



## forestry, fisheries & the environment

Department:  
Forestry, Fisheries and the Environment  
REPUBLIC OF SOUTH AFRICA

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### SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

#### REPORT TITLE

Hydrological Assessment Report for the proposed construction and maintenance of New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludge line in Panfontein and associated infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province

#### Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at <https://www.dffe.gov.za/documents/forms>.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with 'the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020', where applicable.

#### 1. SPECIALIST INFORMATION

Title of Specialist Assessment	Hydrological Assessment Report for the proposed construction and maintenance of New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludge line in Panfontein and associated infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province
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**SPECIALIST DECLARATION FORM – AUGUST 2023**

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## SPECIALIST DECLARATION FORM – AUGUST 2023

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### 2. DECLARATION BY THE SPECIALIST

I, Sbongiseni Christian Mazibuko declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. “the Protocols”) and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
  - any decision to be taken with respect to the application by the competent authority; and;
  - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.



---

Signature of the Specialist

Ariys Consultant (Pty) Ltd

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Name of Company:

22 Aug 2025

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Date

**SPECIALIST DECLARATION FORM – AUGUST 2023**

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**3. UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Sbongiseni Christian Mazibuko, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.



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Signature of the Specialist

Ariys Consultant (Pty) Ltd

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Name of Company

22/08/2025

Date



Click or tap here to enter text.

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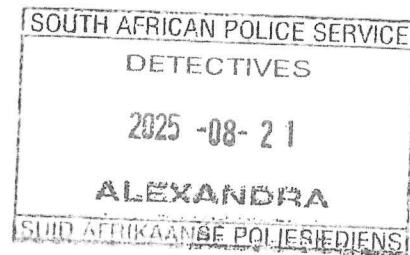
Signature of the Commissioner of Oaths

21/08/2025

Click or tap to enter a date.

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Date





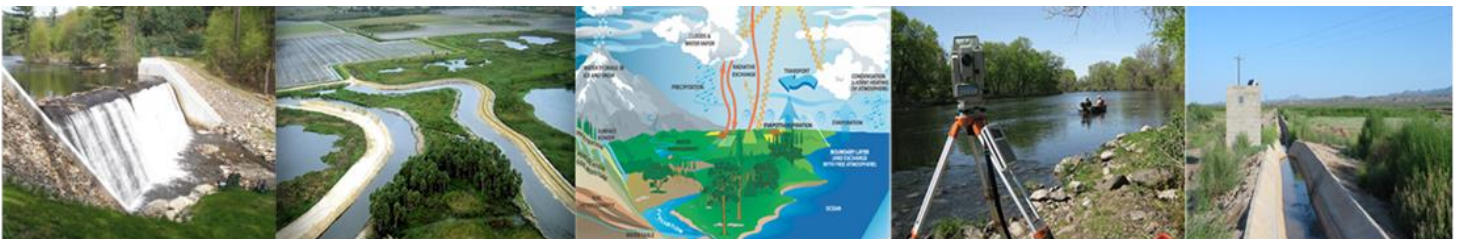
**Hydrological Assessment for the proposed construction and maintenance of New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludge line in Panfontein and associated infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng.**

**Report: Version – 2<sup>nd</sup>**

**30 July 2025**




**Client Reference: Rand Water New System 1 and Sludgeline's – Hydrological Assessment**



**Hydrological Assessment for the proposed construction and maintenance of New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludge line in Panfontein and associated infrastructure within the jurisdiction of Sedibeng District Municipality, Gauteng Province.**

**Report**

**DOCUMENT VERIFICATION**

<b>TITLE:</b> Rand Water New System 1 and Sludgeline's – Hydrological Assessment			
<b>Report Number</b>			
<b>Date</b>		<b>30 July 2025</b>	
<b>Report Version</b>		<b>Second</b>	
<b>Verification</b>	<b>Name</b>	<b>Signature</b>	<b>Date</b>
Author	Sbongiseni Mazibuko (Hydrologist) <i>Pr. Sci. Nat: 011204</i>		30 July 2025

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*This report is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose without Ariys Consultant's prior written consent*

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**LIST OF ACRONYMS**

BA	Basic Assessment
BPGs	Best Practice Guidelines
EIA	Environmental Impact Assessment
DWS	Department of Water and Sanitation
IWRM	Integrated Water Resources Management
LULC	Land Use and Land Cover
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act
NWA	National Water Act
NWRS	National Water Resource Strategy
QGIS	Quantum Geographical Information System
PES	Present Ecological Status
SABS	South African Bureau of Standards
SANAS	South African National Accreditation System
SANBI	South African National Biodiversity Institute
SAWS	South African Weather Station
WMA	Water Management Area
WR2012	2012 South African Water Resources Study
WTW	Water Treatment Works

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# **1 INTRODUCTION**

## **1.1 Background**

Ariys Consulting (Pty) Ltd was appointed by Selahle Consultancy and Projects (Pty) Ltd to undertake a hydrological assessment for the construction of proposed New System 1 at Rand Water Vereeniging Treatment Works, installation of approximately 7 km phase 2 Sludge Pipeline in Vereeniging, 1.5 km sludgeline in Panfontein within the jurisdiction of Sedibeng District Municipality, Gauteng Province of South Africa (Figure 1-1). The proposed construction activities are likely to pose risks to the surrounding surface water receptors, i.e., the Vaal River and Suikerbosrant.

This study, therefore, aims to identify potential risks to the surrounding surface water receptors and draw mitigation measures for the identified risks that could result from the construction, operation, and decommissioning of the proposed construction of Rand Water New System 1 and its Sludgelines (Figure 1-2) and Panfontein Water Treatment Residue site and its associated sludgeline (Figure 1-3). The results from this study will provide specialist inputs in support of the Basic Assessment (BA) requirements for 2014 (as amended) Environmental Impact Assessment (EIA) Regulations in terms of the National Environmental Management Act (NEMA Act 103 of 1998 - as amended) as well as to support Water Use Licence Application (WULA) required in terms of the National Water Act (NWA) (Act No. 107 of 1998). These listed compliance requirements are agreed upon based on the study's scope and terms of reference.

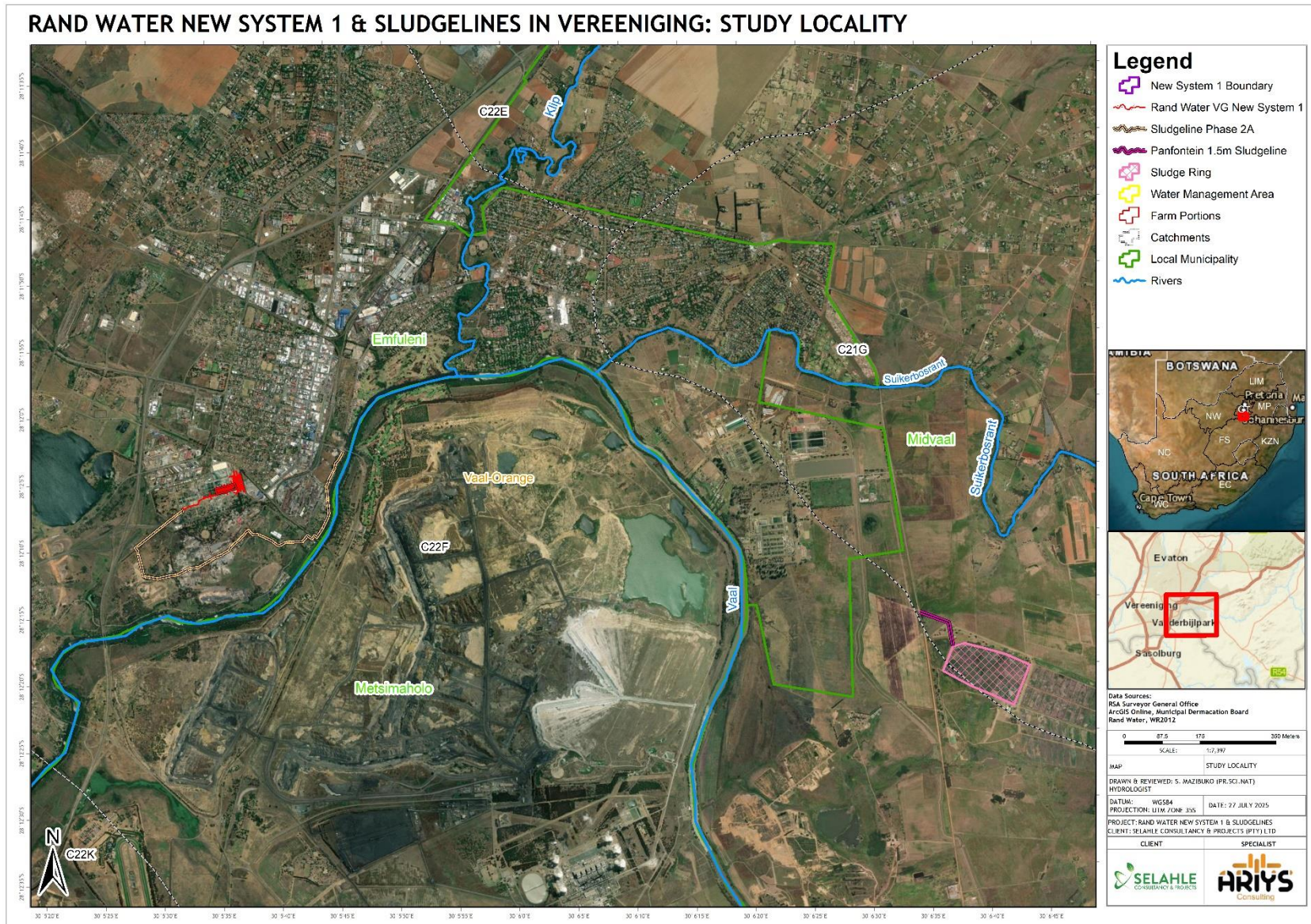


Figure 1-1: Study locality

30 July 2025

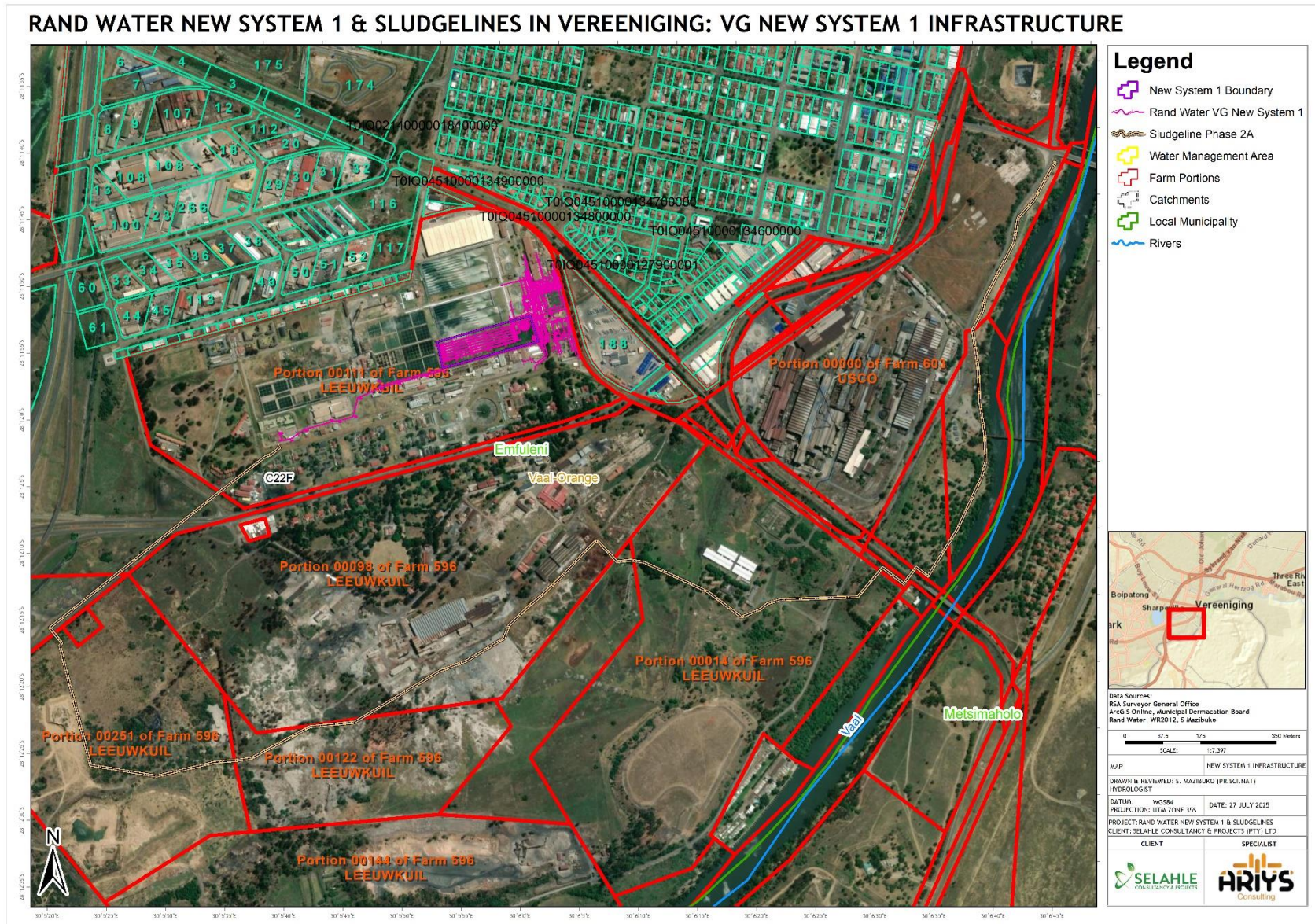


Figure 1-2: Locality of Rand Water VG New System 1 infrastructure

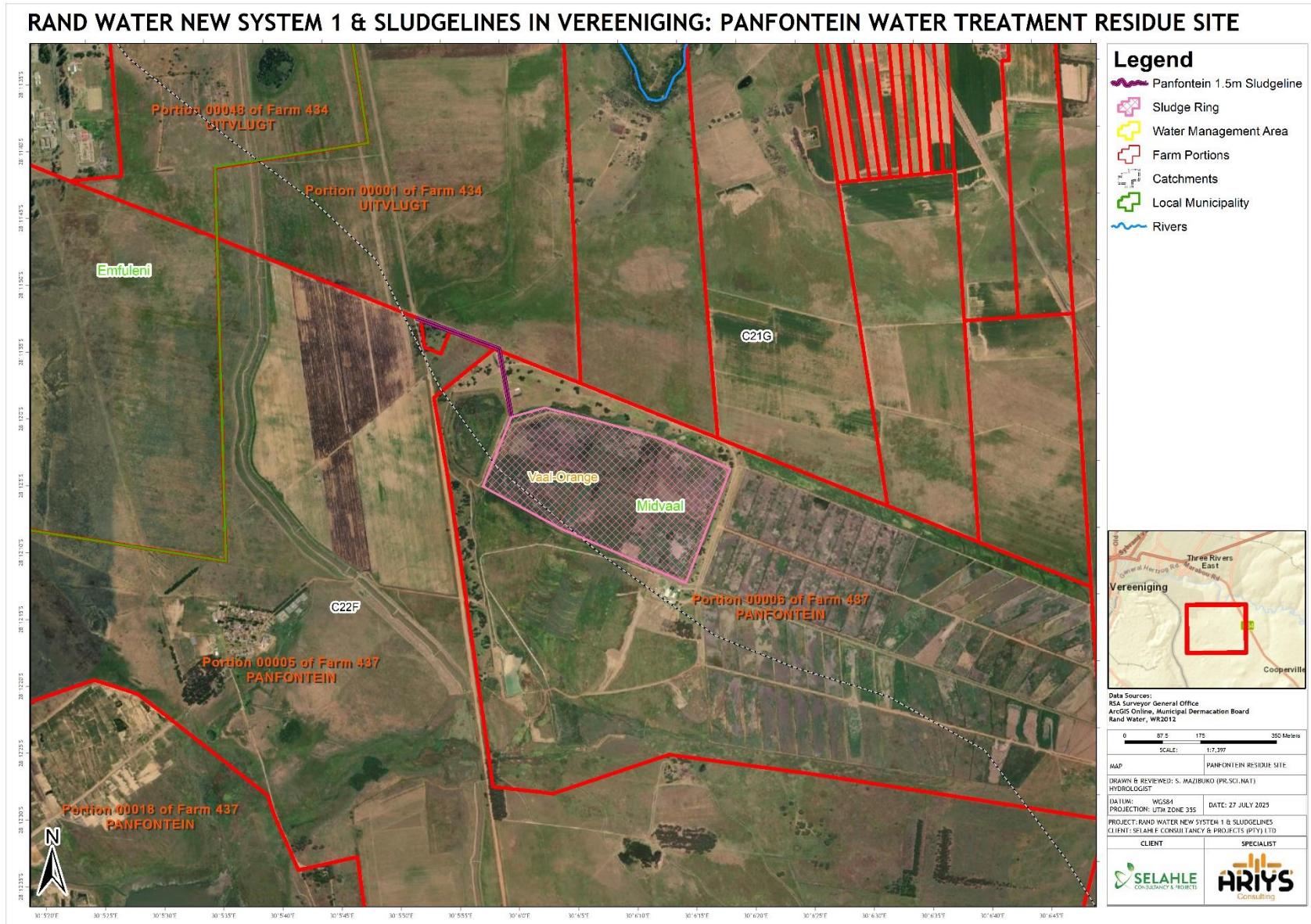


Figure 1-3: Locality of Panfontein Water Treatment Residue site

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## 2 SCOPE OF WORK

The scope of work for the water balance study is defined as follows:

1. Baseline Hydrology:
  - Hydroclimatic characterisation and physiographic setting,
2. Surface Water Impact Assessment:
  - A hydrological risk assessment, contextualising the potential surface water risk of the project and drafting the mitigation measures.
3. Surface Water Monitoring Plan:
  - Draft and recommend a surface water monitoring plan for the project's duration.
4. Reporting:
  - A report deliverable that presents the detailed results of the activities mentioned above and the recommendations will be made based on the study's findings.

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## **3 METHODOLOGY**

### **3.1 Desktop Study and Site Visit**

Applicable local, regional and national regulations and best practice guidelines relating to the construction of Rand Water's WTW facilities were reviewed. This review aimed to ensure the proposed developmental activities comply with relevant and up-to-date laws in line with the best practices set by the Department of Water and Sanitation (DWS). As part of environmental protection and sustainably conducting infrastructure development, relevant legislation and guidelines for evaluating the identified impacts on the surrounding environment were developed so that they comply with regulations enacted to protect the environment.

Hydrometeorological data used to define the expected hydrological regimes of the development site were collected and analysed to formulate a baseline understanding of local drivers of hydrological processes. The 2024 Land Use and Land Cover (LULC) data from the South African National Biodiversity Institute (SANBI) (Mucina et al., 2024) and the 2022 LULC from Geoterra Image (Pty) Ltd (2024) were used to establish an understanding of land catchment characteristics relative to the proposed activities of the project. Desktop-derived wetland features data were also used to identify sensitive areas that could be negatively affected by the proposed construction activities.

### **3.2 Baseline Hydrology**

Baseline hydrometeorological data describing the regimes for the area were obtained from the South African Water Resources Study WR2012 database (Bailey and Pitman, 2015), which provided means to establish rainfall and evaporation patterns for the area. This database was also used to determine the naturalised runoff patterns for the area.

### **3.3 Surface Water Impact Assessment**

#### ***3.3.1 Surface Water Sensitive Features***

The information on the proposed construction activities and hydrological characteristics was used to identify the potential impacts of the proposed activities on surface water receptors, including the construction, operation and decommissioning phases. Before all these impacts were assessed, the sensitivity of the surface water resources and surface water impact methodologies were discussed in this section.

Areas likely to impact surface water receptors due to the proposed construction and operational activities were identified. These were based on the baseline information obtained from the sensitive wetland features (100 m, 200 m, 500 m buffer layers) developed by SANBI wetland protection status.

### 3.3.2 Surface Water Impact Assessment

An impact assessment of on-site, local and regional sensitive water receptors resulting from the construction, operation, and decommissioning phases of the project was undertaken using the impact assessment methodology guideline derived from the EIA Regulations of the NEMA and adopted by DWS for Section 21 (c) and 21 (i) of the NWA.

### 3.3.3 Impacts on the Water Resource Quality

This assessment comprises the elements that deal with the direct impact on the status of the quality of a water resource based on the Present Ecological Status (PES) of the Upper Vaal River (DWS, 2016) and the related intensity of the impact on the surrounding surface water resources. The latter is defined by the direct impact (negative or positive) on the hydrology, water quality, geomorphology, vegetation, and fauna and all these are defined on scales based on the rating presented in Table 3-1.

**Table 3-1: Impact on the water resource quality (hydrology, water quality, geomorphology, biota)**

<b>Negative Impacts</b>	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
<b>Positive Impacts</b>	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

The *likelihood* of an impact is determined by assessing the frequency of the identified activity, the frequency of the impact, the extent to which the activity is regulated and the ability to detect the occurrence of the impact. These range from a very small scale to areas beyond the proposed construction's footprint. The *duration* of the identified impact can be classified as permanent on a one-day time scale. The *probability* of the impact occurring is scaled up to five classes, where the unknown is quantified as 100% and the unlikely is 20%. These three components are summarised in Table 3-2.

The cumulative factors presented in Table 3-2 were used to derive the intensity, severity, consequence and risk the identified activity will have on the natural resource. The calculation and their matrix scores are given in Table 3-3.

**Table 3-2: Scale, duration and likelihood components of the impact assessment**

<b>SPATIAL SCALE (EXTENT) OF IMPACT</b>	
Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5
<b>DURATION OF IMPACT</b>	
Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5
<b>LIKELIHOOD OF THE IMPACT</b>	
Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

**Table 3-3: Consequences components of the impact assessment**

<b>CALCULATIONS AND MAXIMUM VALUES</b>	
Intensity = Maximum Intensity Score (negative value for positive impact) X 2	MAX = 10
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 20 (MIN = -20 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 100
Significance/Risk = Consequence X (Likelihood / 100)	MAX = 100

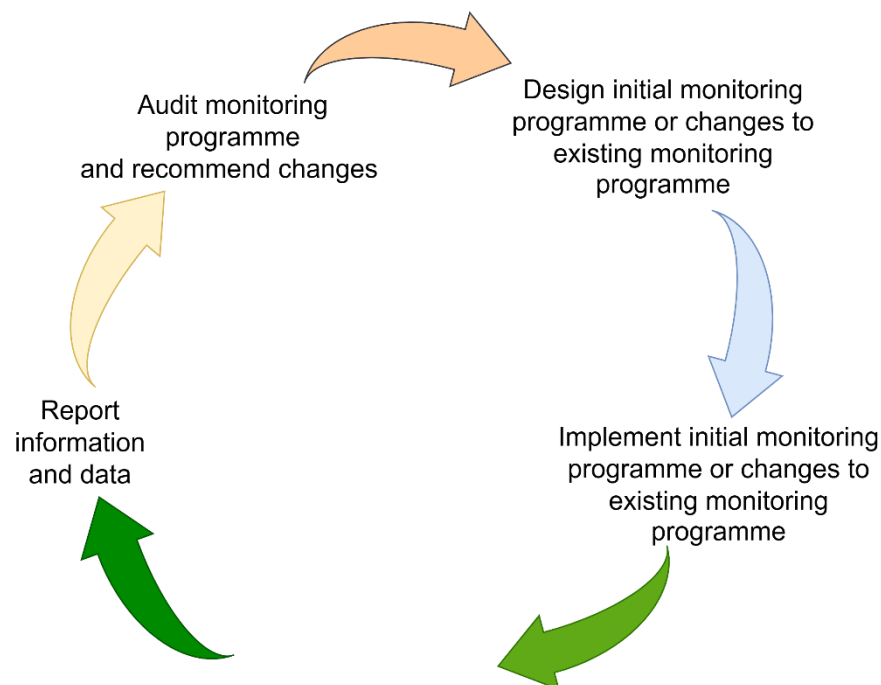
The final step was to calculate the significance rating (Table 3-4) based on the calculations presented above for the intensity, severity, and consequence (in Table 3-3 above). Risk is rated as Low, Moderate and High based on the cumulative scores. The low-risk class suggests that the impact is accepted as it is or with the proposed mitigation measures, while the high-risk class suggests that the impact will have negative long-term effects.

**Table 3-4: Significance ratings, classification and applicable management actions**

<b>RISK RATING CLASSES</b>		
<b>RATING</b>	<b>CLASS</b>	<b>MANAGEMENT DESCRIPTION</b>
<b>1 – 29</b>	<b>(L) Low Risk OR (+) Positive (+ +) Highly positive</b>	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
<b>30 – 60</b>	<b>(M) Moderate Risk</b>	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
<b>61 – 100</b>	<b>(H) High Risk</b>	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

### 3.4 Surface Water Monitoring Plan

A surface water monitoring plan was drafted for implementation during the construction, operation and decommissioning of the project. The monitoring plan was based on the principles of a monitoring network design and sampling frequency described by DWS Best Practice Guidelines (BPGs): G3 Water Monitoring Systems (DWAF, 2006b). This typical surface water monitoring methodology is presented in Figure 3-1 aims to ensure that Rand Water New System 1 and Panfontein Water Treatment Residue site operations align with the regulations for protecting surface water resources and other downstream receptors. Also, this plan was drafted to account for the cumulative impacts that might be introduced into the downstream receptors, particularly the environment and surface water component.



**Figure 3-1: Surface water monitoring process (adopted from DWAF, 2006c)**

Surface water sampling must be conducted in accordance with the South African Bureau of Standards (SABS), International Standard Organisation (ISO) 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques, ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams, and ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of water samples. Surface water samples must be collected and submitted to a South African National Accreditation System (SANAS) accredited laboratory for analysis according to SANAS 241-1:2011 for the surrounding environment. Results must be compared against the recommended limits set in the gazetted Resource Quality Objectives (RQOs) for significant water resources of the Upper Vaal catchments (DWS, 2016).

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## 4 DESKTOP ASSESSMENT

The following sub-sections present the dataset and information obtained during the desktop phase of the hydrological assessment study.

### 4.1 Data Used

The following dataset and tools were used to derive the results of the study:

- **KMZ files** – for the location and placement of the proposed infrastructure development,
- **WR2012 dataset** – defining hydrological regimes of the study site,
- **WR2012 dataset** – defining hydrological regimes of the study site,
- **2024 LULC dataset** – defining dominant land use and land cover features,
- **NFEPA dataset** – identifying wetland features, and
- **QGIS** – editing spatial data and mapping.

### 4.2 Legislation and Guidelines

#### 4.2.1 National Legislation

##### 4.2.1.1 Constitution of the Republic of South Africa

Constitution of the Republic of South Africa, 1996 (Act 108 of 1996) – The Bill of Rights states that everyone has the right to an environment that is not harmful to their health or well-being. As such, the State must respect, protect, promote and fulfil everyone's social, economic and environmental rights and strive to meet the basic needs of previously disadvantaged communities.

##### 4.2.1.2 The National Water Act

The NWA aims to provide for the management of the national water resources to achieve sustainable water use for the benefit of all water users. This act requires that the quality of water resources be protected, as well as the integrated management of water resources, with the delegation of powers to institutions at the regional or catchment level. The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved and managed in ways which take into account (relevant to this study):

- Protecting aquatic and associated ecosystems and their biological diversity,
- Reducing and preventing pollution and degradation of water resources,

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Section 19 of the National Water Act (Act No. 36 of 1998) (NWA) sets out the principles for “an owner of the land, a person in control of the land or a person who occupies or uses land” to:

- Cease, modify or control any act or process causing pollution,
- Comply with any prescribed waste standard or management practice,
- Contain or prevent the movement of pollutants,
- Eliminate any source of pollution,
- Remedy the effects of the pollution, and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

It also describes the actions that the catchment management agency can take to enforce the requirements of the NWA. Section 26 (1) of the NWA provides for the development of regulations that:

- Require the use of incoming and discharging water from a water resource to be monitored, measured and recorded,
- Regulate or prohibit any activity to protect a water resource or in-stream or riparian habitat, and
- Prescribe the outcome or effect that must be achieved through management practices for the treatment of waste, or any class of waste, before it is discharged or deposited into or allowed to enter a water resource.

#### *4.2.1.3 National Environmental Management Act*

The National Environmental Management Act (Act 107 of 1998 (NEMA) sets out the duty of care principle (Sections 28 (1) and (3) of NEMA), which applies to all types of pollution that might arise as a result of the proposed developments on landscape and must be taken into account in considering any aspects of potential environmental degradation. Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise the negative impacts and rectify such pollution or degradation of the environment.

Table 4-1 presents Appendix 6 of Government Notice (GN 326) of EIA Regulations 2017, which governs hydrological impact assessments, to which this study conforms. Some of the regulations relevant to this study are highlighted in the table below and this is based on the understanding of the existing conditions and the activities associated with the construction.

**Table 4-1: NEMA Government Notices that are applicable to this study**

<b>Listing Notice 1, GNR 983 of 4 December 2014 (as amended GN517, 11 June 2021)</b>		
<b>Activity</b>	<b>Description</b>	<b>Applicability</b>
9	The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where— (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	There is the potential that pipelines for stormwater conveyance may be required and the stipulated threshold will be exceeded.
12	The development of— Infrastructure or structures with a physical footprint of 100 square metres or more, where such development occurs— within a watercourse; in front of a development setback; or if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare, excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	This activity will likely be applicable due to the proposed sludgeline's vicinity to the watercourse.
45	The expansion of infrastructure for the bulk transportation of water or storm water, where the existing infrastructure for— (i) has an estimated diameter of 0.36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) Where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) Where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion— (aa) relates to the transportation of water or stormwater within a road reserve; or (bb) will occur within an urban area	The development of the proposed activities of Rand Water New System 1 site will result in the decommissioning of the proposed activities.
<b>Listing Notice 3 (GNR 985 of 4 December 2014 (as amended GN517, 11 June 2021)</b>		
<b>Activity</b>	<b>Description</b>	<b>Applicability</b>
14(ii), (iv), (vi), (x), (xii),	The development of— (ii) channels exceeding 10 square metres in size; (iv) dams, where the dam, including infrastructure and water surface area, exceeds 10 square metres in size; (ii) infrastructure or structures with a physical footprint of 10 square metres or more, where such development occurs— (a) within a watercourse;	Construction of stormwater control measures



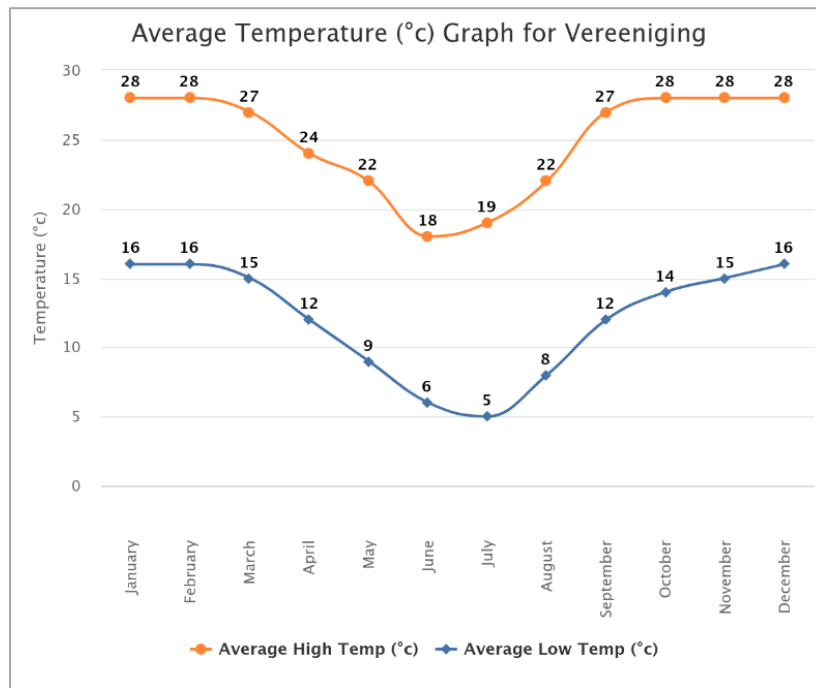


Figure 5-2: Average minimum and maximum temperatures for Vereeniging

## 5.2 Rainfall and Evaporation

The entire project falls within quaternary catchment C22F of the upper Vaal River, which forms part of the Vaal-Orange Water Management Area (WMA). Catchment average-based rainfall records from the 90-year record WR2012 study (Bailey & Pitman, 2015) indicate that the area experiences a Mean Annual Precipitation (MAP) of 655 mm while the Mean Annual Evaporation (MAE) is 1 650 mm. The statistical distribution of monthly rainfall and evaporation is presented in Figure 5-3 and Table 5-1 indicates these variables' high seasonality.

Table 5-1: Monthly evaporation for the study area

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
181	188	204	202	163	148	108	82	62	70	101	142

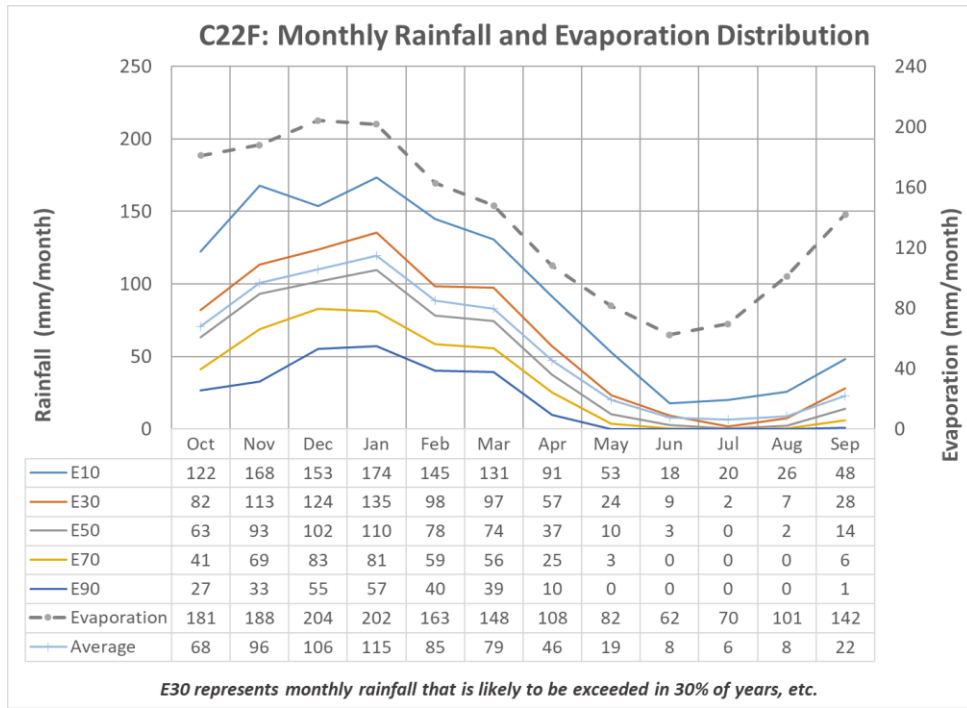


Figure 5-3: Seasonal distribution of rainfall and evaporation (Bailey and Pitman, 2015)

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## **6 SURFACE WATER IMPACT ASSESSMENT**

The potential impacts of the proposed construction activities on surface water receptors and the sensitivity of the surface water resources in the Rand Water New System 1 and Panfontein Water Treatment Residue site are discussed and presented, along with a summary of the mitigation measures that have been drawn. The proposed construction layout plan and baseline hydrology guided this report's segment. This assessment primarily focuses on the areas surrounding the proposed construction site to assess the receptors identified in the surface water sensitivity assessment

### **6.1 Surface Water Sensitivity**

The local surface water resources of medium sensitivity are those based on the surrounding wetlands. The area around the Panfontein Water Treatment Residue infrastructure is not within the 500 m buffer lines of the surrounding wetlands, as shown in Figure 6-1. The Present Ecological State (PES) for the study site, category C, was determined to be that of a Modified, which indicates that the water resources in the area are highly modified, and as part of the large resources protection, measures to improve and restore water quality will be essential. Adequate management of potential waste disposal needs to be implemented to ensure that the current status of the water resource is maintained and improved.

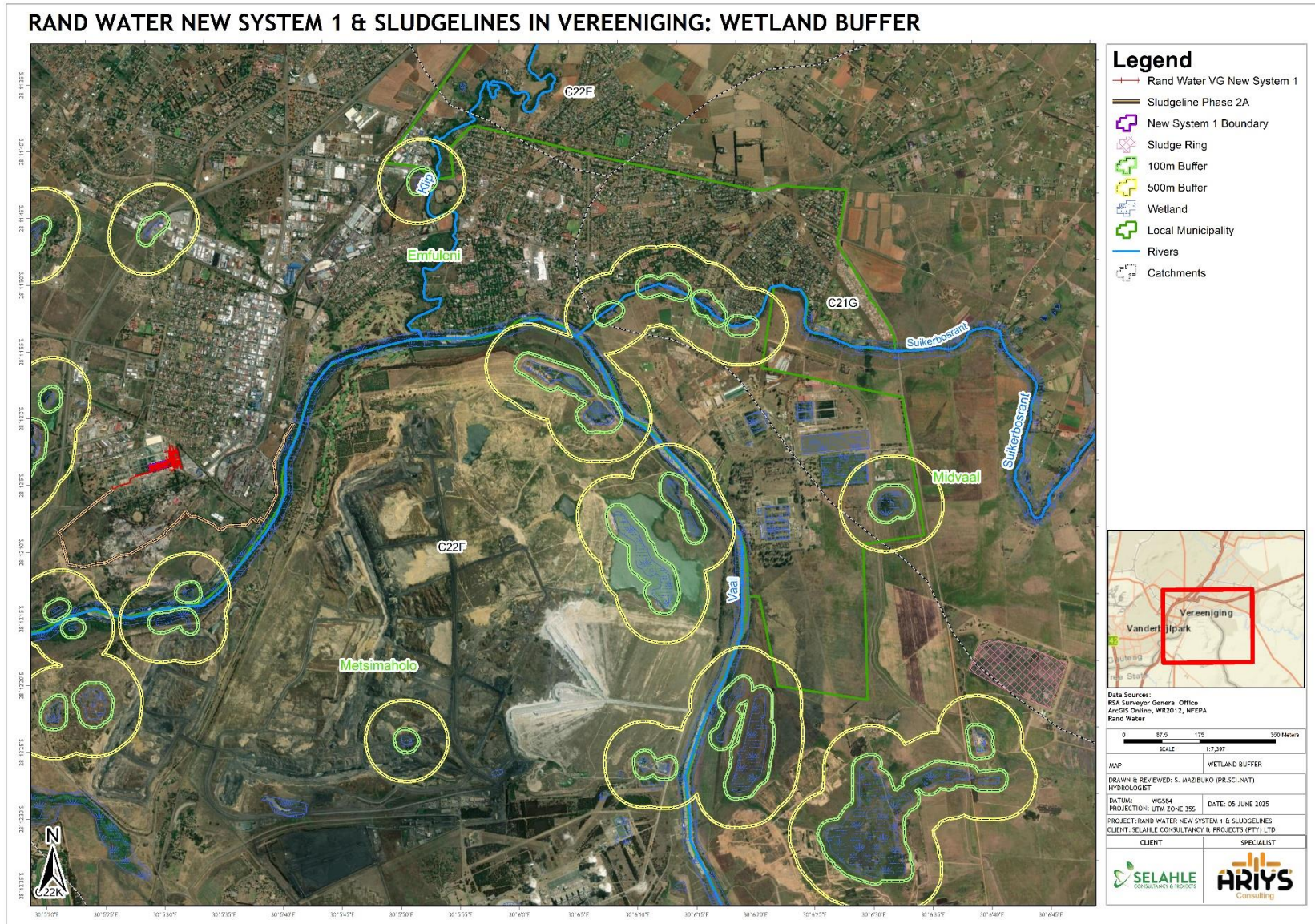


Figure 6-1: Wetland buffer

30 July 2025

## 6.2 Construction Phase

Table 6-1 summarises the potential impacts associated with the construction activities of the Randwater New System 1 and Panfontein Water Treatment Residue site. Potential surface water pollution due to the accidental spills (hydrocarbons, oil, and fuel) that might run into the Vaal River and the Suikerbosrant. Site clearance, removal of natural vegetation cover, and increased surface compaction due to the movement of heavy machinery on the site were identified as elements likely to cause erosion and siltation downstream.

**Table 6-1: Identified impacts during the construction phase**

Aspects Assessment - Construction Phase		
Activity	Impact	Causes (effect on the environment)
Clearance of Vegetation and Topsoil	Water Quality Deterioration	<ul style="list-style-type: none"> <li>Clearing the surface and site preparations will expose soil surfaces to erosion factors. Increased erosion and siltation of the downstream water resources.</li> </ul>
Heavy machinery and vehicle movement		
Hydrocarbon, fuel or chemical spillage		<ul style="list-style-type: none"> <li>Surface water pollution is due to accidental oil spillages and improper waste handling, storage, and disposal of chemicals.</li> </ul>
Pipe Construction		<ul style="list-style-type: none"> <li>Alter the site's natural, pre-existing surface water drainage patterns, influencing the local hydrology due to heavy vehicle movement</li> </ul>
Flooding	Infrastructure damage	<ul style="list-style-type: none"> <li>Damage to the infrastructure and potential loss</li> </ul>

## 6.3 Operational Phase

Table 6-2. list the potential impact associated with the operational phase of the project. These include potential leaks that may result in isolated erosion and siltation into the surrounding watercourses.

**Table 6-2: Identified impacts during the operation phase**

Aspects Assessment - Operational Phase		
Activity	Impacts	Causes (effect on the environment)
Potential pipe burst	Water quality deterioration	<ul style="list-style-type: none"> <li>Deterioration of water quality due to increased sediments in the river courses</li> </ul>

## 6.4 Decommissioning Phase

The identified potential impacts of the decommissioning phases of the project are described and summarised in Table 6-3. Amongst the identified include (i) the spilling of fuel, oil and hydrocarbons from on-site heavy machinery used to demolish and dispose of Rand Water's New System 1 and Panfontein Water Treatment Residue site components (including Sludgelines), (ii) changes in the local hydrological processes as a result of modified landscape might increase soil erosion and sedimentation to the downstream as a result of loose soils induced by the movement of heavy machinery.

**Table 6-3: Identified impacts during the decommissioning and closure phase**

Aspects Assessment - Decommissioning and Closure Phases		
Activity	Impacts	Causes (effect on the environment)
Demolition of infrastructure	Deterioration of water quality	<ul style="list-style-type: none"> <li>Spilling of hazardous oil or hydrocarbons from heavy machinery may result in water quality deterioration</li> </ul>
Landscape Rehabilitation	Soil erosion and sedimentation, invasive plants	<ul style="list-style-type: none"> <li>Potential for alien invasive plant growth</li> </ul>
		<ul style="list-style-type: none"> <li>An increase in uncompacted areas due to moving maintenance vehicles could lead to increased soil erosion and sedimentation</li> </ul>

## 6.5 Mitigation Measures

Below is a summary of the mitigation measures recommended to reduce impacts on the surface water quality in the area surrounding the New System 1 and Panfontein Water Treatment Residue site:

### *Construction Phase*

- In case of accidental spillages of oils, hydrocarbons, and hazardous waste, emergency response procedures (e.g., spillage control kits) should be implemented to contain and dispose of the spillage immediately.
- Servicing of construction vehicles and equipment and refuelling station areas must be bundled with completely contained compact surfaces to contain all waste in the storage facility, like sumps, for proper disposal per waste handling protocols.
- The scheduling of earthworks should be implemented to minimise the footprint at risk of erosion at any given time, or work should be scheduled according to the season.
- Construction material on site and removed topsoil must be stored in minimally designated areas to reduce contamination, compaction and erosion (thus must be vegetated).
- Construction should be done during the dry season to reduce the flooding risk.

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### *Operational Phase*

- Implementing the proposed surface water monitoring program will reduce the potential of the identified negative impacts on the surrounding surface water receptors through early detection and formulation of remediation measures.
- Regular monitoring and maintenance of sludgeline path and stormwater management infrastructure to ensure efficiency and reduce potential overspill and erosion that might emanate from system failure, such as pipe damage.

### *Decommissioning Phase*

- A post-rehabilitation audit should be undertaken during the closure to ascertain whether the landscape has been successful. If not, further measures should be recommended and implemented.
- Designated areas for demolition vehicles must have adequate pollutant storage such that any accidental oil, fuel, and grease spillages are contained and disposed of accordingly before further contaminating the environment through contact with areas susceptible to overland runoff.
- Schedule demolition during the dry season to ensure less erosion of the contaminated soils that may increase siltation and contaminate the downstream water resources. To minimise the flow alteration, the infrastructure's demolition should be scheduled to ensure that the heavy machinery track is kept to a minimum.
- Rehabilitation must ensure that indigenous vegetation is seeded and re-vegetated repeatedly until it becomes sustainable, such that the natural preferential flow into the environment is restored. This will help the catchment to restore its hydrological processes and other environmental dynamics associated with it.

## **6.6 Management Actions**

The management plan of the proposed construction activities relating to surface water is summarised in Table 6-4. This plan is aimed at ensuring that the relevant regulations, guidelines and best practices are implemented.

**Table 6-4: Proposed management plans and actions**

Activity	Management Actions	Standard
<b>Construction Phase</b>		
Site establishment and infrastructure development	<ul style="list-style-type: none"> <li>• Demarcate areas prior to commencement of the construction to minimise construction footprints and control the edge effects from construction activities, ensure that vegetation clearing is kept at a minimum and implement erosion control measures.</li> <li>• Undertake construction during the low flow season, implement rehabilitation activities to address temporary disturbance, and implement stormwater management measures, including water energy dispersers at outlet points, to minimise erosion.</li> <li>• The necessary erosion prevention and protection mechanisms must be employed to ensure the sustainability of structures and activities and to prevent sedimentation in the surrounding watercourses.</li> <li>• Implement emergency incident procedures, reportable incident procedures to be followed as required by law, and immediate remediation and rehabilitation of the footprint of the spill area.</li> <li>• Any area where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible.</li> <li>• Implement monitoring programs for surface water, and all structures must be inspected regularly for accumulation of debris, blockage, instabilities, erosion of abutments and overflow areas – debris must be removed, and damages must be repaired and reinforced immediately.</li> </ul>	BPG G1 & G3, Section 19, NWA and Section 30, NEMA
<b>Operational Phase</b>		
Transportation of sludge water within the proposed new system	<ul style="list-style-type: none"> <li>• Implement visual assessments for signs of leaks and erosion and address them accordingly.</li> </ul>	BPG G1 & G3
<b>Decommissioning Phase</b>		
Rehabilitation and closure, site re-vegetation	<ul style="list-style-type: none"> <li>• Ensure proper stormwater management designs are in place and implemented until the restoration of the landscape ambient conditions</li> </ul>	

**Table 6-5: Proposed mitigation measures for the identified impacts of the three phases**

	<b>Activity</b>	<b>Mitigation Measures</b>
<b>CONSTRUCTION</b>	Site clearing and removal of topsoil and vegetation.	<ul style="list-style-type: none"> <li>• The footprint of the proposed construction area must be demarcated.</li> <li>• Vegetation-clearing activities will be restricted to the demarcated infrastructure footprint area and will be undertaken in a phased manner.</li> <li>• Areas disturbed by pre-construction activities, which will not be required for construction, will be rehabilitated immediately upon completion of construction of each area.</li> <li>• Activities should be limited to months of low rainfall (dry season) to reduce the probability of potential impact.</li> <li>• Use minimal road access for heavy machinery and construction vehicles</li> </ul>
	Heavy machinery and vehicle movement. Hydrocarbon, fuel, chemical handling and spillage	<ul style="list-style-type: none"> <li>• All hazardous substances must be stored and handled on impervious substrates and bunded areas that can contain potential spillage.</li> <li>• Waste handling and storage facilities must be located away from surface water resources and drainage lines.</li> <li>• All construction vehicles and equipment must be kept in good working order and regularly serviced.</li> </ul>
	Flooding of the Infrastructure Construction	<ul style="list-style-type: none"> <li>• Construction must be done during winter to reduce the risk of infrastructure and machine flooding by the Vaal River.</li> <li>• Revegetating exposed areas with indigenous vegetation as an erosion control option and maintaining the overland slope.</li> </ul>
	Construction Hydrocarbon spillages	<ul style="list-style-type: none"> <li>• Revegetation of exposed areas with indigenous vegetation as an erosion control option and maintaining the overland slope.</li> <li>• All hazardous substances must be stored and handled on impervious substrates and bunded areas containing potential spillage.</li> <li>• Waste handling and storage facilities must be located away from surface water resources and drainage lines.</li> </ul>
<b>OPERATIONAL</b>	Transportation of sludge	<ul style="list-style-type: none"> <li>• Sludgeline and its associated infrastructure must be monitored regularly to identify any potential leaks; if those are identified, remedial actions must be taken to address them.</li> </ul>
<b>DECOMMISSIONING</b>	Demolition of the infrastructure	<ul style="list-style-type: none"> <li>• All infrastructure areas should be revegetated to manage erosion, and all rehabilitation activities should be monitored until vegetation is well established.</li> <li>• Use indigenous vegetation planted following the site's slopes.</li> </ul>

**Table 6-6: Impact assessment matrix before and after mitigation measures during the construction, operation and decommissioning phases of the Rand Water New System1 and Panfontein Water Treatment Water Residue Site with their associated Sludgelines**

Phase	Activity	Impact	Mitigation Measures	Potentially affected watercourses			Intensity of Impact on Resource Quality					Intensity	Scale	Duration	Severity	Importance	Likelihood	Significance	Risk Rating	Confidence level
				Name	PES	Importance	Abiotic Habitat			Biota										
							H	W	G	V	F									
CONSTRUCTION	Initial earthworks associated with site clearing, preparations and construction	Water Quality Deterioration	No	Vaal	C	Very high	4	3	3	4	3	8	4	3	15	5	80%	60	M	Medium
			Yes			Moderate	3	2	3	4	3	8	3	3	14	3	20%	8	L	Low
		Flooding	No			Very high	4	2	5	4	3	10	5	4	19	5	80%	76	H	High
			Yes			High	5	1	4	4	3	10	4	4	18	4	60%	43	M	Medium
		Soil erosion and sedimentation	No			Moderate	3	4	4	3	3	8	4	4	16	3	80%	38	M	Medium
			Yes			Moderate	2	3	3	3	2	6	4	3	13	3	40%	16	L	Low
OPERATION	Transportation of sludge within the proposed new system	Water quality deterioration due to potential leaks that might cause erosion	No	Vaal	C	Very high	3	4	2	2	3	8	4	3	15	5	60%	45	M	Low
			Yes			High	2	3	1	2	3	6	4	2	12	4	20%	10	L	Low
DECOMMISSIONING	Rehabilitation and closure, site re-vegetation	Water quality deterioration	No	Vaal	C	Very high	2	5	4	5	4	10	4	3	17	5	60%	51	M	Medium
			Yes			Moderate	2	1	4	2	3	8	3	3	14	3	40%	17	L	Low
		Water quantity	No			Moderate	4	4	3	2	2	8	4	4	16	3	40%	19	L	Low
			Yes			Moderate	-2	-2	0	-1	-2	0	4	4	8	3	80%	19	L	Low
		Soil erosion and sedimentation	No			Moderate	3	5	4	5	3	10	4	4	18	3	60%	32	M	Medium
			Yes			Moderate	2	4	4	4	3	8	3	3	14	3	40%	17	L	Low

## 7 SURFACE WATER MONITORING PLAN

A surface water monitoring program was drafted based on the identified activities that can impact surface water in the project area's surroundings. The proposed monitoring points were based on the targeted locations that can reflect changes in the water quality of the surrounding area as a result of the construction activities. This program aims to ensure that the Integrated Water Resources Management (IWRM) principles are implemented to address the broader water resource challenges in the area. It is proposed that a stormwater and surface water monitoring program be constructed in the construction area.

Monitoring would need to be conducted as follows for the proposed expansion site:

- Monitoring during the preparation and construction phases for both project sites.
- During the operational phases of the Rand Water New System 1 infrastructure and the Panfontein Water Treatment Water Residue site.
- Closure/decommissioning phase (and for a period after the activity).

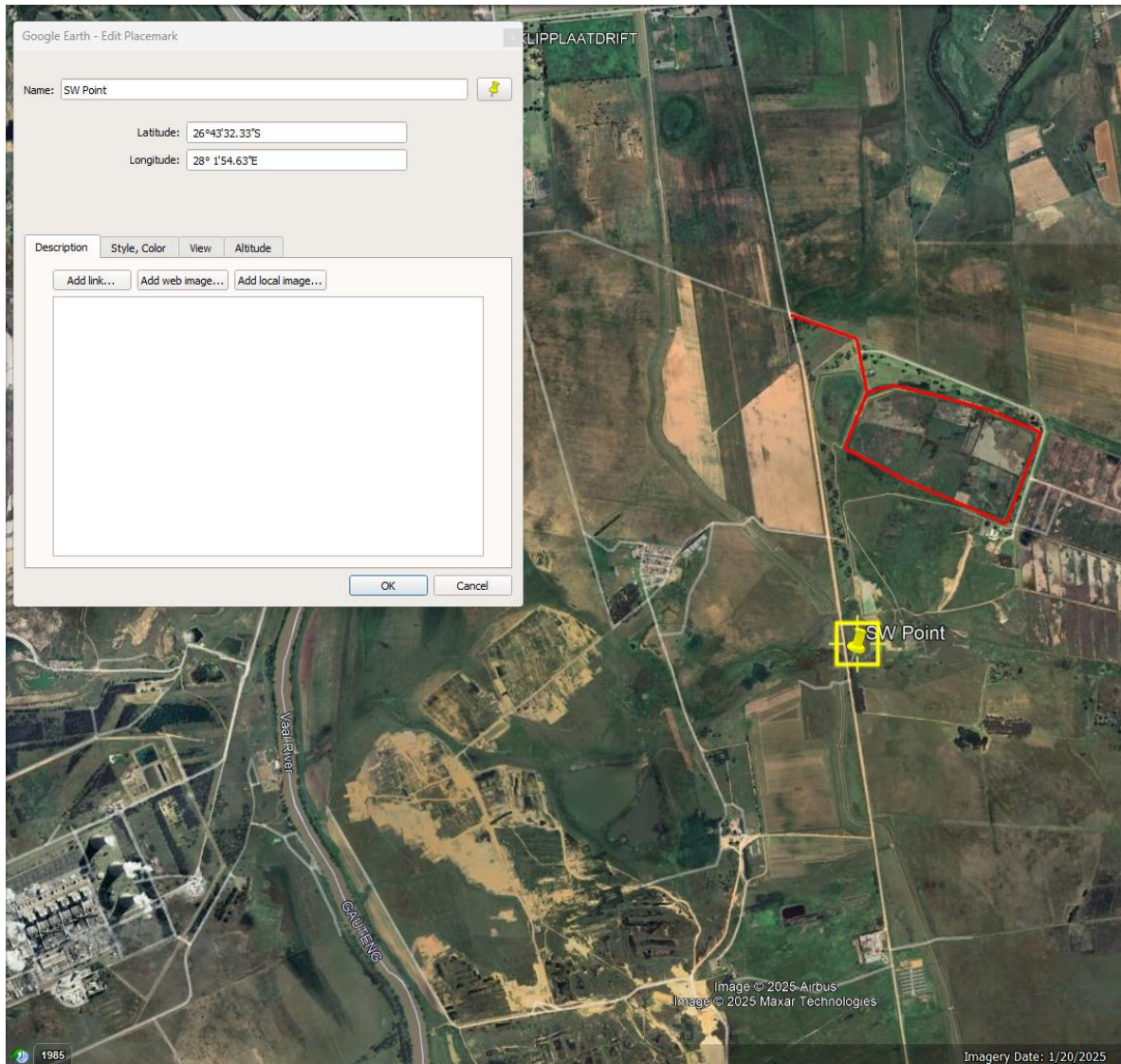
It is proposed that routine maintenance monitoring be conducted as specified in Table 7-1 for the duration of the project. If concerns are noted, monitoring must be conducted more frequently until the issues are resolved.

**Table 7-1: Maintenance monitoring routing**

Site	Frequency	Type
Stormwater Monitoring points	During the storm event or once the storm has subsided	Field assessment
Surface water monitoring	Monthly during construction	Field assessment
	Quarterly for the duration of operations, one week after a storm event.	

### 7.1 Monitoring Network

During the project's construction phase, inspections at the construction site and re-vegetated areas must be monitored regularly for any signs of erosion in the event of storm events. These points will be on an ad-hoc basis as the project progresses. The surface water monitoring network includes a point in the downstream reaches of the proposed construction of the Panfontein Water Treatment Residue site. All surface water monitoring parameters will be continually assessed to meet legislative requirements and indicate water quality management and potential impacts associated with the proposed activities. One surface water monitoring point is proposed (towards the Vaal River) and its spatial locality is presented in Figure 7-1. This point aims to trace any changes that might occur towards the wetland and the Vaal River.



**Figure 7-1: Location of the proposed surface water monitoring point**

## 7.2 Monitoring Parameters

The proposed surface water monitoring plan should be reviewed periodically to ensure the appropriateness of selected sites for sampling and sampling frequency during the system's operation. Water quality parameters to be monitored include the physical parameters in the event of spillages. Monthly surface water samples must be collected and analysed by a recognised SANAS-accredited laboratory or one that participates in the Proficiency Testing Scheme to analyse the relevant constituents of the surface water sample. These samples will be analysed and compared to the Resource Quality Objectives (RQOs) for the area as part of a broader objective of protecting and improving the water quality of the area as envisaged in the NWRS and NWA.

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## 8 RECOMMENDATIONS AND CONCLUSIONS

### 8.1 Conclusions

- During the construction phase of the project, deteriorating of surface water quality as a result of siltation (sedimentation from cleared surfaces), accidental spillages and washing of hydrocarbons, oil, lubricants, fuel, grease and other toxic waste into the drainage paths of the Vaal River and Suikerbosrant and flooding of the construction site were identified as the main negative impacts that might affect surface water receptors in the areas of the Rand Water New System 1 and Panfontein Water Treatment Water Residue sites.
- Keeping a minimal footprint of the construction site, constructing during the dry season, demarcating and isolating on-site waste, and rehabilitating the disturbed landscape are likely to reduce the potential negative impacts on the surrounding surface water resources related to water quality.
- The proposed sludge pipeline is within the high flood risk zone, which puts the infrastructure at a high risk of flooding and potential spillages into the river system.
- Routine monitoring of the construction footprint for any accidental spillages, erosion, or leaks needs to be conducted, and if any of these are identified, mitigation measures need to be implemented to reduce the extent of potential impacts that may negatively affect the surrounding water resources.
- A surface water monitoring point is proposed in the lower reaches of the Panfontein Water Treatment Water Residue site to capture and represent variations in water quality.

### 8.2 Recommendations

Recommendations derived from this study are outlined as follows:

- Keeping the construction footprint limited to a small area (i.e., development footprint) is recommended during the construction phase and must be done during the dry months of the year. This also includes having fewer construction site access roads to prevent the unnecessary tracking of sediments into the Vaal River.
- Implement erosion control measures, such as adding vegetation, using erosion control blankets, or installing sedimentation basins to prevent soil erosion within and around the discharge points.
- Routine maintenance and monitoring of potential spills along the sludge line is recommended.

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## 9 REFERENCES

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