OVERALL SITE CLASSIFICATION		**C Category (from expert judgement)**	

Boundary values		
Determinant	**Lower boundary value**	**Upper boundary value**
TIN (mg/L) – 50^{th} %ile		2.0
PHYTOPLANKTON Chl a (µg/L) – 50^{th} %ile	15	20
SRP or PO4 (mg/L) – 50^{th} %ile		0.058
PERIPHYTON Chl a (mg/m^2) – 50^{th} %ile	12	21
pH – 5^{th} %ile and 95^{th} %ile	5^{th} percentile: 5.00 – 5.23	
TEMPERATURE (°C) – 10 th %ile and 90 th %ile	Vary by no more than 2°C from natural range	
Dissolved oxygen (mg/L) - 5^{th} %ile	6	
BIOLOGICAL INDICATOR (ASPT)	5.67	

Table 5.32: PES categories and overall site assessment for Gwaing (Malgas/Keur River) at WQSU1

RIVER	Malgas River (Keur River)	**WATER QUALITY MONITORING POINTS**		
WQSU	WQSU 1	**RC**	Rooi R. @ George K3H002-Q01 ('77 – '79 n = 84)	
EWR SITE	None	**PES**	K3H002-Q01 ('01 – '06 n = 65)	
Confidence assessment	Low. NB: extrapolated from an adjacent catchment			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$			No data
	Na_2SO_4			
	$MgCl_2$			
	$CaCl_2$			
	NaCl			
	$CaSO_4$			
Nutrients (mg/L)	SRP	0.014	≤0.014*	Category = A
	TIN	0.04	≤0.25*	Category = A
Physical Variables	pH (5^{th} – 95^{th} %)		3.7 – 6.7	Naturally acidic
	Temperature			No data but expected to be natural as little development in upstream catchment.
	Dissolved oxygen			
	Turbidity (NTU)			
	Electrical conductivity (mS/m)	16	17	Category = A
Response variables	Chl a: periphyton			No data
	Chl a: phytoplankton			
	Macroinvertebrates			Good (RHP)
	Fish community score			Natural (RHP)
Toxics				No data
OVERALL SITE CLASSIFICATION		**A Category** (from expert judgement)		

Boundary values		
Determinant	**Lower boundary value**	**Upper boundary value**
TIN (mg/L) – 50^{th} %ile		≤ 0.25
PHYTOPLANKTON Chl a (µg/L) – 50^{th} %ile		<10
SRP or PO4 (mg/L) – 50^{th} %ile		≤ 0.005
PERIPHYTON Chl a (mg/m^2) – 50^{th} %ile		< 1.7
pH – 5^{th} %ile and 95^{th} %ile	6.5 – 8.00	
TEMPERATURE (°C) – 10 th %ile and 90 th %ile	Nat temp range	
Dissolved oxygen (mg/L) - 5^{th} %ile	>8	
BIOLOGICAL INDICATOR (ASPT)	7	

Table 5.33: PES categories and overall site assessment for Gwaing (Malgas River) at WQSU2

RIVER	Malgas River	**WATER QUALITY MONITORING POINTS**			
WQSU	WQSU 2	**RC**	Default values		
EWR SITE	Mal 1	**PES**	Malgas R. @ Blanco - K3H004-Q01 ('01 – '06 n = 53)		
Confidence assessment	Good for the overall WQSU. Low for the EWR Site.				
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**	**G-power (Confidence)**
Inorganic salts (mg/L)	$MgSO_4$				No data
	Na_2SO_4				
	$MgCl_2$				
	$CaCl_2$				
	NaCl				
	$CaSO_4$				
Nutrients (mg/L)	SRP	≤0.005	0.038	Category = C. Trend increasing.	0.116 (Low)
	TIN	≤0.25	0.413	Category = A/B. Trend increasing	
Physical Variables	pH (5th – 95th %)		4.3 – 7.2	Naturally acidic.	0.84 (High)
	Temperature	16.3 (50%ile)	-	No PES data. Not expected to be a problem since no dam upstream	
	Dissolved oxygen				
	Turbidity (NTU)			No data. Could be a problem due to quarry	
	Electrical conductivity (mS/m)	<30	15	Category = A. Trend = slight increase	0.64 (Medium)
Response variables	Chl a: periphyton			No data	No data (but visual inspection indicated localised problem).
	Chl a: phytoplankton			No data	
	Macroinvertebrates			**A** category; ASPT = 8.2, SASS = 164 (this study)	
	Fish community score			**C/D** (this study)	
Toxics				No data. Possible toxicity from quarry/cement/asphalt works, outflows from village and return flows	
OVERALL SITE CLASSIFICATION	**B Category** (from PAI model). **Likely to be better at EWR site itself.**				

Boundary values		
Determinant	**Lower boundary value**	**Upper boundary value**
TIN (mg/L) – 50th %ile		0.75
PHYTOPLANKTON Chl a (µg/L) – 50th %ile	5	10
SRP or PO4 (mg/L) – 50th %ile		0.02
PERIPHYTON Chl a (mg/m²) – 50th %ile	1.7	12
pH – 5th %ile and 95th %ile	5th percentile: 6.00 – 6.24 95th percentile: 8.37 – 8.69	
TEMPERATURE (°C) – 10 th %ile and 90 th %ile	Nat temp range	
Dissolved oxygen (mg/L) - 5th %ile	7	
BIOLOGICAL INDICATOR (ASPT)	6.34	

Table 5.34: PES categories and overall site assessment for Gwaing (Gwaing River) at WQSU3

RIVER	Gwaing River		**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 3		**RC**	Default values
EWR SITE	None		**PES**	No DWAF monitoring station
Confidence assessment	Low for RC as default values used. Medium for the PES as no monitoring station, but supported by biomonitoring data and (limited) supplementary data.			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$			No data
	Na_2SO_4			
	$MgCl_2$			
	$CaCl_2$			
	NaCl			
	$CaSO_4$			
Nutrients (mg/L)	SRP	≤0.005	1.4 mg/L	Category = F
	TIN	≤0.25		Category = D
Physical Variables	pH (5^{th} – 95^{th} %)			
	Temperature			No data. Likely to be a problem with low DO and elevated turbidity
	Dissolved oxygen			
	Turbidity (NTU)			
	Electrical conductivity (mS/m)	<30	49	
Response variables	Chl a: periphyton			No data
	Chl a: phytoplankton			
	Macroinvertebrates (ASPT)			RHP = "Poor water quality"
	Fish community score			
Toxics				No data, but likely to be a problem
OVERALL SITE CLASSIFICATION		**D/E Category** (expert judgement)		

Boundary values		
Determinant	**Lower boundary value**	**Upper boundary value**
TIN (mg/L) – 50^{th} %ile		4.0
PHYTOPLANKTON Chl a (µg/L) – 50^{th} %ile	20	30
SRP or PO4 (mg/L) – 50^{th} %ile		0.125
PERIPHYTON Chl a (mg/m^2) – 50^{th} %ile	21	84
pH – 5^{th} %ile and 95^{th} %ile	5^{th} percentile: 5.46 – 5.7 95^{th} percentile: 8.56 – 10.00	
TEMPERATURE (°C) – 10 th %ile and 90 th %ile	Vary by no more than 4°C from natural range	
Dissolved oxygen (mg/L) - 5^{th} %ile	4	
BIOLOGICAL INDICATOR (ASPT)	5	

Where a difference in the water quality values for the Ecological Reserve and Basic Human Needs Reserve was found, the stricter or more protective value was selected for the water quality component of the Reserve.

Table 5.35: PES categories and overall site assessment for the Kaaimans River at WQSU 2

RIVER	Kaaimans River		**WATER QUALITY MONITORING POINTS**		
WQSU	WQSU 2		**RC**	Kaaimans R. @ Barbierskraal - K3H001-Q01 ('77 – '81; n = 175)	
EWR SITE	Ka1		**PES**	K3H001-Q01 ('01 – '06; n = 56)	
Confidence assessment	High for both the RC and PES, because the monitoring station is in the WQSU, has a good length of data, and because there is little land transformation in the catchment.				
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**	**G-power (Confidence)**
Inorganic salts (mg/L)	$MgSO_4$				No data
	Na_2SO_4				
	$MgCl_2$				
	$CaCl_2$				
	NaCl				
	$CaSO_4$				
Nutrients (mg/L)	SRP	0.011	0.028*	Category = B. Trend = slight increase	0.122 (Low)
	TIN	0.04	0.061	Category = A. Very slight increase in trend	
Physical Variables	pH (5^{th} – 95^{th} %)		4.4 – 7.4	Naturally acidic waters	0.87 (High)
	Temperature			No data. Unlikely to be a problem	
	Dissolved oxygen				
	Turbidity (NTU)			No data. Visual inspection = low turbidity. Unlikely to be a problem	
	Electrical conductivity (mS/m)	16	17	A Category. Trend = stable	0.87 (High)
Response variables	Chl a: periphyton			No data. Visual inspection = no excessive algal growth	
	Chl a: phytoplankton				
	Macroinvertebrates			A category; ASPT = 8.0, SASS = 175 (this study). Natural (RHP)	
	Fish community score			B	
Toxics				No data, but unlikely to be a problem	
OVERALL SITE CLASSIFICATION		**A Category** (calculated from PAI model)			

Table 5.36: Water Ecospecs for the Kaaimans River in K30C

Quality Constituent	Parameter	Ecological Reserve Requirements	Basic Human Needs Requirement[5]	Reserve Requirement: water quality
General chemistry – major inorganic salts	$MgSO_4$ (mg/l) [1]	< 16	N/A	< 16
	Na_2SO_4 (mg/)l [1]	< 20	N/A	< 20
	$MgCl_2$ (mg/l) [1]	< 15	N/A	< 15
	$CaCl_2$ (mg/l) [1]	< 21	N/A	< 21
	NaCl (mg/l) [1]	< 45	N/A	< 45
General chemistry – Major Ions	Sodium (mg/l)	N/A	<200	<200
	Magnesium (mg/l)	N/A	<100	<100
	Chloride (mg/l)	N/A	<200	<200
	Calcium (mg/l)	N/A	<80	<80
	Sulphate (mg/l)	N/A	<400	<400
Nutrients	Phosphate (PO_4) (mg/l) [2]	<0.02mg/L	N/A	<0.02mg/L
	Total Inorganic Nitrogen (mgN/l) [2]	<0.25mg/L	N/A	<0.25mg/L
Physical water quality	pH (range) 5th percentile 95th percentile	 6.7 7.4	 5 9.5	 5 7.4
	Dissolved Oxygen (mg/l)[1]	>1.7 mg/L	N/A	**>1.7 mg/L**
	Temperature[1]	Small change from natural		Small change from natural
	Electrical conductivity (mS/m) – USE ONLY IF AGGREGATED SALTS CANNOT BE PRODUCED	≤30mS/m	0-70	≤30mS/m
Biological water quality	Chl-a: periphyton[3]	<1.7 mg/m^2	N/A	
	Chl-a: phytoplankton[3]	< 10 µg/L (A category)	N/A	
	Biotic community composition - macroinvertebrates	ASPT: 8 (A category)		
	In-stream toxicity	In-stream toxicity should not occur		
Toxics and complex mixtures	Toxics (as listed in DWAF, 1996 [6])	≤ TWQR	≤ TWQR	≤ TWQR

NOTES:
[1] : 95th percentile compliance. [2]: 50th percentile compliance. [3] Chl-a is not applicable to Desktop Reserve studies. [4] 90th percentile compliance
[5] ref: *South African Water Quality Guidelines, Volume 1: Domestic Water Use, 2nd Ed.* 1996. Department of Water Affairs and Forestry. Pretoria, South Africa.
[6] ref: *South African Water Quality Guidelines, Volume 7: Aquatic Ecosystems, 2nd Ed.* 1996. Department of Water Affairs and Forestry. Pretoria, South Africa.

Table 5.37: PES categories and overall site assessment for the Diep River at WQSU 3

RIVER	Diep River		**WATER QUALITY MONITORING POINTS**		
WQSU	WQSU 3 (start of level II Ecoregion 20.02 to the beginning of the mountain stream zone)		**RC**	Diep R. @ Woodville Forest Reserve K4H003Q01 ('77 – '80; n = 58)	
EWR SITE	3		**PES**	K4H003Q01 ('03 – '07; n = 36)	
Confidence assessment	Moderate to high confidence				
Water Quality Constituents			**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$		8.86	15.87	TEACHA was used for data assessment. Salts = an A category
	Na_2SO_4		0.00	0.00	
	$MgCl_2$		14.83	14.52	
	$CaCl_2$		7.18	9.89	
	NaCl		102.10*	94.31	
	$CaSO_4$		0.66	0.59	
Nutrients (mg/L)	SRP		0.003	0.018	B/C category.
	TIN		0.04	0.07	A category.
Physical Variables	pH (5^{th} + 95^{th} %ile)		4.8 + 6.2	4.8 + 7.5	B category.
	Temperature		-	-	No data but no impacts expected.
	Dissolved oxygen		-	-	
	Turbidity (NTU)		-	-	No data. Slight evidence of sedimentation.
	Electrical conductivity (mS/m)			18.0	A category
Response variables	Chl a: periphyton		-	21.25	Some nutrient elevations shown by periphyton data (C/D category; n=1)
	Chl a: phytoplankton		-	0.18	
	Macroinvertebrates		ASPT$^{\$}$: mean of 6.58	ASPT: 7.3 MIRAI**: 86.1%	B category for the present state.
	Fish community score		-	FRAI$^{\blacklozenge}$: 86.1%	B category for the present state.
	Diatoms		-	SPI$^{\#}$=17.6	High quality water
Toxics			-	-	No data, but some impact expected due to farming-related pesticides and fertilizer use.
OVERALL SITE CLASSIFICATION			**B** (PAI model)		

*: boundary value recalibrated
-: no data
#: Specific Pollution Index
♦: FRAI = Fish Response Assessment Index
**: MIRAI = Macro Invertebrate Response Assessment Index
$: ASPT = Average Score Per Taxon

Table 5.38: Water quality Ecospecs for Diep River (WQSU 3, K40A)

River: Diep		EWR Site: 3	Monitoring site: K4H003Q01
Water quality metrics		ECOSPEC	
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 ≤ 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 and 95th percentiles of the data must range from 4.5 to 7.5.	
	Temperature	Small deviation from the natural temperature range.	
	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; minor silting of instream habitats acceptable.	
Nutrients	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 <15 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 52.5 mg/m^2.**	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.
** Periphyton (21.25 mg/m^2) is actually in a C/D category (C = 12 - 21 and D = 21 - 84 mg/m^2; DWAF, 2008), so have defined the upper boundary of a C/D as the EcoSpec.

Table 5.39: Water quality TPC's for Diep River (WQSU 3, K40A)

River: Diep		EWR Site: 3	Monitoring site: K4H003Q01
Water quality metrics		TPC	
Inorganic salts*	$MgSO_4$	The 95th percentile of the data must be 13 – 16 mg/L.	
	Na_2SO_4	The 95th percentile of the data must be 16 – 20 mg/L.	
	$MgCl_2$	The 95th percentile of the data must be 12 – 15 mg/L.	
	$CaCl_2$	The 95th percentile of the data must be 17 – 21 mg/L.	
	NaCl	The 95th percentile of the data must be 36 – 45 mg/L.	
	$CaSO_4$	The 95th percentile of the data must be 153 – 191 mg/L.	
Physical variables	EC	The 95th percentile of the data must be 24 – 30 mS/m.	
	pH	The 5th and 95th percentiles of the data must be <4.7 and >7.3.	
	Temperature	Small to moderate deviation from the natural temperature range. Some highly temperature sensitive species in lower abundances and frequency of occurrence than expected for reference.	
	Dissolved oxygen	The 5th percentile of the data must be 7.8 – 7.5 mg/L.	
	Turbidity	Moderate changes to the catchment land-use resulting in temporary unnaturally high sediment loads and high turbidities.	
Nutrients	TIN	The 50th percentile of the data must be 0.2 – 0.25 mg/L.	
	PO_4-P	The 50th percentile of the data must be 0.02 – 0.025 mg/L.	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be 12 – 15 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be 42 – 52.5 mg/m^2.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

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Table 5.40: PES categories and overall site assessment for the Karatara River at WQSU 5

RIVER	Karatara River		**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 5 (source to Swartvlei)		**RC**	Karatara R. @ Karatara Forest Reserve K4H002Q01 ('76 – '79; n = 115)
EWR SITE	4		**PES**	K4H002Q01 ('03 – '07; n = 36)
Confidence assessment	Moderate as adequate data to assess reference and present states			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$	7.62	12.63	TEACHA was used for data assessment. Salts = an A category.
	Na_2SO_4	2.05	3.01	
	$MgCl_2$	4.43	4.16	
	$CaCl_2$	9.89	9.16	
	NaCl	35.59	36.15	
	$CaSO_4$	0.73	0.73	
Nutrients (mg/L)	SRP	0.022 *	0.047	B category.
	TIN	0.07	0.128	A category.
Physical Variables	pH (5^{th} + 95^{th} %ile)	3.7 + 7.7	3.8 + 6.6	A category.
	Temperature	-	-	No data but no impacts expected
	Dissolved oxygen	-	-	
	Turbidity (NTU)	-	-	No data. Slight evidence of sedimentation.
	Electrical conductivity (mS/m)	-	7.0	A category.
Response variables	Chl a: periphyton	-	9.91	B category for periphyton.
	Chl a: phytoplankton	-	0.09	
	Macroinvertebrates	ASPT: 7.3	ASPT: 8.1 MIRAI: 92.3%	A/B category for the present state.
	Fish community score	-	FRAI: 82.4%	B category for the present state.
	Diatoms	-	SPI=19.9	High quality water
Toxics		-	-	No data, but some impact from timber processing at Geelhoutvlei.
OVERALL SITE CLASSIFICATION	**B for WQSU 5**, although an A category for upstream river stretch (PAI model)			

*: boundary value recalibrated
-: no data

Table 5.41: Water quality Ecospecs for Karatara River at WQSU 5

River: Karatara		EWR Site: 4	Monitoring site: K4H002Q01
Water quality metrics		**ECOSPEC**	
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 ≤ 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 and 95th percentiles of the data must range from 4.5 to 7.5.	
	Temperature	Natural temperature range.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8.0 mg/L.	
	Turbidity	Vary by a small amount from the natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.25 mg/L.	
	PO_4-P	The 50th percentile of the data must be ≤ 0.075 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.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

Table 5.42: Water quality TPC's for Karatara River at WQSU 5

River: Karatara		EWR Site: 4	Monitoring site: K4H002Q01
Water quality metrics		**TPC**	
Inorganic salts*	$MgSO_4$	The 95th percentile of the data must be 13 – 16 mg/L.	
	Na_2SO_4	The 95th percentile of the data must be 16 – 20 mg/L.	
	$MgCl_2$	The 95th percentile of the data must be 12 – 15 mg/L.	
	$CaCl_2$	The 95th percentile of the data must be 17 – 21 mg/L.	
	NaCl	The 95th percentile of the data must be 36 – 45 mg/L.	
	$CaSO_4$	The 95th percentile of the data must be 153 – 191 mg/L.	
Physical variables	EC	The 95th percentile of the data must be 24 – 30 mS/m.	
	pH	The 5th and 95th percentiles of the data must be <4.7 and >7.3.	
	Temperature	Small deviation from the natural temperature range.	
	Dissolved oxygen	The 5th percentile of the data must be 8.2 – 8.0 mg/L.	
	Turbidity	Small to moderate changes to the catchment land-use resulting in minor and temporary effects of silting of habitats.	
Nutrients	TIN	The 50th percentile of the data must be 0.2 – 0.25 mg/L.	
	PO_4-P	The 50th percentile of the data must be 0.06 – 0.075 mg/L.**	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be 8 – 10 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be 10 – 12 mg/m^2.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.
**** Although the upper boundary for the relevant phosphate category is 0.125 mg/L, the TPC has been set at 0.075 mg/L as PES levels for phosphate were 0.046 mg/L.**

Table 5.43: PES categories and overall site assessment for the Hoëkraal River at WQSU 4

RIVER	Hoëkraal River		**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 4 (source to beginning of lower foothills)		**RC**	Hoëkraal R. @ Eastbrook K4H001Q01 ('77 – '80; n = 83)
EWR SITE	-		**PES**	K4H001Q01 ('03 – '07; n = 28)
Confidence assessment	Low - Moderate as limited data for the present state assessment. Lower section in the backup zone from Swartvlei lake. Note that the gauging weir is located on the lower Hoëkraal River.			
Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$	35.87	153.20	TEACHA was used for the analysis of WMS data. Results should be disregarded as data shows salt intrusion from the saline Swartvlei lake.
	Na_2SO_4	9.95	159.5	
	$MgCl_2$	35.92	100.33	
	$CaCl_2$	24.80	45.24	
	NaCl	399.69	1560.41	
	$CaSO_4$	0.59	0.73	
Nutrients (mg/L)	SRP	0.014 *	0.034	B category.
	TIN	0.06	0.088	A category.
Physical Variables	pH (5^{th} + 95^{th} %ile)	4.4 + 7.2	4.5 + 7.8	A category.
	Temperature	-	-	No data but no impacts expected, although the river is deep and wide above the lower site, which may result in lowering oxygen levels.
	Dissolved oxygen	-	-	
	Turbidity (NTU)	-	-	No data, but some evidence of sedimentation.
	Electrical conductivity (mS/m)		4.2: Upper site	A category
Response variables	Chl a: periphyton	-	4.81: Upper site 152.93: Lower site	Lower site shows some nutrient build-up in the water.
	Chl a: phytoplankton	-	0.14: Upper site 0.47: Lower site	
	Macroinvertebrates	-	-	Not assessed as not an EWR site.
	Fish community score	-	-	
	Diatoms	-	SPI=19.8: Upper river. SPI=16.2: Lower river.	Upper site: High quality water. Lower site: Good quality water.
Toxics		-	-	No data, but no impacts expected.
OVERALL SITE CLASSIFICATION		**C Category** (PAI model)		

* boundary value recalibrates

Table 5.44: Water quality Ecospecs for Hoëkraal River at WQSU 4

River: Hoëkraal		EWR Site: -	Monitoring site: K4H001Q01, although located in the lower section of the river and salt water intrusion detected due to back-up from Swartvlei Lake.
Water quality metrics		**ECOSPEC**	
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 ≤ 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 and 95th percentiles of the data must range from 4.5 to 7.5.	
	Temperature	Small deviation from the natural temperature range.	
	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; minor silting of instream habitats acceptable.	
Nutrients	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 <10 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 12 mg/m².	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

Table 5.45: Water quality TPC's for Hoëkraal River at WQSU 4

River: Hoekraal		EWR Site: -	Monitoring site: K4H001Q01
Water quality metrics		**TPC**	
Inorganic salts*	$MgSO_4$	The 95th percentile of the data must be 13 – 16 mg/L.	
	Na_2SO_4	The 95th percentile of the data must be 16 – 20 mg/L.	
	$MgCl_2$	The 95th percentile of the data must be 12 – 15 mg/L.	
	$CaCl_2$	The 95th percentile of the data must be 17 – 21 mg/L.	
	NaCl	The 95th percentile of the data must be 36 – 45 mg/L.	
	$CaSO_4$	The 95th percentile of the data must be 153 – 191 mg/L.	
Physical variables	EC	The 95th percentile of the data must be 24 – 30 mS/m.	
	pH	The 5th and 95th percentiles of the data must be <4.7 and >7.3.	
	Temperature	Small to moderate changes to the catchment land-use resulting in minor and temporary effects of silting of habitats.	
	Dissolved oxygen	The 5th percentile of the data must be 7.8 – 7.5 mg/L.	
	Turbidity	Moderate changes to the catchment land-use resulting in temporary unnaturally high sediment loads and high turbidities.	
Nutrients	TIN	The 50th percentile of the data must be 0.2 – 0.25 mg/L.	
	PO_4-P	The 50th percentile of the data must be 0.1 – 0.125 mg/L.	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be 8 – 10 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be 10 – 12 mg/m².	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

Table 5.46: PES categories and overall site assessment for Goukamma River at WQSU 1

RIVER	Goukamma River	WATER QUALITY MONITORING POINTS	
WQSU	WQSU 1 (source to the end of the mountainous area)	RC	Rooi R. @ George K3H002-Q01 ('77 – '79 n = 84)
EWR SITE	None	PES	K3H002-Q01 ('01 – '06 n = 65)
Confidence assessment	Low to medium because no DWAF monitoring station. However unimpacted catchment and likely to be similar to other mountain streams.		

Water Quality Constituents		RC Value	PES Value	Category/Comment
Inorganic salts (mg/L)	$MgSO_4$			No data
	Na_2SO_4			
	$MgCl_2$			
	$CaCl_2$			
	NaCl			
	$CaSO_4$			
Nutrients (mg/L)	SRP	0.014	≤0.014*	A category.
	TIN	0.04	≤0.25*	A category.
Physical Variables	pH (5th – 95th %)		3.7 – 6.7	Naturally acidic.
	Temperature			No data but expected to be natural as little development in upstream catchment.
	Dissolved oxygen			
	Turbidity (NTU)			
	Electrical conductivity (mS/m)	16	17	A category.
Response variables	Chl a: periphyton			No data
	Chl a: phytoplankton			No data
	Macroinvertebrates			No data
	Fish community score			No data
Toxics				No data.
OVERALL SITE CLASSIFICATION		A		

Table 5.47: Water quality Ecospecs and TPCs for the Goukamma River at WQSU 2

RIVER		Goukamma River	**WATER QUALITY MONITORING POINTS**			
WQSU		2	**DWAF WQ WMS**	None		
EWR SITE		none	**RHP**	Currently a RHP site higher up in catchment		
Confidence in PES assessment		Low because extrapolated from another catchment (Karatara R) and WQSU (Goukamma WQSU 2). Biological data (from current project and RHP upper catchment) support inferred PES for water quality.				
Water Quality Constituents		**PES Category**	**WQ ecospecs**	**Improvement required?**	**TPC**	**Monitoring frequency**
Inorganic salts (mg/L)	$MgSO_4$	Not available	≤16 mg/L	N/A	95th percentile to be < 16 mg/L	Every 2 months
	Na_2SO_4		≤20 mg/L		95th percentile to be < 20 mg/L	
	$MgCl_2$		≤15 mg/L		95th percentile to be < 15 mg/L	
	$CaCl_2$		≤21 mg/L		95th percentile to be < 21 mg/L	
	NaCl		≤45 mg/L		95th percentile to be < 45 mg/L	
Nutrients (mg/L)	**SRP**	**A**	**≤0.012 mg/L**	Yes - B/C	50th percentile to be < 0.025 mg/L	Every 2 months
	TIN	A	≤0.25 mg/L	No	50th percentile to be < 0.25 mg/L	Every 2 months
Physical Variables	pH	Naturally acidic river	< 6.4	No	95th percentile to be < 6.4	Every 2 months
	Temperature	No data. Visual inspection did not reveal a turbidity problem.	Natural range	N/A	Natural temp. range	Every 2 months
	Dissolved oxygen		8 mg/L	N/A	5th percentile to be > 8 mg/L	Every 2 months
	Turbidity (NTU)		No change	N/A	No change allowed	Every 2 months
	Electrical conductivity (mS/m)	A – Stable	≤30 mS/m	No	95th percentile to be < 30 mS/m	Every 2 months
Response variables	Chl a: periphyton	No data. Visual inspection did not reveal a problem.	≤ 1.7 mg/m² (A category)	N/A	50th percentile to be < 1.7 mg/m²	Quarterly
	Chl a: phytoplankton		≤ 10 µg/L (B category)		50th percentile to be < 10 µg/L	
	Macroinvertebrates (ASPT)	B (this study)	See Ecospecs for fish and invertebrates respectively			
	Fish community score	C (this study				
	Instream toxicity	No data	Unlikely to be a problem. Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown.			
Toxics		No data.				

Table 5.48: PES categories and overall site assessment for Goukamma River at WQSU 2

RIVER	Goukamma River	**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 2 (edge of mountainous/forested area to the upper limit of tidal influence - at approximately the N2 Bridge)	**RC**	Karatara R. @ Karatara State Forest K4H002-Q01 ('71 – '76; n = 107)
EWR SITE	Gou 1	**PES**	K4H002-Q01 ('01 – '06; n = 51)
Confidence assessment	Low, the monitoring station is in an adjacent catchment.		

Water Quality Constituents		**RC Value**	**PES Value**	**Category/Comment**	**G-power (Confidence)**
Inorganic salts (mg/L)	$MgSO_4$				No data
	Na_2SO_4				
	$MgCl_2$				
	$CaCl_2$				
	NaCl				
	$CaSO_4$				
Nutrients (mg/L)	SRP	0.018	0.048*	Category = C. Trend = increasing	0.232 (Low)
	TIN	0.11	0.11	Category = A. Trend = stable	
Physical Variables	pH (5^{th} – 95^{th} %)		3.8 – 6.4	Naturally acidic waters	0.781 (Medium)
	Temperature			No data. Unlikely to be a problem	
	Dissolved oxygen				
	Turbidity (NTU)			No data. Visual inspection = low turbidity	
	Electrical conductivity (mS/m)	10	12	Category = A. Trend = stable	0.997 (High)
Response variables	Chl a: periphyton			No data. Visual inspection = no excessive algal growth	
	Chl a: phytoplankton				
	Macroinvertebrates			B category; ASPT = 7.2, SASS = 143 (this study). Natural (RHP)	
	Fish community score			C (this study)	
Toxics				No data, but unlikely to be a problem	
OVERALL SITE CLASSIFICATION		**A Category** (PAI model)			

Table 5.49: Water quality Ecospecs and TPCs for the Goukamma River at WQSU 2

RIVER		Goukamma River	**WATER QUALITY MONITORING POINTS**			
WQSU		2	**DWAF WQ WMS**	None		
EWR SITE		Gou 1	**RHP**	Currently a RHP site higher up in catchment		
Confidence in PES assessment		Low - medium because extrapolated from another catchment (Karatara R). Biological data (from current project and RHP upper catchment) support inferred PES for water quality.				
Water Quality Constituents		**PES Category**	**WQ ecospecs**	**Improvement required?**	**TPC**	**Monitoring frequency**
Inorganic salts (mg/L)	$MgSO_4$	Not available	≤16 mg/L	N/A	95th percentile to be < 16 mg/L	Every 2 months
	Na_2SO_4		≤20 mg/L		95th percentile to be < 20 mg/L	
	$MgCl_2$		≤15 mg/L		95th percentile to be < 15 mg/L	
	$CaCl_2$		≤21 mg/L		95th percentile to be < 21 mg/L	
	NaCl		≤45 mg/L		95th percentile to be < 45 mg/L	
Nutrients (mg/L)	**SRP**	**C**	**≤0.025 mg/L**	Yes - B/C	50th percentile to be < 0.025 mg/L	Every 2 months
	TIN	A	≤0.25 mg/L	No	50th percentile to be < 0.25 mg/L	Every 2 months
Physical Variables	pH	Naturally acidic river	< 6.4	No	95th percentile to be < 6.4	Every 2 months
	Temperature	No data. Visual inspection did not reveal a turbidity problem.	Natural range	N/A	Natural temp. range	Every 2 months
	Dissolved oxygen		8 mg/L	N/A	5th percentile to be > 8 mg/L	Every 2 months
	Turbidity (NTU)		No change	N/A	No change allowed	Every 2 months
	Electrical conductivity (mS/m)	A – Stable	≤30 mS/m	No	95th percentile to be < 30 mS/m	Every 2 months
Response variables	Chl a: periphyton	No data. Visual inspection did not reveal a problem.	≤ 1.7 mg/m² (A category)	N/A	50th percentile to be < 1.7 mg/m²	Quarterly
	Chl a: phytoplankton		≤ 10 µg/L (B category)		50th percentile to be < 10 µg/L	
	Macroinvertebrates (ASPT)	B (this study)	See Ecospecs for fish and invertebrates respectively			
	Fish community score	C (this study				
	Instream toxicity	No data	Unlikely to be a problem. Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown.			
Toxics		No data.				

Table 5.50: PES categories and overall site assessment for the Knysna River ay WQSU 1

RIVER	Knynsa River		**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 1		**RC**	Knysna R. @ Millwood K5H002Q01 ('77 – '80; n = 75)
EWR SITE	1		**PES**	K5H002Q01 ('04 – '07; n = 26)
Confidence assessment	Moderate as adequate data to assess reference and present states			
Water Quality Constituents			**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$		7.18	7.19	TEACHA was used for data assessment. Salts = A category
	Na_2SO_4		1.49	4.20	
	$MgCl_2$		2.60	2.73	
	$CaCl_2$		11.50	3.92	
	NaCl		50.83*	39.54	
	$CaSO_4$		0.53	0.38	
Nutrients (mg/L)	SRP		0.011*	0.021	B category
	TIN		0.06	0.112	A category
Physical Variables	pH (5^{th} + 95^{th} %ile)		4.0 + 6.9	4.5 + 7.2	A category
	Temperature		-	-	No data but no impacts expected, although less shading may result in a slight increase in instream temperature.
	Dissolved oxygen		-	-	
	Turbidity (NTU)		-	-	No data. Some evidence of slight sedimentation seen.
	Electrical conductivity (mS/m)			9.0	A category.
Response variables	Chl a: periphyton		-	4.08	Some nutrient elevation indicated by periphyton values (B category; n=1).
	Chl a: phytoplankton		-	0.12	
	Macroinvertebrates		ASPT: mean of 8.1	ASPT: 6.9 MIRAI: 86.92%	B category for the present state.
	Fish community score		-	FRAI: 86.4%	B category for the present state.
	Diatoms		-	SPI=18.9	High quality water.
Toxics			-	-	No data but no impacts expected.
OVERALL SITE CLASSIFICATION			**A/B for WQSU 1**, although an A category for EWR 1 and upstream of the site (PAI model)		

Table 5.51: Water quality Ecospecs for Knysna River at WQSU 1

River: Knysna		EWR: 1	Monitoring site: K5H002Q01
Water quality metrics		ECOSPEC	
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 ≤ 30 mS/m.	
	pH	The 5th and 95th percentiles of the data must range from 4.5 to 7.5.	
	Temperature	Natural temperature range.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8.0 mg/L.	
	Turbidity	Vary by a small amount from the natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	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 <15 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 12 mg/m^2.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

Table 5.52: Water quality TPC's for Knysna River at WQSU 1

River: Knysna		EWR: 1	Monitoring site: K5H002Q01
Water quality metrics		TPC	
Inorganic salts*	$MgSO_4$	The 95th percentile of the data must be 13 – 16 mg/L.	
	Na_2SO_4	The 95th percentile of the data must be 16 – 20 mg/L.	
	$MgCl_2$	The 95th percentile of the data must be 12 – 15 mg/L.	
	$CaCl_2$	The 95th percentile of the data must be 17 – 21 mg/L.	
	NaCl	The 95th percentile of the data must be 36 – 45 mg/L.	
	$CaSO_4$	The 95th percentile of the data must be 280 – 351 mg/L.	
Physical variables	EC	The 95th percentile of the data must be 24 – 30 mS/m.	
	pH	The 5th and 95th percentiles of the data must be <4.7 and >7.3.	
	Temperature	Small deviation from the natural temperature range.	
	Dissolved oxygen	The 5th percentile of the data must be 8.2 – 8.0 mg/L.	
	Turbidity	Moderate changes to the catchment land-use resulting in temporary unnaturally high sediment loads and high turbidities.	
Nutrients	TIN	The 50th percentile of the data must be 0.2 – 0.25 mg/L.	
	PO_4-P	The 50th percentile of the data must be 0.02 – 0.025 mg/L.	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be 12 – 15 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be 10 – 12 mg/m^2.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

Table 5.53: PES categories and overall site assessment for the Gouna River at WQSU 2

RIVER	Gouna River		**WATER QUALITY MONITORING POINTS**	
WQSU	WQSU 2		**RC**	Gouna R. @ Gouna Commonage K5H001Q01 ('77 – '80; n = 76)
EWR SITE	2		**PES**	K5H001Q01 ('81 – '84; n = 30)
Confidence assessment	Low confidence due to limited data, particularly for present state			
Water Quality Constituents			**RC Value**	**PES Value**	**Category/Comment**
Inorganic salts (mg/L)	$MgSO_4$		14.45	23.19	TEACHA was used for data assessment. Slight elevation in salts seen, i.e. an A/B category
	Na_2SO_4		3.78	0.30	
	$MgCl_2$		10.75	12.11	
	$CaCl_2$		10.59	9.35	
	NaCl		95.29*	102.20	
	$CaSO_4$		0.54	0.72	
Nutrients (mg/L)	SRP		0.009*	0.011	A category.
	TIN		0.070	0.120	A category.
Physical Variables	pH (5^{th} + 95^{th} %ile)		4.0 + 6.8	4.0 + 5.6	A category as little change from natural.
	Temperature		-	-	No data but no impacts expected.
	Dissolved oxygen		-	-	
	Turbidity (NTU)		-	-	No data. Sedimentation seen in lower section of the WQSU, i.e. below the pump station.
	Electrical conductivity (mS/m)			15.0	A category.
Response variables	Chl a: periphyton		-	43.70	Nutrient elevations indicated by periphyton value (D category; n=1).
	Chl a: phytoplankton		-	0.09	
	Macroinvertebrates		ASPT: 6.9 – 7.6	ASPT: 7.6 MIRAI: 92.8%	A category for the present state.
	Fish community score		-	FRAI: 93.8%	A category for the present state.
	Diatoms		-	SPI=19.8	High quality water.
Toxics			-	-	No data but no toxics expected.
OVERALL SITE CLASSIFICATION			**B for WQSU 2**, although an A category for river stretch upstream of the pump station (PAI model)		

Table 5.54: Water quality EcoSpecs for Gouna River at WQSU 2

River: Gouna		EWR: 2	Monitoring site: K5H001Q01
Water quality metrics		**ECOSPEC**	
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 ≤ 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 ≤ 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 ≤ 43 mS/m.	
	pH	The 5th and 95th percentiles of the data must range from 4.5 to 7.5.	
	Temperature	Largely natural to small deviation from the natural temperature range.	
	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; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.15 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 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 84 mg/m^2.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

* To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

Table 5.55: Water quality TPC's for Gouna River at WQSU 2

River: Gouna		EWR: 2	Monitoring site: K5H001Q01
Water quality metrics		**TPC**	
Inorganic salts*	$MgSO_4$	The 95th percentile of the data must be 18 – 23 mg/L.	
	Na_2SO_4	The 95th percentile of the data must be 16 – 20 mg/L.	
	$MgCl_2$	The 95th percentile of the data must be 12 – 15 mg/L.	
	$CaCl_2$	The 95th percentile of the data must be 17 – 21 mg/L.	
	NaCl	The 95th percentile of the data must be 36 – 45 mg/L.	
	$CaSO_4$	The 95th percentile of the data must be 153 – 191 mg/L.	
Physical variables	EC	The 95th percentile of the data must be 35 – 43 mS/m.	
	pH	The 5th and 95th percentiles of the data must be <4.7 and >7.3.	
	Temperature	Small to moderate deviation from the natural temperature range. Some highly temperature sensitive species in lower abundances and frequency of occurrence than expected for reference.	
	Dissolved oxygen	The 5th percentile of the data must be 7.8 – 7.5 mg/L.	
	Turbidity	Moderate changes to the catchment land-use resulting in temporary unnaturally high sediment loads and high turbidities.	
Nutrients	TIN	The 50th percentile of the data must be 0.2 – 0.25 mg/L.	
	PO_4-P	The 50th percentile of the data must be 0.012 – 0.015 mg/L.	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be 12 – 15 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be 67 – 84 mg/m^2.	
Toxics		The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996).	

6. GROUNDWATER - QUANTITY COMPONENT

The groundwater quantity component was determined using values (recharge and groundwater baseflow) obtained during the determination of water resource classes and associated resource quality objectives in the Breede-Gouritz WMA, (DWS 2017), shown in Table 6.1.

Population values were obtained from the Water Services dataset of 2011 for the Breede catchment and from the Gouritz Catchment Intermediate Reserve study for the Gouritz catchment. The Basic Human Needs Reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, food preparation and for personal hygiene. A life-line amount of 25 litres per person per day was used.

Table 6.1: Breede-Gouritz Groundwater Reserve

Quaternary Catchment	Recharge (Mm^3/a)	Population	Basic Human Needs (Mm^3/a)	Groundwater Baseflow (Mm^3/a)	Reserve (Mm3/a)	Reserve as % of Recharge
G40A	13.06	15963	0.15	3.17	3.32	25.39
G40B	19.19	4612	0.04	5.33	5.37	27.99
G40C	45.16	38379	0.35	6.25	6.60	14.62
G40D	59.72	15963	0.15	14.45	14.60	24.44
G40E	13.19	7670	0.07	4.41	4.48	33.97
G40F	11.28	28422	0.26	2.12	2.38	21.09
G40G	16.02	17112	0.16	3.72	3.88	24.20
G40H	6.53	32767	0.30	1.58	1.88	28.77
G40J	6.92	1574	0.01	2.53	2.54	36.77
G40K	9.13	15963	0.15	4.67	4.82	52.75
G40L	13.96	15963	0.15	1.63	1.78	12.72
G40M	10.57	355	0.003	5.17	5.17	48.94
G50A	7.37	1370	0.01	2.61	2.62	35.58
G50B	6.59	1507	0.01	3.47	3.48	52.86
G50C	8.56	1748	0.02	2.05	2.07	24.13
G50D	5.39	9430	0.09	2.55	2.64	48.91
G50E	4.92	14355	0.13	1.37	1.50	30.51
G50F	6.64	1989	0.02	1.27	1.29	19.40
G50G	2.40	844	0.01	1.43	1.44	59.90
G50H	5.75	736	0.01	3.28	3.29	57.16
G50J	6.07	3325	0.03	1.90	1.93	31.80
G50K	2.72	1748	0.02	0.76	0.78	28.53
H10A	13.15	12494	0.11	0.76	0.87	6.65
H10B	12.20	12494	0.11	0.48	0.59	4.87
H10C	21.28	57300	0.52	2.00	2.52	11.86
H10D	14.89	12494	0.11	2.05	2.16	14.53
H10E	20.35	12494	0.11	3.20	3.31	16.29
H10F	25.24	20720	0.19	1.39	1.58	6.26
H10G	31.82	12494	0.11	0.44	0.55	1.74
H10H	28.48	12494	0.11	2.80	2.91	10.23
H10J	61.45	1035	0.01	7.94	7.95	12.94
H10K	43.17	12494	0.11	7.40	7.51	17.41
H10L	2.76	4268	0.04	0.00	0.04	1.41

Quaternary Catchment	Recharge (Mm^3/a)	Population	Basic Human Needs (Mm^3/a)	Groundwater Baseflow (Mm^3/a)	Reserve (Mm3/a)	Reserve as % of Recharge
H20A	2.42	427	0.00	0.47	0.47	19.58
H20B	5.37	17136	0.16	0.17	0.33	6.08
H20C	2.84	1266	0.01	0.05	0.06	2.17
H20D	8.74	1266	0.01	2.11	2.12	24.27
H20E	14.68	1266	0.01	2.01	2.02	13.77
H20F	8.65	875	0.01	0.32	0.33	3.79
H20G	4.83	1266	0.01	0.47	0.48	9.97
H20H	1.56	140420	1.28	0.07	1.35	86.62
H30A	5.17	1102	0.01	0.33	0.34	6.58
H30B	6.04	39573	0.36	0.16	0.52	8.63
H30C	10.59	1317	0.01	0.07	0.08	0.77
H30D	3.18	926	0.01	0.06	0.07	2.15
H30E	2.95	9784	0.09	0.31	0.40	13.53
H40A	3.74	2233	0.02	0.87	0.89	23.81
H40B	12.26	2152	0.02	0.87	0.89	7.26
H40C	4.90	2233	0.02	0.86	0.88	17.97
H40D	4.18	2233	0.02	1.85	1.87	44.75
H40E	10.91	2233	0.02	0.20	0.22	2.02
H40F	1.07	1798	0.02	0.58	0.60	55.74
H40G	3.22	2233	0.02	0.23	0.25	7.78
H40H	4.71	1217	0.01	0.13	0.14	3.00
H40J	4.44	26455	0.24	0.18	0.42	9.49
H40K	2.99	3916	0.04	0.24	0.28	9.22
H40L	2.47	2290	0.02	0.42	0.44	17.85
H50A	1.42	3842	0.04	0.26	0.30	20.78
H50B	5.04	5825	0.05	0.78	0.83	16.53
H60A	30.87	10083	0.09	2.49	2.58	8.36
H60B	42.43	7900	0.0720875	7.28	7.35	17.33
H60C	30.89	15284	0.14	1.64	1.78	5.76
H60D	14.76	511	0.00	0.95	0.95	6.47
H60E	9.73	10305	0.09	0.71	0.80	8.26
H60F	7.65	3321	0.03	0.66	0.69	9.02
H60G	4.11	10083	0.09	0.64	0.73	17.81
H60H	7.49	10083	0.09	1.14	1.23	16.45
H60J	8.17	10083	0.09	1.31	1.40	17.16
H60K	3.59	10083	0.09	1.04	1.13	31.53
H60L	2.88	10083	0.09	0.87	0.96	33.40
H70A	5.55	4786	0.04	1.47	1.51	27.27
H70B	22.83	19350	0.18	4.17	4.35	19.04
H70C	3.99	4915	0.04	0.23	0.27	6.89
H70D	20.70	4786	0.04	5.53	5.57	26.93
H70E	26.55	6729	0.06	5.16	5.22	19.67
H70F	15.50	2721	0.02	2.31	2.33	15.06

Quaternary Catchment	Recharge (Mm^3/a)	Population	Basic Human Needs (Mm^3/a)	Groundwater Baseflow (Mm^3/a)	Reserve (Mm3/a)	Reserve as % of Recharge
H70G	3.92	4786	0.04	1.26	1.30	33.26
H70H	2.80	746	0.01	1.89	1.90	67.74
H70J	3.95	4786	0.04	1.43	1.47	37.31
H70K	3.03	772	0.01	1.21	1.22	40.17
H80A	16.34	0	0.00	7.21	7.21	44.12
H80B	24.01	0	0.00	6.45	6.45	26.86
H80C	5.75	10 110	0.09	0.61	0.70	12.21
H80D	2.57	0	0.00	1.23	1.23	47.86
H80E	7.66	392	0.00	2.11	2.11	27.59
H80F	5.96	585	0.01	2.72	2.73	45.73
H90A	19.62	0	0.00	9.04	9.04	46.08
H90B	12.96	0	0.00	6.02	6.02	46.45
H90C	5.51	18 526	0.17	1.93	2.10	38.10
H90D	10.38	1 697	0.02	3.29	3.31	31.84
H90E	9.70	6 253	0.06	4.88	4.94	50.90
J11A	2.98	0	0.00	0.00	0.00	0.00
J11B	3.11	0	0.00	0.00	0.00	0.00
J11C	0.22	192	0.00	0.00	0.00	0.80
J11D	3.74	48	0.00	0.00	0.00	0.01
J11E	1.40	4 773	0.04	0.00	0.04	3.11
J11F	0.43	734	0.01	0.00	0.01	1.56
J11G	0.12	84	0.00	0.00	0.00	0.64
J11H	4.01	885	0.01	0.00	0.01	0.20
J11J	6.02	1 333	0.01	0.00	0.01	0.20
J11K	2.52	11 732	0.11	0.00	0.11	4.25
J12A	3.15	0	0.00	0.02	0.02	0.63
J12B	1.55	7 857	0.07	0.00	0.07	4.63
J12C	1.59	152	0.00	0.01	0.01	0.72
J12D	6.32	535	0.00	0.02	0.02	0.39
J12E	1.93	507	0.00	0.02	0.02	1.28
J12F	6.15	336	0.00	0.03	0.03	0.54
J12G	5.66	294	0.00	0.01	0.01	0.22
J12H	4.53	0	0.00	0.02	0.02	0.44
J12J	4.59	0	0.00	0.01	0.01	0.22
J12K	2.44	0	0.00	0.01	0.01	0.41
J12L	6.59	681	0.01	0.05	0.06	0.85
J12M	3.04	0	0.00	0.06	0.06	1.97
J13A	4.10	0	0.00	0.02	0.02	0.49
J13B	2.86	660	0.01	0.03	0.04	1.26
J13C	2.91	0	0.00	0.03	0.03	1.03
J21A	4.28	34 661	0.32	0.00	0.32	7.39
J21B	0.56	389	0.00	0.00	0.00	0.63
J21C	0.12	406	0.00	0.00	0.00	3.09

Quaternary Catchment	Recharge (Mm^3/a)	Population	Basic Human Needs (Mm^3/a)	Groundwater Baseflow (Mm^3/a)	Reserve (Mm3/a)	Reserve as % of Recharge
J21D	0.24	0	0.00	0.00	0.00	0.00
J21E	0.26	0	0.00	0.00	0.00	0.00
J22A	3.04	0	0.00	0.00	0.00	0.00
J22B	1.12	0	0.00	0.00	0.00	0.00
J22C	1.27	241	0.00	0.00	0.00	0.17
J22D	1.22	133	0.00	0.00	0.00	0.10
J22E	1.31	0	0.00	0.00	0.00	0.00
J22F	0.12	1 237	0.01	0.00	0.01	9.41
J22G	2.92	0	0.00	0.00	0.00	0.00
J22H	4.19	919	0.01	0.00	0.01	0.20
J22J	0.90	0	0.00	0.00	0.00	0.00
J22K	0.35	0	0.00	0.00	0.00	0.00
J23A	0.28	2 080	0.02	0.00	0.02	6.78
J23B	0.50	47	0.00	0.00	0.00	0.09
J23C	0.25	12	0.00	0.00	0.00	0.04
J23D	0.70	12	0.00	0.00	0.00	0.02
J23E	2.03	674	0.01	0.18	0.19	9.17
J23F	1.33	6 901	0.06	0.00	0.06	4.73
J23G	0.00	0	0.00	0.00	0.00	0.00
J23H	1.11	0	0.00	0.00	0.00	0.00
J23J	1.82	0	0.00	0.97	0.97	53.30
J24A	2.58	193	0.00	0.00	0.00	0.07
J24B	0.51	1 521	0.01	0.00	0.01	2.72
J24C	0.21	0	0.00	0.00	0.00	0.00
J24D	0.08	314	0.00	0.00	0.00	3.58
J24E	0.39	0	0.00	0.00	0.00	0.00
J24F	1.37	0	0.00	0.00	0.00	0.00
J25A	2.42	200	0.00	1.02	1.02	42.22
J25B	4.45	4 135	0.04	1.23	1.27	28.49
J25C	1.04	1 342	0.01	0.02	0.03	3.10
J25D	2.94	5 170	0.05	0.61	0.66	22.35
J25E	1.12	402	0.00	0.04	0.04	3.90
J31A	7.88	0	0.00	1.13	1.13	14.34
J31B	1.57	0	0.00	0.48	0.48	30.57
J31C	1.87	0	0.00	0.35	0.35	18.72
J31D	2.07	266	0.00	0.38	0.38	18.47
J32A	0.08	50	0.00	0.00	0.00	0.57
J32B	0.01	881	0.01	0.00	0.01	80.39
J32C	0.01	77	0.00	0.00	0.00	7.03
J32D	0.00	0	0.00	0.00	0.00	0.00
J32E	1.76	719	0.01	0.00	0.01	0.37
J33A	4.81	130	0.00	1.44	1.44	29.96
J33B	8.98	680	0.01	1.47	1.48	16.44

Quaternary Catchment	Recharge (Mm^3/a)	Population	Basic Human Needs (Mm^3/a)	Groundwater Baseflow (Mm^3/a)	Reserve (Mm3/a)	Reserve as % of Recharge
J33C	2.83	76	0.00	0.01	0.01	0.38
J33D	3.82	255	0.00	1.24	1.24	32.52
J33E	8.22	13 522	0.12	1.98	2.10	25.59
J33F	4.50	34 154	0.31	2.19	2.50	55.59
J34A	3.08	7 465	0.07	1.48	1.55	50.26
J34B	6.44	1 850	0.02	2.85	2.87	44.52
J34C	9.60	669	0.01	3.51	3.52	36.63
J34D	4.06	1 915	0.02	1.80	1.82	44.77
J34E	2.29	1 321	0.01	1.13	1.14	49.87
J34F	3.44	2 928	0.03	0.47	0.50	14.44
J35A	8.47	31 018	0.28	1.20	1.48	17.51
J35B	8.12	5 831	0.05	1.24	1.29	15.93
J35C	1.98	3 633	0.03	0.88	0.91	46.12
J35D	9.82	5 284	0.05	3.65	3.70	37.66
J35E	1.33	1 224	0.01	0.21	0.22	16.63
J35F	6.67	2 796	0.03	2.02	2.05	30.67
J40A	9.73	970	0.01	5.03	5.04	51.79
J40B	5.45	0	0.00	2.71	2.71	49.72
J40C	15.81	1 076	0.01	6.58	6.59	41.68
J40D	10.21	8 056	0.07	4.20	4.27	41.86
J40E	7.48	1 908	0.02	3.45	3.47	46.36
K10A	2.34	53 970	0.49	1.16	1.65	70.62
K10B	1.96	4 727	0.04	1.20	1.24	63.43
K10C	4.43	0	0.00	2.33	2.33	52.60
K10D	2.53	1 579	0.01	1.10	1.11	44.05
K10E	13.70	4 122	0.04	4.30	4.34	31.66
K10F	2.82	7 002	0.06	0.99	1.05	37.37
K20A	19.85	9 650	0.09	6.15	6.24	31.43
K30A	28.06	6 994	0.06	7.15	7.21	25.71
K30B	21.52	6 334	0.06	5.03	5.09	23.64
K30C	27.80	146 970	1.34	7.83	9.17	32.99
K30D	18.44	9 839	0.09	7.43	7.52	40.78
K40A	8.99	512	0.00	3.79	3.79	42.21
K40B	13.52	0	0.00	4.85	4.85	35.87
K40C	17.00	6 256	0.06	4.32	4.38	25.75
K40D	17.74	20 130	0.18	3.71	3.89	21.95
K40E	26.56	13 515	0.12	10.61	10.73	40.41
K50A	27.43	49	0.00	10.09	10.09	36.79
K50B	24.71	14 745	0.13	8.58	8.71	35.27
K60A	6.43	154	0.00	4.20	4.20	65.34
K60B	8.43	43	0.00	5.70	5.70	67.62
K60C	10.95	1 668	0.02	6.60	6.62	60.41
K60D	23.54	681	0.01	12.43	12.44	52.83

Quaternary Catchment	Recharge (Mm^3/a)	Population	Basic Human Needs (Mm^3/a)	Groundwater Baseflow (Mm^3/a)	Reserve (Mm3/a)	Reserve as % of Recharge
K60E	6.39	2 392	0.02	3.95	3.97	62.16
K60F	14.35	10 113	0.09	9.35	9.44	65.80
K60G	11.31	23 053	0.21	5.02	5.23	46.25
K70A	14.30	5 364	0.05	6.84	6.89	48.17
K70B	20.46	852	0.01	4.46	4.47	21.84

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. A summary of the results for the groundwater quality classification at quaternary level in the terms of basic human needs requirements is included in the tables that follow.

Table 6.2: Physical and chemical water quality

Parameter	Target Water Quality Ranges [1]				
	Units	Class 0	Class I	Class II	Class III
pH	pH units	6 – 9	5 – 6 & 9 – 9.5	4 – 5 & > 9.5 – 10	<4 & > 10
Electrical Conductivity	mS/m	< 70	70 - 150	150 – 370	> 370
Calcium as Ca	mg/l	< 80	80 - 150	150 – 300	> 300
Magnesium as Mg	mg/l	< 70	70 - 100	100 – 200	> 200
Sodium as Na	mg/l	< 100	100 - 200	200 – 400	> 400
Chloride as Cl	mg/l	< 100	100 - 200	200 – 600	> 600
Sulphate as SO_4	mg/l	< 200	200 - 400	400 – 600	> 600
Nitrate as NO_x-N	mg/l	< 6	6 - 10	10 – 20	> 20
Fluoride as F	mg/l	<0.7	0.7 – 1.0	1.0 – 1.5	> 1.5

1) Reference: Classification Systems 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 representative groundwater quality data):

- G40B; G40D; G40E; G40G; G40K
- G50A; G50B; G50C; G50D; G50G; G50J
- H10D; H10E; H10J; H10K
- H20C; H20G; H20H
- H30B; H30E
- H40C; H40D; H40E; H40G; H40J; H40K; H40L
- H50A; H50B
- H60A; H60B; H60C; H60D; H60E; H60F; H60G; H60H; H60J; H60K; H60L
- H70A; H70C; H70D; H70E; H70F; H70G; H70H; H70J
- J11A; J11C; J11D; J11F; J11H; J11J; J11K
- J12A; J12C; J12E; J12J; J12M
- J13A; J13C, J22A; J22G; J22K, J23B; J23E; J23J, J24, J25B; J25D; J25E
- J31A; J31B; J31C, J32D, J33A; J33B; J33C, J34C; J34E, J35C; J35E; J35F
- J40A; J40B; J40C
- K10C; K10E; K10F
- K20A
- K30A; K30C; K30D
- K40A; K40B; K40C; K40D; K40E
- K50A
- K60A; K60B; K60C; K60D; K60E; K60F; K60G
- K70A; K70B

Table 6.3. Groundwater Quality Reserve: Breede Gouritz Water Management Area

Chemical Parameter	Unit	Quaternary Catchments G40C, G40F, G40J, G40L												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		G40C	G40F	G40J	G40L	G40C	G40F	G40J	G40L		G40C	G40F	G40J	G40L
pH		39	61	45	43	7.09	7.26	7.01	8.16	5.0 – 9.5	6.38–7.80	6.53–7.99	6.31–7.71	7.34–8.97
Electrical Conductivity	mS/m	39	61	45	43	20.70	20.90	21.20	208.00	<150	22.77	22.99	23.32	228.80
Calcium as Ca	mg/l	36	57	42	40	7.94	7.67	7.68	105.32	<150	8.73	8.43	8.45	115.85
Magnesium as Mg	mg/l	36	57	42	40	3.30	3.30	3.40	33.40	<100	3.63	3.63	3.74	36.74
Sodium as Na	mg/l	36	55	42	38	18.08	18.40	18.32	**253.05**	<200	19.89	20.24	20.16	**253.05**
Chloride as Cl	mg/l	36	58	42	40	31.94	32.69	32.57	**391.39**	<200	35.13	35.96	35.83	**391.39**
Sulphate as SO_4	mg/l	36	58	42	40	5.71	5.35	5.81	78.14	<400	6.28	5.89	6.39	85.95
Nitrate as NO_x-N	mg/l	36	57	42	38	0.04	0.05	0.06	5.17	<10	0.04	0.06	0.07	5.68
Fluoride as F	mg/l	36	54	42	35	0.30	0.31	0.29	0.28	<1.0	0.33	0.34	0.32	0.31
Chemical Parameter	**Unit**	**Quaternary Catchments G40M, G50E, G50F, G50H**												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		G40M	G50E	G50F	G50H	G40M	G50E	G50F	G50H		G40M	G50E	G50F	G50H
pH		37	49	45	23	8.17	6.21	8.17	8.02	5.0 – 9.5	7.35–8.99	5.59–6.83	7.35–8.99	7.22–8.82
Electrical Conductivity	mS/m	37	49	45	23	109.10	54.90	91.90	**1630.00**	<150	120.01	60.39	101.09	**1630.00**
Calcium as Ca	mg/l	37	44	42	23	88.34	4.37	84.20	**182.00**	<150	97.18	4.81	92.62	**182.00**
Magnesium as Mg	mg/l	37	44	42	23	15.03	8.91	12.37	**358.00**	<100	16.54	9.81	13.61	**358.00**
Sodium as Na	mg/l	37	42	40	23	113.15	80.39	85.23	**3107.18**	<200	124.47	88.43	93.76	**3107.18**
Chloride as Cl	mg/l	37	44	42	23	**203.98**	143.85	153.44	**5302.10**	<200	**203.98**	158.24	168.79	**5302.10**
Sulphate as SO_4	mg/l	37	44	41	23	31.52	20.58	25.59	**742.40**	<400	34.67	22.64	28.15	**742.40**
Nitrate as NO_x-N	mg/l	37	43	40	23	1.70	0.06	0.26	0.13	<10	1.87	0.07	0.29	0.14
Fluoride as F	mg/l	37	40	39	23	0.18	0.11	0.22	1.35	<1.0	0.20	0.12	0.25	1.49
Chemical Parameter	**Unit**	**Quaternary Catchments G50J, H10A, H10B, H10C**												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		G50J	H10A	H10B	H10C	G50J	H10A	H10B	H10C		G50J	H10A	H10B	H10C
pH		9	34	73	60	7.58	7.69	7.88	7.33	5.0 – 9.5	6.82–8.34	6.92–8.46	7.09–8.67	6.60–8.06
Electrical Conductivity	mS/m	9	34	73	60	**142.90**	**180.00**	49.00	45.60	<150	**157.19**	**180.00**	53.90	50.16
Calcium as Ca	mg/l	9	34	70	60	92.00	65.00	46.98	20.35	<150	101.20	71.50	51.67	22.39
Magnesium as Mg	mg/l	9	34	70	60	23.40	54.25	6.72	12.85	<100	25.74	59.68	7.39	14.14
Sodium as Na	mg/l	9	34	68	60	194.60	219.35	36.21	49.80	<200	**200.00**	241.29	39.83	54.78
Chloride as Cl	mg/l	9	34	70	60	**338.90**	380.55	80.09	106.25	<200	**338.90**	418.61	88.10	116.88
Sulphate as SO_4	mg/l	9	34	70	60	38.70	153.60	21.75	22.30	<400	42.57	168.96	23.92	24.53
Nitrate as NO_x-N	mg/l	9	34	70	60	1.04	0.42	0.17	0.44	<10	1.14	0.46	0.19	0.48
Fluoride as F	mg/l	9	34	68	60	0.16	0.34	0.18	0.17	<1.0	0.18	0.37	0.20	0.19

Chemical Parameter	Unit	Quaternary Catchments H10F, H10G, H10H, H10L												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		H10F	H10G	H10H	H10L	H10F	H10G	H10H	H10L		H10F	H10G	H10H	H10L
pH		15	117	54	82	7.29	7.05	7.59	6.98	5.0 – 9.5	6.56–8.02	6.35–7.76	6.83–8.35	6.28–7.68
Electrical Conductivity	mS/m	15	117	54	82	24.70	13.40	117.70	9.87	<150	27.17	14.74	129.47	10.85
Calcium as Ca	mg/l	15	111	53	78	6.10	7.49	28.50	3.70	<150	6.71	8.24	31.35	4.07
Magnesium as Mg	mg/l	15	112	53	78	12.00	2.80	28.30	2.12	<100	13.20	3.08	31.13	2.34
Sodium as Na	mg/l	12	107	52	76	18.85	12.10	176.10	8.60	<200	20.74	13.31	193.71	9.46
Chloride as Cl	mg/l	15	114	54	79	30.50	18.45	**308.75**	14.80	<200	33.55	20.30	**308.75**	16.28
Sulphate as SO_4	mg/l	12	109	52	79	4.15	5.50	53.65	3.00	<400	4.57	6.05	59.02	3.30
Nitrate as NO_x-N	mg/l	15	112	54	78	0.06	0.25	0.03	0.18	<10	0.07	0.28	0.03	0.20
Fluoride as F	mg/l	15	110	54	75	0.31	0.16	0.57	0.12	<1.0	0.34	0.17	0.62	0.13

Chemical Parameter	Unit	Quaternary Catchments H20A, H20B, H20D, H20E												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		H20A	H20B	H20D	H20E	H20A	H20B	H20D	H20E		H20A	H20B	H20D	H20E
pH		85	344	12	15	7.20	7.09	6.77	6.46	5.0 – 9.5	6.48–7.92	6.38–7.79	6.09–7.44	5.81–7.11
Electrical Conductivity	mS/m	85	344	12	15	50.60	40.75	12.75	2.30	<150	55.66	44.83	14.03	2.53
Calcium as Ca	mg/l	85	344	12	15	34.80	23.45	9.70	0.50	<150	38.28	25.80	10.67	0.55
Magnesium as Mg	mg/l	85	344	12	15	5.60	9.15	2.15	0.50	<100	6.16	10.07	2.37	0.55
Sodium as Na	mg/l	85	344	11	15	25.70	31.80	7.70	2.60	<200	28.27	34.98	8.47	2.86
Chloride as Cl	mg/l	85	344	12	15	55.00	50.55	13.90	1.50	<200	60.50	55.61	15.29	1.65
Sulphate as SO_4	mg/l	85	344	11	15	81.20	39.65	4.00	2.00	<400	89.32	43.62	4.40	2.20
Nitrate as NO_x-N	mg/l	85	344	12	15	0.05	0.90	0.33	0.05	<10	0.06	0.99	0.36	0.06
Fluoride as F	mg/l	85	344	12	15	0.11	0.13	0.05	0.05	<1.0	0.12	0.14	0.06	0.06

Chemical Parameter	Unit	Quaternary Catchments H20F, H30A, H30C, H30D												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		H20F	H30A	H30C	H30D	H20F	H30A	H30C	H30D		H20F	H30A	H30C	H30D
pH		302	9	21	45	7.10	7.95	7.70	7.81	5.0 – 9.5	6.39–7.80	7.16–8.75	6.93–8.47	7.03–8.59
Electrical Conductivity	mS/m	302	9	21	45	29.00	**142.00**	41.70	19.50	<150	31.90	**156.20**	45.87	21.45
Calcium as Ca	mg/l	302	9	21	42	22.80	63.80	36.40	17.10	<150	25.08	70.18	40.04	18.81
Magnesium as Mg	mg/l	302	9	21	42	4.70	32.50	6.00	3.31	<100	5.17	35.75	6.60	3.64
Sodium as Na	mg/l	302	9	21	40	24.90	191.90	37.00	10.94	<200	27.39	**200.00**	40.70	12.04
Chloride as Cl	mg/l	302	9	21	43	28.30	**273.50**	82.00	18.08	<200	31.13	**300.85**	90.20	19.89
Sulphate as SO_4	mg/l	302	9	21	43	28.00	121.90	48.00	4.30	<400	30.80	134.09	52.80	4.73
Nitrate as NO_x-N	mg/l	302	9	21	42	0.11	0.02	0.02	0.13	<10	0.12	0.02	0.02	0.14
Fluoride as F	mg/l	302	9	16	40	0.10	0.55	0.23	0.16	<1.0	0.11	0.61	0.25	0.18

Chemical Parameter	Unit	Quaternary Catchments H40A, H40B, H40F, H70B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		H40A	H40B	H40F	H70B	H40A	H40B	H40F	H70B		H40A	H40B	H40F	H70B
pH		54	14	17	9	7.86	7.35	6.54	8.21	5.0 – 9.5	7.07–8.65	6.62–8.09	5.89–7.19	7.39–9.03
Electrical Conductivity	mS/m	55	14	17	9	112.50	10.88	28.90	**925.00**	<150	123.75	11.97	31.79	**925.00**
Calcium as Ca	mg/l	48	14	17	9	92.38	2.24	14.80	98.9	<150	101.62	2.47	16.28	108.79
Magnesium as Mg	mg/l	49	14	17	9	44.90	0.93	7.00	**259.10**	<100	49.39	1.02	7.70	**259.10**
Sodium as Na	mg/l	47	12	17	9	88.94	21.43	26.30	**1722.90**	<200	97.83	23.57	28.93	**1722.90**
Chloride as Cl	mg/l	50	14	17	9	127.45	21.15	35.90	**2741.20**	<200	140.20	23.27	39.49	**2741.20**
Sulphate as SO_4	mg/l	50	14	17	9	229.91	3.50	20.70	338.60	<400	252.90	3.85	22.77	372.46
Nitrate as NO_x-N	mg/l	50	14	17	9	0.06	0.18	4.70	0.02	<10	0.06	0.20	5.27	0.02
Fluoride as F	mg/l	46	13	17	9	0.43	0.36	0.05	**1.75**	<1.0	0.47	0.39	0.06	**1.75**

Chemical Parameter	Unit	Quaternary Catchments H70K, H90D, H90E, J11B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		H70K	H90D	H90E	J11B	H70K	H90D	H90E	J11B		H70K	H90D	H90E	J11B
pH		29	21	85	37	7.50	8.12	8.09	7.80	5.0 – 9.5	6.75–8.25	7.31–8.94	7.28–8.90	7.02–8.58
Electrical Conductivity	mS/m	29	21	85	37	121.00	102.70	**179.00**	81.30	<150	133.10	112.97	**179.00**	89.43
Calcium as Ca	mg/l	26	21	81	37	46.20	53.66	87.18	60.50	<150	50.82	59.02	95.89	66.55
Magnesium as Mg	mg/l	26	21	82	37	19.20	17.40	28.50	18.40	<100	21.12	19.14	31.35	20.24
Sodium as Na	mg/l	26	21	80	37	166.95	144.96	**208.48**	79.20	<200	183.65	159.45	**208.48**	87.12
Chloride as Cl	mg/l	26	20	81	37	**273.10**	**247.79**	**358.72**	94.70	<200	**273.10**	**247.79**	**358.72**	104.17
Sulphate as SO_4	mg/l	26	21	82	37	29.88	33.16	36.65	68.60	<400	32.87	36.47	40.31	75.46
Nitrate as NO_x-N	mg/l	26	20	79	37	0.02	0.83	3.40	1.41	<10	0.02	0.91	3.74	1.55
Fluoride as F	mg/l	26	20	77	37	0.52	0.14	0.18	0.82	<1.0	0.57	0.15	0.19	0.90

Chemical Parameter	Unit	Quaternary Catchments J11E, J11G, J12B, J12D												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J11E	J11G	J12B	J12D	J11E	J11G	J12B	J12D		J11E	J11G	J12B	J12D
pH		81	20	17	11	8.19	8.18	7.73	8.23	5.0 – 9.5	7.37–9.01	7.36–9.00	6.96–8.50	7.41–9.05
Electrical Conductivity	mS/m	81	20	17	11	**174.30**	**164.50**	**368.00**	**195.00**	<150	**174.30**	**164.50**	**368.00**	**195.00**
Calcium as Ca	mg/l	77	20	17	11	98.70	115.05	117.10	68.30	<150	108.57	126.56	128.81	75.13
Magnesium as Mg	mg/l	77	20	17	11	45.00	44.65	**129.30**	50.60	<100	49.50	49.12	**129.30**	55.66
Sodium as Na	mg/l	73	20	17	11	197.89	190.65	**335.70**	**252.80**	<200	217.68	**200.00**	**335.70**	**252.80**
Chloride as Cl	mg/l	75	20	17	11	**250.10**	**294.70**	**726.10**	**415.00**	<200	**250.10**	**294.70**	**726.10**	**415.00**
Sulphate as SO_4	mg/l	77	20	17	11	179.50	120.45	144.20	104.80	<400	197.45	132.50	158.62	115.28
Nitrate as NO_x-N	mg/l	71	20	17	11	0.30	1.18	0.06	0.02	<10	0.33	1.29	0.07	0.02
Fluoride as F	mg/l	67	20	17	11	0.88	0.92	0.80	0.53	<1.0	0.96	0.92	0.88	0.58

Chemical Parameter	Unit	Quaternary Catchments J12F, J12G, J12H, J12K												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J12F	J12G	J12H	J12K	J12F	J12G	J12H	J12K		J12F	J12G	J12H	J12K
pH		10	11	13	10	8.23	8.20	7.75	8.13	5.0 – 9.5	7.41–9.05	7.38–9.02	6.98–8.53	7.32–8.94
Electrical Conductivity	mS/m	10	11	13	10	**306.50**	**323.00**	**157.00**	**462.00**	<150	**306.50**	**323.00**	**157.00**	**462.00**
Calcium as Ca	mg/l	10	11	13	10	79.65	103.10	121.90	**212.95**	<150	87.62	113.41	134.09	**212.95**
Magnesium as Mg	mg/l	10	11	13	10	81.35	91.80	26.00	112.55	<100	89.49	100.98	28.60	123.81
Sodium as Na	mg/l	10	11	13	10	**406.70**	**262.30**	151.50	**703.25**	<200	**406.70**	**262.30**	166.65	**703.25**
Chloride as Cl	mg/l	10	11	13	10	**691.30**	**795.60**	**258.70**	**1168.85**	<200	**691.30**	**795.60**	**258.70**	**1168.85**
Sulphate as SO_4	mg/l	10	11	13	10	241.45	107.20	156.00	**459.80**	<400	265.60	117.92	171.60	**459.80**
Nitrate as NO_x-N	mg/l	10	11	13	10	0.02	0.02	0.02	0.02	<10	0.02	0.02	0.02	0.02
Fluoride as F	mg/l	10	11	13	10	0.56	0.50	0.39	0.55	<1.0	0.61	0.55	0.43	0.61

Chemical Parameter	Unit	Quaternary Catchments J12L, J13B, J21A, J21B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J12L	J13B	J21A	J21B	J12L	J13B	J21A	J21B		J12L	J13B	J21A	J21B
pH		57	15	64	56	7.54	7.98	7.97	7.60	5.0 – 9.5	6.79–8.29	7.18–8.78	7.17–8.76	6.84–8.35
Electrical Conductivity	mS/m	57	15	64	56	25.50	**418.00**	61.40	100.50	<150	28.05	**418.00**	67.54	110.55
Calcium as Ca	mg/l	54	14	60	56	16.11	94.90	58.18	60.10	<150	17.72	104.39	64.00	66.11
Magnesium as Mg	mg/l	54	15	59	56	2.89	93.80	18.81	19.45	<100	3.18	103.18	20.69	21.40
Sodium as Na	mg/l	52	15	60	54	21.85	**623.60**	43.23	116.95	<200	24.03	**623.60**	47.55	128.65
Chloride as Cl	mg/l	53	15	58	56	30.71	**906.39**	18.77	104.70	<200	33.78	**906.39**	20.64	115.17
Sulphate as SO_4	mg/l	54	15	57	54	7.55	253.60	75.14	113.80	<400	8.31	278.96	82.65	125.18
Nitrate as NO_x-N	mg/l	52	15	54	56	0.03	0.35	0.09	2.56	<10	0.03	0.39	0.09	2.81
Fluoride as F	mg/l	51	15	54	56	0.21	0.72	0.46	0.87	<1.0	0.23	0.79	0.51	0.96

Chemical Parameter	Unit	Quaternary Catchments J21C, J21D, J21E, J22B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J21C	J21D	J21E	J22B	J21C	J21D	J21E	J22B		J21C	J21D	J21E	J22B
pH		107	40	26	21	7.75	7.66	7.96	8.00	5.0 – 9.5	6.98–8.53	6.89–8.42	7.16–8.76	7.20–8.80
Electrical Conductivity	mS/m	107	40	26	21	76.40	85.20	78.80	74.20	<150	84.04	93.72	86.68	81.62
Calcium as Ca	mg/l	107	40	26	21	56.90	43.30	61.00	60.30	<150	62.59	47.63	67.10	66.33
Magnesium as Mg	mg/l	107	40	26	21	16.40	17.70	16.00	24.80	<100	18.04	19.47	17.60	27.28
Sodium as Na	mg/l	107	38	26	21	83.80	107.90	83.40	67.90	<200	92.18	118.69	91.74	74.69
Chloride as Cl	mg/l	107	40	26	21	76.90	102.60	93.00	57.20	<200	84.59	112.86	102.30	62.92
Sulphate as SO_4	mg/l	107	38	26	21	83.50	95.70	53.05	63.40	<400	91.85	105.27	58.36	69.74
Nitrate as NO_x-N	mg/l	107	39	26	21	3.13	3.55	2.23	1.95	<10	3.44	3.91	2.45	2.15
Fluoride as F	mg/l	107	40	26	21	0.68	**1.00**	0.95	0.91	<1.0	0.75	**1.00**	0.95	1.00

Chemical Parameter	Unit	Quaternary Catchments J22C, J22D, J22E, J22F												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J22C	J22D	J22E	J22F	J22C	J22D	J22E	J22F		J22C	J22D	J22E	J22F
pH		26	46	80	24	8.00	7.94	7.79	7.80	5.0 – 9.5	7.20–8.80	7.15–8.73	7.01–8.57	7.02–8.58
Electrical Conductivity	mS/m	26	46	80	24	97.10	89.85	88.70	103.45	<150	106.81	98.84	97.57	113.80
Calcium as Ca	mg/l	26	46	80	24	50.15	44.95	61.80	82.10	<150	55.17	49.45	67.98	90.31
Magnesium as Mg	mg/l	26	46	80	24	27.00	24.80	21.00	18.95	<100	29.70	27.28	23.10	20.85
Sodium as Na	mg/l	26	46	80	24	102.75	118.25	95.95	86.35	<200	113.03	130.08	105.55	94.99
Chloride as Cl	mg/l	26	46	80	24	94.00	102.75	92.40	109.40	<200	103.40	113.03	101.64	120.34
Sulphate as SO_4	mg/l	26	46	80	24	123.80	121.30	90.80	110.70	<400	136.18	133.43	99.88	121.77
Nitrate as NO_x-N	mg/l	26	46	80	24	1.78	1.47	4.12	3.82	<10	1.95	1.61	4.53	4.20
Fluoride as F	mg/l	26	46	80	24	**1.03**	**1.10**	**1.05**	0.89	<1.0	**1.03**	**1.10**	**1.05**	0.97

Chemical Parameter	Unit	Quaternary Catchments J22H, J22J, J23A, J23C												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J22H	J22J	J23A	J23C	J22H	J22J	J23A	J23C		J22H	J22J	J23A	J23C
pH		32	26	39	10	7.79	7.83	7.93	7.78	5.0 – 9.5	7.01–8.56	7.05–8.61	7.14–8.72	7.00–8.56
Electrical Conductivity	mS/m	32	26	39	10	145.05	83.20	**238.00**	136.00	<150	145.05	91.52	**238.00**	149.60
Calcium as Ca	mg/l	32	26	36	10	105.60	50.75	125.25	126.75	<150	116.16	55.83	137.78	139.43
Magnesium as Mg	mg/l	32	26	36	10	38.25	20.45	16.26	32.70	<100	42.08	22.50	17.89	35.97
Sodium as Na	mg/l	32	26	35	10	158.05	86.90	**342.80**	143.70	<200	173.86	95.59	**342.80**	158.07
Chloride as Cl	mg/l	32	26	35	10	**208.55**	82.15	**265.46**	159.05	<200	229.41	90.37	**265.46**	174.96
Sulphate as SO_4	mg/l	32	26	36	10	225.10	117.50	**497.01**	112.50	<400	247.61	129.25	**497.01**	123.75
Nitrate as NO_x-N	mg/l	32	26	35	10	3.31	3.02	0.04	1.10	<10	3.64	3.32	0.04	1.21
Fluoride as F	mg/l	32	26	33	10	1.09	0.90	**2.14**	0.69	<1.0	1.19	0.99	**2.14**	0.76

Chemical Parameter	Unit	Quaternary Catchments J23D, J23F, J24A, J24B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J23D	J23F	J24A	J24B	J23D	J23F	J24A	J24B		J23D	J23F	J24A	J24B
pH		26	85	168	220	8.10	7.97	7.77	7.79	5.0 – 9.5	7.29–8.91	7.17–8.76	6.99–8.54	7.01–8.56
Electrical Conductivity	mS/m	26	85	168	220	**155.00**	126.70	86.30	86.54	<150	**155.00**	139.37	94.93	95.19
Calcium as Ca	mg/l	26	83	168	213	98.95	51.07	70.60	76.59	<150	108.85	56.17	77.66	84.24
Magnesium as Mg	mg/l	26	83	168	214	40.65	28.60	18.55	17.15	<100	44.72	31.46	20.41	18.87
Sodium as Na	mg/l	26	80	168	210	166.55	120.85	91.25	83.50	<200	183.21	132.94	100.38	91.85
Chloride as Cl	mg/l	26	83	168	214	**208.95**	140.10	78.80	78.20	<200	**208.95**	154.11	86.68	86.02
Sulphate as SO_4	mg/l	26	83	168	214	151.40	157.15	103.40	69.00	<400	166.54	172.86	113.74	75.90
Nitrate as NO_x-N	mg/l	26	83	168	212	1.89	0.12	1.85	3.45	<10	2.08	0.13	2.04	3.80
Fluoride as F	mg/l	26	81	168	209	0.79	0.48	0.92	0.81	<1.0	0.86	0.52	1.01	0.89

Chemical Parameter	Unit	Quaternary Catchments J24C, J24D, J24E, J25A												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J24C	J24D	J24E	J25A	J24C	J24D	J24E	J25A		J24C	J24D	J24E	J25A
pH		112	97	18	33	7.70	7.90	7.94	7.11	5.0 – 9.5	6.93–8.47	7.11–8.69	7.15–8.73	6.40–7.83
Electrical Conductivity	mS/m	112	97	18	33	96.70	146.70	**161.50**	50.90	<150	106.37	146.70	**161.50**	55.99
Calcium as Ca	mg/l	112	93	18	33	68.45	94.20	106.00	14.80	<150	75.30	103.62	116.60	16.28
Magnesium as Mg	mg/l	112	93	18	33	18.00	28.80	30.95	10.90	<100	19.80	31.68	34.05	11.99
Sodium as Na	mg/l	112	86	18	33	103.40	162.40	198.65	50.40	<200	113.74	178.64	198.65	55.44
Chloride as Cl	mg/l	112	95	18	33	120.20	194.50	**213.80**	96.50	<200	132.22	194.50	**213.80**	106.15
Sulphate as SO_4	mg/l	112	89	18	33	78.40	114.00	105.70	26.40	<400	86.24	125.40	116.27	29.04
Nitrate as NO_x-N	mg/l	112	95	18	32	3.90	1.76	0.82	0.02	<10	4.28	1.94	0.90	0.02
Fluoride as F	mg/l	112	93	18	32	0.79	0.81	1.05	0.31	<1.0	0.87	0.89	1.05	0.34

Chemical Parameter	Unit	Quaternary Catchments J25C, J31D, J32A, J32B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J25C	J31D	J32A	J32B	J25C	J31D	J32A	J32B		J25C	J31D	J32A	J32B
pH		31	48	19	15	7.11	6.54	7.68	7.86	5.0 – 9.5	6.40–7.83	5.89–7.19	6.91–8.45	7.07–8.65
Electrical Conductivity	mS/m	31	48	19	15	50.90	14.06	**165.80**	**187.00**	<150	55.99	15.46	**165.80**	**187.00**
Calcium as Ca	mg/l	31	43	19	15	14.80	4.92	85.60	99.50	<150	16.28	5.41	94.16	109.45
Magnesium as Mg	mg/l	31	43	19	15	10.90	2.86	42.50	44.50	<100	11.99	3.14	46.75	48.95
Sodium as Na	mg/l	31	41	19	15	50.40	9.30	172.20	175.10	<200	55.44	10.23	189.42	192.61
Chloride as Cl	mg/l	31	43	19	15	96.50	23.80	**203.20**	**242.60**	<200	106.15	26.18	**203.20**	**242.60**
Sulphate as SO_4	mg/l	31	43	19	15	26.40	9.90	180.30	170.80	<400	29.04	10.89	198.33	187.88
Nitrate as NO_x-N	mg/l	31	41	19	15	0.02	0.03	3.80	0.88	<10	0.02	0.03	4.18	0.96
Fluoride as F	mg/l	31	39	19	15	0.31	0.29	1.06	0.99	<1.0	0.34	0.32	1.06	0.99

Chemical Parameter	Unit	Quaternary Catchments J32C, J32E, J33D, J33E												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J32C	J32E	J33D	J33E	J32C	J32E	J33D	J33E		J32C	J32E	J33D	J33E
pH		29	41	40	149	7.76	7.55	7.53	6.64	5.0 – 9.5	6.98–8.54	6.80–8.30	6.78–8.29	6.98–7.30
Electrical Conductivity	mS/m	29	41	40	149	127.40	19.80	19.80	12.10	<150	140.14	21.78	21.78	13.31
Calcium as Ca	mg/l	29	40	39	148	80.80	11.07	11.00	2.76	<150	88.88	12.17	12.10	3.04
Magnesium as Mg	mg/l	29	40	39	148	30.90	3.50	3.50	2.07	<100	33.99	3.85	3.85	2.27
Sodium as Na	mg/l	29	39	38	146	143.90	12.40	12.39	13.40	<200	158.29	13.64	13.63	14.74
Chloride as Cl	mg/l	29	40	38	147	170.70	23.87	23.64	22.99	<200	187.77	26.26	26.01	25.29
Sulphate as SO_4	mg/l	29	39	38	146	121.00	5.72	5.58	6.34	<400	133.10	6.29	6.14	6.97
Nitrate as NO_x-N	mg/l	29	39	38	147	2.15	0.04	0.04	0.19	<10	2.37	0.04	0.04	0.20
Fluoride as F	mg/l	29	37	36	146	0.90	0.27	0.27	0.11	<1.0	0.99	0.30	0.30	0.12

Chemical Parameter	Unit	Quaternary Catchments J33F, J34A, J34B, J34D												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J33F	J34A	J34B	J34D	J33F	J34A	J34B	J34D		J33F	J34A	J34B	J34D
pH		70	36	11	22	6.82	6.33	6.77	6.56	5.0 – 9.5	6.14–7.50	5.70–6.96	6.09–7.45	5.90–7.22
Electrical Conductivity	mS/m	70	36	11	22	44.60	19.55	114.50	12.54	<150	49.06	21.51	125.95	13.79
Calcium as Ca	mg/l	70	36	11	22	11.95	3.26	46.30	2.39	<150	13.15	3.58	50.93	2.63
Magnesium as Mg	mg/l	70	36	11	22	7.05	3.44	21.80	1.73	<100	7.76	3.78	23.98	1.91
Sodium as Na	mg/l	70	36	11	22	34.25	25.95	136.70	15.40	<200	37.68	28.55	150.37	16.94
Chloride as Cl	mg/l	70	36	11	22	61.74	40.85	**252.50**	27.36	<200	67.92	44.94	**252.50**	30.10
Sulphate as SO_4	mg/l	70	36	11	22	27.50	5.22	42.20	2.50	<400	30.25	5.74	46.42	2.75
Nitrate as NO_x-N	mg/l	68	36	11	22	0.08	**0.17**	0.37	0.22	<10	0.09	0.19	0.41	0.24
Fluoride as F	mg/l	69	36	11	22	0.22	**0.11**	0.29	0.08	<1.0	0.24	0.12	0.32	0.08

Chemical Parameter	Unit	Quaternary Catchments J34F, J35A, J35B, J35D												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J34F	J35A	J35B	J35D	J34F	J35A	J35B	J35D		J34F	J35A	J35B	J35D
pH		9	17	49	49	7.66	8.07	7.01	7.64	5.0 – 9.5	6.89–8.43	7.26–8.88	6.31–7.71	6.88–8.4(
Electrical Conductivity	mS/m	9	17	49	49	46.60	42.00	46.20	**173.10**	<150	51.26	46.20	50.82	**173.10**
Calcium as Ca	mg/l	9	17	47	48	6.87	62.70	6.23	86.30	<150	7.55	68.97	6.85	94.93
Magnesium as Mg	mg/l	9	17	47	48	7.70	6.30	8.70	35.65	<100	8.47	6.93	9.57	39.22
Sodium as Na	mg/l	9	17	45	48	61.80	11.10	57.30	145.70	<200	67.98	12.21	63.03	160.27
Chloride as Cl	mg/l	9	17	45	48	101.64	19.10	108.70	**239.50**	<200	111.81	21.01	119.57	**239.50**
Sulphate as SO_4	mg/l	9	17	47	48	27.90	11.50	4.85	95.95	<400	30.69	12.65	5.34	105.55
Nitrate as NO_x-N	mg/l	9	17	45	48	0.05	0.16	4.51	0.64	<10	0.06	0.18	4.96	0.70
Fluoride as F	mg/l	9	17	43	47	0.48	0.16	0.10	0.52	<1.0	0.53	0.18	0.11	0.57

Chemical Parameter	Unit	Quaternary Catchments J40D, J40E, K10A, K10B												
		No. of Samples				Ambient GW quality or median[1]				BHN Reserve[2]	Groundwater Quality Reserve[3]			
		J40D	J40E	K10A	K10B	J40D	J40E	K10A	K10B		J40D	J40E	K10A	K10B
pH		48	63	20	14	7.30	7.52	7.88	7.51	5.0 – 9.5	6.57–8.03	6.77–8.28	7.09–8.67	6.76–8.26
Electrical Conductivity	mS/m	48	63	20	14	83.15	**219.00**	**276.00**	**214.50**	<150	91.47	**219.00**	**276.00**	**214.50**
Calcium as Ca	mg/l	48	63	20	14	12.41	59.40	52.50	32.87	<150	13.65	65.34	57.75	36.15
Magnesium as Mg	mg/l	48	63	20	14	14.72	31.97	44.17	35.74	<100	16.19	35.17	48.58	39.32
Sodium as Na	mg/l	45	63	20	14	131.41	**288.45**	**399.60**	**288.65**	<200	144.55	**288.45**	**399.60**	**288.65**
Chloride as Cl	mg/l	48	63	20	13	**213.26**	**492.38**	**698.45**	**545.73**	<200	**213.26**	**492.38**	**698.45**	**545.73**
Sulphate as SO_4	mg/l	45	63	20	14	31.69	65.21	97.08	59.60	<400	34.86	71.73	106.79	65.56
Nitrate as NO_x-N	mg/l	47	62	20	12	0.09	0.04	0.05	0.27	<10	0.10	0.04	0.06	0.29
Fluoride as F	mg/l	48	63	20	13	0.14	0.22	0.22	0.25	<1.0	0.16	0.24	0.24	0.28

Chemical Parameter	Unit	Quaternary Catchments K10D, K30B, K50B											
		No. of Samples			Ambient GW quality or median[1]			BHN Reserve[2]	Groundwater Quality Reserve[3]				
		K10D	K30B	K50B	K10D	K30B	K50B		K10D	K30B	K50B		
pH		11	47	9	7.85	6.83	7.48	5.0 – 9.5	7.07–8.64	6.15–7.51	6.73–8.22		
Electrical Conductivity	mS/m	11	47	9	**257.00**	27.72	61.90	<150	**257.00**	30.49	68.09		
Calcium as Ca	mg/l	11	43	9	30.82	4.27	15.08	<150	33.90	4.70	16.58		
Magnesium as Mg	mg/l	11	43	9	28.10	7.49	9.80	<100	30.91	8.24	10.78		
Sodium as Na	mg/l	11	41	9	**426.18**	28.35	85.57	<200	**426.18**	31.19	94.13		
Chloride as Cl	mg/l	11	42	9	**533.12**	41.92	139.99	<200	**533.12**	46.11	153.98		
Sulphate as SO_4	mg/l	11	44	9	66.60	7.95	17.54	<400	73.26	8.74	19.29		
Nitrate as NO_x-N	mg/l	10	43	9	0.09	7.99	0.48	<10	0.10	8.79	0.52		
Fluoride as F	mg/l	10	23	9	0.84	0.16	0.34	<1.0	0.93	1.49	0.18		

[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%. Where a difference in the water quality values for the ambient groundwater quality and basic human needs was found, the lesser or more protective value was selected for the groundwater quality Reserve. Where the ambient groundwater quality was selected as the groundwater quality Reserve, the value was scaled up by 10 per cent provided that the value does not exceed the BHN Reserve.

Table 6.4: Summary of the water quality class and parameters of concern

Quaternary catchment	Water quality class (WRC, 1998)	Water quality parameters of concern
G40C	0	None
G40F	0	None
G40J	0	None
G40L	II	Sodium, Chloride
G40M	II	Chloride
G50E	I	Chloride
G50F	I	Chloride
G50H	III	Electrical Conductivity, Magnesium, Sodium, Chloride, Sulphate
G50J	II	Chloride, Sodium, Electrical Conductivity
H10A	II	Sodium, Chloride, Electrical Conductivity
H10B	0	None
H10C	I	Chloride
H10F	0	None
H10G	0	None
H10H	II	Chloride
H10L	0	None
H20A	0	None
H20B	0	None
H20D	0	None
H20E	0	None
H20F	0	None
H30A	II	Chloride
H30C	0	None
H30D	0	None
H40A	I	Electrical Conductivity, Calcium, Chloride
H40B	0	None
H40F	0	None
H70B	III	Electrical Conductivity, Magnesium, Sodium, Chloride
H70K	II	Chloride
H90D	II	Chloride
H90E	II	Electrical Conductivity, Sodium, Chloride
J11B	I	Electrical Conductivity
J11E	II	Electrical Conductivity, Chloride
J11G	II	Electrical Conductivity, Chloride
J12B	III	Electrical Conductivity, Magnesium, Sodium, Chloride
J12D	II	Electrical Conductivity, Sodium, Chloride
J12F	III	Electrical Conductivity, Sodium, Chloride
J12G	III	Electrical Conductivity, Sodium, Chloride
J12H	II	Electrical Conductivity, Chloride
J12K	III	Electrical Conductivity, Calcium, Sodium, Chloride, Sulphate
J12L	0	None
J13B	III	Electrical Conductivity, Sodium, Chloride
J21A	0	None
J21B	I	Electrical Conductivity, Sodium, Chloride
J21C	I	Electrical Conductivity
J21D	I	Electrical Conductivity, Sodium, Chloride
J21E	I	Electrical Conductivity
J22B	I	Electrical Conductivity
J22C	I	Electrical Conductivity, Sodium
J22D	I	Electrical Conductivity, Sodium, Chloride
J22E	I	Electrical Conductivity
J22F	I	Electrical Conductivity, Calcium, Chloride
J22H	II	Electrical Conductivity, Calcium, Sodium, Chloride
J22J	I	Electrical Conductivity
J23A	II	Electrical Conductivity, Sodium, Chloride, Sulphate
J23C	I	Electrical Conductivity, Calcium, Sodium, Chloride
J23D	II	Electrical Conductivity, Chloride
J23F	I	Electrical Conductivity, Sodium, Chloride
J24A	I	Electrical Conductivity
J24B	I	Electrical Conductivity
J24C	I	Electrical Conductivity, Sodium, Chloride
J24D	II	Electrical Conductivity, Chloride

Quaternary catchment	Water quality class (WRC, 1998)	Water quality parameters of concern
J24E	II	Electrical Conductivity, Chloride
J25A	0	None
J25C	0	None
J31D	0	None
J32A	II	Electrical Conductivity, Chloride
J32B	II	Electrical Conductivity, Chloride
J32C	I	Electrical Conductivity, Calcium, Sodium, Chloride
J32E	0	None
J33D	0	None
J33E	0	None
J33F	0	None
J34A	0	None
J34B	II	Chloride
J34D	0	None
J34F	I	Chloride
J35A	0	None
J35B	I	Chloride
J35D	II	Electrical Conductivity, Chloride
J40D	II	Chloride, Sodium
J40E	II	Electrical Conductivity, Sodium, Chloride
K10A	III	Electrical Conductivity, Sodium, Chloride
K10B	II	Electrical Conductivity, Sodium, Chloride
K10D	III	Electrical Conductivity, Sodium, Chloride
K30B	0	None
K50B	I	Chloride

7. ESTUARIES (WATER QUANTITY COMPONENT)

Table 7.1 Water Quantity

Quaternary Catchment	Estuary name	PES	REC	nMAR (MCM)	EWR (MCM nMAR)
G40B	Rooiels	B	B	*9.44	n/a
G40D	Palmiet	C	B	*177.94	n/a
G40G	Bot/Kleinmond	C	B	*77.67	n/a
G40H	Onrus	E	D	*4.74	n/a
G40L	Klein	C	B	*51.21	n/a
G40M	Uilkraals	D	C	*6.82	n/a
G40F	Heuningnes	C	A	29.53	n/a
H70K	Breede	B	B	1785.00	954.00
H80E	Duiwenhoks	B	A	89.29	73.01
H90C	Goukou	C	B	115.95	91.73
J40B	Gouritz	C	B	623.52	377.23
K10A	Blinde	C	C	n/a	n/a
K10B	Hartenbos	D	C	n/a	n/a
K10F	Klein Brak	C	C	50.67	37.66
K20A	Groot Brak	D	C	36.79	11.11
K30A	Maalgate	B	C	41.51	24.41
K30B	Gwaing	B	C	35.07	21.7
K30C	Kaaimans	B	B	53.6	41.3

Quaternary Catchment	Estuary name	PES	REC	nMAR (MCM)	EWR (MCM nMAR)
K30D	Wilderness system: Touws	B	A	29.66	25.15
K40D	Swartvlei	B	B	83.4	56.6
K40E	Goukamma	B	A	57.5	48.8
K50B	Kynsna	B	B	83.2	63.4
K60 E and F	Keurbooms	A/B	A/B	232	214.10
K60G	Noetsie	B	B	4.8	n/a
K60G	Piesang	D	B/C	n/a	n/a
K70A	Groot (Wes)	B	A	n/a	n/a
K70A	Matjie	B	B	5.10	n/a
K70A	Sout	A	A	11.22	n/a
K70B	Bloukrans	A	A	n/a	n/a

***Present Day MAR**

ESTUARY WATER QUALITY COMPONENT

Table 7.2: EcoSpecs and Thresholds of Potential Concern for the Blinde Estuary

Ecological component	EcoSpecs	Thresholds of Potential Concern
Hydrology	Maintain flow regime (small system needs most flows)	MAR does not vary by more than 10% from present Floods (indicated by 1:10 year event) do not reduce by more than 5% from present Base flows do not differ by more than 5% from present
Hydrodynamics	Maintain mouth state to create the require habitat for birds, fish, macrophytes, microalgae and water quality	Closed mouth state increase/decrease by 10% from present Presence of semi-closed mouth state with continuous outflow to sea. Average water depth <0.5 m (to be confirmed by monitoring) Rate of change in water level > 30% from present
Water quality	Salinity distribution not to cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae Turbidity and dissolved oxygen not to cause exceedance of TPCs for biota Dissolved inorganic (DIN)/dissolved inorganic phosphate (DIP) concentrations not to cause exceedance of TPCs for macrophytes and microalgae Toxic substances not to cause exceedance of TPCs for biota	Salinity > 20 (expected range 5-15) Dissolved oxygen (DO)< 5 mg/ℓ in estuary Turbidity> 10 NTU in low flow Secchi depth: to bottom DIN >100 µg/ℓ (average) DIP > 20 µg/ℓ (average) Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per Western Indian Ocean (WIO) Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (in stream physical habitat) so as not to exceed TPCs for biota Changes in sediment grain-size distribution patterns not to cause exceedance of TPCs in benthic invertebrates Change in average sediment composition and characteristics Change in average bathymetry	Average sediment composition (% fractions) along estuary change from baseline (to be measured) by 30% (per survey) Average depth along main channel change from 30% of baseline (to be determined) (system expected to experience significant fluctuation in bathymetry between flood and extended closed periods)
Microalgae	Maintain low/median phytoplankton/benthic microalgae biomass Prevent formation of phytoplankton blooms	Phytoplankton> 3.5 µg/ℓ (median) Benthic microalgae >23 mg/m^2 (median) Phytoplankton >20 µg/ℓ and/or cell density >10 000 cells/ml (once-off)
Macrophytes	Maintain distribution of macrophyte habitats Prevent the spread of reeds into open water Prevent an increase in nutrients and macro-algal blooms Prevent the spread of invasive trees (e.g. *Acacia* spp.) in the riparian zone	20% change in the macrophyte area. (Reeds currently cover 0.04 ha.) Reeds occupy > 0.5 ha Macro-algal blooms cover > 50% of the open water area Presence of invasive aquatic macrophytes e.g. *Azolla*, water hyacinth etc. Invasive trees cover > 50% of riparian zone
Invertebrates	Establish presence/absence of sand prawn Callichirus kraussi on sand banks in lower estuary Establish presence/absence of the copepod Pseudodiaptomus hessei or estuarine congeneric in the zooplankton of the estuary	If present populations deviate from average baselines (as determined in first three visits) by more 30%
Fish	Fish assemblage should comprise the five estuarine association categories in similar proportions (diversity and abundance) to that under the reference. Numerically, assemblage should comprise: Ia estuarine residents (50-80% of total abundance)	Ia estuarine residents <50% Ib marine and estuarine breeders <10% IIa obligate estuarine-dependent <10% IIb estuarine associated species <5% IIc marine opportunists < 20% III marine vagrants > 5% IV indigenous fish<1%

Ecological component	EcoSpecs	Thresholds of Potential Concern
	Ib marine and estuarine breeders (5-20%) IIa obligate estuarine-dependent (10-20%) IIb estuarine associated species (5-15%), IIc marine opportunists (20-80%) III marine vagrants (not more than 5%) IV indigenous fish (1-5%) V catadromous species (1-5%) Category Ia species should contain viable populations of at least two species (e.g. G.aestuaria, & Hyporamphus capensis). Category IIa obligate dependents should be well represented by at least two large exploited species (i.e. L. lithognathus, Lichia amia). REI (River Estuary Interface) species dominated by both Myxus capensis and G. aestuaria.	V catadromous species <1%
Birds	Maintain population of original groups of birds present on the estuary	Number of birds in any group, other than species that are increasing regionally such as Egyptian geese, drops below the baseline median (determined by past data and or initial surveys) number of species and/or birds counted for three consecutive summer or winter counts

Table 7.3: EcoSpecs and Thresholds of Potential Concern for the Hartenbos Estuary

Ecological component	EcoSpecs	Thresholds of Potential Concern
Hydrology	Maintain at least present day base flows (to be confirmed)	MAR does not vary by more than 10% Floods (indicated by 1:10 year event) do not reduce by more than 5% from present Base flows do not increase by more than 50% from present
Hydrodynamics	Maintain mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality	Closed mouth state does not decrease by 10% from present Average water level in system > 10% from present Tidal amplitude (when open) < 20%
Water quality	Salinity distribution not to cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae Turbidity and dissolved oxygen not to cause exceedance of TPCs for biota DIN/DIP concentrations not to cause exceedance of TPCs for macrophytes and microalgae Toxic substances not to cause exceedance of TPCs for biota	Average salinity along estuary decreases by 5 below baseline average (to be determined) DO < 5 mg/ℓ in estuary Turbidity> 20 NTU in low flow Secchi in fresher part: <0.5 m DIN >200 µg/ℓ average (to be confirmed) DIP > 50 µg/ℓ average (to be confirmed) Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota Changes in sediment grain-size distribution patterns not to cause exceedance of TPCs in benthic invertebrates Change in average sediment composition and characteristics Change in average bathymetry	Average sediment composition (% fractions) along estuary change from baseline (to be measured) by 30% (per survey) Average depth along main channel changes from 30% of baseline (to be determined) (system expected to experience significant fluctuation in bathymetry between flood and extended closed periods)

Ecological component	EcoSpecs	Thresholds of Potential Concern
Microalgae	Maintain median phytoplankton/benthic microalgae biomass Prevent formation of phytoplankton blooms	Phytoplankton >8 µg/ℓ (median) Benthic microalgae >42 mg/m^2 (median) Phytoplankton >20 µg/ℓ and/or cell density >10 000 cells/ml (once-off) Dinoflagellates, chlorophytes and/or cyanobacteria >10% of relative abundance
Macrophytes	Maintain distribution of macrophyte habitats Prevent the spread of reeds into open water Prevent an increase in nutrients and macroalgal blooms Prevent the spread of invasive trees (e.g. *Acacia* spp.) in the riparian zone. Maintain integrity of salt marsh	20% change in macrophyte area (Reeds currently cover 9 ha, saltmarsh 47 ha.) Macroalgal blooms cover > 50% of the open water area Presence of invasive aquatic macrophytes e.g. *Azolla*, water hyacinth Invasive plants cover > 10% of flood plain Increase in bare areas in salt marsh because of decrease in moisture and increase in salinity >30% of salt marsh
Invertebrates	Establish presence/absence of sand prawn *Callichirus kraussi* on sand banks in lower estuary Establish abundance of the copepod *Pseudodiaptomus hessei* or estuarine congeneric in the zooplankton of the estuary	If present populations deviate from average baselines (as determined in first three visits) by more 30%
Fish	Fish assemblage should comprise the five estuarine association categories in similar proportions (diversity and abundance) to that under the reference. Numerically, assemblage should comprise: Ia estuarine residents (20-60%) Ib marine and estuarine breeders (10-30%) IIa obligate estuarine-dependent (20-40%) IIb estuarine associated species (5-20%) IIc marine opportunists (20-80%) IV indigenous fish (1-5%) V catadromous species (1-5%) Category Ia species should contain viable populations of at least two species (e.g. *G.aestuaria, Hyporamphus capensis, Omobranchus woodii*). Category IIa obligate dependents should be well represented by large exploited species (i.e. *A. japonicus, L. lithognathus, P. commersonnii, Lichia amia*). REI species dominated by both *Myxus capensis* and *G. aestuaria*.	Ia estuarine residents <20% Ib marine and estuarine breeders < 10% IIa obligate estuarine-dependent <20% IIb estuarine associated species <5% IIc marine opportunists < 20% IV indigenous fish<1% V catadromous species <1% Ia represented only by *G. aestuaria*. IIa exploited species in very low numbers or absent REI species represented only by *G. aestuaria*, *Myxus capensis* absent
Birds	Maintain population of original groups of birds present on the estuary	Number of birds in any group, other than species that are increasing regionally such as Egyptian geese, drops below the baseline median (determined by past data and or initial surveys) number of species and/or birds counted for three consecutive summer or winter counts

Table 7.4: Eco-Specs and Thresholds of Potential Concern for the Piesang Estuary

Ecological component	EcoSpecs	Thresholds of Potential Concern
Hydrology	Maintain present day base flow as a minimum (to be confirmed)	MAR does not vary by more than 10% Floods (indicated by 1:10 year event) do not reduce by more than 5% from present. Base flows do not increase by more than 50% from present
Hydrodynamics	Maintain mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality	Closed mouth state increase by 10% from present Average water level in system > 10% from present Tidal amplitude (when open) < 20%
Water quality	Salinity distribution not to cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae Turbidity and dissolved oxygen not to cause exceedance of TPCs for biota DIN/DIP concentrations not to cause exceedance of TPCs for macro-phytes and microalgae Toxic substances not to cause exceedance of TPCs for biota	Salinity > 20 (expected range 10-20) Salinity < 5 (expected range 10-20) DO < 5 mg/ℓ in estuary Turbidity> 10 NTU in low flow Secchi: to bottom DIN >100 µg/ℓonce-off DIP > 20 µg/ℓonce-off Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota Changes in sediment grain-size distribution patterns not to cause exceedance of TPCs in benthic invertebrates Change in average sediment composition and characteristics Change in average bathymetry	Average sediment composition (% fractions) along estuary changes from baseline (to be measured) by 30% (per survey) Average depth along main channel changes from 30% of baseline (to be determine) (system expected to experience significant fluctuation in bathymetry between flood and extended closed periods)
Microalgae	Maintain median phytoplankton/benthic microalgae biomass Prevent formation of phytoplankton blooms	Phytoplankton >3.5 µg/ℓ (median) Benthic microalgae >11 mg/m^2 (median) Phytoplankton >20 µg/ℓ and/or cell density >10 000 cells/ml (once-off)
Macrophytes	Maintain distribution of macrophyte habitats Prevent an increase in nutrient input leading to macroalgal blooms Control the spread of invasive plants in the riparian zone	Greater than 20 % change in the area covered by macrophytes (reeds and sedges currently cover 3.14 ha, submerged macrophytes and salt marsh present) Macroalgal blooms cover > 50% of the open water area during closed mouth conditions Invasive plants cover >5% of total habitat
Invertebrates	Maintain presenceof sand prawn *Callichirus kraussi* on sand banks in lower estuary Maintain presence of the copepod *Pseudodiaptomus hessei* or estuarine congeneric in the zooplankton of the estuary	Populations deviate from average baselines (as determined in first three visits) by more 30%

Ecological component	EcoSpecs	Thresholds of Potential Concern
Fish	Fish assemblage should comprise the five estuarine association categories in similar proportions (diversity and abundance) to that under the reference. Numerically, assemblage should comprise: Ia estuarine residents (50-80% of total abundance) Ib marine and estuarine breeders (5-20%) IIa obligate estuarine-dependent (10-20%) IIb estuarine associated species (5-15%), IIc marine opportunists (20-80%) III marine vagrants (not more than 5%) IV indigenous fish (1-5%) V catadromous species (1-5%) Category Ia species should contain viable populations of at least two species (e.g. *G.aestuaria, & Hyporamphus capensis.* Category IIa obligate dependents should be well represented by at least two large exploited species (i.e. *L. lithognathus, Lichia amia*). REI species dominated by both *Myxus capensis* and *G. aestuaria.*	Ia estuarine residents <50% Ib marine and estuarine breeders <10% IIa obligate estuarine-dependent <10% IIb estuarine associated species <5% IIc marine opportunists < 20% III marine vagrants > 5% IV indigenous fish<1% V catadromous species <1%
Birds	Maintain population of original groups of birds present on the estuary	Number of birds in any group, other than species that are increasing regionally such as Egyptian geese, drops below the baseline median (determined by past data and or initial surveys) number of species and/or birds counted for three consecutive summer or winter counts

Table 7.5: EcoSpecs for the Groot (Wes) Estuary

Ecological component	EcoSpecs	Thresholds of Potential Concern
Hydrology	Maintain present day base flow as a minimum (to be confirmed)	MAR does not vary by more than 10% Floods (indicated by 1:10 year event) do not reduce by more than 5% from present. Base flows do not increase by more than 50% from present
Hydrodynamics	Maintain mouth state to create the required habitat for birds, fish, macrophytes, microalgae and water quality	Closed mouth state increases by 10% from present Average water level in system > 10% from present Tidal amplitude (when open) < 20%
Water quality	Salinity distribution not to cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae Turbidity and dissolved oxygen not to cause exceedance of TPCs for biota DIN/DIP concentrations not to cause exceedance of TPCs for macrophytes and microalgae Toxic substances not to cause exceedance of TPCs for biota	Average salinity along estuary decreases by 5 below baseline average (to be determined) Average salinity < 10at the head of the estuary (expected average range 5-10 for most of the system) DO < 5 mg/ℓ in estuary Turbidity> 10 NTU in low flow Secchi: to bottom DIN >100 µg/ℓonce-off DIP > 20 µg/ℓonce-off Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Ecological component	EcoSpecs	Thresholds of Potential Concern
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota Changes in sediment grain-size distribution patterns not to cause exceedance of TPCs in benthic invertebrates Change in average sediment composition and characteristics Change in average bathymetry	Average sediment composition (% fractions) along estuary changes from baseline (to be measured) by 30% (per survey) Average depth along main channel changes from 30% of baseline (to be determined) (system expected to experience significant fluctuation in bathymetry between flood and extended closed periods)
Microalgae	Maintain median phytoplankton/benthic microalgae biomass Prevent formation of phytoplankton blooms	Phytoplankton >3.5 µg/ℓ (median) Benthic microalgae >11 mg/m^2 (median) Phytoplankton >20 ug/ℓ and/or cell density >10 000 cells/ml (once-off)
Macrophytes	Maintain distribution of macro-phyte habitats. Prevent an increase in nutrient input leading to macroalgal blooms. Control the spread of invasive plants in the riparian zone	Greater than 20 % change in the area covered by macro-phytes (reeds and sedges currently cover 2.54 ha salt marsh 0.76 ha) Macro-algal blooms cover > 50% of the open water area during closed mouth conditions. Invasive plants cover >5% of total habitat
Invertebrates	Establish presence/absence of sand prawn *Callichirus kraussi* on sand banks in lower estuary Establish presence/absence of the copepod *Pseudodiaptomus hessei* or estuarine congeneric in the zooplankton of the estuary	If present populations deviate from average baselines (as determined in first three visits) by more 30%
Fish	Fish assemblage should comprise the five estuarine association categories in similar proportions (diversity and abundance) to that under the reference. Numerically, assemblage should comprise: Ia estuarine residents (50-80% of total abundance) Ib marine and estuarine breeders (5-20%) IIa obligate estuarine-dependent (10-20%) IIb estuarine associated species (5-15%), IIc marine opportunists (20-80%) III marine vagrants (not more than 5%) IV indigenous fish (1-5%) V catadromous species (1-5%) Category Ia species should contain viable populations of at least two species (e.g. *G.aestuaria, & Hyporamphus capensis).* Category IIa obligate dependents should be well represented by at least two large exploited species (i.e. *L. lithognathus, Lichia amia*). REI species dominated by both *Myxus capensis* and *G. aestuaria*.	Ia estuarine residents <50% Ib marine and estuarine breeders < 10% IIa obligate estuarine-dependent <10% IIb estuarine associated species <5% IIc marine opportunists < 20% III marine vagrants > 5% IV indigenous fish<1% V catadromous species <1%
Birds	Maintain population of original groups of birds present on the estuary	Number of birds in any group, other than species that are increasing regionally such as Egyptian geese, drops below the baseline median (determined by past data and or initial surveys) number of species and/or birds counted for three consecutive summer or winter counts

Table 7.6: EcoSpecs and Thresholds of Potential Concern for the Bloukrans Estuary

Ecological component	EcoSpecs	Thresholds of Potential Concern
Hydrology	Maintain present flow regime	Varies more than 10% of MAR
Hydrodynamics	Maintain mouth state to create the required habitat for birds, fish, macro-phytes, microalgae and water quality	Estuary mouth closes
Water quality	Salinity distribution not to cause exceedance of TPCs for fish, invertebrates, macrophytes and microalgae Turbidity and dissolved oxygen not to cause exceedance of TPCs for biota DIN/DIP concentrations not to cause exceedance of TPCs for macrophytes and microalgae Toxic substances not to cause exceedance of TPCs for biota	Average salinity < 10at the head of the estuary (expected average range >30 for most of the system) DO < 5 mg/ℓ in estuary Turbidity> 10 NTU in low flow Secchi: to bottom DIN >100 µg/ℓonce-off DIP > 20 µg/ℓonce-off Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)
Sediment dynamics	Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota Changes in sediment grain-size distribution patterns not to cause exceedance of TPCs in benthic invertebrates Change in average sediment composition and characteristics Change in average bathymetry	Average sediment composition (% fractions) along estuary change from baseline (to be measured) by 30% (per survey) Average depth along main channel change from 30% of baseline (to be determine) (system expected to significant fluctuation in bathymetry between flood and extended closed periods)
Microalgae	Maintain median phytoplankton/benthic microalgae biomass Prevent formation of phytoplankton blooms	Phytoplankton >1.0 µg/ℓ (median) Benthic microalgae >11 mg/m^2 (median) Phytoplankton >20 µg/ℓ and/or cell density >10 000 cells/ml (once-off)
Macrophytes	The estuary habitats only consists of sand/mud banks (0.63 ha) and channel (2.88 ha), no macrophytes	N/A
Invertebrates	Establish presence/absence of sand prawn *Callichirus kraussi* on sand banks in lower estuary Establish presence/absence of the copepod *Pseudodiaptomus hessei* or estuarine congeneric in the zooplankton of the estuary	If present populations deviate from average baselines (as determined in first three visits) by more 30%

Ecological component	EcoSpecs	Thresholds of Potential Concern
Fish	Fish assemblage should comprise the five estuarine association categories in similar proportions (diversity and abundance) to that under the reference. Numerically, assemblage should comprise: Ia estuarine residents (50-80% of total abundance) Ib marine and estuarine breeders (10-20%) IIa obligate estuarine-dependent (10-20%) IIb estuarine associated species (5-15%), IIc marine opportunists (20-80%) III marine vagrants (not more than 5%) IV indigenous fish (1-5%) V catadromous species (1-5%) Category Ia species should contain viable populations of at least 4 species (*G.aestuaria, Hyporamphus capensis, Omobranchus woodii*). Category IIa obligate dependents should be well represented by large exploited species (*A. japonicus, L. lithognathus, P. commersonii, Lichia amia*). REI species dominated by both *Myxus capensis* and *G. aestuaria*.	Ia estuarine residents <50% Ib marine and estuarine breeders < 10% IIa obligate estuarine-dependent < 10% IIb estuarine associated species < 5% IIc marine opportunists < 20% III marine vagrants > 5% IV indigenous fish< 1% V catadromous species <1%
Birds	Maintain population of original groups of birds present on the estuary	Number of birds in any group, other than species that are increasing regionally such as Egyptian geese, drops below the baseline median (determined by past data and or initial surveys) number of species and/or birds counted for three consecutive summer or winter counts

Table 7.7: EcoSpecs and TPCs for the Goukou Estuary

EcoSpecs	TPC
Water quality	
Salinity distribution not to cause exceedance of TPCs for biota.	▪ Salinity > 0 at head of estuary. ▪ Average salinity in Zone D > 5. ▪ Average salinity in Zone C > 20. ▪ Average salinity 5 km upstream from mouth > 20 more than three months of the year.
System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 6.0 < pH > 7.5. ▪ DO < 5 mg/L. ▪ Suspended solids >5 mg/L (low flow). Estuary: ▪ Average turbidity >10 Nephelometric Turbidity Units (NTU) (low flow). ▪ Average 6.0 < pH > 8.5 (increasing with increase in salinity). ▪ Average DO < 5 mg/L.
Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause in exceedance of TPCs for macrophytes and microalgae.	River inflow: ▪ NO_x-N >150 µg/L over two consecutive months. ▪ NH_3-N > 20 µg/L over two consecutive months. ▪ PO_4-PP > 20 µg/L over two consecutive months. Estuary (except during upwelling or floods): ▪ Average NO_x-N 150 µg/L single concentration > 200 µg/L.

EcoSpecs	TPC
	▪ Average NH_3-N > 20 µg/L during survey, single concentration > 100 µg/L. ▪ Average PO_4-P > 20 µg/L during survey, single concentration > 50 µg/L.
Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be refined and confirmed through future monitoring) ▪ Pesticides/herbicides (to be refined and confirmed through future monitoring). Estuary: ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for Coastal Marine Waters (DWAF, 1995). ▪ Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.8: Water Quality EcoSpecs and TPCs for the Gouritz Estuary

Component	EcoSpecs	Thresholds of Potential Concern
Water Quality	Salinity distribution not to cause exceedance of TPCs for biota.	▪ Salinity > 0 at head of estuary ▪ Average salinity in Site 11, 1 km upstream of bridge > 5 ▪ Average salinity in Zone C > 20 ▪ Average salinity 11 km upstream from mouth > 20 more than three months of the year ▪ Salinity > 40 in saltmarsh sediments (linked to decrease in moisture and drying of floodplain habitat).
	System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 7.0 < pH > 8.3 ▪ DO < 5 mg/ℓ ▪ Suspended solids > 5 mg/ℓ (low flow) Estuary: ▪ Average turbidity > 10 NTU (low, calm condition flow, wind mixing can increase turbidity to 20-40 NTU) ▪ Average 7.0 < pH > 8.5 (increasing with increase in salinity) ▪ Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause exceedance of TPCs for macrophytes and microalgae.	River inflow: ▪ NOx-N > 100 µg/ℓ over two consecutive months ▪ NH3-N > 20 µg/ℓ over two consecutive months ▪ PO4-P > 20 µg/ℓ over two consecutive months Estuary (except during upwelling or floods): ▪ Average NOx-N > 100 µg/ℓ single concentration > 150 µg/ℓ ▪ Average NH3-N > 20 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average PO4-P > 20 µg/ℓ during survey, single concentration > 50 µg/ℓ
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be confirmed) ▪ Pesticides/herbicides (to be confirmed) Estuary ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per Western Indian Ocean (WIO) Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.9: Eco Specs and TPCs for the Klein Brak Estuary

Component	EcoSpecs	Thresholds of Potential Concern
Water quality	Salinity distribution not to cause exceedance of TPCs for biota.	▪ No salinity gradient in the upper reaches of the estuary (Zone D and F) ▪ No REI in the upper reaches of the estuary (Zone D and F) ▪ Salinity > 35
	System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 7.0 < pH > 8.5 ▪ DO < 5 mg/ℓ ▪ Suspended solids > 5 mg/ ℓ (low flow) Estuary: ▪ Average turbidity >10 NTU (low flow) ▪ Average 7.0 < pH > 8.5 (increasing with increase in salinity) ▪ Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause in exceedance of TPCs for macro-phytes and microalgae.	River inflow: ▪ NO_x-N >150 µg/ℓ over two consecutive months ▪ NH_3-N> 20 µg/ℓ over two consecutive months ▪ PO_4-P > 20 µg/ℓ over two consecutive months Estuary (except during upwelling or floods): ▪ Average NO_x-N > 150 µg/ℓ during survey, single concentration > 200 µg/ℓ ▪ Average NH_3-N > 20 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average PO_4-P > 20 µg/ℓ during survey, single concentration > 50 µg/ℓ
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be confirmed) ▪ Pesticides/herbicides (to be confirmed) Estuary ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) ▪ Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.10: EcoSpecs and TPCs for the Wilderness System

Component	EcoSpecs	Thresholds of Potential Concern
Water quality	Salinity	Estuary in the closed state: ▪ Average salinity in Zone A < 12, ▪ Average salinity in Zone B: < 10 ▪ Average salinity in Zone C < 5 Lakes average salinity +2 from baseline (2013) and variability do not increase as below: ▪ Serpentine: 12 ± 10 ▪ Eilandvlei: 8 ± 5 ▪ Langvlei: 10 ± 4 ▪ Rondevlei: 10 ± 5

	System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 6.0 < pH > 7.0 (Touw) ▪ 7.0 < pH > 8.0 (Duiwe) ▪ DO < 5 mg/ℓ ▪ Suspended solids > 5 mg/ ℓ (low flow) Estuary: ▪ Average turbidity > 5 NTU (low flow) ▪ Average 6.0 < pH > 8.5 (increasing with increase in salinity) ▪ Average DO < 5 mg/ℓ Lakes: ▪ Average turbidity > 5 NTU ▪ Average 7.0 < pH > 8.5 ▪ Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause exceedance of TPCs for macro-phytes and microalgae.	River inflow: ▪ NO_x-N > 50 µg/ℓ over two consecutive months ▪ NH_3-N > 10 µg/ℓ over two consecutive months ▪ PO_4-P > 10 µg/ℓ over two consecutive months Estuary (except during upwelling or floods): ▪ Average NO_x-N > 50 µg/ℓ single concentration > 100 µg/ℓ ▪ Average NH_3-N > 10 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average PO_4-P > 10 µg/ℓ during survey, single concentration > 50 µg/ℓ Lakes: ▪ Average NO_x-N > 50 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average NH_3-N > 20 µg/ℓ during survey (to be confirmed) ▪ Average PO_4-P > 20 µg/ℓ during survey (to be confirmed)
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be confirmed) ▪ Pesticides/herbicides (to be confirmed) Estuary: ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) ▪ Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.11: Water quality present state assessment for H8DUIW-EWR1

Water Quality Constituents	PES Value	Category/Comment
Inorganic salt ions (mg/l)		
Sulphate as SO_4	N/A	-
Sodium as Na	382.2	Exceeds the ≤ 70 mg/L (TWQR) for Agricultural Use: Irrigation.
Magnesium as Mg	67.4	No guideline.
Calcium as Ca	55.0	No guideline.
Chloride as Cl	805.4	Exceeds the ≤ 100 mg/L (TWQR) for Agricultural Use: Irrigation.
Potassium as K	9.25	No guideline.
Electrical conductivity (mS/m)		
	272	E/F: RC = 80 mS/m.
Nutrients (mg/l)		
SRP	0.014	A
TIN	0.118	A

Water Quality Constituents	PES Value	Category/Comment
Physical variables		
pH (5th + 95th %ile)	6.6 and 8.1	B
Temperature (°C)	N/A	A/B. Impacts expected at low flows.
Dissolved oxygen (mg/L)	N/A	B. Impacts expected at low flows.
Turbidity (NTU)	N/A	B. Changes in turbidity appear to be largely related to natural with minor man-made modifications, e.g. gravel mining upstream
Response variables		
Chl-*a*: phytoplankton (ug/L)	N/A	N/A
Macroinvertebrate score (MIRAI) SASS score ASPT score	50.7% 78 56	D
Diatoms	11.1	C/D (n = 1, Jan 2014)
Fish score (FRAI)	51.6%	D (all estuarine spp. that moved into the freshwater zone and aliens).
Toxics		
Ammonia (as N)	0.003	A
Fluoride (as F)	0.33	A
OVERALL SITE CLASSIFICATION (PAI model)		**C (73.2%)**

(a) N/A- No data were available for this assessment.

Table 7.12: H8DUIW-EWR1: Water quality (C category) EcoSpecs and TPCs

Metrics	EcoSpecs	TPCs
Inorganic salt ions		
Sulphate as SO_4	N/A	N/A
Sodium as Na	The 95th percentile of the data must be ≤ 380 mg/L.	The 95th percentile of the data must be 300 - 380 mg/L.
Magnesium as Mg	The 95th percentile of the data must be ≤ 67 mg/L.	The 95th percentile of the data must be 53.5 - 67 mg/L.
Calcium as Ca	The 95th percentile of the data must be ≤ 55 mg/L.	The 95th percentile of the data must be 44 - 55 mg/L.
Chloride as Cl	The 95th percentile of the data must be ≤ 800 mg/L.	The 95th percentile of the data must be 640 - 800 mg/L.
Potassium as K	The 95th percentile of the data must be ≤ 9 mg/L.	The 95th percentile of the data must be 7 - 9 mg/L.
Physical Variables		
Electrical conductivity (mS/m)	The 95th percentile of the data must be ≤ 270 mS/m.	The 95th percentile of the data must be 210 - 270 mS/m.
pH	The 5th percentile of the data must be 6.5. – 8.0, and the 95th percentile 8.0 - 8.8.	The 5th percentile of the data is ≤ 6.3 and the 95th percentile is ≥ 8.6.
Temperature[a]	Natural temperature range.	Initiate baseline monitoring for this variable.
Dissolved oxygen[a](DO)	The 5th percentile of the data must be ≥ 7.0 mg/L.	The 5th percentile of the data must be 7.2 - 7.0 mg/L. Initiate baseline monitoring for this variable.
Turbidity[a]	Changes in turbidity are related to minor man-made modifications (e.g. gravel mining upstream). Some silting of habitats is expected.	Initiate baseline monitoring for this variable.
Nutrients		

Metrics	EcoSpecs	TPCs
TIN	The 50th percentile of the data must be ≤ 0.25 mg/L.	The 50th percentile of the data must be 0.2 - 0.25 mg/L.
PO_4-P	The 50th percentile of the data must be ≤ 0.015 mg/L.	The 50th percentile of the data must be 0.012 - 0.015 mg/L.
Response variables		
Chl-a phytoplankton	The 50th percentile of the data must be < 15 µg/L.	The 50th percentile of the data must be 12 - 15 µg/L.
Chl-a periphyton	The 50th percentile of the data must be ≤ 12 mg/m^2.	The 50th percentile of the data must be 10 - 12 mg/m^2.
Toxics		
Fluoride	The 50th percentile of the data must be ≤ 1.5 mg/L.	The 50th percentile of the data must be 1.2 - 1.5 mg/L.
Ammonia (NH_3-N)	The 50th percentile of the data must be ≤ 0.015 mg/L.	The 50th percentile of the data must be 0.012 - 0.015 mg/L.
Other toxics	The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) or the A Category boundary as stated in DWAF (2008).	An impact is expected if the 95th percentile of the data exceeds the TWQR as stated in DWAF (1996) or the upper limit of the A Category boundary as stated in DWAF (2008).

(a) N/A- No data were available for this assessment

Table 7.13: EcoSpecs and TPCs for the Duiwenhoks Estuary

Component	EcoSpecs	Thresholds of Potential Concern
Water quality	Salinity distribution not to cause exceedance of TPCs for biota.	▪ Salinity > 0 at head of estuary ▪ Average salinity in Zone D > 5 ▪ Average salinity in Zone C > 20 ▪ Average salinity 5 km upstream from mouth > 20 more than three months of the year
	System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 6.0 < pH > 7.5 ▪ DO < 5 mg/ℓ ▪ Suspended solids > 5 mg/ℓ (low flow) Estuary: ▪ Average turbidity > 10 NTU (low flow) ▪ Average 6.0 < pH > 8.5 (increasing with increase in salinity) ▪ Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause an exceedance of TPCs for macrophytes and microalgae.	River inflow: ▪ NOx-N >150 µg/ℓ over 2 consecutive months ▪ NH3-N > 20 µg/ℓ over 2 consecutive months ▪ PO4-P > 20 µg/ℓ over 2 consecutive months Estuary (except during upwelling or floods): ▪ Average NOx-N > 150 µg/ℓ single concentration > 200 µg/ℓ ▪ Average NH3-N > 20 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average PO4-P > 20 µg/ℓ during survey, single concentration > 50 µg/ℓ
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be confirmed) ▪ Pesticides/herbicides (to be confirmed) Estuary ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) ▪ Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.14: EcoSpecs and TPCs for the Goukou Estuary

EcoSpecs	TPC
Water quality	
Salinity distribution not to cause exceedance of TPCs for biota.	▪ Salinity > 0 at head of estuary. ▪ Average salinity in Zone D > 5. ▪ Average salinity in Zone C > 20. ▪ Average salinity 5 km upstream from mouth > 20 more than three months of the year.
System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 6.0 < pH > 7.5. ▪ DO < 5 mg/L. ▪ Suspended solids >5 mg/L (low flow). Estuary: ▪ Average turbidity >10 Nephelometric Turbidity Units (NTU) (low flow). ▪ Average 6.0 < pH > 8.5 (increasing with increase in salinity). ▪ Average DO < 5 mg/L.
Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause in exceedance of TPCs for macrophytes and microalgae.	River inflow: ▪ NO_x-N >150 µg/L over two consecutive months. ▪ NH_3-N > 20 µg/L over two consecutive months. ▪ PO_4-PP > 20 µg/L over two consecutive months. Estuary (except during upwelling or floods): ▪ Average NO_x-N 150 µg/L single concentration > 200 µg/L. ▪ Average NH_3-N > 20 µg/L during survey, single concentration > 100 µg/L. ▪ Average PO_4-P > 20 µg/L during survey, single concentration > 50 µg/L.
Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be refined and confirmed through future monitoring). ▪ Pesticides/herbicides (to be refined and confirmed through future monitoring). Estuary: ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for Coastal Marine Waters (DWAF, 1995). ▪ Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.15: Water Quality EcoSpecs and TPCs for the Gouritz Estuary

Component	EcoSpecs	Thresholds of Potential Concern
Water Quality	Salinity distribution not to cause exceedance of TPCs for biota.	▪ Salinity > 0 at head of estuary ▪ Average salinity in Site 11, 1 km upstream of bridge > 5 ▪ Average salinity in Zone C > 20 ▪ Average salinity 11 km upstream from mouth > 20 more than three months of the year ▪ Salinity > 40 in saltmarsh sediments (linked to decrease in moisture and drying of floodplain habitat).
	System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 7.0 < pH > 8.3 ▪ DO < 5 mg/ℓ ▪ Suspended solids > 5 mg/ℓ (low flow) Estuary: ▪ Average turbidity > 10 NTU (low, calm condition flow, wind mixing can increase turbidity to 20-40 NTU) ▪ Average 7.0 < pH > 8.5 (increasing with increase in salinity) ▪ Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause exceedance of TPCs for macrophytes and microalgae.	River inflow: ▪ NOx-N > 100 µg/ℓ over two consecutive months ▪ NH3-N > 20 µg/ℓ over two consecutive months ▪ PO4-P > 20 µg/ℓ over two consecutive months Estuary (except during upwelling or floods): ▪ Average NOx-N > 100 µg/ℓ single concentration > 150 µg/ℓ ▪ Average NH3-N > 20 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average PO4-P > 20 µg/ℓ during survey, single concentration > 50 µg/ℓ
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be confirmed) ▪ Pesticides/herbicides (to be confirmed) Estuary ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) Concentrations in sediment exceed target values as per Western Indian Ocean (WIO) Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

Table 7.16: EcoSpecs and TPCs for the Wilderness System

Component	EcoSpecs	Thresholds of Potential Concern
Water quality	Salinity	Estuary in the closed state: ▪ Average salinity in Zone A < 12, ▪ Average salinity in Zone B: < 10 ▪ Average salinity in Zone C < 5 Lakes average salinity +2 from baseline (2013) and variability do not increase as below: ▪ Serpentine: 12 ± 10 ▪ Eilandvlei: 8 ± 5 ▪ Langvlei: 10 ± 4 ▪ Rondevlei: 10 ± 5
	System variables (pH, dissolved oxygen and turbidity) not to cause exceedance of TPCs for biota.	River inflow: ▪ 6.0 < pH > 7.0 (Touw) ▪ 7.0 < pH > 8.0 (Duiwe) ▪ DO < 5 mg/ℓ ▪ Suspended solids > 5 mg/ ℓ (low flow) Estuary: ▪ Average turbidity > 5 NTU (low flow) ▪ Average 6.0 < pH > 8.5 (increasing with increase in salinity) ▪ Average DO < 5 mg/ℓ Lakes: ▪ Average turbidity > 5 NTU ▪ Average 7.0 < pH > 8.5 ▪ Average DO < 5 mg/ℓ
	Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause exceedance of TPCs for macro-phytes and microalgae.	River inflow: ▪ NO_x-N > 50 µg/ℓ over two consecutive months ▪ NH_3-N > 10 µg/ℓ over two consecutive months ▪ PO_4-P > 10 µg/ℓ over two consecutive months Estuary (except during upwelling or floods): ▪ Average NO_x-N > 50 µg/ℓ single concentration > 100 µg/ℓ ▪ Average NH_3-N > 10 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average PO_4-P > 10 µg/ℓ during survey, single concentration > 50 µg/ℓ Lakes: ▪ Average NO_x-N > 50 µg/ℓ during survey, single concentration > 100 µg/ℓ ▪ Average NH_3-N > 20 µg/ℓ during survey (to be confirmed) ▪ Average PO_4-P > 20 µg/ℓ during survey (to be confirmed)
	Presence of toxic substances (e.g. trace metals and pesticides/herbicides) not to cause exceedance of TPCs for biota.	River inflow: ▪ Trace metals (to be confirmed) ▪ Pesticides/herbicides (to be confirmed) Estuary: ▪ Concentrations in water column exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995) ▪ Concentrations in sediment exceed target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)

8. WETLANDS

Table 8.1: Wetlands - Quaternary Protection Specification

Quaternary catchment	EIS	PES	REC	How to achieve the REC
K10A	Moderate	C	C	Control invasive alien vegetation, erosion and land-use encroachment.
K10B	Moderate	C	C	
K10C	Moderate	B/C	B/C	
K10D	Moderate	B/C	B/C	
K10E	Moderate	B/C	B/C	
K10F	Moderate	C	C	
K20A	Moderate	C	C	
K30A	High	C	C	
K30B	High	D	C/D	Buffers in urban and agricultural areas, manage water quality, erosion and invasive vegetation.
K30C	Moderate	D	D	Control invasive alien vegetation, erosion and land-use encroachment.
K30D	Very High	B	B	
K40A	Moderate	D	D	
K40B	Moderate	C	C	
K40C	Moderate	C	C	
K40D	Very High	B	B	
K40E	Moderate	B/C	B/C	
K50A	Moderate	B/C	B/C	
K50B	High	C/D	C	Protect and improve the condition of remaining wetland patches, control invasive vegetation.
K60A	Moderate	B	B	Control invasive alien vegetation, erosion and land-use encroachment.
K60B	Moderate	B	B	
K60C	Moderate	B	B	
K60D	High	A	A	
K60E	High	C	C	
K60F	High	C	C	
K60G	Moderate	C	C	
K70A	Moderate	C	C	
K70B	Low	A	A	
H80A	HIGH	C/D	C	
H80B	Moderate	C	C	
H80C	Moderate	D	D	
H80D	Moderate	D	D	
H80E	Moderate	C/D	C/D	
H90A	Moderate	C	C	

Quaternary catchment	EIS	PES	REC	How to achieve the REC
H90B	Moderate	D	D	Control invasive alien vegetation, erosion and land-use encroachment.
H90C	Moderate	D	D	
H90D	Moderate	C	C	
H90E	Moderate	C/D	C/D	
J11D	Low	C	C	
J11F	Moderate	C	C	
J11G	Moderate	B	B	
J12A	Moderate	B	B	
J12B	Moderate	B	B	
J12J	Moderate	B	B	
J12K	Moderate	B	B	
J12L	Moderate	C	C	
J21A	Moderate	B/C	B/C	
J21B	Moderate	B	B	
J22B	Moderate	B	B	
J22G	Moderate	B	B	
J22K	Low	B/C	B/C	
J23E	Low	C	C	
J23J	Moderate	B	B	
J24F	Low	C	C	
J25A	Low	B	B	
J33B	Low	C	C	
J33E	Low	C	C	
J34C	Low	C	C	
J34D	Low	C	C	
J34E	Low	C/D	C/D	
J34F	Low	D	D	
J40B	Low	B	B	
J40C	Moderate	C/D	C/D	
J40D	Moderate	D	D	
J40E	High	C	C	

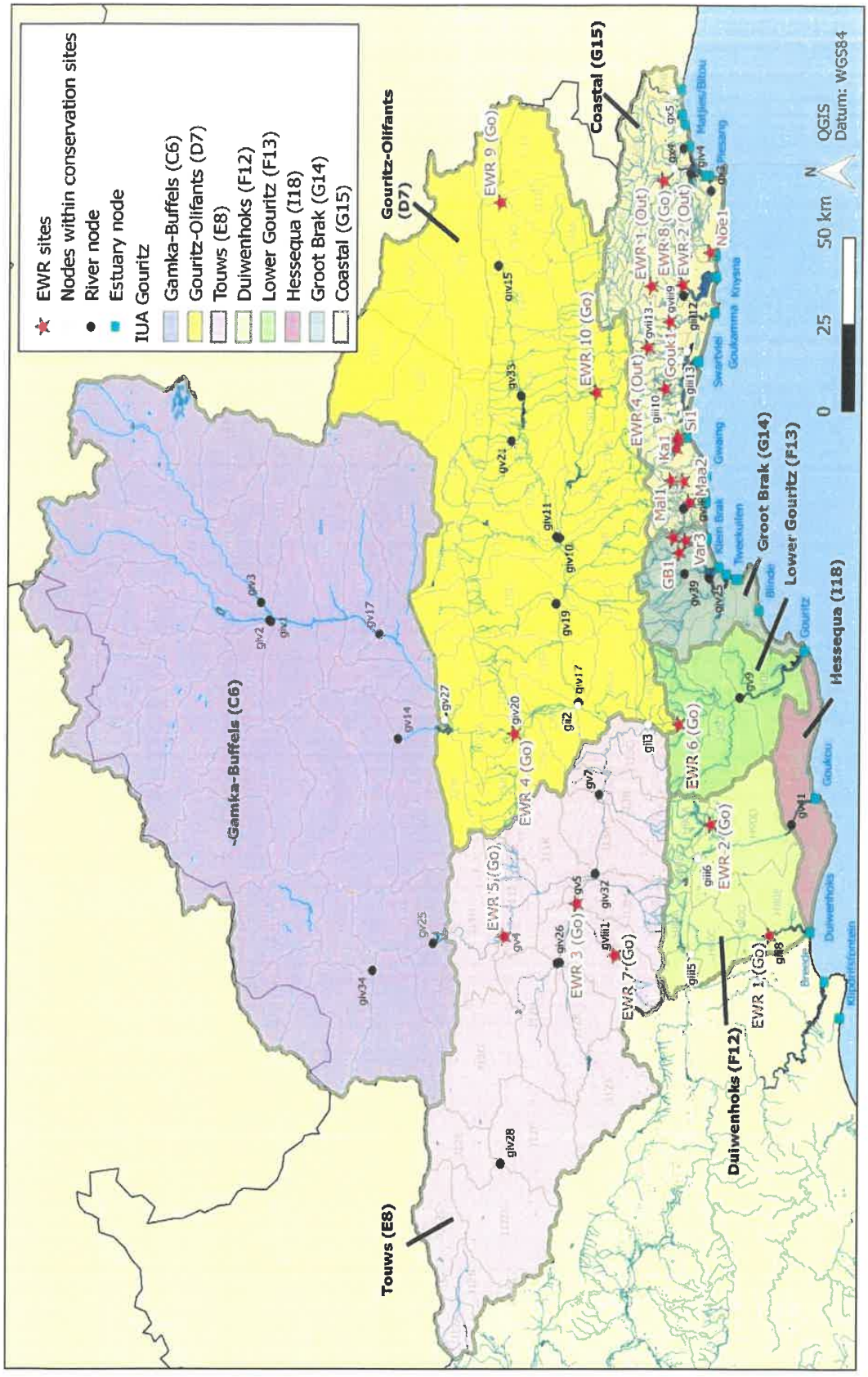

Figure 1: Locations of Gouritz region river/estuary nodes and EWR sites

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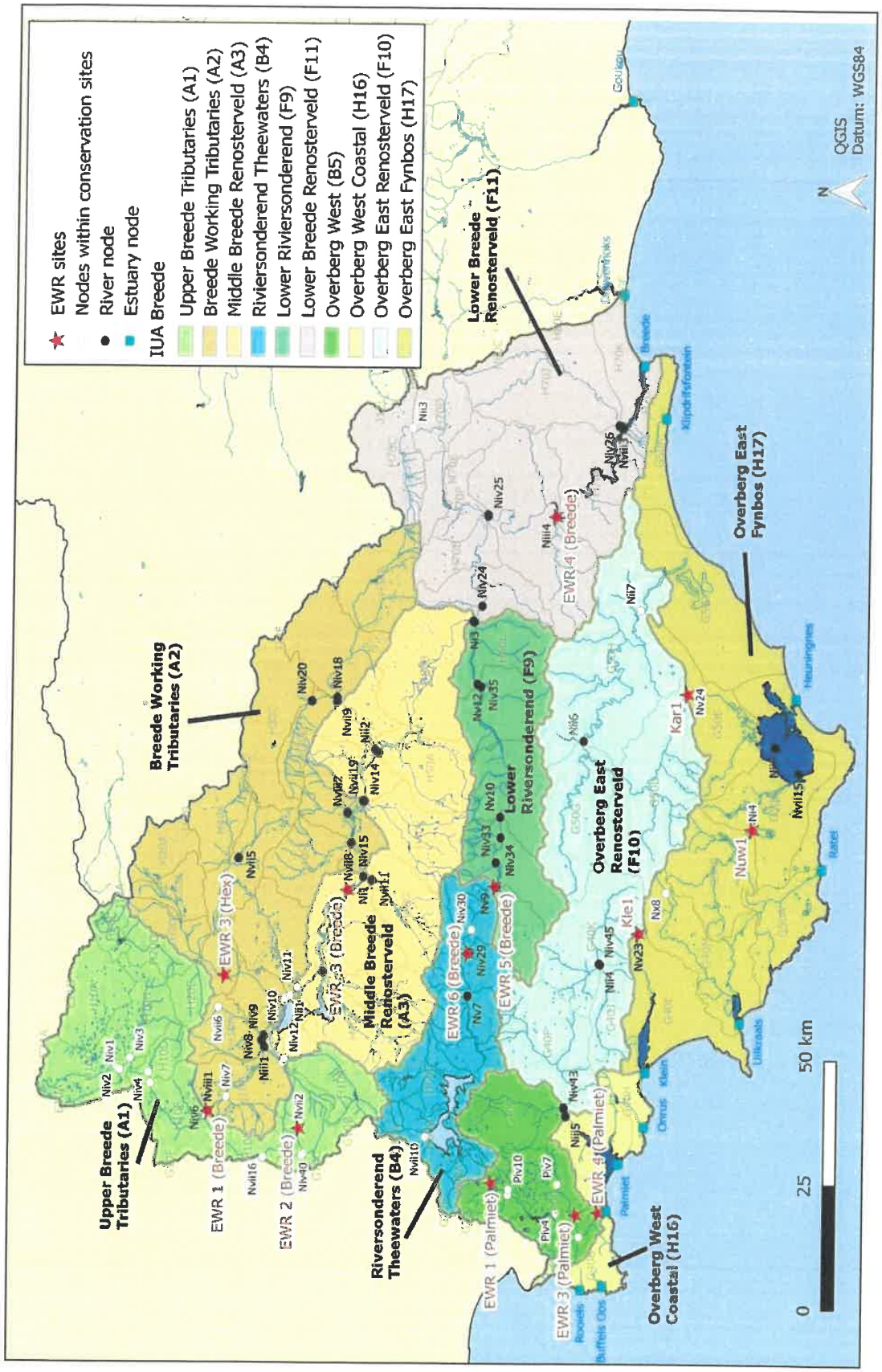

Figure 2: Locations of Breede-Overberg region river/estuary nodes and EWR sites

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