THE PROPOSED POSTMASBURG WASTE WATER TREATMENT WORKS AND SEWER PIPELINE

POSTMASBURG, NORTHERN CAPE

FINAL ENVIRONMENTAL IMPACT REPORT

D:E&NC reference number: NC/EIA/20/ZFM/TSA/POS1/2014

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TSANTSABANE MUNICIPALITY

PROPOSED POSTMASBURG WWTW AND SEWER LINE

Postmasburg, Northern Cape

D:E&NC Ref No.: NC/EIA/20/ZFM/TSA/POS1/2014

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ACRONYMS

BGIS	Biodiversity Geographic Information System
CBA	Critical Biodiversity Area
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation (Northern Cape)
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Programme
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NID	Notice of Intent to Develop
NWA	National Water Act
OESA	Other Ecological Support Area
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
WWTW	Waste Water Treatment Works
WULA	Water Use Licence Application

1. INTRODUCTION

1.1 BACKGROUND

Consideration is being given to the construction of a new Waste Water Treatment Works and sewer line in Postmasburg, Northern Cape. The total area of the new Waste Water Treatment Works will be approximately 10 ha.

The applicant is Tsantsabane Municipality who will undertake the activity should it be approved. EnviroAfrica CC has been appointed as the independent environmental assessment practitioner (EAP) responsible for undertaking the relevant EIA and the Public Participation Process required in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA).

The Final Scoping Report and Plan of Study for EIA were submitted to the Department of Environment and Nature Conservation (DENC). The Scoping Report and Plan of Study for EIA were approved by DENC on the 27 July 2015 and EnviroAfrica were advised to proceed with the EIA process (**Appendix 1B**).

1.2 SCOPE OF WORK

There has been no particular brief given to the consultants to undertake this study. However, the scope of the study has been determined with reference to the requirements of the relevant legislation and undertaken in terms of the Information Document on Requirements with respect to the EIA Process (January 2003), issued by the Department of Environmental Affairs and Development Planning of the Western Cape.

The basic scope of work will include the following:

- Review of all information.
- Participating in the progress of the development proposal.
- Scoping (identification of significant issues).
- Assessment of anticipated impacts.
- Identification of suitable mitigation measures to reduce negative impacts and enhance positive impacts.
- Submission for decision.

One of the crucial aims of an EIA is to ensure that the demands of sustainable development are met on a project level, within the context of the greater area. The most common definition of sustainable development is development that meets the needs of the present while not compromising the needs of future generations.

This EIA is therefore being undertaken with sustainable development as a goal. The assessment will look at the impacts of the proposals on the environment and assess the significance of these, as well as propose mitigation measures, as required, to reduce anticipated impacts to acceptable levels.

1.3 ASSUMPTIONS AND LIMITATIONS

The assumption is made that the information on which the report is based (i.e. specialist studies and project information) is correct.

Future management of the site is essential and the assumption is made that the mitigation measures recommended by the specialists will be implemented on a long-term basis. This has a major bearing on the reliability of the predictions of significance of impact.

1.4 DESCRIPTION OF THE PROPOSED ACTIVITY

It is proposed that a new Waste Water Treatment Works be constructed on Farm Olynfontein No.475 Portion 3, Postmasburg to accommodate the growing population of Postmasburg and the growing costs of operating the existing waste water treatment works.

Currently, all wastewater in Postmasburg drains to the Postmasburg Pump Station No.1, which is located to the south of Postmasburg within the Groenwater Spruit. The logical extension would be to extend the existing main sewer downstream to a point where it would daylight and then construct a new wastewater treatment plant there. Calculations have however indicated that the current main sewer, which is only a 300mm diameter pipe, would not be adequate to convey the existing and future flows.

Given the planned developments in Postmasburg, a flow of 100 litres per second was calculated as being the future Average Dry Weather Flow for Postmasburg. This equates to a wastewater treatment plant with a minimum design capacity of 8 640m^3/day. A decision was taken to allow for a percentage of future growth and expansion and a figure of 10 000m^3/day was arrived at as the Average Dry Weather Flow and the minimum required size for a new wastewater treatment plant for the future flows expected to be generated at Postmasburg.

It is proposed that the new wastewater treatment plant will utilize the modified Ludzack-Ettinger process which is a biological nutrient removal process for the removal of carbonaceous and nitrogen based soluble nutrients. This plant utilizes only aerobic processes and as such minimizes the risks for generating offensive odours. The gradient of the site also allows the raw wastewater to be pumped once after which flow through the treatment plant can take place under gravity.

It is suggested that the treatment plant be designed in such a manner that modules capable of treating 5000m^3/day each are constructed. Such a philosophy will ensure that sufficient space is allowed for future requirements and that common elements such as the inlet works, lifting pump station etc. are sized correctly from the beginning of the planning process.

The plant will have a common inlet works providing facilities for screenings removal, grit removal and flow measurement of a size capable of dealing with current and future peak flows of up to 250 litres per second which equates to a maximum daily flow of 21 600m^3 / day.

It should be noted that this flow is not the design capacity of the plant, but the ultimate peak flow which could reasonably be expected during occurrences of high rainfall and as such, only the inlet works is to be designed for this capacity and not the process units within the treatment plant. Postmasburg is located in an arid region, but is subject to heavy thunder showers in summer which

can cause flash floods. In addition, the natural water table in the area is quite shallow and the fact that the town's main sewer runs inside a watercourse lends itself to large volumes of water ingress during flood occurrences.

To convey these flows, a new main outfall sewer of at least 600mm diameter is required. Such a sewer will run at 80% capacity for a flow of 100 liters per second providing some space for future runoff. It is planned that this new sewer will be extended from the current position of Postmasburg Pump Station No.1 in a southerly direction following the run of the Groenwater Spruit to a point approximately 1 350m downstream of the town where the pipe will daylight at a gradient of 1 in 200.

Please refer to Section 4 of the Preliminary Design Report (**Appendix 3A**) and the Concept General Layout (**Appendix 3B**) for more details on the design of the proposed waste water treatment works.

The proposed sewer line will cross the following erven in Postmasburg: Erf 1, Erf 123, Erf 125, Erf 126, Erf 127, Erf 764, Erf 779, Erf 1504.

Figure 1: Locality Plan.

2. NEED AND DESIRABILITY

In terms of the National Environmental Management Act, as amended, EIA 2010 regulations the Scoping/EIA report must provide a description of the need and desirability of the proposed activity. The consideration of "need and desirability" in EIA decision-making requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest.

While the concept of need and desirability relates to the *type* of development being proposed, essentially, the concept of need and desirability can be explained in terms of the general meaning of its two components in which *need* refers to *time* and *desirability* to *place* – i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed? Need and desirability can be equated to *wise use of land* – i.e. the question of what is the most sustainable use of land.

2.1 NEED

Postmasburg falls within the jurisdiction of the Tsantsabane Municipality and within the ZF Mgcawu District Municipality in the Northern Cape Province. The town is located in a valley through which the Groenwater Spruit is the major watercourse. The town of Postmasburg has a population of approximately 42 000 persons and has over the last 3 years maintained a growth rate of 2.5% per annum. This is primarily due to a major increase in mining activities with the two mining houses KUMBA and ASSMANG being the primary economic drivers.

The existing Postmasburg WWTP was constructed in 1986 with a design capacity of 2400 m^3/day (2400 megaliters per day). For political reasons, the treatment plant was constructed on a high point south of the town's CBD. This decision necessitated that all sewage draining from the town must be pumped to the wastewater treatment plant. Subsequently, Postmasburg was initially equipped with 3 sewage pump stations and later on a 4^{th} booster pump station was constructed.

In 2006, the civil works at the treatment plant was doubled in preparation of the coming expansion of mining activities, but the works was never equipped mechanically due to a shortage of funding. In 2009, the Kolomela Mine development commenced and KUMBA started a housing project of 885 housing units in Postmasburg as well as development of required bulk infrastructure. In 2010 the existing Postmasburg Wastewater Treatment Plant was assessed to make proposals to get the plant operational again as it was in a very poor state. A refurbishment project was undertaken and concurrently to this, the mechanical and electrical installation was done on the new portion of the works expanding the plant capacity to 4800m^3/day. The plant was recommissioned on 1st September 2011 and has been operating successfully since.

Since middle 2012, the new houses of Kumba were occupied in phases and ASSMANG commenced development of 450 stands to relocate their employees from Beeshoek to Postmasburg to facilitate expansion of the Beeshoek Mine. The first 250 of these new houses have been occupied since mid-2013. All these houses of both KUMBA and ASSMANG have increased the flow of wastewater to the existing Postmasburg WWTP gradually until a point was reached where the treatment plant was exceeding its design capacity on a daily basis.

In addition to these recently constructed housing units, several private developers have in the past year applied for land to develop further housing projects as KUMBA have indicated that they plan to

expand their operations at Kolomela Mine and have an immediate need for another 1 300 housing units. In addition to the above, the municipality are also in a planning process to develop a 3 500 unit mixed housing development. All these planned developments now require that the existing wastewater treatment plant either be upgraded to accommodate these envisaged flows, or as an alternative, that a new wastewater treatment plant be considered.

Please also refer to Section 3 of the Preliminary Design Report (**Appendix 3**) for more details on the Average Daily Flows, expected future hydraulic load and proposed future developments in Postmasburg.

According to the Tsantsabane Local Municipality Integrated Development Plan Review 2014-2015, according to the Spatial Development Framework the following Spatial Framework Proposals were made:

- Future residential extensions of Postdene and Postmasburg
- Future residential extensions of Newtown and Boichoko • In-fill planning opportunities should be exploited as well as densifying large properties within the residential neighborhoods through high density developments
- Future Golf Estate for upper housing market
- Possible future residential extension for the west of Postdene
- Possible long-term future residential extension integrating Boichoko with Postmasburg and Newtown.
- Possible future residential development on Portion 3 & 5 of the farm Pensfontein No. 475 • An area north of the CBD next to R325 was identified for the development of a Mall.
- An area to the Northwest of the industrial area along the R385 is identified for future industrial sites
- Two possible cemetery sites for the long-term solution has been identified to serve the community of Boichoko
- The cemetery located next to the intersection of the R385 and R309 should be closed and fenced
- A taxi rank is proposed at the mixed land use area identified in Postmasburg.

It is therefore clear that the proposed Postmasburg WWTW will be needed to accommodate this future growth.

2.2 DESIRABILITY

The following factors determine the desirability of the area for the proposed Postmasburg Waste Water Treatment works

2.2.1 LOCATION AND ACCESSIBILITY

The proposed location of the Waste Water Treatment Works site is considered ideally suited for the construction of the WWTW.

From an engineering point of view, the proposed site location is preferred since the flow of wastewater to the WWTW can be undertaken under gravity, avoiding the increased costs involved with pumping the wastewater, which is currently the situation with the existing waste water treatment works. It is planned that this new sewer will be extended from the current position of Postmasburg Pump Station

No.1 in a southerly direction following the run of the Groenwaterspruit to a point approximately 1 350m downstream of the town where the pipe will daylight at a gradient of 1 in 200. At this point, the Groenwater Spruit's gradient is steeper than the gradient of the pipe allowing the pipe to daylight above the envisaged 1 in 50 year floodline of the Groenwater Spruit. This represents an ideal position for the proposed new wastewater treatment plant.

The current electricity costs to pump all wastewater to the existing plant costs the Tsantsabane Municipality in excess of R5 million per annum and a decision was taken to look at the possibility of constructing a new wastewater treatment works on a site where gravity flow to the plant was possible and also where future expansion was not limited by spatial constraints.

The preferred site alternative meets these requirements.

2.2.2 COMPATIBILITY WITH THE SURROUNDING AREA

The proposed WWTW site is located on Farm Olynfontein No.475 Portion 3 just south of the town. The land is mostly undeveloped and is close enough to the town to avoid further costs due to extra pipelines and pump stations, but still far enough to avoid any potential nuisances and/or negative impacts on the residential areas of Postmasburg.

As discussed above, the site is not limited by spatial constraints due to future expansion.

Figure 2: Aerial image of the surrounding landscape.

3. LEGAL REQUIREMENTS

The current assessment is being undertaken in terms of the National Environmental Management Act (Act 107 of 1998, NEMA), to be read with section 24 (5): NEMA EIA Regulations 2010. However, the provisions of various other Acts must also be considered within this EIA.

The legislation that is relevant to this study is briefly outlined below.

3.1 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The Constitution of the Republic of South Africa (Act 108 of 1996) states that everyone has a right to a non-threatening environment and that reasonable measure are applied to protect the environment. This includes preventing pollution and promoting conservation and environmentally sustainable development, while promoting justifiable social and economic development.

3.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The National Environmental Management Act (Act 107 of 1998) (NEMA), as amended, makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the relevant authorities based on the findings of an environmental assessment. NEMA is a national act, which is enforced by the Department of Environmental Affairs (DEA). These powers are delegated in the Northern Cape to the Department of Environment and Nature Conservation (DE&NC).

On the 18 June 2010 the Minister of Water and Environmental Affairs promulgated regulations in terms of Chapter 5 of the NEMA, namely the EIA Regulations 2010 (GN No. R. 543, R. 544 (Listing Notice 1), R. 545 (Listing Notice 2), R. 546 (Listing Notice 3) and R. 547 in Government Gazette No. 33306 of 18 June 2010). These regulations came into effect on the 2 August 2010. Listing Notice 1 and 3 are for a Basic Assessment and Listing Notice 2 for a full Environmental Impact Assessment.

According to the regulations of Section 24(5) of NEMA, authorisation is required for the following listed activities for the proposed Postmasburg Waste Water Treatment Works and sewer line:

Government Notice R544 (Listing Notice 1) listed activities:

11 The construction of:

(i) canals
(ii) channels
(iii) bridges
(iv) dams
(v) weirs
(vi) bulk storm water outlet structures
(vii) marinas
(viii) jetties exceeding 50 square meters in size
(ix) slipways exceeding 50 square meters in size
(x) buildings exceeding 50 square meters in size or;
(xi) infrastructure or structures covering 50 square meters or more;

where such construction occurs within 32 meters of a watercourse, measured from the edge of a watercourse.

18 The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from a watercourse.

19 The **construction** of facilities or infrastructure exceeding 1000 meters in length for the bulk transportation of water, sewage or storm water –

(i) With internal diameter of 0.36 meters or more; or
(ii) With a peak throughput of 120 liters per second or more,

Excluding where:

a. Such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or
b. Where such construction will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.

23 The transformation of undeveloped, vacant or derelict land to –

(i) Residential, retail, commercial, recreational, industrial or institutional use, inside an urban area, and where the total area to be transformed is 5 hectares or more, but less than 20 hectares, or
(ii) Residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares;

Except where such transformation takes place

(i) For linear activities; and
(ii) For purposes of agricultural/afforestation, in which case Activity 16 of Notice No. R. 545 applies.

55a The construction of facilities for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2000 cubic metres but less than 15 000 cubic metres.

Government Notice **R545** (Listing notice 2) listed activities:

5 The **construction** of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.

Government Notice **R546** (Listing notice 3) listed activities:

13 The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for:

(1) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list;
(2) the undertaking of a linear activity falling below the thresholds mentioned in Listing 1 in terms of GN R.544 of 2010.

14 The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for:

(1) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes;
(2) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list;
(3) the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.

The environmental process is being undertaken in distinct phases, refer to **Figure 3**.

An Application Form has been submitted to Department of Environment and Nature Conservation (DE&NC). On acknowledgment from DE&NC (**Appendix 1A**), the Scoping Process was undertaken to identify potential issues.

The Final Scoping Report and Plan of Study for EIA were submitted to the Department of Environment and Nature Conservation (DE&NC). The Scoping Report and Plan of Study for EIA were approved by DE&NC and EnviroAfrica was advised to proceed with the EIA process (**Appendix 1B**).

The principles of environmental management as set out in section 2 of NEMA have been taken into account. The principles pertinent to this activity include:

- People and their needs will be placed at the forefront while serving their physical, psychological, developmental, cultural and social interests. The activity seeks to provide additional employment and economic development opportunities, which are a local and national need – *the proposed activity is expected to have a beneficial impact on people, especially developmental and social benefits, as well providing additional employment and economic development opportunities.*
- Development will be socially, environmentally and economically sustainable. Where disturbance of ecosystems, loss of biodiversity, pollution and degradation, and landscapes and sites that constitute the nation's cultural heritage cannot be avoided, are minimised and remedied. The impact that the activity will potentially have on these will be considered, and

mitigation measures will be put in place - *potential impacts have been identified and considered, and any further potential impacts will be identified during the public participation process. Mitigation measures will be included in the EMP*.

- Where waste cannot be avoided, it will be minimised and remedied through the implementation and adherence of the Environmental Management Programme (EMP) – *this will be included in the EIR*.
- The use of non-renewable natural resources will be responsible and equitable.
- The negative impacts on the environment and on people's environmental rights will be anticipated, investigated and prevented, and where they cannot be prevented, will be minimised and remedied.
- The interests, needs and values of all interested and affected parties will be taken into account in any decisions through the Public Participation Process.
- The social, economic and environmental impacts of the activity will be considered, assessed and evaluated, including the disadvantages and benefits.
- The effects of decisions on all aspects of the environment and all people in the environment will be taken into account, by pursuing what is considered the best practicable environmental option.

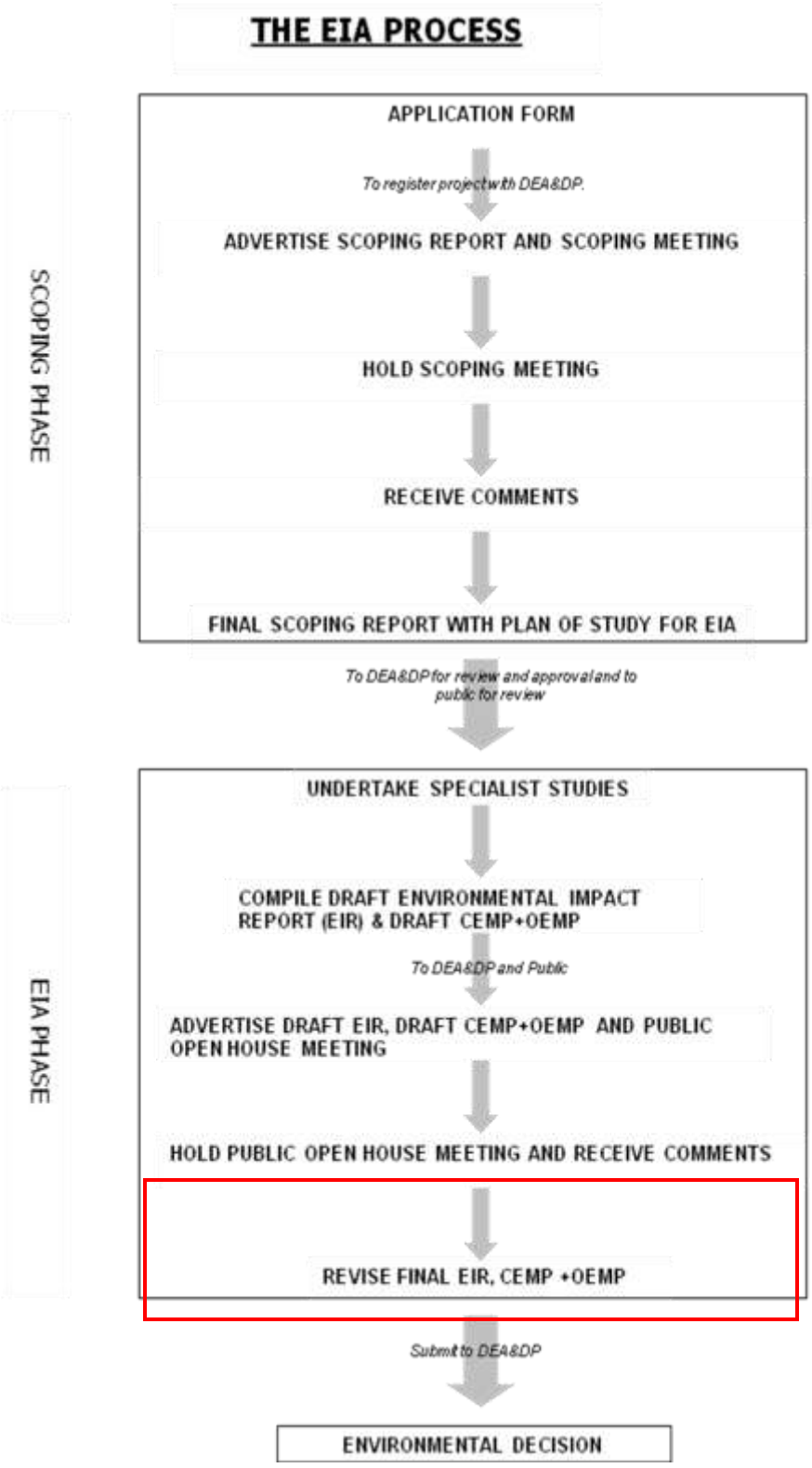

Figure 3: The EIA Process. Currently, this process is in the 'EIA Phase – Compile draft Environmental Impact Report (EIR) and draft CEMP an OEMP', as indicated in red.

3.3 NATIONAL HERITAGE RESOURCES ACT

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act No. 25 of 1999). South African National Heritage Resources Agency (SAHRA) is the enforcing authority.

In terms of Section 38 of the National Heritage Resources Act, SAHRA will require a Heritage Impact Assessment (HIA) where certain categories of development are proposed. Section 38(8) also makes provision for the assessment of heritage impacts as part of an EIA process and indicates that if such an assessment is found to be adequate, a separate HIA is not required.

The National Heritage Resources Act requires relevant authorities to be notified regarding this proposed development, as the following activities are relevant:

- *any development or other activity which will change the character of a site exceeding 5 000 m² in extent;*
- *the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length*

Furthermore, in terms of Section 34(1), no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the SAHRA, or the responsible resources authority. Nor may anyone destroy, damage, alter, exhume or remove from its original position, or otherwise disturb, any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority, without a permit issued by the SAHRA, or a provincial heritage authority, in terms of Section 36 (3). In terms of Section 35 (4), no person may destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object, without a permit issued by the SAHRA, or the responsible resources authority.

3.4 EIA GUIDELINE AND INFORMATION DOCUMENT SERIES

The following are the latest guidelines and information Documents that have been consulted:

- Department of Environmental Affairs and Development Planning's (DEA&DP) *Environmental Impact Assessment Guideline and Information Document Series (Dated: March 2013)*:
  - ✓ *Guideline on Transitional Arrangements*
  - ✓ *Generic Terms of Reference for EAPs and Project Schedules*
  - ✓ *Guideline on Alternatives*
  - ✓ *Guideline on Public Participation*
  - ✓ *Guideline on Exemption Applications*
  - ✓ *Guideline on Appeals*
  - ✓ *Guideline on Need and Desirability*

- Department of Environmental Affairs and tourism (DEAT*) Integrated Environmental Management Information Series*

3.5 NATIONAL WATER ACT

Besides the provisions of NEMA for this EIA process, the proposed Waste Water Treatment Works also requires authorizations under the National Water Act (NWA) (Act N0. 36 of 1998). The Department of Water Affairs, who administer that Act, will be a leading role-player in the EIA.

According to the Freshwater Impact Assessment (**Appendix 4B**), the NWA guides the management of water in South Africa as a common resource. The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact on water resources through the categorisation of 'listed water uses' encompassing water abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where the DWS is the administering body in this regard.

Defined water use activities require the approval of DWS in the form of a General Authorisation or Water Use Licence authorisation. Government Notice No. 665 of 6 September 2013 provides for General Authorisations for certain specified water use activities in terms of the disposal of wastewater which then do not require a licensing process. There are restrictions on the extent and scale of listed activities for which General Authorisations apply.

Section 22(3) of the National Water Act allows for a responsible authority (DWS) to dispense with the requirement for a Water Use Licence if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other law.

Potential water use activities that are of relevance to the proposed upgrade activities for the WWTW are:

- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(e): Engaging in a controlled activities, identified as such in Section 37(1)(a): Irrigation of any land with waste or water containing waste generated through any industrial activity by a waterwork;
- Section 21(f): Discharge of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

DWS will need to be approached to provide guidance on which water uses would need to be applied for an authorised.

3.6 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) is part of a suite of legislation falling under NEMA, which includes the Protected Areas Act, the Air Quality Act, the Integrated Coastal Management Act and the Waste Act. Chapter 4 of NEMBA deals with threatened and protected ecosystems and species and related threatened processes and restricted activities. The need to protect listed ecosystems is addressed (*Section 54*).

4. ALTERNATIVES

Various alternatives have been considered during the Scoping phase and these are described below.

4.1 SITE AND ACTIVITY ALTERNATIVES FOR THE PROPOSED WASTE WATER TREATMENT WORKS

After much investigation, only two viable alternatives have been considered. The two alternatives are as follows:

- The construction a new WWWT on Farm Olynfontein No.475 Portion 3 (Alternative 1 – preferred alternative)
- Upgrading of the existing Postmasburg WWTW (Alternative 2)

These are indicated in Figure 3 below.

Alternative 1 (Preferred alternative):
This is the option of construction a new Waste Water Treatment Works on Farm Olynfontein No.475 Portion 3, and a new main sewer line from the existing Postmasburg pump station.

Technically and financially (in terms of future Operation and Maintenance costs) this is the preferred option. The reason for this is that the chosen site allows the total sewage load of the town (with the exception of Boichoko) to flow to the wastewater treatment plant under gravity.

This also has the advantage that the municipality will be able to eliminate 4 of their 6 wastewater pump stations. This will firstly generate an annual saving of about R5 million per annum just on the cost of electricity. Secondly it will eliminate 4 operational points which require constant electrical and mechanical maintenance.

Thirdly, it will reduce the risks associated with sewage spills which currently occur on a weekly basis, as these pump stations are operating at their design limits due to the unprecedented growth experienced by Postmasburg. With a number of residential developments being planned in Postmasburg, these developments will put additional strain on the pump stations increasing the risk for spills.

Alternative 2:
The only other viable option is to extend the capacity of the existing wastewater treatment plant (4.8Ml/day) by doubling its capacity to9.8Ml/day. This will cost approximately the same as the construction of the new proposed WWTW (Alternative 1). The reason for this being that the current plant's inlet works has reached its design capacity which means that the entire plant must be duplicated to achieve the required treatment capacity.

There is sufficient space at the current site to do this, however, it would entail substantial blasting as the site is basically a calcrete koppie.

This alternative is also not preferred as it will continue to require that all sewage generated in the town of Postmasburg be pumped. This will require that at least 4 of the six pump stations be upgraded to

increase their capacity by at least 50%. Given that Postmasburg Pump station No.1 has a sump of 11m in depth, this will entail major construction works on a very constricted site at great cost.
If the lifecycle cost of a pump is considered over 20 years, 85% of the cost is for energy (electricity), 10% for the initial capital investment and 5% for maintenance. The continued use of the pump stations will also require continued electrical and mechanical maintenance.

This alternative is also not preferred as the existing site has no more space for the safe disposal of the treated effluent. The current naturally occurring pans which are used to evaporate the treated effluent have been overflowing since May 2014. This overflowing treated effluent is now flowing onto the roads and stormwater system of the Airfield residential suburb. Although the water is of good quality, the continuous flooding of the roads and streets of Airfield will eventually lead to their premature failure. This issue can only be addressed by constructing a pipeline from the existing works to the Groenwaterspruit at an additional cost of R12 million, as this water needs to be disposed of and the future flows cannot be accommodated at the pans any more.

Figure 4: Aerial image showing the various alternatives that were considered and investigated

4.2 NO-GO ALTERNATIVE

This is the option of not developing the proposed Waste Water Treatment Works. Although this might result in no potential negative environmental impacts, the direct and indirect socio-economic benefits of not constructing the WWTW will not be realised. As described in *Section 2.1*, future expansion and development of the town of Postmasburg, and as a result, mining operations in the area, will be limited in future.

According to the Freshwater Impact Assessment (**Appendix 4B**), the 'No-Go' alternative would imply not developing the proposed WWTW. This alternative would result in no additional potential negative environmental impacts as a result of the new WWTW and sewer line, however one could expect that there would be impacts associated with the limited capacity of the existing WWTW to treat the wastewater arising from the expanding town as well as increased loading (greater quantities of poor quality water) of the wetland areas and tributary of the Groenwaterspruit Tributary near the WWTW that would result in a gradual degradation of these aquatic ecosystems.

According to the Biodiversity Assessment (**Appendix 4C**), the "No-Go alternative" does not signify significant biodiversity gain or loss especially on a regional basis. However, it will ensure that none of the potential impacts in Section 9 below occur.

The No-Go option will result in continual pollution and health risks, coupled with huge maintenance costs. In addition the current WWTW will still have to be upgraded in order to handle the current and projected sewerage volumes expected. The location of the current works will remain problematic (uncontrolled discharge of raw effluent) and very expensive to operate (pumping costs).

5. SITE DESCRIPTION

5.1 LOCATION

The site of the proposed Waste Water Treatment Works is located on Portion 3 of Farm Olynfontein No. 475, Postmasburg in the Northern Cape. The proposed new sewer line will cross the following erven:

- Erf 1,
- Erf 123,
- Erf 125,
- Erf 126,
- Erf 127,
- Erf 764,
- Erf 779 and
- Erf 1504.

The proposed WWTW will be located approximately 350m south-west of the nearest residential area in Postmasburg.

The site coordinates for the WWTW are: S 28^{o} 20' 23.41", E23^{o} 03' 04.92".

The proposed sewer line starts at the existing Postmasburg pump station located at: S 28^{o} 20' 03.78", E23^{o} 03' 29.53".

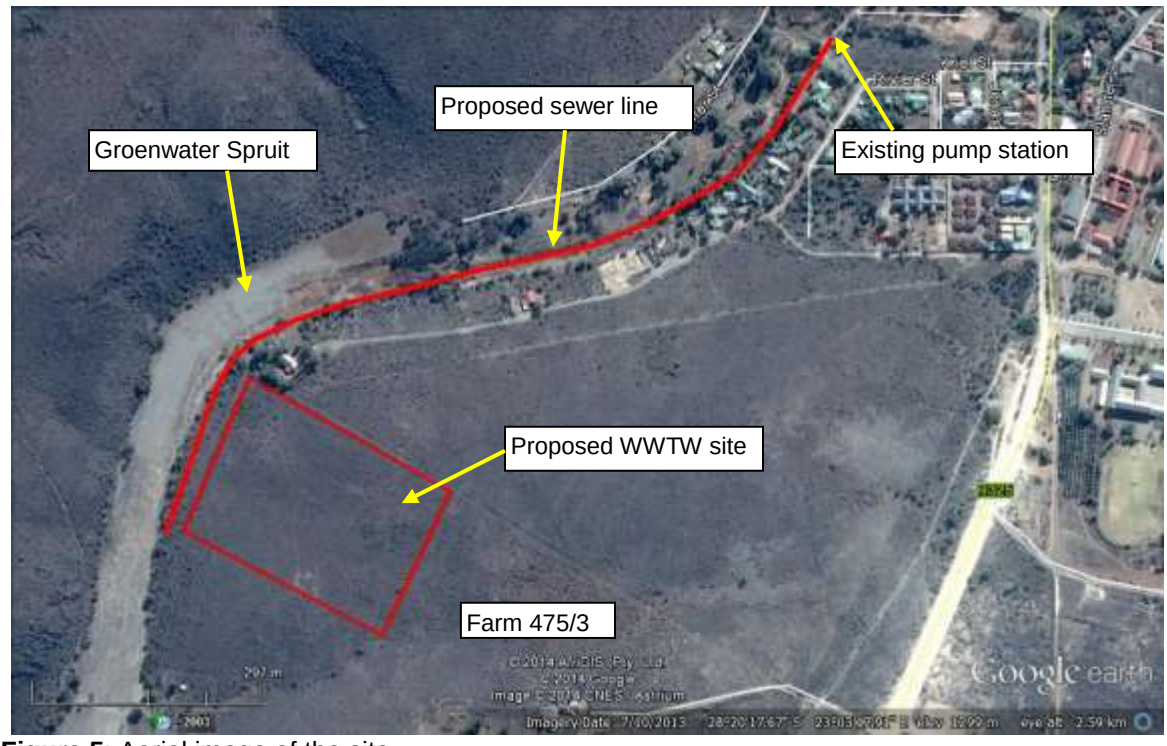

Figure 5: Aerial image of the site.

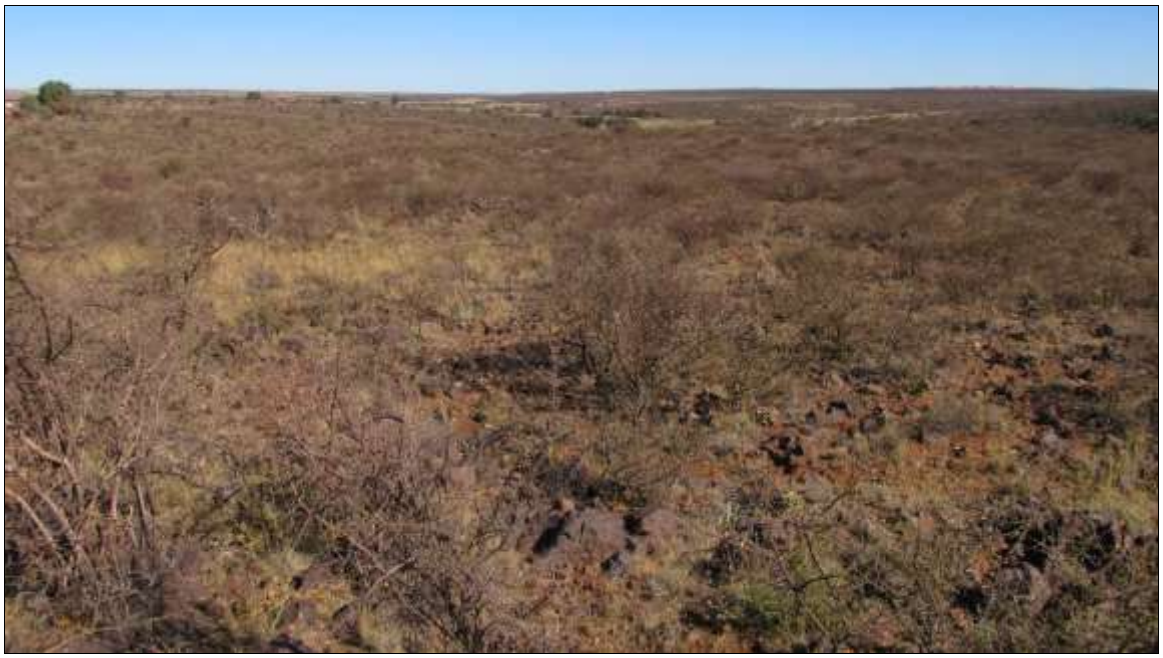

Figure 6: General view of the proposed WWTW site, looking south east

5.2 VEGETATION

From the vegetation map (SANBI BGIS), the vegetation that occurs on the properties is Kuruman Thornveld and Postmasburg Thornveld.

None of these vegetation types are classified in terms of Section 52 (1)(a) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA).

According to the National list of ecosystems that are threatened and in need of protection (GN. 1002 of 9 Dec. 2011), these vegetation types are classified as:

- Kuruman Thornveld - Least threatened.
- Postmasburg Thornveld - Least threatened.

Kuruman Thornveld is described as very well developed, closed shrub layer and well-developed open tree stratum consisting of *Acacia erioloba* on flat rocky plains and some sloping hills.

Postmasburg Thornveld is described as an open, shrubby thornveld characterized by a dense shrub layer, often lacking a tree layer, with a sparse grass layer. Shrubs are normally low with a karroid affinity.

The site of the WWTW is undeveloped and generally near natural. The site of the WWTW is covered relatively densely in Black Thorn/ Swaarthaak (*Acacia mellifera*), which in places has become impregnable.

According to the Biodiversity Assessment (**Appendix 4C**), the thornveld was in relative good condition, but showed signs of having been subjected to stock grazing over time.

The riparian vegetation along the Groenwater Spruit from pump station 1 to the proposed new WWTW location can be described as very degraded and impacted as a result of urban creep and agricultural practices. Apart from a few natural reeds and sedges as well as the occasional *Acacia karroo* and *Searsia lancea* (which were mostly planted as decorative trees), the natural riparian vegetation has been replaced by alien invasive plant species.

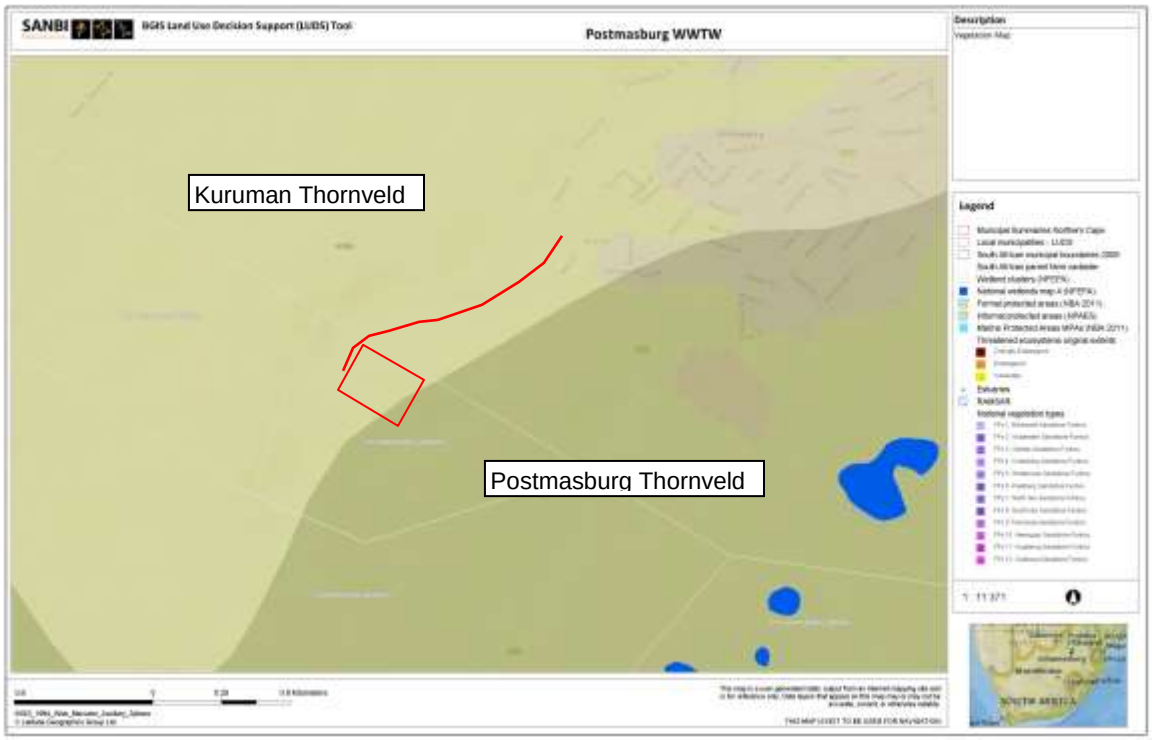

Figure 7: SANBI Vegetation map of the area. The proposed site is indicated by the red polygon and the proposed sewer line by the red line.

According to the Freshwater Impact Assessment (**Appendix 4B**), much of the natural vegetation in and surrounding Postmasburg itself has been lost to urban and peri-urban / agricultural activities. Similarly, the riparian vegetation along the stream is in a modified condition within and immediately upstream and downstream of the town as a result of farming activities taking place along the stream. Trees such as sweet thorn *Acacia karoo,* camel thorn *A. erioloba,* buffalo thorn *Ziziphus mucronata* and a number of alien invasive trees such as mesquite *Prosopis glandulosa* and weeping willow *Salix babylonica* occur.

5.3 FRESHWATER

According to the Freshwater Impact Assessment (**Appendix 4B**), the aquatic features which occur within the study area include the Groenwaterspruit and its smaller tributaries at Postmasburg, and some largely natural pans and artificial wetland areas.

The Groenwaterspruit is a south-west flowing tributary of the Skeifontein River which discharges into the Orange River as the Soutloop River near Boegoeberg. The stream has been significantly modified within the town, with much of the natural indigenous vegetation have been removed and replaced by grassed and cultivated areas. Patches of natural vegetation remain within the Groenwaterspruit and its tributary within the town that tend to be dominated by *A. Karoo* along the banks and *P. australis* and *J. kraussii* within the stream channel. Small ephemeral tributaries and drainage lines also occur within the study area. These features consist of small channels with terrestrial vegetation and little to no visible aquatic habitat.

The wetland areas consist of some natural depression wetland features as well as artificial wetland areas that are associated with the existing WWTW and dominated by *P. australis*. The freshwater features tend to be seasonal, mostly only carrying during the rainy season (March-April) although more permanent wetland areas exist that are linked to the existing WWTW.

5.4 GEOLOGY

According to the Geo-hydrological Impact Assessment (**Appendix 4A**), the Lime Acres member of the Ghaap Plateau Formation outcrops and extensively underlies the study area. The lithology consists of dolomites, limestone and chert. Postmasburg is located on the axis of the Marimane Anticline, and the Ghaap Plateau Formation outcrops along this fold axis.

The Lime Acres Member is overlain by the Kuruman Member of the Asbestos Hills Formation. Outcrops of the Gamagara Formation occur west of Postmasburg and these consist of shale, flagstone, quartzite and conglomerate.

Large parts of the study area are covered by relatively recent deposits of surface limestone, calcrete and windblown sand. The windblown sand occurs particularly to the east, west and south of the town along the flanks of the Asbestos Hills Formation.

Intrusions in the area consist of dolerite and diabase dykes which are commonly associated with fault zones. Kimberlite pipes also occur which are mined for diamonds in some instances.

5.5 GEOHYDROLOGY

The Geo-hydrological Impact Assessment (**Appendix 4A**) describes the geohydrology of the area as such:

- **Aquifers**

Secondary aquifers are prevalent in the area (refer to Map 5 of Geo-hydrological Impact Assessment (**Appendix 4A**)). Fractured (secondary) aquifers are associated with the joints and fractures caused by intrusions (dolerite, diabase and kimberlite), cooling of igneous and volcanic bodies and faulting. The presence of limestones and dolomite means that karst aquifers also prevail. Solution cavities form within these carbonaceous rocks, particularly along fracture zones and geological contacts. These aquifers form a significant source of water for municipal, domestic and agricultural supply. Additionally groundwater is also found in the upper weathered zone which generally extends to a depth of 25 m below ground level.

- **Groundwater Quality**

Groundwater quality in the area is good and reports show that all field Electrical Conductivity (EC) measurements were less than 150 mS/m, making it Class 1 water, suitable for long term human consumption. It was also stated that higher EC values can generally be linked to groundwater pollution from potential sources such as the WWTW, homesteads, kraals, overflowing dams and stock water points and pans.

The regional EC is between 70 and 300 mS/m. The pH of the groundwater is alkaline (between 7.5 and 8.5) and the EC ranges from a very low 37.5 mS/m at the Soetfontein Spring to 204 mS/m at the Makoudam borehole. All the other boreholes EC values are between 108 mS/m and 153 mS/m.

- **Groundwater Abstraction**

Aquifer type and yields from the DWS Hydrogeological Map Series are presented in Map 7 of the Geo-hydrological Impact Assessment and indicate that yields in the study area range between 0.5 and 2 L/s and the groundwater is abstracted from a Karst aquifer. From more detailed investigations and pumping tests presented in previous literature it is evident that yields are greater than 2 L/s. Sustainable yields vary between 2 and 15 L/s (pumping 24 hours per day i.e. non-stop) for yield tested boreholes in the study area.

- **Groundwater Vulnerability**

The vulnerability rating of the aquifer is presented in Map 8 of the Geo-hydrological Impact Assessment. The groundwater in the area has high to very high vulnerability to surface based contamination. This is to be expected as a result of high hydraulic conductivity and the extensive nature of the karst aquifers.

- **Aquifer Classification**

The land proposed for the construction of the new WWTW is located on what is classified as a Major Aquifer. The Karst aquifers are highly permeable, are able to support high yielding boreholes and have a good water quality with regard to EC (generally less than 150 mS/m). The aquifer is also believed to be extensive in nature as evidenced from the pumping test results. Farmers in the area are entirely dependent on groundwater for their domestic use and for agricultural purposes.

5.6 CLIMATE

The Postmasburg area is typically a semi-desert area characterised by hot summers and cold dry winters. Rains occur in the summer and autumn, and frost is frequent in the winter.

The area receives approximately 330mm of rain per year with 80% rainfall between November and April.

It receives the lowest rainfall in July and the highest (81mm average) in February. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Postmasburg range from 17°C in June and July to 30°C in January. The region is the coldest during June and July when the temperature drops to 1°C on average during the night.

According to the Freshwater Impact Assessment (**Appendix 4B**), the area normally receives about 269mm of rain per year, with most rainfall (80%) occurring mainly during summer and autumn (November to April) with very dry winters. The lowest rainfall (0mm) occurs in July and the highest (76mm) in February. The rainfall commonly takes place in the form of thunder showers with a rapid increase in storm water run-off. The average midday temperatures range from 17°C in June to 30°C in January. The region is the coldest during July when the mercury drops below 1°C on average during the night.

5.7 SOCIO-ECONOMIC CONTEXT

According to the Tsantsabane Local Municipality IDP Review 2014-2015, the Tsantsabane Municipality is characterized by a mixture of land uses of which agriculture and mining is dominant land use within the rural areas. The residential areas vary from the relatively large town of Postmasburg to small scattered rural communities. Some of these communities are the remains of

railway stations.

The population figures in terms of census 2011 is 35093 compare to 31014 in 2001 (the current estimated population is approximately 42 000). The male population has increased with 24% while the female population has increased with only 2.7% since 2001. This increase can be relatively influenced by job migration and other factors.

According to the stats the unemployment figure has drastically reduced from 4466 in 2001 to 3795 in 2011 which shows a decrease of -15%. Employment has increase with 69% in 2011, which translates in more people working in 2011 than 2001. If the jobs are permanent then it attributes to higher level of skills.

Tsantsabane is characterized by a mixture of land uses of which agriculture and mining is dominant within the rural areas. Although diamonds have been mined here since 1892, the most important mineral currently mined is manganese. The residential areas vary between relatively large town (Postmasburg) to small scattered rural communities – some the remains of railway stations.

5.8 HERITAGE FEATURES

According to the Heritage Impact Assessment (HIA) (**Appendix 4D)** thirty four stone implements were encountered during the baseline study, but none of these were found in the proposed sewer pipeline alongside the Groenwater Spruit.

A few isolated banded ironstone flakes and chunks were found on the rocky slopes and small outcrops alongside the proposed route, while the majority of the finds were encountered in the small strip of land cleared alongside the fence line including a very diffuse scatter.

Only eight implements were found in the proposed footprint area for the sewerage treatment works on top the kopje above the proposed pipeline route, overlooking the Groenwater Spruit. These include several retouched and utilized flakes chunks and two cores including one MSA disc core.

No visible graves or typical surface grave markers were found in the pipeline route or associated infrastructure

There are no other old buildings, structures or features older than 60 years that will be impacted by proposed construction activities.

6. PROCESS TO DATE

The section below outlines the various tasks undertaken to date, the members of the team involved in the project, as well as the Public Participation Process.

6.1 TASKS UNDERTAKEN TO DATE

Table 1: Tasks undertaken in the EIA to date

DATE	TASK
SCOPING PHASE	
06 October 2014	Submit Application Form to DE&NC
20 October 2014	Received acknowledgement from DE&NC
21 October 2014 – 10 December 2014	Initial public participation, including newspaper advertisements, posters, letter drops and notification letters to identified interested and affected parties. Distribution of notification letters and the Draft Scoping Report to Registered Interested and Affected Parties
10 December 2014	40-day comment period ends.
December 2014 – January 2015	Compile the Final Scoping Report and make available for comment to registered Interested and Affected Parties.
28 January 2015	Distribution of Notification Letter and Comments and Response Report to all registered I&APs.
03 March 2015	21-day comment period ends
25 March 2015	Submit Final Scoping Report to DE&NC.
27 July 2015	Acceptance of Scoping report and Plan of Study for EIA (Appendix 1B)
	Undertake Specialist Studies where required

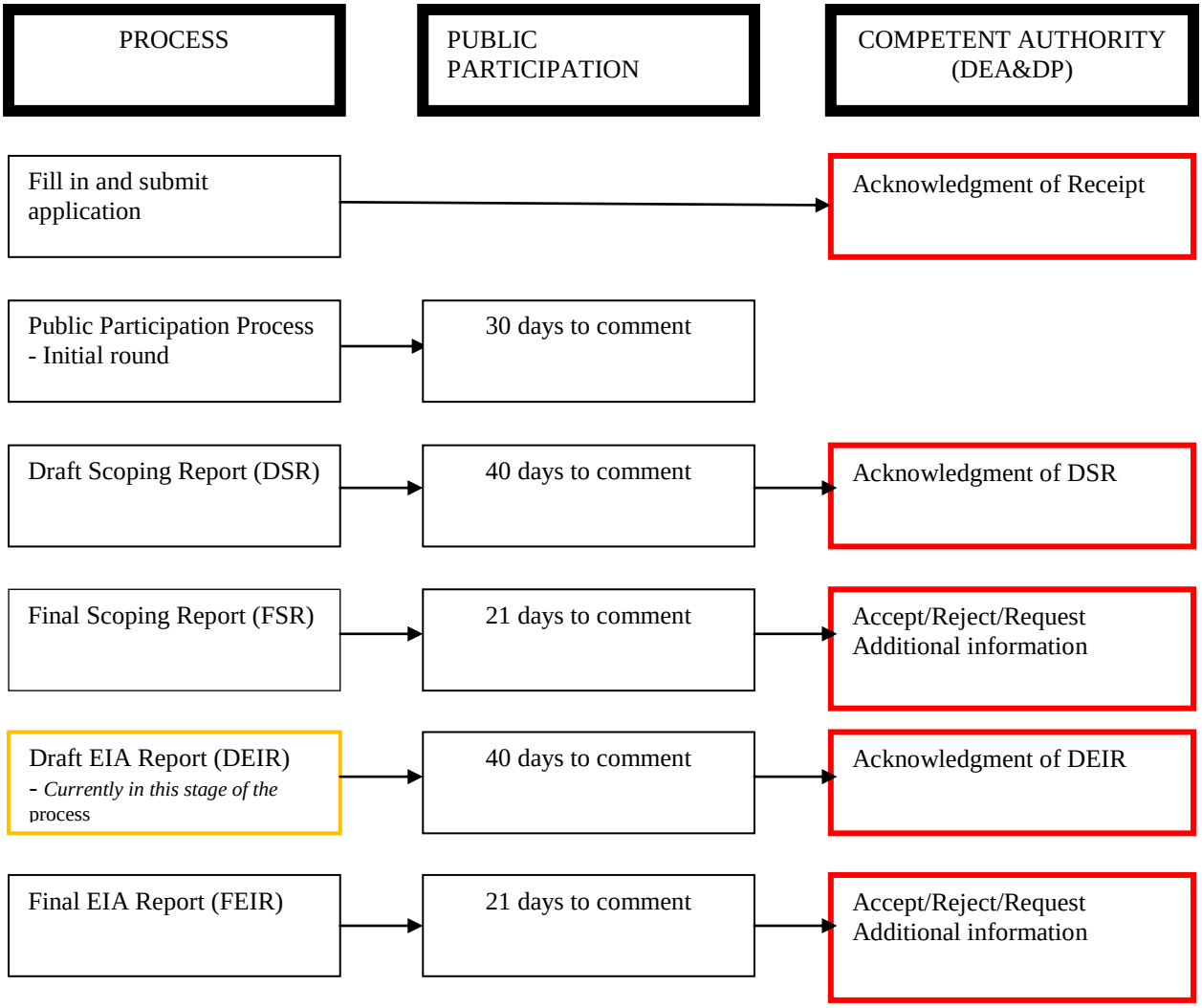

Figure 8. Summary of the EIA process and public participation process. The red indicates the stages where the competent authority will be consulted during the process.

6.2 TASKS TO BE UNDERTAKEN DURING THE EIA PHASE

The following tasks must still be undertaken during the EIA phase of the process:

- Compile Draft Environmental Impact Report (EIR) for public comment based on specialist information (THIS DOCUMENT).
- Advertise Draft EIR for public comment
- Distribute and/or make the Draft EIR available for viewing and comment
- Receive comments on Draft EIR. All comments received and responses to the comments will be incorporated into the Final Environmental Impact Report (EIR).
- Preparation of a FINAL EIR for submission to DE&NC for consideration and decision-making.

Please refer to Figure 8 to see where the public participation process is present in the environmental impact assessment. The Interested and Affected Parties will have a chance to view and comment on all the reports that are submitted. The figures also indicated what timeframes are applicable to what stage in the process. If required, meetings with key stakeholders will be held.

At the end of the comment period, the EIR will be revised in response to feedback received from I&APs. All comments received and responses to the comments will be incorporated into the Final Environmental Impact Report (EIR). The Final EIR will then be submitted to DE&NC for consideration and decision-making.

Correspondence with I&APs will be via post, fax, telephone, email and newspaper advertisements.

Should it be required, this process may be adapted depending on input received during the on-going process and as a result of public input. DE&NC will be informed of any changes in the process.

6.3 PROFESSIONAL TEAM

The following professionals are part of the project team.

Table 2: Members of the professional team

DISCIPLINE	SPECIALIST	ORGANISATION
Environmental Consultants	Clinton Geyser / Bernard de Witt	**EnviroAfrica**
Consulting Engineers	Gert Meiring	**BVi Engineering**
Botanist	Peet Botes	**PB Consult**
Freshwater	Dana Grobler	**Blue Science**
Heritage	Jonathan Kaplin	**Agency for Cultural Resource Management**
Geo-hydrological	Julian Conrad, Charles Peek and Dale Barrow	**GEOSS – Geohydrological and Spatial Solutions International (Pty) Ltd**

6.4 PUBLIC PARTICIPATION

A Public Participation Process was undertaken in accordance with the requirements of the NEMA Environmental Impact Assessment Regulations: Guideline and Information Document Series. *Guidelines on Public Participation 2013*. Issues and concerns raised during the Scoping phase are dealt within this report

6.4.1 PUBLIC PARTICIPATION UNDERTAKEN DURING SCOPING PHASE:

Interested and Affected Parties (I&APs) were identified throughout the process. Landowners adjacent to the proposed site, relevant organs of state, organizations, ward councillors and the Local and District Municipality were added to this database. A complete list of organisations and individual groups identified to date is shown in **Appendix 2A.**

Public Participation was conducted for the proposed development in accordance with the requirements outlined in Regulation 54 and 55 and 56 of the NEMA EIA Regulations, as well as the Department of Environmental Affairs and Development Planning's guideline on Public Participation 2013. The issues and concerns raised during the scoping phase will be dealt with in the EIA phase of this application.

As such each subsection of Regulation 54 contained in Chapter 6 of the NEMA EIA Regulations will be addressed separately to thereby demonstrate that all potential Interested and Affected Parties (I&AP's) were notified of the proposed development.

R54 (2) (a):

R54 (2) (a) (i): A poster was displayed on the property fence near the farm entrance of the proposed site. Posters were also be placed at conspicuous sites in Postmasburg, including at the Spar shopping centres, post office in Postmasburg and at the Tsantsabane Municipality offices (please refer to **Appendix 2D**)

The posters contained all details as prescribed by R56 (3) (a) & (b) and the size of the on-site poster was 60cm by 42cm as prescribed by section 56 (4) (a).

R54 (2) (a) (ii): N/A. There is no alternative site.

R54 (2) b):

R54 (2) (b) (i): An initial notification letter was sent to the landowner/s (please refer to **Appendix 2C** for proof of notification letters sent).

R54 (2) (b) (iii): Initial notification letters will be delivered to landowners and occupiers adjacent to the site (please refer to **Appendix 2C** for proof of notification letters sent).

R54 (2) (b) (iv): An initial notification letter was sent to the municipal Ward councillor at the Tsantsabane Municipality, for the ward in which the site is situated (please refer to **Appendix 2C** for proof of notification letters sent).

R54 (2) (b) (v): An initial notification letter was sent to the Municipal Manager of Tsantsabane Municipality as the municipality is the Applicant

R54 (2) (b) (vi): Initial notification letter (please refer to **Appendix 2C** for proof of notification letters sent) will be sent to the following organs of state having jurisdiction in respect of any aspect of the activity:

- Department of Water Affairs

- Department of Agriculture and Land Reform
- Department of Roads and Public Works
- Department of Agriculture, Forestry and Fisheries
- Department of Environment and Nature Conservation: Waste Management

R54 (2) (c) (i): An advertisement was placed in the local newspaper, Kalahari Bulletin, on 30 October 2014 (please refer to **Appendix 2B** for proof of advertisement).

R54 (2) (d): N/A

R54 (7):
R54 (7) (a): All relevant facts in respect of the application were made available to potential I&AP's.

R54 (7) (b): I&AP's were given more than a 40-day registration and comment period on the proposed application during the first round of public participation for the Draft Scoping Report. A 21 day comment period was given for the Final Scoping Report. A copy of the Draft Scoping Report was made available at the Postmasburg Public Library (**Appendix 2C**)

R55 (1) (a), (b), (c) and R56(2): A register of interested and affected parties was opened, maintained and is available to any person requesting access to the register in writing (please refer to **Appendix 2A** for the list of Interested and Affected Parties.

6.4.2 PUBLIC PARTICIPATION UNDERAKEN DURING THE EIA PHASE:

A number of groups and individuals were identified as Interested and Affected Parties during the initial Public Participation Process. A complete list of organisations and individual groups identified to date, as well as those I&APs that have registered are shown in **Appendix 2A.**

Full copies of the EIR will be sent to all Registered I&APs, and will be notified of the Environmental Impact Report (EIR) by means of notification letters (via preferred method of communication), informing them of the availability of the Draft EIR and will be invited to comment. In addition, advertisements will be placed in Kalahari Bulletin. The EIR will be made available for a 40-day comment period.

At the end of the comment period, the EIR will be revised in response to feedback received from I&APs. All comments received and responses to the comments will be incorporated into the Final Environmental Impact Report (Final EIR) in the form of a Comments and Response Table. The Final EIR will be made available for a further 21-day comment period. The Final EIR will then be submitted to DEA&DP for decision.

Should it be required, this process may be adapted depending on input received during the ongoing process and as a result of public input. Both DENC and registered I&APs will be informed of any changes in the process.

6.4.3 INTERESTED AND AFFECTED PARTIES

Interested and Affected Parties (I&APs) have been notified by means of advertisements in regional and local newspapers, site notices and letters and/or emails to registered I&APs on the project database.

A list of I&APs is included as **Appendix 2A**.

7. ENVIRONMENTAL ISSUES AND POTENTIAL IMPACTS

Environmental issues were raised through informal discussions with the project team, specialists and authorities. All issues raised will be assessed in the specialist reports and will form part of the Environmental Impact Report. Additional issues raised during the public participation will be listed in the Final Environmental Impact Report.

The following potential issues have been identified:

7.1 BIODIVERSITY

7.1.1 BOTANICAL

A Biodiversity Impact Assessment (Appendix 4C) will be conducted to determine if there is any sensitive or endangered vegetation on the proposed site. Due to the size of the development (approximately 10ha), there will be a loss of vegetation during the construction phase of the project.

A Biodiversity scoping assessment will be conducted, which will describe and assess the botanical sensitivity of the area. The terms of reference for this study required a baseline analysis of the flora of the property, including the broad ecological characteristics of the site.

The botanical assessment will include the following:

- The significance of the potential impact of the proposed project, alternatives and related activities – with and without mitigation – on biodiversity pattern and process at the site, landscape and regional scales.
- Recommended actions that should be taken to prevent or, if prevention is not feasible, to mitigate impacts.

7.1.2 FAUNA

Mammal and bird species was not regarded as the proposed activity is not expected to have any significant, permanent impact on these species.

However, fauna will be assessed as part pf the Biodiversity assessment, and no further faunal assessments are deemed necessary.

7.2 FRESHWATER

Due to the size and nature of the development and the location of the proposed Waste Water Treatment Works and sewer line in close proximity to the Groenwater Spruit, a freshwater impact assessment (**Appendix 4B**) will be conducted.

The terms of reference for the Freshwater assessment are as follows:

- Literature review and assessment of existing information
- Site Assessment of the proposed activities and impact on the associated freshwater systems. This will include an assessment of the freshwater ecological condition, using river health indices such as in-stream and riparian habitat integrity, aquatic macro-invertebrates and riparian vegetation to determine set back lines and geomorphological condition of the

streams, which will then determine the overall Ecostatus of the streams and provide data that will inform the Water Use Licence Application of the project. This will include both the stream to be impacted by the dam development and the pump station establishment.
- Describe ecological characteristics of freshwater systems and compile report based on the data and information collected in the previous two tasks, describe ecological characteristics of the freshwater systems, comment on the conservation value and importance of the freshwater systems and delineate the outer boundary of the riparian zones/riverine corridors.
- Evaluate the freshwater issues on the site and propose mitigation measures and measures for the rehabilitation of the site as well as setback lines for future development.
- Compilation of the documentation for submission of the water use authorisation application (WULA) to the Department of Water Affairs (if deemed necessary).

7.3 HERITAGE

The possible impact on heritage resources has been identified as a possible environmental impact as a result of the construction of the Waste Water Treatment Works and sewer line.

A Heritage Impact Assessment (Appendix 4D) will be conducted on the site.

The terms of reference for the heritage and archaeological study are as follows:
- To determine whether there are likely to be any important archaeological sites or remains that might be impacted by the proposed development;
- To identify and map archaeological sites/remains that might be impacted by the proposed development;
- To assess the sensitivity and conservation significance of archaeological sites/remains in the inundation area;
- To assess the status and significance of any impacts resulting from the proposed development, and
- To identify measures to protect any valuable archaeological sites/remains that may exist within the estimated inundation area.

7.4 VISUAL IMPACT

The potential impact on the sense of place of the proposed Waste Water Treatment Works and sewer line will also be considered. However, due to the nature of the activity, the surrounding land-uses and the proximity of any significant settlements to the site, and that the sense of place is not expected to be significantly altered by the proposed Waste Water Treatment Works, no further studies were suggested.

7.5 GEOHYDROLOGY

Due to the potential geohydrological impacts of the proposed Waste Water Treatment Works, the treatment works itself and the associated discharge of the treated effluent will need to be assessed in a Geo-hydrological Impact Assessment (**Appendix 4A**).

This includes assessing groundwater characteristics, quality and flow directions of the area as well as an assessment of the potential groundwater impacts based on the planned quantity and quality of the final effluent to be discharged.

7.6 OTHER ISSUES AND IMPACTS

The proposed Postmasburg Waste Water Treatment Works has the following additional impacts:

7.6.1 ENERGY REQUIREMENTS

Construction energy requirements:

The proposed Postmasburg Waste Water Treatment Works comprises the construction of several small to medium sized concrete structures. Subsequently, the initial energy requirements of the project will basically be limited to the use of small power tools typically to be powered by a portable on-site generator. Typically, the size of such a generator would not exceed 15KVA.

Operational phase energy requirements:

The proposed treatment plant is to be constructed in phased modules of 5 Megaliter capacity each. It is proposed that the first phase comprise two complete modules of 5 Megaliter capacity each. The operational energy estimate for each of these modules is based on measurements taken at the existing Postmasburg WWTP in 2011. The existing plant has a treatment capacity of 4,8Megaliters per day and consumes approximately 135 000kW.h per month with a maximum demand of 513 KVA. If these measured figures are extrapolated to the new size of the proposed treatment plant, which will utilize basically the same technology, it is expected that the average monthly consumption will be approximately 330 000kW.h per month with an expected maximum demand of around 1MVA.

Source of power:

The power supply for the proposed new treatment plant has two possible sources. The preferred option would be to source electricity from the existing municipal 11kV Medium Voltage network which is already available on the proposed WWTP site.

The second available option is to source electricity directly from ESKOM, but this will require a new MV line to be constructed from the ESKOM network.

7.6.2 WATER REQUIREMENTS

Construction water requirements:

It is estimated that an amount in the order of 10 - 15 kiloliter per day will be required for construction purposes for a period of 18 – 24 months.

Operational phase water requirements:

During the operational phase, it is estimated that no more than 20 kiloliter per day will be required on average. Potable water on a WWTW is mostly used for drinking water and ablutions/showers, preparation of meals, etc by operational staff.

Irrigation of the grounds such as lawns and trees, etc is normally done using treated effluent.

There are 3 existing boreholes within close proximity of the site which could be utilized as source during the construction period.

It is envisaged that a dedicated potable water supply pipeline will be constructed from the existing municipal network as permanent water supply to the proposed WWTP on completion of construction.

7.6.3 NATURE AND QUANTITY OF RAW MATERIALS

This project comprises the construction of several small to medium sized concrete structures. Subsequently several hundreds of cubic meters of crushed stone and sand will be utilized together with several hundred tons of reinforcing steel as input materials during construction.

Exact quantities can only be determined once detailed designs of the structures have been completed.

This treatment plant is not expected to utilize any raw materials during the operational phase.

7.6.4 WASTE TYPES, QUANTITIES AND DISPOSAL METHODS

Construction Phase

As this is a "greefields" project, there are no existing structures to be demolished. It is therefore envisaged that very little building rubble and waste will be generated during construction. Typically, losses of raw materials due to transport, stockpiling on site and conveyance losses amount to approximately 5% of the volumes required. A best estimate at this point in time is that some 200m^3 of solid waste will be generated during the construction period. This waste will typical be builders rubble, concrete debris, timber from used shutters, etc. The waste will be stockpiled on site and periodically disposed of at the Postmasburg Solid Waste landfill site by the contractor.

Operational Phase

During the operational phase of a WWTW there are two waste streams, i.e.: The treated effluent and waste sludge. An application will be submitted to the Department of Water and Sanitation to dispose of the treated effluent by discharging it into the Groenwater Spruit.

The waste sludge is basically a stable aerobic biomass which is dewatered and then dried on sludge drying beds to a stable, dry, granular product. The dried sludge can be used as an organic fertilizer or composted to further stabilize it. Typically, there is no market for this product and it will be disposed of at the Postmasburg Solid Waste landfill site. In terms of quantity, it is extremely difficult to quantify accurately, as it is highly dependent on the quality of the raw sewage entering the plant. A typical estimate is based on what is generated at the existing works and then extrapolated to what we expect. Typically, approximately 4 drying beds of dried sludge will be removed daily, this equates to a volume of approximately 15m^3 per day. Given that the first phase of the new WWTW is to be double the existing plant, it is estimated that the dry sludge production will be in the order of 30 – 45m^3/day.

7.6.5 EMPLOYMENT OPPORTUNITIES

Construction Phase

During the construction phase it is envisaged that some 60 temporary jobs will be created for a period of 18 months.

Operational Phase

During the operational phase, a typical shift will consist of a Senior Operator + Shift Assistant x 4 shifts (3 duty + 1 standby) = 8 persons. An additional 10 – 15 labourers and 1 Supervisor will be required for daily plant maintenance and keeping the grounds tidy. Typically, the fixed personnel component for a plant this size will be 25 to 30 persons employed on a full time basis.

8. SPECIALIST STUDIES

Based on the issues raised by the I&APs and the project team, specialist studies were undertaken to provide information to address the concerns and assess the impacts of the proposed development alternatives on the environment.

The specialists are provided with set criteria for undertaking their assessments, to allow for comparative assessment of all issues. These criteria are detailed in the Terms of Reference to each specialist and summarised below.

8.1 CRITERIA FOR SPECIALIST ASSESSMENT OF IMPACTS

These criteria are based on the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act No. 73 of 1989.

These criteria include:

- **Nature of the impact**
  This is an appraisal of the type of effect the construction, operation and maintenance of a development would have on the affected environment. This description should include what is to be affected and how.
- **Extent of the impact**
  Describe whether the impact will be: local extending only as far as the development site area; or limited to the site and its immediate surroundings; or will have an impact on the region, or will have an impact on a national scale or across international borders.
- **Duration of the impact**
  The specialist should indicate whether the lifespan of the impact would be short term (0-5 years), medium term (5-15 years), long terms (16-30 years) or permanent.
- **Intensity**
  The specialist should establish whether the impact is destructive or benign and should be qualified as low, medium or high. The specialist study must attempt to quantify the magnitude of the impacts and outline the rationale used.
- **Probability of occurrence**
  The specialist should describe the probability of the impact actually occurring and should be described as improbable (low likelihood), probable (distinct possibility), highly probable (most likely) or definite (impact will occur regardless of any prevention measures).

The impacts should also be assessed in terms of the following aspects:

- **Status of the impact**
  The specialist should determine whether the impacts are negative, positive or neutral (“cost – benefit” analysis). The impacts are to be assessed in terms of their effect on the project and the environment. For example, an impact that is positive for the proposed development may be negative for the environment. It is important that this distinction is made in the analysis.

- **Accumulative impact**
  Consideration must be given to the extent of any accumulative impact that may occur due to the proposed development. Such impacts must be evaluated with an assessment of similar developments already in the environment. Such impacts will be either positive or negative, and will be graded as being of negligible, low, medium or high impact.
- **Degree of confidence in predictions**
  The specialist should state what degree of confidence (low, medium or high) is there in the predictions based on the available information and level of knowledge and expertise.

Based on a synthesis of the information contained in the above-described procedure, the specialist is required to assess the potential impacts in terms of the following significance criteria:

- **No significance**: the impacts do not influence the proposed development and/or environment in any way.
- **Low significance**: the impacts will have a minor influence on the proposed development and/or environment. These impacts require some attention to modification of the project design where possible, or alternative mitigation.
- **Moderate significance**: the impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures.
- **High significance**: the impacts will have a major influence on the proposed development and/or environment.

The final impact assessment report should at least include the following sections:

- Executive Summary
- Introduction And Description Of Study
- Methodology
- Results
- Assessment Of Impacts (including mitigation measures to reduce negative impacts and measures to enhance positive impacts and the completion of impact tables)
- Discussion
- Recommendations (Pre-Construction, Construction and Operational Phases)
- Conclusion

8.2 BRIEFS FOR SPECIALIST STUDIES TO BE UNDERTAKEN AS PART OF THE EIA

8.2.1 HERITAGE IMPACT ASSESSMENT

Jonathan Kaplan of the Agency of Cultural Resource Management was appointed to compile the Heritage Impact Assessment (HIA) – **Appendix 4D**.

The terms of reference for the archaeological study were:

- To determine whether there are likely to be any important archaeological sites or remains that might be impacted by the proposed development;

- To identify and map archaeological sites/remains that might be impacted by the proposed development;
- To assess the sensitivity and conservation significance of archaeological sites/remains in the inundation area;
- To assess the status and significance of any impacts resulting from the proposed development, and
- To identify measures to protect any valuable archaeological sites/remains that may exist within the estimated inundation area.

8.2.2 FRESHWATER ASSESSMENT

Dana Grobler (Blue Science) has been appointed to undertake the Freshwater Impact Assessment of the proposed site – **Appendix 4B**.

The terms of reference for this study include the following:

- Investigate the impact of the proposed activities and impact on the associated freshwater systems, which will include an assessment of the freshwater ecological condition; using river health indices such as instream and riparian habitat integrity, aquatic macro-invertebrates, riparian vegetation to determine set back lines and geomorphological condition of the streams to determine the overall EcoStatus of the streams and provide data that will inform the Water Use Licence Application of the project. These tasks will include both the stream to be impacted by the dam development and the pump station establishment.
- Describe ecological characteristics of the freshwater systems, comment on the conservation value and importance of the freshwater systems and delineate the outer boundary of the riparian zones/riverine corridors.
- Evaluate the freshwater issues on the site and propose measures for the rehabilitation of the site as well as setback lines for future development. Write up findings and recommendations.

8.2.3 BIODIVERSITY ASSESSMENT

Peet Botes of PB Consult undertook the Biodiversity Assessment – **Appendix 4C**.

The terms of reference for this study include the following:

- Complete a Biodiversity Scan of the proposed site in order to determine whether any significant features will be impacted as a result of the proposed development.
- Make recommendations on impact minimisation should it be required
- Consider short- to long-term implications of impacts on biodiversity and highlight irreversible impacts or irreplaceable loss of species.

The study includes the following:

- A brief discussion of the local environment in order to give some background on the ecological factors influencing the ecological drivers associated with the specific area.
- A brief discussion of the vegetation types expected and encountered with emphasis on protected species encountered.
- A species list encountered during the site visit.
- Determination of the occurrence, or possible occurrence of threatened or sensitive plant species, and sensitive plant communities, on the basis of the field survey and records

obtained from the South African National Biodiversity Institute (SANBI) and available literature.
- Assessment of habitat sensitivity, incorporating faunal distribution on the hand of the field survey and from available literature.
- An evaluation of the potential impact of the proposed project on habitat and species.
- A discussion of significant impacts focusing on possible mitigation and amendments to the development proposal.

8.2.4 GEO-HYDROLOGICAL IMPACT ASSESSMENT

Julian Conrad of GEOSS was appointed to conduct a Geo-hydrological Impact Assessment of the proposed waste water treatment works - **Appendix 4A**.

The primary objective of this study is to complete a geo-hydrological impact assessment of what impacts the proposed developments and disposal of the treated effluent may have.

The groundwater risk characterization is determined by problem identification, receptor characterization, an exposure assessment and a toxicity assessment.

The study involved the following key tasks:

Task 1: Data Collation. This involves obtaining all relevant data to the project (i.e. data from the National Groundwater Archive (NGA), Water Quality Management System and Water Information Management System), geological maps and geo-hydrological maps. This includes reviewing relevant reports and studies pertaining to the Waste Water Treatment Works and study area.

Task 2: Hydrocensus and Site Visit. This involves a site visit and completing a hydrocensus surrounding the treatment works, pipeline and outflow point (i.e. visiting all boreholes on the property and measuring yields and water quality (pH, EC, TDS and ORP). This includes an evaluation of the water quality of the discharged treated effluent and an evaluation of potential contamination sources, pathways and receptors.

Task 3: Data Analysis. All collected data obtained will be analysed using geo-hydrological methods and the groundwater risks were evaluated in relation to the proposed developments.

All the results and findings from the study will be presented in detail within the report.

8.3 ADDITIONAL SPECIALIST INPUT REQUIRED TO INFORM THE EIA

8.3.1 WATER USE LICENCE APPLICATION

As specified in Section 3.5 above, Section 22(3) of the National Water Act allows for a responsible authority (DWS) to dispense with the requirement for a Water Use Licence if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other law.

Potential water use activities that are of relevance to the proposed upgrade activities for the WWTW are:

- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(e): Engaging in a controlled activities, identified as such in Section 37(1)(a): Irrigation of any land with waste or water containing waste generated through any industrial activity by a waterwork;
- Section 21(f): Discharge of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

DWS will need to be approached to provide guidance on which water uses would need to be applied for an authorised.

9. ASSESSMENT OF ENVIRONMENTAL IMPACTS

The specialist studies detailed in Section 12 were undertaken to determine significance of the impacts that may arise from the proposed development. The findings of the specialist studies are summarised here. Full copies of the studies are included in **Appendices 4A – 4D**.

The following specialist studies were undertaken:

9.1 HERITAGE IMPACT ASSESSMENT

Jonathan Kaplan of the Agency of Cultural Resource Management was appointed to undertake an Heritage Impact Assessment (HIA) of the proposed site. The HIA is included as **Appendix 4D**.

9.1.1 KEY FINDINGS

Thirty-four stone implements were recorded during the baseline study, but none were found in the proposed sewer pipeline alongside the Groenwater Spruit (refer to Table 1 in Appendix l & Figure 26 of the HIA).

A few isolated, banded ironstone MSA and LSA retouched/utilized flakes and chunks (Sites 037, 138, 039 & 041) were found on a small outcropping and gravel hill slope alongside the Groenrivier Spruit below a row of houses (Figure 20 of HIA). The gravel hills are covered in broken glass, rusted metal, broken tiles, building rubble and hard plastic that have been discarded by residents over their boundary fences (Figure 21 of HIA). A banded ironstone core and chunk (Site 044) was found among a pile of rocks cleared from alongside the spruit.

A handful of banded ironstone MSA and LSA flakes were recorded in strip of land cleared alongside (i. e. inside) the fence line adjacent to the proposed sewer pipeline (refer to Figures 22-24 of the HIA). All the tools, including several blades, are utilized and/or retouched, but no formal tools such as scrapers, points or adzes were found.

Eight banded ironstone flakes were found in the proposed footprint area for the WWTP overlooking the Groenwater Spruit (refer to Figures 25 of the HIA). The entire kopje is covered with Swarthaak vegetation. The tools comprised retouched and utilized flakes (Sites 061, 062, 064 & 065), two chunks (Sites 068 & 069) and two cores including one MSA disc/prepared core (Site 067).

A banded ironstone chunk (Site 070) was encountered in the alternative pipeline route, which runs directly alongside the gravel road above the existing houses overlooking the Groenwater Spruit.

No visible graves or typical surface grave markers were found in the study area.

There are no old buildings, structures or features older than 60 years that will be impacted by the proposed activities.

According to specialist palaeontologist, Dr John Almond2, the study area is underlain at depth by Precambrian carbonate rocks of the Campbell Rand Subgroup (Ghaap Group & Transvaal

Supergroup) that may contain well-preserved stromatolites (fossil microbial mounds). However, these older bedrocks are mantled here by near-surface calcretes and alluvial deposits of Late Caenozoic age that are generally of low palaeontological sensitivity.

9.1.2 IMPACT ASSESSMENT

The small numbers and isolated context in which the tools were found mean that the archaeological remains have been rated as having low (Grade 3C) significance. The small traces of tools most likely represent flake debris or discarded flakes.

The impact significance of the proposed development as far as palaeontological heritage resources is concerned is assessed as LOW.

9.1.3 MITIGATION MEASURES

With regard to the proposed new, Postmasburg pipeline and Waste Water Treatment Plant, the following recommendations are made:

- No further archaeological mitigation is required
- Should any unmarked human burials/remains or ostrich eggshell water flask caches be uncovered during construction activities, these must immediately be reported to the archaeologist (Jonathan Kaplan 082 321 0172), or Ms Mariagrazia Galimberti at the South African Heritage Resources Agency (021 462 4502). Burials, etc must not be removed or disturbed until inspected by the archaeologist.

9.1.4 CONCLUSION

Construction of the proposed sewer pipeline alongside the Groenwater Spruit will not impact on any important archaeological heritage. A small number of MSA and LSA tools were recorded in a strip of land inside the fence line, alongside the proposed sewer route.

Construction of the proposed WWTP on the kopje overlooking the Spruit will also have a very limited impact on archaeological remains.

No evidence of any factory or workshop site, or the result of any human settlement was identified. No organic remains such as bone, pottery, or ostrich eggshell were found. The tools recorded probably represent discarded flakes or flake debris.

Indications are that in terms of archaeological heritage, the receiving environment is not a sensitive archaeological landscape.

9.2 FRESHWATER IMPACT ASSESSMENT

Dana Grobler (Blue Science) has been appointed to undertake the Freshwater Impact Assessment of the proposed site – The Freshwater Impact Assessment is included as **Appendix 4B**.

9.2.1 KEY FINDINGS

According to the Freshwater Impact Assessment, aquatic features which occur within the study area include the following:

- The Groenwaterspruit and its smaller tributaries at Postmasburg; and
- Some largely natural pans and artificial wetland areas.

The Groenwaterspruit is a south-west flowing tributary of the Skeifontein River which discharges into the Orange River as the Soutloop River near Boegoeberg. The stream has been significantly modified within the town, with much of the natural indigenous vegetation have been removed and replaced by grassed and cultivated areas. Patches of natural vegetation remain within the Groenwaterspruit and its tributary within the town that tend to be dominated by *A. Karoo* along the banks and *P. australis* and *J. kraussii* within the stream channel. Small ephemeral tributaries and drainage lines also occur within the study area. These features consist of small channels with terrestrial vegetation and little to no visible aquatic habitat.

The wetland areas consist of some natural depression wetland features as well as artificial wetland areas that are associated with the existing WWTW and dominated by *P. australis*.The freshwater features tend to be seasonal, mostly only carrying during the rainy season (March-April) although more permanent wetland areas exist that are linked to the existing WWTW. The freshwater features are described in more detail in the following section.

Freshwater Ecosystem Priority Areas (FEPA)

In terms of Freshwater Ecosystem Priority Areas (FEPA) the Groenwaterspruit is considered to be a River FEPA. River FEPAs are intended to ensure that biodiversity targets for river ecosystems and threatened/near-threatened fish species are achieved, and were identified in rivers that are currently in a good condition (A or B ecological category). Their FEPA status indicates that they should remain in a good condition in order to contribute to the biodiversity goals of the country.

Wetland FEPAs also occur within the study area. Although wetland condition was a factor in selection of wetland FEPAs, wetlands selected were not necessary in a good condition (A or B ecological category) to be chosen as a FEPA. Wetland FEPAs currently in an A or B ecological condition should be managed to maintain their good condition. Those currently in a condition lower than A or B should be rehabilitated to the best attainable ecological condition.

Habitat integrity

In terms of habitat integrity, the Groenwaterspruit and its tributary are in a largely modified ecological state. The riparian habitat of the stream and its tributary are more impacted by the surrounding farming and urban activities.

Ecological importance and sensitivity (EIS)
In terms of ecological importance and sensitivity, the Groenwaterspruit within the study area is deemed to be moderate.

Wetland Integrity
In terms of the current ecological state of the wetland areas associated with the existing WWTW, they are as a whole considered to be in a moderately modified state, with the smaller pans in general in a less impacted and largely natural ecological state.

Wetland Ecosystems Services
In terms of goods and services, the pans provide limited goods and services. This is largely due to the fact that they are relatively small in extent In this sense, the wetland areas provide particular goods and services associated with mitigating the potential impact of the treated wastewater discharge, including some flood attenuation and sediment trapping functionality, as well as mitigating the water quality impacts of the treated wastewater discharge.

The pans are all considered to have a moderate Ecological Importance and Sensitivity while the wetland areas associated with the WWTW are of low Ecological Importance and Sensitivity.

Water Quantity
Normally, the implication of the environmental flow requirements for a treated wastewater discharge into the river is that the seasonal variability within the river should be maintained as far as possible through the capping of treated wastewater discharges to the river particularly during the drier winter months. This would mean that as far as possible, the treated wastewater should rather be reused in summer than releasing it to the river.

For the Groenwaterspruit Stream however, the catchment is entirely endorheic which implies that flow in the stream will tend to infiltrate into subsurface rather than remain as surface water flow. The impact of the proposed treated wastewater is thus likely only have a limited impact in terms of the extent of aquatic habitat that would be negatively impacted by the elevated flows during the dry period.

Water Quality
The most recent final treated wastewater analysis results are presented in Table 17 of Appendix 4B, along with the general limit for the discharge of treated wastewater to a water resource.

There is no surface water data available for the water resources in the area, only groundwater. The electrical conductivity of the groundwater is about 110 mS/m while nutrients (NO2/NO3 and PO4) are mostly less than 10 mg/l and 1 mg/l respectively.

Considering that there will be little to no dilution of the treated wastewater discharged into the stream and that the treated wastewater will infiltrate into the ground rather than flow within the stream for most of the year, the final quality of the treated wastewater should comply with the General Limit as provided above as a minimum.

As the stream channel will to a large extent become a final treatment pond of the WWTW, it is recommended that the phosphates within the final effluent be removed as much as possible over and above that required for the General Limit. The establishment of a reed bed adjacent to or within the stream channel would assist to mitigate the potential impact of the treated wastewater discharge on the stream system.

9.2.2 IMPACT ASSESSMENT

This section provides an assessment of the impacts to freshwater ecosystems that are likely to be associated with proposed pipeline and the disposal of treated waste water from the proposed Postmasburg Waste Water Treatment Works development.

Impacts from the proposed pipeline:

- **Loss of riparian/wetland habitat and bed/bank modification:**

With the proposed construction of the sewer pipeline along the Groenwaterspruit, it is probable that the instream and riparian vegetation of the stream may be impacted.

Significance of impacts without mitigation: Low negative impact - As the instream and riparian vegetation are in a degraded state, the potential impact on this already degraded system is expected to be small and largely limited to the corridor of the pipeline.

Proposed mitigation: The proposed pipeline should be constructed within the stream channel where the vegetation has already been completely transformed by past cultivation activities. There should be limited disturbance within the instream and riparian vegetation during the construction phase. After construction, the disturbed area should be rehabilitated, particularly to prevent erosion taking place as well as to prevent the potential colonisation of these areas with invasive alien plants. Rehabilitation requires removal of invasive alien plants from the riparian zone, some landscaping of the stream bank if required and re-vegetation with indigenous riparian plants.

Significance of impacts after mitigation: A negative impact of a very low significance

- **Water quality impairment**:

With construction activities in and adjacent to the stream, there is a short-term risk of water quality impacts on the downstream aquatic ecosystem. These relate mostly to increased turbidity as result of increased availability of sediment from the disturbance of the vegetated cover which may be transported to the stream in the runoff water. Over the longer term, there is a risk of sewerage spills or overflows into the stream.

Significance of impacts without mitigation: Short and longer term medium to low negative impact.

Proposed mitigation: Contaminated runoff from the pipeline installation site should be prevented from directly entering the stream. Construction of the pipeline should preferably not be undertaken in the higher rainfall months when the water quality impacts from the construction activities may impact on the stream.

The construction camp/laydown area should be located away from the stream. All materials on the associated with the construction activities should be properly stored and contained. Disposal of waste from the site should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located away from the river (at least 30m) and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Plan (EMP) for the construction phase.

All possible measures should be made in the construction of the sewer pipeline adjacent to the stream to prevent any future breakages as a result of flood damage or any spills/overflows from the pipeline from entering the stream. The pipeline should be regularly monitored and maintained to ensure that any problems with the pipeline are rectified before they can impact on the stream.

Significance of impacts after mitigation: Provided that the mitigation measures are effectively implemented, the water quality-related impacts of the proposed pipeline construction should be limited to the construction phase with a low positive significance over the longer term.

Impacts from the disposal of treated waste water from the proposed new WWTW:

- **Water quality impairment:**

The nature of this impact is highly dependent on the level of treatment achieved and the effluent water quality standards that would be met by the proposed WWTW. As a minimum, it is assumed that General Limit will be met. Wastewater treated to the General Limit still contains elevated nutrient and ammonia concentrations, while the Special Limits specifically has reduced nutrient and ammonia levels. Preferably the Roth-phosphate concentrations in the final treated wastewater should be further reduced to minimise eutrophication of the receiving aquatic ecosystem.

Significance of impacts without mitigation: Medium negative impact

Proposed mitigation: The wastewater from the WWTW should at least comply with the General Limits as required in the General Authorisations for water use. Considering the limited dilution of the final treated wastewater discharged to the stream, it would be preferable to reduce the nutrient concentrations (specifically phosphate) in the treated wastewater to reduce eutrophication of the stream, with the associated nuisance plant growth in downstream impoundments. This could be achieved either by ensuring that the WWTW achieves Special Limit quality in the final treated wastewater or to construct wetland areas within the receiving watercourse to further polish the treated wastewater. Another alternative would be to dispose of the wastewater in another way such as through reuse. To a certain extent the treated wastewater is in fact reused as it flows downstream in the Groenwaterspruit where it would be available for use downstream.

Significance of impacts after mitigation: Provided that the mitigation measures are effectively implemented, the water quality-related impacts should be limited and of a low significance.

- **Flow modification:**

The discharge of treated wastewater to the stream will result in an increase in the flow in the stream, particularly during the dry months. The abstraction of water from the Olifants River can have a number of impacts especially during the low flow season.

Significance of impacts without mitigation: Medium to low negative impact on the stream.
Proposed mitigation: The use of the treated wastewater during the drier months should be encouraged to reduce the volumes that need to be discharged to the stream. Creation of a reed bed either within or adjacent to the stream at the discharge point would not only mitigate the quality of the treated wastewater discharged but also the extent of the flow impact on the stream.

Significance of impacts after mitigation: Low negligible impact.

Cumulative impacts

The surrounding farming activities have already had a significant impact on the stream and wetland features in the area. Without mitigation the cumulative impact of the new WWTW and sewer line could be expected result in some degradation of the condition of the stream. However, considering the current degraded state of the stream and the impacts of the existing activities, the relative impact would be low. With effective implementation of the recommended mitigation measures, the condition of the stream could be maintained at an acceptable level or even improved.

In addition, the proposed new WWTW would result in the decommissioning of the existing WWTW which has altered to characteristic of the pans within the area from being largely ephemeral features to being primarily permanently inundated wetland areas. With the alteration of the proposed discharge of treated wastewater this existing impact on the freshwater features in the area would be eliminated.

9.2.3 MITIGATION MEASURES

Proposed mitigation measures consist of the following recommendations:

- The proposed sewer pipeline should be constructed within the stream channel where the vegetation has already been completely transformed by past cultivation activities. There should be limited disturbance within the instream and riparian vegetation during the construction phase. After construction, the disturbed area should be rehabilitated, particularly to prevent erosion taking place as well as to prevent the potential colonisation of these areas with invasive alien plants. Rehabilitation requires removal of invasive alien plants from the riparian zone, some landscaping of the stream bank if required and re-vegetation with indigenous riparian plants.
- Contaminated runoff from the pipeline installation site should be prevented from directly entering the stream. Construction of the pipeline should preferably not be undertaken in the higher rainfall months when the water quality impacts from the construction activities may impact on the stream.
- The construction camp/laydown area should be located away from the stream. All materials on the associated with the construction activities should be properly stored and contained. Disposal of waste from the site should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located away from the river (at least 30m) and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Plan (EMP) for the construction phase.
- All possible measures should be made in the construction of the sewer pipeline adjacent to the stream to prevent any future breakages as a result of flood damage or any spills/overflows from the pipeline from entering the stream. The pipeline should be regularly monitored and maintained to ensure that any problems with the pipeline are rectified before they can impact on the stream.
- The wastewater from the WWTW should at least comply with the General Limits as required in the General Authorisations for water use. Considering the limited dilution of the final treated wastewater discharged to the stream, it would be preferable to reduce the nutrient concentrations (specifically phosphate) in the treated wastewater to reduce eutrophication of the stream, with the associated nuisance plant growth in downstream impoundments. This could be achieved either by ensuring that the WWTW achieves Special Limit quality in the

final treated wastewater or to construct wetland areas within the receiving watercourse to further polish the treated wastewater. Another alternative would be to dispose of the wastewater in another way such as through reuse. To a certain extent the treated wastewater is in fact reused as it flows downstream in the Groenwaterspruit where it would be available for use downstream.

- The use of the treated wastewater during the drier months should be encouraged to reduce the volumes that need to be discharged to the stream. Creation of a reed bed either within or adjacent to the stream at the discharge point would not only mitigate the quality of the treated wastewater discharged but also the extent of the flow impact on the stream.
- Monitoring of the ecological state of the stream should take place to allow for adaptive management of the wastewater disposal practice.
- The Department of Water and Sanitation should be approached with regards to the water use authorisation requirements for the proposed activities.

9.2.4 CONCLUSION

The Freshwater Impact Assessment concluded that Aquatic features which occur within the study area consist of the Groenwaterspruit and its smaller tributaries at Postmasburg; and some largely natural pans and artificial wetland areas (at the existing WWTW site). The ecological condition of the Groenwaterspruit at Postmasburg is considered to be largely modified, while the ecological importance and sensitivity of the stream is moderate. In terms of FEPAs, the Groenwaterspruit is considered to be a River FEPA. Wetland FEPAs also occur within the study area.

The pans in the study area are subjected to some physical habitat modification with some flow and water quality modification largely as a result of the surrounding farming and peri-urban activities while the wetland areas have similar impacts but are also subjected to additional flow of treated wastewater from the existing WWTW.

In terms of the current ecological state of the wetland areas, they are as a whole considered to be in a moderately modified state, with the smaller pans in general in a less impacted and largely natural ecological state. In terms of goods and services, the pans provide limited goods and services. This is largely due to the fact that they are relatively small in extent In this sense, the wetland areas provide particular goods and services associated with mitigating the potential impact of the treated wastewater discharge, including some flood attenuation and sediment trapping functionality, as well as mitigating the water quality impacts of the treated wastewater discharge. The pans are all considered to have a moderate Ecological Importance and Sensitivity while the wetland areas associated with the WWTW are of low Ecological Importance and Sensitivity.

Without mitigation the cumulative impact of the new WWTW and sewer line could be expected result in some degradation of the condition of the stream. However, considering the current degraded state of the stream and the impacts of the existing activities, the relative impact would be low. With effective implementation of the recommended mitigation measures, the condition of the stream could be maintained at an acceptable level or even improved. In addition, the proposed new WWTW would result in the decommissioning of the existing WWTW which has altered to characteristic of the pans within the area from being largely ephemeral features to being primarily permanently inundated wetland areas. With the alteration of the proposed discharge of treated wastewater this existing impact on the freshwater features in the area would be eliminated.

9.3 BIODIVERSITY ASSESSMENT

Peet Botes of PB Consult undertook the Biodiversity Assessment – The Biodiversity Assessment is included as **Appendix 4D**.

9.3.1 KEY FINDINGS

Vegetation along the pipeline route
The riparian vegetation along the Groenwater Spruit from pump station 1 to the proposed new WWTW location can be described as very degraded and impacted as a result of urban creep and agricultural practices

Apart from a few natural reeds and sedges as well as the occasional *Acacia karroo* and *Searsia lancea* (which were mostly planted as decorative trees), the natural riparian vegetation has been replaced by alien invasive plant species. In the vicinity of pump station 1 and along the town edge the riparian vegetation is characterised by dense stands of trees of which most are alien species

Further downstream the dense alien tree stands gives way to a more open landscape (mostly cultivated or grazed land). Even though *Prosopis* still dominate in patches, a more natural riparian vegetation was encountered which included while indigenous species like *Acacia karroo* (Soetdoring), *A. mellifera*, (Swarthaak) *A. hebeclada*, *Aloe grandidentata* (on rocky outcrops), *Cynodon dactylon*, *Cyperus marginatus*, *Diospyros lycioides*, *Grewia flava*, *Gymnosporia buxifolia*, *Phragmites australis*, *Pseudoschoenus inanis*, *Searsia burchellii*, *Searsia lancea* and *Ziziphus mucronata* (Blinkblaar wag-'n-bietjie).

The main feature of note with regards to biodiversity was the degraded status of the riparian vegetation as well as the number of alien invasive species associated with the river corridor.

Vegetation at the proposed WWTW site
The proposed new WWTW site is located against a rocky slope rising eastwards away from the Groenwater Spruit. The vegetation encountered on site can be described as a low thornveld dominated by *Acacia mellifera* and *Rhigozum trichotomum* (refer to Photo 5). What was interesting was *Rhigozum trichotomum* become more prominent as one moves away from the Groenwater Spruit (higher up the slope, eastwards). The vegetation cover was approximately 70%, reaching approximately 0.6 m in height. Occasionally a small trees or larger shrub layer individuals would rise above the thornveld. The bottom layer consists out of a sparse grassy and shrub layer. Overall the vegetation was very uniform with a low species turnover.

A clump of 4 small (less than 3 m) *Acacia erioloba* trees was encountered to the south west of the proposed site (just outside the riparian zone), while a clump of *Aloe hereroensis* was also located just east of the Camelthorn trees. In addition 2 smallish individuals of *Boscia albitrunca* (both on poor condition as a result of grazing) was also encountered (Figure 8). *Aloe grandidentata* was also very prominent and numerous clumps of this hardy species were encountered on the rocky slopes of the site (actually dominating the ground layer in patches). *Aloe grandidentata* is one of spotted aloes and an especially hardy species which forms colonies by growing underground stolon's or suckers spreading sideways. Another interesting plant encountered were a single individual of *Pachypodium succulentum* ("Halfmens" family). *Pachypodium* (closely related to the genus *Adenium*) falls into a

group of the Apocynaceae family notorious for yielding potent poisons which has been used effectively in arrow poisons since ancient times.

Apart from the dominant Swarthaak and Driedoring and species already mentioned above the following plants were also encountered on site: *Acacia hebeclada*, *Asparagus* species, *Diospyros lycioides, Eriocephalus* cf*. ericoides, Grewia flava, Gymnosporia buxifolia, Helichrysum zeyheri, Lycium cinereum, L. hirsutum, Nymania capensis (klapperbos), Olea europaea, Pentzia* species*, Tapinanthus oleifolius (*Mistletoe*), Ziziphus mucronata* ("Wag-'n-bietjie") and *Zygophyllum pubescens.*

The thornveld was in relative good condition, but showed signs of having been subjected to stock grazing over time. Connectivity is still good, even with its proximity to Postmasburg. The main features of biodiversity interested encountered during the site visit are the protected plant species and especially the number of *Aloe grandidentata* patches distributed all over the proposed site and its surroundings.

9.3.2 IMPACT ASSESSMENT

According to the Biodiversity Impact Assessment (Appendix 4D), the Postmasburg WWTW and connection pipeline entails the construction of a new pipeline of approximately 1.3 km along the Groenwater Spruit and the construction of a new WWTW (to replace the existing works) adjacent to the Groenwater Spruit.

The placement of the proposed pipeline is likely to impact on the riparian vegetation along the Groenwater Spruit, especially along the first portion of the pipe where it will runs next to existing housing of Postmasburg as a result of limited space. Physical barriers like rocky outcrops will also prevent the pipeline being removed totally from the riparian zone at some points. Still it should aim at minimising the impact on the riparian zone wherever possible.

However, along most of the pipeline route the riparian zone can be described as degraded and in a poor ecological state. Alien infestation coupled with agricultural practices (intensive agriculture within the alluvial valley bottom) and the urban edge effect has transformed the river status in large sections within the proposed construction site.

It must also be noted that with good alien management and better environmental practices being implemented along this watercourse the natural riparian vegetation should be easily re-established.

Pollution from the town and its associated activities (including the sewerage works) as well as nearby industries has also recently resulted in significant impacts on the water quality of the Groenwater Spruit. It is very likely that the current water quality poses significant health risks if consumed or used for recreation.

Direct impacts will be associated with the pipeline will be relative short construction period (months) and are considered temporary, since the pipeline will be located underground. However, even though the impact will be localised and temporary in nature it will have a direct impact on the riparian zone of the Groenwater Spruit (no matter in what poor condition it currently is). In addition the potential to aggravate infestation ratios of specifically *Prosopis* trees are high if not managed correctly. The direct impact on the proposed WWTW will be permanent of nature. The vegetation types encountered are all considered Least Threatened (thus not under any immediate threat in terms of extinction) but both are

currently poorly protected and will require further conservation efforts. It is important to understand that these vegetation types are not particularly rich in plant species and does not contain any centre of endemism. Unlike some biomes of South Africa, local endemism is also very low. Meaning that the vegetation type is fairly similar over extended areas and it would be unlikely that small localised impacts will have any significant impact on any specific species or the vegetation type as a whole. The vegetation is also not fragmented in any way with extended areas of excellent connectivity remaining throughout.

Two (2) protected species in terms of the NFA were encountered on or near the proposed new WWTW site. The *Acacia erioloba* individuals are located just to the southwest of the proposed site and with environmental control there should be no reason that these trees are impacted. Two individuals (both in poor state) of the Sheppard's tree (*Boscia albitrunca*) was encountered within the proposed new WWTW site and will be impacted. In addition two *Aloe* species and one *Pachypodium* individual, protected in terms of the NCNCA was encountered, along the pipeline route as well as within the proposed WWTW site. Please note that both are classified as of Least Concern according to the latest IUCN status (International Union for the Conservation of Nature). Only a limited patch of *Aloe hereroensis* was encountered and even though they will be impacted it will be possible to transplant them in the immediate surrounding area.

However, the hardy *Aloe grandidentata* was encountered in great numbers spread all over the proposed WWTW site and its immediate surroundings. It will not be practical to replant all of these species, but the project should aim at transplanting at least 10% of these plants to the adjacent natural areas. Furthermore, conservation bodies should be contacted with regards to possible re-use of the remainder before construction began. Even though quite a few *Aloe grandidentata* individuals will thus be lost as a result of the proposed new WWTW locations it is highly unlikely that the construction activities will have any significant impact on local or regional populations of any of the protected species.

Of greater concern is the possible impact of the pipeline on the riparian vegetation of the Groenwater Spruit. The disturbance of habitat during and after the construction activities also provides an opportunity for further invasive alien plants to establish in the area and might leave erosion potential. However, it should be taken into account that the construction will be temporary of nature and with good control should not add to further degradation of its ecological status. But it will be important that the alien control methods are used as species such as *Prosopis* will become much larger problems if incorrect or mechanical means alone are used for their removal.

Vegetation Type

Both vegetation types are classified as "Least threatened" but poorly protected. According to the Draft Siyanda EMF, both vegetation types have a high conservation priority (being poorly protected) but a low/medium sensitivity index (more than 98% remaining and low species turnover). It is thus highly unlikely that small localised impacts will have any significant impact on any specific species, local and regional conservation targets or threatened ecosystems.

The impact on vegetation is thus rated as low.

Corridors and or conservancy networks

According to the Draft Siyanda EMF, both vegetation types have a high conservation priority (being poorly protected) but a low/medium sensitivity index (more than 98% remaining and low species turnover). It is thus highly unlikely that small localised impacts will have any significant impact on any

specific species, local and regional conservation targets or threatened ecosystems. The impact on river corridors will be short term and temporary of nature, but is likely to impact on the riparian vegetation.

Mitigation will entail minimising the impact on riparian vegetation and to ensure erosion control through good rehabilitation. Correct alien eradication will also be important.

The impact is thus rated as low.

Protected species

No SA red list species was observed. Two tree NFA protected tree species were encountered and 3 NCNCA protected plant species were observed.

No *Acacia erioloba* individual should be impacted, but two *Boscia albitrunca* shrubs in poor condition will be impacted. In addition a number of *Aloe* individuals and one *Pachypodium* will be impacted.

The impact is thus rated as low.

Fauna and avi-fauna

Because of the temporary and localised nature of the activity it is considered highly unlikely that it will have any significant impact on fauna or avi-fauna.

Mitigation will entail staying within the road reserve and minimising footprint and the impact on mature indigenous tree species.

The impact is thus rated as Insignificant.

Rivers and wetlands

Even though the riparian vegetation is in poor state and the impact will be localised and short term, uncontrolled excavation can have serious additional impacts on the riparian zone especially with regards to infestation escalation (specifically *Prosopis* infestation).

Mitigation will entail excellent environmental control in order to minimise the impact on riparian zones, to ensure good rehabilitation and to reduce the risk of erosion.

The impact on rivers and wetlands is thus rated as Medium-low.

Invasive alien vegetation

A total of 14 alien species or indigenous weeds were observed of which the most concerning are the presence of *Prosopis* along the Groenwater Spruit and the Cactaceae species.

All listed invasive alien species must be removed during the construction. However, incorrect alien control methods used for especially *Prosopis* species may aggravate the situation and result in spreading in place of control of these species.

Mitigation will entail correct alien control methods coupled with follow up work after rehabilitation.

The impact will be positive.

Direct impacts
The proposed activity will have a direct impact on natural vegetation, which is likely to include protected plant species in terms of the NFA and NCNCA, riparian vegetation of the Groenwater Spruit and vegetation with a potential high conservation value. The impact on soil, landuse, fauna and avi-fauna and veld fire is considered to be low. However, it is unlikely that the proposed project will have significant impact on local or regional conservation targets.

Taking the above into account the direct impact on the environment is rated as Low.

Indirect impacts
It is very likely that the proposed project will have indirect impacts like the establishment of temporary lay-down areas, temporary construction sites and concrete mixing areas. However, with good environmental control it will be possible to minimise the impact of such indirect impacts.

Mitigation will entail excellent environmental control, placement of temporary lay-down areas or construction sites within areas that are not environmentally sensitive and will not impact on protected plant species. It will also entail good waste and wastewater control.

On its own the impact is considered to be low.

Cumulative impacts
The proposed project will have a localised impact, which should not result in significant additional permanent impacts. Overall it is not considered likely that the cumulative impact will result in any significant additional impact on regional biodiversity targets.

On the whole the cumulative impact is considered to be medium-low.

9.3.3 MITIGATION MEASURES

The following mitigation measures have been proposed by the Biodiversity Assessment:

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and the Biodiversity study recommendations as well as any other conditions pertaining to other specialist studies and requirements of the DENC or DAFF.
- The pipeline route and WWTW site must be demarcated (aiming at the smallest footprint).
- Before any excavation is allowed all significant plant species identified during the botanical scan must be rescued in a search and rescue operation supervised by a suitably qualified botanist.
- Only existing access routes should be used wherever possible.
- An application must be made for a permit in terms of the NFA with regards to the potential impact on the two protected tree species.

- An application must be made for a flora permit in terms of the NCNCA with regards to the impact on listed species identified in terms of Schedule 1 and 2 of the act.
- An application for a Department of Water Affairs authorization might be applicable with regards to the location of the new WWTW and the pipeline as well as end use (irrigation) in terms of the NWA.
- When working within or near water courses the impact on riparian vegetation must be minimised through excellent environmental control with the aim of minimising the impact on riparian zones;
- Ensuring good rehabilitation and re-vegetation with suitable indigenous vegetation to reduce the risk of erosion in the stream channels.
- The final pipeline route must be adjusted on site via ECO approval, with the aim of minimising impact on mature indigenous tree species (especially protected tree species), through slight route alterations.
- If required, river crossing should only be done when they are not in flow (dry season) and wherever possible, the crossings should be diagonally to the river banks (the shortest route possible).
- Where possible work in the vicinity of the Groenwater Spruit should aim at utilising already disturbed areas (e.g. road verges) thus minimising any additional footprint within the river corridor.
- The integrity of the Groenwater Spruit system must be protected throughout the construction and operation phase of the pipeline.
- Adequate measures must be implemented to ensure against erosion.
- Additional lay-down areas or construction sites must be located within already disturbed areas or areas of low ecological value and must be pre-approved by the ECO.
- Indiscriminate clearing of areas must be avoided.
- At the WWTW location, topsoil (the top 10-20 cm layer of soil), which will contain 80-90% of the seedbearing material and bulbs, must be protected throughout the project (removal and separately storage).
- The topsoil and vegetation must be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of plant species (topsoil from the new WWTW location can be re-used for pipeline rehabilitation outside of the riparian zone).
- All alien vegetation must be removed from within the construction footprint (the road reserve) and immediate surroundings (especially river corridors).
- It is imperative that the correct alien eradication methods are employed (especially with regards to *Prosopis* control) as incorrect methods will aggravate the infestation.
- Follow up work must be carried out after rehabilitation to ensure that no invasive alien plant re-establishes itself.
- An integrated waste management approach must be implemented during construction.
- Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
- Spoil from excavation work should be used as fill where possible.

9.3.4 CONCLUSION

The Biodiversity Assessment concluded that having evaluated the biodiversity aspects and associated impacts pertaining to the proposed development, the author is of the opinion that the proposed project will have a significant impact on cutting operational costs, pollution prevention and health risks.

The improved treatment method should enable easy expansion without major footprint enlargements (or further work within the riparian zone). From a biodiversity perspective it will have very little impact on local or regional conservation targets, but will have a slight impact on protected species and a temporary impact on the Groenwater Spruit riparian vegetation. But the impact will be localised and with good environmental control and mitigation should not have any significant impact on conservation targets.

The evaluation of the potential environmental impacts indicates the most significant potential impacts identified where:

- The potential impact on two NFA *Boscia albitrunca* individuals;
- The impact on a number of species protected in terms of the NCNCA;
- The potential impact on vegetation with a high conservation priority as a result of its current poor conservation status (fortunately more than 98% of both these vegetation types remains);
- The potential impact on the riparian vegetation associated with the Groenwater Spruit.

With mitigation it is considered highly unlikely that the proposed project will contribute significantly to any of the following:

- Significant loss of vegetation type and associated habitat.
- Loss of ecological processes (e.g. migration patterns, pollinators, river function etc.) due to development and operational activities.
- Loss of local biodiversity and threatened plant species.
- Loss of ecosystem connectivity

Lastly it is felt that good environmental planning and control during development, the appointment of a suitably qualified ECO and the implementation of an approved EMP could significantly reduce environmental impact.

With the available information to the author's disposal it is recommended that project be approved, provided that mitigation is adequately addresses.

9.4 GEO-HYDROLOGICAL IMPACT ASSESSMENT

Julian Conrad, Charles Peek and Dale Barrow of GEOSS – Geohydrological and Spatial Solutions International (Pty) Ltd were appointed to undertake a specialist Geo-hydrological Impact Assessment as part of the EIA process, and is included as **Appendix 4A**.

9.4.1 KEY FINDINGS AND IMPACT ASSESSMENTS

The Geo-hydrological Impact Assessment has looked at the potential impacts related to the WWTW and proposed discharge of the treated effluent. It is also noted that the current uncontrolled discharge of the effluent towards the town, and ultimately into the Groenwater Spruit, may have had impacts already.

Contamination source and toxicity assessment
The discharge of the effluent is the primary concern with regard to contamination. The effluent will flow from the proposed WWTW directly into the Groenwater Spruit. The proposed pipeline from an existing sewer main runs along the course of the river and any leakages or breakages in the pipeline will also represent secondary sources of potential contamination.

From the final effluent chemistry analysis it is evident that the effluent orthophosphate concentrations are greater than that of groundwater. Orthophosphate, although generally not very toxic to human beings, can have adverse effects relating to eutrophication of water bodies and impact the smell and taste of the water. With regard to the other parameters for which analysis data was obtained, it is evident that the final effluent will have a quality comparable and even better than that of the groundwater.

The current WWTW can treat a maximum of 4 800 m3/day, and over the months of September, October and November the WWTW treated in the region of 3 000 m3/day. This amounts to a discharge rate of 35 L/s, if the rate were to be constant throughout the day. The discharge will be into a small impoundment with an earth embankment and a concrete overflow structure in order to attenuate the flow and to control outflow velocities preventing possible erosion of the river bed.

Pathways
The discharge of the effluent is expected to seep into alluvium within the Groenwater Spruit and the tributary where it is discharged. It will percolate through the unsaturated zone into the groundwater within the weathered zone as well as the dolomite aquifer(s). These aquifers are laterally extensive and highly conductive due to the presence of solution cavities. The groundwater flow direction is expected to follow topography and the course of the Groenwater Spruit in a south-westerly direction.

Receptors
At the point of discharge the vegetation will be a receptor of the discharged effluent. Agricultural lands within the Groenwater Spruit may also be receptors of the effluent depending on the time it takes for the discharged effluent to infiltrate into the alluvium.

The effluent will seep into the alluvium and into the groundwater. Groundwater users around and down-gradient of the discharge point are therefore considered receptors despite the fact that the effluent will be diluted. Groundwater is used for domestic purposes, irrigation and stock watering and it will therefore be important that the quality not be compromised. The closest domestic supply

boreholes down-gradient of the proposed discharge point are borehole OF2 (~980 m) and OF6 (1 070 m) (see map 3 of the Geo-hydrological Impact Assessment).

Anticipated Impacts

Anticipated impacts on groundwater are related to the development of the proposed WWTW and the discharge of the treated effluent. The development of the proposed WWTW should not have an effect on the groundwater if it is properly constructed and managed. Infrastructure will need to be well constructed, monitored and maintained. Assuming this to be the case the investigation will focus on the impacts resulting from the discharging of the treated effluent.

Surface runoff

The Groenwater Spruit is an episodic river and does not flow every year. The effluent discharge will be ongoing but it is anticipated that the discharged effluent will filter into the river alluvium and not result in river flow. The amount of time taken for the flow to take place prior to infiltrating the alluvium is uncertain and detailed hydrological investigation would be able to provide more clarity on this matter.

Aquifer characteristics

The area of choice has a high groundwater vulnerability to surface based contaminants (Map 8 of the Geo-hydrological Impact Assessment) and is regarded as a major aquifer. The surface geology consists of unconsolidated sands and river alluvium and it is anticipated that infiltration and mixing will take place between the effluent and the groundwater. The alluvium is underlain by highly transmissive and extensive dolomite aquifers which would support the transport of contaminants. The aquifer is sensitive to contamination sources and as it supplies water for domestic purposes it will be important not to compromise its quality.

Groundwater Levels

The proposed new WWTW effluent discharge is expected to have an effect on groundwater levels. Numerous landowners stated that in dry periods the groundwater levels drop. While the quality of the effluent is not of suitable quality for injection directly into the aquifer the discharge of the effluent will serve as a form of managed recharge for the aquifers in the vicinity of, and hydraulically linked to, the Groenwater Spruit. The result will be that the groundwater levels are buffered from dropping too significantly during dry periods. This is considered a favourable effect as long as the groundwater quality is not compromised.

Groundwater Quality

The biggest concern regarding the proposed new WWTW is its effluent discharge and the impacts that it may have on groundwater and the down-gradient groundwater users. Groundwater is the sole source of water for a number of farmers in the area and its quality must not be negatively impacted.

That said, it is evident from the effluent analysis results that the quality of the treated effluent is within general standards for treated effluent (National Water Act, 1998) and is generally better than regional groundwater with regard to EC. The effluent also contains 0 faecal coliforms (organisms/100 ml) and is ideal quality with regard to nitrate and nitrite concentrations.

Orthophosphates are elevated with regard to the groundwater concentrations for the area but are still within the discharge and irrigation limits. In September, October and November 2011, January 2012 and November 2014 the ammonia concentration was less than 3 mg/L but it exceeded the general limit of 6 mg/L (National Water Act) in December 2011. This was due to a problem with the aerator at the plant and is therefore not considered of significance.

Ecosystems
The springs and groundwater dependant ecosystems are not expected to be impacted by the effluent discharge. It is anticipated that vegetation will increase around the discharge point, as is evident at the two springs that were visited. The vegetation and foliage will become relatively impenetrable if left for a long period of time, and is expected to result in development of new ecosystems. Constituents such as orthophosphates are plant nutrients that will support the rapid growth.

9.4.2 MITIGATION MEASURES

According to the Geo-hydrological Impact Assessment, the following recommendations are made: -

- Ensure that the treated effluent parameters are within the general disposal limits (National Water Act, 1998) and that ammonia is kept below 3 mg/L.
- If chemistry analyses are favourable for irrigation engage farmers regarding the use of the effluent for irrigation. A gravity feed system can be implemented for the irrigation enabling electricity saving and a decrease in the need for fertilizers. This will be the most favourable means of disposal.
- Implement a groundwater monitoring network at and down-gradient of the proposed WWTW. The monitoring should include automated water level measurement and quarterly sampling. These will serve as an early warning system for contamination. Infrastructure must be able to withstand flooding of the river. Existing boreholes can be included in the monitoring network where suitable. Monitoring boreholes should be appropriately designed and constructed.

9.4.3 CONCLUSION

The Geo-hydrological Impact Assessment concluded that the groundwater in the area is a valuable resource and is vulnerable to surface based contamination. While the water quality of the final effluent is good with regard to certain indicator parameters (for November 2014) it has a relatively elevated orthophosphate concentration. As this is considered a plant nutrient it is recommended that the water be used for crop irrigation as opposed to letting the water flow out in a single stream where infiltration to groundwater will be more rapid. The water quality suitability for irrigation should be considered with special reference to the relevant crops (i.e. lucerne). From existing data this is the most favourable method of disposal.

It is essential that monitoring of the groundwater levels and quality takes place at and down-gradient of the point of effluent disposal, be it via irrigation or discharge as proposed. The monitoring will serve as an early warning system for groundwater users down-gradient of the site. Existing boreholes could be incorporated into the monitoring network.

10. SUMMARY OF IMPACTS

Table 3 is a summary of all the impacts that are associated with the construction and operational phase for the preferred alternative.

Table 3: Summary of all impacts

Study	Impact	Significance No Mitigation	Significance With Mitigation
Biodiversity	Geology and soils	Low (Negative impact)	Low (Negative impact)
	Land use and cover	Low (Negative impact)	Low (Negative impact)
	Vegetation types	Low (Negative impact)	Low (Negative impact)
	Corridors and conservation priority areas/networks	Medium Low (Negative Impact)	Low (Negative impact)
	Protected Plant Species	Medium Low (Negative Impact)	Low (Negative impact)
	Fauna and avi-fauna	Low (Negative impact)	Insignificant
	Rivers and wetlands	Medium (Negative Impact)	Medium Low (Negative Impact)
	Invasive Alien infestation	Medium Low (Negative Impact)	Positive
Freshwater	Proposed wastewater pipeline and the new WWTW - loss of freshwater related habitats	Low (Negative impact)	Very Low (Negative impact)
	Construction of proposed wastewater pipeline and new WWTW – water quality impacts	Medium Low (Negative impact)	Very Low (Negative impact)

	Construction of proposed wastewater pipeline and new WWTW – flow modification impacts	Medium Low (Negative impact)	Low (Negative impact)
Heritage	Loss of archaeological heritage	Low (Negative impact)	Low (Negative impact)

11. RECOMMENDATIONS

The following mitigation measures must be enforced if the proposed development were approved. These are also included in the Environmental Management Programme (Appendix 5).

Construction Phase:

The following mitigation measures have been proposed by the Biodiversity Assessment:

- All construction must be done in accordance with an approved construction and operational phase Environmental Management Plan (EMP), which must be developed by a suitably experienced Environmental Assessment Practitioner.
- A suitably qualified Environmental Control Officer must be appointed to monitor the construction phase in terms of the EMP and the Biodiversity study recommendations as well as any other conditions pertaining to other specialist studies and requirements of the DENC or DAFF.
- The pipeline route and WWTW site must be demarcated (aiming at the smallest footprint).
- Before any excavation is allowed all significant plant species identified during the botanical scan must be rescued in a search and rescue operation supervised by a suitably qualified botanist.
- Only existing access routes should be used wherever possible.
- An application must be made for a permit in terms of the NFA with regards to the potential impact on the two protected tree species.
- An application must be made for a flora permit in terms of the NCNCA with regards to the impact on listed species identified in terms of Schedule 1 and 2 of the act.
- An application for a Department of Water Affairs authorization might be applicable with regards to the location of the new WWTW and the pipeline as well as end use (irrigation) in terms of the NWA.
- When working within or near water courses the impact on riparian vegetation must be minimised through excellent environmental control with the aim of minimising the impact on riparian zones;
- Ensuring good rehabilitation and re-vegetation with suitable indigenous vegetation to reduce the risk of erosion in the stream channels.
- The final pipeline route must be adjusted on site via ECO approval, with the aim of minimising impact on mature indigenous tree species (especially protected tree species), through slight route alterations.
- If required, river crossing should only be done when they are not in flow (dry season) and wherever possible, the crossings should be diagonally to the river banks (the shortest route possible).
- Where possible work in the vicinity of the Groenwater Spruit should aim at utilising already disturbed areas (e.g. road verges) thus minimising any additional footprint within the river corridor.
- The integrity of the Groenwater Spruit system must be protected throughout the construction and operation phase of the pipeline.
- Adequate measures must be implemented to ensure against erosion.
- Additional lay-down areas or construction sites must be located within already disturbed areas or areas of low ecological value and must be pre-approved by the ECO.
- Indiscriminate clearing of areas must be avoided.

- At the WWTW location, topsoil (the top 10-20 cm layer of soil), which will contain 80-90% of the seedbearing material and bulbs, must be protected throughout the project (removal and separately storage).
- The topsoil and vegetation must be replaced over the disturbed soil to provide a source of seed and a seed bed to encourage re-growth of plant species (topsoil from the new WWTW location can be re-used for pipeline rehabilitation outside of the riparian zone).
- All alien vegetation must be removed from within the construction footprint (the road reserve) and immediate surroundings (especially river corridors).
- It is imperative that the correct alien eradication methods are employed (especially with regards to *Prosopis* control) as incorrect methods will aggravate the infestation.
- Follow up work must be carried out after rehabilitation to ensure that no invasive alien plant re-establishes itself.
- An integrated waste management approach must be implemented during construction.
- Construction related general and hazardous waste may only be disposed of at Municipal approved waste disposal sites.
- Spoil from excavation work should be used as fill where possible.

According to the Freshwater Impact Assessment, proposed mitigation measures consist of the following recommendations:

- The proposed sewer pipeline should be constructed within the stream channel where the vegetation has already been completely transformed by past cultivation activities. There should be limited disturbance within the instream and riparian vegetation during the construction phase. After construction, the disturbed area should be rehabilitated, particularly to prevent erosion taking place as well as to prevent the potential colonisation of these areas with invasive alien plants. Rehabilitation requires removal of invasive alien plants from the riparian zone, some landscaping of the stream bank if required and re-vegetation with indigenous riparian plants.
- Contaminated runoff from the pipeline installation site should be prevented from directly entering the stream. Construction of the pipeline should preferably not be undertaken in the higher rainfall months when the water quality impacts from the construction activities may impact on the stream.
- The construction camp/laydown area should be located away from the stream. All materials on the associated with the construction activities should be properly stored and contained. Disposal of waste from the site should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located away from the river (at least 30m) and regularly serviced. These measures should be addressed, implemented and monitored in terms of the Environmental Management Plan (EMP) for the construction phase.
- All possible measures should be made in the construction of the sewer pipeline adjacent to the stream to prevent any future breakages as a result of flood damage or any spills/overflows from the pipeline from entering the stream. The pipeline should be regularly monitored and maintained to ensure that any problems with the pipeline are rectified before they can impact on the stream.
- The Department of Water and Sanitation should be approached with regards to the water use authorisation requirements for the proposed activities.

According to the Heritage Impact Assessment:

- No further archaeological mitigation is required
- Should any unmarked human burials/remains or ostrich eggshell water flask caches be uncovered during construction activities, these must immediately be reported to the archaeologist (Jonathan Kaplan 082 321 0172), or Ms Mariagrazia Galimberti at the South African Heritage Resources Agency (021 462 4502). Burials, etc must not be removed or disturbed until inspected by the archaeologist.

Operational Phase:

According to the Geo-hydrological Impact Assessment, the following recommendations are made: -

- Ensure that the treated effluent parameters are within the general disposal limits (National Water Act, 1998) and that ammonia is kept below 3 mg/L.
- If chemistry analyses are favourable for irrigation engage farmers regarding the use of the effluent for irrigation. A gravity feed system can be implemented for the irrigation enabling electricity saving and a decrease in the need for fertilizers. This will be the most favourable means of disposal.
- Implement a groundwater monitoring network at and down-gradient of the proposed WWTW. The monitoring should include automated water level measurement and quarterly sampling. These will serve as an early warning system for contamination. Infrastructure must be able to withstand flooding of the river. Existing boreholes can be included in the monitoring network where suitable. Monitoring boreholes should be appropriately designed and constructed.

The following mitigation measures have been proposed by the Biodiversity Assessment:

- The integrity of the Groenwater Spruit system must be protected throughout the construction and operation phase of the pipeline.

According to the Freshwater Impact Assessment, proposed mitigation measures consist of the following recommendations:

- The wastewater from the WWTW should at least comply with the General Limits as required in the General Authorisations for water use. Considering the limited dilution of the final treated wastewater discharged to the stream, it would be preferable to reduce the nutrient concentrations (specifically phosphate) in the treated wastewater to reduce eutrophication of the stream, with the associated nuisance plant growth in downstream impoundments. This could be achieved either by ensuring that the WWTW achieves Special Limit quality in the final treated wastewater or to construct wetland areas within the receiving watercourse to further polish the treated wastewater. Another alternative would be to dispose of the wastewater in another way such as through reuse. To a certain extent the treated wastewater is in fact reused as it flows downstream in the Groenwaterspruit where it would be available for use downstream.
- The use of the treated wastewater during the drier months should be encouraged to reduce the volumes that need to be discharged to the stream. Creation of a reed bed either within or adjacent to the stream at the discharge point would not only mitigate the quality of the treated wastewater discharged but also the extent of the flow impact on the stream.
- Monitoring of the ecological state of the stream should take place to allow for adaptive management of the wastewater disposal practice.

12. CONCLUSIONS

The following specialist studies were undertaken as part of this Environmental Impact Assessment:

- Geo-hydrological Impact Assessment
- Freshwater Impact Assessment
- Biodiversity Assessment
- Heritage Impact Assessment

The specialist studies and the information provided within the EIA Report, indicates that the proposed Postmasburg WWTW development does not pose any significant impacts and can be implemented with appropriate mitigation.

The need and desirability of the proposed Postmasburg Waste Water Treatment Works is indicated in the Preliminary Design Report. This is mostly due to the growth of Postmasburg, and the average daily flows exceeding the design capacity of the existing WWTW.

In terms of alternatives, **Alternative 1** is the preferred alternative due to technical and financial reasons in terms of future Operation and Maintenance costs. The proposed site allows the total sewage load of the town (with the exception of Boichoko) to flow to the wastewater treatment plant under gravity. This also has the advantage that the municipality will be able to eliminate 4 of their 6 wastewater pump stations. This will firstly generate an annual saving of about R5 million per annum just on the cost of electricity. Secondly it will eliminate 4 operational points which require constant electrical and mechanical maintenance.

It will also reduce the risks associated with sewage spills which currently occur on a weekly basis, as these pump stations are operating at their design limits due to the unprecedented growth experienced by Postmasburg. With a number of residential developments being planned in Postmasburg, these developments will put additional strain on the pump stations increasing the risk for spills.

The “no-go” option, which is the option of not developing the proposed Waste Water Treatment Works, might result in no additional potential negative environmental impacts, the direct and indirect socio-economic benefits of not constructing the WWTW will not be realised. As described in *Section 2.1*, future expansion and development of the town of Postmasburg, and as a result, mining operations in the area, will be limited in future.

According to the Freshwater Impact Assessment (**Appendix 4B**), the ‘No-Go’ alternative would imply not developing the proposed WWTW. This alternative would result in no additional potential negative environmental impacts as a result of the new WWTW and sewer line, however one could expect that there would be impacts associated with the limited capacity of the existing WWTW to treat the wastewater arising from the expanding town as well as increased loading (greater quantities of poor quality water) of the wetland areas and tributary of the Groenwaterspruit Tributary near the WWTW that would result in a gradual degradation of these aquatic ecosystems.

The No-Go option will result in continual pollution and health risks, coupled with huge maintenance costs. In addition the current WWTW will still have to be upgraded in order to handle the current and

projected sewerage volumes expected. The location of the current works will remain problematic (uncontrolled discharge of raw effluent) and very expensive to operate (pumping costs).

According to the Biodiversity Assessment, the biodiversity aspects and associated impacts pertaining to the proposed development, the proposed project will have a significant impact on cutting operational costs, pollution prevention and health risks.

From a biodiversity perspective it will have very little impact on local or regional conservation targets, but will have a slight impact on protected species and a temporary impact on the Groenwater Spruit riparian vegetation. But the impact will be localised and with good environmental control and mitigation should not have any significant impact on conservation targets.

According to the Freshwater Impact Assessment, without mitigation the cumulative impact of the new WWTW and sewer line could be expected to result in some degradation of the condition of the stream. However, considering the current degraded state of the stream and the impacts of the existing activities, the relative impact would be low. With effective implementation of the recommended mitigation measures, the condition of the stream could be maintained at an acceptable level or even improved. In addition, the proposed new WWTW would result in the decommissioning of the existing WWTW which has altered to characteristic of the pans within the area from being largely ephemeral features to being primarily permanently inundated wetland areas. With the alteration of the proposed discharge of treated wastewater this existing impact on the freshwater features in the area would be eliminated.

According to the Geo-hydrological Impact Assessment, the groundwater in the area is a valuable resource and is vulnerable to surface based contamination. While the water quality of the final effluent is good with regard to certain indicator parameters it has a relatively elevated orthophosphate concentration. As this is considered a plant nutrient it is recommended that the water be used for crop irrigation as opposed to letting the water flow out in a single stream. The water quality suitability for irrigation should be considered with special reference to the relevant crops. From existing data this is the most favourable method of disposal.

It is essential that monitoring of the groundwater levels and quality takes place at and down-gradient of the point of effluent disposal, be it via irrigation or discharge as proposed. The monitoring will serve as an early warning system for groundwater users down-gradient of the site. Existing boreholes could be incorporated into the monitoring network.

According to the Heritage Impact Assessment, construction of the proposed sewer pipeline alongside the Groenwater Spruit will not impact on any important archaeological heritage. Construction of the proposed WWTP on the kopje overlooking the Spruit will also have a very limited impact on archaeological remains. Indications are that in terms of archaeological heritage, the receiving environment is not a sensitive archaeological landscape.

Considering all the information, it is not envisaged that this proposed Postmasburg Waste Water Treatment Works will have a significant negative impact on the environment, and the socio-economic benefits are expected to greatly outweigh any negative impacts.

It is therefore recommended that the proposed new waste water treatment works (**Alternative 1**) be supported and be authorised with the necessary conditions of approval, subject to the implementation of the recommended enhancement and mitigation measures contained in Section 11.

13. DETAILS AND EXPERTISE OF THE EAP

This Draft Environmental Impact Report was prepared by Clinton Geyser who has a MSc. Degree in Environmental Management. He has been working as an Environmental Assessment Practitioner since 2009 and is currently employed at EnviroAfrica CC. He has over 5 years' experience as an Environmental Control Officer and as an Environmental Assessment Practitioner, working on a wide variety of projects, including waste water treatment works, housing developments, telecommunication masts, cemeteries and other civil engineering projects.

The whole process and report was supervised by Bernard de Witt who has more than 20 years experience in environmental management and environmental impact assessments.

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