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**Part 2 Amendment application of Exemption approval for the  
continuous ashing at the Ash Disposal Facility, at Tutuka  
Power Station, Mpumalanga Province**

**MOTIVATION REPORT**

**DRAFT FOR PUBLIC REVIEW**

July 2019

**Eskom (Pty) Ltd**

**GCS Project Number: 19.0217**

**DEA Ref No: 14/12/16/3/3/3/52 and**

**NEAS Ref. No.: DEA/EIA/0001416/2012**

**Client Reference: Tutuka Part 2 Amendment Application**



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## EXECUTIVE SUMMARY

Eskom Tutuka Power Station (Tutuka) applied for, and obtained, an Integrated Environmental Authorisation (IEA), 14/12/16/3/3/3/52 & DEA/EIA/0001416/2012, for its continuous Ash Disposal Facility (ADF) from the Department of Environmental Affairs on 19 October 2015.

Subsequent to this authorisation, the station applied for a 4-year Exemption from installing the required liner (a Class C liner), as a means to allow station ashing operations to continue while the required designs of the Class C liner were being developed, and to allow for its installation. To inform the Exemption application process, the equivalent footprint (area) for the 4-year Exemption was estimated to be 54ha and was assessed and motivated by an independent Environmental Consultant. The DEA granted the 4-year Exemption on 5 May 2016, and it had some conditions. The Exemption period will lapse on 4 May 2020. Parallel to ashing on the area under the Exemption, developmental work was executed for the Class C liner for the Ash Disposal Facility, commencing beyond the area under the Exemption.

In 2018, Tutuka realised that the 54ha approved under the Exemption would not be fully utilised at the end of the 4-year Exemption period, and a process to determine the most feasible option to manage this gap was undertaken, whereby a few alternative strategies were assessed. Through the assessment process a decision was made that the most feasible option was to apply for an extension of the Exemption period, without extending the area under the Exemption.

To execute this strategy, Eskom undertook a Part 1 amendment process in November 2018, but the DEA rejected that application (dated 09 January 2019) and required that a Part 2 amendment process be undertaken instead (which is the subject of this application).

This application includes the following as requested by the DEA in a letter dated, 09 January 2019:

- This motivation report outlining detailed reasons and a justification for the amendment application;
- Specialist Hydrogeological Assessment Review, Appendix A, prepared by GCS Pty Ltd.
- Specialist Wetland Impact Assessment Review, Appendix B, prepared by Ecotone Freshwater Consultants CC;
- A Public Participation Report, Annexure C, prepared by GCS (Pty) Ltd outlining the public participation process conducted in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA) EIA Regulations;
- The results of monitoring programmes requested to be developed in the Exemption issued on 05 May 2016; and

- An amended EMP Report, Annexure D, prepared in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment Regulations.

## CONTENTS PAGE

<b>1</b>	<b>INTRODUCTION</b> .....	<b>7</b>
<b>2</b>	<b>LEGAL FRAMEWORKS</b> .....	<b>8</b>
2.1	AMENDMENT PROCESS REQUIREMENTS .....	8
<b>3</b>	<b>ACTIVITY DESCRIPTION</b> .....	<b>8</b>
<b>4</b>	<b>Eskom MOTIVATION FOR THIS AMENDMENT APPLICATION</b> .....	<b>9</b>
<b>5</b>	<b>WETLAND IMPACT ASSESSMENT REVIEW</b> .....	<b>11</b>
5.1	PROJECT AREA .....	11
5.2	WETLAND ASSESSMENT .....	11
5.3	SUMMARY OF WETLAND INFORMATION .....	12
5.4	WETLAND ASSOCIATED WITH THE EXEMPTION AREA .....	12
5.5	BACKGROUND WATER QUALITY .....	14
5.6	REVISION OF WETLAND IMPACT ASSESSMENT .....	17
5.6.1.1	Alteration in Wetland Hydrology due to Changes in Surface Roughness .....	17
5.6.1.2	Impact on Surface Water Quality Due to Construction Activity .....	18
5.6.1.3	Impact on Wetland Vegetation and Disturbance of Wetland Habitat .....	19
5.6.1.4	Impact Related to Increase of Alien/Pioneer Vegetation in Areas Disturbed by Construction Activities	19
5.6.1.5	Impact on Residual Wetland Functionality and Associated Ecosystem Goods and Services .....	20
5.6.2.1	Hydrological Impacts on Downstream Wetlands During Operations .....	21
5.6.2.2	Impact on Surface Water Quality During Operations .....	22
<b>6</b>	<b>HYDROGEOLOGICAL ASSESSMENT REVIEW</b> .....	<b>23</b>
6.1	VERIFY POTENTIAL IMPACTS .....	23
6.2	PREVIOUS PREDICTED GROUNDWATER IMPACTS .....	23
6.3	VERIFICATION OF PREVIOUS GROUNDWATER IMPACTS .....	25
<b>7</b>	<b>THE RESULTS OF MONITORING PROGRAMMES</b> .....	<b>27</b>
<b>8</b>	<b>PUBLIC PARTICIPATION</b> .....	<b>30</b>
8.1	PURPOSE OF PUBLIC PARTICIPATION .....	30
8.2	I&APs CONSULTATION .....	30
<b>9</b>	<b>CONCLUSION</b> .....	<b>32</b>

## LIST OF FIGURES

Figure 5.1:	Study area in relation to Exemption area .....	11
Figure 5.2:	Historical aerial images of the ADF showing the advancement between October 2009 and April 2019. ....	15
Figure 5.3:	Relevant surface water quality monitoring points on the Wolwespruit. ....	16

## LIST OF TABLES

Table 5.1:	Significance rating categories showing values for Low, Medium and High significance .....	12
Table 5.2:	Total wetland size within primary and secondary study area, PES totals, indirect ecosystem service scores and EIS score for Alternative A .....	14
Table 5.3:	Extract of water quality monitoring data for GHT monitoring reports for surface site located on the Wolwespruit (WSS06) and upstream of the Wolwespruit confluence (WSS32). ....	16

## LIST OF APPENDICES

<b>APPENDIX A:</b>	<b>HYDROGEOLOGICAL ASSESSMENT REVIEW</b> .....	<b>16</b>
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**APPENDIX B: WETLAND IMPACT ASSESSMENT REVIEW ..... 17**  
**APPENDIX C: PUBLIC PARTICIPATION REPORT ..... 18**  
**APPENDIX D: ENVIRONMENTAL PERFORMANCE ASSESSMENT REPORT ..... 19**

## 1 INTRODUCTION

Eskom Tutuka Power Station (Tutuka) is located approximately 25 km north-north-east (NNE) of Standerton in the Mpumalanga Province. The power station falls within the Lekwa Local Municipality which falls within the Gert Sibande District Municipality. The station applied for, and obtained, an Integrated Environmental Authorisation (IEA), 14/12/16/3/3/3/52 & DEA/EIA/0001416/2012, for its continuous Ash Disposal Facility (ADF) from the Department of Environmental Affairs on 19 October 2015.

Subsequent to this authorisation, the station applied for a 4-year Exemption from installing the required liner (a Class C liner), as a means to allow station ashing operations to continue while the required designs of the Class C liner were being developed, and to allow for its installation. As part of the Exemption application process, the equivalent footprint (area) for the 4-year Exemption was estimated to be 54ha and was assessed and motivated by an independent Environmental Consultant. The DEA granted the 4-year Exemption on 5 May 2016, and it had some conditions. The Exemption period will lapse on 4 May 2020. Parallel to ashing on the area under the Exemption, developmental work was executed for the Class C liner for the Ash Disposal Facility, commencing beyond the area under the Exemption.

In 2018, Tutuka realised that the 54ha approved under the Exemption would not be fully utilised at the end of the 4-year Exemption period, and a process to determine the most feasible option to manage this usage gap was undertaken, whereby a few alternative strategies were assessed. Through the assessment process a decision was made that the most feasible option was to apply for an extension of the Exemption period, without extending the area under the Exemption.

To execute this strategy, Eskom undertook a Part 1 amendment process in November 2018, but the DEA rejected that application (dated 09 January 2019) and required that a Part 2 amendment process be undertaken instead (which is the subject of this application).

GCS Water and Environment (Pty) Ltd (GCS), as independent environmental consultants were appointed by Eskom (Pty) Ltd to undertake the Part 2 Exemption amendment application process to the Exemption issued, in terms of Regulation 31 and 32 of GN 326; prepare this motivation Report and conduct the associated public participation process in terms of Chapter 6 of the EIA Regulations, 2014, as amended. In addition, confirmation from specialists is required that the proposed extension will not have any additional impacts to those that have already been identified during the 2014 application.

## 2 LEGAL FRAMEWORKS

This report fulfils the requirement of the EIA Regulations (2014) for the documentation of the Amendment Application process. This Amendment Report was compiled in accordance with Section 32 of NEMA's 2014 EIA Regulation (GN R. 982).

### 2.1 Amendment process requirements

In terms of Regulation 31 and 32 of the NEMA Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) Eskom is applying for an amendment to the Exemption that was issued to Tutuka Power Station. Regulation 31 (Part 2) of the 2014 NEMA EIA Regulations states that:

***“An environmental authorisation may be amended by following the process prescribed in this Part if the amendment will result in a change to the scope of a valid environmental authorisation where such change will result in an increased level or nature of impact where such level or nature of impact was not (a) assessed and included in the initial application for environmental authorisation; or (b) taken into consideration in the initial environmental authorisation; and the change does not, on its own, constitute a listed or specified activity.”***

As per sub-regulation (a), the potential impacts which the changes to the land use and approved layout plan might have on the receiving environment, need to be assessed according to the change in level or nature of impact.

## 3 ACTIVITY DESCRIPTION

The operation of the ash disposal facility is such that the facility expands in the eastern direction, where the main stacker system is shifted to the next position every 6 months. This process is repeated twice a year. The main disposal facility is expanding by 80 meters (horizontally) annually, where the shift distance is 40 meters at a time. Through these shifting Eskom covers the remaining landscape in front of the ash disposal facility at a rate of 80 meters per year. The face width of this main disposal facility is about 1300 meters and the front face height is about 32 meters.

The main disposal facility is in operation for about 85% of the time every year. The standby ash disposal facility is also expanding in the eastern direction at a rate of 240 meters and its face width is about 100 meters. The height of this face is about 35 meters. This standby ash disposal facility is covering the front landscape at a rate of 240 meters every year. The standby ash disposal facility is in operation for the remaining 15% of the time when the main ash disposal facility system is not available. The standby ash disposal facility's remaining volume is much smaller than the main ash disposal facility.



## 4 ESKOM MOTIVATION FOR THIS AMENDMENT APPLICATION

Tutuka Ashing Disposal Facility (ADF) applied for, and obtained, an Integrated Environmental Authorisation (IEA), 14/12/16/3/3/3/52 & DEA/EIA/0001416/2012, for its continuous Ash Disposal Facility (ADF) from the Department of Environmental Affairs on 19 October 2015. From an environmental perspective, the motivation for the Exemption application was based on surface water and groundwater reports as well as the ash classification results that formed part of the ADF's EIA process. The intention of the studies and models was to illustrate a worst-case scenario (i.e. ashing without installing a Class C liner) and therefore did not include any mitigation measures in the formulation of predictions. The result of that exercise was that the identified impacts and their significance ratings sketch the unmitigated state. The impacts as identified in the surface and groundwater reports were determined to be the potential impacts that would be experienced during the transitional period (prior to lining). Although Eskom is committed to be compliant with all environmental legislation in connection with its ashing activities for Tutuka Power station, the lining of the future ashing area could only be provided after four (4) years from receipt of the IEA. This duration was due to consideration of project planning lead times within the internal and external governance processes (e.g. Public Finance Management Act (PFMA), application to the Department of Public Enterprises). The estimated footprint required for this 4-year exemption period was only 54ha.

Subsequent to the 2015 IEA, the station applied for a 4-year Exemption from installing the required liner (a Class C liner). The equivalent footprint for the 4-year Exemption was estimated to be 54ha and was assessed and motivated by an independent Environmental Consultant. The DEA granted the 4-year Exemption on 5 May 2016, and it had some conditions. The Exemption period lapses on 4 May 2020. Parallel to ashing on the area under the Exemption, developmental work was executed for the Class C liner for the rest of the Ash Disposal Facility.

In 2018, it was realised that the 54ha approved under the Exemption would not be fully utilised at the end of the 4-year Exemption period due to a change in the Generation Load Factor (GLF) which happened after the issuance of the Exemption approval. An approximate extent of 11ha (of this 54ha) will remain unused after the four-year period which ends in 4 May 2020. A process to determine the most feasible option to manage this usage gap was undertaken, whereby a few alternative strategies were assessed.

To address the 11ha gap, Eskom proposed and assessed the following three (3) options (as presented below):

**1. Retrofit designs to include lining the gap area:**

With this option, a bigger footprint of the ADF would be covered under the Class C liner resulting in less impact than assessed in the exemption application. The retrofit would require time and costs and would delay the submission to the Authorities for decision making, as well as cause a delay in execution of the liner project. In terms of striving for compliance with the liner, this option creates a risk to the project. It was decided that this option should not be pursued, as it does not support the project timelines.

**2. Leave the gap area unused:**

Through this option, there would be a gap in the body of the ADF, between the current/unlined footprint and the new lined footprint. This option would result in loss of ashing capacity, which would require Tutuka power station to source an additional ashing capacity, on additional grounds. This strategy would not support the objective of reducing the environmental footprint. From the operations point of view, the conveyor belts are run on top of a continuous ash body. The gap would create discontinuity which would create risks of ash spillages, thereby causing environmental problems. It was decided that this option should not be pursued, as it does not support the continuous operations and it creates environmental risks.

**3. Continue to ash on the gap area under Exemption without a liner (i.e. this application):**

By executing this option, the operational functionality of the ADF will be continuous, and there will be no risks related to spillages from conveyor belts due to uneven support. There are no additional impacts created since this 11ha is part of the footprint assessed under the exemption application. No rights of individuals will be infringed upon. Tutuka power station will not need to source an additional ashing capacity elsewhere, but this option allows optimisation of the current ADF designs. It was decided that this option should be pursued, as its footprint and significance of impacts is the same as the current exemption approval.

Through the assessment process a decision was made that the most feasible option was to apply for an extension of the Exemption period, without extending the area under the Exemption.

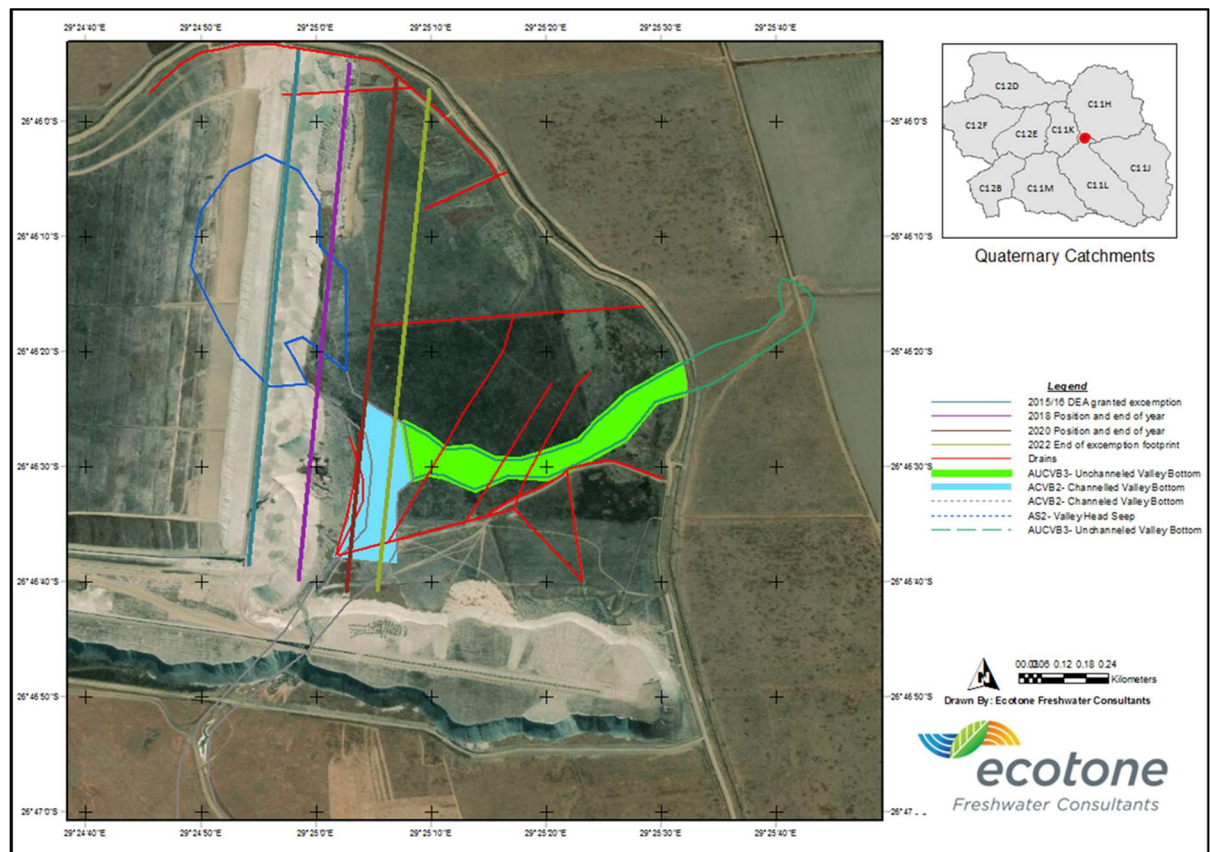
To execute this strategy, Eskom undertook a Part 1 amendment process in November 2018, but the DEA rejected that application (dated 09 January 2019) and required that a Part 2 amendment process be undertaken instead (which is the subject of this application).

## 5 WETLAND IMPACT ASSESSMENT REVIEW

For the full Wetland Impact Assessment Review report compiled by Ecotone Freshwater Consultants, refer to **Annexure C**.

### 5.1 Project area

Tutuka Power Station is located approximately 25 km north-north-east (NNE) of Standerton in the Mpumalanga Province. The power station falls within the Lekwa Local Municipality which falls within the Gert Sibande District Municipality. A greater part of the study area is, is within an 8 km radius of the centre point of the Tutuka Power Station Site, and is made up of agricultural, mining and power generation activities **Figure 5.1** shows the study area in relation to Exemption area.



**Figure 5.1: Study area in relation to Exemption area**

### 5.2 Wetland Assessment

The following wetland assessment methods have been applied after the May 2019 field assessment:

- A WET-Health level 2 assessment was undertaken to ascertain variation in the PES between the 2013 and 2019 assessments. Wetland PES assessment was completed according to the methodology by Macfarlane *et al.* (2009);
- A WET-EcoServices level 2 assessment was used to assess the “ecological goods and services” provided by each particular HGM wetland unit. The tool provides information on the importance of a wetland in delivering different ecosystem services under a number of different categories (Kotze *et al.*, 2009);
- Ecological Importance and Sensitivity (EIS) scores were calculated using the RDM (Kleynhans, 1999) methods.

### 5.3 Summary of Wetland Information

#### 5.3.1 Desktop Information

The authorised Exemption area is located with the upper parts of the Wolwespruit catchment. The Wolwespruit drains into the Grootdraai Dam which in turn, is drained by the Vaal River. Desktop information regarding the Wolwespruit is summarised in Table 5.1.

**Table 5.1: Significance rating categories showing values for Low, Medium and High significance**

Desktop Information	Details/Category/Class
River	Wolwespruit
River Order	1
River Length	23.2km
Hydrological Class	Non-perennial
River Signature	Highveld 3
Conservation Status (Nel <i>et al.</i> , 2004)	Critically Endangered
C-Plan (MBCP- Ferrar & Lötter, 2007)	Ecosystem Maintenance
River NFEPA (Nel <i>et al.</i> , 2004)	Upstream Management Area
Water Management Area	Upper Vaal
Aquatic Ecoregion	Highveld
Quaternary Catchment	C11L
Sub-Quaternary Reach Name	C11L-01825
Present Ecological State (PES- DWS 2012)	D
Ecological Importance and Sensitivity (EIS)	Moderate

### 5.4 Wetland Associated with the Exemption Area

The Exemption area occupies about 54 ha of the upper parts of the Wolwespruit catchment. Two hydrogeomorphic (HGM) units are directly affected by the footprint of this area, these include a valley head seep (AS2) and a channeled valley bottom system (ACVB2) (Figure

5.1). Jointly, the two HGM units represented approximately 18 ha of residual seasonal and temporary wetland extent during the 2014 baseline assessment (**Table 5.2**).

The 2014 PES assessment indicated that both units fell into an E PES, indicating a Seriously Modified state. The poor PES was attributed to hydrological, geomorphological and other physical disturbances. For example, a review of historical aerial images shows that the valley head seep was drained during 2009 (see red arrow in **Figure 5.2A**). Similarly, hydrological connectivity with the upslope catchment has partially been lost pre-dating 2009 (**Figure 5.2A**), with a further loss associated with the expansion of the cut-off trench during 2014 (**Figure 5.2 B**) and complete hydrological isolation of the wetlands affected by the expansion of the cut-off trench around the southern parts of the ash disposal facility (**Figure 5.2 E**).

A revision of the PES indicated a further loss of functional integrity from an E to an F category as assessed during May 2019. The residual wetland extent on the Exemption footprint comprised approximately 5 ha. The valley head seep (HGM AS1) and a portion of the channelled valley bottom wetland (ACVB2) have been ashed over. The examination of the historical aerial images also indicated that additional hydrological modification occurred due to the draining of an unchanneled valley bottom system flowing into HGM ACVB2 (**Figure 5.2 E**). The spatial relationship between the residual wetland ACVB2 and AUCVB3 are provided in **Figure 5.1**.

The 2014 functional ecosystem services assessment of the wetlands indicated likely functions associated with flow augmentation, water purification, erosion control and maintenance of biodiversity (**Table 5.2**). The 2019 revision reflected a lower average Eco-Services score. The decrease in ecosystem services relates to the hydrological isolation of the HGM units associated with the Exemption area and the Ash Facility at large. Similarly, the EIS category decreased from Moderate (important and sensitive on a local scale) during 2014 to Low/Marginal (not important or sensitive at any scale) during 2019 (**Table 5.2**). The decrease in EIS may be attributed to the decrease in wetland extent (direct loss of wetland habitat) and the hydrological isolation of the HGM units as part of the stormwater management and pollution control for the ash disposal area.

The 2014 assessment (inter alia) identified and assessed the wetlands within the footprint of the exemption area. It was expected that the residual functions associated with these wetlands will be completely compromised after ashing. The additional loss in function described in the precluding paragraphs is expected and was considered within the 2014 assessment. It follows that residual wetland functions will remain (albeit constraint) until

the affected wetland unit is completely ashed over. Of critical consideration is the downslope environment in relation to an extended Exemption period (without increasing the footprint under the Exemption application).

**Table 5.2: Total wetland size within primary and secondary study area, PES totals, indirect ecosystem service scores and EIS score for Alternative A**

Wetland (HGM ACVB2)	ACVB2
Residual Wetland Extent on Exemption Footprint (2014)	18 ha
Residual Wetland Extent on Exemption Footprint (2019)	5 ha
PES (2013)	E
PES (2019)	E/F
PES of receiving watercourses	E/F
Eco-Services Score (Average 2013)	2.16
Eco-Services Score (Average 2019)	1.50
EIS (Median 2013)	Moderate
EIS (Median 2019)	Low

## 5.5 Background Water Quality

Water quality monitoring data was extracted from the relevant GHT reports. Surface water quality data relevant to the area downslope of the Ash Facility include monitoring locations WSS61, WSS32 and WSS06 (**Figure 5.3**). The 2015/2016 monitoring data for these sites are presented in **Table 5.3**. Site WSS61 was dry during this monitoring period. Site WSS32 is situated upslope of any runoff or seepage from the Ash Facility and therefore represented the control site. Site WSS06 is located further downstream on the Wolwespruit, but generally represented stagnant water.

The water quality data reviewed reflected alkaline pH values with moderately high salt loads. The September 2015 survey data does not reflect any spatial variation between the control (WSS32) and test (WSS06) sites that may suggest point source pollution from the ash disposal facility. However, the June 2016 data measured a notable increase in Calcium, Magnesium and Sulphate levels at the test site, relative to the control site (**Table 5.3**). Thus, indicating some intermittent influence on the downstream water quality from the pollution control dams.



Figure 5.2: Historical aerial images of the ADF showing the advancement between October 2009 and April 2019.

Table 5.3: Extract of water quality monitoring data for GHT monitoring reports for surface site located on the Wolwespruit (WSS06) and upstream of the Wolwespruit confluence (WSS32).

Sites	Date	pH	EC mS/m	TDS ppm	Na mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	F mg/L	K mg/L
WSS32	Sep-15	8.1	88.4	565	46.8	72.4	51.7	32.9	93.7	0.296	3.4
WSS32	Mar-16	Dry									
WSS32	Jun-16	8.2	64	506	40.3	45	36	32.4	72.5	0.3	5
WSS32	Oct-16	Dry									
WSS06	Sep-15	8.2	87.7	555	46.8	71.3	49.9	37.2	97.4	0.306	33
WSS06	Mar-16	8.7	68	430	36.3	47	48	26.5	35.7	0.4	9
WSS06	Jun-16	8.2	94	765	40.3	82	68	35.5	218.4	0.37	6
WSS06	Oct-16	8.57	131	818	80.8	111	73.4	58.4	60.5	0.523	12

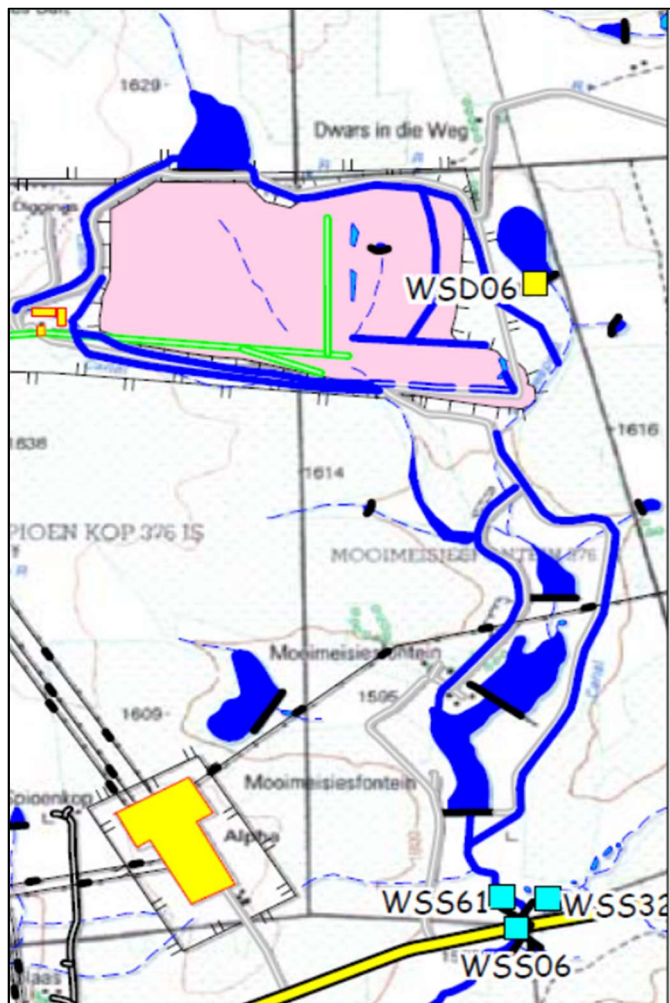


Figure 5.3: Relevant surface water quality monitoring points on the Wolwespruit.



## 5.6 Revision of Wetland impact Assessment

This section provides a revision of impacts identified during the 2014 wetland impact assessment for the construction and operation phases. Operation activities occurs concurrently with construction activities (at different footprint area) and involves the spreading and stacking of dry ash, prepared during the construction phase. Construction activities entail removing vegetation and topsoil in the area immediately required for the advancement of the ashing facility, and preparation of the area. The current ashing philosophy is that ashing facility footprint is moving in an easterly direction and occupies a portion of the Wolwespruit catchment which is draining in a southern direction. Surface runoff and interflow from the Exemption footprint and general ashing facility are intercepted and directed to pollution control dams located within the natural drainage of the Wolwespruit.

### 5.6.1 Impacts identified during Construction Phase

#### 5.6.1.1 Alteration in Wetland Hydrology due to Changes in Surface Roughness

##### **Impact Description**

Clearing of vegetation results in decrease surface roughness and change in runoff characteristics. The residual area that will be cleared of vegetation within the Exemption area is approximately 11 ha. The natural topography of these 11 ha drains south towards a topographical low point as indicated in **Figure 5.1**. The surface and soil hydrology in this area is intercepted by 'fish bone' drains (see **Figure 5.1**, **Figure 5.2 E** and **F**). The downstream extent of hydrological alteration is limited for the following reasons:

- (i) all runoff from the area is intercepted by the southern portion of the ash disposal facility which results in localised ponding.
- (ii) Runoff is temporarily retained and drained underneath the ash disposal facility in the direction of three pollution control dams (the pollution control dams are located on the Wolwespruit).
- (iii) The underlying soils within the Exemption area predominantly consist of vertic soils with low hydrological conductivity.

It follows that the majority of the hydrological maintenance of the downstream wetlands will be through surface runoff. Because of these reasons the hydrological impacts associated with an increase in runoff rates due to changes in surface roughness will be limited to the Exemption footprint and the pollution control dams.

The resultant impact significance remains '**Low**' prior mitigation and the significance of the impact on hydrology due to changes in surface roughness during construction is assessed as '**Low**' prior to mitigation.

Extending the duration of construction within the existing Exemption area will not pose an additional risk to wetland hydrology.

#### **Proposed Mitigation Measures**

The following mitigation measures are recommended:

- Minimize peripheral vegetation clearing to the smallest possible extent and for the smallest possible time during construction;
- Stormwater management will require draining the topographical low point associated with the Exemption area, into the downslope pollution control dams. No flows will be released from the pollution control dams that may influence the hydrology of the downstream water resources.

The proposed mitigation measures aim to reduce the extent and duration of changes in runoff characteristics during construction.

The impact can further be reduced but will remain of '**Low**' significance after mitigation

#### *5.6.1.2 Impact on Surface Water Quality Due to Construction Activity*

##### **Impact Description**

The clearing of vegetation and topsoil in preparation for ashing will result in increased sediment loads, as well as other pollutants derived from spillage and leakage of construction machinery operating within the Exemption area during construction. The significance of the impact is assessed as '**Low**' prior to mitigation for the following reasons:

- (i) surface water is intercepted by the stormwater system and becomes part of the 'dirty' water which is directed into the pollution control dams.
- (ii) The intensity of seepage is likely to be low due to the underlying vertic soils.

Extending the duration of construction within the existing Exemption area will not pose an additional risk to water quality of the downstream water resource.

#### **Proposed Mitigation Measures**

Embedded controls are associated with the stormwater management during construction and relate to the following:

- Interception of sediment-laden (and otherwise contaminated) runoff through stormwater management of the construction area into the existing dirty water systems;
- Discharge of contaminated runoff will occur into the pollution control facilities and or reapplied within the existing as disposal facility footprint.

The residual impact significance is assessed as '**Low**' after to mitigation as the implementation of the proposed mitigation will further reduce the probability of Water quality related impacts within the downstream environment.

### 5.6.1.3 Impact on Wetland Vegetation and Disturbance of Wetland Habitat

#### **Impact Description**

The residual wetland extent within the Exemption area is approximately 5 ha. The associated wetland vegetation that will be cleared during construction is largely transformed either through direct disturbances, alien vegetation encroachment (for example the high abundance and cover of *Bidens Formosa*- *Cosmos*) or terrestrialisation due to extensive draining of the wetland.

The loss of wetland vegetation and associated wetland habitat is assessed as '**Medium**' significance prior to mitigation. The significance of the impact is independent of an extension in the duration of the construction activities and the significance of the impact will remain the same if the construction period is increased.

Extending the duration of construction within the existing Exemption area will not pose an additional risk to wetland vegetation.

#### **Proposed Mitigation Measures**

The following mitigation measure is proposed:

- Limit the extent of vegetation clearing to the authorised footprint.

The proposed mitigation measure aims to reduce the extent of vegetation clearing. The likelihood of wetland habitat loss impact to the adjacent wetland will further be reduced.

The residual impact significance is assessed as '**Low**' after Mitigation.

### 5.6.1.4 Impact Related to Increase of Alien/Pioneer Vegetation in Areas Disturbed by Construction Activities

#### **Impact Description**

Disturbances to the wetland (HGM ACVB2) on site will provide opportunity for invasion by alien and invasive species. Species such as *Bidens formosa* (*Cosmos*) which are already occurring with a high abundance and cover, within and outside the HGM unit. The additional spread of alien and invasive species into wetland unit AUCVB2 (to the east of the Exemption area) may further reduce the ecological integrity of the wetlands on site. However, the significance of the impact of alien and invasive encroachment due to construction activity will not increase due to the extension of the Exemption period; as the primary driver relates to the extent of soil disturbance in preparation for ashing.

The impact of alien and invasive species encroachment during construction is assessed to be of '**Low**' significance prior to mitigation.

Extending the duration of construction within the existing Exemption area will not pose an additional risk of alien vegetation.

### **Proposed Mitigation Measures**

Mitigation measures to further reduce the impact of alien and invasive species encroachment include the following:

- The extent of vegetation clearing and soil preparation prior to ashing will be limited to the absolute minimum at any given moment during the construction phase. This mitigation measure will also assist erosion control and the rate at which the receiving pollution control facility silts up;
- Control the spread of alien and invasive species from disturbed areas into the neighbouring areas, through the application of an alien and invasive species monitoring programme.

The impact is assessed to be of '**Low**' significance after mitigation.

#### *5.6.1.5 Impact on Residual Wetland Functionality and Associated Ecosystem Goods and Services*

### **Impact Description**

Hydrogeomorphic unit ACVB2 reflects a residual extent of approximately 5 ha. The HGM represents a seasonal and temporary channelled valley bottom system. The loss in wetland habitat, and flow maintenance will result in a decrease in ecosystem services associated with this wetland. However, this wetland unit falls into an E/F PES state and its residual capacity to provide ecological goods and services are largely lost. Moreover, the rehabilitation potential for this wetland unit is virtually sterilised. The upslope hydrological pathways have been lost and the downslope drainage is intercepted by the ash disposal facility and directed into the pollution control system.

The impact significance is assessed as '**Medium**' prior to and after mitigation.

Extending the duration of construction within the existing Exemption area will not pose an additional risk to wetland functionality.

### **Proposed Mitigation Measures**

The current direction of ashing will unavoidably sterilise HGM ACVB2 and the residual ecosystem functions, goods and services will be lost. Functionality related to erosion control, water purification and stormwater attenuation will largely be substituted through the stormwater and pollution control system. However, the actual loss of wetland habitat and associated biodiversity cannot be readily mitigated.

This impact assessment assumes a net loss within the biodiversity functions associated with HGM ACVB2 and the post-mitigation impact significance remain '**Medium**'.

However, a review of the baseline wetland report (Ecotone, 2014) indicates a number of similar HGM units in and around the ash disposal facility. Nearly all of the wetlands reflect

some loss in functionality. An opportunity exists, to regain some wetland goods and services through the rehabilitation of wetland units offsite from the Exemption footprint. The ecological gain associated with the implementation of this mitigation measure may not be justified solely in the context of the residual impact of ashing within the Exemption footprint. However, in the context of the cumulative loss of wetlands associated with the larger extension of the facility, a wetland rehabilitation and management plan is prudent to mitigate the net loss of wetland habitat and particularly biodiversity functions associated with these wetlands.

It is possible to mitigate the net loss of wetland functions associated with the Exemption area through rehabilitation of degraded wetlands around the existing and future ashing facility. The residual significance of this impact can be reduced to be of '**Low**' significance.

### *5.6.2 Impacts identified during Operational Phase*

It has been determined during this assessment that the operational impacts identified during the 2014 baseline study will not be affected by increasing the duration of ashing within the authorised Exemption due to the following reasons:

- (i) all drainage associated with the Exemption area is already intercepted and directed into the pollution control system and
- (ii) the extent of downstream water pollution is mitigated by the existing separation of clean and dirty water. Dirty water that will arise from runoff is directed into the pollution control system

Impacts and associated mitigation measures relating to the operational phase are revised in the following sections with a specific reference to increasing the duration of ashing within the authorised Exemption area.

#### *5.6.2.1 Hydrological Impacts on Downstream Wetlands During Operations*

##### **Impact Description**

Wetland unit ACVB2 drains a catchment of approximately 250 ha. This catchment is almost completely occupied by the existing Ash Facility footprint. The north-eastern portion of this catchment remains open veld but is earmarked for the future expansion of the Ash Facility. The catchment of HGM ACVB2 drains into Tributary 1 which drains into the Wolwespruit, which in turn flows into the Grootdraai Dam. Tributary 1 represents a subcatchment of approximately 480 ha, while the Wolwespruit drains about 10 000 ha at its confluence with the Grootdraai Dam. It follows that the proportional water contribution of the ACVB2 catchment is about 52% that of the Tributary 1 catchment and 2.5% that of the Wolwespruit catchment (at the location where it flows into the Grootdraai Dam).

All the flows from the ACVB2 catchment is intercepted and directed into the pollution control facility, subsequently decreasing the water budget for the downstream

watercourses. From the analyses, the proposal contribution associated with the ACVB2 catchment to the downstream environment is relatively small and insignificant at the location of where the Wolwespruit flows into the Grootdraai Dam. The magnitude of the impact is further reduced due to the poor PES of Wolwespruit.

The hydrological impact on the downstream wetlands during operations, specifically assessed in terms of the Exemption area will be of '**Low**' significance prior to mitigation. Extending the duration of the ashing within the authorised Exemption area will not influence the significance of the impact associated with hydrological changes to the downslope water resources.

#### **Proposed Mitigation Measures**

The hydrological contribution associated with HGM ACVB2 (that fall within the footprint of the Exemption area) will be lost. As a related measure the control of alien and invasive species (particularly wattle and blue gum species) around the pollution control dams will contribute positively to the local water budget. The implementation of such measures is likely to further reduce the residual significance hydrological impact to the downstream environment.

#### *5.6.2.2 Impact on Surface Water Quality During Operations*

##### **Impact Description**

Seepage or leakage of polluted water out of the ash disposal facility into adjacent wetlands is likely to result in a deterioration of water quality within the receiving watercourses. Decreasing water quality within the downslope environment is likely to have a deleterious effect on the biodiversity supported by these wetlands, as well as making the water less fit for use for downstream water users. Downstream water users at a local scale include farmers using the water for livestock watering and irrigation, while further downstream the water enters the Grootdraai Dam and the Vaal River.

The extent of the pre-mitigation impact has conservatively been assessed as '**Medium**' as the pollution control dams are located within the Wolwespruit with no buffer to the downstream drainage system if spillage should occur during larger flood events. Additional factors influencing the extent of water quality deterioration is ash deposition through wind. Wind poses the risk of mobilizing ash dust particles and depositing it into receiving watercourses.

An extension of the duration of the ashing period within the authorised exclusion Exempted area will not influence the significance of downstream wetland impacts related to water quality.

### **Proposed Mitigation Measures**

The extent, duration, magnitude and probability of water pollution through the following would be reduced through the following measures:

- Contaminated runoff will be intercepted and isolated from the downstream drainage; Surface water quality monitoring for sites WSS61, WSS32 and WSS06 (refer to Routine Monitoring Report- GHT 2016) will continue. These monitoring points are located downstream of pollution control dams on the Wolwespruit;
- The continuation of proper management of the dirty / clean water separation system south and east of the Ash Facility is critical to control water pollution along the natural drainage system of the Wolwespruit;
- Effective suppression of dust during operations will further reduce the extent of surface water pollution through wind.

The implementation of effective dirty water separation and containment through the pollution control system and effective dust control in conjunction with surface water monitoring along the Wolwespruit will reduce the residual impact of water quality deterioration to '**Low**' during operation.

## **6 HYDROGEOLOGICAL ASSESSMENT REVIEW**

For the full Hydrogeological Assessment Review report compiled by GCS Pty Ltd, refer to **Annexure C**.

### **6.1 Verify Potential Impacts**

The previous hydrogeological studies conducted during the original exemption application was reviewed together with the site information received from Eskom. Findings were made to determine if SLR Global Environmental Solutions (SLR)'s previously predicted groundwater impacts will change or not due to additional time used to ash over the same footprint (54ha) under the exemption approval area.

### **6.2 Previous predicted groundwater impacts**

#### **6.2.1 Ground Water Levels**

SLR 2014 Groundwater Specialist Study (SLR 2014) noted that even though a dry ashing technique will be used during the operational phase from 2015 onwards for the ash disposal facility, precipitation will collect on top of the ash disposal facility and eventually infiltrate through the ash and liner to the underlying aquifer.

SLR stated that water will likely be stored within the ash disposal facility over time and subsequently increase the 'recharge' within the footprint of the facility which may cause mounding of groundwater. However, this ultimately depends of the volume of water that falls on the facility and the relative permeability of the ash, which were only estimated in the study. This may have the potential to cause a rise in the water table beneath the ash disposal facility and may impact local groundwater flow directions. Notwithstanding, it was considered by SLR unlikely that a significant rise in the water table beneath the ash disposal facility will occur as a direct result of the ash itself. SLR also noted that the use of toe drains, stormwater dams and other surface water impoundments close to the proposed ash disposal facility may lead to local water table rise.

### *6.2.2 Groundwater quality*

The SLR numerical model predictions results suggested that the movement of leachate away from the ash disposal facility as a groundwater plume should take place relatively slowly, with predicted plume extent being generally less than 1 km from the ash disposal facility after 100 years. However, the input concentration for the model was only made as 100 % and the ash material was never characterised by means of geochemical analyses. Geochemical modelling to determine potential contaminants of concern and the final expected water quality emanating from the ash disposal facility has not been undertaken to date.

SLR (2014) concluded that the quality of groundwater beneath the site will most likely deteriorate, since natural groundwater will be mixing with the poorer quality ash leachate (either directly draining from the ash disposal facility or leaking from surface water impoundments). Geochemical data for the ash at Tutuka was not made available for the SLR (2014) assessment, but typical constituents of concern (elements that are elevated above water quality standards) listed by SLR included: arsenic, boron, chromium, molybdenum, antimony, selenium, vanadium and wolfram. In addition, the pH of water was also mentioned to be impacted upon. It was noted however that groundwater quality data indicated that groundwater quality has already been impacted by the existing ash disposal facility.

SLR stated that if contaminated water was impounded at the surface in unlined ponds, there was a risk to both groundwater and surface water resources. SLR reviewed monitoring data and there was an indication that boreholes located near ponds were adversely impacted both in terms of groundwater levels and quality.



### 6.2.3 Summary of Impacts

The cumulative impacts from the ash disposal facility of all three phases (construction, operation and decommissioning) determined by SLR (2014) were summarised as:

- A rise in water table in the vicinity of the site due to increased recharge from stored water within the ash disposal facility and any associated surface water impoundments.
- Deterioration in groundwater quality.

The potential impacts of the proposed ash disposal facility on the local groundwater were also qualitatively assessed by SLR and the nature of the impacts were assessed using a standard significance rating scale. The significance rating for the cumulative impacts from the ash disposal facility with and without mitigation measures were determined by SLR as medium to low respectively in terms of deterioration of groundwater quality due to leachate from ash disposal facility.

### 6.3 Verification of previous groundwater impacts

The previous hydrogeological study conducted by SLR (2014) during the original exemption application was reviewed together with the site information received in order to determine if SLR's previously predicted groundwater impacts will change or not due to additional time used to ash over the same footprint (54ha) under the exemption approval area.

Regarding groundwater levels, SLR concluded that there was a risk that a rise in water table in the vicinity of the site due to increased recharge from stored water within the ash disposal facility and any associated surface water impoundments could occur. A slight rise in water table depth were noted from monitoring data around the ash disposal facility and were determined by GHT Consulting Scientists to be potentially due to historic influences of brine water irrigation and/or recharge occurring through the top. Although the rise in water levels were extremely slow, it was recommended by GHT Consulting Scientists to further investigate as this could potentially be as a result of the ash disposal facility slowly becoming more saturated.

During the operational, decommissioning and post closure phases the main impact on groundwater that may result from the additional time used to ash over the same footprint under the exemption approval area is the contamination of the groundwater as a result of seepage from the ash disposal facility. Based on the results from the previous SLR (2014) study and on-site monitoring the following can be concluded related to groundwater quality:

- SLR (2014) found from previous monitoring data that the groundwater of the sites on the current ash disposal facility shows signs of severe contamination.

- SLR (2014) noted that the deteriorating qualities of the deep piezometers from the current ash disposal facility was reported to be impacting on the shallow aquifer directly below the current ash disposal facility.
- Severe contamination reported downstream of the current ash disposal facility were reported by SLR (2014) to indicate that contaminant migration has occurred away from the current ash disposal facility and detrimental impacts on the groundwater quality have resulted primarily towards the east and south-east.
- The hydrocensus conducted by SLR (2014) included the sampling of three groundwater samples and the results indicated that chromium, iron, manganese and selenium were observed at concentrations above the SANS 241 (2011) limits. The electrical conductivity, total dissolved solids, chloride and sulphate concentrations were all significantly elevated above the most stringent water quality limits in one sample.
- The majority of groundwater monitoring sites on the ash stack shows signs of severe contamination.
- The deteriorating qualities of the deep piezometers indicated, according to GHT Consulting Scientists, that the ash stack is impacting on the shallow aquifer directly below the ash stack. The water quality monitoring results indicated that contaminant migration has occurred away from the ash stack and detrimental impacts on the groundwater quality have resulted primarily towards the east and south-east, approximately 30 to 800 metres downstream of the ash stack at that period.
- It was concluded by GHT Scientific Consultants that the impact on the groundwater sites downstream from the ash stack were likely attributed to the dams and channels transferring dirty water from the ash stack than solely the seepage from the ash stack. Contaminations were reported for monitoring boreholes located approximately one kilometre downstream from the dirty/clean water dams.
- Contaminants of concern reported from monitoring data were fluoride, magnesium, sodium, chloride, and sulphate. Elevated electrical conductivity was also noted.
- Surface water samples of the stream south of the ash disposal facility, the dirty water dams and the clean water dams showed severe signs of contaminations with sulphate concentrations from the dirty water dams ranging between 621 mg/L and 11 083.0 mg/L and electrical conductivity ranging between 299 mS/m and 4 222 mS/m.
- Chemical constituents analysed during site monitoring do not include all contaminants of concern identified from groundwater case studies, conducted in South Africa as well as internationally, that may potentially be present in leachate emanating from similar ash disposal facilities.
- No geochemical assessment has been conducted during the SLR (2014) assessment and no geochemical data were received from the client in order to identify all the contaminants of concern that may have an impact on groundwater quality.

## 7 THE RESULTS OF MONITORING PROGRAMMES

Eskom Tutuka Power Station (Tutuka), applied for a 4-year Exemption from installing the required liner (a Class C liner), as a means to allow station ashing operations to continue while the required designs of the Class C liner were being developed, and to allow its installation. The station was granted the 4-year Exemption on 5 May 2016, and it had the following conditions that Tutuka is expected to comply with.

1. 1 The permanent ash disposal facility will be lined as per Environmental Authorisation dated 19 October 2015, after four (4) years of the issuance of this exemption, with a view to minimise seepage of poor-quality leachate into the groundwater resources;
2. The Holder of EA must compile and submit annual progress reports annually on the status of the engineering drawings;
3. The ash disposal facility, pollution control dams, drainage trenches or any effluent storage facility must not be constructed on geological features such as lineaments, dykes, fault zones or shallow water table;
4. A groundwater monitoring programme in terms of quality and quantity must be developed and implemented which will include monitoring of boreholes up gradient and down gradient of the proposed ash disposal facility and be submitted for approval before disposal of ash;
5. A monitoring programme which defines the frequency of measurements, parameters to be monitored as well as database and reporting must be developed;
6. Groundwater levels and quality must be monitored on a two-month basis in order to quantify ongoing impact and provide early warnings of any problems;
7. Additional groundwater monitoring boreholes must be incorporated into the existing monitoring programme and must be sited and drilled to a depth that penetrates the whole system for both shallow and deep groundwater;
8. The shallow aquifer zone must be ceased and sealed off in the deeper boreholes to minimise the risk of cross contamination. A few of the monitoring boreholes must be installed in the shallow aquifer as an early detection system;
9. If all parameters after being monitored for a period of two years or less show an increasing trend, the groundwater quality monitoring frequency must be changed from bimonthly to monthly;
10. Emergency actions plans in case of groundwater pollution from the ash disposal facility and pipe leakages must be adhered to in order to protect groundwater quality from degradation;
11. Abstraction from boreholes close to the ash disposal site must be avoided due to the fact that the water quality is unsuitable for human consumption.

12. The licence holder must maintain the structural integrity of the ash disposal facility to prevent lipping and erosion.
13. Any subsided surface adjacent to the ash disposal facility must be rehabilitated to minimise ingress of surface water into the ash disposal facility. Massive subsides must be reported to the council of Geoscience immediately.
14. The site should be capped effectively to minimise ponding and runoff should be directed away from the ash disposal facility.

GCS Water and Environment (Pty) Ltd. (GCS) was contracted by Eskom to conduct an independent Environmental Performance Assessment (EPA) Audit for the Tutuka Power Station Ash Disposal Facility as part of the Part 2 Exemption amendment application process to the Exemption issued, in terms of Regulation 31 and 32 of GN 326. The EPA audit was carried out against all conditions included in the Exemption approval of 05 May 2016.

A one (1) day site visit was undertaken at the Tutuka Power Station on 21 May 2019. The site visit was initiated with a project kick-off meeting during which GCS met with Tutuka's Environmental Officer (EO) for this project. Following the kick-off meeting, a comprehensive review of the documentation and associated checklists was undertaken. This assessment monitored compliance in terms of document control, systems and procedures. Following the checklist audit and documentation review. Accordingly, the following activities were undertaken as part of the EPA Audit:

- Assessment and comparison of the current site activities with those described in the Exemption approval;
- Comparison of environmental mitigation measures implemented on site to those required and committed to in terms of the exemption in order to assess whether these comply with the management objectives committed to in the Exemption approval;
- Assessment of monitoring requirements to current monitoring practices;
- Assessment of relevant documentation pertaining to various compliance aspects; and
- Identification of current activities and facilities at the Tutuka Power Station ADF, which are not specifically included in the Exemption approval.

A detailed description of all the audit findings, the ranking and scoring together with observations and recommendations are provided for in the Audit Report attached as **Annexure D.**

A summary of the critical and moderate findings made during the EPA is presented in the section that follow.

## **7.1 Monitoring Frequency**

### Condition 6 of the Exemption approval

Groundwater levels and quality is monitored on a quarterly basis at Tutuka Power station. The existing Tutuka monitoring protocol and also the conditions of the WUL stipulates that the monitoring should be done on a quarterly basis. It is difficult to conduct the monitoring on a two-monthly frequency as the acceptable period from DWS for groundwater monitoring is quarterly.

It is recommended that Eskom consult with the DEA in order to motivate for monitoring at the station to be undertaken on a quarterly basis as with the conditions of the WUL.

From the auditing findings, it can be concluded that Tutuka is 96% compliant with their conditions of the exemption approval. Through the on-site meetings and observations, it is clear that Tutuka is aware of all the areas of concern.

## 8 PUBLIC PARTICIPATION

### 8.1 Purpose of Public Participation

GCS were appointed by Eskom (Pty) Ltd to undertake the Part 2 Exemption amendment application process to the Exemption issued, in terms of Regulation 31 and 32 of GN 326; and as part of the application process, conduct the associated public participation process in terms of Chapter 6 of the EIA Regulations, 2014, as amended.

The Public Participation Process (PPP) is a requirement of the environmental authorisation process and ensures that all relevant I&APs are consulted and involved. The process ensures that all stakeholders have an opportunity to raise their comments as part of an open and transparent process, which in turn ensures for a complete comprehensive environmental study.

The purpose of PPP and the engagement process is to:

- Introduce the proposed extension project;
- Explain the Amendment Application and PP processes to be undertaken;
- Determine and record public issues and concerns;
- Provide opportunities for public input and gathering of local knowledge;
- Inform a broad range of stakeholders about the project and the environmental process to be followed;
- Establish lines of communication between stakeholders and the project team; and
- Identify all the significant issues in the project.

### 8.2 I&APs Consultation

The sections that follow detail the PPP to be undertaken for the project. The PPP will be undertaken in terms of the NEMA EIA Regulations (2014). The PPP will be initiated when this draft Motivation Report is placed for public review and comments.

#### 8.2.1 Site Notices

A2 laminated site notices will be placed on and around the project area.

#### 8.2.2 Background Information Document (BID)

A Background Information Document (BID) will be provided to the stakeholders/Interested and Affected Parties (I&APs) and will contain the basic facts about the proposed project. The BID will include as a minimum, the following information:

- A project description;
- A locality map;

- An outline of the environmental process being followed;
- The details of the public consultation process; and
- The contact details of the appointed EAP.

BIDs will also be distributed by email, fax, post to all registered stakeholders/I&APs in the existing database from the recent ADF and Exemption processes, and by placement in a public venue for access to stakeholders/I&APs that have not registered as I&APs yet. The BID will be produced in English only.

### 8.2.3 Newspaper Advertisements

An advertisement will be placed in two (2) different newspapers used previously for Tutuka applications. The newspapers in which the advertisements will be placed are:

- The Highveld tribute, and
- The Cosmos News.

### 8.2.4 Public Review

For this project, the draft Report will be made available for public review and comments from 30 July 2019 until 29 August 2019, on the GCS Website (<http://www.gcs-sa.biz>) and at the Eskom website ([http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment\\_Impact\\_Assessments.aspx](http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx)).

The Draft report (hard copy) will also be made available at the venues below for review and comments during the period from Tuesday, 30 July 2019 to Thursday, 29 August 2019:

Venue	Working Hours	Street Address	Contact No.
Standerton Public Library	08:30 - 16:30	Cnr Beyers Naude and Mbonani Mayisela Street	017 712 9678
Tutuka Power Station Reception Area	07:00 - 16:00	Between Standerton and Bethal Road (after R 38)	017 749 9111

### 8.2.5 Issues and Response Register (IRR)

To date, no issues, concerns or comments on the project have been received by the EAP, as such the IRR currently has no information contained therein. It is anticipated that issues, concerns and comments will be received by the EAP when adverts and site notices are placed, when the BID is distributed, and when the Draft Report is released for review. The EAP commits to include a summary of the issues, concerns and comments received in the Final Report.

## 9 CONCLUSION

Eskom Tutuka Power Station (Tutuka) undertook a Part 1 amendment process in November 2018, which was rejected by the DEA in a letter dated 09 January 2019; and required that a Part 2 amendment process in terms of Regulation 31 and 32 of GN 326 be undertaken instead for the Exemption approval issued on 5 May 2016 (which is the subject of this application). In addition to the Part 2 Exemption amendment application process, Tutuka was requested to undertake the following:

- Public Participation Process report conducted in terms chapter 6 of the EIA Regulations, 2014, as amended;
- Confirmation from all specialists that conducted the studies that the proposed amendment will not have additional impacts on the environment; and
- The results of monitoring programmes requested to be developed in the Exemption issued on 05 May 2016.

GCS Water and Environment (Pty) Ltd (GCS) and Ecotone Freshwater Consultants CC assessed the previous specialist reports produced during the exemption application in order to confirm if the 2014 findings will change due to additional time used to ash over the same footprint (54ha) under the exemption approval, and have made the following conclusions:

### **Specialist Wetland Impact Assessment Review**

An extension of the duration of Exemption period to cover the residual area of 11 ha does not influence the residual significance of any of the anticipated impacts identified during the 2014 assessment. The affected wetlands drain a portion of the Wolwespruit catchment that is entirely intercepted by the pollution control of the existing facility. Residual functions such as water purification, flood attenuation and erosion control are thus represented within the pollution control system. Conversely, a net loss in downstream flow augmentation and biodiversity functions have already occurred.

### **Hydrogeological Impact Assessment Review**

The cumulative impacts from the ash disposal facility of all three phases (construction, operation and decommissioning) determined by SLR (2014) were summarised as:

- A rise in water table in the vicinity of the site due to increased recharge from stored water within the ash disposal facility and any associated surface water impoundments.
- Deterioration in groundwater quality.

It can be concluded that, an extension in the duration of ashing within the residual Exemption period to cover the residual area of 11 ha will not change the groundwater



impacts determined by SLR (2014), the 2014 identified impacts will still remain in terms of groundwater levels and quality.

An independent Environmental Performance Assessment (EPA) Audit for the Tutuka Power Station Ash Disposal Facility as part of the Part 2 Exemption amendment application process to the Exemption issued, in terms of Regulation 31 and 32 of GN 326. The EPA audit was carried out against all conditions included in the Exemption approval of 05 May 2016.

Currently the overall compliance with the Exemption approval is noteworthy. Overall there was one (1) incident of minor non-compliance, and zero (0) incidents of major non-compliance observed for the audit period. Tutuka is compliant with most of the conditions of the Exemption approval that apply to the current status of the project. There were no incidents of Major Non-compliances observed. This is a verification that Tutuka takes their compliance to the Exemption approval seriously and the Auditor is satisfied that the conditions of the Exemption approval are being complied with in full. From the auditing findings, it can be concluded that Tutuka is 96% compliant with their conditions. Through the on-site meetings and observations, it is clear that Tutuka is aware of all the areas of concern.

Overall it can be concluded that extending the duration of the Exemption period, resulting in use of the residual 11ha, will not have additional impacts that those that were predicted in the 2014 specialist study. It is crucial for Tutuka to ensure that all management and mitigation measures are implemented and adhered to in order to comply with to ensure minimum harm to the environment. The impacts identified for the construction operation phase are mostly medium in nature and with the proper implementation of the mitigation measures proposed; these impacts can be further reduced to avoid long term damage to the biological and social environment.

## **APPENDIX A: HYDROGEOLOGICAL ASSESSMENT REVIEW**

## **APPENDIX B: WETLAND IMPACT ASSESSMENT REVIEW**

## **APPENDIX C: PUBLIC PARTICIPATION REPORT**

## **APPENDIX D: ENVIRONMENTAL PERFORMANCE ASSESSMENT REPORT**