# DEPARTMENT OF WATER AND SANITATION

NO. 1559

3 December 2021

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

RESERVE DETERMINATION FOR WATER RESOURCES OF THE CROCODILE WEST AND MARICO CATCHMENTS IN TERMS OF SECTION 16(1) AND (2) OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

I Senzo Mchunu, in my capacity as Minister of 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 *Gazette* No. 33541, 17 September 2010), and duly authorised in terms of sections 16(1) and 63(1)(a) of the Act, after having complied with section 16(2) and (3) of the Act, hereby publish the Reserve determination for water resources of the Crocodile West and Marico catchments.

Director: Reserve Determination Attention: Mr Yakeen Atwaru Department of Water and Sanitation Ndinaye Building 178 Francis Baard Street Private Bag X313 Pretoria 0001 Email: <u>atwaruy@dws.gov.za</u>

SÉNZO MCHÚNU (MP) MINISTER OF WATER AND SANITATION DATE: (3) (6) (20 2)

# SCHEDULE

RESERVE DETERMINATION OF WATER RESOURCES FOR THE CROCODILE WEST AND MARICO CATCHMENTS IN TERMS OF SECTION 16(1) AND (2) OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

### 1. ACRONYMS AND DEFINITIONS

# 1.1. List of Acronyms

| ASPT     | Average Score Per Taxon                       |
|----------|---|
| BHN      | Basic Human Needs                             |
| CEV      | Chronic Effects Value                         |
| DWA      | Department of Water Affairs                   |
| DWAF     | Department of Water and Forestry              |
| DWS      | Department of Water and Sanitation            |
| EcoSpecs | Ecological Specifications                     |
| EIS      | Ecological Importance and Sensitivity         |
| EWR      | Ecological Water Requirements                 |
| FRAI     | Fish Response Assessment Index                |
| GRDM     | Groundwater Reserve Determination Methodology |
| GW       | Ground Water                                  |
| HN       | Hydro-Node                                    |
| MCM      | Million Cubic Metres                          |
| MLF      | Maintenance Low Flow                          |
| NMAR     | Natural Mean Annual Runoff                    |
| NTU      | Nephelometric Turbidity Units                 |
| PAI      | Physico-chemical Driver Assessment Index      |
| PES      | Present Ecological Status                     |
| RC       | Reference Condition                           |
| REC      | Recommended Ecological Category               |
| RHP      | River Health Programme                        |
| SRP      | Soluble Reactive Ortho-Phosphorus             |
| TIN      | Total Inorganic Nitrogen                      |
| TPCs     | Thresholds of Potential Concern               |
| WMS      | Water Management System                       |
| WRC      | Water Research Commission                     |
| WQ       | Water Quality                                 |
| WQSU     | Water Quality Subunits                        |

#### 1.2. Definitions

In this Schedule any word to which a meaning has been assigned in the National Water Act shall bear the meaning so assigned and, unless the context otherwise indicates -

- "Baseflow" is a sustained low flow in rivers during dry or fair weather conditions, but not necessarily all contributed by groundwater; and includes contribution from delayed interflow and groundwater discharge;
- "Class of a Water Resource" means a set of desired characteristics for use and ecological condition for significant water resources in a given catchment (integrated unit of analysis). The Class must describe the extent of use of the water resource; the Reserve; the resource quality objectives and the determination of the allocable portion of the water resource for use. Water resources must be classified into one of the three classes, Class I water resource Class II water resource and Class III water resource;
- "Ecological Category means the ecological condition to a water resource that reflects the deviation of the biophysical components of the water resource from the natural reference condition;
- "Ecological Importance and Sensitivity" (EIS) means key indicators in the ecological categorisation 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 Requirement" (EWR) means the flow patterns (the magnitude, timing and duration thereof) and the water quality needed to maintain a riverine ecosystem in a particular condition and refers to both the quantity and quality components of a riverine ecosystem;
- "EWR Sites" means 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);
- "Recharge" means 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) means 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" means 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) means modelling points representative of an upstream reach or area of an aquatic eco-system (rivers, wetlands, estuaries and groundwater) for which a suite of relationships apply.

#### 2. DESCRIPTION OF WATER RESOURCE

2.1 The Reserve is determined for all or part of every significant water resource within the catchments of the Crocodile (West) and Marico, as set out below:

| Water Management Area: | Limpopo  |
|------------------------|--|
| Drainage Region:       | A21 to A24, A31 & A32 Tertiary Drainage Region |
| River(s):              | Crocodile (West) and Marico river systems      |

- 2.2 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.
- 2.3 The Minister, in terms of section 16(1) and (2) of the Act, declares the following Reserves for the Crocodile West and Marico catchments.

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

A summary of the quantity component for the Rivers which include the EWR (**Figure 1**) and the BHN in terms of section 16(1) of the Act for the Crocodile (West) and Marico catchment is set out in Section 4. **Table 4.1& 4.2** includes the results of the EWR sites and the biophysical nodes;

A summary of the quality component for the River at EWR sites in terms of section 16(1) of the Act for the Crocodile (West) and Marico catchments is set out in **Table 5.1-5.24**;

A summary of the groundwater contribution to the Reserve for Water Quantity in terms of section 16(1) of the Act for the Crocodile (West) and Marico catchment is set out in **Table 6.1**;

A summary of the groundwater contribution to the Reserve for Water Quality in terms of section 16(1) of the Act for the Crocodile (West) and Marico catchment is set out in **Table 7.1**, **7.2** and **7.3**;

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

# 4. SURFACE-WATER - QUANTITY COMPONENT FOR RIVERS

Proposed results for the Reserve determination and ecological categorisation for the Crocodile (West) and Marico catchment, where the Reserve amounts are expressed as a percentage of the NMAR for the respective catchments (cumulative) in terms of section (16)(1).

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| Node Name              | Quaternary<br>Catchment | River Name   | PES | EIS       | Recommended<br>Ecological<br>Category to be<br>maintained | NMAR<br>(MCM) <sup>1</sup> | EWR<br>% NMAR <sup>2</sup> | BHN<br>Reserve <sup>3</sup><br>(%NMAR) | Total<br>Reserve <sup>4</sup><br>(%NMAR) |
|------------------------|-------------------------|--|-----|-----------|---|----------------------------|----------------------------|--|--|
| EWR site<br>Croc_EWR1  | A21 H                   | Crocodile River from Jukskei confluence to inflow<br>Hartbeespoort Dam   | ٩   | Moderate  | ۵   | 231.05                     | 24.07                      | 0.17                                   | 24.24                                    |
| EWR site<br>Croc EWR2  | A21C                    | Jukskei River  | ш   | Moderate  | ٥   | 139.9                      | 29.19                      | 3.55                                   | 32.74                                    |
| EWR site<br>Croc EWR3  | A21J                    | Crocodile from Hartbeespoort Dam to upstream Roodekopjes<br>Dam  | C/D | High      | C/D   | 143.3                      | 25.02                      | 0.84                                   | 25.87                                    |
| EWR site<br>Croc EWR4  | A23B                    | Pienaars from Roodeplaat Dam to outlet of quaternary catchment   | U   | High      | U   | 28.2                       | 30.81                      | 1.18                                   | 31.99                                    |
| EWR Site<br>Croc EWR5  | A23J                    | Moretele (Pienaars) to confluence with Crocodile   |     | High      | ۵   | 113.0                      | 11.82                      | 5.23                                   | 17.05                                    |
| EWR site<br>Croc EWR6  | A22J                    | Hex from Bospoort Dam to inflow Vaalkop Dam  | ٥   | Moderate  | ۵   | 26.9                       | 14.96                      | 1.35                                   | 16.31                                    |
| EWR Sites<br>Croc EWR7 | A24C                    | Crocodile River outflow Roodekopjes Dam to upstream Sand<br>River confluence, Sleepfonteinspruit, Klinspruit tributaries                             | ۵   | Moderate  | D   | 463.4                      | 13.9                       | 0                                      | 13.9                                     |
| EWR Site<br>Croc_EWR8  | A24J                    | Lower Crocodile from Bierspruit confluence to confluence with<br>Limpopo   | 0   | Moderate  | D   | 565.16                     | 7.48                       | 60.0                                   | 7.57                                     |
| Croc Rapid<br>EWR9     | A21F                    | Magalies below Maloney's Eye   | -   | Moderate  | B   | 14.61                      | 45.93                      | 0.58                                   | 46.51                                    |
| Croc<br>Rapid_EWR10    | A22A                    | Upper reaches of Elands (source) to Swartruggens Dam   | U   | Moderate  | B/C   | 10.1                       | 30.48                      | 3.66                                   | 34.14                                    |
| Croc<br>Rapid_EWR11    | A21K                    | Upper reaches of Sterkstroom (source) to inflow Buffelspoort<br>Dam  | υ   | High      | υ   | 13.95                      | 28.41                      | 5.76                                   | 34.17                                    |
| Croc<br>Rapid_EWR12    | A23G                    | Plat River   | C/D | Moderate  | C/D   | 4.864                      | 23.08                      | 14.20                                  | 37.28                                    |
| Croc<br>Rapid EWR13    | A22E                    | Elands from Lindleyspoort Dam to Vaalkop Dam   | U   | Low       | v   | 18.77                      | 21.90                      | 0.312                                  | 22.21                                    |
| Croc<br>apid EWR14     | A22H                    | Waterkloofspruit to confluence with Hex  | B/C | Low       | B/C   | 5 469                      | 28.27                      | 38.44                                  | 66.71                                    |
| Croc Rapid<br>EWR15    | A21F                    | Magalies, Klein Magalies, Bloubank   | сЪ  | Low       | C/D   | 21.89                      | 21.18                      | 0.39                                   | 21.57                                    |
| Croc Rapid<br>EWR 16   | A21A                    | Rietvlei (source)  | v   | Low       | U   | 4.788                      | 27.83                      | 28.865                                 | 56.69                                    |
| EWR site<br>Mar_EWR1   | A31A                    | Marico Eye, Kaaloog-se-Loop, Bokkraal-se-Loop,<br>Ribbokfontein-se-Loop, Rietspruit (southern eye),<br>Kuilsfontein. Svferfontein. Bronkhorstfontein | m   | Very high | æ   | 10.539                     | 76.32                      | 0                                      | 76.32                                    |
| EWR Site<br>Mar_EWR2   | A31B                    | Groot Marico main stem upstream to Polkadraaispruit confluence   | 8   | Very high | в   | 42.08                      | 50.26                      | 0.03                                   | 50.29                                    |
| EWR Site               | A31E                    | Marico Groot Marico from outflow Marico Bosveld Dam to   |     |           |   |                            |                            |  |  |

# CONTINUES ON PAGE 130 OF BOOK 2

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|---|---|---|--|
| Total<br>Reserve <sup>4</sup><br>(%NMAR)                  | 7.97  | 11.75   | 49.39                                      |
| BHN<br>Reserve <sup>3</sup><br>(%NMAR)                    | 0.01  | 0.05  | 0.13                                       |
| EWR<br>% NMAR <sup>2</sup>                                | 7.96  | 11.70   | 49.27                                      |
| NMAR<br>(MCM) <sup>1</sup>                                | 153.25  | 16.25   | 9.87                                       |
| Recommended<br>Ecological<br>Category to be<br>maintained | U   | U   | 8  |
| EIS   | High  | Moderate  | Moderate                                   |
| PES   | ပ   | υ   | B/C  |
| River Name  | Marico from Molatedi Dam to confluence with Limpopo,<br>Rasweu, Maselaje rivers | Klein Marico from Klein Maricopoort Dam to Kromellemboog<br>Dam | Polkadraaispruit to confluence with Marico |
| Quaternary<br>Catchment                                   | A32D  | A31E  | A31B                                       |
| Node Name   | EWR Site<br>Mar_EWR4  | EWR Site<br>Mar_EWR5  | Mar<br>Rapid_EWR6                          |

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NMAR is the Natural Mean Annual Runoff. This amount represents the long term mean based on the NMAR. If the NMAR changes, this volume will also change. Represents the percentage of BHN. The total Reserve amount accounts for both the Ecological Reserve and the Basic Human Needs Reserve (BHN).

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| Node Name            | Quaternary<br>Catchment | River Name   | PES | EIS       | Recommended<br>Ecological<br>Category to be<br>maintained | NMAR<br>(MCM) <sup>1</sup> | EWR<br>% NMAR <sup>2</sup> | BHN<br>Reserve <sup>3</sup><br>(%NMAR) | Total<br>Reserve⁴<br>(%NMAR) |
|----------------------|-------------------------|--|-----|-----------|---|----------------------------|----------------------------|--|------------------------------|
| HN1                  | A21A                    | Hennops River upstream Rietvlei Dam                                    | c   | Low       | υ   | 11.66                      | 27.83                      | 11.84                                  | 39.67                        |
| HN25                 | A22H                    | Hex from Olifantsnek Dam to Bospoort Dam, Sandspruit                   | ٥   | Moderate  | D   | 12.11                      | 15.26                      | 17.36                                  | 32.62                        |
| HN29                 | A22A                    | Elands from Swartruggens Dam to Lindleyspoort Dam                      | υ   | High      | c   | 12.87                      | 23.99                      | 2.88                                   | 26.87                        |
| HN30                 | A22B                    | Upper Koster (source) to Koster Dam                                    | U   | High      | v   | 2.54                       | 22.77                      | 15.19                                  | 37.97                        |
| EWR Site<br>Mar_EWR2 | A31B                    | Groot Marico main stem upstream to Polkadraaispruit confluence         | ۵   | Very high | в   | 42.08                      | 50.26                      | 0.03                                   | 50.29                        |
| HN63                 | A31B                    | Groot Marico from Polkadraaispruit confluence to<br>Marico Bosveld Dam | 8   | Very high | В   | 56.92                      | 50.61                      | 0.02                                   | 50.63                        |
| HN65                 | A31E                    | Klein Marico from Zeerust to Klein Maricopoort Dam                     | C/D | Moderate  | C/D   | 16.25                      | 14.26                      | 0.05                                   | 14.31                        |
| HN43                 | A24H                    | Sand to confluence with Crocodile                                      | æ   | High      | 8   | 26.56                      | 27.04                      | 1.93                                   | 28.97                        |

NMAR is the Natural Mean Annual Runoff. This amount represents the long term mean based on the NMAR. If the NMAR changes, this volume will also change. Represents the percentage of BHN. The total Reserve amount accounts for both the Ecological Reserve and the Basic Human Needs Reserve (BHN).

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SUMMARY OF SURFACE WATER QUALITY COMPONENT FOR RIVERS AT EWR SITES ທີ

EWR 1: A21H-CROCODILE RIVER, Upstream of the Hartbeespoort Dam

| River                      | Crocodile River  | DWA Water Q  | DWA Water Quality Monitoring points           | ooints   |
|----------------------------|--|--|---|--|
| WQSU                       | 3  | RC   | A2H013 Magalies<br>2007( <i>n</i> =205)       | A2H013 Magalies River at Scheerpoort 2002-<br>2007( <i>n</i> =205) |
| EWR Site                   | EWR1   | PES  | A2H012 at Kalkhe<br>2004-2008( <i>n</i> =118) | A2H012 at Kalkheuwel on Crocodile River<br>2004-2008(n=118)        |
| Water Quality Constituents | nstituents   | Value  |   | Category/Comment   |
|                            | MgSO4  | 72.755   |   | F(5)   |
|                            | Na <sub>2</sub> SO <sub>4</sub>                                    | 13.465   |   | A(0)   |
| Inorganic                  | MgCl <sub>2</sub>  | 1.368  |   | A(0)   |
| Salts (mg/L)               | CaCl <sub>2</sub>  | 15.198   |   | A(0)   |
|                            | NaCI   | 109.399  |   | B(1)   |
| Nutrients (mg/L)           | PO4  | 0.610  |   | E(4)   |
|                            | NIL  | 4.848  |   | E(4)   |
| Physical variables         | pH (pH units)  | 7.4-8.3  |   | B(1)   |
|                            | Temperature(°C)  | 16 (Single measurement)                            | surement)                                     | Raised due to sewage/sealed surfaces                               |
|                            | Dissolved oxygen<br>(mg/L)   | 6.3  |   | C(2)Riffles covered  |
|                            | Electrical Conductivity<br>(mS/m)                                  | 66.56  |   | C(2)   |
| Response variable          |  | 1  |   | D<br>High algal concentrations                                     |
|                            | Biotic community composition -<br>macro-invertebrates (ASPT) score | 4.07-4.25  |   | u  |
|                            | Fish score (FRAI)  | 44.5   |   | ٥  |
|                            | In-stream toxicity   | Weekly from waste<br>water works, high in organics | aste<br>gh in organics                        |  |
| Toxics                     | Ammonia(mg/L)  | 32   |   | B(1)   |
| Overall site ecologi       | Overall site ecological category (from PAI model)                  | Δ  |   | 1.1- I   |

Table 5.1: PES categories and overall site assessment for EWR Site 1

| RIVER                 |                                   | Crocodile (West) River                           | WATER QUALITY MONITORING POINTS                                   | <b>AONITORING POIN</b>                       | TS   |  |
|-----------------------|-----------------------------------|--|---|--|--|--|
| WQSU                  |                                   | 3  | DWAWQWMS  | A2H012 Croc                                  | A2H012 Crocodile River at Kalkheuwel   |  |
| <b>EWR SITE</b>       |                                   | EWR1   | RHP   | Currently se                                 | Currently several monitoring sites   |  |
| Confidence ir         | Confidence in PES assessment      | Medium   |   |  |  |  |
| Water Quality         | Water Quality constituents        | PES Category                                     | WQ Ecospecs   | Improvement<br>required?                     | TPC  | Monitoring<br>frequency                            |
|                       | MgSO₄                             |  | >45mg/L   |  | 95 <sup>th</sup> percentile to be<45mg/L   | •  |
|                       | Na <sub>2</sub> SO <sub>4</sub>   |  | <20mg/L   |  | 95 <sup>th</sup> percentile to be<20mg/L   | 1  |
| salts (ma/L)          | MgCl <sub>2</sub>                 |  | <15mg/L   | N/A  | 95 <sup>th</sup> percentile to be<15mg/L   | Monthly  |
|                       | CaCl <sub>2</sub>                 |  | <21mg/L   |  | 95 <sup>th</sup> percentile to be<21mg/L   |  |
|                       | NaCI                              |  | <191mg/L  |  | 95 <sup>th</sup> percentile to be<191mg/L  |  |
| Nutrients             | SRP                               | Category=E                                       | <0.125mg/L  | Yes, to D                                    | 50 <sup>th</sup> percentile to be<0.125mg/L  | Monthly  |
| (mg/L)                | TIN                               | Category=E                                       | <4.0mg/L  | Yes, to D                                    | 50 <sup>th</sup> percentile to be<4.0mg/L  | Monthly  |
|                       | Hd                                | Neutral river                                    | 5 percentile(5.9-<br>6.5)95 <sup>th</sup> percentile<br>(8.0–8.8) | N<br>N                                       | 5 <sup>th</sup> bercentile(5.9-6.5)95 peltcentile(8.0<br>-8.8)   | Monthly  |
| Physical<br>Variables | Temperature                       | Limited data and is impacted by                  | Maintain range  | N/A  | Initiate baseline monitoring for this variable.  | When Biotic  |
|                       | Dissolved oxygen                  | and urbanisation.                                | 7-8mg/L   | N/A  | 5 <sup>th</sup> percentile to be>6.1mg/L. Initiate<br>Baseline monitoring for this variable.   | undertaken   |
|                       | Turbidity (NTU)                   | Turbid after heavy rains.                        | Moderate change<br>allowed  | N/A  | Initiate baseline monitoring for this<br>Variable and maintain natural range.  | Quarterly  |
|                       | Electrical conductivity<br>(mS/m) | Category=C.                                      | <85mS/m   | No   | 95 <sup>th</sup> percentile to be≺85mS/m   | Quarterly  |
|                       | Chla: periphyton                  | Category= D.<br>Visual inspection indicates high | <84mg/m <sup>-2</sup><br>(D category)                             | MICA   | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>  |  |
|                       | Chla: phytoplankton               | algal concentrations on rocks<br>and in pools    |   | NA   | 50 <sup>th</sup> percentile to be<30µg/L   | Quarterry  |
| Response              | Macro-invertebrates<br>(ASPT)     | E (this study)                                   | Con Encourse for fish and investments accountingly                | th and investor                              |  |  |
| Valiables             | Fish community score              | D (this study)                                   |   |  | lesheonveiy  |  |
|                       | In-stream toxicity                |  | Assess only if the b<br>impact is expected if<br>(1996).          | io-monitoring result<br>the 95 percentile of | Assess only if the bio-monitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | ie cause is unknown. An<br>(CEV) as stated in DWAF |
| Toxics                | Ammonia                           | B  | <43.7ug/L   |  | 95 <sup>th</sup> percentile to be<43.7ug/L   | Monthly  |

Table 5.2: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 1: Upstream of the Hartbeespoort Dam

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|  | Jukskei River  | DWAF V                | <b>DWAF Water Quality Monitoring points</b>                        | oints                |
|--|--|-----------------------|--|----------------------|
| WQSU 1                                       |  | S                     | A2H013 Magalies River at Scheerpoort 2002-<br>2007( <i>n</i> =205) | it Scheerpoort 2002- |
| EWR Site EV                                  | EWR2   | PES                   | A2H023 Jukskei River at Nietgedacht 2004-<br>2008(n=114)           | Nietgedacht 2004-    |
| Water Quality Constituents                   | tuents   | Value                 |  | Category/Comment     |
|  | MgSO4  | 71.494                |  | F(5)                 |
|  | Na <sub>2</sub> SO <sub>4</sub>                                | 26.244                |  | B(1)                 |
| Inorganic salts                              | MgCl <sub>2</sub>  | 0.312                 |  | A(0)                 |
| mg/L)  | CaCl2  | 20.236                |  | A(0)                 |
|  | NaCI   | 96.146                |  | B(1)                 |
| Nutrients(mg/L)                              | PO4  | 0.266                 |  | E(4)                 |
|  | NIL  | 5.460                 |  | E(4)                 |
| Physical variables                           | pH (pH units)  | 7.1-8.1               |  | B(1)                 |
|  | Temperature (° C)  | Raised t<br>water tre | Raised temperatures from waste<br>water treatment ponds            | ۵                    |
|  |  |                       |  |                      |
|  | Dissolved oxygen (mg/L)  |                       |  | 1                    |
|  | Electrical Conductivity (mS/m)                                 | 63                    |  | C(2)                 |
| Response variable                            | Chl-a: periphyton (mg/m <sup>2</sup> )                         | 14.41                 |  | D(1)                 |
|  | Biotic community composition - macro-invertebrate (ASPT) score | 3.8-4.0               |  | E/F                  |
|  | Fish score   | 21.4%                 |  | E/F                  |
|  | In-stream toxicity   | 1                     |  |                      |
| Toxics                                       | Ammonia (µg/L)   | 80                    |  | D(3)                 |
| Overall site ecological category (PAI model) | category (PAI model)   | ٥                     |  |                      |

for EWP site 3 Table 5.3: PES

EWR 2: A21C-JUKSKEI RIVER at Heron Bridge School

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| RIVER         |                                   | Juskei River  | WATER QUALITY MONITORING POINTS   | MONITORING POIN  | VTS  |  |
|---------------|-----------------------------------|---|---|--|--|--|
| WQSU          |                                   | 2   | DWAWQWMS  | A2H023 Just  | A2H023 Juskei River at Nietgedacht   |  |
| EWR SITE      |                                   | EWR2  | RHP   | Currently se   | Currently several monitoring sites   |  |
| Confidence i  | Confidence in PES assessment      | Medium  |   |  |  |  |
| Water Quality | Water Quality constituents        | PES Category  | WQ Ecospecs   | Improvement<br>required?                                   | TPC  | Monitoring<br>frequency                          |
|               | MgSO₄                             |   | <45mg/L   |  | 95 <sup>th</sup> percentile to be<45mg/L   |  |
| Inorganic     | Na₂SO₄                            |   | <33mg/L   |  | 95 <sup>th</sup> percentile to be<33mg/L   |  |
| salts (mg/L)  | MgCl <sub>2</sub>                 |   | <15mg/L   | N/A  | 95 <sup>th</sup> percentile to be<15mg/L   | Monthly  |
|               | CaCl <sub>2</sub>                 |   | <21mg/L   |  | 95 <sup>th</sup> percentile to be<21mg/L   |  |
|               | NaCI                              |   | <191mg/L  |  | 95 <sup>th</sup> percentile to be<191mg/L  |  |
| Nutrients     | SRP                               | Category=E  | <0.125mg/L  | Yes, to D  | 50 <sup>th</sup> percentile to be<0.125mg/L  | Monthly  |
| (mg/L)        | TIN                               | Category=E  | <4.0mg/L  | Yes, to D  | 50 <sup>th</sup> percentile to be<4.0mg/L  | Monthly  |
|               | Hd                                | Good  | 5 <sup>th</sup> percentile(5.9-<br>6.5)95 <sup>th</sup> percentile<br>(8.0–8.8) | Yes, to natural  | 5 <sup>Th</sup> bercentile(5.9-6.5) 95 <sup>th</sup> percentile (8.0<br>-8.8)  | Monthly  |
|               | Temperature                       | Limited data and is impacted by                             | Maintain range  | N/A  | Initiate baseline monitoring for this variable.  | When Biotic                                      |
| Variables     | Dissolved oxygen                  | waste water reautient works and urbanisation.               | 7-8mg/L   | N/A  | 5 <sup>th</sup> percentile to be>6.1mg/L. Initiate<br>Baseline monitoring for this variable.   | assessments<br>undertaken                        |
|               | Turbidity (NTU)                   | Turbid after heavy rains.                                   | Moderate change<br>Allowed  | N/A  | Initiate baseline monitoring for this<br>Variable and maintain natural range.  | Quarterly  |
|               | Electrical conductivity<br>(mS/m) | Category=C.   | <85mS/m   | No   | 95 <sup>th</sup> percentile to be<85mS/m   | Quarterly  |
|               | Chla: periphyton                  | Category=C.<br>Visual inspection indicates high             | <84mg/m <sup>2</sup><br>(D category)  | VIN  | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>  |  |
|               | Chla: phytoplankton               | algal concentrations on rocks<br>and in pools               | <15µg/L<br>(D category)   |  | 50 <sup>th</sup> percentile to be<15µg/L   | Quarterly  |
| Response      | Macro-invertebrates<br>(ASPT)     | E/F (this study)  | Soo Erosnare for fish and investments accountingly                              | th and invortation   |  |  |
|               | Fish community score              | E/F (this study)  |   |  | i cohecuted  |  |
|               | In-stream toxicity                | Some toxicity from industry and waste water treatment works | Assess only if the b<br>impact is expected if<br>(1996).                        | io-monitoring result<br>the 95 <sup>th</sup> percentile of | Assess only if the bio-monitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | e cause is unknown. An<br>CEV) as stated in DWAF |
| Toxics        | Ammonia                           | D   | <100ug/L  |  | 95 <sup>th</sup> percentile to be<100ug/L  | Monthly  |
|               |                                   |   |   |  |  |  |

Table 5.4: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 2: Jukskei River at Heron Bridge School

| River                            | Crocodile River   | DWAF Wat            | <b>DWAF Water Quality Monitoring points</b> | ) points  |
|----------------------------------|---|---------------------|---|---|
| wasu                             | ß   | RC                  | A2H013 Magalies F<br>2007( <i>n</i> =205)   | A2H013 Magalies River at Scheerpoort 2002-<br>2007(n=205)     |
| EWR Site                         | EWR3  | PES                 | A2H083 Hartbeesp<br>( <i>n</i> =113)        | A2H083 Hartbeespoort Dam:d/sWeir2004-2008<br>( <i>n</i> =113) |
| WaterQuality Constituents        | ents  | Value               |   | Category/Comment  |
| Inorganic salts                  | MgSO4   | 67.562              |   | F(5)  |
| (mg/L)                           | Na <sub>2</sub> SO <sub>4</sub>                                   | 9.867               |   | A(0)  |
|                                  | MgCl <sub>2</sub>   | 6.856               |   | A(0)  |
|                                  | CaCl <sub>2</sub>   | 27.569              |   | B(1)  |
|                                  | NaCI  | 96.462              |   | B(1)  |
| Nutrients(mg/L)                  | PO4   | 0.123               |   | E(4)  |
|                                  | NIL   | 1.594               |   | B(1)  |
| Physical                         | pH (pH units)   | 7.51-8.73           |   | B(1)  |
| variables                        | Temperature (°C)  | 2 data points       | S   | C(2)  |
|                                  | Dissolved oxygen (mg/L)   | 2 data points       | S   | C/D   |
|                                  | Electrical Conductivity (mS/m)                                    | 59.24               |   | C(2)  |
| Response                         | Chl-a: periphyton (mg/m <sup>2</sup> )                            | Visual observations | rvations                                    | ш   |
| variable                         | Biotic community composition<br>-macro-invertebrates (ASPT) score | 3.8                 |   | ш   |
|                                  | Fish score  | 24.9                |   | ш   |
|                                  | In-stream toxicity  |                     |   |   |
| Toxics                           | Ammonia (mg/L)  | 139                 |   | E(4)  |
| Overall site ecological category | ategory   | D/E                 |   |   |

EWR 3: A21J-CROCODILE RIVER, Downstream of the Hartbeespoort Dam

for EWR site 3 rall cite Tahla 5 5. PES 11

| RIVER                 |                                     | Crocodile (West) River  | WATER QUALITY MONITORING POINTS   | MONITORING POIN  | ITS  |  |
|-----------------------|-------------------------------------|---|---|--|--|--|
| WQSU                  |                                     | 5   | DWAWQWMS  | A2H083 Hart  | A2H083 Hartbeespoort Dam downstream weir   |  |
| <b>EWR SITE</b>       |                                     | EWR3  | RHP   | Currently se   | Currently several monitoring sites   |  |
| Confidence            | <b>Confidence in PES assessment</b> | Medium  |   | -  |  |  |
| Water Qualit          | Water Quality constituents          | PES Category  | WQ Ecospecs   | Improvement<br>required?                                   | TPC  | Monitoring<br>frequency                        |
|                       | MgSO₄                               |   | <45mg/L   |  | 95 <sup>th</sup> percentile to be<45mg/L   |  |
| Inordanic             | Na <sub>2</sub> SO <sub>4</sub>     |   | <20mg/L   |  | 95 <sup>th</sup> percentile to be<20mg/L   |  |
| salts (mg/L)          | MgCl <sub>2</sub>                   |   | <15mg/L   | N/A  | 95 <sup>th</sup> percentile to be<15mg/L   | Monthly  |
| )<br>-                | CaCl <sub>2</sub>                   |   | <57mg/L   |  | 95 <sup>th</sup> percentile to be<57mg/L   |  |
|                       | NaCi                                |   | <191mg/L  |  | 95 <sup>th</sup> percentile to be<191mg/L  |  |
| Nutrients             | SRP                                 | Category=E  | <0.125mg/L  | Yes, to D  | 50 <sup>th</sup> percentile to be<0.125mg/L  | Monthly  |
| (mg/L)                | TIN                                 | Category≕D  | <4.0mg/L  | Yes, to D  | 50 <sup>th</sup> percentile to be<4.0mg/L  | Monthly  |
|                       | Hđ                                  | Good  | 5 <sup>th</sup> percentile(5.9-<br>6.5)95 <sup>th</sup> percentile<br>(8.0-8.8) | Yes, to natural  | 5 <sup>th</sup> percentile(5.9-6.5)95 p <sup>t</sup> brcentile(8.0<br>8.8)   | Monthly  |
| Physical<br>Variables | Temperature                         | Limited data and is impacted by waste water treatment works and urbanisation. | Maintain range  | N/A  | Site is downstream from a dam which will<br>result in fluctuations in temperature and<br>possible biotic response.<br>Biological assessments recommended.<br>Initiate baseline monitoring.   | When Biotic<br>assessments<br>undertaken       |
|                       | Dissolved oxygen                    |   | 7-8mg/L   | N/A  | 5 <sup>th</sup> percentile to be>6.1mg/L. Initiate<br>Baseline monitoring for this variable.   |  |
|                       | Turbidity (NTU)                     | Turbid after heavy rains.   | Moderate change<br>allowed  | N/A  | Initiate baseline monitoring for this<br>Variable and maintain natural range.  | Quarterly                                      |
|                       | Electrical conductivity<br>(mS/m)   | Category=C.   | <85mS/m   | No   | 95 <sup>th</sup> percentile to be<85mS/m   | Quarterly                                      |
|                       | Chla: periphyton                    | Category =C. Visual<br>inspection indicates high algal                        | <84mg/m <sup>2</sup><br>(D category)  | NIA  | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>  |  |
| Doctorio              | Chla: phytoplankton                 | concentrations on rocks and in pools  | <30µg/L<br>(D category)   | <b>E</b> N   | 50 <sup>th</sup> percentile to be<30µg/L   | uuarteny                                       |
| variables             | Macro-invertebrates<br>(ASPT)       | E (this study)  | See Ecospecs for fish and invertebrates respectively                            | sh and invertebrates                                       | respectively   |  |
|                       | In-stream toxicity                  | Some toxicity from industry<br>and waste water treatment<br>works             | Assess only if the b<br>impact is expected if<br>(1996).                        | io-monitoring result<br>the 95 <sup>th</sup> percentile of | Assess only if the bio-monitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | cause is unknown. An<br>CEV) as stated in DWAF |
| Toxics                | Ammonia                             | ш   | <129ug/L  |  | 95 <sup>th</sup> percentile to be<129ug/L  | Monthly  |

Table 5.6: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 3: Crocodile River downstream of the Hartbeespoort Dam

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| ownstream of the Roodeplaat Dam        | all site assessment for EWR site 4   |
|--|--------------------------------------|
| EWR 4: A23B-PIENAARS RIVER, Downstream | Table 5.7: PES categories and overal |

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| River                            | Pienaars River  | DWA Water           | Ouslity Monitoring                        | ocințe<br>1  |
|----------------------------------|---|---------------------|---|--|
| WQSU                             | 15  | RC                  | A2H013 Magalies F<br>2007( <i>n</i> =205) | RC A21013 Magalies River at Scheerpoort 2002-<br>2007/n=205)     |
| EWR Site                         | EWR4  | PES                 | A2H006 Pienaars R<br>(n=118)              | A2H006 Pienaars River at Klipdrift 2004-2008<br>( <i>n</i> =118) |
| Water Quality Constituents       | nstituents  | Value               |   | Category/Comment   |
| Inorganic salts (mg/L)           | g/L) MgSO4  | 51.250              |   | F(5)   |
|                                  | Na <sub>2</sub> SO <sub>4</sub>                                     | 5.120               |   | A(0)   |
|                                  | MgCl <sub>2</sub>   | 3.704               |   | A(0)   |
|                                  | CaCl <sub>2</sub>   | 14.856              |   | A(0)   |
|                                  | NaCI  | 81.789              |   | B(1)   |
| Nutrients (mg/L)                 | PO4   | 0.049               |   | B(1)   |
|                                  | TIN   | 0.442               |   | A(0)   |
| Physical variables               | pH (pH units)   | 7.8-8.4             |   | B(1)   |
|                                  | Temperature (°C)  | 1 data point        |   | B(1) C(2)  |
|                                  | Dissolved oxygen<br>(mg/L)  | 5.5 (2 data points) | oints)                                    |  |
|                                  | Electrical Conductivity<br>(mS/m)                                   | 57.1                |   | C(2)   |
| Response variable                |   | I                   |   | Visual observations  |
|                                  | Biotic community<br>Composition macro-invertebrates<br>(ASPT) score | s<br>5.8            |   | C(2)   |
|                                  | Fish score  | 65.4%               |   | C(2)   |
|                                  | In-stream toxicity  | 1                   |   |  |
| Toxics                           | Ammonia (µg/L)  | 20                  |   | A(0)   |
| Overall site ecological category | jical category  | o                   |   |  |

| RIVER                 |                                   | Pienaars River  | WATER QUALITY I   | WATER QUALITY MONITORING POINTS                             | ITS   |   |
|-----------------------|-----------------------------------|---|---|---|---|---|
| WQSU                  |                                   | 15  | DWAWQWMS  | A2H006 Pier   | A2H006 Pienaars at Klipdrift weir   |   |
| <b>EWR SITE</b>       |                                   | EWR4  | RHP   | Currently se  | Currently several monitoring sites  |   |
| Confidence ir         | Confidence in PES assessment      | Medium  |   |   |   |   |
| Water Quality         | Water Quality constituents        | PES Category  | WQ Ecospecs   | Improvement<br>required?                                    | TPC   | Monitoring<br>frequency                       |
|                       | MgSO₄                             |   | <45mg/L   |   | 95 <sup>th</sup> percentile to be<45mg/L  |   |
| normanic              | Na <sub>2</sub> SO <sub>4</sub>   |   | <20mg/L   |   | 95 <sup>th</sup> percentile to be<20mg/L  |   |
| salts (mo/l)          | MgCl <sub>2</sub>                 |   | <15mg/L   | N/A   | 95 <sup>th</sup> percentile to be<15mg/L  | Monthly                                       |
|                       | CaCl <sub>2</sub>                 |   | <21mg/L   |   | 95 <sup>th</sup> percentile to be<21mg/L  |   |
|                       | NaCI                              |   | <191mg/L  |   | 95 <sup>th</sup> percentile to be<191mg/L   |   |
| Nutrients             | SRP                               | Category=B  | <0.015mg/L  |   | 50 <sup>th</sup> percentile to be<0.15mg/L  | Monthly                                       |
| (mg/L)                | TIN                               | Category=B  | <0.25mg/L   |   | 50 <sup>th</sup> percentile to be<0.25mg/L  | Monthly                                       |
|                       | Hd                                | Category=B, Good  | 5 <sup>th</sup> percentile(5.9-<br>6.5)95 <sup>th</sup> percentile<br>(8.0-8.8) | Yes, to natural   | 5 <sup>th</sup> percentile(5.9-6.5)95 pbrcentile(8.0<br>-8.8)   | Monthly                                       |
|                       |                                   |   |   |   | Site is downstream from a dam which will result in fluctuations in temperature and  |   |
|                       | Temperature                       | Limited data and is impacted by                                   | Maintain range  | N/A   | possible biotic response. Biological  |   |
| Physical<br>Variables |                                   | waste water treatment works<br>and urbanisation.                  |   |   | assessments recommended. Initiate baseline monitoring.  | assessments<br>undertaken                     |
|                       |                                   |   | -   |   | 5 <sup>th</sup> percentile to be>6.1ma/L. Initiate  |   |
|                       | Dissolved oxygen                  |   | 7-8mg/L   | N/A   | Baseline monitoring for this variable.  |   |
|                       | Turbidity (NTU)                   | Turbid after heavy rains.   | Moderate change<br>Allowed  | N/A   | Initiate baseline monitoring for this<br>Variable and maintain natural range.   | Quarterly                                     |
|                       | Electrical conductivity<br>(mS/m) | Category=C  | <85mS/m   | No  | 95 <sup>th</sup> percentile to be<85mS/m  | Quarterly                                     |
|                       | Chla: periphyton                  | Category =C.<br>Visual inspection indicates high                  | <84mg/m <sup>2</sup><br>(D category)  | NICA  | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>   |   |
|                       | Chla: phytoplankton               | algal concentrations on rocks<br>and in pools                     | <30µg/L<br>(D category)   |   | 50 <sup>th</sup> percentile to be<30µg/L  | Quarterry                                     |
| variables             | Macro-invertebrates<br>(ASPT)     | C (this study)  | See Ecospecs for fit  | See Ecospecs for fish and invertebrates respectively        | respectively  |   |
|                       | In-stream toxicity                | Some toxicity from industry<br>and waste water treatment<br>works | Assess only if the b<br>impact is expected if<br>(1996).                        | biomonitoring results<br>the 95 <sup>th</sup> percentile of | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | cause is unknown. An<br>EV) as stated in DWAF |
| Toxics                | Ammonia                           | A   | <15ug/L   |   | 95 <sup>th</sup> percentile to be<15ug/L  | Monthly                                       |

Table 5.8: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 4: Pienaars River downstream of the Roodeplaat Dam

EWR 5: A23J-PIENAARS RIVER, Downstream of the Klipvoor Dam in Borakalalo National Park

| River                            | Pienaars River   | DWA Wat  | DWA Water Quality Monitoring points                                | points              |
|----------------------------------|--|----------|--|---------------------|
| WQSU                             | 17   | S        | A2H013Magalies River at Scheerpoort 2002-2007(n=205)               | at Scheerpoort      |
| EWR Site                         | EWR5   | PES      | A2H021 Pienaars River at Buffelspoort<br>2004-2008( <i>n</i> =107) | r at Buffelspoort   |
| Water Quality Constituents       | tituents   | Value    | Ca   | Category/Comment    |
| Inorganic salts(mg/L)            | MgSO4  | 78.335   | F(5)   | 5)                  |
|                                  | Na <sub>2</sub> SO <sub>4</sub>                                    | 16.527   | A(0)   | (0                  |
|                                  | MgCl <sub>2</sub>  | 3.820    | A(0)   | (0                  |
|                                  | CaCl <sub>2</sub>  | 24.153   | B(1)   | 1)                  |
|                                  | NaCI   | 131.982  | B(1)   | (1                  |
| Nutrients(mg/L)                  | PO4  | 0.598    | B(1)   | 1)                  |
|                                  | TIN  | 0.250    | A(0)   | (0                  |
| Physical variables               | pH(pH units)   | 7.7-8.7  | B(1)   | 1)                  |
|                                  | Temperature (° C)  | 16(n=1)  | Re   | Recovers from dam B |
|                                  | Dissolved oxygen (mg/L)  | 5.2(n=1) |  |                     |
|                                  | Electrical Conductivity(mS/m)                                      | 80.8     | C(2)   | 2)                  |
| Response variable                | Chi-a: periphyton (mg/m <sup>2</sup> )                             |          |  |                     |
|                                  | Biotic community composition - macro-<br>invertebrate (ASPT) score | 5.5      |  |                     |
|                                  | Fish score (FRAI)  | 51.3%    | Δ  |                     |
|                                  | In-stream toxicity   | .1       |  |                     |
| Toxics                           | Ammonia (µg/L)   | 47       | B(1)   | 1)                  |
|                                  | Fluoride (µg/L)  | 600      | A(0)   | (0                  |
| Overall site ecological category | I category   | o        |  |                     |
| >                                |  |          |  |                     |

# Table 5.9: PES categories and overall site assessment for EWR site 5

| RIVER                        |                                   | Pienaars River  | WATER QUALITY MONITORING POINTS  | IONITORING POIN                             | Pienaars River WATER QUALITY MONITORING POINTS   |  |
|------------------------------|-----------------------------------|---|--|---|--|--|
| WQSU                         |                                   | 17  | DWAWQWMS   | A2H021 Pier                                 | A2H021 Pienaars River at Buffelspooort   |  |
| EWR SITE                     |                                   | EWR5  | RHP  | Currently se                                | Currently several monitoring sites   |  |
| Confidence in PES assessment | assessment                        | Medium  |  |   |  |  |
| Water Quality constituents   | tituents                          | PES Category  | WQ Ecospecs  | Improvement<br>required?                    | TPC  | Monitoring frequency                             |
|                              | MgSO₄                             |   | <45mg/L  |   | 95 <sup>th</sup> percentile to be<45mg/L   |  |
| Inornanic salts              | Na₂SO₄                            |   | <20mg/L  |   | 95 <sup>th</sup> percentile to be<20mg/L   |  |
| (ma/L)                       | MgCl <sub>2</sub>                 |   | <15mg/L  | N/A   | 95 <sup>th</sup> percentile to be<15mg/L   | Monthly  |
| 2                            | CaCl <sub>2</sub>                 |   | <57mg/L  |   | 95 <sup>th</sup> percentile to be<57mg/L   |  |
|                              | NaCI                              |   | <191mg/L   |   | 95 <sup>th</sup> percentile to be<191mg/L  |  |
| Nutrients (ma/L)             | SRP                               | Category=D  | <0.015mg/L   |   | 50 <sup>th</sup> percentile to be<0.015mg/L  | Monthly  |
|                              | TIN                               | Category=B  | <0.25mg/L  |   | 50 <sup>th</sup> percentile to be<0.25mg/L   | Monthly  |
|                              | Hd                                | Category=B, Good  | 5 <sup>th</sup> percentile(5.9-<br>6.5) 95 <sup>th</sup> percentile<br>(8.0-8.8) | Yes, to natural                             | 5percentile(5.9-6.5)<br>95 percentile(8.0-8.8)   | Monthly  |
| Physical Variables           | Temperature                       | Limited data and is impacted by<br>waste water treatment works<br>and urbanisation. | Maintain range   | N/A   | Site is downstream from a dam which will<br>result in fluctuations in temperature and<br>possible biotic response. Biological<br>assessments recommended. Initiate<br>baseline monitoring.   | When Biotic assessments<br>undertaken            |
|                              | Dissolved oxygen                  |   | 7-8mg/L  | N/A   | 5 <sup>th</sup> percentile to be>6.1mg/L. Initiate<br>Baseline monitoring for this variable.   |  |
|                              | Turbidity (NTU)                   | Turbid after heavy rains.   | Moderate change<br>allowed   | N/A   | Initiate baseline monitoring for this<br>Variable and maintain natural range.  | Quarterly  |
|                              | Electrical conductivity<br>(mS/m) | Category=C  | <85mS/m  | No  | 95 <sup>th</sup> percentile to be<85mS/m   | Quarterly  |
|                              | Chla: periphyton                  | Category=C.<br>Visual inspection indicates high                                     | <84mg/m (D <sup>*</sup><br>category)   |   | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>  |  |
|                              | Chla: phytoplankton               | algal concentrations on rocks<br>and in pools                                       | <30µg/L (D<br>category)  | AN  | 50 <sup>th</sup> percentile to be<30µg/L   | Quarterly  |
| Response variables           | Macro-invertebrates<br>(ASPT)     | D (this study)  | Con Formand for for  |   |  |  |
|                              | Fish community score              | D (this study)  |  | II AIIU IIIVEILEDIALES                      | respectively   |  |
|                              | In-stream toxicity                | Some toxicity from industry<br>and waste water treatment<br>works                   | Assess only if the bic is expected if the 95 <sup>th</sup>                       | -monitoring results<br>percentile of the da | Assess only if the bio-monitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | use is unknown. An impa<br>stated in DWAF (1996) |
| Toxics                       | Ammonia                           | æ   | <43.75ug/L   |   | 95 <sup>th</sup> percentile to be<43.75ug/L  | Monthly  |

Table 5.10: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 5: Pienaars River downstream of Klipvoor dam

EWR 6: A22J-HEX RIVER, Upstream of the Vaalkop Dam

Table 5.11: PES categories and overall site assessment for EWR site 6

| River                            | Hax River  | DWAF W        | DWAE Water Ouslity Monitoring points            | ta nointe   |
|----------------------------------|--|---------------|---|---|
| WQSU                             | 6  | RC            | A2H013 Magalies Ri                              | A2H013 Magalies River at Scheerpoort 2002-2007( <i>n</i> =205)              |
| EWR Site                         | EWR6   | PES           | A2H094BospoortDa<br>1999-2004( <i>n</i> =22) LO | A2H094BospoortDam d/s weir at Tweedepoort<br>1999-2004(n=22) LOW confidence |
| Water Quality Constituents       | ituents  | Value         |   | Category/Comment  |
| Inorganic salts(mg/L)            | MgSO4  | 133.123       |   | F(5)  |
|                                  | Na <sub>2</sub> SO <sub>4</sub>                                      |               |   | A(0)  |
|                                  | MgCl <sub>2</sub>  | 33.113        |   | C(2)  |
|                                  | CaCl2  | 110.127       |   | E(4)  |
|                                  | NaCI   | 170.523       |   | B(1)  |
| Nutrients(mg/L)                  | PO4  | 0.234         |   | E(4)  |
|                                  | TIN  | 0.775         |   | A(0)  |
| Physical variables               | pH(pHunits)  | 7.6-9.1       |   | C(2)  |
|                                  | Temperature(°C)  | 2 data points | ints  | C(2)  |
|                                  | Dissolved oxygen<br>(mg/L)   | 3 data points | ints  | D(3)  |
|                                  | Electrical Conductivity<br>(mS/m)                                    | 95.3          |   | D(3)  |
| Response variable                | Chl-a: periphyton<br>(mg/m <sup>2</sup> )                            | 1             |   | Visual observations   |
|                                  | Biotic community<br>composition- macro-<br>invertebrate (ASPT) score | 4.6           |   | ш   |
|                                  | Fish score (FRAI)  | 49.1%         |   | Q   |
|                                  | In-stream toxicity   |               |   |   |
| Toxics                           | Ammonia (µg/L)   | 138           |   | E(4)  |
|                                  | Fluoride (µg/L)  | 300           |   | A(0)  |
| Overall site ecological category |  | ۵             |   |   |

| RIVER                 |                                   | Hex River   | WATER QUALITY I  | WATER QUALITY MONITORING POINTS                            | TS  |                                       |
|-----------------------|-----------------------------------|---|--|--|---|---------------------------------------|
| WQSU                  |                                   | 6   | DWAWQWMS   | A2H094 Bos   | A2H094 Bospoort Dam downstream weir   |                                       |
| EWRSITE               |                                   | EWR6  | RHP  | Currently se   | Currently several monitoring sites  |                                       |
| Confidence i          | Confidence in PES assessment      | Medium  |  |  |   |                                       |
| Water Quality         | Water Quality constituents        | PES Category  | WQ Ecospecs  | Improvement<br>required?                                   | TPC   | Monitoring<br>frequency               |
|                       | MgSO4                             |   | <45mg/L  |  | 95 <sup>th</sup> percentile to be<45mg/L  |                                       |
| laoraania             | Na <sub>2</sub> SO <sub>4</sub>   |   | <20mg/L  |  | 95 <sup>th</sup> percentile to be<20mg/L  |                                       |
| salts (ma/L)          | MgCl <sub>2</sub>                 |   | <36mg/L  | N/A  | 95 <sup>th</sup> percentile to be<36mg/L  | Monthly                               |
|                       | CaCl <sub>2</sub>                 |   | <141mg/L   |  | 95 <sup>th</sup> percentile to be<141mg/L   |                                       |
|                       | NaCI                              |   | <191mg/L   |  | 95 <sup>th</sup> percentile to be<191mg/L   |                                       |
| Nutrients             | SRP                               | Category=E  | <0.125mg/L   | Yes, to D  | 50 <sup>th</sup> percentile to be<0.125mg/L   | Monthly                               |
| (mg/L)                | TIN                               | Category=C  | <0.25mg/L  |  | 50 <sup>th</sup> percentile to be<25mg/L  | Monthly                               |
|                       | На                                | Category=C, moderate  | 5 <sup>th</sup> percentile (5.6-<br>5.9)<br>95 <sup>th</sup> percentile<br>(8.8–9.2) | Yes  | 5 <sup>th</sup> percentile(5.6-5.9)95 p <sup>b</sup> rcentile(8.8<br>-9.2)  | Monthly                               |
| Physical              | Temperature                       | Limited data and is impacted by                             | Maintain range   | N/A  | Initiate baseline monitoring for this variable.   |                                       |
| Variables             | Dissolved oxygen                  | waste water treatment works and urbanisation.               | 7-8mg/L  | N/A  | 5 <sup>th</sup> percentile tobe>6.1mg/L. Initiate<br>baseline monitoring for this variable.   | assessments<br>undertaken             |
|                       | Turbidity (NTU)                   | Turbid after heavy rains.                                   | Moderate change<br>allowed   | N/A  | Initiate baseline monitoring for this variable<br>and maintain natural range.   | Quarterly                             |
|                       | Electrical conductivity<br>(mS/m) | Category=D  | <85mS/m  | Yes, to C  | 95 <sup>Ti</sup> percentile to be<85mS/m  | Quarterly                             |
|                       | Chla: periphyton                  | Category =C. Visual inspection<br>indicates high algal      | <84mg/m (D <sup>2</sup><br>category)   | NIN N  | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>   | -                                     |
|                       | Chla: phytoplankton               | concentrations on rocks and in pools                        |  | A/N  | 50 <sup>th</sup> percentile to be<30µg/L  | Quarterly                             |
| Response<br>variables | Macro-invertebrates<br>(ASPT)     | E (this study)  | Saa Errenare for fie   | Saa Ernenare for fich and invotational                     | roenodivolu   |                                       |
|                       | Fish community score              | D (this study)  |  |  | respectively  |                                       |
|                       | In-stream toxicity                | Some toxicity from industry and waste water treatment works | Assess only if the t<br>impact is expected if<br>(1996).                             | iomonitoring results<br>the 95 <sup>th</sup> percentile of | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | cause is unknow<br>EV) as stated in D |
| Toxics                | Ammonia                           | Ш   | <129ug/L   | Yes to D   | 95 <sup>th</sup> percentile to be<129ua/L   | Monthiv                               |

Table 5.12: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 6: Hex River upstream of the Vaalkop Dam

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| River                            | Crocodile River  | DWA Water Quality Monitoring points      | nitoring points  |
|----------------------------------|--|--|--|
| WQSU                             | 21   | RC A2H013 Maga<br>( <i>n</i> =205)       | A2H013 Magalies River at Scheerpoort 2004-2007<br>( <i>n</i> =205)   |
| EWR Site                         | EWR7   | PES A2H060 Croco<br>2008( <i>n</i> =113) | A2H060 Crocodile River at Nooitgedacht 2004-<br>2008( <i>n</i> =113) |
| Water Quality Constituents       | tuents   | Value                                    | Category/Comment   |
| Inorganic salts (mg/L)           | MgSO4  | 112.138                                  | F(5)   |
|                                  | Na₂SO₄   | 12.102                                   | A(0)   |
|                                  | MgCl <sub>2</sub>  | 1.507                                    | A(0)   |
|                                  | CaCl2  | 20.658                                   | A(0)   |
|                                  | NaCI   | 187.768                                  | B(1)   |
| Nutrients (mg/L)                 | PO4  | 0.243                                    | E(4)   |
|                                  | TIN  | 0.302                                    | A(0)   |
| Physical variables               | pH(pH units)   | 7.8-8.5                                  | B(1)   |
|                                  | Temperature (° C)  | Raised temp due to lower and             | ir and   |
|                                  |  | shallower<br>flows                       | D(3)   |
|                                  | Dissolved oxygen<br>(mg/L)   | As above                                 |  |
|                                  | Electrical Conductivity<br>(mS/m)                                    | 92.3                                     | D(3)   |
| Response variable                | Chl-a: periphyton<br>(mg/m <sup>2</sup> )                            | I  | Algal growth on sand (visual observation)                            |
|                                  | Biotic community composition<br>-macro-invertebrates<br>(ASPT) score | 4.6                                      | U  |
|                                  | Fish score (FRAI)  | 46.2%                                    | Ω  |
|                                  | In-stream toxicity   | 1  |  |
| Toxics                           | Ammonia (µg/L)   | 20                                       | B(1)   |
| Overall site ecological category |  | ۵  |  |

| RIVER                 |                                   | Crocodile (West) River                                      | WATER QUALITY MONITORING POINTS   | MONITORING POIL   | VTS   |  |
|-----------------------|-----------------------------------|---|---|---|---|--|
| WQSU                  |                                   | 21  | DWAWQWMS  | A2H060 Cro  | A2H060 Crocodile River at Nooitgedacht  |  |
| EWRSITE               |                                   | EWR7  | RHP   | Currently se  | Currently several monitoring sites  |  |
| Confidence            | Confidence in PES assessment      | Medium  |   |   |   |  |
| Water Qualit          | Water Quality constituents        | PES Category  | WQEcospecs  | Improvement<br>required?                                    | TPC   | Monitoring<br>frequency                            |
|                       | MgSO4                             |   | <45mg/L   |   | 95 <sup>th</sup> percentile to be<45mg/L  |  |
| Inornanio             | Na <sub>2</sub> SO <sub>4</sub>   |   | <20mg/L   |   | 95 <sup>th</sup> percentile to be<20mg/L  | 1  |
| salts (mg/L)          | MgCl <sub>2</sub>                 |   | <15mg/L   | N/A   | 95 <sup>th</sup> percentile to be<15mg/L  | Monthly  |
|                       | CaCl <sub>2</sub>                 |   | <21mg/L   |   | 95 <sup>th</sup> percentile to be<21mg/L  |  |
|                       | NaCI                              |   | <191mg/L  |   | 95 <sup>th</sup> percentile to be<191mg/L   | 1-   |
| Nutrients             | SRP                               | Category=E  | <0.125mg/L  | Yes, to D   | 50 <sup>th</sup> percentile to be<0.125mg/L   | Monthly  |
| (mg/L)                | TIN                               | Category=A  | <0.25mg/L   |   | 50 <sup>th</sup> percentile to be<0.25mg/L  | Monthly  |
|                       | H                                 | Category=B, Good  | 5 <sup>th</sup> percentile(5.9-<br>6.5)95 <sup>th</sup> percentile<br>(8.0–8.8) | N/A   | 5 percentile (5.9-6.5)<br>95 percentile (8.0<br>-8.8)   | Monthly  |
| Physical              | Temperature                       | Limited data and is impacted by                             | Maintain range  | N/A   | Initiate baseline monitoring for this variable.   | When Biotic  |
| valiables             | Dissolved oxygen                  | and urbanisation.   | 7-8mg/L   | N/A   | 5 <sup>th</sup> percentile to be>6.1mg/L. Initiate<br>baseline monitoring for this variable.  | undertaken   |
|                       | Turbidity (NTU)                   | Turbid after heavy rains.                                   | Moderate change<br>allowed  | N/A   | Initiate baseline monitoring for this<br>Variable and maintain natural range.   | Quarterly  |
|                       | Electrical conductivity<br>(mS/m) | Category=D  | <85mS/m   | Yes, to C   | 95 <sup>th</sup> percentile to be<85mS/m  | Quarterly  |
|                       | Chla: periphyton                  | Category =C.<br>Visual inspection indicates high            | <84mg/m <sup>-*</sup><br>(D category)   | ALLA A  | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>   | c  |
|                       | Chla: phytoplankton               | algal concentrations on rocks<br>and in pools               | <30µg/L<br>(D category)   |   | 50 <sup>th</sup> percentile to be<30µg/L  | quarteny   |
| Response<br>variables | Macro-invertebrates<br>(ASPT)     | E (this study)  | See Ernenere for fish and invertebrates researchively                           | sh and invertebrated  | s recoordively.   |  |
|                       | Fish community score              | D (this study)  |   |   |   |  |
|                       | In-stream toxicity                | Some toxicity from industry and waste water treatment works | Assess only if the b<br>impact is expected if<br>(1996).                        | biomonitoring result<br>f the 95 <sup>th</sup> percentile o | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | ne cause is unknown. Al<br>(CEV) as stated in DWAR |
| Toxics                | Ammonia                           | 8   | ≤44ug/L   | Yes to D  | 95 <sup>th</sup> percentile to be<44ug/L  | Monthly  |
|                       |                                   |   |   |   |   |  |

Table 5.14: Water quality specifications for the Reserve (Quality Ecospecs) at EWR 7: Crocodile River upstream of confluence with Bierspruit River

| River         |
|---------------|
| ierspruit     |
| h the B       |
| with          |
| confluence    |
| the           |
| Downstream of |
| RIVER,        |
| J-CROCODILE   |
| EWR 8: A24J   |
| _             |

Table 5.15: PES categories and overall site assessment for EWR site 8

| WA WATER QUALITY NOTIFICITING POINTS WATER QUALITY MONITORING POINTS WOSU 24 AVHORS MANAGINA PARAMANA PARAMANANA PARAMANA PARAMAN | Diver  | Crocodilo Divor  | DIM/A Marken Oviality, Manifestine and and |
|--|--------|------------------|--|
| WOSU 24 24 ACHINE Achin | INIACI | CI OCOMILE VIAEL |  |
|  | WQSU   | 24               | RC A2H013 Magalies River at Scheen         |
|  |        |                  | 2007/ 2005/                                |
|  |        |                  |  |

| River                            | Crocodile River   | DWA W   | <b>DWA Water Quality Monitoring points</b>                               | 1 points   |
|----------------------------------|---|---------|--|--|
| WQSU                             | 24  | RC      | A2H013 Magalies Rive<br>2007( <i>n</i> =205)                             | A2H013 Magalies River at Scheerpoort 2002-<br>2007( <i>n</i> =205) |
| EWR Site                         | EWR8  | PES     | A2H116 Haakdoorndriftd/s weir Paul Hugo<br>Dam 2003-2008( <i>n</i> =104) | iftd/s weir Paul Hugo<br>\$)                                       |
| Water Quality Constituents       | uents   | Value   |  | Category/Comment   |
| Inorganic salts (mg/L)           | MgSO4   | 113.147 |  | F(5)   |
|                                  | Na <sub>2</sub> SO <sub>4</sub>                                   | 10.358  |  | A(0)   |
|                                  | MgCl <sub>2</sub>   | 2.622   |  | A(0)   |
|                                  | CaCl <sub>2</sub>   | 38.530  |  | B(1)   |
|                                  | NaCI  | 180.659 |  | B(1)   |
| Nutrients (mg/L)                 | PO4   | 0.107   |  | D(3)   |
|                                  | TIN   | 0.187   |  | A(0)   |
| Physical variables               | pH (pH units)   | 7.7-8.6 |  | B(1)   |
|                                  | Temperature (°C)  | 1record |  | B(1)   |
|                                  | Dissolved oxygen (mg/L)   | 1record |  |  |
|                                  | Electrical Conductivity<br>(mS/m)                                 | 91      |  | D(3)   |
| Response variable                | Chl-a: periphyton (mg/m <sup>2</sup> )                            |         |  | Visual observation: no algae                                       |
|                                  | Biotic community composition-<br>macro-invertebrates (ASPT) score | 4.39    |  | U  |
|                                  | Fish score (FRAI)   | 54.7%   |  | CD   |
|                                  | In-stream toxicity  |         |  |  |
| Toxics                           | Ammonia (µg/L)  | 25      |  | B(1)   |
| Overall site ecological category | sategory  | C/D     |  |  |

STAATSKOERANT, 3 DESEMBER 2021

| RIVER                  |                              | Crocodile(West)River | WATERQUALITYMONITORINGPOINTS                                       | ONITORINGPOINT           | 2   |            |
|------------------------|------------------------------|----------------------|--|--------------------------|---|------------|
| WQSU                   |                              | 24                   | DWAWQWMS   | A2H116 Croc              | A2H116 Crocodile River at Haakdooringdrift downstream weir                | am weir    |
| EWRSITE                |                              | EWR8                 | RHP  | Currently se             | Currently several monitoring sites  |            |
| Confidence in          | Confidence in PES assessment | Medium               |  |                          |   |            |
| Water Quality constitu | constituents                 | PES Category         | WQ Ecospecs  | Improvement<br>required? | TPC   | Monitoring |
|                        | MgSO₄                        |                      | <45mg/L  |                          | 95 <sup>th</sup> percentile to be<45mg/L                                  |            |
| Inordanic              | Na₂SO₄                       |                      | <20mg/L  |                          | 95 <sup>th</sup> percentile to be<20mg/L                                  |            |
| salts (mo/L)           | MgCl <sub>2</sub>            |                      | <15mg/L  | N/A                      | 95 <sup>th</sup> percentile to be<15mg/L                                  | Monthly    |
|                        | CaCl <sub>2</sub>            |                      | <57mg/L  |                          | 95 <sup>th</sup> percentile to be<57mg/L                                  |            |
|                        | NaCI                         |                      | <191mg/L   |                          | 95 <sup>th</sup> percentile to be<191mg/L                                 |            |
| Nutrients              | SRP                          | Category=D           | <0.125mg/L   | Yes, to C                | 50 <sup>th</sup> percentile to be<0.125mg/L                               | Monthly    |
| (mg/L)                 | TIN                          | Category=A           | <0.25mg/L  |                          | 50 <sup>in</sup> percentile to be<0.25mg/L                                | Monthly    |
|                        | Hd                           | Category=B, Good     | 5 <sup>th</sup> percentile(5.9-<br>6.5)95 <sup>th</sup> percentile | N/A                      | 3 <sup>th</sup> percentile (5.9-6.5) <sup>th</sup><br>4 95 percentile(8.0 | Monthly    |

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| 00014         |                                   | 24  | DVV AVV CVVIIIS   | AZHITID ULO   | AZH116 Crocodile River at Haakdooringdrift downstream weir  | am weir  |
|---------------|-----------------------------------|---|---|---|---|--|
| EWRSITE       |                                   | EWR8  | RHP   | Currently ser   | Currently several monitoring sites  |  |
| Confidence ir | Confidence in PES assessment      | Medium  |   |   |   |  |
| Water Quality | Water Quality constituents        | PES Category  | WQ Ecospecs   | Improvement<br>required?                                  | TPC   | Monitoring<br>frequency                          |
|               | MgSO₄                             |   | <45mg/L   |   | 95 <sup>th</sup> percentile to be<45mg/L  |  |
| Inorganic     | Na₂SO₄                            |   | <20mg/L   |   | 95 <sup>th</sup> percentile to be<20mg/L  |  |
| salts (mg/L)  | MgCl <sub>2</sub>                 |   | <15mg/L   | N/A   | 95 <sup>th</sup> percentile to be<15mg/L  | Monthly  |
| ,<br>,        | CaCl <sub>2</sub>                 |   | <57mg/L   |   | 95 <sup>th</sup> percentile to be<57mg/L  |  |
|               | NaCI                              |   | <191mg/L  |   | 95 <sup>th</sup> percentile to be<191mg/L   |  |
| Nutrients     | SRP                               | Category=D  | <0.125mg/L  | Yes, to C   | 50 <sup>th</sup> percentile to be<0.125mg/L   | Monthly  |
| (mg/L)        | TIN                               | Category=A  | <0.25mg/L   |   | 50 <sup>th</sup> percentile to be<0.25mg/L  | Monthly  |
|               | Hd                                | Category=B, Good  | 5 <sup>th</sup> percentile(5.9-<br>6.5)95 <sup>th</sup> percentile<br>(8.0–8.8) | N/A   | 3 <sup>th</sup> percentile (5.9-6.5) <sup>th</sup><br>4 B percentile(8.0)<br>-8.8)  | Monthly  |
| Dhveiraí      | Temperature                       | Limited data and is impacted by                             | Maintain range  | N/A   | Inititate baseline monitoring for this variable.  | When Biotic                                      |
| Variables     | Dissolved oxygen                  | waste water ucaunient works and urbanisation.               | 7-8mg/L   | N/A   | 5" percentile to be>6.1mg/L. Initiate<br>Baseline monitoring for this variable.   | assessments<br>undertaken                        |
|               | Turbidity (NTU)                   | Turbid after heavy rains.                                   | Moderate change<br>allowed  | N/A   | Initiate baseline monitoring for this<br>Variable and maintain natural range.   | Quarterly  |
|               | Electrical conductivity<br>(mS/m) | Category=D  | <85mS/m   | Yes, to C   | 95 <sup>th</sup> percentile to be<85mS/m  | Quarterly  |
|               | Chla: periphyton                  | Category=C.<br>Visual inspection indicates high             | <84mg/m <sup>4</sup><br>(D category)  |   | 50 <sup>th</sup> percentile to be<84mg/m <sup>2</sup>   |  |
|               | Chla: phytoplankton               | algal concentrations on rocks<br>and in pools               | <30µg/L<br>(D category)   | AN  | 50 <sup>th</sup> percentile to be<30µg/L  | Quarterly  |
| Response      | Macro-invertebrates<br>(ASPT)     | E (this study)  | Saa Ennenane for fich and invortabledate meanadiualu                            | and invortohrator   |   |  |
|               | Fish community score              | C/D (this study)  |   |   |   |  |
|               | In-stream toxicity                | Some toxicity from industry and waste water treatment works | Assess only if the bic<br>impact is expected if the tic (1996).                 | omonitoring results<br>the 95 <sup>th</sup> percentile of | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. An impact is expected if the 95 <sup>th</sup> percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996). | e cause is unknown. An<br>CEV) as stated in DWAF |
| Toxics        | Ammonia                           | В   | <44ug/L   | Yes to D  | 95 <sup>th</sup> percentile to be<44ug/L  | Monthly  |

| e confluence with Marico River |
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| MAR EWR1:                      |

| River                            | Kaaloog se Loop                   | Water     | Water Quality Monitoring points | g points   |                                  |
|----------------------------------|-----------------------------------|-----------|---------------------------------|--|----------------------------------|
| WQSU                             |                                   | RC        | A2H036 Steenbol                 | A2H036 Steenbokfontein on Koster River 2003-2007 (n=97)        | -2007 (n=97)                     |
| EWR Site                         | MAR EWR 1                         | PES       | 188041 Rietspruit               | 188041 Rietspruit at Bridge on Kaaloog se Loop 2004-2008 (n≕9) | 2004-2008 (n≕9)                  |
| Water Quality Constituents       | stituents                         | RC Value  | lue                             | PES Value  | Category/Comment                 |
| Inorganic salts(mg/L)            | (L) MgSO4                         | 14.765    |                                 |  | Insufficient data to run TEACHA  |
|                                  | Na <sub>2</sub> SO <sub>4</sub>   | 0         |                                 |  | effectively. EC can be used as   |
|                                  | MgCl <sub>2</sub>                 | 3.015     |                                 |  | an indication of inorganic salts |
|                                  | CaCl <sub>2</sub>                 | 4.978     |                                 |  | TOF PAI                          |
|                                  | NaCI                              | 8.717     |                                 |  |                                  |
| Nutrients(mg/L)                  | PO4                               | 0.016     |                                 | 0.02   | B(1)                             |
|                                  | NIT                               | 0.090     |                                 | 0.13   | A (0)                            |
| Physical variables               | pH (5th-95th %)                   | 7.32-7.98 | 98                              | 8.15-8.45  | B (1)                            |
|                                  | Temperature (°C)                  |           |                                 | 9.95-19.44   | A/B (0.5)                        |
|                                  | Dissolved oxygen (mg/L)           |           |                                 | 4.65-13.32   | A/B (0.5)                        |
|                                  | Electrical Conductivity<br>(mS/m) | 16.58     |                                 | 31.06  | B (1)                            |
| Response variable                |                                   |           |                                 |  |                                  |
|                                  | Macro-invertebrates               |           |                                 | 5.8  | A/B                              |
|                                  | Fish community score              |           |                                 | 86.3   | 8                                |
|                                  | In-stream toxicity                |           |                                 |  |                                  |
| Toxics                           | Ammonia (µg/L)                    | 0.003     |                                 | 0.14   | A(0)                             |
|                                  | Fluoride (µg/L)                   | 0.20      |                                 | 0.02   | B(1)                             |
| Overall site ecological category | ical category                     |           |                                 | A/R  |                                  |

| RIVER                      |                                   | Kaaloog se Loop River   | WATER QUALITY MONITORING POINTS                      | IONITORING POIN          | IS   |                         |
|----------------------------|-----------------------------------|---|--|--------------------------|--|-------------------------|
| WQSU                       |                                   | 1   | DWAWQWMS   | 188041 Riets             | 188041 Rietspruit at bridge on Kaaloog se Loop 2004-2008 (n=9)   | 008 (n=9)               |
| EWR SITE                   |                                   | EWR1  | RHP  | Currently sev            | Currently several monitoring sites   |                         |
| Confidence in              | Confidence in PES assessment      | Low   |  |                          |  |                         |
| Water Quality constituents | r constituents                    | PES Category  | WQ Ecospecs  | Improvement<br>required? | TPC  | Monitoring<br>frequency |
|                            | MgSO4                             | Insufficient data to run TEACHA   | ≤23mg/L  |                          | 95 <sup>th</sup> percentile to be<23mg/L   |                         |
| Inorganic                  | Na <sub>2</sub> SO <sub>4</sub>   | Indication of inorganic salts for   | ≤33mg/L  |                          | 95 <sup>th</sup> percentile to be<33mg/L   |                         |
| salts (mg/L)               | MgCl <sub>2</sub>                 | PAI   | ≤30mg/L  | N/A                      | 95 <sup>th</sup> percentile to be<30mg/L   | Monthly                 |
|                            | cacl <sub>2</sub>                 |   | ≤57mg/L  |                          | 95 <sup>th</sup> percentile to be<57mg/L   |                         |
|                            | NaCI                              |   | ≤191mg/L   |                          | 95 <sup>th</sup> percentile to be<191mg/L  |                         |
| Nutrients                  | SRP                               | Category=B  | <0.015mg/L   | No                       | 50 <sup>th</sup> percentile to be<0.015mg/L  | Monthly                 |
| (mg/L)                     | TIN                               | Category=A  | <0.75mg/L  | No                       | 50 <sup>th</sup> percentile to be<0.75mg/L   | Monthly                 |
|                            | pH                                | Neutral river   | >6.5 and <8.8  | No                       | 95 <sup>th</sup> percentile to be<8.8 and >6.5   | Monthly                 |
|                            | Temperature                       | Limited data and is not   | Maintain range                                       | N/A                      | Maintain natural range   | Monthly                 |
| Physical                   | Dissolved oxygen                  |   | 7-8mg/L  | N/A                      | 5 <sup>th</sup> percentile to be>7mg/L.  | Monthly                 |
| Variables                  | Turbidity (NTU)                   | Turbid after heavy rains due to<br>upstream slate mining  | Moderate change<br>allowed                           | N/A                      | Moderate change allowed  | Monthly                 |
|                            | Electrical conductivity<br>(mS/m) | Category=B  | ≤55mS/m  | No                       | 95 <sup>th</sup> percentile to be<55mS/m   | Quarterly               |
|                            | Chla: periphyton                  | Visual inspection indicates <1.7mg/m<br>limited algal concentrations on (A categor<br>morks and in mode | ≤1.7mg/m<br>(A category)                             | N/A                      | 50"percentile to be<1.7mg/m²   | Quarterly               |
| c                          | Chla: phytoplankton               |   | ≤10µg/L<br>(A category)                              |                          | 50 <sup>th</sup> percentile to be<10µg/L   |                         |
| variables                  | Macro-invertebrates<br>(ASPT)     | A/B (this study and RHP)  | Saa Ernsnars for fish and invariabratas rasnartivalv | h and invertehrates      | raenartivaly.  |                         |
|                            | Fish community score              | B (this study)  |  |                          |  |                         |
|                            | In-stream toxicity                | No toxicity   | Assess only if the bio                               | monitoring results ir    | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. | use is unknown.         |
| Toxics                     | Ammonia                           | A   | ≤15ug/L  |                          | 95 <sup>th</sup> percentile to be<15ug/L   | Monthly                 |

Table 5.18: Water quality specifications for the Reserve (Quality Ecospecs) at MAR EWR 1Kaaloog se Loop River

MAR EWR2: A31B-Groot Marico River Upstream confluence of the Sterkstroom

| River                            | Groot Marico                      | Wate      | Water Quality Monitoring points | ing points  |                             |
|----------------------------------|-----------------------------------|-----------|---------------------------------|---|-----------------------------|
| MQSU                             | -                                 | RC        | A2H036 Steenb                   | A2H036 Steenbokfontein on Koster River 2003-2007 (n=97)     | er 2003-2007 (n=97)         |
| EWR Site                         | MAR EWR 2                         | PES       |                                 | 188035 Koedoesfontein on Groot-Marico River 2004-2008 (n=9) | River 2004-2008 (n=9)       |
| Water Quality Constituents       | onstituents                       | RC Value  | alue                            | PES Value   | Category/Comment            |
| Inorganic salts (mg/L)           | ng/L) MgSO4                       | 14.765    | 5                               |   | Insufficient data to run    |
|                                  | Na <sub>2</sub> SO <sub>4</sub>   | 0         |                                 |   | TEACHA effectively. EC can  |
|                                  | MgCl <sub>2</sub>                 | 3.015     |                                 |   | be used as an indication of |
|                                  | CaCl <sub>2</sub>                 | 4.978     |                                 |   | Inorganic saits for PAI     |
|                                  | NaCI                              | 8.717     |                                 |   |                             |
| Nutrients (mg/L)                 | PO4                               | 0.016     |                                 | 0.02  | B(1)                        |
|                                  | TIN                               | 0.090     |                                 | 0.11  | A(0)                        |
| Physical variables               | s pH (5th-95th %)                 | 7.32-7.98 | 7.98                            | 8.02-8.38   | B(1)                        |
|                                  | Temperature (°C)                  |           |                                 | 11.95-22.65   | B(1)                        |
|                                  | Dissolved oxygen (mg/L)           |           |                                 | 2.09-8.83   | B(1)                        |
|                                  | Electrical Conductivity<br>(mS/m) | 16.58     |                                 | 34.1  | B(1)                        |
| Response variable                |                                   |           |                                 |   |                             |
|                                  | Macro-invertebrates               |           |                                 |   | A/B                         |
|                                  | Fish community score              |           |                                 |   | В                           |
|                                  | In-stream toxicity                |           |                                 |   |                             |
| Toxics                           | Fluoride (µg/L)                   | 0.20      |                                 | 0.02  | A(0)                        |
| Overall site ecological category | igical category                   |           |                                 |   |                             |

Table 5.19: PES categories and overall site assessment for Mar EWR site 2

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| RIVER                 |                                   | Marico  | WATER QUALITY              | WATER QUALITY MONITORING POINTS | ITS  |                         |
|-----------------------|-----------------------------------|---|----------------------------|---------------------------------|--|-------------------------|
| WQSU                  |                                   | -   | DWAWQWMS                   | 188035 Koei                     | 188035 Koedoesfontein on Groot-Marico River 2004-2008 (n=9)  | 2004-2008 (n=9)         |
| EWRSITE               |                                   | MAR EWR2  | RHP                        | Currently se                    | Currently several monitoring sites   | 1                       |
| Confidence in         | Confidence in PES assessment      | Low   |                            |                                 |  |                         |
| Water Quality         | Water Quality constituents        | PES Category  | WQ Ecospecs                | Improvement<br>required?        | TPC  | Monitoring<br>frequency |
|                       | MgSO4                             | Insufficient data to run TEACHA   | ≤23mg/L                    |                                 | 95 <sup>th</sup> percentile to be<23mg/L   |                         |
| Inomanic              | Na₂SO₄                            | indication of inorganic salts for   | ≤33mg/L                    |                                 | 95 <sup>th</sup> percentile to be<33mg/L   |                         |
| salts (mg/L)          | MgCl <sub>2</sub>                 | PAI   | ≤30mg/L                    | N/A                             | 95 <sup>th</sup> percentile to be<30mg/L   | Monthly                 |
|                       | CaCl <sub>2</sub>                 |   | ≤57mg/L                    |                                 | 95 <sup>th</sup> percentile to be<57mg/L   |                         |
|                       | NaCI                              |   | s191mg/L                   |                                 | 95 <sup>th</sup> percentile to be<191mg/L  |                         |
| Nutrients             | SRP                               | Category≂ B   | <0.015mg/L                 | N                               | 50 <sup>th</sup> percentile to be<0.015mg/L  | Monthly                 |
| (mg/L)                | TIN                               | Category=A  | <0.75mg/L                  | No                              | 50 <sup>th</sup> percentile to be<0.75ma/L   | Monthly                 |
|                       | Ηd                                | Neutral river   | >6.5 and <8.8              | No                              | 95 <sup>th</sup> percentile to be<8.8 and >6.5   | Monthly                 |
|                       | Temperature                       | Limited data and is not   | Maintain range             | N/A                             | Maintain natural range   | Monthly                 |
| Physical              | Dissolved oxygen                  |   | 7-8mg/L                    | N/A                             | 5 <sup>th</sup> percentile to be>7mg/L.  | Monthly                 |
| Variables             | Turbidity (NTU)                   | Turbid after heavy rains due to upstream slate mining   | Moderate change<br>allowed | N/A                             | Moderate change allowed  | Monthly                 |
|                       | Electrical conductivity<br>(mS/m) | Category= B   | ≤55mS/m                    | No                              | 95 <sup>th</sup> percentile to be<55mS/m   | Quarterly               |
|                       | Chla: periphyton                  | Visual inspection indicates <1.7mg/m <sup>2</sup><br>limited algal concentrations on (A category) | ≤1.7mg/m²<br>(A category)  | N/A                             | 50 <sup>th</sup> percentile to be<1.7mg/m <sup>2</sup>   | Quarterly               |
|                       | Chla: phytoplankton               |   | ≤10µg/L<br>(A category)    |                                 | 50 <sup>th</sup> percentile to be<10µg/L   |                         |
| kesponse<br>variables | Macro-invertebrates<br>(ASPT)     | A/B (this study)  | Coo Economo for fi         |                                 |  | -                       |
|                       | Fish community score              | B/C (this study)  |                            |                                 | respectively   |                         |
|                       | In-stream toxicity                | No toxicity   | Assess only if the bi      | omonitoring results i           | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. | le cause is unknown.    |
| Toxics                | Ammonia                           | A   | ≤15ug/L                    |                                 | 95 <sup>th</sup> percentile to be<15ug/L   | Monthly                 |

MAR EWR3: A31F-Groot Marico River downstream of Marico Bosveld Dam

| River                            | Groot Marico                             | Water     | Water Quality Monitoring points | d points  |   |
|----------------------------------|--|-----------|---------------------------------|---|---|
| WQSU                             | 3  | ßC        | A2H036 Steenbo                  | A2H036 Steenbokfontein on Koster River 2003-2007 (n=97) | 003-2007 (n=97)   |
| EWR Site                         | MAR EWR 3                                | PES       | A3H028 Riekersd                 | am on left canal from Maric                             | PES A3H028 Riekersdam on left canal from Marico-Bosveld Dam 2002-2007 (n=141) |
| Water Quality Constituents       | nstituents                               | RC Value  | ne                              | PES Value   | Category/Comment  |
| Inorganic salts (mg/L)           | J/L) MgSO4                               | 14.765    |                                 | 17.112  | B(1)  |
|                                  | Na <sub>2</sub> SO <sub>4</sub>          | 0         |                                 | 0   | A(0)  |
|                                  | MgCl <sub>2</sub>                        | 3.015     |                                 | 3.7   | A(0)  |
|                                  | CaCl <sub>2</sub>                        | 4.978     |                                 | 4.226   | A(0)  |
|                                  | NaCI                                     | 8.717     |                                 | 5.603   | A(0)  |
| Nutrients (mg/L)                 | PO4                                      | 0.016     |                                 | 0.023   | C(2)  |
|                                  | NIL                                      | 0.090     |                                 | 0.12  | B(1)  |
| Physical variables               | pH (5 <sup>th</sup> -95 <sup>th</sup> %) | 7.32-7.98 | 98                              | 7.795-8.445   | B(1)  |
|                                  | Temperature (°C)                         |           |                                 | 12.7-24.3   | B(1)  |
|                                  | Dissolved oxygen (mg/L)                  |           |                                 | 2.29-8.33   | B(1)  |
|                                  | Electrical Conductivity<br>(mS/m)        | 16.58     |                                 | 37.3  | B(1)  |
| Response variable                |  |           |                                 |   |   |
|                                  | Macro-invertebrates                      |           |                                 | 5.3   | C(2)  |
|                                  | Fish community score                     |           |                                 | 35  | D(3)  |
|                                  | In-stream toxicity                       |           |                                 |   |   |
| Toxics                           | Ammonia (µg/L)                           | 0.003     |                                 | 32  | B(1)  |
|                                  | Fluoride (µg/L)                          | 0.20      |                                 | 0.2   | A(0)  |
| Overall site ecological category | ical category                            |           |                                 | B/C   |   |

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| specifications |
| quality        |
| Water          |
| Table 5.22:    |

| RIVER         |                                   | Marico  | WATER QUALITY MONITORING POINTS                      | <b>AONITORING POIN</b>   | TS   |                     |
|---------------|-----------------------------------|---|--|--------------------------|--|---------------------|
| wasu          |                                   | 3   | DWAWQWMS   | A3H028 Rie<br>(n=141)    | A3H028 Riekersdam on left canal from Marico-Bosveld Dam 2002-2007 ( $n$ =141)                          | sveld Dam 2002-2007 |
| EWR SITE      |                                   | MAR EWR3  | RHP  | Currently ser            | Currently several monitoring sites   |                     |
| Confidence in | Confidence in PES assessment      | Medium  |  | -                        |  |                     |
| Water Quality | Water Quality constituents        | PES Category  | WQ Ecospecs  | Improvement<br>required? | TPC  | Monitoring          |
|               | MgSO₄                             |   | ≤23mg/L  |                          | 95 <sup>th</sup> percentile to be<23mg/L   | •                   |
| Inornanic     | Na <sub>2</sub> SO <sub>4</sub>   |   | ≤20mg/L  |                          | 95 <sup>th</sup> percentile to be<20mg/L   |                     |
| salts (mg/L)  | MgCl <sub>2</sub>                 | AB  | ≤15mg/L  | N/A                      | 95 <sup>th</sup> percentile to be<15mg/L   | Monthly             |
| •             | CaCl <sub>2</sub>                 |   | ≤21mg/L  |                          | 95 <sup>th</sup> percentile to be<21mg/L   |                     |
|               | NaCI                              |   | s45mg/L  |                          | 95 <sup>th</sup> percentile to be<45mg/L   |                     |
| Nutrients     | SRP                               | Category= C   | <0.015mg/L   | Yes to D                 | 50 <sup>th</sup> percentile to be<0.025mg/L  | Monthly             |
| (mg/L)        | TIN                               | Category=B  | <0.75mg/L  | Yes to D                 | 50 <sup>th</sup> percentile to be<0.7mg/L  | Monthly             |
|               | ЬН                                | Good  | >6.5 and <8.8  | No                       | 95 <sup>th</sup> percentile to be<8.8 and >6.5   | Monthly             |
|               | Temperature                       | Limited data and is impacted by   | Maintain range                                       | N/A                      | Maintain natural range   | Monthly             |
| Physical      | Dissolved oxygen                  |   | 7-8mg/L  | N/A                      | 5 <sup>th</sup> percentile to be>7mg/L.  | Monthly             |
| Variables     | Turbidity (NTU)                   | Turbid after heavy rains due to upstream slate mining                                       | Moderate change<br>allowed                           | N/A                      | Moderate change allowed  | Monthly             |
|               | Electrical conductivity<br>(mS/m) | Category= B   | ≤55mS/m  | No                       | 95 <sup>th</sup> percentile to be<85mS/m   | Quarterly           |
|               | Chla: periphyton                  | Category=C. Visual inspection <u>584mg/m<sup>2</sup></u><br>indicates high algal (D categor | ≤84mg/m²<br>(D category)                             | N/A                      | 50 <sup>th</sup> percentile to be<84mg/m²  | Quarterly           |
| Decement      | Chla: phytoplankton               | pools due to upstream agricultural runoff   | ≤30µg/L<br>(D category)                              |                          | 50 <sup>th</sup> percentile to be<30µg/L   |                     |
| variables     | Macro-invertebrates<br>(ASPT)     | C (this study)  | Saa Eroenare for fich and invertebration memory volu | th and invertahrates     | reenactivalu   |                     |
|               | Fish community score              | D (this study)  |  |                          | leabecritery   |                     |
|               | In-stream toxicity                | Some toxicity from agricultural runoff upstream   | Assess only if the bi                                | omonitoring results i    | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. | ause is unknown.    |
| Toxics        | Ammonia                           | В   | ≤43.7ug/L  | Yes to D                 | 95 <sup>th</sup> percentile to be<43.7ug/L   | Monthly             |
|               |                                   |   |  |                          |  |                     |

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| River                            | Groot Marico                             | Water Q   | Water Quality Monitoring points                                 |                            |                  |
|----------------------------------|--|-----------|---|----------------------------|------------------|
| WQSU                             | 6  | RC        | A2H036 Steenbokfontein on Koster River 2003-2007 (n=97)         | ster River 2003-2007 (n=9) | 7)               |
| EWR Site                         | MAR EWR 4                                | PES       | A3H040 Marico River at Mooiplaats/Tzwasa weir 2002-2007 (n=181) | ats/Tzwasa weir  2002-2007 | ' (n=181)        |
| Water Quality Constituents       | istituents                               | RC Value  | e PES Value   | Categ                      | Category/Comment |
| Inorganic salts (mg/L)           | /L) MgSO4                                | 14.765    | 32.787  | D(3)                       |                  |
|                                  | Na <sub>2</sub> SO <sub>4</sub>          | 0         | 0   | A(0)                       |                  |
|                                  | MgCl <sub>2</sub>                        | 3.015     | 5.949   | A(0)                       |                  |
|                                  | CaCl <sub>2</sub>                        | 4.978     | 5.903   | A(0)                       |                  |
|                                  | NaCI                                     | 8.717     | 8.698   | A(0)                       |                  |
| Nutrients (mg/L)                 | PO4                                      | 0.016     | 0.018   | B/C(1.5)                   | .5)              |
|                                  | TIN                                      | 060.0     | 0.08  | B(1)                       |                  |
| Physical variables               | pH (5 <sup>th</sup> -95 <sup>th</sup> %) | 7.32-7.98 | 8.025-8.524   | B(1)                       |                  |
|                                  | Temperature (°C)                         |           | 14.5-26.5   | B(1)                       |                  |
|                                  | Dissolved oxygen (mg/L)                  |           | 5.5-11.4  | B(1)                       |                  |
|                                  | Electrical Conductivity<br>(mS/m)        | 16.58     | 54.2  | B(1)                       |                  |
| Response variable                | Chl-a: periphyton (mg/m <sup>2</sup> )   |           |   |                            |                  |
|                                  | Macro-invertebrates                      |           | 4.5   | U                          |                  |
|                                  | Fish community score                     |           | 61.8  | C/D                        |                  |
|                                  | In-stream toxicity                       |           |   |                            |                  |
| Toxics                           | Ammonia (µg/L)                           | 0.003     | 0.003   | A(0)                       |                  |
|                                  | Fluoride (µg/L)                          | 0.20      | 0.6   | A(0)                       |                  |
| Overall site ecological category | cal category                             |           |   | ď                          |                  |

| ty Ecospecs) at MAR EWR 4    | ATER OUALITY MONITORING POINTS |
|------------------------------|--------------------------------|
|                              | WATER OUAL                     |
| itions for the Reserve (Qual |                                |
| ity specifications fo        | Marico                         |
| Table 5.24: Water quality    |                                |
| Table 5.2                    | RIVER                          |
|                              |                                |

| RIVER                 |                                   | Marico  | WATER QUALITY MONITORING POINTS         | <b>NONITORING POIL</b>   | NTS  |                         |
|-----------------------|-----------------------------------|---|---|--------------------------|--|-------------------------|
| wasu                  |                                   | <b>5</b>  | DWAWQWMS                                | A3H040 Ma                | A3H040 Marico River at Mooiplaats/Tzwasa weir 2002-2007 (n=181)  | ir 2002-2007 (n=181     |
| EWRSITE               |                                   | MAR EWR4  | RHP                                     | Currently se             | Currently several monitoring sites   |                         |
| Confidence in         | Confidence in PES assessment      | Medium  |   |                          |  |                         |
| Water Quality         | Water Quality constituents        | PES Category  | WQ Ecospecs                             | Improvement<br>required? | TPC  | Monitoring<br>frequency |
|                       | MgSO4                             |   | ≤15mg/L                                 |                          | 95 <sup>th</sup> percentile to be<15mg/L   |                         |
| Inornanic             | Na₂SO₄                            |   | ≤20mg/L                                 |                          | 95 <sup>th</sup> percentile to be<20mg/L   |                         |
| salts (mg/L)          | MgCl <sub>2</sub>                 | A/B   | s15mg/L                                 | N/A                      | 95 <sup>th</sup> percentile to be<15mg/L   | Monthly                 |
|                       | CaCl <sub>2</sub>                 |   | ≤21mg/L                                 |                          | 95 <sup>th</sup> percentile to be<21mg/L   |                         |
|                       | NaCI                              |   | s45mg/L                                 |                          | 95 <sup>th</sup> percentile to be<45mg/L   | 1                       |
| Nutrients             | SRP                               | Category=B/C  | ≤0.125mg/L                              | Yes to D                 | 50 <sup>th</sup> percentile to be<0.125mg/L  | Monthly                 |
| (mg/L)                | TIN                               | Category=A  | ≤0.25mg/L                               | Yes to D                 | 50 <sup>th</sup> percentile to be<0.25ma/L   | Monthly                 |
|                       | Hd                                | Category=B, Good  | >5.9 and <8.8                           | No                       | 95 <sup>th</sup> percentile to be<8.8 and >5.9   | Monthly                 |
|                       | Temperature                       | Limited data and is impacted by   | Maintain range                          | N/A                      | Maintain natural range   | Monthly                 |
| Physical              | Dissolved oxygen                  |   | 7-8mg/L                                 | N/A                      | 5 <sup>th</sup> percentile to be>7mg/L.  | Monthly                 |
| Variables             | Turbidity (NTU)                   | Turbid after heavy rains  | Moderate change<br>allowed              | N/A                      | Moderate change allowed  | Monthly                 |
|                       | Electrical conductivity<br>(mS/m) | Category= B   | ≤55mS/m                                 | N                        | 95 <sup>th</sup> percentile to be≺55mS/m   | Quarterly               |
|                       | Chla: periphyton                  | Visual inspection indicates low ≤12mg/m <sup>2</sup><br>algal concentrations on rocks (B categor          | ≤12mg/m²<br>(B category)                | N/A                      | 50 <sup>th</sup> percentile to be<12mg/m <sup>2</sup>  | Quarterly               |
| ſ                     | Chla: phytoplankton               |   | s15µg/L<br>(B category)                 |                          | 50 <sup>th</sup> percentile to be<15µg/L   |                         |
| Kesponse<br>variables | Macro-invertebrates<br>(ASPT)     | C (this study)  | Coo Econome for fish and invotable days | h and invototo           |  | _                       |
|                       | Fish community score              | C/D (this study)  |   |                          | s respectively   |                         |
|                       | In-stream toxicity                | Limited toxicity from upstream<br>urbanisation, waste water<br>treatment works and<br>agricultural runoff | Assess only if the bic                  | amonitoring results      | Assess only if the biomonitoring results indicate there is a serious problem and the cause is unknown. | e cause is unknown.     |
| Toxics                | Ammonia                           | A   | s15ug/L                                 |                          | 95 <sup>th</sup> percentile to be<15ug/L   | Monthly                 |
|                       |                                   |   |   |                          |  | _                       |

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| Quaternary | Area(km <sup>2</sup> ) | Recharge | Population<br>(Water<br>Services) | Baseflow<br>(Mm3ia) | MLF_EWR | BHN<br>Reserve | Reserve | Reserve as<br>% of | Current<br>Groundwater | Stress |
|------------|------------------------|----------|-----------------------------------|---------------------|---------|----------------|---------|--------------------|------------------------|--------|
| A10A       | 559                    | 8.81     | 49366                             | 0.00                | 0.35    | 0.45           | 0.80    | 9 08               | Use (MIT7a)            | 0.16   |
| A10B       | 1015                   | 12.56    | 25432                             | 0.00                | 0.85    | 0.23           | 1.08    | 8.60               | 1.32                   | 0 11   |
| A10C       | 271                    | 3.58     | 4099                              | 0.00                | 0.19    | 0.04           | 0.23    | 6.42               | 0.85                   | 0.24   |
| A21A       | 483                    | 27.641   | 151332                            | 0.54                | 2.51    | 1.38           | 3.89    | 14.08              | 20.35                  | 0.74   |
| A21B       | 527                    | 30.215   | 758882                            | 0.32                | 1.60    | 6.92           | 8.52    | 28.21              | 11.58                  | 0.38   |
| A21C       | 761                    | 18.684   | 545170                            | 1.04                | 5.90    | 4.97           | 10.87   | 58.20              | 1.17                   | 0.06   |
| A21D       | 372                    | 19.655   | 210207                            | 1.51                | 4.20    | 1.92           | 6.12    | 31.13              | 11.53                  | 0.59   |
| A21E       | 290                    | 9.207    | 15659                             | 0.41                | 2.49    | 0.14           | 2.63    | 28.60              | 0.77                   | 0.08   |
| A21F       | 1,000                  | 47.399   | 9362                              | 1.26                | 3.10    | 0.09           | 3.19    | 6.72               | 33.62                  | 0.71   |
| A21G       | 161                    | 6.238    | 110652                            | 1.74                | 5.23    | 1.01           | 6.24    | 100.03             | 0.49                   | 0.08   |
| A21H       | 514                    | 20.892   | 45327                             | 2.56                | 3.67    | 0.41           | 4.08    | 19.55              | 3.23                   | 0.15   |
| A21J       | 1,150                  | 29.893   | 133204                            | 0.29                | 2.02    | 1.22           | 3.24    | 10.82              | 14.10                  | 0.47   |
| A21K       | 864                    | 23.279   | 88100                             | 1.51                | 2.87    | 0.80           | 3.67    | 15.78              | 13.54                  | 0.58   |
| A21L       | 213                    | 4.497    | 43                                | 0.16                | 0.19    | 0.00           | 0.19    | 4.23               | 0.61                   | 0.14   |
| A22A       | 706                    | 21.318   | 40641                             | 0.35                | 1.20    | 0.37           | 1.57    | 7.37               | 1.87                   | 0.09   |
| A22B       | 284                    | 9.365    | 40288                             | 0.19                | 0.66    | 0.37           | 1.03    | 10.97              | 1.80                   | 0.19   |
| A22C       | 515                    | 17.303   | 40288                             | 0.00                | 1.30    | 0.37           | 1.67    | 9.64               | 1.03                   | 0.06   |
| A22D       | 541                    | 14.177   | 40288                             | 0.10                | 09.0    | 0.37           | 0.97    | 6.83               | 4.02                   | 0.28   |
| A22E       | 812                    | 19.386   | 6427                              | 0.16                | 1.41    | 0.06           | 1.47    | 7.58               | 1.90                   | 0.10   |
| A22F       | 1,688                  | 35.691   | 130476                            | 0.95                | 2.25    | 1.19           | 3.44    | 9.64               | 4.02                   | 0.11   |
| A22G       | 499                    | 17.989   | 846                               | 0.35                | 1.00    | 0.01           | 1.01    | 5.60               | 1.46                   | 0.08   |
| A22H       | 579                    | 15.612   | 230416                            | 0.06                | 0.36    | 2.10           | 2.46    | 15.77              | 6.16                   | 0.39   |
| A22J       | 592                    | 8.518    | 39935                             | 0.22                | 0.81    | 0.36           | 1.17    | 13.79              | 2.20                   | 0.26   |
| A23A       | 682                    | 28.30    | 391615                            | 13.45               | 4.10    | 3.57           | 7.67    | 27.10              | 12.77                  | 0.45   |
| A23B       | 814                    | 10.502   | 36522                             | 0.28                | 2.00    | 0.33           | 2.33    | 22.22              | 1.45                   | 0.14   |
| A23C       | 491                    | 6.2      | 2308                              | 0.10                | 0.74    | 0.02           | 0.76    | 12.28              | 0.79                   | 0.13   |
| A23D       | 252                    | 18.726   | 125166                            | 1.77                | 2.43    | 1.14           | 3.57    | 19.08              | 13.73                  | 0.73   |
| A23E       | 490                    | 6.28     | 75096                             | 0.06                | 1.51    | 0.69           | 2.20    | 34.96              | 3.10                   | 0.49   |
| A23F       | 565                    | 6.476    | 361907                            | 0.28                | 0.69    | 3.30           | 3.99    | 61.65              | 0.74                   | 0.11   |
| A23G       | 951                    | 20.58    | 75670                             | 0.82                | 0.82    | 0.69           | 1.51    | 7.34               | 10.89                  | 0.53   |
| A23H       | 1,058                  | 28.124   | 14570                             | 0.13                | 2.20    | 0.13           | 2.33    | 8.30               | 2.59                   | 0.09   |
| AZ3U       | 930                    | 6.782    | 647955                            | 0.82                | 1.56    | 5.91           | 7.47    | 110.18             | 0.43                   | 0.06   |
| AZ3K       | 1,131                  | 10.964   | 452332                            | 0.13                | 1.20    | 4.13           | 5.33    | 48.59              | 0.50                   | 0.05   |
| AZ3L       | 329                    | 3.0/4    | 4423                              | 0.35                | 0.60    | 0.04           | 0.64    | 20.83              | 0.62                   | 0.20   |

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Table 6.1: Groundwater Resource Directed Measures (GRDM) Template

6.

**GROUNDWATER - QUANTITY COMPONENT** 

| Area(km <sup>2</sup> ) | Recharge<br>(Mm <sup>3</sup> /a) | Population<br>(Water<br>Services)<br>2011) | Baseflow<br>(Mm³/a) | MLF_EWR<br>(Mm <sup>3</sup> /a) | BHN<br>Reserve<br>(Mm <sup>3</sup> /a) | Reserve<br>(Mm <sup>3</sup> /a) | Reserve as<br>% of<br>Recharge | Current<br>Groundwater<br>Use (Mm <sup>3</sup> /a) | Stress<br>Index |
|------------------------|----------------------------------|--|---------------------|---------------------------------|--|---------------------------------|--------------------------------|--|-----------------|
|                        | 5.73                             | 8153                                       | 0.92                | 0.95                            | 0.07                                   | 1.02                            | 17.88                          | 2.91   | 0.51            |
|                        | 18.594                           | 732  | 0.22                | 1.10                            | 0.01                                   | 1.11                            | 5.95                           | 1.05   | 0.06            |
|                        | 20.297                           | 25539                                      | 0.13                | 0.07                            | 0.23                                   | 0.30                            | 1.49                           | 11.18  | 0.55            |
|                        | 20.547                           | 50853                                      | 0.00                | 1.43                            | 0.46                                   | 1.89                            | 9.22                           | 1.46   | 0.07            |
|                        | 10.585                           | 42926                                      | 0.00                | 0.73                            | 0.39                                   | 1.12                            | 10.60                          | 0.01   | 00.0            |
|                        | 12.09                            | 25539                                      | 0.00                | 0.68                            | 0.23                                   | 0.91                            | 7.55                           | 6.04   | 0.50            |
| 735                    | 24.662                           | 25539                                      | 0.35                | 2.12                            | 0.23                                   | 2.35                            | 9.54                           | 0.36   | 0.01            |
| 80                     | 37.309                           | 56281                                      | 1.86                | 1.35                            | 0.51                                   | 1.86                            | 4.99                           | 4.21   | 0.11            |
| 9                      | 35.192                           | 3778                                       | 0.60                | 1.71                            | 0.03                                   | 1.74                            | 4.96                           | 39.50  | 1.12            |
| 632                    | 16.878                           | 9106                                       | 6.00                | 1.83                            | 0.08                                   | 1.91                            | 11.33                          | 3.64   | 0.22            |
| (0)                    | 15.928                           | 1390                                       | 6.00                | 3.02                            | 0.01                                   | 3.03                            | 19.04                          | 2.68   | 0.17            |
| 5                      | 15.045                           | 2597                                       | 1.00                | 0.32                            | 0.02                                   | 0.34                            | 2.28                           | 3.77   | 0.25            |
|                        | 20.906                           | 15615                                      | 1.00                | 0.55                            | 0.14                                   | 0.69                            | 3.31                           | 3.42   | 0.16            |
|                        | 17.336                           | 936  | 2.00                | 1.25                            | 0.01                                   | 1.26                            | 7.26                           | 0.81   | 0.05            |
|                        | 22.388                           | 24060                                      | 2.00                | 0:00                            | 0.22                                   | 1.12                            | 5.00                           | 2.13   | 0.10            |
| 5                      | 24.094                           | 46990                                      | 4.00                | 3.17                            | 0.43                                   | 3.60                            | 14.94                          | 0.67   | 0.03            |
| 684                    | 15.299                           | 32553                                      | 0.00                | 0.64                            | 0.30                                   | 0.94                            | 6.12                           | 0.45   | 0.03            |
| -                      | 18.52                            | 536  | 0.00                | 0.31                            | 0.00                                   | 0.31                            | 1.70                           | 0.27   | 0.01            |
| 472                    | 5.425                            | 9952                                       | 0.00                | 0.18                            | 0.09                                   | 0.27                            | 4.99                           | 0.04   | 0.01            |
|                        | 14.587                           | 5439                                       | 0.00                | 0.47                            | 0.05                                   | 0.52                            | 3.56                           | 0.05   | 0.00            |
| 902                    | 17.582                           | 17   | 0.00                | 0.59                            | 0.00                                   | 0.59                            | 3.36                           | 0.00   | 0.00            |
| 843                    | 14.373                           | 1538                                       | 0.00                | 0.59                            | 0.01                                   | 09.0                            | 4.20                           | 0.13   | 0.01            |
| 2,499                  | 15.775                           | 2776                                       | 0.00                | 1.66                            | 0.03                                   | 1.69                            | 10.68                          | 0.60   | 0.04            |

| BHN<br>Reserve       | Reserve | Reserve as<br>% of | Current<br>Groundwater   | Stress |
|----------------------|---------|--------------------|--------------------------|--------|
| (Mm <sup>3</sup> /a) |         | Recharge           | Use (Mm <sup>3</sup> /a) | Index  |
| 0.07                 |         | 17.88              | 2.91                     | 0.51   |
| 0.01                 |         | 5.95               | 1.05                     | 0.06   |
| 0.23                 | 0.30    | 1.49               | 11.18                    | 0.55   |
| 0.46                 | 1.89    | 9.22               | 1.46                     | 0.07   |
| 0.39                 | 1.12    | 10.60              | 0.01                     | 00.0   |
| 0.23                 | 0.91    | 7.55               | 6.04                     | 0.50   |
| 0.23                 | 2.35    | 9.54               | 0.36                     | 0.01   |
| 0.51                 | 1.86    | 4.99               | 4.21                     | 0.11   |
| 0.03                 | 1.74    | 4.96               | 39.50                    | 1.12   |
| 0.08                 | 1.91    | 11.33              | 3.64                     | 0.22   |
| 0.01                 | 3.03    | 19.04              | 2.68                     | 0.17   |
| 0.02                 | 0.34    | 2.28               | 3.77                     | 0.25   |
| 0.14                 | 0.69    | 3.31               | 3.42                     | 0.16   |
| 0.01                 | 1.26    | 7.26               | 0.81                     | 0.05   |
| 0.22                 | 1.12    | 5.00               | 2.13                     | 0.10   |
|                      |         |                    |                          |        |

# 7. GROUNDWATER - QUALITY COMPONENT

Groundwater quality per quaternary catchment was determined from the data sets obtained from the Water Management System of the Department of Water and Sanitation. Groundwater quality was defined by the water quality specifications in Table 7.1 below.

**Table 7.1: Water Quality Specifications** 

| Chemical Parameter            | Target Water Quality Ranges <sup>1</sup> |           |                   |           |  |
|-------------------------------|--|-----------|-------------------|-----------|--|
|                               | Class 0                                  | Class I   | Class II          | Class III |  |
| pH                            | 6-9                                      | 5-6&9-9.5 | 4 - 5 &> 9.5 - 10 | <4 &> 10  |  |
| Electrical Conductivity       | < 70                                     | 70 - 150  | 150 - 370         | > 370     |  |
| Calcium as Ca                 | < 80                                     | 80 - 150  | 150 - 300         | > 300     |  |
| Magnesium as Mg               | < 70                                     | 70 - 100  | 100 - 200         | > 200     |  |
| Sodium as Na                  | < 100                                    | 100 - 200 | 200 - 400         | > 400     |  |
| Chloride as Cl                | < 100                                    | 100 - 200 | 200 - 600         | > 600     |  |
| Sulphate as SO <sub>4</sub>   | < 200                                    | 200 - 400 | 400 - 600         | > 600     |  |
| Nitrate as NO <sub>x</sub> -N | < 6                                      | 6 - 10    | 10 – 20           | > 20      |  |
| Fluoride as F                 | <0.7                                     | 0.7 - 1.0 | 1.0 - 1.5         | > 1.5     |  |

<sup>1)</sup> Ref: Quality of Domestic Water Supplies, Volume 1: Assessment Guide, 2<sup>nd</sup> Ed.1998. Water Research Commission Report No: TT 101/98. Pretoria, South Africa.

### NOTE:

- **Class 0** This is ideal water quality, suitable for lifetime use, with no adverse health effects on the user. This class is essentially the same as the target water quality range in the 2<sup>nd</sup> edition of the *South African Water Quality Guidelines for Domestic Use* (DWAF, 1996).
- Class I Water in this class is safe for lifetime use, but falls short of the ideal water quality in that there may be instances of adverse health effects, but these are usually mild, and overt health effects are almost sub-clinical and difficult to demonstrate. Water in Class I does not cause health effects under normal circumstances. Aesthetic effects may, however, be apparent.
- Class II Water in this class is defined as that where adverse health effects are unusual for limited short-term use. Adverse health effects may become more common particularly with prolonged use over many years, or with lifetime use. This class represents water suitable for short-term or emergency use only, but not necessarily suitable for continuous use over a lifetime.
- **Class III** This water has constituents in a concentration range where serious health effects might be anticipated, particularly in infants or elderly people with short-term use, and even more so with longer term use. The water in this class is not suitable for use as drinking water without adequate treatment to shift the water into a lower and safer class.

|                               |      |      |        |                |      |       | Quatern                                   | ary Catchm                  | ents A21A,        | Quaternary Catchments A21A, A21B, A21C & A21D | A21D       |               |  |            |
|-------------------------------|------|------|--------|----------------|------|-------|---|-----------------------------|-------------------|---|------------|---------------|--|------------|
| Chemical Parameter            | Unit |      | No. o  | Vo. of Samples |      | Amt   | Ambient GW quality or median <sup>1</sup> | ality or mee                | dian <sup>1</sup> | BHN   |            | Groundwater ( | Groundwater Quality Reserve <sup>3</sup> | 3          |
|                               |      | A21A | A21B   | A21C           | A21D | A21A  | A21B                                      | A21C                        | A21D              | Reserve <sup>2</sup>                          | A21A       | A21B          | A21C                                     | A21D       |
| Hd                            |      | 377  | 227    | 1510           | 635  | 7.75  | 7.60                                      | 6.54                        | 7.23              | 5.0-9.5                                       | 6.98 -8.53 | 6.848.36      | 5.89-7.19                                | 6.51 -7.95 |
| Electrical Conductivity       | mS/m | 383  | 227    | 1501           | 638  | 25.80 | 51.00                                     | 198.00                      | 66.00             | <150  | 28.38      | 56.10         | 198.00                                   | 72.60      |
| Calcium as Ca                 | mg/l | 344  | 227    | 1294           | 635  | 25.40 | 47.00                                     | 198.40                      | 59.00             | <150  | 27.94      | 51.70         | 198.40                                   | 64.90      |
| Magnesium as Mg               | l/gm | 344  | 227    | 1295           | 635  | 15.10 | 31.00                                     | 94.90                       | 28.00             | <100  | 16.61      | 34.10         | 100.00                                   | 30.80      |
| Sodium as Na                  | l/gm | 344  | 227    | 1294           | 638  | 3.00  | 10.00                                     | 87.30                       | 25.00             | <200  | 3.30       | 11.00         | 96.03                                    | 27.50      |
| Chloride as CI                | l/gm | 344  | 227    | 1331           | 638  | 3.60  | 12.00                                     | 70.00                       | 14.00             | <200  | 3.96       | 13.20         | 77.00                                    | 15.40      |
| Sulphate as SO4               | l/gm | 344  | 227    | 1452           | 629  | 4.50  | 13.00                                     | 460.00                      | 154.00            | <400  | 4.95       | 14.30         | 460.00                                   | 169.40     |
| Nitrate as NO <sub>x</sub> -N | l/gm | 343  | 227    | 1316           | 578  | 0.80  | 2.30                                      | 71.90                       | 2.30              | <10   | 0.88       | 2.53          | 71.90                                    | 2.53       |
| Fluoride as F                 | mg/l | 344  | 227    | 520            | 578  | 0.12  | 0.14                                      | 0.70                        | 0.05              | <1.0  | 0.13       | 0.15          | 0.77                                     | 0.06       |
|                               |      |      |        |                |      |       | Quaterna                                  | Quaternary Catchments A21E, | ents A21E,        | A21F, A21G & A21H                             | A21H       |               |  |            |
| Chemical Parameter            | Unit |      | No. of | lo. of Samples |      | Amb   | Ambient GW quality or median <sup>1</sup> | ality or med                | lian <sup>1</sup> | BHN   |            | Groundwater C | Groundwater Quality Reserve <sup>3</sup> |            |
|                               |      | A21E | A21F   | A21G           | A21H | A21E  | A21F                                      | A21G                        | A21H              | Reserve <sup>2</sup>                          | A21E       | A21F          | A21G                                     | A21H       |
| Hd                            |      | e    | 307    | 118            | 7    | 6.70  | 7.58                                      | 8.24                        | 7.90              | 5.0 - 9.5                                     | 6.03 -7.37 | 6.82          | 7.42 –9.06                               | 7.11 -8.69 |
| Electrical Conductivity       | mS/m | e    | 324    | 126            | 7    | 20.10 | 25.60                                     | 37.00                       | 47.10             | <150  | 22.11      | 28.16         | 40.70                                    | 51.81      |
| Calcium as Ca                 | l/gm | m    | 311    | 116            | 4    | 10.83 | 25.40                                     | 39.80                       | 27.72             | <150  | 11.92      | 27.94         | 43.78                                    | 30.49      |
| Magnesium as Mg               | mg/l | e    | 311    | 116            | 4    | 4.30  | 15.80                                     | 24.00                       | 22.10             | <100  | 4.73       | 17.38         | 26.40                                    | 24.30      |
| Sodium as Na                  | mg/l | 3    | 311    | 116            | 4    | 18.10 | 2.50                                      | 1.00                        | 28.76             | <200  | 19.91      | 2.75          | 1.10                                     | 31.63      |
| Chloride as Cl                | l/gm | 3    | 311    | 116            | 4    | 19.73 | 1.50                                      | 3.70                        | 12.89             | <200  | 21.71      | 1.65          | 4.07                                     | 14.17      |
| Sulphate as SO <sub>4</sub>   | l/gm | е    | 311    | 116            | 4    | 4.47  | 4.80                                      | 5.05                        | 12.23             | <400  | 4.91       | 5.28          | 5.56                                     | 13.45      |
| Nitrate as NO <sub>x</sub> -N | l/gm | e    | 312    | 118            | 4    | 2.57  | 0.26                                      | 0.17                        | 0.45              | <10   | 2.82       | 0.29          | 0.19                                     | 0.49       |
| Fluoride as F                 | mg/l | i    | 311    | 116            | 4    | I     | 0.10                                      | 0.12                        | 0.29              | <1.0  | 1          | 0.11          | 0.13                                     | 0.32       |

Table 7.2: Groundwater quality per Quaternary Catchment

|                               |      |                   |        |                   |      |        | Quaterna                                  | ary Catchm   | ents A21J,        | Quaternary Catchments A21J, A21K, A21L & A22A | A22A       |                   |  |            |
|-------------------------------|------|-------------------|--------|-------------------|------|--------|---|--------------|-------------------|---|------------|-------------------|--|------------|
| Chemical Parameter            | Unit |                   | No. of | No. of Samples    |      | Amb    | Ambient GW quality or median <sup>1</sup> | ality or mec | lian <sup>1</sup> | BHN   |            | Groundwater Q     | Groundwater Quality Reserve <sup>3</sup> |            |
|                               |      | A21J              | A21K   | A21L              | A22A | A21J   | A21K                                      | A21L         | A22A              | Reserve <sup>2</sup>                          | A21J       | A21K              | A21L                                     | A22A       |
| Hd                            |      | 150               | 1795   | 10                | 40   | 6.90   | 7.67                                      | 7.61         | 7.50              | 5.0 - 9.5                                     | 6.21 –7.59 | 6.90 8.43         | 6.85 -8.37                               | 6.75 -8.25 |
| Electrical Conductivity       | mS/m | 150               | 1794   | 10                | 40   | 179.50 | 330.50                                    | 31.80        | 32.35             | <150  | 179.50     | 330.50            | 34.98                                    | 35.38      |
| Calcium as Ca                 | mg/ì | 142               | 1801   | 6                 | 36   | 72.36  | 234.00                                    | 32.00        | 5.72              | <150  | 79.60      | 234.00            | 35.20                                    | 6.29       |
| Magnesium as Mg               | mg/l | 142               | 1801   | 6                 | 36   | 97.98  | 158.00                                    | 6.10         | 22.43             | <100  | 100.00     | 158.00            | 6.71                                     | 24.67      |
| Sodium as Na                  | mg/I | 141               | 1800   | 6                 | 36   | 125.30 | 256.96                                    | 23.46        | 17.56             | <200  | 136.83     | 256.96            | 25.80                                    | 19.32      |
| Chloride as Cl                | mg/l | 142               | 1796   | 6                 | 36   | 199.06 | 370.59                                    | 5.00         | 5.00              | <200  | 200.00     | 370.59            | 5.50                                     | 5.50       |
| Sulphate as SO4               | l/gm | 141               | 1796   | 6                 | 36   | 192.65 | 836.09                                    | 5.20         | 5.79              | <400  | 211.92     | 836.09            | 5.72                                     | 6.37       |
| Nitrate as NO <sub>x</sub> -N | l/gm | 142               | 1770   | 6                 | 36   | 7.29   | 3.05                                      | 3.75         | 0.31              | <10   | 8.02       | 3.35              | 4.12                                     | 0.33       |
| Fluoride as F                 | mg/l | 142               | 1560   | 6                 | 36   | 0.22   | 0.01                                      | 0.33         | 0.32              | <1.0  | 0.24       | 0.011             | 0.37                                     | 0.35       |
|                               |      |                   |        |                   |      |        | Quaterna                                  | ary Catchm   | ents A22B,        | Quaternary Catchments A22B, A22C, A22D & A22E | A22E       |                   |  |            |
| Chemical Parameter            | Unit |                   | No. ol | No. of Samples    |      | Amb    | Ambient GW quality or median <sup>1</sup> | ality or mec | Jian <sup>1</sup> | BHN   |            | Groundwater Q     | Groundwater Quality Reserve <sup>3</sup> |            |
|                               |      | A22B <sup>•</sup> | A22C*  | A22D <sup>+</sup> | A22E | A22B'  | A22C <sup>*</sup>                         | A22D *       | A22E              | Reserve <sup>2</sup>                          | A22B*      | A22C <sup>+</sup> | A22D*                                    | A22E       |
| Hq                            |      | 29                | 108    | 4                 | 29   | 7.96   | 7.80                                      | 7.23         | 7.96              | 5.0-9.5                                       | 7.16 -8.75 | 7.02 -8.58        | 6.51 -7.96                               | 7.16 -8.75 |
| Electrical Conductivity       | mS/m | 29                | 108    | 4                 | 29   | 38.80  | 42.95                                     | 38.95        | 38.80             | <150  | 42.68      | 47.25             | 42.84                                    | 42.68      |
| Calcium as Ca                 | l/gm | 29                | 101    | 4                 | 29   | 27.40  | 45.50                                     | 17.20        | 27.40             | <150  | 30.14      | 50.05             | 18.92                                    | 30.14      |
| Magnesium as Mg               | l/gm | 29                | 101    | 4                 | 29   | 25.83  | 26.90                                     | 23.62        | 25.83             | <100  | 28.42      | 29.59             | 25.99                                    | 28.42      |
| Sodium as Na                  | mg/l | 29                | 101    | 4                 | 29   | 6.80   | 4.44                                      | 13.58        | 6.80              | <200  | 7.48       | 4.88              | 14.94                                    | 7.48       |
| Chloride as Cl                | l/gm | 29                | 101    | 4                 | 29   | 5.00   | 4.10                                      | 5.25         | 5.00              | <200  | 5.50       | 4.51              | 5.78                                     | 5.50       |
| Sulphate as SO₄               | mg/l | 29                | 101    | 4                 | 29   | 6.18   | 5.00                                      | 3.70         | 6.18              | <400  | 6.80       | 5.50              | 4.07                                     | 6.80       |
| Nitrate as NO <sub>x</sub> -N | l/gm | 29                | 101    | 4                 | 29   | 0.56   | 1.04                                      | 2.01         | 0.56              | <10   | 0.61       | 1.15              | 2.21                                     | 0.61       |
| Fluoride as F                 | l/gm | 29                | 101    | 4                 | 29   | 0.35   | 0.12                                      | 0.35         | 0.35              | <1.0  | 0.38       | 0.13              | 0.39                                     | 0.38       |
|                               |      |                   |        |                   |      |        |   |              |                   |   |            |                   |  |            |

|                               |      |      |       |                |      |       | Quatern     | ary Catchme                               | ents A22F, A      | Quaternary Catchments A22F, A22G, A22H & A22J | 22.1      |  |                             |           |
|-------------------------------|------|------|-------|----------------|------|-------|-------------|---|-------------------|---|-----------|--|-----------------------------|-----------|
| Chemical Parameter            | Unit |      | No. o | No. of Samples |      | Am    | bient GW qu | Ambient GW quality or median <sup>1</sup> | dian <sup>1</sup> | BHN   |           | Groundwater Quality Reserve <sup>3</sup> | uality Reserve <sup>3</sup> |           |
|                               |      | A22F | A22G  | A22H           | A22J | A22F  | A22G        | A22H                                      | A22J              | Reserve <sup>2</sup>                          | A22F      | A22G                                     | A22H                        | A22J      |
| Hd                            |      | 52   | 108   | 3457           | 25   | 7.88  | 7.80        | 7.64                                      | 7.94              | 5.0-9.5                                       | 7.09-8.67 | 7.02-8.58                                | 6.88-8.40                   | 7.15-8.73 |
| Electrical Conductivity       | mS/m | 52   | 108   | 3457           | 25   | 58.05 | 42.95       | 412.00                                    | 108.00            | <150  | 63.86     | 47.25                                    | 412.00                      | 118.80    |
| Calcium as Ca                 | mg/l | 46   | 101   | 3460           | 20   | 43.75 | 45.50       | 288.84                                    | 100.68            | <150  | 48.13     | 50.05                                    | 288.84                      | 110.75    |
| Magnesium as Mg               | mg/l | 46   | 101   | 3461           | 20   | 20.74 | 26.90       | 205.50                                    | 62.56             | <100  | 22.81     | 29.59                                    | 205.50                      | 68.82     |
| Sodium as Na                  | mg/l | 46   | 101   | 3461           | 20   | 28.27 | 4.44        | 313.50                                    | 48.37             | <200  | 31.10     | 4.88                                     | 313.50                      | 53.20     |
| Chloride as Cl                | mg/l | 46   | 101   | 3456           | 20   | 18.63 | 4.10        | 325.94                                    | 43.32             | <200  | 20.49     | 4.51                                     | 325.94                      | 47.65     |
| Sulphate as SO4               | mg/l | 46   | 101   | 3457           | 20   | 25.99 | 5.00        | 1169.29                                   | 46.64             | <400  | 28.59     | 5.50                                     | 1169.29                     | 51.30     |
| Nitrate as NO <sub>x</sub> -N | mg/l | 46   | 101   | 3405           | 20   | 0.24  | 1.04        | 1.00                                      | 15.95             | <10   | 0.26      | 1.15                                     | 1.10                        | 15.95     |
| Fluoride as F                 | mg/l | 46   | 101   | 2967           | 20   | 0.48  | 0.12        | 0.01                                      | 0.15              | <1.0  | 0.53      | 0.13                                     | 0.011                       | 0.16      |
|                               |      |      |       |                |      |       | Quaterne    | ary Catchme                               | ents A23A, A      | Quaternary Catchments A23A, A23B, A23C & A23D | 23D       |  |                             |           |
| Chemical Parameter            | Unit |      | No. o | No. of Samples |      | Am    | bient GW qu | Ambient GW quality or median <sup>1</sup> | dian <sup>1</sup> | BHN   |           | Groundwater Quality Reserve <sup>3</sup> | uality Reserve <sup>3</sup> |           |
|                               |      | A23A | A23B  | A23C           | A23D | A23A  | A23B        | A23C                                      | A23D              | Reserve <sup>2</sup>                          | A23A      | A23B                                     | A23C                        | A23D      |
| Hd                            |      | 148  | 798   | 83             | 31   | 7.20  | 7.90        | 7.92                                      | 7.70              | 5.0 - 9.5                                     | 6.48–7.92 | 7.11-8.93                                | 7.13-8.71                   | 6.93-8.47 |
| Electrical Conductivity       | mS/m | 148  | 817   | 83             | 31   | 47.00 | 53.00       | 250.00                                    | 37.20             | <150  | 51.70     | 58.30                                    | 250.00                      | 40.92     |
| Calcium as Ca                 | mg/l | 149  | 757   | 76             | 31   | 40.00 | 54.00       | 84.06                                     | 32.20             | <150  | 44.00     | 59.40                                    | 92.47                       | 35.42     |
| Magnesium as Mg               | mg/l | 149  | 758   | 76             | 31   | 23.00 | 33.00       | 53.15                                     | 24.00             | <100  | 25.30     | 36.30                                    | 58.47                       | 26.40     |
| Sodium as Na                  | l/gm | 149  | 758   | 74             | 31   | 16.00 | 4.00        | 371.04                                    | 4.90              | <200  | 17.60     | 4.40                                     | 371.04                      | 5.39      |
| Chloride as CI                | mg/l | 149  | 758   | 76             | 31   | 7.00  | 6.00        | 413.64                                    | 5.30              | <200  | 7.70      | 6.60                                     | 413.64                      | 5.83      |
| Sulphate as SO <sub>4</sub>   | mg/l | 149  | 758   | 74             | 31   | 5.00  | 5.00        | 109.77                                    | 11.50             | <400  | 5.50      | 5.50                                     | 120.74                      | 12.65     |
| Nitrate as NO <sub>x</sub> -N | mg/l | 149  | 797   | 76             | 31   | 3.00  | 1.00        | 11.45                                     | 0.83              | <10   | 3.30      | 1.10                                     | 11.45                       | 0.91      |
| Fluoride as F                 | mg/l | 149  | 758   | 76             | 31   | 0.20  | 0.15        | 1.01                                      | 0.11              | <1.0  | 0.22      | 0.17                                     | 1.01                        | 0.12      |
|                               |      |      |       |                |      |       |             |   |                   |   |           |  |                             |           |

|                               |      |      |        |                |      |        | Quaterr    | ary Catchn                                | nents A23E,        | Quaternary Catchments A23E, A23F, A23G, A23H  | 13H       |  |                             |           |
|-------------------------------|------|------|--------|----------------|------|--------|------------|---|--------------------|---|-----------|--|-----------------------------|-----------|
| Chemical Parameter            | Unit |      | No. of | No. of Samples |      | Am     | bient GW q | Ambient GW quality or median <sup>4</sup> | sdian <sup>1</sup> | BHN   |           | Groundwater Quality Reserve <sup>3</sup> | uality Reserve <sup>3</sup> |           |
|                               |      | A23E | A23F   | A23G           | A23H | A23E   | A23F       | A23G                                      | A23H               | Reserve <sup>2</sup>                          | A23E      | A23F                                     | A23G                        | A23H      |
| Hd                            |      | 988  | 9      | 266            | 68   | 7.66   | 7.32       | 7.93                                      | 8.47               | 5.0 - 9.5                                     | 6.89-8.43 | 6.59-8.05                                | 7.14-8.72                   | 7.62-8.47 |
| Electrical Conductivity       | mS/m | 988  | 9      | 255            | 68   | 90.80  | 69.55      | 65.30                                     | 56.70              | <150  | 99.88     | 76.51                                    | 71.83                       | 62.37     |
| Calcium as Ca                 | l/gm | 988  | 9      | 255            | 67   | 82.60  | 41.40      | 24.10                                     | 53.90              | <150  | 90.86     | 45.54                                    | 26.51                       | 59.29     |
| Magnesium as Mg               | l/gm | 988  | 9      | 258            | 67   | 51.80  | 35.70      | 6.49                                      | 28.30              | <100  | 56.98     | 39.27                                    | 7.14                        | 31.13     |
| Sodium as Na                  | l/gm | 988  | 9      | 266            | 67   | 31.46  | 24.65      | 60.90                                     | 18.60              | <200  | 34.60     | 27.12                                    | 66.99                       | 20.46     |
| Chloride as Cl                | l/gm | 988  | 9      | 255            | 67   | 71.25  | 42.60      | 53.55                                     | 10.10              | <200  | 78.38     | 46.86                                    | 58.91                       | 11.11     |
| Sulphate as SO <sub>4</sub>   | mg/l | 988  | 9      | 258            | 67   | 109.50 | 19.65      | 8.90                                      | 5.10               | <400  | 120.45    | 21.62                                    | 6.79                        | 5.61      |
| Nitrate as NO <sub>x</sub> -N | l/gm | 988  | 9      | 266            | 67   | 5.16   | 5.09       | 0.85                                      | 2.03               | <10   | 5.67      | 5.60                                     | 0.94                        | 2.23      |
| Fluoride as F                 | mg/l | 988  | 9      | 258            | 67   | 0.05   | 0.36       | 0.69                                      | 0.30               | <1.0  | 0.06      | 0.39                                     | 0.76                        | 0.33      |
|                               |      |      |        |                |      |        | Quatern    | ary Catchm                                | ents A23J, A       | Quaternary Catchments A23J, A23K, A23L & A24A | 24A       |  |                             |           |
| Chemical Parameter            | Unit |      | No. of | No. of Samples |      | Am     | bient GW q | Ambient GW quality or median <sup>1</sup> | dian <sup>1</sup>  | BHN   |           | Groundwater Quality Reserve <sup>3</sup> | uality Reserve <sup>3</sup> |           |
|                               |      | A23J | A23K   | A23L           | A24A | A23J   | A23K       | A23L                                      | A24A               | Reserve <sup>2</sup>                          | A23J      | A23K                                     | A23L                        | A24A      |
| Hq                            |      | 127  | 2      | 21             | 57   | 8.37   | 8.18       | 8.13                                      | 7.84               | 5.0 - 9.5                                     | 7.53-9.21 | 7.36–9.00                                | 7.32-8.95                   | 7.06-8.62 |
| Electrical Conductivity       | mS/m | 127  | 2      | 21             | 57   | 38.40  | 63.00      | 112.40                                    | 89.90              | <150  | 42.24     | 69.30                                    | 123.64                      | 98.89     |
| Calcium as Ca                 | mg/l | 121  | 2      | 18             | 53   | 38.90  | 53.07      | 15.47                                     | 90.85              | <150  | 42.79     | 58.38                                    | 17.02                       | 99.94     |
| Magnesium as Mg               | l/gm | 122  | £      | 18             | 53   | 23.75  | 16.20      | 2.30                                      | 52.14              | <100  | 26.13     | 17.82                                    | 2.53                        | 57.36     |
| Sodium as Na                  | l/gm | 122  | 2      | 18             | 53   | 2.38   | 52.99      | 215.24                                    | 19.38              | <200  | 2.62      | 58.29                                    | 215.24                      | 21.32     |
| Chloride as Cl                | l/gm | 122  | 5      | 18             | 53   | 5.00   | 64.79      | 226.96                                    | 63.96              | <200  | 5.50      | 71.26                                    | 226.96                      | 70.36     |
| Sulphate as SO4               | l/gm | 121  | ъ      | 18             | 53   | 6.70   | 11.90      | 10.43                                     | 10.60              | <400  | 7.37      | 13.09                                    | 11.47                       | 11.66     |
| Nitrate as NO <sub>x</sub> -N | l/gm | 123  | υ      | 18             | 53   | 0.17   | 0.77       | 0.04                                      | 1.24               | <10   | 0.18      | 0.85                                     | 0.05                        | 1.37      |
| Fluoride as F                 | mg/l | 121  | 5      | 21             | 53   | 0.16   | 1.03       | 8.81                                      | 0.54               | <1.0  | 0.18      | 1.03                                     | 8.81                        | 0.59      |
|                               |      |      |        |                |      |        |            |   |                    |   |           |  |                             |           |

| Obside the functional beam of the functional function |                               |      |      |        |           |      |        | Quatern   | ary Catchm   | ents A24B, A24     | Quaternary Catchments A24B, A24C, A24D & A24E | ų         |              |                |           |
|--|-------------------------------|------|------|--------|-----------|------|--------|-----------|--------------|--------------------|---|-----------|--------------|----------------|-----------|
| 1         2446         2440         2446         24  | Chemical Parameter            | Unit |      | No. ol | f Samples |      | An     | nbient GW | quality or m | edian <sup>1</sup> | BHN   | 9         | roundwater Q | uality Reserve |           |
| 3          |                               |      | A24B | A24C   | A24D      | A24E | A24B   | A24C      | A24D         | A24E               | Reserve <sup>2</sup>                          | A24B      | A24C         | A24D           | A24E      |
| mSmis of is  | Hd                            |      | 36   | 137    | 24        | 10   | 7.70   | 7.70      | 8.19         | 7.92               | ര്  | 6.93-8.47 | 6.93-8.47    | 7.37-9.01      | 7.13-8.71 |
| 1          | Electrical Conductivity       | mS/m | 36   | 137    | 24        | 10   | 129.15 | 129.00    | 91.25        | 63.00              | <150  | 142.07    | 141.90       | 119.60         | 69.30     |
| щи         щи<   | Calcium as Ca                 | l/gm | 36   | 139    | 20        | 80   | 115.50 | 79.50     | 1.96         | 64.10              | <150  | 127.05    | 87.45        | 2.15           | 70.51     |
| 1         1         1         2         8         77.40         85.7         55.60         65.0  | Magnesium as Mg               | mg/l | 36   | 139    | 20        | ø    | 85.50  | 58.00     | 129.85       | 34.65              | <100  | 100.00    | 63.80        | 129.85         | 38.12     |
| mgi         is   | Sodium as Na                  | l/ɓm | 36   | 139    | 20        | ω    | 77.40  | 90.50     | 5.91         | 26.50              | <200  | 85.14     | 99.55        | 6.50           | 29.15     |
| 1         1         2         0         8         3         1         5  | Chloride as Cl                | mg/l | 36   | 139    | 20        | æ    | 139.30 | 143.10    | 5.25         | 29.79              | <200  | 153.23    | 157.41       | 5.78           | 32.77     |
| (m)         (m) <td>Sulphate as SO4</td> <td>mg/l</td> <td>36</td> <td>139</td> <td>20</td> <td>æ</td> <td>63.70</td> <td>68.20</td> <td>4.83</td> <td>22.50</td> <td>&lt;400</td> <td>70.07</td> <td>75.02</td> <td>5.32</td> <td>24.75</td>  | Sulphate as SO4               | mg/l | 36   | 139    | 20        | æ    | 63.70  | 68.20     | 4.83         | 22.50              | <400  | 70.07     | 75.02        | 5.32           | 24.75     |
| mg/l         36         130         20         8         0.81         0.84         0.10         0.25         <10         0.89         0.32         0.11           Mart         A         A         A         A         A         A         A         0.11         0.39         0.32         0.11         0.11           Mart         A   | Nitrate as NO <sub>x</sub> -N | mg/l | 36   | 139    | 20        | 8    | 8.63   | 3.75      | 1.98         | 14.95              | <10   | 9.49      | 4.13         | 2.17           | 14.95     |
| Mathematical Activity Calibric Activity Calibri Activity Calibric Activity Calibric Activity Calibri Ac            | Fluoride as F                 | mg/l | 36   | 139    | 20        | 8    | 0.81   | 0.84      | 0.10         | 0.25               | <1.0  | 0.89      | 0.92         | 0.11           | 0.28      |
| Unit         No. or Samples         Ambient GW quality or median         BHN         BHN         Act   |                               |      |      |        |           |      |        | Quatern   | ary Catchm   | ents A24F, A24     | IG, A24H & A24                                | 2         |              |                |           |
| 1 <b>A24FA24JA24JA24JA24JA24FA24JA24FA24JA24F</b> <th>Chemical Parameter</th> <th>Unit</th> <th></th> <th>No. of</th> <th>Samples</th> <th></th> <th>An</th> <th>bient GW</th> <th>quality or m</th> <th>edian<sup>1</sup></th> <th>BHN</th> <th>G</th> <th>roundwater Q</th> <th>uality Reserve</th> <th></th>  | Chemical Parameter            | Unit |      | No. of | Samples   |      | An     | bient GW  | quality or m | edian <sup>1</sup> | BHN   | G         | roundwater Q | uality Reserve |           |
| 1         444         8         26         309         7.00         7.59         7.90         5.0-9.5         6.30-7.70         6.83-8.35           1         mSim         435         8         26         309         7.00         7.59         7.90         6.94-8.36         6.30-7.70         6.83-8.35           1         mSim         435         8         26         309         297.00         45.00         76.35         102.40         <150         297.00         49.50         83.99           1         mgl         434         8         26         270         44.75         62.80         <150         45.10         49.53         83.99           1         mgl         434         8         26         278         41.00         32.30         58.10         <150         45.10         49.23           1         mgl         436         8         26         2780         58.10         45.10         45.46         35.33           1         mgl         436         8         26         2780         58.10         74.00         35.33         42.46           1         mgl         434         8         266         150.0   |                               |      | A24F | A24G   | A24H      | A24J | A24F   | A24G      | A24H         | A24J               | Reserve <sup>2</sup>                          | A24F      | A24G         | A24H           | A24J      |
| mS/m         435         8         26         309         45.00         45.00         45.00         49.50         83.99         83.99           mg/l         434         8         26         278         45.00         45.00         45.10         49.50         49.50         83.99         83.99           mg/l         434         8         26         278         152.00         41.00         44.75         62.80         <150.00   | Hđ                            |      | 444  | æ      | 26        | 309  | 7.60   | 7.00      | 7.59         | 7.90               | 5.0-9.5                                       | 6.84-8.36 | 6.30-7.70    | 6.83-8.35      | 7.11-8.69 |
| mg/l         434         8         26         278         152.00         41.05         62.80         <150         152.00         45.10         49.23           mg/l         433         8         26         278         115.00         400         32.30         58.10         <100   | Electrical Conductivity       | mS/m | 435  | 8      | 26        | 309  | 297.00 | 45.00     | 76.35        | 102.40             | <150  | 297.00    | 49.50        | 83.99          | 112.64    |
| mg/l         433         8         268 <b>115.00</b> 4.00         35.33         55.10<   | Calcium as Ca                 | mg/l | 434  | 8      | 26        | 278  | 152.00 | 41.00     | 44.75        | 62.80              | <150  | 152.00    | 45.10        | 49.23          | 69.08     |
| mg/l         446         8         26         278         365.00         33.00         38.60         62.80         <200         36.30         42.46         42.46           mg/l         434         8         26         278         35.00         33.00         38.60         62.80         36.30         36.30         42.46         42.46           mg/l         434         8         26         278         85.56         10.00         29.50         85.35         <200   | Magnesium as Mg               | l/gm | 433  | œ      | 26        | 278  | 115.00 | 4.00      | 32.30        | 58.10              | <100  | 115.00    | 4.40         | 35.53          | 63.91     |
| mg/l         434         8         26         278         825.60         10.00         29.50         85.35         <200         825.60         11.00         32.45           mg/l         445         8         26         278         15.50         18.00         9.90         46.70         <400   | Sodium as Na                  | l/gm | 446  | ø      | 26        | 278  | 305.00 | 33.00     | 38.60        | 62.80              | <200  | 305.00    | 36.30        | 42.46          | 69.08     |
| mg/l         445         8         26         278         115.50         18.00         9.90         46.70         <400         127.05         19.80         10.89         10.89           mg/l         336         8         26         278         3.48         0.12         0.89         556         <10   | Chloride as Cl                | l/gm | 434  | ω      | 26        | 278  | 825.60 | 10.00     | 29.50        | 85.35              | <200  | 825.60    | 11.00        | 32.45          | 93.89     |
| mg/l         336         8         26         278         3.48         0.12         0.89         5.56         <10         3.82         0.13         0.98           mg/l         392         8         26         278         0.11         3.00         0.67         0.68         <10   | Sulphate as SO₄               | l/gm | 445  | œ      | 26        | 278  | 115.50 | 18.00     | 9.90         | 46.70              | <400  | 127.05    | 19.80        | 10.89          | 51.37     |
| mg/l         392         8         26         278         0.21         3.00         0.67         0.68         <1.0         0.23         3.30         0.73  | Nitrate as NO <sub>x</sub> -N | l/gm | 336  | œ      | 26        | 278  | 3.48   | 0.12      | 0.89         | 5.56               | <10   | 3.82      | 0.13         | 0.98           | 6.12      |
|  | Fluoride as F                 | l/gm | 392  | 80     | 26        | 278  | 0.21   | 3.00      | 0.67         | 0.68               | <1.0  | 0.23      | 3.30         | 0.73           | 0.75      |

|                               |      |      |        |                |      |       | Quaterr   | nary Catchn                               | nents A31, A31      | Quaternary Catchments A31, A31B, A31C & A31D  |           |               |  |           |
|-------------------------------|------|------|--------|----------------|------|-------|-----------|---|---------------------|---|-----------|---------------|--|-----------|
| Chemical Parameter            | Unit |      | No. of | No. of Samples |      | An    | nbient GW | Ambient GW quality or median <sup>1</sup> | iedian <sup>1</sup> | BHN   | 0         | iroundwater Q | Groundwater Quality Reserve <sup>3</sup> |           |
|                               |      | A31A | A31B   | A31C           | A31D | A31A  | A31B      | A31C                                      | A31D                | Reserve <sup>2</sup>                          | A31A      | A31B          | A31C                                     | A31D      |
| Hq                            |      | 75   | 30     | 480            | 710  | 8.05  | 7.37      | 7.90                                      | 8.00                | 5.0 - 9.5                                     | 7.25-8.86 | 6.63-8.11     | 7.11-8.69                                | 7.20-8.80 |
| Electrical Conductivity       | mS/m | 75   | 30     | 526            | 758  | 30.50 | 69.75     | 47.40                                     | 50.90               | <150  | 33.55     | 76.73         | 52.14                                    | 55.99     |
| Calcium as Ca                 | mg/l | 75   | 25     | 473            | 695  | 30.54 | 85.27     | 47.60                                     | 53.50               | <150  | 33.59     | 93.80         | 52.36                                    | 58.85     |
| Magnesium as Mg               | mg/I | 75   | 25     | 473            | 697  | 18.20 | 56.80     | 31.25                                     | 32.17               | <100  | 20.02     | 62.48         | 34.38                                    | 35.39     |
| Sodium as Na                  | mg/l | 75   | 25     | 473            | 697  | 3.40  | 17.60     | 2.60                                      | 3.20                | <200  | 3.74      | 19.35         | 2.86                                     | 3.52      |
| Chloride as Cl                | mg/l | 75   | 25     | 473            | 698  | 5.69  | 35.90     | 4.60                                      | 5.69                | <200  | 6.26      | 39.49         | 5.06                                     | 6.26      |
| Sulphate as SO₄               | l/gm | 75   | 25     | 473            | 697  | 3.00  | 59.33     | 4.50                                      | 10.10               | <400  | 3.30      | 65.26         | 4.95                                     | 11.11     |
| Nitrate as NO <sub>x</sub> -N | l/gm | 75   | 25     | 476            | 695  | 0.23  | 1.64      | 0.21                                      | 0.31                | <10   | 0.25      | 1.81          | 0.23                                     | 0.35      |
| Fluoride as F                 | l/gm | 75   | 25     | 473            | 682  | 0.10  | 0.26      | 0.19                                      | 0.23                | <1.0  | 0.11      | 0.29          | 0.21                                     | 0.25      |
|                               |      |      |        |                |      |       | Quatern   | ary Catchm                                | ents A31E, A31      | Quaternary Catchments A31E, A31F, A31G & A31H | Ŧ         |               |  |           |
| Chemical Parameter            | Unit |      | No. of | Vo. of Samples |      | An    | nbient GW | Ambient GW quality or median <sup>1</sup> | hedian <sup>1</sup> | BHN   | 0         | roundwater Q  | Groundwater Quality Reserve <sup>3</sup> |           |
|                               |      | A31E | A31F   | A31G           | A31H | A31E  | A31F      | A31G                                      | A31H                | Reserve <sup>2</sup>                          | A31E      | A31F          | A31G                                     | A31H      |
| Hd                            |      | 2    | 26     | 16             | 27   | 7.50  | 7.79      | 8.13                                      | 7.92                | 5.0 - 9.5                                     | 6.75-8.25 | 7.01-8.57     | 7.32-8.95                                | 7.13-8.71 |
| Electrical Conductivity       | mS/m | 2    | 26     | 16             | 27   | 17.70 | 74.65     | 41.95                                     | 76.40               | <150  | 19.47     | 82.12         | 46.15                                    | 84.04     |
| Calcium as Ca                 | l/gm | 7    | 21     | 13             | 22   | 14.20 | 18.10     | 20.93                                     | 44.68               | <150  | 15.62     | 19.91         | 23.02                                    | 49.15     |
| Magnesium as Mg               | l/ɓm | 7    | 21     | 13             | 22   | 10.00 | 15.50     | 35.00                                     | 23.11               | <100  | 11.00     | 17.05         | 38.50                                    | 25.42     |
| Sodium as Na                  | l/gm | 7    | 21     | 13             | 22   | 5.80  | 14.70     | 8.55                                      | 81.63               | <200  | 6.38      | 16.17         | 9.40                                     | 89.79     |
| Chloride as Cl                | l/gm | 7    | 22     | 13             | 22   | 3.30  | 5.30      | 5.00                                      | 65.68               | <200  | 3.63      | 5.83          | 5.50                                     | 72.24     |
| Sulphate as SO <sub>4</sub>   | l/gm | 7    | 22     | 13             | 22   | 2.00  | 9.99      | 3.00                                      | 10.77               | <400  | 2.20      | 10.99         | 3.30                                     | 11.85     |
| Nitrate as NO <sub>x</sub> -N | l/gm | 7    | 53     | 13             | 22   | 0.35  | 2.06      | 0.27                                      | 8.43                | <10   | 0.38      | 2.27          | 0:30                                     | 9.27      |
| Fluoride as F                 | mg/l | 7    | 53     | 13             | 22   | 0.27  | 0.16      | 0.11                                      | 0.42                | <1.0  | 0.30      | 0.18          | 0.12                                     | 0.46      |
|                               |      |      |        |                |      |       |           |   |                     |   |           |               |  |           |

|                               |      |                   |        |                |       |        | Quatern  | ary Catchme                               | ents A31J, A32     | Quaternary Catchments A31J, A32A, A32B & A32C | 0         |              |  |                   |
|-------------------------------|------|-------------------|--------|----------------|-------|--------|----------|---|--------------------|---|-----------|--------------|--|-------------------|
| Chemical Parameter            | Unit |                   | No. of | No. of Samples |       | An     | bient GW | Ambient GW quality or median <sup>1</sup> | edian <sup>1</sup> | BHN   | 5         | roundwater Q | Groundwater Quality Reserve <sup>3</sup> |                   |
|                               |      | A31J              | A32A   | A32B *         | A32C* | A31J   | A32A     | A32B *                                    | A32C <sup>+</sup>  | Reserve <sup>2</sup>                          | A31J      | A32A         | A32B*                                    | A32C <sup>°</sup> |
| Hd                            |      | 2                 | 23     | 24             | 7     | 7.72   | 8.15     | 8.19                                      | 7.72               | 5.0-9.5                                       | 6.95-8.49 | 7.34-8.97    | 7.37–9.01                                | 6.95-8.49         |
| Electrical Conductivity       | mS/m | 7                 | 23     | 24             | 7     | 76.00  | 90.10    | 91.25                                     | 76.00              | <150  | 83.60     | 99.11        | 119.60                                   | 83.60             |
| Calcium as Ca                 | mg/l | 5                 | 18     | 20             | 5     | 46.60  | 25.29    | 1.96                                      | 46.60              | <150  | 51.26     | 27.82        | 2.15                                     | 51.26             |
| Magnesium as Mg               | mg/l | 5                 | 18     | 20             | 5     | 72.10  | 96.40    | 129.85                                    | 72.10              | <100  | 79.31     | 106.04       | 129.85                                   | 79.31             |
| Sodium as Na                  | mg/l | 5                 | 18     | 20             | 5     | 27.70  | 23.87    | 5.91                                      | 27.70              | <200  | 30.47     | 26.25        | 6.50                                     | 30.47             |
| Chloride as Cl                | mg/l | 9                 | 18     | 20             | 9     | 4.70   | 25.39    | 5.25                                      | 4.70               | <200  | 5.17      | 27.92        | 5.78                                     | 5.17              |
| Sulphate as SO₄               | mg/l | 5                 | 18     | 20             | 5     | 22.40  | 33.30    | 4.83                                      | 22.40              | <400  | 24.64     | 36.63        | 5.32                                     | 24.64             |
| Nitrate as NO <sub>x</sub> -N | mg/l | 9                 | 18     | 20             | 6     | 2.53   | 5.77     | 1.98                                      | 2.53               | <10   | 2.78      | 6.35         | 2.17                                     | 2.78              |
| Fluoride as F                 | mg/l | 5                 | 18     | 20             | 5     | 0.18   | 0.19     | 0.10                                      | 0.18               | <1.0  | 0.20      | 0.21         | 0.11                                     | 0.20              |
|                               |      |                   |        |                |       |        | Quatern  | ary Catchm                                | ents A32D, A3;     | Quaternary Catchments A32D, A32E, A10A& A10B  | 8         |              |  |                   |
| Chemical Parameter            | Unit |                   | No. of | No. of Samples |       | An     | bient GW | Ambient GW quality or median <sup>1</sup> | edian <sup>1</sup> | BHN   | 9         | roundwater Q | Groundwater Quality Reserve <sup>3</sup> |                   |
|                               |      | A32D <sup>°</sup> | A32E   | A10A           | A10B  | A32D ^ | A32E     | A10A                                      | A10B               | Reserve <sup>2</sup>                          | A32D *    | A32E         | A10A                                     | A10B              |
| Hq                            |      | 24                | 89     | 503            | 38    | 8.19   | 8.06     | 7.98                                      | 7.88               | 5.0-9.5                                       | 7.37-9.01 | 7.25-8.87    | 7.18-8.78                                | 7.09-8.67         |
| Electrical Conductivity       | mS/m | 24                | 68     | 473            | 38    | 91.25  | 106.70   | 45.70                                     | 76.20              | <150  | 119.60    | 117.34       | 50.27                                    | 83.82             |
| Calcium as Ca                 | l/gm | 20                | 63     | 435            | 31    | 1.96   | 64.97    | 49.10                                     | 45.20              | <150  | 2.15      | 71.47        | 54.01                                    | 49.72             |
| Magnesium as Mg               | mg/l | 20                | 63     | 499            | 31    | 129.85 | 67.79    | 29.00                                     | 26.40              | <100  | 129.85    | 74.57        | 31.90                                    | 29.04             |
| Sodium as Na                  | l/gm | 20                | 63     | 499            | 31    | 5.91   | 66.66    | 2.40                                      | 56.41              | <200  | 6.50      | 73.33        | 2.64                                     | 62.05             |
| Chloride as Cl                | mg/l | 20                | 63     | 432            | 31    | 5.25   | 59.93    | 4.80                                      | 54.00              | <200  | 5.78      | 65.48        | 5.28                                     | 59.40             |
| Sulphate as SO <sub>4</sub>   | mg/l | 20                | 63     | 499            | 31    | 4.83   | 15.86    | 4.40                                      | 10.79              | <400  | 5.32      | 17.45        | 4.84                                     | 11.87             |
| Nitrate as NO <sub>x</sub> -N | l/gm | 20                | 67     | 500            | 32    | 1.98   | 11.81    | 0.79                                      | 7.34               | <10   | 2.17      | 11.81        | 0.87                                     | 8.08              |
| Fluoride as F                 | mg/l | 20                | 63     | 499            | 31    | 0.10   | 0.41     | 0.10                                      | 0.40               | <1.0  | 0.11      | 0.45         | 0.11                                     | 0.44              |
|                               |      |                   |        |                |       |        |          |   |                    |   |           |              |  |                   |

|                               |      |                | Quaterna                                     | Quaternary CatchmentA10C |   |
|-------------------------------|------|----------------|--|--------------------------|---|
| Chemical Parameter            | Unit | No. of Samples | Ambient GW<br>quality or median <sup>1</sup> | BHN Reserve <sup>2</sup> | Groundwater Quality<br>Reserve <sup>3</sup> |
|                               |      | A10C           | A10C   |                          | A10C  |
| Hd                            |      | 22             | 7.96   | 5.0 - 9.5                | 7.16–8.75                                   |
| Electrical Conductivity       | mS/m | 22             | 108.60                                       | <150                     | 119.46                                      |
| Calcium as Ca                 | mg/l | 17             | 109.10                                       | <150                     | 120.01                                      |
| Magnesium as Mg               | mg/f | 17             | 89.65  | <100                     | 98.62                                       |
| Sodium as Na                  | mg/l | 17             | 6.53   | <200                     | 7.18  |
| Chloride as Cl                | mg/l | 17             | 18.91  | <200                     | 20.80                                       |
| Sulphate as SO₄               | mg/l | 17             | 9.12   | <400                     | 10.03                                       |
| Nitrate as NO <sub>x</sub> -N | mg/l | 17             | 8.06   | <10                      | 8.86  |
| Fluoride as F                 | mg/l | 17             | 0.24   | <1.0                     | 0.26  |
|                               |      |                |  |                          |   |

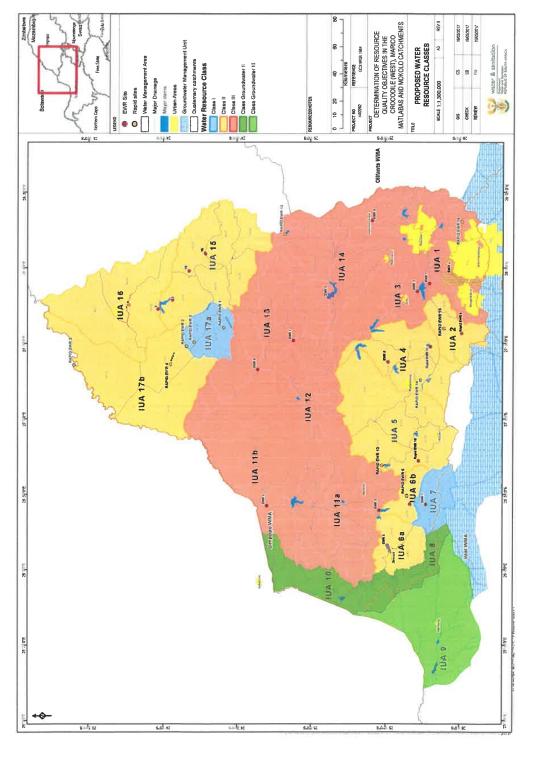
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<sup>21</sup> Ref. *Quality of Domestic Water Supplies, Volume 1: Assessment Guide, 2<sup>rd</sup> Ed. 1998. Water Research Commission Report No: TT 101/98. Pretoria, South Africa (Set for a Class 1).* <sup>3</sup>Where a difference in the water quality 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 reserve, the value was scaled up by 10 per cent provided that the value does not exceed the BHN Reserve.

A total of 6 quaternary catchments do not have groundwater chemistry data, and are as highlighted in red in Table 7.2 above. The ambient groundwater quality was extrapolated from neighbouring quaternary catchments with a similar geology because geology has a huge bearing on the water quality of an area.

# Table 7.3: Summary of the water quality class and parameters of concern

| Quaternary catchment | Water quality class<br>(WRC, 1998) | Water quality parameters of concern  |
|----------------------|------------------------------------|--|
| A10A                 | 0                                  | None   |
| A10B                 | 1                                  | None   |
| A10C                 |                                    | Calcium, Electrical Conductivity, Magnesium, Nitrate   |
| A21A                 | 0                                  | None   |
| A21B                 | 0                                  | None   |
| A21C                 |                                    | Calcium, Electrical Conductivity, Magnesium, Nitrate, Sulphate   |
| A21D                 | 0                                  | None   |
| A21E                 | 0                                  | None   |
| A21E                 | 0                                  | None   |
| A21G                 | 0                                  | None   |
| A210                 | 0                                  | None   |
|                      |                                    |  |
| A21J<br>A21K         | 111                                | Sodium, Magnesium, Chloride, Nitrate, Electrical Conductivity<br>Sulphate, Calcium, Magnesium, Sodium, Chloride, Electrica |
| 4041                 | 0                                  | Conductivity   |
| A21L                 | 0                                  | None   |
| A22A                 | 0                                  | None   |
| A22B                 | 0                                  | None   |
| A22C                 | 0                                  | None   |
| A22D                 | 0                                  | None   |
| A22E                 | 0                                  | None   |
| A22F                 | 0                                  | None   |
| A22G                 | 0                                  | None   |
| A22H                 | Ш                                  | Sulphate, Electrical Conductivity, Calcium, Magnesium, Sodium Chloride,  |
| A22J                 |                                    | Electrical Conductivity, Nitrate   |
| A23A                 | 0                                  | None   |
| A23B                 | 0                                  | None   |
| A23C                 |                                    | Chloride, Electrical Conductivity, Fluoride, Nitrate, Sodium   |
| A23D                 | 0                                  | None   |
| A23E                 | 1                                  | Calcium, Electrical Conductivity   |
| A23F                 | 0                                  | None   |
| A23G                 | 0                                  | None   |
| A236                 | 0                                  | None   |
| A23J                 | 0                                  | None   |
| A235<br>A23K         | 1                                  | Fluoride   |
|                      |                                    |  |
| A23L                 |                                    | Fluoride, Sodium, Chloride   |
| A24A                 |                                    | Calcium, Electrical Conductivity   |
| A24B                 |                                    | Electrical Conductivity, Calcium, Magnesium, Sodium, Chloride  |
| A24C                 |                                    | Chloride, Fluoride, Electrical Conductivity  |
| A24D                 |                                    | Magnesium, Electrical Conductivity   |
| A24E                 | 0                                  | None   |
| A24F                 |                                    | Chloride, Electrical Conductivity, Sodium, Magnesium, Calcium  |
| A24G                 | 0                                  | None   |
| A24H                 |                                    | Electrical Conductivity  |
| A24J                 | I                                  | Electrical Conductivity  |
| A31A                 | 0                                  | None   |
| A31B                 |                                    | Calcium  |
| A31C                 | 0                                  | None   |
| A31D                 | 0                                  | None   |
| A31E                 | 0                                  | None   |
| A31F                 |                                    | Electrical Conductivity  |
| A31G                 | 0                                  | None   |
| A31H                 |                                    | Electrical Conductivity, Nitrate   |
| A31J                 |                                    | Magnesium, Electrical Conductivity   |
| A32A                 |                                    | Magnesium, Electrical Conductivity   |
| A32B                 |                                    | Magnesium, Electrical Conductivity   |
| A32C                 | · · ·                              | Magnesium, Electrical Conductivity   |
| A32D                 |                                    | Magnesium, Electrical Conductivity   |
| A32E                 | <br>                               | Nitrate  |





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# KITSISO YA KAKARETSO

# KITSISO YA No. \_\_\_\_YA 2021

# LEFAPHA LA METSI LE KGELELOLESWE

# MOLAO WA BOSETŠHABA WA METSI WA 1998 (MOLAO WA NO. YA 36 WA 1998)

# TLHOMAMISO YA RESEFE YA METSWEDI YA METSI YA MADUTELO A BOPHIRIMA JWA CROCODILE LE MARICO GO YA KA KAROLO YA 16(1) LE YA (2) YA MOLAO WA BOSETŠHABA WA METSI WA 1998 (MOLAO WA NO.YA 36 WA 1998)

Nna Senzo Mchunu, mo maemong a me jaaka Tona ya Metsi le Kgeleloleswe, morago ga go obamela karolo ya 13 ya Molao wa Bosetšhaba wa Metsi wa 1998 (Molao wa No. ya 36 wa 1998) ("Molao"), le Molawana wa 3 wa Melawana ya Tlhagiso ya Thulaganyo ya Karoganyo ya Didirisiwa tsa Metsio (No.ya R. 810 No, ya Kitsiso ya 33541, ya 17 Lwetse 2010), e bile ke dumeletswe sentle go ya ka karolo ya 16(1) le ya 63(1)(a) ya Molao, morago ga go obamela karolo ya 16(2) le ya (3) ya Molao, ke phasalatsa Tlhomamiso ya Resefe ya metswedi ya metsi ya madutelo a Bophirima jwa Crocodile le Marico.

Mokaedi: Tihomamiso ya Resefe Go: Rre Yakeen Atwaru Lefapha la Metsi le Kgeleloleswe Kago ya Ndinaye 178 Mmila wa Francis Baard Private Bag X313 Pretoria 0001 Imeile: atwaruy@dws.gov.za

SENZO MCHUNU (MP) TONA YA METSI LE KGELELOLESWE LETLHA: (3/0 /2002/

### MAMETLELELO

### TLHOMAMISO YA RESEFE YA METSWEDI YA METSI YA MADUTELO A BOPHIRIMA JWA CROCODILE LE MARICO GO YA KA KAROLO YA 16(1) LE YA (2) YA MOLAO WA BOSETŠHABA WA METSI WA 1998 (MOLAO WA NO.YA 36 WA 1998)

### 1. DIAKERONIMI LE DITLHALOSO

### 1.1. Lenane la Diakeronimi

| ASPT     | Sekoro sa Palogare go ya ka Thekesene   |
|----------|---|
| BHN      | Ditlhokwa tsa Motheo tsa Batho  |
| CEV      | Boleng jwa Ditlamorago tse di Tswelelang pele                                   |
| DWA      | Lefapha la Merero ya Metsi  |
| DWAF     | Lefapha la Metsi le Dikgwa  |
| DWS      | Lefapha la Metsi le Kgeleloleswe  |
| EcoSpecs | Dikaelo tsa Ekholoji  |
| EIS      | Botlhokwa jwa Ekholoji le Bomasisi  |
| EWR      | Ditlhokego tsa Metsi tsa Ekholoji   |
| FRAI     | Indekese ya Tshekatsheko ya Tsibogo ya Ditlhapi                                 |
| GRDM     | Mokgwa wa Tlhomamiso ya Resefe ya Metsi a ka fa teng ga<br>lefatshe             |
| GW       | Metsi a ka fa Teng ga lefatshe  |
| HN       | Sedirisiwa  |
| МСМ      | Dikubikimitara di le Milione  |
| MLF      | Kelo ya Metsi ya Tlhokomelo   |
| NMAR     | Go gogiwa ga Metsi ka Ngwaga ka Mokgwa wa TIhago                                |
| NTU      | Diyuniti tsa Nefelometiriki tsa Tebiditi  |
| PAI      | Tshupane ya Tshekatsheko ya Setlhotlheletsi se se Bonagalang le<br>sa Khemikale |
| PES      | Maemo a Gajaana a Ekholoji  |
| RC       | Maemo a Tshupetso   |
| REC      | Karolo e e Atlanegisitsweng ya Ekholoji   |
| RHP      | Lenaane la Boitekanelo la Noka  |
| SRP      | Otofoseforase e e Tlhaologang e e Tsibogang                                     |
| TIN      | Naeterojene ya Botlalo e e sa Boleng  |
| TPCs     | Matseno a Ntlha ya Kgonagalo  |
| WMS      | Thulaganyo ya Tsamaiso ya Metsi   |
| WRC      | Khomišene ya Patlisiso ya Metsi   |
| WQ       | Boleng jwa Metsi  |
|          |   |

### 1.2. Ditlhaloso

Mo Mametlelelong e, lefoko lengwe le lengwe le le neetsweng bokao mo Molaong wa Bosetšhaba wa Metsi le tla kaya bokao jo le bo neetsweng gape, ntle le fa bokao bo kaya ka mokgwa mongwe-

- "Kelelo ya kwa tlase" ke kelelo ya kwa tlase e e tswelediwang ya mo dinokeng ka nako ya maemo a bosa a a omileng le le a a siameng, fela a sa abelwa otlhe ke metsi a a kwa tlase ga lefatshe; go akaretsa kabelo go tswa mo kelelong ya ka fa gare e e diegileng le go tswa ga metsi a a ka fa tlase ga lefatshe;
- "SetIhopha sa Motswedi wa Metsi" ke setIhopha sa dimelo tse di elediwang tsa tiriso le maemo a ekholoji a metswedi e e botlhokwa ya metsi mo bodutelong jo bo rileng (yuniti e e tshwaraganeng ya tshekatsheko). SetIhopha se tshwanetse go tlhalosa bogolo jwa tiriso ya metswedi ya metsi; Resefe; maitIhomo a boleng jwa motswedi le tlhomamiso ya karolo e e abiwang ya motswedi wa metsi o o dirisiwang. Motswedi wa metsi o tshwanetse go farologanngwa ka e le nngwe ya ditlhopha di le tharo, SetIhopha sa I motswedi wa metsi le SetIhopha sa II motswedi wa metsi;
- "Setlhopha sa Ekholoji"ke maemo a ekholoji go motswedi wa metsi a a kayang phapogo ya dikarolo tsa baeyofisikale ya motswedi wa mesti go tswa mo maemong a kaelo a tlhago;
- "Botlhokwa le Bomasisi jwa Ekholoji" (EIS) bo kaya dibontshi tse di botlhokwa mo tlhophelong ya ekholoji ya metswedi ya metsi. Botlhokwa jwa Ekholoji bo amana le go nna teng, go emelwa le mefutafuta ya ditshedi tsa mo lefelong le le rileng le bonno. Bomasisi jwa ekholoji bo amana le ketsaetsego ya bonno le ditshedi mo lefelong le le rileng mo diphetogong tse di ka diragalang mo dikelelong, mo maemong a metsi le mo maemong a lefatshe a a nang le dikhemikale;
- "Ditlhokego tsa Metsi tsa Ekholoji" (EWR) ke mekgwa ya kelelo (bogolo, nako le lobaka) le metsi a a boleng a a tlhokegang go tshola tikologo ya dinoka mo maemong a a rileng e bile lereo le le dirisiwa go kaya dikarolo tsa bokanakang le boleng ka bobedi tsa tikologo ya dinoka;
- "Mafelo a Ditlhokego tsa Metsi tsa Ekholoji" (EWR) ke dintlha tse di totobetseng tsa noka jaaka go tlhomamisitswe ka thulaganyo ya tlhopho ya lefelo. Lefelo la EWR le na le boleele jwa noka e e ka nnang le mefuta ya dikarolo tse di farologaneng ka maikemisetso a metsi le ekholoji. Mafelo a, a tlamela ka dibontshi tse di lekaneng go tlhatlhoba dikelelo tsa tikologo le go tlhatlhoba maemo a dikarolo tsa saense ya tiriso ya melao ya fisika mo bayolojing (ditlhotlheletsi tse di jaaka haeteroloji, jeomofoloji le dikhemikale tsa fisika) le ditsibogo tsa bayoloji (viz. ditlhapi, ditshedi tse di senang mokwatla le dimela tse di mo lotshitshing);
- "Go tlatsa" ke koketso ya metsi mo lefelong le le kolobileng, ka nwelelo ya kwa tlase ya pula kgotsa metsi a a mo boalong le/ kgotsa go elela ga metsi a a ka fa tlase ga lefatshe a a gaufi le matlapa a a monang metsi;
- "Karolo e e Atlanegisitsweng ya Ekholoji" (REC) ke karolo ya ekholoji e e bontshang taolo e e totilweng ya motswedi wa metsi e e ka ga tlhophelo ya ona ya ekholoji e e tshwanetseng go fitlhelelwa. Dikarolo di tloga ka Karolo ya A (se se sa fetolwang, tlhago) go fitlha go Karolo ya D (se se fetotsweng thata);
- "Resefe" ke bokanakang le boleng jwa metsi a a tlhokegang go kgotsofatsa ditlhokwa tsa motheo tsa batho ka go bona thebolelo ya motheo ya metsi le go sireletsa tikologo ya mo metsing kgotsa ya fa gaufi le metsi go bona tlhabololo e e tswelelang ya tikologo le tiriso ya motswedi o o maleba wa metsi;
- "Mo noka e kopang le e nngwe teng" (kopano ya bayofisikale) ke dintlha tsa sekao tse di emetseng kelelo godimo kgotsa lefelo la metsi la thulaganyotikologo (dinoka, meraga, kgwelo le metsi a a ka fa tlase ga lefatshe) mo setlhopha sa dikamano se dirang teng.

### 2. TLHALOSO YA MOTSWEDI WA METSI

2.1 Resefe e tlhomamisiwago motswedi wa metsi otlhe o o botlhokwa kgotsa go karolo nngwe le nngwe e e botlhokwa ya ona mo madutelong a (Bophirima) jwa Crocodile le Marico, jaaka go tlhagisiwa fa tlase:

| Lefelo la Tsamaiso ya Metsi: | Limpopo   |
|------------------------------|---|
| Kgaolo ya Kgamolo:           | A21 go A24, A31 & A32 Kgaolo e Kgolwane ya Kgamolo      |
| Noka kgotsa dinoka:          | Dithulaganyo tsa noka ya (Bophirima) jwaCrocodile le ya |
|                              | Marico  |

- 2.2 Tona o go ya ka karolo ya 12 ya Molao wa Bosetšhaba wa Metsi wa 1998 (Molao wa No. ya 36 wa 1998) ("Molao"), tlhagisitse thulaganyo ya go arologanya metswedi ya metsi ka go rebola Kitsiso ya Puso ya No. ya R. 810, e e phasaladitsweng mo Kuranteng ya Puso ya No. ya 33541 ya letlha la 17 Lwetse 2010. Go ya ka karolo ya 16(1) ya Molao, Tona o tshwanetse, ka bonako jo bo matshwanedi morago ga karologanyo ya motswedi otlhe wa metsi kgotsa karolo ya ona e setse e tlhomamisitswe, ka Kitsiso mo Kuranteng, go tlhomamisa resefe go motswedi otlhe wa metsi kgotsa karolo ya ona.
- 2.3 Tona, go ya ka karolo ya 16(1) le ya (2) ya Molao, o kaya Diresefe tse di latelang mabapi le madutelo a Bophirima jwa Crocodile le Marico.

### 3. TLHOMAMISO YA RESEFE E E TSHITSHINTSWENG JAAKA GO TLHOKEGA GO YA KA KAROLO YA 16(1) LE YA (2) YA MOLAO WA BOSETŠHABA WA METSI WA 1998

Tshobokanyo ya karolo ya bogolo mabapi le Dinoka tse di akaretsang EWR (**Setshwantsho sa 1**) le BHN go ya ka karolo ya 16(1) ya Molao mabapi le bodutelo jwa (Bophirima) Crocodile le jwa Marico e tlhagisiwa mo Karolong ya 4. **Thulaganyo ya 4.1& 4.2** e akaretsa dipholo tsa mafelo a EWR le dikopano tsa bayofisikale;

Tshobokanyo ya karolo ya boleng mabapi le Noka kwa mafelong a EWR go ya ka karolo ya 16(1) ya Molao mabapi le bodutelo jwa (Bophirima) jwa Crocodile le jwa Marico e tlhagisiwa mo **Thulaganyong ya 5.1-5.24**;

Tshobokanyo ya seatse sa metsi a ka fa tlase ga lefatshe go Resefe mabapi le Bontsi jwa Metsi go ya ka karolo ya 16(1) ya Molao mabapi le bodutelo jwa (Bophirima) jwa Crocodile le jwa Marico e tlhagisiwa mo **Thulaganyong ya 6.1**;

Tshobokanyo ya seabe sa metsi a ka fa tlase ga lefatshe go Resefe mabapi le Boleng jwa Metsi go ya ka karolo ya 16(1) ya Molao mabapi le botutelo jwa (Bophirima) jwa Crocodile le jwa Marico e tlhagisiwa mo **Thulaganyong ya 7.1, 7.2 le 7.3**;

Resefe e tla dira go simolola ka letlha le le kailweng jaaka go tlhomamisitswe go ya ka Karolo ya 16(1) ya Molao, ntle le fa go totobaditswe ke Tona ka mokgwa mongwe.

### 4. METSI A MO BOALONG - KAROLO YA BONTSI MABAPI LE DINOKA

Dipholo tse di tshitshintsweng mabapi le tlhomamiso ya Resefe le karologanyo ya ekholoji mabapi le bodutelo jwa (Bophirima) jwa Crocodile le jwa Marico, mo bokanakang jwa Resefe bo tlhagisiwa e le peresente ya NMAR mabapi le madutelo a a rileng (ka botlalo) go ya ka karolo ya (16)(1).

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| Leina la Kopano            | Botutelo jwa<br>Kwatenari | Leina la Noka  | PES | EIS             | Karolo e e Atlanegisitsweng<br>ya Ekholoji e e tshwanetseng<br>go tlhokomelwa | NMAR<br>(MCM) | EWR<br>%<br>NMAR <sup>2</sup> | Resefe ya<br>BHN<br>(%NMAR) <sup>3</sup> | Resefe ya<br>Botlalo<br>(%NMAR) <sup>4</sup> |
|----------------------------|---------------------------|--|-----|-----------------|---|---------------|-------------------------------|--|--|
| Lefelo la EWR<br>Croc_EWR1 | A21 H                     | Noka ya Crocodile go tswa mo dikgathong tsa<br>Jukskei go tshela Hartbeespoort Dam   | ٥   | Bogareng        | Q   | 231.05        | 24.07                         | 0.17                                     | 24.24  |
| Lefelo la EWR<br>Croc EWR2 | A21C                      | Noka ya Jukskei  | ш   | Bogareng        | ۵   | 139.9         | 29.19                         | 3.55                                     | 32.74  |
| Lefelo la EWR<br>Croc EWR3 | A21J                      | Crocodile go tswa go Hartbeespoort Dam go<br>tihatloga le Roodekopies Dam  | C/D | Godimo          | C/D   | 143.3         | 25.02                         | 0.84                                     | 25.87  |
| Lefelo la EWR<br>Croc EWR4 | A23B                      | Pienaars go tswa go Roodeplaat Dam botso jwa<br>bodutelo jwa kwatenari   | v   | Godimo          | U   | 28.2          | 30.81                         | 1.18                                     | 31.99  |
| Lefelo la EWR<br>Croc EWR5 | A23J                      | Moretele (Pienaars) go dikgatlho le Crocodile  | 0   | Godimo          | ۵   | 113.0         | 11.82                         | 5.23                                     | 17.05  |
| Lefelo la EWR<br>Croc EWR6 | A22J                      | Hex go tswa go Bospoort Dam go tshela Vaalkop<br>Dam   | ٥   | Bogareng        | ۵   | 26.9          | 14.96                         | 1.35                                     | 16.31  |
| Mafelo a EWR<br>Croc_EWR7  | A24C                      | Noka ya Crocodile go tswa go Roodekopjes Dam<br>go thatboga le dikgatiho tsa Sand Rive,<br>Sleepfonteinspruit, medutela ya Klipspruit                    | ۵   | Bogareng        | ۵   | 463.4         | 13.9                          | 0  | 13.9   |
| Lefelo la EWR<br>Croc EWR8 | A24J                      | Crocodile e e kwa Tlase go tswa go dikgatlho tsa<br>Bierspruit go dikgatlho le Limpopo   | ٥   | Bogareng        | D   | 565.16        | 7.48                          | 0.09                                     | 7.57   |
| Croc Rapid<br>EWR9         | A21F                      | Magalies kwa tlase ga Maloney's Eye  | æ   | Bogareng        | ß   | 14.61         | 45.93                         | 0.58                                     | 46.51  |
| Croc<br>Rapid EWR10        | A22A                      | Dikgala tse di kwa godimo tsa Elands (motswedi)<br>go fitlha go Swartruggens Dam   | ပ   | Bogareng        | B/C   | 10.1          | 30.48                         | 3.66                                     | 34.14  |
| Croc<br>Rapid_EWR11        | A21K                      | Dikgala tse di kwa godimo tsa Sterkstroom<br>(motswedi) go tshela Buffelspoort Dam   | υ   | Godimo          | U   | 13.95         | 28.41                         | 5.76                                     | 34.17  |
| Croc<br>Rapid EWR12        | A23G                      | Plat River   | СЪ  | Bogareng        | C/D   | 4.864         | 23.08                         | 14.20                                    | 37.28  |
| Croc<br>Rapid EWR13        | A22E                      | Elands go tswa go Lindleyspoort Dam go fitlha<br>go Vaalkop Dam  | ပ   | Botlase         | U   | 18.77         | 21.90                         | 0.312                                    | 22.21  |
| Croc<br>Rapid EWR14        | A22H                      | Waterkloofspruit go dikgatlho le Hex   | B/C | Botlase         | B/C   | 5.469         | 28.27                         | 38.44                                    | 66.71  |
| Croc Rapid<br>EWR15        | A21F                      | Magalies, Klein Magalies, Bloubank   | сЪ  | Botlase         | C/D   | 21.89         | 21.18                         | 0.39                                     | 21.57  |
| Croc Rapid<br>EWR 16       | A21A                      | Rietvlei (motswedi)  | υ   | Botlase         | U   | 4.788         | 27.83                         | 28.865                                   | 56.69  |
| Lefelo la EWR<br>Mar_EWR1  | A31A                      | Marico Eye, Kaaloog-se-Loop, Bokkraal-se-<br>Loop, Ribbokfontein-se-Loop, Rietspruit<br>(southern eye), Kuilsfontein, Syferfontein,<br>Bronkhorstfontein | œ   | Godimo<br>thata | m   | 10.539        | 76.32                         | 0  | 76.32  |
| Lefelo la EWR<br>Mar_EWR2  | A31B                      | Bogothe jwa Groot Marico go thatloga le dikgatho tsa Polkadraaispruit  | ۵   | Godimo<br>thata | œ   | 42.08         | 50.26                         | 0.03                                     | 50.29  |
| Lefelo la EWR              | A34E                      | Marico Groot Marico oo tswa oo Marico Bosveld  |     |                 |   |               |                               |  |  |

| Leina la Kopano           | Botutelo jwa<br>Kwatenari | Leina la Noka   | PES | EIS      | Karolo e e Atlanegisitsweng<br>ya Ekholoji e e tshwanetseng<br>go tlhokomelwa | NMAR<br>(MCM) | EWR<br>%<br>NMAR <sup>2</sup> | Resefe ya<br>BHN<br>(%NMAR) <sup>3</sup> | Resefe ya<br>Botlalo<br>(%NMAR)⁴ |
|---------------------------|---------------------------|---|-----|----------|---|---------------|-------------------------------|--|----------------------------------|
| Lefelo la EWR<br>Mar_EWR4 | A32D                      | Marico go tswa go Molatedi Dam go dikgatlho le<br>Limpopo, noka ya Rasweu, noka ya Maselaje | υ   | Godimo   | U   | 153.25        | 7.96                          | 0.01                                     | 7.97                             |
| Lefelo la EWR<br>Mar_EWR5 | A31E                      | Klein Marico go tswa go Klein Maricopoort Dam<br>go fittha go Kromellemboog Dam             | υ   | Bogareng | U   | 16.25         | 11.70                         | 0.05                                     | 11.75                            |
| Mar<br>Rapid_EWR6         | A31B                      | Polkadraaispruit go dikgatiho le Marico   | B/C | Bogareng | æ   | 9.87          | 49.27                         | 0.13                                     | 49.39                            |

NMAR ke Go gogiwa ga Metsi ka Ngwaga ka Mokgwa wa Tihago. Bokanakang jo bo emela mokgwa wa pakatelele go ikaegiwe ka NMAR. Fa NMAR e fetoga, bokanakang jo le bona go tla fetoga. Bo emela peresente ya BHN. Bokanakang jotthe jwa Resefe bo emela Resefe ya Ekholoji le Resefe ya Ditthokwa tsa Motheo tsa Batho (BHN). <del>6</del>064

# Thulaganyo ya 4.2: Tshobokanyo ya karolo ya bontsi mabapi le mafelo a didirisiwa tse di akaretsang EWR & BHN

| Leina la<br>Kopano        | Botutelo jwa<br>Kwatenari | Leina la Noka   | PES | E               | Karolo e e<br>Atlanegisitswe<br>ng ya Ekholoji<br>e e<br>tshwanetseng<br>go<br>tihokomelwa | NMAR<br>(MCM)' | EWR<br>% NMAR <sup>2</sup> | Resefe ya<br>BHN<br>(%NMAR) <sup>3</sup> | Resefe ya<br>Botlalo<br>(%NMAR)⁴ |
|---------------------------|---------------------------|---|-----|-----------------|--|----------------|----------------------------|--|----------------------------------|
| HN1                       | A21A                      | Noka ya Hennops go tihatioga le Rietvlei Dam  | υ   | Botlase         | o  | 11.66          | 27.83                      | 11.84                                    | 39.67                            |
| HN25                      | A22H                      | Hex go tswa go Olifantsnek Dam go ya go Bospoort Dam,<br>Sandspruit                   | ٥   | Bogareng        | D  | 12.11          | 15.26                      | 17.36                                    | 32.62                            |
| HN29                      | A22A                      | Elands go tswa go Swartruggens Dam go ya go Lindleyspoort<br>Dam                      | ပ   | Godimo          | U  | 12.87          | 23.99                      | 2.88                                     | 26.87                            |
| HN30                      | A22B                      | Upper Koster (motswedi) go ya go Koster Dam   | υ   | Godimo          | U  | 2.54           | 22.77                      | 15.19                                    | 37.97                            |
| _efelo la EWR<br>Mar_EWR2 | A31B                      | Bogotthe jwa Groot Marico go thatloga le dikgatho tsa<br>Polkadraaispruit             | ۵   | Godimo<br>thata | в  | 42.08          | 50.26                      | 0.03                                     | 50.29                            |
| HN63                      | A31B                      | Groot Marico go tswa go dikgattho tsa Polkadraaispruit go ya<br>go Marico Bosveld Dam | в   | Godimo<br>thata | в  | 56.92          | 50.61                      | 0.02                                     | 50.63                            |
| HN65                      | A31E                      | Klein Marico go tswa go Zeerust go ya go Klein Maricopoort<br>Dam                     | C/D | Bogareng        | C/D  | 16.25          | 14.26                      | 0.05                                     | 14.31                            |
| HN43                      | A24H                      | Sand go dikgatho le Crocodile   | ۵   | Godimo          | ß  | 26.56          | 27.04                      | 1.93                                     | 28.97                            |

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NMAR ke Go gogiwa ga Metsi ka Ngwaga ka Mokgwa wa Tihago. Bokanakang jo bo emela mokgwa wa pakatelele go likaegliwe ka NMAR. Fa NMAR e fetoga, bokanakang jo le bona go tla fetoga. Bo emela peresente ya BHN. Bokanakang jothhe jwa Resefe bo emela Resefe ya Ekholoji le Resefe ya Ditihokwa tsa Motheo tsa Batho (BHN).

TSHOBOKANYO YA KAROLO YA BOLENG JWA METSI A MO BOALONG MABAPI LE DINOKA KWA MAFELONG A EWR

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EWR 1: A21H-NOKA YA CROCODILE, go Tihatloga le Hartbeespoort Dam

| WQSU   | Noka ya Crocodile  | Dintlha tsa Tekolo ya Boleng jwa Metsi tsa DWA                              | jwa Metsi tsa DWA  |
|--|--|---|--|
|  | 3  | RC  | A2H013 Noka ya Magalies kwa Scheerpoort<br>2002-2007( <i>n</i> =205) |
| Lefelo la EWR  | EWR1   | PES   | A2H012 kwa Kalkheuwel mo Nokeng ya<br>Crocodile                      |
| Dikarolo tsa Boleng jwa Metsi                                  | jwa Metsi  | Boleng  | Karolo/Tshwaelo  |
|  | MgSO4  | 72.755  | F(5)   |
|  | Na <sub>2</sub> SO <sub>4</sub>  | 13.465  | A(0)   |
| Sesaboleng   | MgCl <sub>2</sub>  | 1.368   | A(0)   |
| Matswai (mg/L)   | CaCl2  | 15.198  | A(0)   |
|  | NaCI   | 109.399   | B(1)   |
| Dinontsha (mg/L)   | PO4  | 0.610   | E(4)   |
|  | TIN  | 4.848   | E(4)   |
| Didirisiwa tse di  | pH (diyuniti tsa pH)   | 7.4-8.3   | B(1)   |
| bonagalang   | Themphereitšhara(°C)   | 16 (Tekanyetso e Lenngwe)   | Kgodiso ka ntiha ya boalo jwa mantle/boalong jo bo tswetsweng        |
|  | Okosijene e e tihaologileng<br>(mg/L)  | 6.3   | C(2)Diraefole tse di tswetsweng                                      |
|  | Go tsenngwa ga motlakase<br>(mS/m)   | 66.56   | C(2)   |
| Sedirisiwa tsa tsibogo Chl-a: pherifitone (mg/m <sup>2</sup> ) | ChI-a: pherifitone<br>(mg/m <sup>2</sup> )   | 1   | D<br>Dikoketso tsa maatla tse di kwa godimo tsa                      |
|  |  |   | alekale  |
|  | Tihamego ya ditshedi tsa setšhaba - sekoro sa diphologolo tse dintsi tse di<br>senang lerapo la mokwatla (ASPT | 4.07-4.25   | ш  |
|  | Sekoro sa dithapi (FRAI)   | 44.5  |  |
|  | Se se mabapi le bothole  | Beke le beke go tswa mo<br>matlakaleng<br>ditiro tsa metsi, tse di tletseng |  |
| Tse di mabapi le   | Ammonia(mg/L)  | 32  | B(1)   |
| Karolo ya ekholoji ya l  | Karolo ya ekholoji ya lefelo ka kakaretso (go tswa mo mmotlolong wa PAI)                                       | Ω   |  |

Thulaganyo ya 5.1: Dikarolo tsa PES le tshekatsheko ka botlalo ya lefelo mabapi le Lefelo la EWR 1

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| NOKA  |   | (Bophirima) jwa Noka ya<br>Crocodile   | DINTLHA TSA TEKOLO YA BOLENG JWA METSI   | YA BOLENG JV   | VA METS!   |   |
|---|---|--|--|--|--|---|
| wasu  |   | 8  | DWAWQWMS   | A2H0   | A2H012 Noka ya Crocodile kwa Kalkheuwel  |   |
| LEFELO LA EWR   | 6   | EWR1   | RHP  | Gajaa  | Gajaanong mafelo a a mmalwa a tekolo   |   |
| Boikanyo mo tsl   | Boikanyo mo tshekatshekong ya PES                                   | Magareng   |  | -  |  |   |
| Dikarolo tsa Boleng jwa Metsi   | leng jwa Metsi  | Karolo ya PES  | WQEcospecs   | Tokafatso<br>a e a                                       | TPC  | Tekolo<br>kgapetsakgapetsa  |
|   | MgSO4   |  | >45mg/L  |  | Boleng jwa bo95 go nna<45mg/L  |   |
| Matswai a a   | Na <sub>2</sub> SO <sub>4</sub>                                     |  | <20mg/L  |  | Boleng jo bo kana ka 95 go nna<20mg/L  |   |
| sa boleng   | MgCl <sub>2</sub>   |  | <15mg/L  | N/A  | Boleng jwa bo95 go nna<15mg/L  | Kgwedi le kgwedi  |
| (mg/L)  | cacl <sub>2</sub>   |  | <21mg/L  |  | Boleng jwa bo95 go nna<21mg/L  |   |
|   | NaCi  |  | <191mg/L   | 1  | Boleng jwa bo95 go nna<191mg/L   |   |
| Dinontsha   | SRP   | Karolo=E   | <0.125mg/L   | Ee, go D   | Boleng jwa bo50 go nna<0.125mg/L   | Kgwedi le kgwedi  |
| (mg/L)  | TIN   | Karolo=E   | <4.0mg/L   | Ee, go D   | Boleng jwa bo50 go nna<4.0mg/L   | Kgwedi le kgwedi  |
|   | Hd  | Noka e e mo magareng   | Boleng jwa bo5(5.9-<br>6.5)Boeng jwa bo95<br>(8.0–8.8)                                   | Nnyaa  | Bbleng jwa bo5(5.9-6.5)bðleng jwa<br>bo95(8.0<br>-8.8)   | Kgwedi le kgwedi  |
| Se se   | Themphereitšhara  | Tshedimosetso e e  | Tihokomela sekgala   | N/A  | Go tlhagisa tekolo ya motheo mabapi le sedirisiwa.   | Fa ditshekatsheko tsa bayotiki                                      |
| bonagalang<br>Didirisiwa  | Okosijene e e<br>tihaologileng                                      | ickanyeuruweng e une e unowa ke<br>ditiro tsa tiriso ya metsi a a maswe<br>le tiwaetsa botoropo. |  | N/A  | Boleng jwa bo5 go nna>6.1mg/L. Go<br>thagisa<br>Tekolo ya motheo mabapi le sedirisiwa se.  |   |
|   | Tebiditi (NTU)  | Se se seng sentle ka ntlha dipula<br>tse dintsi.   | Sekgala se se mo<br>magareng<br>se se dumeletsweng                                       | N/A  | Go thagisa tekolo ya motheo mabapi le<br>Sedirisiwa se le go thokomela sekgala se<br>se magareng.  | Ka kotara   |
|   | Go tsenngwa ga<br>motlakase<br>(mS/m)                               | Karolo=C.  | <85mS/m  | Nnyaa  | Bolleng jwa bo95 go nna≺85mS/m   | Ka kotara   |
|   | Chla: pherfitone  | Karolo= D.<br>Tlhatlhobo ya pono e kaya  | <84mg/m * (karolo ya D)  | VII V  | Boleng jwa bo50 go nna<84mg/m2   |   |
| Didition of the second s | Chla: faetopolanketone  | dikoketso tsa maatla tse di kwa<br>godimo tsa alekale mo matlapeng le<br>mo megobeng             | <30µg/L<br>(karolo ya D)   |  | Boleng jwa bo50 go nna<30µg/L  | na kulara   |
| tsa tsibogo   | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatla(ASPT) | E (thuto e)  | Lebelela Ecospecs mabapi   | le dithapi le dip  | Lebelela Ecospecs mabapi le dithapi le diphologolo tse di senang lerapo la mokwatla  |   |
|   | Sekoro sa setšhaba sa<br>ditlhapi                                   | D (thuto e)  |  |  |  |   |
|   | Se se mabapi le bothole   |  | Sekaseka fela fa e le gore (<br>Kutlwalo e solofetswe fa e<br>pele (CEV) jaaka go kailwe | dipholo tsa tekolo<br>le gore boleng jv<br>mo go DWAF (1 | Sekaseka fela fa e le gore dipholo tsa tekolo ka botialo di kaya fa go na le bothata jo bo masisi e bile sebakwa se sa itsiwe.<br>Kutiwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Dittamorago tse di Tsweletang<br>pele (CEV) jaaka go kaitwe mo go DWAF (1996). | asisi e bile sebakwa se sa itsiwe<br>a Ditlamorago tse di Tswelelan |
| Tse di mabapi le<br>holthole  | Ammonia   | В  | <43.7ug/L  |  | Boleng jwa bo95 go nna<43.7ug/L  | Kgwedi le kgwedi  |

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| Noka                          | Noka ya Jukskei   | Dintlha tsa Tekolo ya Boleng jwa Metsi tsa DWAF                                       |  |
|-------------------------------|---|---|--|
| WQSU                          |   | RC  | A2H013 Noka ya Magalies kwa<br>Scheerpoort 2002-2007( <i>n</i> =205) |
| Lefelo la EWR                 | EWR2  | PES   | A2H023 Noka ya Jukskei kwa<br>Nietgedacht 2004-2008( <i>n</i> =114)  |
| Dikarolo tsa Boleng jwa Metsi | wa Metsi  | Boleng  | Karolo/Tshwaelo  |
|                               | MgSO4   | 71.494  | F(5)   |
|                               | Na <sub>2</sub> SO <sub>4</sub>   | 26.244  | B(1)   |
| Sesaboleng                    | MgClz   | 0.312   | A(0)   |
| matsw                         | CaCl <sub>2</sub>   | 20.236  | A(0)   |
|                               | NaCI  | 96.146  | B(1)   |
| Dinontsha(mg/L)               | PO4   | 0.266   | E(4)   |
|                               | TIN   | 5.460   | E(4)   |
| Didirisiwa tse di             | pH (diyuniti tsa pH)  | 7.1-8.1   | B(1)   |
| bonagalang                    | Themphereitshara (° C)  | Dithemphereitšhara tse di kwa godimo go tswa<br>megobeng ya tiriso ya metsi a a maswe | D  |
|                               |   |   |  |
|                               | Okosijene e e Tlhaologileng (mg/L)  |   | ſ  |
|                               | Go tsenngwa ga Motlakase (mS/m)   | 63  | C(2)   |
| Sedirisiwa tsa tsibogo        | Chl-a: pherifaetone (mg/m2)   | 14.41   | D(1)   |
|                               | Thamego ya ditshedi tsa setšhaba - sekoro sa diphologolo tse dintsi tse di senang lerapo la mokwatla (ASPT) | 3.8-4.0   | E/F  |
|                               | Sekoro sa ditlhapi  | 21.4%   | E/F  |
|                               | Se se mabapi le bothole   | a   |  |
| Tse di mabapi le              | Ammonia (µg/L)  | 80  | D(3)   |
| Karolo va ekholoii va k       | Karolo va ekholoji va lefelo ka kakaretso (mmotlolo wa PAI)   | 0   |  |

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| o tsa boleng jwa metsi mabapi le Resefe ( Ec                       |   |
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| 5.4: Dikaelo tsa boleng jwa metsi mabapi le Resefe ( Ec            |   |
| 3 5.4: Dikaelo tsa boleng jwa metsi mabapi le Resefe ( Ec          |   |
| ya 5.4: Dikaelo tsa boleng jwa metsi mabapi le Resefe ( Ec         |   |
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| NOKA                          |   | Noka ya Juskei   | DINTLHA TSA TEKOLO YA BOLENG JWA METSI  | <b>YABOLENG</b>  | JWA METSI  |   |
|-------------------------------|---|--|---|--|--|---|
| wasu                          |   | 2  | DWAWQWMS  | A2H02  | A2H023 Noka ya Juskei kwa Nietgedacht  |   |
| LEFELO LA EWR                 |   | EWR2   | RHP   | Gajaaı   | Gajaanong mafelo a a mmalwa a tekolo   |   |
| Boikanyo mo tsh               | Boikanyo mo tshekatshekong ya PES                             | Magareng   |   |  |  |   |
| Dikarolo tsa Boleng jwa Metsi | ang jwa Metsi   | Karolo ya PES  | WQEcospecs  | Tokafatso<br>a e a   | TPC  | Tekolo<br>kgapetsakgapetsa                                    |
|                               | MgSO4   |  | <45mg/L   |  | Boleng jwa bo95 go nna<45mg/L  | -   |
| Materia a a ca                | Na <sub>2</sub> SO <sub>4</sub>                               |  | <33mg/L   |  | Boleng jwa bo95 go nna<33mg/L  |   |
| holena (ma/l )                | MgCl <sub>2</sub>   |  | <15mg/L   | N/A  | Boleng jwa bo95 go nna<15mg/L  | Kgwedi le kgwedi  |
| 1                             | CaCl <sub>2</sub>   |  | <21mg/L   |  | Boleng jwa bo95 go nna<21mg/L  |   |
|                               | NaCI  |  | <191mg/L  |  | Boleng jwa bo95 go nna<191mg/L   |   |
| Dinontsha                     | SRP   | Karolo=E   | <0.125mg/L  | Ee, go D   | Boleng jwa bo50 go nna<0.125mg/L   | Kgwedi le kgwedi  |
| (mg/L)                        | TiN   | Karolo=E   | <4.0mg/L  | Ee, go D   | Boleng jwa bo50 go nna<4.0mg/L   | Kgwedi le kgwedi  |
|                               | Hd  | Bontle   | Boleng jwa bo5(5.9-<br>6.5)Boeng jwa bo95<br>(8.0–8.8)                                | Ee, go tlhago  | 5 <sup>Th</sup> boleng(5.9-6.5) 95 bởleng (8.0<br>–8.8)  | Kgwedi le kgwedi  |
|                               | Themphereitšhara  | Tshedimosetso e e lekanyeditsweng  | Tihokomela sekgala  | N/A  | Go tlhagisa tekolo ya motheo mabapi le<br>sedirisiwa.  | Fa ditshekatsheko tsa   |
| bonagalang<br>Didirisiwa      | Okosijene e e<br>tlhaologileng                                | metsi a a maswe le tiwaetsa<br>botoropo.   | 7-8mg/L   | N/A  | Boleng jwa bo5 go nna>6.1mg/L. Go<br>thhagisa<br>Tekolo va motheo mabapi le sedirisiwa se.   | Dayouni ui uiliwa   |
|                               | Tebiditi (NTU)  | Se se seng sentle ka ntha dipula tse dintsi.                                       | Sekgala se se mo<br>magareng<br>Dumeletswe  | N/A  | Go tihagisa tekolo ya motheo mabapi<br>leSedirisiwa se le go tihokomela sekgala se<br>se magareng.   | Ka kotara   |
|                               | Go tsenngwa ga<br>motłakase                                   | Karolo=C.  | <85mS/m   | Nnyaa  | Bolleng jwa bo95 go nna<85mS/m   | Ka kotara   |
|                               | Chla: pherfitone  | Karolo≕C.<br>Tlhatlhobo ya pono e kaya dikoketso                                   | <84mg/m *<br>(karolo ya D)  | VIV  | Boleng jwa bo50 go nna≺84mg/m2   |   |
| Didirisiwa tsa                | Chia: faetopolanketone  | tsa maatla tse di kwa godimo tsa<br>alekale mo matlapeng le mo<br>megobeng         | <15µg/L<br>(karolo ya D)  |  | Boleng jwa 50 go nna<15µg/L  | Na Kolara   |
| tsibogo                       | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatla | E/F (thuto e)  | Lebeleia Ecospecs maba  | pi le dithapi le c   | Lebelela Ecospecs mabapi le ditihapi le diphologolo tse di senang lerapo la mokwatla   |   |
|                               | Sekoro sa setšhaba sa<br>ditlhapi                             | E/F (thuto e)  |   |  |  |   |
|                               | Se se mabapi le botlhole                                      | Bothhole go tswa mo ditirong tsa<br>indaseteri le tsa tiriso ya metsi a a<br>maswe | Sekaseka fela fa e le gora<br>itsiwe. Kutlwalo e solofets<br>Tswelelang pele (CEV) ja | e dipholo tsa tek<br>swe fa e le gore<br>taka go kailwe <i>m</i> | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo masisi e bile sebakwa se sa itsiwe. Kutiwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Ditlamorago tse di Tswelelang pele (CEV) jaaka go kailwe mo go DWAF (1996). | i masisi e bile sebakwa se si<br>boleng jwa Ditlamorago tse c |
| Tse di mabapi le              | Ammonia   | Q  | <100ug/L  |  | Boleng jwa bo95 go nna<100ug/L   | Kgwedi le kgwedi  |

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| Noka                                      | Noka ya Crocodile  | Dintiha tsa Tekolo ya | Dintiha tsa Tekolo ya Boleng jwa Metsi tsa DWAF                       |
|---|--|-----------------------|---|
| WQSU                                      | ß  | SS                    | A2H013 Noka ya Magalies kwa Scheerpoort 2002-<br>2007( <i>n</i> ≖205) |
| Lefelo la EWR                             | EWR3   | PES                   | A2H083HartbeespoortDam:d/sWeir2004-2008<br>( <i>n</i> =113)           |
| Dikarolo tsa Boleng jwa Metsi             | 21   | Boleng                | Karolo/Tshwaelo   |
| Sesaboleng matswai                        | MgSO4  | 67.562                | F(5)  |
| (mg/L)                                    | Na <sub>2</sub> SO <sub>4</sub>  | 9.867                 | A(0)  |
|   | MgCl <sub>2</sub>  | 6.856                 | A(0)  |
|   | CaCl <sub>2</sub>  | 27.569                | B(1)  |
|   | NaCl   | 96.462                | B(1)  |
| Dinontsha(mg/L)                           | PO4  | 0.123                 | E(4)  |
|   | NIL  | 1.594                 | B(1)  |
| Didirisiwa tse di                         | pH (diyuniti tsa pH)   | 7.51-8.73             | B(1)  |
| bonagalang                                | Thempereitšhara (°C)   | 2 dintlha tsa         | C(2)  |
|   | Okosijene e e Tlhaologileng (mg/L)   | 2 dintlha tsa         | C/D   |
|   | Go tsenngwa ga Motlakase (mS/m)  | 59.24                 | C(2)  |
| Tsibogo                                   | Chl-a: pherifaetone (mg/m2)  | Ditemogo tsa pono     | ш   |
| sedirisiwa                                | Thamego ya ditshedi tsa setšhaba<br>-sekoro sa diphologolo tse dintsi tse di senang lerapo la<br>mokwatla (ASPT) | 3.8                   | Ш   |
|   | Sekoro sa dithapi  | 24.9                  | ш   |
|   | Se se mabapi le bothole  |                       |   |
| Tse di mabapi le botlhole                 | Ammonia(mg/L)  | 139                   | E(4)  |
| Karolo ya ekholoji ya lefelo ka kakaretso | kakaretso  | D/E                   | -   |

STAATSKOERANT, 3 DESEMBER 2021

Thulaganyo ya 5.6: Dikaelo tsa boleng jwa metsi mabapi le Resefe (Ecospecs tsa Boleng) mo EWR 3: Noka ya Crocodile go theoga le Hartbeespoort Dam

| NOKA                              | NOKA  |  | DINTLHA TSA TEKOLO YA BOLENG JWA METSI  | LO YA BOLEI  | (Bophirima) jwa Noka ya DINTLHA TSA TEKOLO YA BOLENG JWA METSI   |   |
|-----------------------------------|---|--|---|--|--|---|
| WQSU                              |   | 5  | DWAWQWMS  | A2H0   | A2H083 go theoga le lebotakganelo la Hartbeespoort Dam   | E   |
| LEFELO LA EWR                     | 0ć  | EWR3   | RHP   | Gajaa  | Gajaanong mafelo a a mmalwa a tekolo   |   |
| Boikanyo mo tsi                   | Boikanyo mo tshekatshekong ya PES                 | Magareng   |   | -  |  |   |
| Dikarolo tsa Boleng jwa Metsi     | eng jwa Metsi                                     | Karolo ya PES  | WQEcospecs  | Tokafatso<br>a e a                                     | TPC  | Tekolo<br>kgapetsakgapetsa                            |
|                                   | MgSO₄   |  | <45mg/L   |  | Boleng jwa bo95 go nna<45mg/L  |   |
| Matewaiaa                         | Na <sub>2</sub> SO <sub>4</sub>                   |  | <20mg/L   |  | Boleng jo bo kana ka 95 go nna<20mg/L  |   |
| sa boleng                         | MgCl <sub>2</sub>                                 |  | <15mg/L   | N/A  | Boleng jwa bo95 go nna<15mg/L  | Kgwedi le kgwedi                                      |
| (mg/L)                            | CaCl <sub>2</sub>                                 |  | <57mg/L   |  | Boleng jwa bo95 go nna<57mg/L  |   |
|                                   | NaCI  |  | <191mg/L  |  | Boleng jwa bo95 go nna<191mg/L   |   |
| Dinontsha                         | SRP   | Karolo=E   | <0.125mg/L  | Ee, go D   | Boleng jwa bo50 go nna<0.125mg/L   | Kgwedi le kgwedi                                      |
| (mg/L)                            | TIN   | Karolo=D   | <4.0mg/L  | Ee, go D   | Boleng jwa bo50 go nna<4.0mg/L   | Kgwedi le kgwedi                                      |
|                                   | Hd  | Bontle   | Boleng jwa bo5(5.9-<br>6.5)Boeng jwa bo95<br>(8.0–8.8)                        | Ee, go<br>tIhago                                       | 5 <sup>th</sup> boleng(5.9-6.5)95 boleħg(8.0<br>8.8)   | Kgwedi le kgwedi                                      |
| Se se<br>boragalang<br>Didirisiwa | Themphereitšhara                                  | Tshedimosetso e e lekanyeditsweng e bile e tiholwa ke ditiro tsa tiriso ya metsi a a maswe le ttwaetsa botoropo.               | Tlhokomela sekgala  | N/A  | Lefelo le a theoga go tswa kwa letamong se se tla<br>bakang go sa tsepamang ga themphereitšhara<br>kgonagalo ya tsapogo ya bayotiki.<br>Dithekatsheko tsa bayoloji tse di atlanegisitsweng.<br>Tihagisa tekolo ya motheo.  | Fa ditshekatsheko tsa<br>bayotiki di diriwa           |
|                                   | Okosijene e e<br>tlhaologileng                    |  | 7-8mg/L   | N/A  | Boleng jwa bo5 go nna>6.1mg/L. Go tlhagisa<br>Tekolo ya motheo mabapi le sedirisiwa se.  |   |
|                                   | Tebiditi (NTU)                                    | Se se seng sentle ka ntlha dipula<br>tse dintsi.   | Sekgala se se mo<br>magareng<br>se se dumeletsweng                            | N/A  | Go tihagisa tekolo ya motheo mabapi le<br>Sedirisiwa se le go tihokomela sekgala se se<br>magareng.  | Ka kotara   |
|                                   | Go tsenngwa ga<br>motlakase                       | Karolo=C.  | <85mS/m   | Nnyaa  | Boʻlèng jwa bo95 go nna<85mS/m   | Ka kotara   |
|                                   | Chla: pherfitone                                  | Karolo ya =C. Thathrobo ya<br>pono e kaya dikoketso tsa maatla<br>tse di kwa godimo tsa alekale mo<br>mattapend le mo meoobend | <84mg/m ž<br>(karolo ya D)  | N/A  | Boleng jwa bo50 go nna<84mg/m2   | Ka kotara   |
| Uldirisiwa<br>tsa tsibogo         | Chla: faetopolanketone                            | 2  | <30µg/L<br>(karolo ya D)  |  | Boleng jwa bo50 go nna<30µg/l.   |   |
|                                   | Diphologolo tse dintsi<br>tse di senang lerapo la | E (thuto e)  | Lebelela Ecospecs ma  | bapi le ditlhapi                                       | Lebelela Ecospecs mabapi le ditihapi le diphologolo tse di senang lerapo la mokwatla   |   |
|                                   | Se se mabapi le<br>botlhole                       | Bothhole go tswa mo ditirong tsa<br>indaseteri<br>le tiriso ya metsi a a maswe   | Sekaseka fela fa e le g<br>sa itsiwe. Kutlwalo e so<br>di Tswelelang pele (CE | lore dipholo tsi<br>lofetswe fa e le<br>V) jaaka go ka | Sekaseka fela fa e le gore dipholo tsa tekolo ka bottalo di kaya fa go na le bothata jo bo masisi e bile sebakwa se<br>sa itsiwe. Kuttwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Ditlamorago tse<br>di Tswelelang pele (CEV) jaaka go kaliwe mo go DWAF (1996). | masisi e bile sebakwa se<br>bleng jwa Ditlamorago tse |
| Tse di mabapi le<br>botihole      | Ammonia   | Ш  | <129ug/L  |  | Boleng jwa bo95 go nna<129ug/L   | Kgwedi le kgwedi                                      |

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| Noka                          | Noka ya Pienaars  | Dintlha tsa Tekolo ya Boleng jwa Metsi tsa DWA | ang jwa Metsi tsa DWA   |
|-------------------------------|---|--|---|
| WQSU                          | 15  | RC   | A2H013 Noka ya Magalies kwa Scheerpoort 2002-<br>2007( <i>n</i> =205) |
| Lefelo la EWR                 | EWR4  | PES  | A2H006 Noka ya Pienaars kwa Klipdrift 2004-2008<br>( <i>n</i> =118)   |
| Dikarolo tsa Boleng jwa Metsi | /a Metsi  | Boleng   | Karolo/Tshwaelo   |
| Matswai a a sa boleng         | MgSO4   | 51.250   | F(5)  |
| (mg/L)                        | Na <sub>2</sub> SO <sub>4</sub>   | 5.120  | A(0)  |
|                               | MgCl <sub>2</sub>   | 3.704  | A(0)  |
|                               | CaCl <sub>2</sub>   | 14.856   | A(0)  |
|                               | NaCI  | 81.789   | B(1)  |
| Dinontsha (mg/L)              | PO4   | 0.049  | B(1)  |
|                               | TIN   | 0.442  | A(0)  |
| Didirisiwa tse di             | pH (diyuniti tsa pH)  | 7.8-8.4  | B(1)  |
| bonagalang                    | Thempereitšhara (°C)  | 1 ntlha ya tshedimosetso                       | B(1) C(2)   |
|                               | Okosijene e e thaologileng  | 5.5 (2 dintlha tsa                             |   |
|                               | (mg/L)  | tshedimosetso)                                 |   |
|                               | Go tsenngwa ga motlakase<br>(mS/m)  | 57.1   | C(2)  |
| Sedirisiwa tsa tsibogo        | Chl-a: pherifitone<br>(mg/m <sup>2</sup> )  | 1  | Ditemogo tsa pono   |
|                               | Thamego ya ditshedi tsa setšhaba<br>Sekoro sa diphologolo tse dintsi tse di senang lerapo la<br>mokwatla (ASPT) | S.<br>S.                                       | C(2)  |
|                               | Sekoro sa dithapi   | 65.4%  | c(2)  |
|                               | Se se mabapi le botthole  | -  |   |
| Teo di mahani lo              | Ammonia (Ind) V   | 00   | A LOLA  |

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| NOKA                          |   | Noka ya Pienaars   | DINTLHA TSA TEKOLO YA BOLENG JWA METSI                                  | OLO YA BOI  | ENG JWA METS!  |  |
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| WQSU                          |   | 15   | DWAWQWMS  | A2H0  | A2H006 Pienaars kwa lebotakganelong la Klipdrift   |  |
| LEFELO LA EWR                 | R   | EWR4   | RHP   | Gaja:   | Gajaanong mafelo a a mmalwa a tekolo   |  |
| Boikanyo mo ts                | Boikanyo mo tshekatshekong ya PES                                       | Magareng   |   |   |  |  |
| Dikarolo tsa Boleng jwa Metsi | leng jwa Metsi  | Karolo ya PES  | WQEcospecs  | Tokafatso<br>a e a                                | TPC  | Tekolo<br>kaapetsakaapetsa                   |
|                               | MgSO4   |  | <45mg/L   |   | Boleng jwa bo95 go nna<45mg/L  |  |
| Materia a                     | Na <sub>2</sub> SO <sub>4</sub>   |  | <20mg/L   |   | Boleng io bo kana ka 95 go nna<20mg/L  |  |
| sa boleng                     | MgCl <sub>2</sub>   |  | <15mg/L   | N/A   |  | Kgwedi le kgwedi                             |
| (mg/L)                        | CaCl <sub>2</sub>   |  | <21mg/L   |   | Boleng jwa bo95 go nna<21mg/L  |  |
|                               | NaCI  |  | <191mg/L  |   | Boleng jwa bo95 go nna<191mg/L   |  |
| Dinontsha                     | SRP   | Karolo ya=B  | <0.015mg/L  |   |  | Kgwedi le kgwedi                             |
| (mg/L)                        | TIN   | Karolo ya=B  | <0.25mg/L   |   | Boleng jwa bo50 go nna<0.25mg/L  | Kgwedi le kgwedi                             |
|                               | Нd  | Karolo ya=B, Bontle  | Boleng jwa bo5(5.9-<br>6.5)Boeng jwa bo95<br>(8.0-8.8)                  | Ee, go<br>tihago                                  |  | Kgwedi le kgwedi                             |
| Se se<br>bonagalang           | Themphereitšhara  | Tshedimosetso e e<br>lekanyeditsweng e bile e tlholwa<br>ke ditiro tsa tiriso ya metsi a a | Tihokomela sekgala  | N/A   | Lefelo le a theoga go tswa kwa letamong se se tla bakang<br>go sa tsepamang ga themphereitishara kgonagalo ya<br>tsibogo ya bayotiki. Dithekatsheko tsa bayoloji tse di<br>atlanegistisweng. Tihagisa tekolo ya motheo.  | Fa ditshekatsheko tsa<br>bayotiki di diriwa  |
| Didirisiwa                    | Okosijene e e<br>tlhaologileng  | maswe le tiwaetsa botoropo.  | 7-8mg/L   | N/A   | Boleng jwa bo5 go nna>6.1mg/L. Go tihagisa<br>Tekolo ya motheo mabapi le sedirisiwa se.  |  |
|                               | Tebiditi (NTU)  | Se se seng sentle ka ntiha dipula<br>tse dintsi.   | Sekgala se se mo<br>magareng<br>Dumeletswe                              | N/A   | Tilhagisa tekolo ya motheo mabapi le se<br>Sedirisiwa se le go thokomela sekgala se se magareng.   | Ka kotara                                    |
|                               | Go tsenngwa ga<br>motlakase   | Karolo ya=C  | <85mS/m   | Nnyaa   | Bolleng jwa bo95 go nna<85mS/m   | Ka kotara                                    |
|                               | Chla: pherfitone  | Karolo ya =C.<br>Tihatihobo ya pono e ƙaya   | <84mg/m <sup>4</sup><br>(karolo ya D)                                   | MIA   | Boleng jwa bo50 go nna≺84mg/m2   | I'v traterio                                 |
| Didirisiwa<br>tsa tsibogo     | Chla: faetopolanketone  | dikoketso tsa maatla tse di kwa<br>godimo tsa alekale mo matlapeng<br>le mo megobeng       | <30µg/L<br>(karolo ya D)  |   | Boleng jwa bo50 go nna≺30µg/L  | Na Kolara                                    |
|                               | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatla<br>(ASPT) | e C (thuto e)  | Lebelela Ecospecs m   | labapi le ditha                                   | Lebelela Ecospecs mabapi le ditihapi le diphologolo tse di senang lerapo la mokwatta   |  |
|                               | Se se mabapi le bothole   | Bothole go tswa mo ditirong tsa<br>i indaseteri<br>le tiriso ya metsi a a maswe            | Sekaseka fela fa e le<br>itsiwe. Kuthwalo e sol<br>Tswełelang pele (CEV | e gore dipholo<br>lofetswe fa e<br>V) jaaka go ka | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo masisi e bije sebakwa se sa itsiwe. Kuttwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Dittamorago tse di Tswelelang pele (CEV) jaaka go kailwe mo go DWAF (1996). | i e bile sebakwa se s<br>jwa Ditlamorago tse |
| Tse di mabapi le<br>botthole  | Ammonia   | A  | <15ug/L   |   | Boleng jwa bo95 go nna<15ug/L  | Kgwedi le kgwedi                             |
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| Noka                                      | Noka ya Pienaars  | Dintlha  | Dintlha tsa Tekolo ya Boleng iwa Metsi tsa DWA               |
|---|---|----------|--|
| WQSU                                      | 17  | RC       | A2H013Noka ya Magalies kwa Scheerpoort2002-<br>2007(n=205)   |
| Lefelo la EWR                             | EWR5  | PES      | A2H021 Noka ya Pienaars kwa Buffelspoort<br>2004-2008(n=107) |
| Dikarolo tsa Boleng jwa Metsi             | Metsi   | Boleng   |  |
| Matswai a a sa                            | MgSO4   | 78.335   | F(5)   |
| boleng(mg/L)                              | Na <sub>2</sub> SO <sub>4</sub>   | 16.527   | A(0)   |
|   | MgCl <sub>2</sub>   | 3.820    | A(0)   |
|   | CaCl2   | 24.153   | B(1)   |
|   | NaCI  | 131.982  | B(1)   |
| Dinontsha(mg/L)                           | P04   | 0.598    | B(1)   |
|   | TIN   | 0.250    | A(0)   |
| Didirisiwa tse di                         | pH(diyuniti tsa pH)   | 7.7-8.7  | B(1)   |
| bonagalang                                | Themphereitšhara (° C)  | 16(n=1)  | E a siama go tswa go letamo la B                             |
|   | Okosijene e e Tlhaologileng (mg/L)  | 5.2(n=1) |  |
|   | Go tsenngwa ga motlakase(mS/m)  | 80.8     | C(2)   |
| Sedirisiwa tsa tsibogo                    | Chl-a: pherifaetone (mg/m2)   |          |  |
|   | Thamego ya ditshedi tsa setšhaba - sekoro sa diphologolo tse dintsi tse di senang lerapo la mokwatla (ASPT) | 5.5      | D  |
|   | Sekoro sa ditlhapi (FRAI)   | 51.3%    | Ω  |
|   | Se se mabapi le bothhole  | ,        |  |
| Tse di mabapi le botlhole Ammonia (µg/L)  | <ul> <li>Ammonia (µg/L)</li> </ul>  | 47       | B(1)   |
|   | Foloraete (µg/L)  | 600      | A(0)   |
| Karolo ya ekholoji ya lefelo ka kakaretso | lo ka kakaretso   | U        |  |

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| NOKA                            |   | Noka ya Pienaars   | DINTLHA TSA TEH  | <b>KOLO YA BO</b>               | DINTLHA TSA TEKOLO YA BOLENG JWA METSI   |   |
|---------------------------------|---|--|--|---------------------------------|--|---|
| WQSU                            |   | 17   | DWAWQWMS   | A2H0                            | A2H021 Noka ya Pienaars kwa Buffelspooort  |   |
| LEFELO LA EWR                   | WR  | EWR5   | RHP  | Gajaa                           | Gajaanong mafelo a a mmalwa a tekolo   |   |
| Boikanyo mo                     | Boikanyo mo tshekatshekong ya PES                                       | Magareng   |  |                                 |  |   |
| Dikarolo tsa B                  | Dikarolo tsa Boleng jwa Metsi   | Karolo ya PES  | WQEcospecs   | Tokafatso<br>a e a<br>tihokega? | TPC  | Go lekola<br>bokgapetsakgapetsa             |
|                                 | MgSO4   |  | <45mg/L  |                                 | Boleng jwa bo95 go nna<45mg/L  |   |
| Matswai a a sa                  | Na <sub>2</sub> SO <sub>4</sub>   |  | <20mg/L  |                                 | Boleng jo bo kana ka 95 go nna<20mg/L  |   |
| viaiomai a de<br>Dolena         | MgCl <sub>2</sub>   |  | <15mg/L  | N/A                             | Boleng jwa bo95 go nna<15mg/L  | Kgwedi le kgwedi                            |
| (mg/L)                          | CaCl <sub>2</sub>   |  | <57mg/L  |                                 | Boleng jwa bo95 go nna<57mg/L  |   |
|                                 | NaCI  |  | <191mg/L   |                                 | Boleng jwa bo95 go nna<191mg/L   |   |
| Jinontsha                       | SRP   | Karolo=D   | <0.015mg/L   |                                 | 50 <sup>th</sup> boleng go nna<0.015mg/L   | Kgwedi le kgwedi                            |
| (mg/L)                          | TIN   | Karolo ya=B  | <0.25mg/L  |                                 | Boleng jwa bo50 go nna<0.25mg/L  | Kgwedi le kgwedi                            |
|                                 | Hd  | Karolo ya=B, Bontle  | Boleng jwa<br>bo5(5.9-<br>6.5) Boleng jwa<br>bo95(8.0–8.8) | Ee, go<br>tlhago                | Boleng jwa bo5(5.9-6.5)<br>Boleng jwa bo95(8.08.8)   | Kgwedi le kgwedi                            |
| Didirisiwa tse<br>di Bonagalang | Themphereitšhara  | Tshedimosetso e e lekanyeditsweng<br>e bile e tiholwa ke ditiro tsa tiriso ya<br>metsi a a maswe le tuwaetsa       | Tlhokomela<br>sekgala                                      | A/A                             | Lefelo le a theoga go tswa kwa letamong se se tla<br>bakang go se tsepame ga themphereitishara le<br>kgonagalo ya tsibogo ya bayotiki. Dithekatsheko tsa<br>bayoloji tse di attanegisitsweng. Thagisa tekolo ya<br>motheo. | Fa ditshekatsheko tsa<br>bayotiki di diriwa |
|                                 | Okosijene e e<br>tihaologileng  | .od  | 7-8mg/L  | N/A                             | Boteng jwa bo5 go nna>6.1mg/L. Go tthagisa<br>Tekolo ya motheo mabapi le sedirisiwa se.  |   |
|                                 | Tebiditi (NTU)  | Se se seng sentle ka ntlha dipula tse<br>dintsi.   | Sekgala se se mo<br>magareng<br>se se                      | N/A                             | Go thhagisa tekolo ya motheo mabapi le<br>Sedirisiwa se le go thokomela sekgala se se<br>magareng.   | Ka kotara                                   |
|                                 | Go tsenngwa ga<br>motlakase (mS/m)                                      | Karolo ya=C  | <85mS/m  | Nnyaa                           | Boľbng jwa bo95_go nna<85mS/m  | Ka kotara                                   |
|                                 | Chla: pherilione  | Karolo=C.<br>Tihatihobo ya pono e kaya dikoketso<br>tsa maatla tse di kwa godimo tsa<br>alekale mo matlapeng le mo | <84mg/m(D <sup>≮</sup><br>karolo ya D)                     | N/A                             | Boleng jwa bo50 go nna≺84mg/m2   | Ka kotara                                   |
| Didirisiwa tsa<br>tsibogo       | Chła: faetopolanketone  | hiredopenin  | <30µg/L(D<br>karolo ya D)                                  |                                 | Boleng jwa bo50 go nna<30µg/L  |   |
| <b>,</b>                        | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatla<br>(ASPT) | D (thuto e)  | Lebelela Ecospecs  | mabapi le ditlh                 | Lebelela Ecospecs mabapi le ditihapi le diphologolo tse di senang lerapo la mokwatta   |   |
|                                 | Sekoro sa setšhaba sa<br>ditlhapi                                       | D (thuto e)  |  |                                 |  |   |

| Tse di mabapi         Ammonia         B         <43.75ug/L |                              | Se se mabapi le bothole | Bothole go tswa mo ditirong tsa<br>indaseteri<br>le tiriso ya metsi a a maswe | Sekaseka fela fa e le gore<br>itsiwe. Kutlwalo e solofetsw<br>Tswelelang pele (CEV) jaai | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo masisi e bile sebakwa se sa<br>itsiwe. Kutiwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Ditlamorago tse di<br>Tswelelang pele (CEV) jaaka go kailwe mo go DWAF (1996). | e bile sebakwa se sa<br>a Ditlamorago tse di |
|--|------------------------------|-------------------------|---|--|--|--|
|  | Tse di mabapi<br>le botihole | Ammonia                 | ۵   | <43.75ug/L   |  | Kgwedi le kgwedi                             |

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| Noka                                      | Noka ya Hex  | Dintlha tsa Tekolo | Dintlha tsa Tekolo ya Boleng jwa Metsi tsa DWAF             |
|---|--|--------------------|---|
| WQSU                                      | S  | RC                 | A2H013 Noka ya Magalies kwa Scheerpoort<br>2002-2007(n=205) |
| Lefelo la EWR                             | EWR6   | PES                | A2H094BospoortDam d/s lebotakganelong kwa<br>Tweedepoort    |
| Dikarolo tsa Boleng jwa Metsi             | va Metsi   | Boleng             | Karolo/Tshwaelo   |
| Matswai a a sa                            | MgSO4  | 133.123            | F(5)  |
| boleng(mg/L)                              | Na <sub>2</sub> SO <sub>4</sub>  |                    | A(0)  |
|   | MgClz  | 33.113             | C(2)  |
|   | CaCl <sub>2</sub>  | 110.127            | E(4)  |
|   | NaCI   | 170.523            | B(1)  |
| Dinontsha(mg/L)                           | PO4  | 0.234              | E(4)  |
|   | IIN  | 0.775              | A(0)  |
| Didirisiwa tse di                         | pH(diyuniti tsa pH)  | 7.6-9.1            | C(2)  |
| bonagalang                                | Themphereitšhara(°C)   | 2 dintha tsa       | C(2)  |
| •   | Okosijene e e tihaologileng  |                    | D(3)  |
|   | (mg/L)   | tshedimosetso      |   |
|   |  |                    |   |
|   | Go tsenngwa ga motlakase<br>(mS/m)   | 95.3               | D(3)  |
| Sedirisiwa tsa tsibogo                    | ChI-a: pherifitone<br>(mg/m²)  |                    | Ditemogo tsa pono   |
|   | Tihamego ya ditshedi tsa setšhaba- sekarolo sa diphologolo tse dintsi tse di |                    |   |
|   | senang lerapo la mokwatla (ASPT)   | 4.6                | ш   |
|   | Sakom sa ditihani (FRAt)   |                    |   |
|   |  | 49.1%              | ۵   |
|   | Se se mabapi le bothole  | 1                  |   |
| Tse di mabapi le                          | Ammonia (µg/L)   | 138                | E(4)  |
|   | Foloraete (µg/L)   | 300                | A(0)  |
| Karolo va ekholoii va lefelo ka kakaretso | ielo ka kakaretso  | <u>د</u>           |   |

| NOKA                       |   | Noka ya Hex  | DINTLHA TSA TEKOLO YA BOLENG JWA METSI                       | VA BOLENG JV                              | VA METSI  |   |
|----------------------------|---|--|--|---|---|---|
| WQSU                       |   | 6  | DWAWQWMS   | A2H094                                    | A2H094 Bospoort Dam go thega le lebotakganelo   |   |
| LEFELO LA EWR              | NR  | EWR6   | RHP  | Gajaano                                   | Gajaanong mafelo a a mmalwa a tekolo  |   |
| <b>Boikanyo mo t</b>       | Boikanyo mo tshekatshekong ya PES                                       | Magareng   |  |   |   |   |
| Dikarolo tsa B             | Dikarolo tsa Boleng jwa Metsi   | Karolo ya PES  | WQEcospecs A   | A ditokafatso<br>di a tlhokega?           | TPC   | Go lekola<br>bokgapetsakgapetsa                                       |
|                            | MgSO4   |  | <45mg/L  |   | Boleng jwa bo95 go nna<45mg/L   |   |
| Antonio o o                | Na <sub>2</sub> SO <sub>4</sub>   |  | <20mg/L  |   | Boleng jo bo kana ka 95 go  |   |
| iviatswai a a<br>sa holend | MgCl <sub>2</sub>   |  |  | N/A                                       | Boleng iwa bo95 go nna<36mg/L   | Kgwedi le kgwedi  |
| (mg/L)                     | CaCl <sub>2</sub>   |  | <141mg/L   |   | Boleng jwa bo95 go nna<141mg/L  |   |
|                            | NaCI  |  | <191mg/L   |   | Boleng jwa bo95 go nna<191mg/L  |   |
| Dinontsha                  | SRP   | Karolo=E   | <0.125mg/L Ee  | Ee, go D                                  | Boleng jwa bo50 go nna<0.125mg/L  | Kgwedi le kgwedi  |
| (mg/L)                     | TIN   | Karolo ya=C  | <0.25mg/L  |   | Boleng iwa bo50 go nna<25mg/L   | Kawedi le kawedi  |
|                            | Hd  | Karolo ya=C, magareng  | Boleng jwa bo5 (5.6-<br>5.9)<br>Boleng jwa bo95<br>(8.8-9.2) | Yes                                       | 5 <sup>th</sup> boleng(5.6-5.9)95 bolefhg(8.8-9.2)  | Kgwedi le kgwedi  |
| Se se                      | Themphereitšhara  | Tshedimosetso e e  | Tihokomela sekgala N/  | N/A                                       | Go tlhagisa tekolo ya motheo mabapi le sedirisiwa.  |   |
| Didirisiwa                 | Okosijene e e<br>tlhaologileng  | texanyeousweng e bile e unowa<br>ke ditiro tsa tiriso ya metsi a a<br>maswe le twaetsa botoropo. | 7-8mg/L N/   | N/A                                       | Boleng jwa bo5 go nna>6.1mg/L. Go<br>tihagisa tekolo ya motheo mabapi le<br>sedirisiwa.   | dirwa   |
|                            | Tebiditi (NTU)  | Se se seng sentle ka nttha dipula tse dintsi.  | Phetogo e e mo<br>magareng e<br>dumeletswe                   | N/A                                       | Thagisa tekolo ya motheo mabapi le<br>sedirisiwa se le go thokomela sekgala<br>sa thago.  | Ka kotara   |
|                            | Go tsenngwa ga<br>motlakase   | Karolo=D   | <85mS/m Ee   | Ee, go C                                  | Bolềng jwa bo95 go nna<85mS/m   | Ka kotara   |
|                            | Chla: pherfitone  | Karolo ya =C. Tlhatthobo ya pono<br>e kaya dikoketso tsa maatla tse                              | <84mg/m(D <sup>2</sup><br>karolo ya D)                       |   | Boleng jwa bo50 go nna<84mg/m2  |   |
|                            | Chla: faetopolanketone  |  | <30µg/L(D<br>karolo ya D)                                    | YN  | Boleng jwa bo50 go nna<30µg/L   | ka kotara   |
| Didirisiwa<br>tsa tsibogo  | Diphologolo tse dintsi<br>tse di senang lerapo la<br>mokwatla<br>(ASPT) | E (thuto e)  | Lebelela Ecospecs maba                                       | api le dithapi le dip                     | Lebelela Ecospecs mabapi le dithapi le diphologolo tse di senang lerapo la mokwatla   |   |
|                            | Sekoro sa setšhaba sa<br>ditlhapi                                       | D (thuto e)  |  |   |   |   |
|                            | Se se mabapi le<br>botthole   | Bothole go tswa mo ditirong tsa<br>indaseteri le tsa tiriso ya metsi a<br>a maswe                | Sekaseka fela fa e le gon<br>Kutiwalo e solofetswe fa        | e dipholo tsa tekol<br>e le gore boleng j | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo masisi e bile sebakwa se sa itsiwe.<br>Kuttwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Ditlamorago tse di Tswelelang | o masisi e bile sebakwa se sa its<br>g jwa Ditlamorago tse di Tswelel |

| Tse di mabapi le | Ammonia | Ш | <129ug/L | Ee go D | Boleng iwa bo95 go nna<129ug/L | Kawedi le kawedi |
|------------------|---------|---|----------|---------|--------------------------------|------------------|
| bothole          |         |   | ,        | ,       |                                |                  |

EWR 7: A24C-NOKA YA CROCODILE, Go tlhatloga le dikgatlho le Noka ya Bierspruit

Thulaganyo ya 5.13: Dikarolo tsa PES le tshekatsheko ya botlalo ya lefelo mabapi le lefelo la EWR 7

| NOKa                                      | Noka ya Crocodile  | Dintlha tsa Tekolo ya Boleng jwa Metsi tsa DWA   | A  |
|---|--|--|--|
| WQSU                                      | 21   | RC   | A2H013 Noka ya Magalies kwa<br>Scheerpoort 2004-2007<br>( <i>n</i> =205)   |
| Lefelo la EWR                             | EWR7   | PES  | A2H060 Noka ya Crocodile kwa<br>Nooitgedacht 2004-<br>2008( <i>n</i> =113) |
| Dikarolo tsa Boleng jwa Metsi             | g jwa Metsi  | Boleng   | Karolo/Tshwaelo  |
| Matswai a a sa                            | MgSO4  | 112.138  | F(5)   |
| boleng (mg/L)                             | Na <sub>2</sub> SO <sub>4</sub>  | 12.102   | A(0)   |
|   | MgCl2  | 1.507  | A(0)   |
|   | CaCl2  | 20.658   | A(0)   |
|   | NaCI   | 187.768  | B(1)   |
| Dinontsha (mg/L)                          | PO4  | 0.243  | E(4)   |
|   | TIN  | 0.302  | A(0)   |
| Didirisiwa tse di                         | pH(diyuniti tsa pH)  | 7.8-8.5  | B(1)   |
| bonagalang                                | Themphereitšhara (° C)   | Themphereitšhara e e tlhatlogileng ka ntlha ya   |  |
|   |  | dikelelo tse di kwa tlase e bile<br>di se boteng | D(3)   |
|   | Okosijene e e tihaologileng<br>(mg/L)  | Go tshwana le fa godimo                          |  |
|   | Go tsenngwa ga motlakase<br>(mS/m)   | 92.3   | D(3)   |
| Sedirisiwa tsa<br>tsibogo                 | Chil-a: pherifitone<br>(mg/m <sup>2</sup> )  |  | Kgolo ya algal mo motihabeng<br>(temogo ya pono)                           |
|   | Tihamego ya ditshedi tsa setšhaba -sekoro sa diphologolo tse<br>di ntsi tse di senang lerapo la mokwatla<br>(ASPT) | 4.6  | U  |
|   | Sekoro sa dithapi (FRAI)   | 46.2%  | Δ  |
|   | Se se mabapi le bothole  | 8  |  |
| Tse di mabapi le                          | Ammonia (µg/L)   | 20   | B(1)   |
| Karolo ya ekholoji ya lefelo ka kakaretso | a lefelo ka kakaretso  |  |  |

Thulaganyo ya 5.14: Dikaelo tsa boleng jwa metsi mabapi le Resefe (Ecospecs tsa Boleng) mo EWR 7: Noka ya Crocodile go tihatloga le dikgatiho le Noka

| NOKA                              |   | (Bophirima) jwa Noka ya<br>Crocodile   | DINTLHA TSA TEKOLO YA BOLENG JWA METSI   | D YA BOLENG                       | 3 JWA METSI  |   |
|-----------------------------------|---|--|--|-----------------------------------|--|---|
| WQSU                              |   | 21   | DWAWQWMS   | A2H0                              | A2H060 Noka ya Crocodile kwa Nooitgedacht  | -   |
| LEFELO LA EWR                     | æ   | EWR7   | RHP  | Gajaa                             | Gajaanong mafelo a a mmalwa a tekolo   |   |
| Boikanyo mo ts                    | Boikanyo mo tshekatshekong ya PES                                       | Magareng   |  |                                   |  |   |
| Dikarolo tsa Boleng jwa Metsi     | ileng jwa Metsi   | Karolo ya PES  | WQEcospecs   | Tokafatso<br>a e a                | TPC  | Tekolo<br>kgapetsakgapetsa  |
|                                   | MgSO4   |  | <45mg/L  |                                   | Boleng jwa bo95 go nna<45mg/L  |   |
| Motorio o o                       | Na <sub>2</sub> SO <sub>4</sub>   |  | <20mg/L  |                                   | Boleng jo bo kana ka 95 go   |   |
| IVIAISWAI a a<br>sa holeno        | MgCl <sub>2</sub>   |  | <15mg/L  | N/A                               | Boleng jwa bo95 go nna<15mg/L  | Kgwedi le kgwedi  |
| (mg/L)                            | CaCl <sub>2</sub>   |  | <21mg/L  |                                   | Boleng jwa bo95 go nna<21mg/L  |   |
|                                   | NaCI  |  | <191mg/L   |                                   | Boleng jwa bo95 go nna<191mg/L   |   |
| Dinontsha                         | SRP   | Karolo=E   | <0.125mg/L   | Ee, go D                          | Boleng jwa bo50 go nna<0.125mg/L   | Kgwedi le kgwedi  |
| (mg/L)                            | TIN   | Karolo ya=A  | <0.25mg/L  |                                   | Boleng jwa bo50 go nna<0.25mg/L  | Kgwedi le kgwedi  |
|                                   | Hd  | Karolo ya=B, Bontle  | Boleng jwa bo5(5.9-<br>6.5)Boeng jwa bo95<br>(8.0–8.8)   | N/A                               | 5 Boleng (5.9-6.5)<br>95 Boleng (8.0-8.8)  | Kgwedi le kgwedi  |
| c                                 | Themphereitšhara  | Tshedimosetso e e  | Tihokomela sekgala   | N/A                               | Go tlhagisa tekolo ya motheo mabapi le sedirisiwa.   | Leng Ditshekatsheko tsa   |
| se se<br>bonagalang<br>Didirisiwa | Okosijene e e<br>tihaologileng  | exanyeousweng e bile e unowa ke<br>ditiro tsa tiriso ya metsi a a maswe<br>le tiwaetsa botoropo. | 7-8mg/L  | N/A                               | Boleng jwa bo5 go ma>6.1mg/L. Go<br>tihagisa tekolo ya motheo mabapi le<br>sedirisiwa.   | uayoun ura uniwa  |
|                                   | Tebiditi (NTU)  | Se se seng sentle ka nttha dipula<br>tse dintsi.   | Sekgala se se mo<br>magareng<br>se se dumeletsweng   | N/A                               | Go tihagisa tekolo ya motheo mabapi<br>le<br>Sedirisiwa se le go tihokomela  | Ka kotara   |
|                                   | Go tsenngwa<br>gamotlakase  | Karolo=D   | <85mS/m  | Ee, go C                          | Bolleng jwa bo95 go nna<85mS/m   | Ka kotara   |
|                                   | Chla: pherfitone  | Karolo ya =C.<br>Tlhatlhobo ya pono e kaya   | <84mg/m <sup>2</sup><br>(karolo ya D)  | NICA                              | Boleng jwa bo50 go nna<84mg/m2   | 1/a katara  |
|                                   | Chla: faetopolanketone  | dikoketso tsa maatla tse di kwa<br>godimo tsa alekale mo matlapeng le<br>mo megobeng             | <30µg/l_<br>(karolo ya D)  |                                   | Boleng jwa bo50 go nna<30µg/L  | Na Nulara   |
| tsa tsibogo                       | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatta<br>(ASPT) |  | Lebelela Ecospecs mab  | api le ditlhapi le                | Lebelela Ecospecs mabapi le dithapi le diphologolo tse di senang lerapo la mokwatla  | watla   |
|                                   | Sekoro sa setšhaba sa<br>ditlhapi                                       | D (thuto e)  |  |                                   |  |   |
|                                   | Se se mabapi le botlhole  | Botlhole go tswa mo ditirong tsa<br>indaseteri le tsa tiriso ya metsi a a                        | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di ka<br>itsiwe. Kuttwalo e solofetswe fa e le gore boleng jwa bo95 j | re dipholo tsa<br>tswe fa e le go | Sekaseka fela fa e le gore dipholo tsa tekolo ka bottalo di kaya fa go na le bothata jo bo masisi e bile sebakwa se sa<br>itsiwe. Kuttwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Dittamorago tse di | hata jo bo masisi e bile sebakwa se<br>bo feta Boleng jwa Ditlamorago tse |

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|--|---|--------------|--|
| Noka   | Noka ya Crocodile   | Dintlha      | Dintlha tsa Tekolo ya Boleng jwa Metsi tsa DWA                                     |
| WQSU   | 24  | RC           | A2H013 Noka ya Magalies kwa Scheerpoort 2002-<br>2007( <i>n</i> =205)              |
| Lefelo la EWR                                | EWR8  | PES          | A2H116 Haakdoorndriftd/s lebotakganelo la Paul<br>HugoDam2003-2008( <i>n</i> =104) |
| Dikarolo tsa Boleng jwa Metsi                | va Metsi  | Boleng       |  |
| Matswai a a sa boleng                        | MgSO4   | 113.147 F(5) | F(5)   |
| (mg/L)                                       | Na <sub>2</sub> SO <sub>4</sub>   | 10.358       | A(0)   |
|  | MgCl <sub>2</sub>   | 2.622        | A(0)   |
|  | CaCl2   | 38.530       | B(1)   |
|  | NaCi  | 180.659      | B(1)   |
| Dinontsha (mg/L)                             | PO4   | 0.107        |  |
|  | TIN   | 0.187        | A(0)   |
| Didirisiwa tse di                            | pH (diyuniti tsa pH)  | 7.7-8.6      | B(1)   |
| bonagalang                                   | Thempereitšhara (°C)  | 1 record     | B(1)   |
|  | Okosijene e e Tlhaologileng (mg/L)  | 1 record     |  |
|  | Go tsenngwa ga motlakase<br>(mS/m)  | 91           | D(3)   |
| Sedirisiwa tsa tsibogo                       | Chl-a: pherifaetone (mg/m2)   | 1            | Temogo ya pono: ga go na malele  |
|  | Thamego ya ditshedi tsa setishaba- sekoro sa diphologolo tse dintsi tse di senang lerapo la mokwatta (ASPT) | 4.39         | U  |
|  | Sekoro sa dithapi (FRAI)  | 54.7%        | C/D  |
|  | Se se mabapi le bothole   |              |  |
| Tse di mabapi le                             | Ammonia (µg/L)  | 25           | B(1)   |
| Karolo ya ekholoji ya lefelo ka kakaretso    | ielo ka kakaretso   | C/D          |  |

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| NOKA                          |   | (Bophirima) jwa Noka ya Crocodile  | DINTLHA TSA TEKOLO YA BOLENG JWA METSIWA   | A BOLENG JW  | A METSIWA   |  |
|-------------------------------|---|--|--|--|---|--|
| WQSU                          |   | 24   | DWAWQWMS   | A2H11  | A2H116 Noka ya Crocodile kwa Haakdooringdrift go theoga le dikgatlho  | jo theoga le dikgatlho   |
| LEFELO LA EWR                 | ~   | EWR8   | RHP  | Gajaaı   | Gajaanong mafelo a a mmalwa a tekolo  |  |
| Boikanyo mo tsh               | Boikanyo mo tshekatshekong ya PES                                       | Magareng   |  |  |   |  |
| Dikarolo tsa Boleng jwa Metsi | eng jwa Metsi   | Karolo ya PES  | WQEcospecs   | Tokafatso<br>a e a                                     | TPC   | Tekolo<br>kaapetsakgapetsa   |
|                               | MgSO4   |  | <45mg/L  |  | Boleng jwa bo95 go nna<45mg/L   |  |
| Matewai a a ca                | Na <sub>2</sub> SO <sub>4</sub>   |  | <20mg/L  |  | Boleng jo bo kana ka 95 go nna<20mg/L   |  |
| bolena (ma/L)                 | MgCl <sub>2</sub>   |  | <15mg/L  | N/A  | Boleng jwa bo95 go nna<15mg/L   | Kgwedi le kgwedi   |
| 1                             | CaCl <sub>2</sub>   |  | <57mg/L  |  | Boleng jwa bo95 go nna<57mg/L   |  |
|                               | NaCI  |  | <191mg/L   |  | Boleng jwa bo95 go nna<191mg/L  |  |
| Dinontsha                     | SRP   | Karolo=D   | <0.125mg/L   | Ee, go C   | Boleng jwa bo50 go nna<0.125mg/L  | Kgwedi le kgwedi   |
| (mg/L)                        | TIN   | Karolo ya≓A  | <0.25mg/L  |  | Boleng jwa bo50 go nna<0.25mg/L   | Kgwedi le kgwedi   |
|                               | Hd  | Karolo ya=B, Bontle  | Boleng jwa bo5(5.9-<br>6.5)Boeng jwa bo95<br>(8.0–8.8)                                       | N/A  | 3 <sup>th</sup> Boleng (5.9-6.5) <sup>th</sup><br>4 95 Boleng(8.0<br>–8.8)  | Kgwedi le kgwedi   |
| 0000                          | Themphereitšhara  | Tshedimosetso e e lekanyeditsweng  | Tihokomela sekgala   | N/A  | Go tihagisa tekolo ya motheo mabapi le sedirisiwa.  | Fa ditshekatsheko tsa bayotiki                                       |
| bonagalang<br>Didirisiwa      | Okosijene e e<br>tihaologileng  | e price e unovra ve curro pa unov a<br>metsi a a maswe le tiwaetsa<br>botoropo.    | 7-8mg/L  | N/A  | Boleng jwa bo5 go nna>6.1mg/L. Go<br>thagisa<br>Tekolo ya motheo mabapi le sedirisiwa se.   |  |
|                               | Tebiditi (NTU)  | Se se seng sentle ka ntlha dipula tse dintsi.                                      | Sekgala se se mo<br>magareng<br>se se dumeletsweng   | N/A  | Go thagisa tekolo ya motheo mabapi le<br>Sedirisiwa se le go thokomela sekgala se<br>se magareng.   | Ka kotara  |
|                               | Go tsenngwa ga<br>motlakase   | Karolo=D   | <85mS/m  | Ee, go C   | Bolleng jwa bo95 go nna<85mS/m  | Ka kotara  |
|                               | Chla: pherfitone  |  | <84mg/m <sup>2</sup><br>(karolo ya D)  | MICA   | Boleng jwa bo50 go nna<84mg/m2  |  |
| Didirisiwa tsa                | Chla: faetopolanketone  |  | <30µg/L<br>(karolo ya D)   | 4M   | Boleng jwa bo50 go nna≺30µg/L   | na koiara  |
| tsibogo                       | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatla<br>(ASPT) | E (thuto e)  | Lebelela Ecospecs mabapi l   | e ditîhapî le diph                                     | Lebelela Ecospecs mabapi le ditihapi le diphologolo tse di senang lerapo la mokwatla  |  |
|                               | Sekoro sa setšhaba sa<br>dithapi  | C/D (thuto e)  |  |  |   |  |
|                               | Se se mabapi le botlhole  | Bothhole go tswa mo ditirong tsa<br>indaseteri le tsa tiriso ya metsi a a<br>maswe | Sekaseka fela fa e le gore d<br>Kuttwalo e solofetswe fa e le<br>(CEV) jaaka go kailwe mo go | ipholo tsa tekolo<br>gore boleng jwa<br>b DWAF (1996). | Sekaseka fela fa e le gore dipholo tsa tekolo ka bottalo di kaya fa go na le bottrata jo bo masisi e bile sebakwa se sa itsiwe.<br>Kuttwalo e solofetswe fa e le gore boleng jwa bo95 jwa tshedimosetso bo feta Boleng jwa Ditlamorago tse di Tswelelang pele<br>(CEV) jaaka go kaliwe mo go DWAF (1996). | asisi e bile sebakwa se sa itsiw<br>Ditlamorago tse di Tswelelang pe |
| Tse di mabapi le<br>botthole  | Ammonia   | Β  | <44ug/L  | Ee go D  | Boleng jwa bo95 go nna<44ug/L   | Kgwedi le kgwedi   |

MAR EWR1: A31A-Kaaloog se Loop, kwa tlase ga pharagatlha, pele ga dikgatlho le Noka ya Marico

| Nove         Note         National Sectop         Diministrat a toxio ya boling j           MOGU         IA         Addo3 Sectop         Diministra a toxio ya boling j           Lefelo La EWR         IA         FPS         Add03 Sectop value           Lefelo La EWR         IA         FPS         183041 Rispruit twa sector saloreg se Loop 2004-2008 (n=9)           Lefelo La EWR         MSEVIT         PS         183041 Rispruit twa sector saloreg matapopi le PAI           Nativali a sag         MSEOI,<br>CaCC         0.0         17166monstato e sa sector sa matavai a sa boleng mabapi le PAI           Nativali a sag         NacC         3.016         0.01         0.01         0.01           Diontshefnenti.         NacC         3.717         0.02         B(1)         Add0           Diontshefnenti.         NacC         3.717         0.02         B(1)         Add0           Diontshefnenti.         NacC         3.717         0.02         B(1)         Add0           Diontshefnenti.         NacC         3.713         Ad(0)         Add0         Add0           Diontshefnenti.         NacC         3.713         Ad(0)         Add0         Add0         Add0         Add0         Add0         Add0         Add0         Add0         Add0     |                          |  |                         |              |  |
|---|--------------------------|--|-------------------------|--------------|--|
| RC         A2H036 Steer           PES         188041 Rietsp           PES         188041 Rietsp           Boleng jwa RC         Boleng jwa           14.765         8.717           0         0           14.765         9.96           14.765         9.015           3.015         9.015           3.015         9.016           0.0016         0.02           0.0016         0.13           1.17         9.95-19.44           Inaologileng (mg/L)         8.717           1.002         0.13           1.003         9.95-19.44           Inaologileng (mg/L)         4.65-13.32           Inaologileng (  | Noka                     | Kaaloog se Loop  | Dintlha tsa Tekolo ya B | oleng        |  |
| PES         188041 Riefspire           Roleng jwa RC         Boleng jwa           14.765         Boleng jwa           0         14.765           3.015         Boleng jwa           4.978         8.717           0.0         0.013           3.015         0.016           0.016         0.013           0.090         0.13           1.3.27.98         8.15-8.45           a (°C)         0.090         0.13           haologileng (mg/L)         7.32-7.98         8.15-8.45           a motlakase         16.58         31.06           one (mg/L)         1.6.58         31.06           brot expension         16.58         31.06           ofintsi tse di senang         16.58         31.06           a tita         9.6.3         86.3           eba sa dithapi         96.3         86.3           botthole         0.003         0.14   | wasu                     | 1  | RC                      | A2H036 Stee  | enbokfontein mo Nokeng ya Koster 2003-2007 (n=97)                          |
| Boleng jwa RC         Boleng jwa           14.765         Boleng jwa           14.765         Boleng jwa           14.765         Boleng jwa           3.015         3.015           3.015         3.015           14.978         8.717           8.717         0.02           0.016         0.02           0.016         0.02           0.0090         8.15-8.45           1.32-7.98         8.15-8.45           1.32-7.98         8.15-8.45           1.100         0.13           1.100         0.13           1.101         1.56           1.101         1.56           1.105         31.06           1.101         1.6.58           1.106         31.06           1.101         1.6.58           1.106         31.06           1.106         31.06           1.101         1.6.58           1.101         1.6.58           1.102         1.1.06           1.103         1.1.06           1.104         1.1.02           1.105         1.1.02           1.106         1.1.1.1.1           1.103   | Lefelo la EWR            | MAR EWR 1  | PES                     | 188041 Riets | spruit kwa Bridge mo Kaaloog se Loop 2004-2008 (n=9)                       |
| 14.765     14.765       0     0       3.015     3.015       4.978     8.717       0     0.000       0     0.013       0     0.0390       0     0.13       1.32-7.98     8.15-8.45       1.32-7.98     8.15-8.45       1.32-7.98     8.15-8.45       1.32-7.98     8.15-8.45       1.10     7.32-7.98       1.10     0.13       1.10     9.95-19.44       1.10     1.132       1.10     1.132       1.10     1.132       1.10     1.132       1.10     1.132       1.10     1.132       1.10     1.132       1.132     1.132       1.132     1.132       1.132     1.132       1.132     1.132       1.132     1.132       1.133     1.132       1.133     1.132       1.14     1.132       1.14     1.132       1.14     1.14       1.14     1.14       1.14     1.14   | Dikarolo tsa Bo          | leng jwa Metsi   | Boleng jwa RC           | Boleng jwa   |  |
| 0         0         1           3.015         3.015         1           3.015         3.015         1           8.717         0.016         0.02           0.016         0.02         0.13           1.32.7.98         8.15-8.45         1           1.32.7.98         8.15-8.45         1           1.32.7.98         8.15-8.45         1           1.000         0.016         0.13           1.013         7.32-7.98         8.15-8.45           1.02         0.030         0.13           1.15.8         1.15.8         31.06           1.16.58         31.06         31.06           1.16.58         31.06         31.06           1.16.58         31.06         31.06           1.16.58         31.06         31.06           1.16.58         31.06         31.06           1.16.58         1.06         31.06           1.16.58         31.06         31.06           1.16.58         5.8         4           attal         1.06         31.06           1.10         1.003         0.03           1.10         0.020         0.020  | Matswai a a sa           | MgSO4  | 14.765                  |              | Tshedimosetso e e sa lekanang mabapi le go tsamaisa TEACHA sentle. EC e ka |
| 3.015         3.015         4.978         4.978           4.978         4.978         8.717         8.717           8.717         0.016         0.02         8(1)           0.016         0.013         A(0)         8(1)           a (°C)         7.32-7.98         8.15-8.45         8(1)           a (°C)         7.32-7.98         8.15-8.45         8(1)           b (°C)         7.32-7.98         8.15-8.45         8(1)           a (°C)         7.32-7.98         8.15-8.45         8(1)           b (°C)         7.32-7.98         8.15-8.45         8(1)           a (°C)         7.32-7.98         8.15-8.45         8(1)           b (°C)         7.32-7.98         8.15-8.45         8(1)           a (°C)         7.32-7.98         8.15-8.45         8(1)           b (°C)         7.32-7.98         8.15-8.45         8(1)           b (°C)         16.6         31.06         8(1)           b (°C)         16.58         31.06         8(1)           b (°C)         16.1         86.3         8           b (°C)         10.00         10.0         10.0           b (°C)         10.0         0.02         0.02 <td>ooleng(mg/L)</td> <td>Na<sub>2</sub>SO<sub>4</sub></td> <td>0</td> <td></td> <td>dirisiwa jaaka sesupo sa matswai a a sa boleng mabapi le PAI</td> | ooleng(mg/L)             | Na <sub>2</sub> SO <sub>4</sub>                            | 0                       |              | dirisiwa jaaka sesupo sa matswai a a sa boleng mabapi le PAI               |
| 4.978     4.978     8.717     8.717       8.717     0.016     0.02     8(1)       0.016     0.013     A(0)       1.32-7.98     8.15-8.45     8(1)       1.32-7.98     8.15-8.45     8(1)       1.32-7.98     8.15-8.45     8(1)       1.32-7.98     8.15-8.45     8(1)       1.53-7.98     8.15-8.45     8(1)       1.53-7.98     8.15-8.45     8(1)       1.53-7.98     8.15-8.45     8(1)       1.53-7.98     8.15-8.45     8(1)       1.53-7.98     8.15-8.45     8(1)       1.53-7.98     9.95-19.44     A(0)       1.658     16.58     31.06     8(1)       1.658     16.58     31.06     8(1)       1.658     5.8     A(8)       dintsi tse di senang     16.58     5.8       dintsi tse di senang     5.8     8(3)       atla     5.8     8(6.3)       aba sa dithapi     8(6.3)     8(6.3)       aba sa dithapi     0.003     0.14       0.003     0.02     0.02  |                          | MgCl <sub>2</sub>  | 3.015                   |              |  |
| 8.717     0.016     0.02     B(1)       0.016     0.01     0.02     B(1)       a (°C)     0.090     0.13     A(0)       a (°C)     7.32-7.98     8.15-8.45     B(1)       a (°C)     7.32-7.98     8.15-8.45     B(1)       a (°C)     7.32-7.98     8.15-8.45     B(1)       a motiakase     16.58     8.15-8.45     B(1)       a motiakase     16.58     31.06     B(1)       a motiakase     16.58     5.8     A/B       a dintisits di senang     5.8     B(5.3)     B       a bathole     1     86.3     B       a bothole     0.003     0.14     A(0)       a bothole     0.20     0.02     B(1)  |                          | CaCl2  | 4.978                   |              |  |
| 0.016         0.02         B(1)           a (°C)         0.090         0.13         A(0)           a (°C)         0.090         0.13         A(0)           a (°C)         0.95-7.98         8.15-8.45         B(1)           haologileng (mg/L)         7.32-7.98         8.15-8.45         B(1)           haologileng (mg/L)         4.65-13.32         AB(0.5)           haologileng (mg/L)         16.58         31.06         B(1)           ontakase         5.8         A/B         B(1)           atla         5.8         B(1)         B(1)           atla         0.003         0.14         A(0)   |                          | NaCi   | 8.717                   |              |  |
| 0.090         0.13         A(0)           a (°C)         7.32-7.98         8.15-8.45         B(1)           a (°C)         9.95-19.44         AB(0.5)           haologileng (mg/L)         4.65-13.32         AB(0.5)           a motlakase         16.58         31.06         B(1)           onte (mg/m2)         16.58         31.06         B(1)           onte (mg/m2)         5.8         AB         AB           a motlakase         16.58         31.06         B(1)           onte (mg/m2)         5.8         AB         AB           atla         86.3         B         AB           atla         0.003         0.14         AO           atla         0.003         0.14         AO  | inontsha(mg/L)           | PO4  | 0.016                   | 0.02         | B(1)   |
| a (°C)         7.32-7.98         8.15-8.45         B(1)           a (°C)         9.95-19.44         AB(0.5)           Ihaologileng (mg/L)         4.65-13.32         AB(0.5)           a motlakase         16.58         31.06         B(1)           one (mg/m2)         16.58         31.06         B(1)           one (mg/m2)         5.8         AB         AB           a motlakase         16.58         31.06         B(1)           one (mg/m2)         5.8         AB         AB           atla         0.003         0.14         AO           b oncod         0.020         0.02         B(1)   |                          | TIN  | 060.0                   | 0.13         | A(0)   |
| a (°C)         a (°C)         9.95-19.44         A/B(0.5)           Ihaologileng (mg/L)         4.65-13.32         A/B(0.5)           a motlakase         16.58         31.06         B(1)           one (mg/m2)         16.58         31.06         B(1)           one (mg/m2)         5.8         A/B         A/B           dintsi tse di senang         5.8         A/B         A/B           atta         66.3         86.3         B           b botthole         0.003         0.14         A(0)           b         0.020         0.02         B(1)  | <b>Didirisiwa tse di</b> | pH(5 <sup>th</sup> -95 <sup>th</sup> %)                    | 7.32-7.98               | 8.15-8.45    | B(1)   |
| Ihaologileng (mg/L)         4.65-13.32         A/B(0.5)           a motlakase         16.58         31.06         B(1)           one (mg/m2)         16.58         31.06         B(1)           one (mg/m2)         5.8         A/B         A/B           dintsi tse di senang         5.8         A/B         A/B           atta         5.9         86.3         B           b botthole         0.0003         0.14         A(0)           b         0.020         0.02         B(1)   | onagalang                | Thempereitšhara (°C)                                       |                         | 9.95-19.44   | A/B(0.5)   |
| a motlakase         16.58         31.06         B(1)           Dne (mg/m2)         31.06         B(1)         51           dintsi tse di senang         5.8         A/B         41           atla         0.003         0.14         A(0)           0         0.20         0.02         B(1)  |                          | Okosijene e e Tlhaologileng (mg/L)                         |                         | 4.65-13.32   | A/B(0.5)   |
| one (mg/m2)     5.8     A/B       dintsi tse di senang     5.8     A/B       atla     6.3     B       aba sa dithapi     86.3     B       ibotihole     0.003     0.14     A(0)       i     0.20     0.02     B(1)  |                          | Go tsenngwa ga motlakase<br>(mS/m)                         | 16.58                   | 31.06        | B(1)   |
| dintsi tse di senang<br>atla<br>aba sa dithapi<br>i bothole<br>i bothole<br>0.003<br>0.14<br>0.02<br>0.02<br>0.02<br>0.02   | edirisiwa tsa ts         | <u> </u>   |                         |              |  |
| laba sa dithapi         86.3         B           bothole         80.003         80.14         A(0)           0.003         0.14         A(0)  |                          | Diphologolo tse dintsi tse di senang<br>lerapo la mokwatla |                         |              | A/B  |
| bothole 0.003 0.14 A(0) 0.02 B(1)   |                          | Sekoro sa setšhaba sa ditlhapi                             |                         | 86.3         | 8  |
| 0.003 0.14 A(0)<br>0.20 0.02 B(1)   |                          | Se se mabapi le bothole                                    |                         |              |  |
| 0.20 0.02 8(1)  | rse di mabapi le         | Γ  | 0.003                   | 0.14         | A(0)   |
|   | othole                   | Foloraete (µg/L)   | 0.20                    | 0.02         | B(1)   |
|   | (arolo ya ekholo         | iji ya lefelo ka kakaretso                                 |                         |              | A/B  |

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| NOKA                              |  | Noka ya Kaaloog se Loop   | DINTLHA TSA TEKOLO YA BOLENG JWA METSI             | ILO YA BOLE                      | NG JWA METSI  |                            |
|-----------------------------------|--|---|--|----------------------------------|---|----------------------------|
| WQSU                              |  | 1   | DWAWQWMS   | 1880                             | 188041 Rietspruit kwa leborogong mo Kaaloog se Loop   | mo Kaaloog se Loop         |
| LEFELO LA EWR                     |  | EWR1  | RHP  | Gaja                             | Gajaanong mafelo a a mmalwa a tekolo  | tekolo                     |
| Boikanyo mo tshekatshekong ya PES | atshekong ya PES   | Botlase   |  | -                                |   |                            |
| Dikarolo tsa Boleng jwa Metsi     | g jwa Metsi  | Karolo ya PES   | WQEcospecs   | Tokafatso<br>a e a               | TPC   | Tekolo<br>koanetsakoanetsa |
|                                   | MgSO4  | Tshedimosetso e e sa lekanang mabapi le go tsamaisa TEACHA  | ≤23mg/L  |                                  | Boleng jwa bo95 go  |                            |
| Mateurai a a sa                   | Na <sub>2</sub> SO <sub>4</sub>                                      | -sentle. EC e ka dirisiwa jaaka sesupo sa matswai a a sa boleng<br>mahani la PAI                        | ≤33mg/L  |                                  | Bolena iwa bo95 ao  |                            |
| iviatswal a a sa<br>bolena (ma/L) | MgCl <sub>2</sub>  |   | ≤30mg/L  | N/A                              | Boleng jwa bo95 go  | Kgwedi le kgwedi           |
|                                   | CaCl <sub>2</sub>  |   | ≤57mg/L  |                                  | Boleng jwa bo95 go  |                            |
|                                   | NaCi   |   | ≤191mg/L   |                                  | Boleng jwa bo95 go  | 1                          |
| Dinontsha                         | SRP  | Karolo ya=B   | <0.015mg/L   | Nnyaa                            | Boleng jwa bo50 go  | Kgwedi le kgwedi           |
| (mg/L)                            | TIN  | Karolo ya=A   | <0.75mg/L  | Nnyaa                            | Boled iwa bo50 go   | Kawedi le kawedi           |
|                                   | Hd   | Noka e e mo magareng  | >6.5 le <8.8                                       | Nnyaa                            | Boleng jwa bo95 go nna<8.8 leKgwedi le kgwedi<br>>6.5   | Kgwedi le kgwedi           |
|                                   | Themphereitšhara   | Tshedimosetso e e lekanyeditsweng e bile ga e amiwe mabapi le   | Tihokomela sekgala                                 | N/A                              | Tlhokomela sekgala sa<br>tlhago   | Kgwedi le kgwedi           |
| Se se bonagalang                  | Okosijene e ethaologileng  |   | 7-8mg/L  | N/A                              | Boleng jwa bo5 go<br>nna>7mg/L.   | Kgwedi le kgwedi           |
|                                   | Tebiditi (NTU)   | Tebiti mogaro ga dipula tse dintsi ka ntlha ya tsa morero wa<br>moepo wa seleiti go tlhatlhoga          | Sekgala se se mo<br>magareng<br>se se dumeletsweng | N/A                              | Phetogo e e mo magareng e kgwedi le kgwedi<br>dumeletswe  | Kgwedi le kgwedi           |
|                                   | Go tsenngwa ga motlakase<br>(mS/m)                                   | Karolo ya=B   | ≤55mS/m  | Nnyaa                            | Boleng jwa bo95 gc<br>nna<55mS/m  | go Ka kotara               |
|                                   | Chla: pherfitone   | Thatthobo ya pono e kaya go nna teng go go lekanyeditsweng ga<br>alekale mo mattapeng le ka mo megobeng | ≤1.7mg/m<br>(Karolo ya A)                          | N/A                              | Boleng jwa bo50 go<br>nnat<1.7mg/m2   | Ka kotara                  |
| Didiriciwa tea                    | Chla: faetopolanketone   |   | ≤10µg/L<br>(Karolo ya A)                           |                                  | Boleng jwa bo50 go<br>nna<10µg/L  |                            |
| tsibogo                           | Diphologolo tse dintsi tse di<br>senang lerapo la mokwatla<br>(ASPT) | A/B (thuto e le RHP)  | Lebelela Ecospecs ma                               | abapi le ditlhap                 | Lebelela Ecospecs mabapi le ditihapi le diphologolo tse di senang lerapo la mokwatla  | erapo la mokwatla          |
|                                   | Sekoro sa setšhaba sa ditlhapi B (thuto e)                           | B (thuto e)   |  |                                  |   |                            |
|                                   | Se se mabapi le bothole  | Ga go na bothole  | Sekaseka fela fa e le<br>masisi e bile sebakwa     | gore dipholo ts<br>se sa itsiwe. | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo<br>masisi e bile sebakwa se sa itsiwe. | go na le bothata jo bc     |
| Tse di mabapi le<br>botihole      | Ammonia  | A   | ≤15ug/L  |                                  | Boleng jwa bo95 go<br>nna≺15ug/L  | Kgwedi le kgwedi           |

MAR EWR2: A31B-Noka ya Groot Marico go Tlhatloga le dikgatlho tsa Sterkstroom

| Thulaganyo ya                 | Thulaganyo ya 5.19: Dikarolo tsa PES le tshekatsheko ya botlalo ya lefelo mabapi le lefelo la Mar EWR 2 | ko ya botlalo ya lefelo i    | mabapi le lefe | sio la Mar EWR 2   |
|-------------------------------|---|------------------------------|----------------|--|
| Noka                          | Groot Marico  | Dintlha tsa Tekolo ya Boleng | oleng          |  |
| WQSU                          | -   | RC                           | A2H036 Stee    | A2H036 Steenbokfontein mo Nokeng ya Koster 2003-2007 (n=97)                |
| Lefelo la EWR                 | MAR EWR 2   | PES                          | 188035 Koed    | 188035 Koedoesfontein mo Nokeng ya Groot-Marico 2004-2008 (n=9)            |
| Dikarolo tsa Boleng jwa Metsi | ileng jwa Metsi   | Boleng jwa RC                | Boleng jwa     | Boleng jwa   Karolo/Tshwaelo   |
| Matswai a a sa                | MgSO4   | 14.765                       |                | Tshedimosetso e e sa lekanang mabapi le go tsamaisa TEACHA sentle. EC e ka |
| boleng (mg/L)                 | Na <sub>2</sub> SO <sub>4</sub>   | 0                            |                | dirisiwa jaaka sesupo sa matswai a a sa boleng mabapi le PAI               |
|                               | MgCl <sub>2</sub>   | 3.015                        |                |  |
|                               | CaCl <sub>2</sub>   | 4.978                        |                |  |
|                               | NaCl  | 8.717                        |                |  |
| Dinontsha (mg/L)              | ) PO4   | 0.016                        | 0.02           | B(1)   |
|                               |   | 0.090                        | 0.11           | A(0)   |
| Didirisiwa tse di             | pH(5 <sup>th</sup> -95 <sup>th</sup> %)   | 7.32-7.98                    | 8.02-8.38      | B(1)   |
| bonagalang                    | Thempereitšhara (°C)  |                              | 11.95-22.65    | B(1)   |
|                               | Okosijene e e Tlhaologileng (mg/L)  |                              | 2.09-8.83      | B(1)   |
|                               | Go tsenngwa ga motlakase<br>(mS/m)  | 16.58                        | 34.1           | B(1)   |
| Sedirisiwa tsa<br>tsibogo     | Chl-a: pherifaetone (mg/m2)   |                              |                |  |
|                               | Diphologolo tse dintsi tse di senang<br>lerapo la mokwatla  |                              |                | A/B  |
|                               | Sekoro sa setšhaba sa ditlhapi  |                              |                | 8  |
|                               | Se se mabapi le botlhole  |                              |                |  |
| Tse di mabapi le              | Foloraete (µg/L)  | 0.20                         | 0.02           | A(0)   |
| Karolo ya ekholc              | i ya le   |                              |                | В  |

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| NOKA                          |  | Marico  | DINTLHA TSA TEKOLO YA BOLENG JWA METSI                                    | LO YA BOLE                       | ENG JWA METSI  |                            |
|-------------------------------|--|---|---|----------------------------------|--|----------------------------|
| WQSU                          |  | -   | DWAWQWMS  | 1880<br>2004                     | 188035 Koedoesfontein mo Nokeng ya Groot-Marico<br>2004-2008 (n=9)   | ing ya Groot-Marico        |
| LEFELO LA EWR                 |  | MAR EWR2  | RHP   | Gaja                             | Gajaanong mafelo a a mmalwa a tekolo   | i tekolo                   |
| Boikanyo mo tshel             | Boikanyo mo tshekatshekong ya PES                                    | Botlase   |   |                                  |  |                            |
| Dikarolo tsa Boleng jwa Metsi | g jwa Metsi  | Karolo ya PES   | WQEcospecs  | Tokafatso<br>a e a               | TPC  | Tekolo<br>kgapetsakgapetsa |
|                               | MgSO4  | Tshedimosetso e e sa lekanang mabapi le go tsamaisa TEACHA  | ≤23mg/L   |                                  | Boleng jwa bo95 go   |                            |
| Matewai a a sa                | 4  | sentie. E∪ e ka dirisiwa jaaka sesupo sa matswai a a sa boleng<br>mabaoi le PAI                         | ≤33mg/L   |                                  | Boleng jwa bo95 go   |                            |
| boleng (mg/L)                 | MgCl <sub>2</sub>  |   | ≤30mg/L   | N/A                              | Boleng jwa bo95 go   | Kgwedi le kgwedi           |
|                               | CaCl <sub>2</sub>  |   | ≤57mg/L   |                                  | Boleng jwa bo95 go   |                            |
|                               | NaCI   |   | ≤191mg/L  |                                  | Boleng jwa bo95 go   |                            |
| Dinontsha                     | SRP  | Karolo ya= B  | <0.015mg/L  | Nnyaa                            | Boleng jwa bo50 go   | Kgwedi le kgwedi           |
| mg/L)                         | TIN  | Karolo ya=A   | <0.75mg/L   | Nnyaa                            | Boleg jwa bo50 go  | Kgwedi le kgwedi           |
|                               | Hd   | Noka e e mo magareng  | >6.5 le <8.8  | Nnyaa                            | Boleng jwa bo95 go nna<8.8Kgwedi le kgwedi<br>le >6.5  | Kgwedi le kgwedi           |
|                               | Themphereitšhara   | Tshedimosetso e e lekanyeditsweng ga e amiwe ke ditiro tsa go   | Tihokomela sekgala  | N/A                              | TIhokomela sekgala sa<br>tihago  | Kgwedi le kgwedi           |
| Se se bonagalang              | Okosijene e e tlhaologileng  | נוגמורכלם   | 7-8mg/L   | N/A                              | Boleng jwa bo5 go<br>nna>7ma/L.  | Kgwedi le kgwedi           |
| Juniswa                       | Tebiditi (NTU)   | Tebiti mogaro ga dipula tse dintsi ka ntiha ya tsa morero wa<br>moepo wa seleiti go tihatihoga          | Sekgala se se mo<br>magareng<br>se se dumeletsweng                        | N/A                              | Phetogo e e mo magareng e Kgwedi le kgwedi<br>dumeletswe   | Kgwedi le kgwedi           |
|                               | Go tsenngwa ga motlakase<br>(mS/m)                                   | Karolo ya= B  | ≤55mS/m   | Nnyaa                            | Boleng jwa bo95 go<br>nna<55mS/m   | go Ka kotara               |
|                               | Chia: pherfitone   | Tihatihobo ya pono e kaya go nna teng go go lekanyeditsweng ga sa lekale mo matlapeng le ka mo megobeng | ≤1.7mg/m²<br>(Karolo ya A)  | N/A                              | Boleng jwa bo50 go<br>nnat<1.7mg/m2  | Ka kotara                  |
| lidiriciwa tea                | Chla: faetopolanketone   |   | ≤10µg/L<br>(Karolo ya A)  |                                  | Boleng jwa bo50 go<br>nna<10µg/L   |                            |
| tsibogo                       | Diphologolo tse dintsi tse di<br>senang lerapo la mokwatla<br>(ASPT) | A/B (thuto e)   | Lebelela Ecospecs ma  | ıbapi le ditlhap                 | Lebelela Ecospecs mabapi le dithapi le diphologolo tse di senang lerapo la mokwatla  | lerapo la mokwatla         |
|                               | Sekoro sa setšhaba sa ditlhapi                                       | B/C (thuto e)   |   |                                  |  |                            |
|                               | Se se mabapi le bothole  | Ga go na bothole  | Sekaseka fela fa e le gore dipholo<br>masisi e bile sebakwa se sa itsiwe. | jore dipholo ts<br>se sa itsiwe. | Sekaseka fela fa e le gore dipholo tsa tekolo ka bottalo di kaya fa go na le bothata jo bo masisi e bile sebakwa se sa itsiwe. | go na le bothata jo b      |
| Tse di mabapi le<br>bothole   | Ammonia  | A   | ≤15ug/L   |                                  | Boleng jwa bo95 go   | Kgwedi le kgwedi           |

| WQSU     3       Lefelo la EWR     MAR EWR 3       Dikarolo tsa Boleng jwa Metsi<br>(mg/L)     Massoleng jwa Metsi | EWR 3<br>a Metsi<br>MgSO4<br>MgCl <sub>2</sub><br>CaCl <sub>2</sub><br>CaCl <sub>2</sub> | RC         A2H           PES         A3H           Boleng jwa RC         Bol           14.765         17.1           0         0           3.015         3.7           8.717         5.6( | A2H036 Steen<br>A3H028 Rieke<br>2007 (n=141)<br>Boleng jwa<br>17.112 | A2H036 Steenbokfontein mo Nokeng ya Koster 2003-2007 (n=97)                                 |
|--|--|---|--|---|
| la EWR MAR<br>lo tsa Boleng jwa<br>ai a a sa boleng  | WR 3<br>Metsi<br>IgSO4<br>IgCl <sub>2</sub><br>SaCl <sub>2</sub>                         | PES<br>Boleng jwa RC<br>14.765<br>0<br>3.015<br>4.978<br>8.717  | A3H028 Rieke<br>2007 (n=141)<br>Boleng jwa<br>17.112                 |   |
| lo tsa Boleng jwa<br>ai a a sa boleng  | Metsi<br>IgSO4<br>IgCl <sub>2</sub><br>igCl <sub>2</sub>                                 | Boleng jwa RC<br>14.765<br>0<br>3.015<br>4.978<br>8.717   | Boleng jwa<br>17.112   | A3H028 Riekersdam mo kanaleng ya molema go tswa go Marico-Bosveld Dam 2002-<br>2007 (n=141) |
| ai a a sa boleng   | IgISO4<br>fa2SO4<br>fgCl2<br>acl2  | 14.765<br>0<br>3.015<br>4.978<br>8.717  | 17.112   | Karolo/Tshwaelo   |
|  | la <sub>2</sub> SO4<br>lgCl <sub>2</sub><br>acl <sub>2</sub>                             | 0<br>3.015<br>4.978<br>8.717  |  | B(1)  |
| Ň  | lgCl <sub>2</sub><br>taCl <sub>2</sub>   | 3.015<br>4.978<br>8.717   | D  | A(0)  |
| •  | aCl <sub>2</sub>   | 4.978<br>8.717  | 3.7  | A(0)  |
|  |  | 8.717   | 4.226  | A(0)  |
| N  | NaCI   |   | 5.603  | A(0)  |
| Dinontsha (mg/L) PC  | PO4  | 0.016   | 0.023  | C(2)  |
|  | TIN  | 0.090   | 0.12   | B(1)  |
| Didirisiwa tse di ph   | pH(5th-95th %)   | 7.32-7.98   | 7.795-8.445  | B(1)  |
| bonagalang   | [hempereitšhara (°C)   |   | 12.7-24.3  | B(1)  |
| ō  | Okosijene e e Tlhaologileng (mg/L)   |   | 2.29-8.33  | B(1)  |
| Q E  | Go tsenngwa ga motłakase<br>(mS/m)   | 16.58   | 37.3   | B(1)  |
| Sedirisiwa tsa tsibogo Ch  | Chl-a: pherifaetone (mg/m2)  |   |  |   |
|  | Diphologolo tse dintsi tse di senang lerapo<br>la mokwatla                               |   | 5.3  | C(2)  |
| ÿ  | Sekoro sa setšhaba sa dithapi  |   | 35   | D(3)  |
|  | Se se mabapi le botihole   |   |  |   |
| Tse di mabapi le An  | Ammonia (µg/L)   | 0.003   | 32   | B(1)  |
|  | Foloraete (µg/L)   | 0.20  | 0.2  | A(0)  |
| Karolo ya ekholoji ya lefelo ka kakaretso  | ) ka kakaretso   |   |  | B/C   |

MAR EWR3: A31F-Noka ya Groot Marico go theoga ga Marico Bosveld Dam

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| NOKA                          |   | Marico  | DINTLHA TSA TEKOLO YA BOLENG JWA METSI | <b>JOB AA BOL</b>          | ENG JWA METSI   |                                   |
|-------------------------------|---|---|--|----------------------------|---|-----------------------------------|
| WQSU                          |   | 3   | DWAWQWMS                               | A3H<br>go N                | A3H028 Riekersdam mo kanaleng ya molema go tswa<br>go Marico-Bosveld Dam 2002-2007 (n≕141)  | g ya molema go tswa<br>07 (n=141) |
| LEFELO LA EWR                 |   | MAR EWR3  | RHP                                    | Gaja                       | Gajaanong mafelo a a mmalwa a tekolo  | olo                               |
| Boikanyo mo tsh               | Boikanyo mo tshekatshekong ya PES                                       | Magareng  |  |                            |   |                                   |
| Dikarolo tsa Boleng jwa Metsi | ing jwa Metsi   | Karolo ya PES   | WQEcospecs                             | Tokafatso<br>a e a         | TPC   | Tekolo<br>kgapetsakgapetsa        |
| Moteuroi o o co               | MgSO4   |   | ≤23mg/L                                | J.                         | Boleng jwa bo95 go<br>nna<23mg/L  |                                   |
| boleng (mg/L)                 | Na <sub>2</sub> SO <sub>4</sub>   |   | ≤20mg/L                                | N/A                        | Boleng jo bo kana ka 95 go  | Kgwedi le kgwedi                  |
| -<br>                         | MgCl <sub>2</sub>   |   | s15mg/L                                |                            | Boleng jwa bo95 go  |                                   |
|                               | CaCl <sub>2</sub>   |   | ≤21mg/L                                |                            | Boleng jwa bo95 go  |                                   |
|                               | NaCI  |   | ≤45mg/L                                |                            | Boleng jwa bo95 go  |                                   |
| Dinontsha<br>(mg/L)           | SRP   | Karolo ya= C  | <0.015mg/L                             | Ee go D                    | Boleng jwa bo50 go<br>nna≺0.025mg/L   | Kgwedi le kgwedi                  |
|                               | TIN   | Karolo ya=B   | <0.75mg/L                              | Ee go D                    | Boleng jwa bo50 go  | Kgwedi le kgwedi                  |
|                               | Hd  | Bontle  | ~                                      | Nnyaa                      | Boleng jwa bo95 go nna<8.8 leKgwedi le kgwedi<br>>6.5   | Kgwedi le kgwedi                  |
|                               | Themphereitšhara  | Tshedimosetso e e lekanyeditsweng e bile e amiwa ke Marico  | Tihokomela sekgala                     | N/A                        | Tlhokomela sekgala sa tlhago  | Kgwedi le kgwedi                  |
| Se se bonagalang              | Se se bonagalang Okosijene e e tihaologileng                            | Bosveig Dam   | 7-8mg/L                                | N/A                        | Boleng jwa bo5 go nna>7mg/L. Kgwedi le kgwedi   | Kgwedi le kgwedi                  |
| Didirisiwa                    | Tebiditi (NTU)  | Tebiti mogaro ga dipula tse dintsi ka ntiha ya tsa morero wa moepo wa seleiti go tihatihoga                   | se se mo<br>g<br>meletsweng            | N/A                        | Phetogo e e mo magareng e<br>dumeletswe   | Kgwedi le kgwedi                  |
|                               | Go tsenngwa ga motlakase<br>(mS/m)                                      | karolo ya= B  | s55mS/m                                | Nnyaa                      | Boleng jwa bo95 go<br>nna<85mS/m  | Ka kotara                         |
|                               | Chla: pherfitone  | Ihatthobo ya pono e kaya go nna teng go go kwa godimo<br>no mattapeng le ka mo megobeng ka nttha ya go gogiwa | ≤84mg/m²<br>(karolo ya D)              | N/A                        | Boleng jwa bo50 go<br>nna≺84mg/m2   | Ka kotara                         |
| Didiricium teo                | Chla: faetopolanketone  | <ul> <li>ga meusi ka ngwaga ka mokgwa wa unago ga kemoriuo go go<br/>fihatlogang</li> </ul>                   | ≤30µg/L<br>(karolo ya D)               |                            | Boleng jwa bo50 go<br>nna<30µq/L  |                                   |
| tsibogo                       | Diphologolo tse dintsi tse<br>di senang lerapo la<br>mokwatla<br>(ASPT) | C (thuto e)   | Lebelela Ecospecs m                    | abapi le dittha            | Lebelela Ecospecs mabapi le dithapi le diphologolo tse di senang lerapo la mokwatta   | rapo la mokwatta                  |
|                               | Sekoro sa setšhaba sa<br>ditthapi                                       | D (thuto e)   |  |                            |   |                                   |
|                               | Se se mabapi le bothole   | Botthole go tswa mo go gogiweng ga metsi ka ngwaga ka mokgwa wa tlhago ga temothuo go go tlhatlogang          |  | jore dipholo ta<br>Itsiwe. | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo masisi<br>e bile sebakwa se sa itsiwe. | ia le bothata jo bo masis         |
| Tse di mabapi le              | Ammonia   | Ξ   | ≤43.7ug/L                              | Ee go D                    | Boleng jwa bo95 go  | Kgwedi le kgwedi                  |

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| MAR EWR4       |

|   | Groot Marico   | Dintlha tsa Tekolo ya Boleng iwa | oleng iwa             |  |
|---|--|----------------------------------|-----------------------|--|
| WQSU 9                                    | Ø  | RC                               | A2H036 Stee           | A2H036 Steenbokfontein mo Nokeng ya Koster 2003-2007 (n=97)                          |
| Lefelo la EWR N                           | MAR EWR 4  | PES                              | A3H040 Nok<br>(n=181) | A3H040 Noka ya Marico kwa lebotakganelong la Mooiplaats/Tzwasa  2002-2007<br>(n=181) |
| Dikarolo tsa Boleng jwa Metsi             | j jwa Metsi  | Boleng jwa RC                    | Boleng jwa            | Karolo/Tshwaelo  |
| Matswai a a sa boleng                     | ng MgSO4   | 14.765                           | 32.787                | D(3)   |
| (mg/L)                                    | Na <sub>2</sub> SO <sub>4</sub>                            | 0                                | 0                     | A(0)   |
|   | MgCl2  | 3.015                            | 5.949                 | A(0)   |
|   | CaCl <sub>2</sub>  | 4.978                            | 5.903                 | A(0)   |
|   | NaCI   | 8.717                            | 8.698                 | A(0)   |
| Dinontsha (mg/L)                          | PO4  | 0.016                            | 0.018                 | B/C(1.5)   |
|   | TIN  | 0:090                            | 0.08                  | B(1)   |
| Didirisiwa tse di                         | pH(5 <sup>th</sup> -95 <sup>th</sup> %)                    | 7.32-7.98                        | 8.025-8.524           | B(1)   |
| bonagalang                                | Thempereitšhara (°C)                                       |                                  | 14.5-26.5             | B(1)   |
|   | Okosijene e e Tlhaologileng (mg/L)                         |                                  | 5.5-11.4              | B(1)   |
|   | Go tsenngwa ga motlakase<br>(mS/m)                         | 16.58                            | 54.2                  | B(1)   |
| Sedirisiwa tsa tsibogo                    | -  |                                  |                       |  |
|   | Diphologolo tse dintsi tse di senang lerapo<br>la mokwatla |                                  | 4.5                   | U  |
|   | Sekoro sa setšhaba sa dithapi                              |                                  | 61.8                  | C/D  |
|   | Se se mabapi le bothole                                    | -                                |                       |  |
| Tse di mabapi le                          | Ammonia (µg/L)   | 0.003                            | 0.003                 | A(0)   |
| bothole                                   | Foloraete (µg/L)   | 0.20                             | 0.6                   | A(0)   |
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| NOKA                             |  | Marico   | DINTLHA TSA TEKOLO YA BOLENG JWA METSI             | <b>JOB AA BOL</b>             | ENG JWA METSI   |                            |
|----------------------------------|--|--|--|-------------------------------|---|----------------------------|
| wasu                             |  | 5  | DWAWQWMS   | A3H<br>Moo                    | A3H040 Noka ya Marico kwa lebotakganelong la<br>Mooiplaats/Tzwasa 2002-2007 (n=181)   | ootakganelong la<br>n=181) |
| LEFELO LA EWR                    |  | MAR EWR4   | RHP  | Gaja                          | Gajaanong mafelo a a mmalwa a tekolo  | ekolo                      |
| Boikanyo mo tshe                 | Boikanyo mo tshekatshekong ya PES                                    | Magareng   |  |                               |   |                            |
| Dikarolo tsa Boleng jwa Metsi    | ng jwa Metsi   | Karolo ya PES  | WQEcospecs   | Tokafatso<br>a e a            | TPC   | Tekolo<br>kgapetsakgapetsa |
|                                  | MgSO₄  |  | s15mg/L  |                               | Boleng jwa bo95 go<br>nna<15mg/L  |                            |
| Matswai a a sa<br>bolong (mg/l_) | Na <sub>2</sub> SO <sub>4</sub>                                      |  | ≤20mg/L  | N/A                           | Boleng jo bo kana ka 95 go  | Kqwedi le kqwedi           |
|                                  | MgCl <sub>2</sub>  | AB   | ≤15mg/L  |                               | Boleng jwa bo95 go  | 2                          |
|                                  | CaCl <sub>2</sub>  |  | ≤21mg/L  |                               | Boleng jwa bo95 go<br>nna<21mg/L  |                            |
|                                  | NaCI   |  | ≤45mg/L  |                               | Boleng jwa bo95 go  |                            |
| Dinontsha<br>(mg/L)              | SRP  | Karolo ya=B/C  | ≤0.125mg/L   | Ee go D                       | Boleng jwa bo50 go<br>nna<0.125mg/L   | Kgwedi le kgwedi           |
|                                  | TIN  | Karolo ya=A  | ≤0.25mg/L  | Ee go D                       | Boleng iwa bo50 go  | Kawedi le kawedi           |
|                                  | Hd   | Karolo ya=B, Bontle  | 80   | Nnyaa                         | Boleng jwa bo95 go nna<8.8 leKgwedi le kgwedi<br>>5.9   | Kgwedi le kgwedi           |
|                                  | Themphereitšhara   | Tshedimosetso e e lekanyeditsweng e bile e amiwa ke go gapiwa go   | Tihokomela sekgala                                 | N/A                           | Tihokomela sekgala sa<br>tihago   | Kgwedi le kgwedi           |
| Se se bonagalang<br>Didirisiwa   | Okosijene e e tlhaologileng  | go unauogang   | 7-8mg/L  | N/A                           | Boleng jwa bo5 go<br>nna>7mg/L.   | Kgwedi le kgwedi           |
|                                  | Tebiditi (NTU)   | Teblit morago ga dipula tse dintsi   | Sekgala se se mo<br>magareng<br>se se dumeletsweng | N/A                           | Phetogo e e mo magareng e<br>dumeletswe   | Kgwedi le kgwedi           |
|                                  | Go tsenngwa ga motlakase<br>(mS/m)                                   | Karolo ya= B   | ≤55mS/m  | Nnyaa                         | Boleng jwa bo95 go<br>nna<55mS/m  | Ka kotara                  |
|                                  | Chla: pherfitone   | Thatthobo ya pno e kaya go nna teng go go kwa tlase ga alekale mo<br>matlapeng le ka mo megobeng   | ≤12mg/m²<br>(Karolo ya B)                          | N/A                           | Boleng jwa bo50 go<br>nna<12mg/m2   | Ka kotara                  |
|                                  | Chla: faetopolanketone   |  | ≤15µg/L<br>(Karolo ya B)                           |                               | Boleng jwa 50 go nna<15µg/L   |                            |
| tsibogo                          | Diphologolo tse dintsi tse di<br>senang lerapo la mokwatla<br>(ASPT) | C (thuto e)  | Lebelela Ecospecs m                                | abapi le ditlha               | Lebelela Ecospecs mabapi le dithapi le diphologolo tse di senang lerapo la mokwatla   | erapo la mokwatla          |
|                                  | Sekoro sa setšhaba sa<br>ditlhapi                                    | C/D (thuto e)  |  |                               |   |                            |
|                                  | Se se mabapi le bothole  | Botthole jo bo lekanyeditsweng go tsa mo go ttwaetseng botoropo go<br>go tthatlogang, mo ditirong tsa tiriso ya metsi a a maswe le go gogiwa<br>ga metsi ka ngwaga ka mokgwa wa tthago ga temothuo | _  | gore dipholo<br>se sa itsiwe. | Sekaseka fela fa e le gore dipholo tsa tekolo ka botlalo di kaya fa go na le bothata jo bo<br>masisi e bile sebakwa se sa itsiwe. | ı go na le bothata jo bo   |
| Tse di mabapi le<br>botlhole     | Ammonia  | А  | ≤15ug/L  |                               | Boleng jwa bo95 go<br>nna<15µ0/l  | Kgwedi le kgwedi           |

| Tshupane<br>ya<br>Kgatelelo   | 0.16  | 0.11  | 0.24 | 0.74   | 0.38   | 0.06   | 0.59   | 0.08  | 0.71   | 0.08   | 0.15   | 0.47   | 0.58   | 0.14  | 0.09   | 0.19  | 0.06   | 0.28   | 0.10   | 0.11   | 0.08   | 0.39   | 0.26  | 0.45   | 0.14   | 0.13  | 0.73   | 0.49  | 0.11   | 0.53  | 0.09   | 0.06   | 0.05   | 0.20  |
|---|-------|-------|------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|-------|--------|-------|--------|--------|--------|--------|--------|--------|-------|--------|--------|-------|--------|-------|--------|-------|--------|--------|--------|-------|
| Tiriso ya<br>Gajaanong<br>ya Metsi a a<br>ka fa Tlase<br>ga Lefatshe<br>(Mm3/a) | 1.37  | 1.32  | 0.85 | 20.35  | 11.58  | 1.17   | 11.53  | 0.77  | 33.62  | 0.49   | 3.23   | 14.10  | 13.54  | 0.61  | 1.87   | 1.80  | 1.03   | 4.02   | 1.90   | 4.02   | 1.46   | 6.16   | 2.20  | 12.77  | 1.45   | 0.79  | 13.73  | 3.10  | 0.74   | 10.89 | 2.59   | 0.43   | 0.50   | 0.62  |
| Resefe<br>jakaa % ya<br>Go neela<br>maatla                                      | 9.08  | 8.60  | 6.42 | 14.08  | 28.21  | 58.20  | 31.13  | 28.60 | 6.72   | 100.03 | 19.55  | 10.82  | 15.78  | 4.23  | 7.37   | 10.97 | 9.64   | 6.83   | 7.58   | 9.64   | 5.60   | 15.77  | 13.79 | 27.10  | 22.22  | 12.28 | 19.08  | 34.96 | 61.65  | 7.34  | 8.30   | 110.18 | 48.59  | 20.83 |
| Resefe<br>(Mm3/a)   | 0.80  | 1.08  | 0.23 | 3.89   | 8.52   | 10.87  | 6.12   | 2.63  | 3.19   | 6.24   | 4.08   | 3.24   | 3.67   | 0.19  | 1.57   | 1.03  | 1.67   | 0.97   | 1.47   | 3.44   | 1.01   | 2.46   | 1.17  | 7.67   | 2.33   | 0.76  | 3.57   | 2.20  | 3.99   | 1.51  | 2.33   | 7.47   | 5.33   | 0.64  |
| Resefe ya<br>BHN<br>(Mm3/a)   | 0.45  | 0.23  | 0.04 | 1.38   | 6.92   | 4.97   | 1.92   | 0.14  | 0.09   | 1.01   | 0.41   | 1.22   | 0.80   | 0.00  | 0.37   | 0.37  | 0.37   | 0.37   | 0.06   | 1.19   | 0.01   | 2.10   | 0.36  | 3.57   | 0.33   | 0.02  | 1.14   | 0.69  | 3.30   | 0.69  | 0.13   | 5.91   | 4.13   | 0.04  |
| MLF_EWR<br>(Mm <sup>3/</sup> a)   | 0.35  | 0.85  | 0.19 | 2.51   | 1.60   | 5.90   | 4.20   | 2.49  | 3.10   | 5.23   | 3.67   | 2.02   | 2.87   | 0.19  | 1.20   | 0.66  | 1.30   | 0.60   | 1.41   | 2.25   | 1.00   | 0.36   | 0.81  | 4.10   | 2.00   | 0.74  | 2.43   | 1.51  | 0.69   | 0.82  | 2.20   | 1.56   | 1.20   | 0.60  |
| Kelelo ya<br>motheo<br>(Mm3/a)  | 0.00  | 0.00  | 0.00 | 0.54   | 0.32   | 1.04   | 1.51   | 0.41  | 1.26   | 1.74   | 2.56   | 0.29   | 1.51   | 0.16  | 0.35   | 0.19  | 0.00   | 0.10   | 0.16   | 0.95   | 0.35   | 0.06   | 0.22  | 13.45  | 0.28   | 0.10  | 1.77   | 0.06  | 0.28   | 0.82  | 0.13   | 0.82   | 0.13   | 0.35  |
| Setšhaba<br>(Ditírelo tsa<br>Metsi) 2011)                                       | 49366 | 25432 | 4099 | 151332 | 758882 | 545170 | 210207 | 15659 | 9362   | 110652 | 45327  | 133204 | 88100  | 43    | 40641  | 40288 | 40288  | 40288  | 6427   | 130476 | 846    | 230416 | 39935 | 391615 | 36522  | 2308  | 125166 | 75096 | 361907 | 75670 | 14570  | 647955 | 452332 | 4423  |
| Go neela<br>maatla<br>(Mm3/a)   | 8.81  | 12.56 | 3.58 | 27.641 | 30.215 | 18.684 | 19.655 | 9.207 | 47.399 | 6.238  | 20.892 | 29.893 | 23.279 | 4.497 | 21.318 | 9.365 | 17.303 | 14.177 | 19.386 | 35.691 | 17.989 | 15.612 | 8.518 | 28.30  | 10.502 | 6.2   | 18.726 | 6.28  | 6.476  | 20.58 | 28.124 | 6.782  | 10.964 | 3.074 |
| Lefelo(km2)   | 559   | 1015  | 271  | 483    | 527    | 761    | 372    | 290   | 1,000  | 161    | 514    | 1,150  | 864    | 213   | 206    | 284   | 515    | 541    | 812    | 1,688  | 499    | 579    | 592   | 682    | 814    | 491   | 252    | 490   | 565    | 951   | 1,058  | 930    | 1,131  | 329   |
| Bodutelo<br>jwa<br>Kwatenari  | A10A  | A10B  | A10C | A21A   | A21B   | A21C   | A21D   | A21E  | A21F   | A21G   | A21H   | A21J   | A21K   | A21L  | A22A   | A22B  | A22C   | A22D   | A22E   | A22F   | A22G   | A22H   | A22J  | A23A   | A23B   | A23C  | A23D   | A23E  | A23F   | A23G  | A23H   | A23J   | A23K   | A23L  |

aanua ua 6 d. Thamaalaisa ua Nilvaata taa di Kaahunaa ka Matauradi un Matai a ka fa flaaa aa | afataha 100

o.

KAROLO - YA BONTSI JWA METSI A KA FA TLASE GA LEFATSHE

| Tshupane<br>ya<br>Kgatelelo   | 0.51  | 0.06   | 0.55   | 0.07   | 0.00   | 0.50  | 0.01   | 0.11   | 1.12   | 0.22   | 0.17   | 0.25   | 0.16   | 0.05   | 0.10   | 0.03   | 0.03   | 0.01  | 0.01  | 0.00   | 0.00   | 0.01   | 0.04   |
|---|-------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|--------|--------|--------|
| Tiriso ya<br>Gajaanong<br>ya Metsi a a<br>ka fa Tlase<br>ga Lefatshe<br>(Mm3(a) | 2.91  | 1.05   | 11.18  | 1.46   | 0.01   | 6.04  | 0.36   | 4.21   | 39.50  | 3.64   | 2.68   | 3.77   | 3.42   | 0.81   | 2.13   | 0.67   | 0.45   | 0.27  | 0.04  | 0.05   | 0.00   | 0.13   | 09.0   |
| Resefe<br>jakaa % ya<br>Go neela<br>maatla                                      | 17.88 | 5.95   | 1.49   | 9.22   | 10.60  | 7.55  | 9.54   | 4.99   | 4.96   | 11.33  | 19.04  | 2.28   | 3.31   | 7.26   | 5.00   | 14.94  | 6.12   | 1.70  | 4.99  | 3.56   | 3.36   | 4.20   | 10.68  |
| Resefe<br>(Mm3/a)   | 1.02  | 1.11   | 0.30   | 1.89   | 1.12   | 0.91  | 2.35   | 1.86   | 1.74   | 1.91   | 3.03   | 0.34   | 0.69   | 1.26   | 1.12   | 3.60   | 0.94   | 0.31  | 0.27  | 0.52   | 0.59   | 0.60   | 1.69   |
| Resefe ya<br>BHN<br>(Mm3/a)   | 0.07  | 0.01   | 0.23   | 0.46   | 0.39   | 0.23  | 0.23   | 0.51   | 0.03   | 0.08   | 0.01   | 0.02   | 0.14   | 0.01   | 0.22   | 0.43   | 0.30   | 0.00  | 0.09  | 0.05   | 0.00   | 0.01   | 0.03   |
| MLF_EWR<br>(Mm <sup>3</sup> /a)   | 0.95  | 1.10   | 0.07   | 1.43   | 0.73   | 0.68  | 2.12   | 1.35   | 1.71   | 1.83   | 3.02   | 0.32   | 0.55   | 1.25   | 0.90   | 3.17   | 0.64   | 0.31  | 0.18  | 0.47   | 0.59   | 0.59   | 1.66   |
| Kelelo ya<br>motheo<br>(Mm3/a)  | 0.92  | 0.22   | 0.13   | 0.00   | 0.00   | 0.00  | 0.35   | 1.86   | 0.60   | 6.00   | 6.00   | 1.00   | 1.00   | 2.00   | 2.00   | 4.00   | 0.00   | 0.00  | 0.00  | 0.00   | 0.00   | 0.00   | 0.00   |
| Setšhaba<br>(Ditirelo tsa<br>Metsi) 2011)                                       | 8153  | 732    | 25539  | 50853  | 42926  | 25539 | 25539  | 56281  | 3778   | 9106   | 1390   | 2597   | 15615  | 936    | 24060  | 46990  | 32553  | 536   | 9952  | 5439   | 17     | 1538   | 2776   |
| Go neela<br>maatla<br>(Mm3/a)   | 5.73  | 18.594 | 20.297 | 20.547 | 10.585 | 12.09 | 24.662 | 37.309 | 35.192 | 16.878 | 15.928 | 15.045 | 20.906 | 17.336 | 22.388 | 24.094 | 15.299 | 18.52 | 5.425 | 14.587 | 17.582 | 14.373 | 15.775 |
| Lefelo(km2)   | 493   | 709    | 801    | 1,327  | 688    | 591   | 735    | 1,338  | 2,516  | 632    | 596    | `485   | 704    | 601    | 702    | 1,425  | 684    | 844   | 472   | 641    | 902    | 843    | 2,499  |
| Bodutelo<br>jwa<br>Kwatenari  | A24A  | A24B   | A24C   | A24D   | A24E   | A24F  | A24G   | A24H   | A24J   | A31A   | A31B   | A31C   | A31D   | A31E   | A31F   | A31G   | A31H   | A31J  | A32A  | A32B   | A32C   | A32D   | A32E   |

## 7. KAROLO - YA BOLENG JWA METSI A KA FA TLASE GA LEFATSHE

Boleng jwa metsi a ka fa tlase ga lefatshe ka bodutelo jwa kwatenari bo ne jwa tlhomamisiwa go tswa mo diseteng tsa tshedimosetso tse di neng tsa bonwa kwa Thulaganyong ya Tsamaiso ya Metsi ya Lefapha la Metsi le Kgeleloleswe. Boleng jwa metsi a ka fa tlase ga lefatshe bo ne jwa tlhalosiwa ke dikaelo tsa boleng jwa metsi mo Thulaganyong ya 7.1 fa tlase.

| Bontsi jwa Khemikhale       |                | Dikgala tsa Boleng | jwa Metsi tsa Setotiwa <sup>1</sup> |                  |
|-----------------------------|----------------|--------------------|-------------------------------------|------------------|
|                             | Setlhopha sa 0 | Setihopha sa l     | Setlhopha sa li                     | Setlhopha sa III |
| pH                          | 6-9            | 5-6&9-9.5          | 4-5&>9.5-10                         | <4 &> 10         |
| Go tsenngwa ga<br>motlakase | < 70           | 70 - 150           | 150 – 370                           | > 370            |
| Khalesiamo jaaka Ca         | < 80           | 80 - 150           | 150 - 300                           | > 300            |
| Makenesiamo jaaka Mg        | < 70           | 70 - 100           | 100 - 200                           | > 200            |
| Sodiamo jaaka Na            | < 100          | 100 - 200          | 200 - 400                           | > 400            |
| Tleloraete jaaka Cl         | < 100          | 100 - 200          | 200 - 600                           | > 600            |
| Salefeite jaaka SO4         | < 200          | 200 - 400          | 400 - 600                           | > 600            |
| Naetereite jaaka NOx-N      | < 6            | 6 - 10             | 10 - 20                             | > 20             |
| Foloraete jaaka F           | <0.7           | 0.7 - 1.0          | 1.0 - 1.5                           | > 1.5            |

## Thulaganyo ya 7.1: Dikaelo tsa Boleng jwa Metsi

1) Ref: Quality Domestic Water Supplies, Volume 1: Assessment Guide, 2nd Ed. 1998. Water Research Commission Report No: TT 101/98. Pretorie, South Africa.

## ELA TLHOKO:

- SetIhopha sa 0 Se ke boleng jwa metsi jwa maikaelelo, jo bo leng maleba go dirisiwa botshelo jotlhe, kwa ntle le ditlamorago tse di sa siamang tsa boitekanelo mo go modirisi. SetIhopha se se tshwana thata le sekgala sa boleng jwa metsi sa setotiwa mo 2nd edition ya the South African Water Quality Guidelines for Domestic Use (DWAF, 1996).
- Setlhopha sa I Metsi mo setlhopheng se a bolokesegileng go dirisiwa botshelo jotlhe, fela a tlhaela boleng jwa metsi jwa maikaelelo ka gonne go ka tswa go na le dintlha tsa ditlamorago tse di sa siamang tsa boitekanelo, fela tsona ka gale di ga se tse di tseneletseng, e bile ditlamorago tsa boitekanelo tse di sa fitlhegang ga di bonagale e bie di thata go ka supiwa. Metsi mo Setlhopheng sa I ga a bake ditlamorago tsa boitekanelo mo maemong a a siameng. Ditlamorago tse dintle di ka bonagala.
- SetIhopha sa II Metsi mo setIhopheng se a tIhalosiwa ka gore ditlamorago tsa boitekanelo tse di sa siamang ga di a tIwaelega mabapi le tiriso ya paka e khutshwane e e lekanyeditsweng. Ditlamorago tse di sa siamang tsa boitekanelo di ka nna teng thata segolobogolo ka tiriso e e tswelelang pele mo dingwageng di lw dintsi, ka tiriso ya botshelo jotlhe. SetIhopha se se emela metsi a a maleba paka e khutshwane fela kgotsa go dirisiwa fela ka nako ya tshoganyetso, mme ga a maleba go dirisiwa ka tswelelo mo botshelong jotlhe.
- Setihopha sa III Metsi a a na le dikarolo mo sekgaleng sa kokoanyo mo ditlamorago tse di masisi tsa boitekanelo di ka solofelwang, segolobogolo mo baneng kgotsa mo batsofeng ka tiriso ya paka e khutshwane, le ka tiriso ya paka e telele. Metsi mo setihopheng se ga a maleba go dirisiwa jaaka metsi a a nwewang ntle le go tihatswiwa go go lekaneng go busetsa metsi ka mo setihopheng se se kwa tlase e bile se bolokesegile.

| jwa Kwatenari |
|---------------|
| Bodutelo      |
| ka            |
| lefatshe      |
| ga            |
| tlase         |
| l fa          |
| k             |
| va Metsi a    |
| g jv          |
| 7.2: Bolen    |
| ä             |
| a 7           |
| ulaganyo ya   |

| Bontsi jwa Khemikhale    |        |      |           |                  |      |           | Madute              | lo a Kwaten   | ari A21A, /  | Madutelo a Kwatenari A21A, A21B, A21C & A21D | A21D       |   |                  |              |
|--------------------------|--------|------|-----------|------------------|------|-----------|---------------------|---|--------------|--|------------|---|------------------|--------------|
|                          | Yuniti | -    | Nomoro. y | ro. ya Disampole | ole  | Boleng jv | va Tikologo<br>maga | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | jotsa mo     | Resefe ya                                    | Resefe ya  | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | si a ka fa tlase | ga lefatshe³ |
|                          |        | A21A | A21B      | A21C             | A21D | A21A      | A21B                | A21C  | A21D         |  | A21A       | A21B  | A21C             | A21D         |
| Ηd                       |        | 377  | 227       | 1510             | 635  | 7.75      | 7.60                | 6.54  | 7.23         | 5.0 - 9.5                                    | 6.98 -8.53 | 6.84 -8.36  | 5.89-7.19        | 6.51 –7.95   |
| Go tsenngwa ga motlakase | mS/m   | 383  | 227       | 1501             | 638  | 25.80     | 51.00               | 198.00  | 66.00        | <150   | 28.38      | 56.10   | 198.00           | 72.60        |
| Khalesiamo jaaka Ca      | mg/l   | 344  | 227       | 1294             | 635  | 25.40     | 47.00               | 198.40  | 59.00        | <150   | 27.94      | 51.70   | 198.40           | 64.90        |
| Makenesiamo jaaka Mg     | mg/l   | 344  | 227       | 1295             | 635  | 15.10     | 31.00               | 94.90   | 28.00        | <100   | 16.61      | 34.10   | 100.00           | 30.80        |
| Sodiamo jaaka Na         | mg/l   | 344  | 227       | 1294             | 638  | 3.00      | 10.00               | 87.30   | 25.00        | <200   | 3.30       | 11.00   | 96.03            | 27.50        |
| Tleloraete jaaka Cl      | mg/l   | 344  | 227       | 1331             | 638  | 3.60      | 12.00               | 70.00   | 14.00        | <200   | 3.96       | 13.20   | 00.77            | 15.40        |
| Salefeite jaaka SO4      | mg/l   | 344  | 227       | 1452             | 629  | 4.50      | 13.00               | 460.00  | 154.00       | <400   | 4.95       | 14.30   | 460.00           | 169.40       |
| Naetereite jaaka NOx-N   | l/gm   | 343  | 227       | 1316             | 578  | 0.80      | 2.30                | 71.90   | 2.30         | <10  | 0.88       | 2.53  | 71.90            | 2.53         |
| Foloraete jaaka F        | mg/l   | 344  | 227       | 520              | 578  | 0.12      | 0.14                | 0.70  | 0.05         | <1.0   | 0.13       | 0.15  | 0.77             | 0.06         |
|                          |        |      |           |                  |      |           | Madute              | lo a Kwater   | hari A21E, J | Madutelo a Kwatenari A21E, A21F, A21G & A21H | A21H       |   |                  |              |
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. y | ro. ya Disampole | ole  | Boleng jv | wa Tikologo<br>maga | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | jotsa mo     | Resefe ya<br>Run <sup>2</sup>                | Resefe ya  | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | si a ka fa tlase | ga lefatshe³ |
|                          |        | A21E | A21F      | A21G             | A21H | A21E      | A21F                | A21G  | A21H         |  | A21E       | A21F  | A21G             | A21H         |
| ΡΗ                       |        | 3    | 307       | 118              | 7    | 6.70      | 7.58                | 8.24  | 7.90         | 5.0 - 9.5                                    | 6.03 -7.37 | 6.82 -8.34  | 7.429.06         | 7.11 8.69    |
| Go tsenngwa ga motlakase | mS/m   | в    | 324       | 126              | 7    | 20.10     | 25.60               | 37.00   | 47.10        | <150   | 22.11      | 28.16   | 40.70            | 51.81        |
| Khalesiamo jaaka Ca      | mg/l   | e    | 311       | 116              | 4    | 10.83     | 25.40               | 39.80   | 27.72        | <150   | 11.92      | 27.94   | 43.78            | 30.49        |
| Makenesiamo jaaka Mg     | mg/l   | e    | 311       | 116              | 4    | 4.30      | 15.80               | 24.00   | 22.10        | <100   | 4.73       | 17.38   | 26.40            | 24.30        |
| Sođiamo jaaka Na         | mg/l   | e    | 311       | 116              | 4    | 18.10     | 2.50                | 1.00  | 28.76        | <200   | 19.91      | 2.75  | 1.10             | 31.63        |
| Tleloraete jaaka Cl      | l/gm   | e    | 311       | 116              | 4    | 19.73     | 1.50                | 3.70  | 12.89        | <200   | 21.71      | 1.65  | 4.07             | 14.17        |
| Salefeite jaaka SO4      | mg/ì   | e    | 311       | 116              | 4    | 4.47      | 4.80                | 5.05  | 12.23        | <400   | 4.91       | 5.28  | 5.56             | 13.45        |
| Naetereite jaaka NOx-N   | mg/l   | e    | 312       | 118              | 4    | 2.57      | 0.26                | 0.17  | 0.45         | <10  | 2.82       | 0.29  | 0.19             | 0.49         |
| Foloraete jaaka F        | mg/Ì   | I    | 311       | 116              | 4    | I         | 0.10                | 0.12  | 0.29         | <1.0   | 1          | 0.11  | 0.13             | 0.32         |

|                          |        |                   |           |                      |      |          | Madute  | lo a Kwater                      | lari A21J, A | Madutelo a Kwatenari A21J, A21K, A21L & A22A | 22A               |                   |   |                         |
|--------------------------|--------|-------------------|-----------|----------------------|------|----------|---|----------------------------------|--------------|--|-------------------|-------------------|---|-------------------------|
| Bontsi jwa Khemikhale    | Yuniti |                   | Nomoro. ) | oro. ya Disampole    | ole  | Boleng j | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | ) jwa GW kç<br>reng <sup>1</sup> | jotsa mo     | Resefe ya                                    | Resefe ya I       | 3oleng jwa Met    | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | a lefatshe <sup>3</sup> |
|                          |        | A21J              | A21K      | A21L                 | A22A | A21J     | A21K  | A21L                             | A22A         | BHN <sup>2</sup>                             | A21J              | A21K              | A21L  | A22A                    |
| Hq                       |        | 150               | 1795      | 10                   | 40   | 6.90     | 7.67  | 7.61                             | 7.50         | 5.0 - 9.5                                    | 6.21 –7.59        | 6.90 - 8.43       | 6.85 -8.37  | 6.75 -8.25              |
| Go tsenngwa ga motlakase | mS/m   | 150               | 1794      | 10                   | 40   | 179.50   | 330.50  | 31.80                            | 32.35        | <150   | 179.50            | 330.50            | 34.98   | 35.38                   |
| Khalesiamo jaaka Ca      | mg/l   | 142               | 1801      | 6                    | 36   | 72.36    | 234.00  | 32.00                            | 5.72         | <150   | 79.60             | 234.00            | 35.20   | 6.29                    |
| Makenesiamo jaaka Mg     | mg/l   | 142               | 1801      | 6                    | 36   | 97.98    | 158.00  | 6.10                             | 22.43        | <100   | 100.00            | 158.00            | 6.71  | 24.67                   |
| Sodiamo jaaka Na         | mg/l   | 141               | 1800      | 6                    | 36   | 125.30   | 256.96  | 23.46                            | 17.56        | <200   | 136.83            | 256.96            | 25.80   | 19.32                   |
| Tleloraete jaaka Cl      | mg/l   | 142               | 1796      | 6                    | 36   | 199.06   | 370.59  | 5.00                             | 5.00         | <200   | 200.00            | 370.59            | 5.50  | 5.50                    |
| Salefeite jaaka SO4      | mg/l   | 141               | 1796      | 6                    | 36   | 192.65   | 836.09  | 5.20                             | 5.79         | <400   | 211.92            | 836.09            | 5.72  | 6.37                    |
| Naetereite jaaka NOx-N   | mg/l   | 142               | 1770      | 6                    | 36   | 7.29     | 3.05  | 3.75                             | 0.31         | <10  | 8.02              | 3.35              | 4.12  | 0.33                    |
| Foloraete jaaka F        | mg/l   | 142               | 1560      | 6                    | 36   | 0.22     | 0.01  | 0.33                             | 0.32         | <1.0   | 0.24              | 0.011             | 0.37  | 0.35                    |
|                          |        |                   |           |                      |      |          | Madute  | lo a Kwater                      | ari A22B, A  | Madutelo a Kwatenari A22B, A22C, A22D & A22E | 22E               |                   |   |                         |
| Bontsi jwa Khemikhale    | Yuniti |                   | Nomoro.   | Nomoro. ya Disampole | ole  | Boleng j | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng¹             | ) jwa GW kç<br>reng <sup>1</sup> | jotsa mo     | Resefe ya                                    | Resefe ya I       | 3oleng jwa Met    | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | a lefatshe³             |
|                          |        | A22B <sup>•</sup> | A22C*     | A22D *               | A22E | A22B'    | A22C <sup>*</sup>   | A22D *                           | A22E         | BHN <sup>z</sup>                             | A22B <sup>*</sup> | A22C <sup>*</sup> | A22D*   | A22E                    |
| Hd                       |        | 29                | 108       | 4                    | 29   | 7.96     | 7.80  | 7.23                             | 7.96         | 5.0 - 9.5                                    | 7.16 -8.75        | 7.02 -8.58        | 6.51 –7.96  | 7.16 -8.75              |
| Go tsenngwa ga motlakase | mS/m   | 29                | 108       | 4                    | 29   | 38.80    | 42.95   | 38.95                            | 38.80        | <150   | 42.68             | 47.25             | 42.84   | 42.68                   |
| Khalesiamo jaaka Ca      | l/gm   | 29                | 101       | 4                    | 29   | 27.40    | 45.50   | 17.20                            | 27.40        | <150   | 30.14             | 50.05             | 18.92   | 30.14                   |
| Makenesiamo jaaka Mg     | mg/i   | 29                | 101       | 4                    | 29   | 25.83    | 26.90   | 23.62                            | 25.83        | <100   | 28.42             | 29.59             | 25.99   | 28.42                   |
| Sodiamo jaaka Na         | l/gm   | 29                | 101       | 4                    | 29   | 6.80     | 4.44  | 13.58                            | 6.80         | <200   | 7.48              | 4.88              | 14.94   | 7.48                    |
| Tleloraete jaaka Cl      | l/gm   | 29                | 101       | 4                    | 29   | 5.00     | 4.10  | 5.25                             | 5.00         | <200   | 5.50              | 4.51              | 5.78  | 5.50                    |
| Salefeite jaaka SO4      | l/gm   | 29                | 101       | 4                    | 29   | 6.18     | 5.00  | 3.70                             | 6.18         | <400   | 6.80              | 5.50              | 4.07  | 6.80                    |
| Naetereite jaaka NOx-N   | mg/l   | 29                | 101       | 4                    | 29   | 0.56     | 1.04  | 2.01                             | 0.56         | <10  | 0.61              | 1.15              | 2.21  | 0.61                    |
| Foloraete jaaka F        | mg/ł   | 29                | 101       | 4                    | 29   | 0.35     | 0.12  | 0.35                             | 0.35         | <1.0   | 0.38              | 0.13              | 0.39  | 0.38                    |
|                          |        |                   |           |                      |      |          |   |                                  |              |  |                   |                   |   |                         |

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|                          |        |      |         |                      |      |         | Madute  | lo a Kwaten                              | ari A22F, A2 | Madutelo a Kwatenari A22F, A22G, A22H & A22J | 2           |   |                               |                          |
|--------------------------|--------|------|---------|----------------------|------|---------|---|--|--------------|--|-------------|---|-------------------------------|--------------------------|
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. | Nomoro. ya Disampole | pole | Boleng. | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | cologo jwa GW k<br>magareng <sup>1</sup> | gotsa mo     | Resefe ya                                    | Resefe ya B | Resefe ya Boleng jwa Metsi                                | ii a ka fa tlase ga lefatshe³ | ja lefatshe <sup>3</sup> |
|                          |        | A22F | A22G    | A22H                 | A22J | A22F    | A22G  | A22H                                     | A22J         | BHN <sup>2</sup>                             | A22F        | A22G  | A22H                          | A22J                     |
| Hd                       |        | 52   | 108     | 3457                 | 25   | 7.88    | 7.80  | 7.64                                     | 7.94         | 5.0 - 9.5                                    | 7.09-8.67   | 7.02-8.58   | 6.88-8.40                     | 7.15-8.73                |
| Go tsenngwa ga motlakase | mS/m   | 52   | 108     | 3457                 | 25   | 58.05   | 42.95   | 412.00                                   | 108.00       | <150   | 63.86       | 47.25   | 412.00                        | 118.80                   |
| Khalesiamo jaaka Ca      | l/gm   | 46   | 101     | 3460                 | 20   | 43.75   | 45.50   | 288.84                                   | 100.68       | <150   | 48.13       | 50.05   | 288.84                        | 110.75                   |
| Makenesiamo jaaka Mg     | mg/l   | 46   | 101     | 3461                 | 20   | 20.74   | 26.90   | 205.50                                   | 62.56        | <100   | 22.81       | 29.59   | 205.50                        | 68.82                    |
| Sodiamo jaaka Na         | l/gm   | 46   | 101     | 3461                 | 20   | 28.27   | 4.44  | 313.50                                   | 48.37        | <200   | 31.10       | 4.88  | 313.50                        | 53.20                    |
| Tleloraete jaaka Cl      | mg/l   | 46   | 101     | 3456                 | 20   | 18.63   | 4.10  | 325.94                                   | 43.32        | <200   | 20.49       | 4.51  | 325.94                        | 47.65                    |
| Salefeite jaaka SO4      | mg/l   | 46   | 101     | 3457                 | 20   | 25.99   | 5.00  | 1169.29                                  | 46.64        | <400   | 28.59       | 5.50  | 1169.29                       | 51.30                    |
| Naetereite jaaka NOx-N   | l/gm   | 46   | 101     | 3405                 | 20   | 0.24    | 1.04  | 1.00                                     | 15.95        | <10  | 0.26        | 1.15  | 1.10                          | 15.95                    |
| Foloraete jaaka F        | l/gm   | 46   | 101     | 2967                 | 20   | 0.48    | 0.12  | 0.01                                     | 0.15         | <1.0   | 0.53        | 0.13  | 0.011                         | 0.16                     |
|                          |        |      |         |                      |      |         | Madute  | lo a Kwaten                              | ari A23A, A2 | Madutelo a Kwatenari A23A, A23B, A23C & A23D | g           |   |                               |                          |
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. | Nomoro. ya Disampole | pole | Boleng  | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | ologo jwa GW k<br>magareng <sup>1</sup>  | gotsa mo     | Resefe ya                                    | Resefe ya B | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe $^3$ | i a ka fa tlase ç             | ja lefatshe <sup>3</sup> |
|                          |        | A23A | A23B    | A23C                 | A23D | A23A    | A23B  | A23C                                     | A23D         | BHN <sup>2</sup>                             | A23A        | A23B  | A23C                          | A23D                     |
| Hd                       |        | 148  | 798     | 83                   | 31   | 7.20    | 7.90  | 7.92                                     | 7.70         | 5.0-9.5                                      | 6.48-7.92   | 7.11-8.93   | 7.13-8.71                     | 6.93-8.47                |
| Go tsenngwa ga motlakase | mS/m   | 148  | 817     | 83                   | 31   | 47.00   | 53.00   | 250.00                                   | 37.20        | <150   | 51.70       | 58.30   | 250.00                        | 40.92                    |
| Khalesiamo jaaka Ca      | mg/l   | 149  | 757     | 76                   | 31   | 40.00   | 54.00   | 84.06                                    | 32.20        | <150   | 44.00       | 59.40   | 92.47                         | 35.42                    |
| Makenesiamo jaaka Mg     | mg/l   | 149  | 758     | 76                   | 31   | 23.00   | 33.00   | 53.15                                    | 24.00        | <100   | 25.30       | 36.30   | 58.47                         | 26.40                    |
| Sodiarno jaaka Na        | mg/l   | 149  | 758     | 74                   | 31   | 16.00   | 4.00  | 371.04                                   | 4.90         | <200   | 17.60       | 4.40  | 371.04                        | 5.39                     |
| Tleloraete jaaka Cl      | l/gm   | 149  | 758     | 76                   | 31   | 7.00    | 6.00  | 413.64                                   | 5.30         | <200   | 7.70        | 6.60  | 413.64                        | 5.83                     |
| Salefeite jaaka SO4      | l/gm   | 149  | 758     | 74                   | 31   | 5.00    | 5.00  | 109.77                                   | 11.50        | <400   | 5.50        | 5.50  | 120.74                        | 12.65                    |
| Naetereite jaaka NOx-N   | l/gm   | 149  | 797     | 76                   | 31   | 3.00    | 1.00  | 11.45                                    | 0.83         | <10  | 3.30        | 1.10  | 11.45                         | 0.91                     |
| Foloraete jaaka F        | l/gm   | 149  | 758     | 76                   | 31   | 0.20    | 0.15  | 1.01                                     | 0.11         | <1.0   | 0.22        | 0.17  | 1.01                          | 0.12                     |
|                          |        |      |         |                      |      |         |   |  |              |  |             |   |                               |                          |

|                          |        |      |         |                      |      |         | Madute  | elo a Kwate                             | nari A23E, A  | Madutelo a Kwatenari A23E, A23F, A23G, A23H  | -           |   |                   |             |
|--------------------------|--------|------|---------|----------------------|------|---------|---|---|---------------|--|-------------|---|-------------------|-------------|
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. | Nomoro. ya Disampole | pole | Boleng. | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | ologo jwa GW k<br>magareng <sup>1</sup> | gotsa mo      | Resefe ya                                    | Resefe ya B | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | i a ka fa tlase g | a lefatshe³ |
|                          |        | A23E | A23F    | A23G                 | A23H | A23E    | A23F  | A23G                                    | A23H          | BHN <sup>2</sup>                             | A23E        | A23F  | A23G              | A23H        |
| рН                       |        | 988  | 9       | 266                  | 68   | 7.66    | 7.32  | 7.93                                    | 8.47          | 5.0-9.5                                      | 6.89-8.43   | 6.59-8.05   | 7.14-8.72         | 7.628.47    |
| Go tsenngwa ga motlakase | mS/m   | 988  | 9       | 255                  | 68   | 90.80   | 69.55   | 65.30                                   | 56.70         | <150   | 99.88       | 76.51   | 71.83             | 62.37       |
| Khalesiamo jaaka Ca      | mg/l   | 988  | 9       | 255                  | 67   | 82.60   | 41.40   | 24.10                                   | 53.90         | <150   | 90.86       | 45.54   | 26.51             | 59.29       |
| Makenesiamo jaaka Mg     | mg/l   | 988  | 9       | 258                  | 67   | 51.80   | 35.70   | 6.49                                    | 28.30         | <100   | 56.98       | 39.27   | 7.14              | 31.13       |
| Sodiamo jaaka Na         | l/gm   | 988  | 9       | 266                  | 67   | 31.46   | 24.65   | 60.90                                   | 18.60         | <200   | 34.60       | 27.12   | 66.99             | 20.46       |
| Tleloraete jaaka Cl      | mg/l   | 988  | 9       | 255                  | 67   | 71.25   | 42.60   | 53.55                                   | 10.10         | <200   | 78.38       | 46.86   | 58.91             | 11.11       |
| Salefeite jaaka SO4      | mg/l   | 988  | 9       | 258                  | 67   | 109.50  | 19.65   | 8.90                                    | 5.10          | <400   | 120.45      | 21.62   | 6.79              | 5.61        |
| Naetereite jaaka NOx-N   | mg/l   | 988  | 9       | 266                  | 67   | 5.16    | 5.09  | 0.85                                    | 2.03          | <10  | 5.67        | 5.60  | 0.94              | 2.23        |
| Foloraete jaaka F        | mg/l   | 988  | 9       | 258                  | 67   | 0.05    | 0.36  | 0.69                                    | 0.30          | <1.0   | 0.06        | 0.39  | 0.76              | 0.33        |
|                          |        |      |         |                      |      |         | Madute  | lo a Kwater                             | nari A23J, A2 | Madutelo a Kwatenari A23J, A23K, A23L & A24A | V           |   |                   |             |
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. | oro. ya Disampole    | pole | Boleng  | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | ologo jwa GW k<br>magareng <sup>1</sup> | gotsa mo      | Resefe ya                                    | Resefe ya B | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | i a ka fa tlase g | a lefatshe³ |
|                          |        | A23J | A23K    | A23L                 | A24A | A23J    | A23K  | A23L                                    | A24A          | BHN <sup>2</sup>                             | A23J        | A23K  | A23L              | A24A        |
| Hq                       |        | 127  | ъ       | 21                   | 57   | 8.37    | 8.18  | 8.13                                    | 7.84          | 5.0 - 9.5                                    | 7.53-9.21   | 7.36–9.00   | 7.32-8.95         | 7.06-8.62   |
| Go tsenngwa ga motlakase | mS/m   | 127  | Ω       | 21                   | 57   | 38.40   | 63.00   | 112.40                                  | 89.90         | <150   | 42.24       | 69.30   | 123.64            | 98.89       |
| Khalesiamo jaaka Ca      | l/gm   | 121  | ۍ       | 18                   | 53   | 38.90   | 53.07   | 15.47                                   | 90.85         | <150   | 42.79       | 58.38   | 17.02             | 99.94       |
| Makenesiamo jaaka Mg     | l/gm   | 122  | ъ       | 18                   | 53   | 23.75   | 16.20   | 2.30                                    | 52.14         | <100   | 26.13       | 17.82   | 2.53              | 57.36       |
| Sodiamo jaaka Na         | l/gm   | 122  | 5       | 18                   | 53   | 2.38    | 52.99   | 215.24                                  | 19.38         | <200   | 2.62        | 58.29   | 215.24            | 21.32       |
| Tleloraete jaaka Cl      | mg/l   | 122  | 2       | 18                   | 53   | 5.00    | 64.79   | 226.96                                  | 63.96         | <200   | 5.50        | 71.26   | 226.96            | 70.36       |
| Salefeite jaaka SO4      | mg/l   | 121  | 5       | 18                   | 53   | 6.70    | 11.90   | 10.43                                   | 10.60         | <400   | 7.37        | 13.09   | 11.47             | 11.66       |
| Naetereite jaaka NOx-N   | l/gm   | 123  | 5       | 18                   | 53   | 0.17    | 0.77  | 0.04                                    | 1.24          | <10  | 0.18        | 0.85  | 0.05              | 1.37        |
| Foloraete jaaka F        | l/gm   | 121  | 5       | 21                   | 53   | 0.16    | 1.03  | 8.81                                    | 0.54          | <1.0   | 0.18        | 1.03  | 8.81              | 0.59        |
|                          |        |      |         |                      |      |         |   |   |               |  |             |   |                   |             |

| Bontsi jwa Khemikhale     Yuniti       Bontsi jwa Khemikhale     Yuniti       Bontsi jwa Khemikhale     mS/m       Go tsenngwa ga motlakase     mS/m       Khalesiamo jaaka Ca     mg/l |      |          |                      |      |        |                   |   |  |                  |              |                |   |                          |
|---|------|----------|----------------------|------|--------|-------------------|---|--|------------------|--------------|----------------|---|--------------------------|
|   |      | Nomoro.  | Nomoro. ya Disampole | oole | Boleng | jwa Tikolo<br>mag | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng¹             | kgotsa mo                                    | Resefe ya        | Resefe ya Bo | oleng jwa Mets | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe³             | ga lefatshe <sup>3</sup> |
|   | A24B | A24C     | A24D                 | A24E | A24B   | A24C              | A24D  | A24E   | BHN <sup>2</sup> | A24B         | A24C           | A24D  | A24E                     |
|   | 36   | 137      | 24                   | 10   | 7.70   | 7.70              | 8.19  | 7.92   | 5.0 - 9.5        | 6.93-8.47    | 6.93-8.47      | 7.37-9.01   | 7.13-8.71                |
|   | 36   | 137      | 24                   | 10   | 129.15 | 129.00            | 91.25   | 63.00  | <150             | 142.07       | 141.90         | 119.60  | 69.30                    |
|   | 36   | 139      | 20                   | æ    | 115.50 | 79.50             | 1.96  | 64.10  | <150             | 127.05       | 87.45          | 2.15  | 70.51                    |
|   | 36   | 139      | 20                   | 8    | 85.50  | 58.00             | 129.85  | 34.65  | <100             | 100.00       | 63.80          | 129.85  | 38.12                    |
| Sodiamo jaaka Na mg/i   | 36   | 139      | 20                   | 8    | 77.40  | 90.50             | 5.91  | 26.50  | <200             | 85.14        | 99.55          | 6.50  | 29.15                    |
| Tieloraete jaaka Cl mg/l  | 36   | 139      | 20                   | 8    | 139.30 | 143.10            | 5.25  | 29.79  | <200             | 153.23       | 157.41         | 5.78  | 32.77                    |
| Salefeite jaaka SO4 mg/l  | 36   | 139      | 20                   | 8    | 63.70  | 68.20             | 4.83  | 22.50  | <400             | 70.07        | 75.02          | 5.32  | 24.75                    |
| Naetereite jaaka NOx-N mg/l   | 36   | 139      | 20                   | 8    | 8.63   | 3.75              | 1.98  | 14.95  | <10              | 9.49         | 4.13           | 2.17  | 14.95                    |
| Foloraete jaaka F mg/l  | 36   | 139      | 20                   | 8    | 0.81   | 0.84              | 0.10  | 0.25   | <1.0             | 0.89         | 0.92           | 0.11  | 0.28                     |
| Ī   |      |          |                      |      |        | Madute            | lo a Kwater   | Madutelo a Kwatenari A24F, A24G, A24H & A24J | 3, A24H & A24J   |              |                |   |                          |
| Bontsi jwa Khemikhale Yuniti  |      | Normoro. | Nomoro. ya Disampole | oole | Boleng | jwa Tikolo<br>mag | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | kgotsa mo                                    | Resefe ya        | Resefe ya Bo | oleng jwa Mets | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | ga lefatshe³             |
|   | A24F | A24G     | A24H                 | A24J | A24F   | A24G              | A24H  | A24J   | BHN <sup>2</sup> | A24F         | A24G           | A24H  | A24J                     |
| Hq  | 444  | 80       | 26                   | 309  | 7.60   | 7.00              | 7.59  | 7.90   | 5.0-9.5          | 6.84-8.36    | 6.30-7.70      | 6.83-8.35   | 7.11-8.69                |
| Go tsenngwa ga motlakase mS/m   | 435  | 8        | 26                   | 309  | 297.00 | 45.00             | 76.35   | 102.40                                       | <150             | 297.00       | 49.50          | 83.99   | 112.64                   |
| Khałesiamo jaaka Ca mg/l  | 434  | œ        | 26                   | 278  | 152.00 | 41.00             | 44.75   | 62.80  | <150             | 152.00       | 45.10          | 49.23   | 69.08                    |
| Makenesiamo jaaka Mg  | 433  | œ        | 26                   | 278  | 115.00 | 4.00              | 32.30   | 58.10  | <100             | 115.00       | 4.40           | 35.53   | 63.91                    |
| Sodiamo jaaka Na mg/l   | 446  | 8        | 26                   | 278  | 305.00 | 33.00             | 38.60   | 62.80  | <200             | 305.00       | 36.30          | 42.46   | 69.08                    |
| Tieloraete jaaka Ci mg/l  | 434  | œ        | 26                   | 278  | 825.60 | 10.00             | 29.50   | 85.35  | <200             | 825.60       | 11.00          | 32.45   | 93.89                    |
| Salefeite jaaka SO4 mg/l  | 445  | 80       | 26                   | 278  | 115.50 | 18.00             | 9.90  | 46.70  | <400             | 127.05       | 19.80          | 10.89   | 51.37                    |
| Naetereite jaaka NOx-N mg/l   | 336  | æ        | 26                   | 278  | 3.48   | 0.12              | 0.89  | 5.56   | <10              | 3.82         | 0.13           | 0.98  | 6.12                     |
| Foloraete jaaka F mg/l  | 392  | 80       | 26                   | 278  | 0.21   | 3.00              | 0.67  | 0.68   | <1.0             | 0.23         | 3.30           | 0.73  | 0.75                     |

|                          |        |      |         |                      |      |        | Madute  | elo a Kwate                           | Madutelo a Kwatenari A31, A31B, A31C & A31D  | A31C & A31D      |              |  |   |                          |
|--------------------------|--------|------|---------|----------------------|------|--------|---|---------------------------------------|--|------------------|--------------|--|---|--------------------------|
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. | Nomoro. ya Disampole | pole | Bolenç | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | ologo jwa GW<br>magareng <sup>1</sup> | kgotsa mo                                    | Resefe ya        | Resefe ya Bo | Resefe ya Boleng jwa Metsi a ka fa tlase | si a ka fa tlase                            | ga lefatshe³             |
|                          |        | A31A | A31B    | A31C                 | A31D | A31A   | A31B  | A31C                                  | A31D   | BHN <sup>2</sup> | A31A         | A31B                                     | A31C  | A31D                     |
| Hd                       |        | 75   | 30      | 480                  | 710  | 8.05   | 7.37  | 7.90                                  | 8.00   | 5.0 - 9.5        | 7.25-8.86    | 6.63-8.11                                | 7.11–8.69                                   | 7.20-8.80                |
| Go tsenngwa ga motlakase | mS/m   | 75   | 30      | 526                  | 758  | 30.50  | 69.75   | 47.40                                 | 50.90  | <150             | 33.55        | 76.73                                    | 52.14                                       | 55.99                    |
| Khalesiamo jaaka Ca      | mg/l   | 75   | 25      | 473                  | 695  | 30.54  | 85.27   | 47.60                                 | 53.50  | <150             | 33.59        | 93.80                                    | 52.36                                       | 58.85                    |
| Makenesiamo jaaka Mg     | mg/l   | 75   | 25      | 473                  | 697  | 18.20  | 56.80   | 31.25                                 | 32.17  | <100             | 20.02        | 62.48                                    | 34.38                                       | 35.39                    |
| Sodiamo jaaka Na         | mg/l   | 75   | 25      | 473                  | 697  | 3.40   | 17.60   | 2.60                                  | 3.20   | <200             | 3.74         | 19.35                                    | 2.86  | 3.52                     |
| Tleloraete jaaka Cl      | mg/l   | 75   | 25      | 473                  | 698  | 5.69   | 35.90   | 4.60                                  | 5.69   | <200             | 6.26         | 39.49                                    | 5.06  | 6.26                     |
| Salefeite jaaka SO4      | mg/l   | 75   | 25      | 473                  | 697  | 3.00   | 59.33   | 4.50                                  | 10.10  | <400             | 3.30         | 65.26                                    | 4.95  | 11.11                    |
| Naetereite jaaka NOx-N   | mg/l   | 75   | 25      | 476                  | 695  | 0.23   | 1.64  | 0.21                                  | 0.31   | <10              | 0.25         | 1.81                                     | 0.23  | 0.35                     |
| Foloraete jaaka F        | mg/l   | 75   | 25      | 473                  | 682  | 0.10   | 0.26  | 0.19                                  | 0.23   | <1.0             | 0.11         | 0.29                                     | 0.21  | 0.25                     |
|                          |        |      |         |                      |      |        | Madute  | lo a Kwater                           | Madutelo a Kwatenari A31E, A31F, A31G & A31H | , A31G & A31H    |              |  |   |                          |
| Bontsi jwa Khemikhale    | Yuniti |      | Nomoro. | ro. ya Disampole     | pole | Boleng | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | ologo jwa GW<br>magareng <sup>1</sup> | kgotsa mo                                    | Resefe ya        | Resefe ya Bo | oleng jwa Mets                           | Boleng jwa Metsi a ka fa tlase ga lefatshe³ | ga lefatshe <sup>3</sup> |
|                          |        | A31E | A31F    | A31G                 | A31H | A31E   | A31F  | A31G                                  | A31H   | BHN <sup>2</sup> | A31E         | A31F                                     | A31G  | A31H                     |
| Ηd                       |        | 7    | 26      | 16                   | 27   | 7.50   | 7.79  | 8.13                                  | 7.92   | 5.0-9.5          | 6.75-8.25    | 7.01-8.57                                | 7.32-8.95                                   | 7.13-8.71                |
| Go tsenngwa ga motlakase | mS/m   | 7    | 26      | 16                   | 27   | 17.70  | 74.65   | 41.95                                 | 76.40  | <150             | 19.47        | 82.12                                    | 46.15                                       | 84.04                    |
| Khalesiamo jaaka Ca      | mg/l   | 7    | 21      | 13                   | 22   | 14.20  | 18.10   | 20.93                                 | 44.68  | <150             | 15.62        | 19.91                                    | 23.02                                       | 49.15                    |
| Makenesiamo jaaka Mg     | l/gm   | 7    | 21      | 13                   | 22   | 10.00  | 15.50   | 35.00                                 | 23.11  | <100             | 11.00        | 17.05                                    | 38.50                                       | 25.42                    |
| Sodiamo jaaka Na         | l/ɓm   | 7    | 21      | 13                   | 22   | 5.80   | 14.70   | 8.55                                  | 81.63  | <200             | 6.38         | 16.17                                    | 9.40  | 89.79                    |
| Tleloraete jaaka Cl      | l/gm   | 7    | 22      | 13                   | 22   | 3.30   | 5.30  | 5.00                                  | 65.68  | <200             | 3.63         | 5.83                                     | 5.50  | 72.24                    |
| Salefeite jaaka SO4      | l/gm   | 7    | 22      | 13                   | 22   | 2.00   | 9.99  | 3.00                                  | 10.77  | <400             | 2.20         | 10.99                                    | 3.30  | 11.85                    |
| Naetereite jaaka NOx-N   | l/gm   | 7    | 22      | 13                   | 22   | 0.35   | 2.06  | 0.27                                  | 8.43   | <10              | 0.38         | 2.27                                     | 0.30  | 9.27                     |
| Foloraete jaaka F        | mg/l   | 7    | 22      | 13                   | 22   | 0.27   | 0.16  | 0.11                                  | 0.42   | <1.0             | 0.30         | 0.18                                     | 0.12  | 0.46                     |
|                          |        |      |         |                      |      |        |   |                                       |  |                  |              |  |   |                          |

|                          |        |       |         |                      |                   |        | Madute             | lo a Kwaten   | ari A31J, A32A  | Madutelo a Kwatenari A31J, A32A, A32B & A32C |              |                |   |                   |
|--------------------------|--------|-------|---------|----------------------|-------------------|--------|--------------------|---|-----------------|--|--------------|----------------|---|-------------------|
| Bontsi jwa Khemikhale    | Yuniti |       | Nomoro. | Nomoro. ya Disampole | ole               | Boleng | jwa Tikolo<br>maç  | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | kgotsa mo       | Resefe ya                                    | Resefe ya Bo | leng jwa Mets  | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe <sup>3</sup> | ga lefatshe³      |
|                          |        | A31J  | A32A    | A32B *               | A32C <sup>*</sup> | A31J   | A32A               | A32B *  | A32C*           | BHN <sup>2</sup>                             | A31J         | A32A           | A32B *  | A32C <sup>°</sup> |
| Hd                       |        | 7     | 23      | 24                   | 7                 | 7.72   | 8.15               | 8.19  | 7.72            | 5.0-9.5                                      | 6.95-8.49    | 7.34-8.97      | 7.37–9.01   | 6.95-8.49         |
| Go tsenngwa ga motlakase | mS/m   | 7     | 23      | 24                   | 7                 | 76.00  | 90.10              | 91.25   | 76.00           | <150   | 83.60        | 99.11          | 119.60  | 83.60             |
| Khalesiamo jaaka Ca      | l/ɓш   | 5     | 18      | 20                   | 5                 | 46.60  | 25.29              | 1.96  | 46.60           | <150   | 51.26        | 27.82          | 2.15  | 51.26             |
| Makenesiamo jaaka Mg     | l/âm   | 5     | 18      | 20                   | 5                 | 72.10  | 96.40              | 129.85  | 72.10           | <100   | 79.31        | 106.04         | 129.85  | 79.31             |
| Sodiamo jaaka Na         | mg/l   | 5     | 18      | 20                   | 5                 | 27.70  | 23.87              | 5.91  | 27.70           | <200   | 30.47        | 26.25          | 6.50  | 30.47             |
| Tleloraete jaaka Cl      | mg/l   | 9     | 18      | 20                   | 9                 | 4.70   | 25.39              | 5.25  | 4.70            | <200   | 5.17         | 27.92          | 5.78  | 5.17              |
| Salefeite jaaka SO4      | l/ɓu   | 5     | 18      | 20                   | 5                 | 22.40  | 33.30              | 4.83  | 22.40           | <400   | 24.64        | 36.63          | 5.32  | 24.64             |
| Naetereite jaaka NOx-N   | l/gm   | 9     | 18      | 20                   | 9                 | 2.53   | 5.77               | 1.98  | 2.53            | <10  | 2.78         | 6.35           | 2.17  | 2.78              |
| Foloraete jaaka F        | ∦/βm   | 5     | 18      | 20                   | 5                 | 0.18   | 0.19               | 0.10  | 0.18            | <1.0   | 0.20         | 0.21           | 0.11  | 0.20              |
|                          |        |       |         |                      |                   |        | Madute             | to a Kwater   | lari A32D, A32I | Madutelo a Kwatenari A32D, A32E, A10A& A10B  |              |                |   |                   |
| Bontsi jwa Khemikhale    | Yuniti |       | Nomoro. | Nomoro. ya Disampole | ole               | Bolenç | jwa Tikolo.<br>mag | Boleng jwa Tikologo jwa GW kgotsa mo<br>magareng <sup>1</sup> | kgotsa mo       | Resefe ya                                    | Resefe ya Bo | oleng jwa Mets | Resefe ya Boleng jwa Metsi a ka fa tlase ga lefatshe³             | ga lefatshe³      |
|                          |        | A32D* | A32E    | A10A                 | A10B              | A32D * | A32E               | A10A  | A10B            | BHN <sup>2</sup>                             | A32D *       | A32E           | A10A  | A10B              |
| Hd                       |        | 24    | 68      | 503                  | 38                | 8.19   | 8.06               | 7.98  | 7.88            | 5.0-9.5                                      | 7.37–9.01    | 7.25-8.87      | 7.18-8.78   | 7.09-8.67         |
| Go tsenngwa ga motlakase | mS/m   | 24    | 68      | 473                  | 38                | 91.25  | 106.70             | 45.70   | 76.20           | <150   | 119.60       | 117.34         | 50.27   | 83.82             |
| Khalesiamo jaaka Ca      | mg/l   | 20    | 63      | 435                  | 31                | 1.96   | 64.97              | 49.10   | 45.20           | <150   | 2.15         | 71.47          | 54.01   | 49.72             |
| Makenesiamo jaaka Mg     | mg/l   | 20    | 63      | 499                  | 31                | 129.85 | 67.79              | 29.00   | 26.40           | <100   | 129.85       | 74.57          | 31.90   | 29.04             |
| Sodiamo jaaka Na         | mg/i   | 20    | 63      | 499                  | 31                | 5.91   | 66.66              | 2.40  | 56.41           | <200   | 6.50         | 73.33          | 2.64  | 62.05             |
| Tleloraete jaaka Cl      | mg/l   | 20    | 63      | 432                  | 31                | 5.25   | 59.93              | 4.80  | 54.00           | <200   | 5.78         | 65.48          | 5.28  | 59.40             |
| Salefeite jaaka SO4      | l/gm   | 20    | 63      | 499                  | 31                | 4.83   | 15.86              | 4.40  | 10.79           | <400   | 5.32         | 17.45          | 4.84  | 11.87             |
| Naetereite jaaka NOx-N   | mg/l   | 20    | 67      | 500                  | 32                | 1.98   | 11.81              | 0.79  | 7.34            | <10  | 2.17         | 11.81          | 0.87  | 8.08              |
| Foloraete jaaka F        | mg/l   | 20    | 63      | 499                  | 31                | 0.10   | 0.41               | 0.10  | 0.40            | <1.0   | 0.11         | 0.45           | 0.11  | 0.44              |
|                          |        |       |         |                      |                   |        |                    |   |                 |  |              |                |   |                   |

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|                          |        |                         | Bodutelo j  | Bodutelo jwa Kwatenari A10C |   |
|--------------------------|--------|-------------------------|---|-----------------------------|---|
| Bontsi jwa Khemikhale    | Yuniti | Nomoro. ya<br>Disampole | Boleng jwa<br>Tikologo jwa GW<br>kgotsa mo<br>magareng' | Resefe ya BHN²              | Resefe ya Boleng jwa<br>Metsi a ka fa tlase ga<br>Iefatshe³ |
|                          |        | A10C                    | A10C  |                             | A10C  |
| Ηd                       |        | 22                      | 7.96  | 5.0 - 9.5                   | 7.16–8.75   |
| Go tsenngwa ga motlakase | mS/m   | 22                      | 108.60  | <150                        | 119.46  |
| Khalesiamo jaaka Ca      | mg/ł   | 17                      | 109.10  | <150                        | 120.01  |
| Makenesiamo jaaka Mg     | mg/l   | 17                      | 89.65   | <100                        | 98.62   |
| Sodiamo jaaka Na         | mg/l   | 17                      | 6.53  | <200                        | 7.18  |
| Tieloraete jaaka Cl      | mg/ì   | 17                      | 18.91   | <200                        | 20.80   |
| Salefeite jaaka SO4      | mg/l   | 17                      | 9.12  | <400                        | 10.03   |
| Naetereite jaaka NOx-N   | mg/ì   | 17                      | 8.06  | <10                         | 8.86  |
| Foloraete jaaka F        | mg/}   | 17                      | 0.24  | <1.0                        | 0.26  |
|                          |        |                         |   |                             |   |

1) Go italegiwe ka tehedimosetso e e borweng go tswa go Athaeleng ya Bosetthaba ya Metsi a ka fa tlaso ga lofatsho. Boleng jo bo bagilweng ka bogara jwa dipalopalo jwa bornisi kongwe la bongwe.

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2) Ref: Quality Domestic Waler Supplies, Volume 1: Assessment Guide, 2nd Ed. 1988. Weier Research Commission Report No: TT 101/98. Pretorie, South Africa (Set for a Class 1),

bo ne jwa tihophiwa jaaka Rasafa ya bolang ya metsi a ka fa tasa ga lefataho, ntiha a no ya okociwa ka diperesente di la 10 ntle le le fa ntiha e sa fete Rasafa ya BHN.

Palogotlhe ya madutelo a le 6 a kwatenari ga a na tshedimosetso ya khemiseteri ya metsi a ka fa tlase ga lefatshe, e bile a bontshitswe ka bohibidu mo Thulaganyong ya 7.2 fa godimo. Boleng jwa metsi a ka fa tlase ga lefatshe a tikologo bo ne jwa balelwa go tswa kwa madutelong a kwatenari a boagisani ka jeoloji e e tshwanang ka gonne jeoloji e botlhokwa thata mo boleng jwa metsi jwa lefelo.

| Bodutelo<br>jwa kwatenari | Setihopha sa Boleng<br>jwa Metsi (WRC,<br>1998) | Bontsi jo bo amegang jwa boleng jwa metsi  |
|---------------------------|---|--|
| A10A                      | 0   | Ga go sepe   |
| A10B                      |   | Ga go sepe   |
| A10C                      | 1   | Khalesiamo, Go tsenngwa ga Motlakase, Makenesiamo                                    |
| 4044                      | 0   | Naetereite   |
| A21A                      | 0   | Ga go sepe   |
| A21B                      | 0   | Ga go sepe   |
| A21C                      | Ш   | Khalesiamo, Go tsenngwa ga Motlakase, Makenesiamo<br>Naetereite, Salefeite           |
| A21D                      | 0   | Ga go sepe   |
| A21E                      | 0   | Ga go sepe   |
| A21F                      | 0   | Ga go sepe   |
| A21G                      | 0   | Ga go sepe   |
| A21H                      | 0   | Ga go sepe   |
| A21J                      | I   | Sodiamo, Makenesiamo, Tleloraete, Naetereite, Go tsenngwa ga<br>Motlakase            |
| A21K                      | 111   | Salefeite, Khalesiamo, Makenesiamo, Sodiamo, Tleloraete, Go<br>tsenngwa ga Motlakase |
| A21L                      | 0   | Ga go sepe   |
| A21L A22A                 | 0   | Ga go sepe   |
| A22B                      | 0   | Ga go sepe   |
| A22D                      | 0   | Ga go sepe   |
| A22D                      | 0   | Ga go sepe   |
| A22E                      | 0   |  |
| A22E                      | 0   | Ga go sepe   |
|                           |   | Ga go sepe   |
| A22G                      | 0   | Ga go sepe   |
| A22H                      | III   | Salefeite, Go tsenngwa ga Motlakase, Khalesiamo<br>Makenesiamo, Sodiamo, Tleloraete, |
| A22J                      | 1   | Go tsenngwa ga Motlakase, Naetereite   |
| A23A                      | 0   | Ga go sepe   |
| A23B                      | 0   | Ga go sepe   |
| A23C                      | II  | Tleloraete, Go tsenngwa ga Motlakase, Foloraete, Naetereite Sodiamo                  |
| A23D                      | 0   | Ga go sepe   |
| A23E                      |   | Khalesiamo, Go tsenngwa ga Motlakase   |
| A23F                      | 0   | Ga go sepe   |
| A23G                      | 0   | Ga go sepe   |
| A23H                      | 0   | Ga go sepe   |
| A23J                      | 0   | Ga go sepe   |
| A23K                      | U U U U U U U U U U U U U U U U U U U           | Foloraete  |
| A23L                      |   | Foloraete, Sodiamo, Tleloraete   |
| A24A                      |   | Khalesiamo, Go tsenngwa ga Motlakase   |
| A24A<br>A24B              |   | Go tsenngwa ga Motlakase, Khalesiamo, Makenesiamo                                    |
|                           |   | Sodiamo, Tleloraete  |
| A24C                      |   | Tleloraete, Foloraete, Go tsenngwa ga Motlakase                                      |
| A24D                      | <u> </u>  | Makenesiamo, Go tsenngwa ga Motlakase  |
| A24E                      | 0   | Ga go sepe   |
| A24F                      | Ш   | Tleloraete, Go tsenngwa ga Motlakase, Sodiamo, Makenesiamo<br>Khalesiamo             |
| A24G                      | 0   | Ga go sepe   |
| A24H                      | I   | Go tsenngwa ga motlakase   |
| A24J                      |   | Go tsenngwa ga motlakase   |
| A31A                      | 0   | Ga go sepe   |
| A31B                      |   | Calcium  |
| A31C                      | 0   | Ga go sepe   |
| A31D                      | 0   | Ga go sepe   |
| A31E                      | 0   | Ga go sepe   |
| A31F                      | 1   | Go tsenngwa ga motlakase   |
| A31G                      | 0   | Ga go sepe   |
| A31H                      | Ī   | Go tsenngwa ga Motlakase, Naetereite   |
| A31J                      |   | Makenesiamo, Go tsenngwa ga Motlakase  |
| A32A                      |   | Makenesiamo, Go tsenngwa ga Motlakase  |
| A32B                      |   | Makenesiamo, Go tsenngwa ga Motlakase  |
| A32C                      |   | Makenesiamo, Go tsenngwa ga Motlakase  |
| A32D                      | i   | Makenesiamo, Go tsenngwa ga Motlakase  |
| A32E                      |   | Naetereite   |

Thulaganyo ya 7.3: Tshobokanyo ya setihopha sa boleng jwa metsi le bontsi jo bo amegang Bodutelo Setihopha sa Boleng Bontei jo bo amegang jwa boleng jwa metsi

