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|---|----------------------|----------------------------|
|  | <b>Scope of work</b> | <b>Duvha Power Station</b> |
|---|----------------------|----------------------------|

Title: **Scope Of Works For Professional Service For Water Retaining Structures In Duvha Power Station**

Unique Identifier:

Alternative Reference Number: **N/A**

Area of Applicability: **Engineering**

Documentation Type: **Specification**

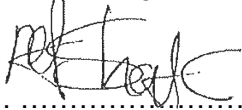
Revision: **0**

Total Pages: **13**

Next Review Date: **N/A**

Disclosure Classification: **CONTROLLED DISCLOSURE**

**Compiled by**



**TC Netshia**

**System Engineer: Civil**

Date: 22/04/2021

**Authorised by**



**NE Hlophe**

**Auxiliary Engineering Manager**

Date: 2021/05/24

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## 1. INTRODUCTION

Duvha Power Station, owned and operated by Eskom is a coal fired power station of six power generating units with a combined capacity of 3,600MW. The power station is located about 13 kilometres south-east of Emalahleni in the Nkangala District Municipality, Mpumalanga Province. The location is illustrated in Figure 1-1 below, as well as the locality plans included under Appendix A. The centre co-ordinates (WGS 84) for the power station are as follows:

25° 57' 40.96" S 29° 20' 17.06" E

The Power Station is comprises of vast number of water retaining civil infrastructures which requires numerous inspection as stipulated in the SANS standards, OSH Acts, latest legislation, Water Acts and various Eskom standard to ensure that the required maintenance is executed as well as complying with the law.

Duvha water returning structure is comprised by the ash water return system structures (Ash dam, Silt Traps, Low Level Dam (LLD), and High Level Dams (HLD)), storm water system (Storm water drains, North station drains (NSD) dams and South station drains (SSD)), Raw water system structures (Raw Water Dams and Clarifiers) and waste water system structures ( Maturation ponds, Aeration pond and sewage reticulation drains).

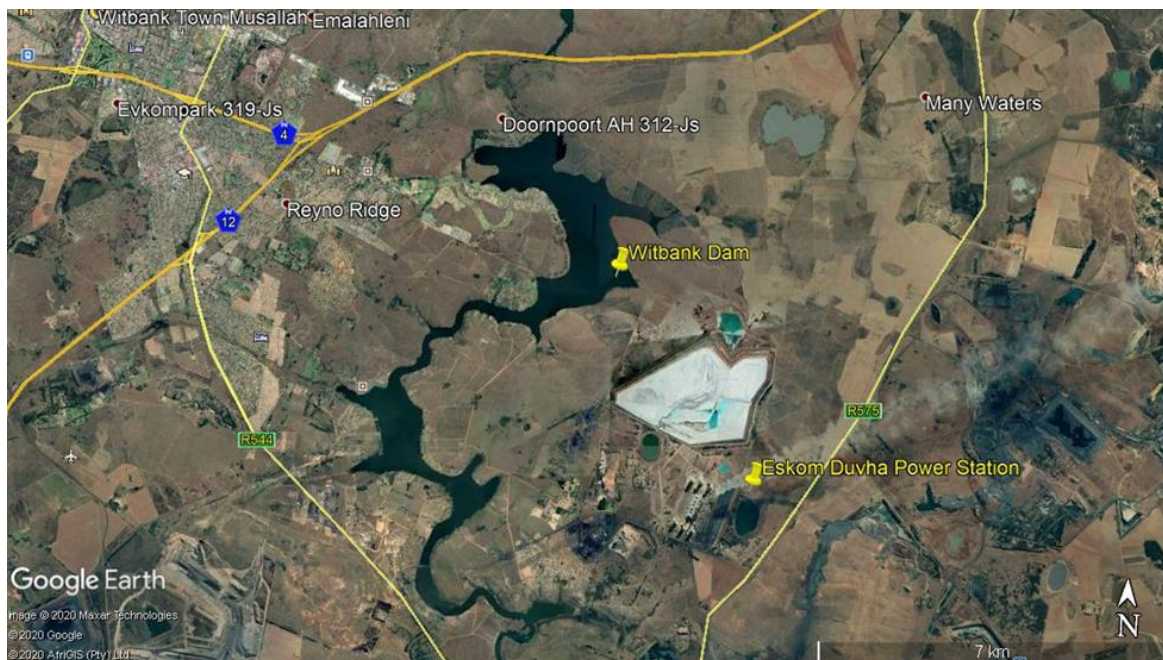


Figure 1-1: Google earth Image showing Duvha Power Station Locality

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## **2. SUPPORTING CLAUSES**

### **2.1 SCOPE**

The scope is to contract a professional service provider to monitor, inspect and provide recommendation for Duvha Power Station water retaining structures for a period of 3 years.

#### **2.1.1 Purpose**

The purpose of this contract is to conduct required civil and structural inspection for all water retaining structures in Duvha Power Station to ensure compliance to latest legislation and legal requirements which are not limited to the following:

- National Water Act (Act 36 of 1998)
- OHS Act inspections requirements
- Government Notice 704 (Government Gazette 2018 of June 1999)(GN704)
- Dam Safety Regulations, Government Notice No. R. 139 of 25, 24 February 2012
- Inspection Manual for Civil Works at Eskom's Power Stations (240-99527377)
- SANS 10268: Mine residue (24013693)

To proactively prevent structural failures that may result to loss of life and financial loss to Eskom.

#### **2.1.2 Applicability**

This document applies to Duvha Power Station.

## **2.2 NORMATIVE/INFORMATIVE REFERENCES**

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

### **2.2.1 Normative**

- [1] 32-727 - Eskom Safety, Health, Environment and Quality (SHEQ) Policy
- [2] 240-99527377 Inspection Manual For Civil Works at Eskom's Power Stations
- [3] 03A-ENM0003 Ash Dams Operations and Maintenance Manual
- [4] 03A-ENM0004 Raw Water Reservoir OMM
- [5] 03A-ENM0005 Ash Water Return OMM
- [6] SANS 10286 Management of Mine Residue
- [7] 240-161547166 Emergency Preparedness Plan for Duvha Power Station Raw Water Reservoirs and Low Level Ash Water Return Dam
- [8] P047-R0040 Duvha Power Station Stormwater Management Plan
- [9] O3C-DDMP0001 Duvha Power Station Integrated Disaster Management Plan for Ash Dam Side Slope Failure

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These documents are indispensable for the application of this document, i.e. documents to be used together with this document.

### **2.2.2 Informative**

- [1] Occupational Health and Safety Act, 1993 (Act 85 of 1993)
- [2] National Environmental Management Act, 1998 (Act 107 of 1998)
- [3] ISO 9001:2015 Quality Management Systems - Requirements.
- [4] ISO 14001: 2015 Environmental Management Systems - Requirements with guidance for use
- [5] OHSAS 18001: 2007 Occupational Health and Safety Management Systems, Specification
- [6] National Disaster Management Act, 2002 (Act 57 of 2002)
- [7] ISO 9001 Quality Management Systems.
- [8] Construction Regulations, 2014
- [10] Occupational Health and Safety Act No. 85 of 1993,
- [11] Government Notice No. 704 of the National Water Act, 4 June 1999
- [12] Dam Safety Regulations, Government Notice No. R. 139 of 25, 24 February 2012
- [13] National Water Act (Act No. 36 of 1998)

## **2.3 DEFINITIONS**

### **2.3.1 Disclosure Classification**

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

**Clean water system:** This includes any clean water diversions bunds, channels, pipelines, clean water dams or other forms of impoundment, and any other structure or facility constructed for the retention or conveyance of unpolluted (clean) water.

**Dirty Water Dam:** This includes any settling dam, slurry dam, evaporation dam, pollution control dam, return water dam, barrier dam and any other form of impoundment used for the storage of polluted water or water containing waste (i.e. dirty water).

**Dirty area:** This refers to any area at a mine or activity which causes, has caused or is likely to cause pollution of a water resource (i.e. polluted water) including coal stock pile area and tailings storage facilities.

**Dirty water system:** This includes any dirty water diversions bunds, channels, pipelines, dirty water dams or other forms of impoundment, and any other structure or facility constructed for the retention or conveyance of water containing waste (i.e. dirty water).

**Task Order:** A task order is a written instruction to proceed with the task as stipulated on the particular task order. The task order will only be valid if a "45 number" appear on the task order. The "45 number" will serve as the order number for the particular task and need to be stated on the invoice for the work done as per task order.

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**Category A Professional Service:** An individual registered as a Professional Civil Engineer/Technologist with ECSA with a minimum of 7 years' experience within the civil engineering industry. The engineer should also be an APP listed in the DWS register of approved professional persons for tasks at dams with a safety risk

**Category B Professional Service:** An individual registered as a professional Civil Engineer/Technologist with ECSA with a minimum of 3 years' experience within the civil engineering industry.

**Category C Professional Service:**

An individual registered as a Candidate Civil Engineer/Technologist/technician with ECSA with a minimum of 1 years' experience within the civil engineering industry. An individual registered as a Candidate Civil Technician with ECSA with a minimum of 1 years' experience.

**Category D Professional Service:** An individual employed as an engineer-in-training or working under an internship or undergoing completion of in-service training.

**Emergency Purchase Order:** An emergency purchase order will be issued when an immediate ad-hoc service is required from the consultant due to risk to the plant and safety of people or production risk. The Employer will notify the Consultant if the Task Order need to be treated as an emergency purchase order.

**Category II Dam:** A dam with a safety risk classified to be a Small size dam with significant hazard potential rating as per the dam safety regulation

**Category III Dam:** A dam with a safety risk classified to be a Large size dam with significant hazard potential rating per the dam safety regulation

## **2.4 ABBREVIATIONS**

| <b>Abbreviation</b> | <b>Description</b>                  |
|---------------------|-------------------------------------|
| APP                 | Approved Professional Person        |
| CMD                 | Coal Management Department          |
| DWS                 | Department of Water and sanitation  |
| ECSA                | Engineering Council of South Africa |
| ERI                 | Eskom Rotek Industries              |
| HLD                 | High Level Dam                      |
| LLD                 | Low Level Dam                       |
| SND                 | Station North Drains                |
| SANS                | South African National Standard     |
| SE                  | System Engineer                     |
| SSD                 | Station South Drains                |
| QA                  | Quality Assurance                   |
| QC                  | Quality Control                     |

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| Abbreviation | Description                |
|--------------|----------------------------|
| QCP          | Quality Control Plan       |
| WGS 84       | World Geodetic System 1984 |

## **2.5 ROLES AND RESPONSIBILITIES**

**Contractor** – To execute the scope of works, compile a report and submitted to the client for approval or acceptance (Eskom Duvha Power Station).

**System Engineer** – The SE will review all works submitted by the engineer and send it to relevant stakeholder for review before acceptance.

**CMD** – Managing the operation and maintenance of ash dam. silt trap and low level dam

**ERI** – A Contractor who is responsible for operation and maintenance of ash dam, silt trap and low level dam on behalf of Eskom

**Eskom Environmental Department** – responsible for ensuring that the entire environmental requirement are adhered to.

## **2.6 REQUIRED CRITERIA FOR CONSULTANT**

- The Consultant must provide the CV's of the technical staff and a proof of qualification and certificates.
- The Consultant must provide a company profile showing previous work done.
- The Consultant will be required to comply with Eskom Duvha Power Station SHEQ requirements. This is mandatory as one of Eskom values is Zero harm.
- The Consultant must have an APP as a mandatory requirement for this contract

## **2.7 RELATED/SUPPORTING DOCUMENTS**

All latest report will be provided to the successful supplier to use as reference for the service.

## **3. SCOPE OF WORKS**

The scope of work is to contract the services of a Consultant for a period of 3 Years, to take the professional responsibility on monitoring and inspection of all Duvha water retaining structures. This also includes identification and management of all risks associated with water retaining structures.

The following resource will be required to execute the scope

- Category A
- Category B
- Category C
- Category D
- Draught person

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### **3.1 DESCRIPTION OF THE *WORKS***

The station has the following water retaining structures which will form part of this contract:

- Ash dam facility (comprises of 4 compartments)
- LLD
- Silt traps (comprises of 2 compartments)
- HLD (comprises of 4 compartments)
- Raw Water Dam (comprises of 2 compartments)
- Three Maturation ponds and one aeration pond at Ikageng sewage plant
- SND and SSD pond (comprises of 4 compartments each side)
- Storm water drainage system
- Sewage reticulation system
- North and south clarifiers ( 5 on the south and 3 on the north side of the station)

#### **3.1.1 Inspection**

The Consultant will be required to do the following inspection and produce a report which must be submitted to Eskom's SE within 14 working days from the day of inspection. These inspection frequencies below will take precedence over other documentation referenced in the scope of work.

3.1.1.1 Monthly inspection will be required on the following facility

- Ash dam
- Silt traps
- Low level Dam

3.1.1.2 Six Monthly inspections will be required on the following facility

- Raw Water dam
- High Level Dam

3.1.1.3 Yearly inspections will be required on the following facility

- Ikageng sewage plant water retaining structures
- SND and SSD ponds
- Clarifiers (5 at the south side and 3 at the north side of the station)
- Storm water drainage system
- Sewage drainage system

#### **3.1.2 Monthly Meeting**

The Consultant will be required to attend a station ash dam monthly meeting which is arranged by the CMD. This is a platform where the contractors monthly inspection report is discussed, and other reports provided by ERI together with presentation from

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environmental department. The Contractors monthly report must incorporate the other reports and give a complete status of the plant

### **3.1.3 Dam Safety Inspection**

Duvha Power Station has dams that have been classified as dams with a safety risk as per the safety of dams regulation in terms of section 123(1) of the national water act, 1998.

| No | Description   | Classification |
|----|---------------|----------------|
| 1  | Ash dam       | Category III   |
| 2  | LLD           | Category II    |
| 3  | Raw Water Dam | Category II    |

The Consultant will be required to conduction a dam safety inspection for each dam as per the dam safety regulation once within a contract duration, submit to the client for acceptance and then to the DWS. The requirements in terms of dam safety assessment are stipulated in Government Gazette, 24 February 2012, The Safety Of Dams In Terms Of Section 123(1) Of The National Water Act, 1998.

### **3.1.4 Dam Break Analysis**

The Consultant will also be required to do dam break analysis (zone of influence) of the ash dam which must be given a hazard classification based on the criteria stipulated in SANS Code No 10286. The zone of influence is defined as the zone which will be affected by a failure of the tailings facility. The study will be required once within the contract duration. This will be done for the area of concerns and different scenarios must be considered.

### **3.1.5 Stability Analysis**

The Consultant will be required to do a stability analysis for all ash dam piezometer sections shown on Appendix B once every year. The stability report must also cover the ash dam rate of rise and the remainder capacity of the facility. The analysis must be done for the three following conditions:

- Current condition
- Undrained: FOS
- Post Liquefaction

The stability analysis must also include the deposition plan that ERI need to adhere to when operating the dam for future construction of the ash dam to ensure proper management of the facility and reliability

### **3.1.6 Aerial survey**

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Aerial survey must be conducted once in a year for the duration of the contract. The survey must cover the following areas:

- Ash dam facility including the roads
- Raw water dam including, the settlement becons
- LLD including the settlement becons
- Silt traps

The survey deliverable should 3D point Cloud LAS/LAZ = Grid spacing of 5cm, XYZ= Grid spacing of 100 cm and Orto mosaic image in geotiff format.

### **3.1.7 Bathymetry survey for AWR dams**

The Consultant will be required to do a Bathymetry survey for all AWR dams which include the HLD and LLD, to measure the amount of silt in the dam. This must also include divers to assess the condition of silt around the intake structure. The survey will be conducted once every 2 years.

### **3.1.8 CPTU test**

The Consultant will be required to conduct the Piezocone penetration test which also known as CPTU test. The CPTU test will be required to assess the current condition of the ash dam in 5 different locations once every year for the duration of the contract. The CPTU location will be determined and agreed upon before execution, the depth for each location will be informed by the survey. It should be noted that the current highest section on the ash dam is 58m and this can increase as per the rate of rise.

During penetration the following parameters are sensed by the piezocone and measured:

- Tip pressure, qc
- Sleeve friction, fs
- Pore-water pressure, u
- Inclination
- Rate of advance.

The test must also include the Pore pressure dissipation testing for each point - used to derive compressibility characteristics of soil/material profiles.

The report following Reporting must be provided to the Ash Dam Engineer before, during or after the testing process.

- Daily progress reports
- CPTu Equipment certificates
- Dissipation test graphs
- CPTu Methodology
- CPTu Profiles and Files listing all measured and derived engineering parameters. A list of the recommended parameters to be provided are listed below:

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|   |  |
|---|--|
| a) $Q_c$                                    | Cone Resistance                          |
| b) $R_f$                                    | Friction Ratio                           |
| c) $u$                                      | Dynamic Pore Pressure                    |
| d) $q_t$                                    | Corrected Cone Resistance                |
| e) $q_n$                                    | Net Cone Resistance                      |
| f) $\sigma_v$                               | Total Vertical Stress                    |
| g) $B_q$                                    | Pore Pressure Ratio                      |
| h) $F_{norm}$                               | Normalized local Friction                |
| i) Soil Fr ID                               | Soil classification                      |
| j) $\Phi$                                   | Internal Friction Angel (IFA)            |
| k) $D_r(\text{over-cons})$<br>consolidated) | Relative Density (normally/over          |
| l) $S_u \max$                               | Undrained Shear Strength                 |
| m) $N_{60}$                                 | Equivalent SPT N60 value                 |
| n) $F_s$                                    | Local Friction                           |
| o) $I$                                      | Inclination                              |
| p) $u_0$                                    | Equilibrium Pore Pressure                |
| q) $q_e$                                    | Effective Cone Resistance                |
| r) $\delta u$                               | Excess Pore Pressure                     |
| s) $\sigma'_v$                              | Effective Vertical Stress                |
| t) $q_{norm}$                               | Normalized Cone Resistance               |
| u) Average soil ID                          | Soil Classification                      |
| v) Soil $B_q$ ID<br>friction                | Soil Classification (by pore pressure or |
|   | ratio)                                   |
| w) $D_r(\text{cons})$                       | Relative Density (normally consolidated) |
| x) $S_u \min$                               | Undrained Shear Strength                 |
| y) $I_c$ Soil                               | Behaviour Type Index                     |

### 3.1.9 Camera Inspection

The Consultant will be required to do cameral inspections for all the sub surface storm water drains and sewage drains to check the condition of the structural components. The inspection will be required once within the contract duration

### 3.1.10 Operation and Maintenance Manual Review

The Consultant will be required to review the operation and maintenance manual for the HLD, LLD and the ash dam facility. The review of manual must consider latest legislation, revised reports and plant conditions.

## 3.2 CONSULTANT 'S DESIGN

Parts of the works if for this contract is for the Consultant to provide design service as and when required in order to improve the functionality of the plant. All designs shall conform to:

- The legal requirements in terms of the relevant acts.
- Eskom Policies and Procedures
- Statutory Design Standard
- Statutory Safety Regulations

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### **3.3 OTHER REQUIREMENTS**

Preparatory Tasks the contractor must ensure the following.

- a. The Consultant needs to make adequate allowance for any preparatory tasks in executing the scope of works. This will include liaison with Eskom engineer, CMD, environmental department and ERI where required.
- b. All staff of the Consultant that will need access to the site must undergo an induction and the Health and Safety File of the contractor must be approved by the power station.
- c. It is important to note that the successful bidder provides a detailed contract plan, and where applicable methodology will be required for the Client's engineer for approval before execution

### **4. AUTHORISATION**

This document has been seen and accepted by:

| <b>Name &amp; Surname</b> | <b>Designation</b>            |
|---------------------------|-------------------------------|
| Nelly Hlophe              | Auxiliary Engineering Manager |
|                           |                               |

### **5. REVISIONS**

| <b>Date</b> | <b>Rev.</b> | <b>Compiler</b> | <b>Remarks</b> |
|-------------|-------------|-----------------|----------------|
| March 2021  | 0           | Netshia TC      | Draft Document |

### **Appendix A: Locality plans**

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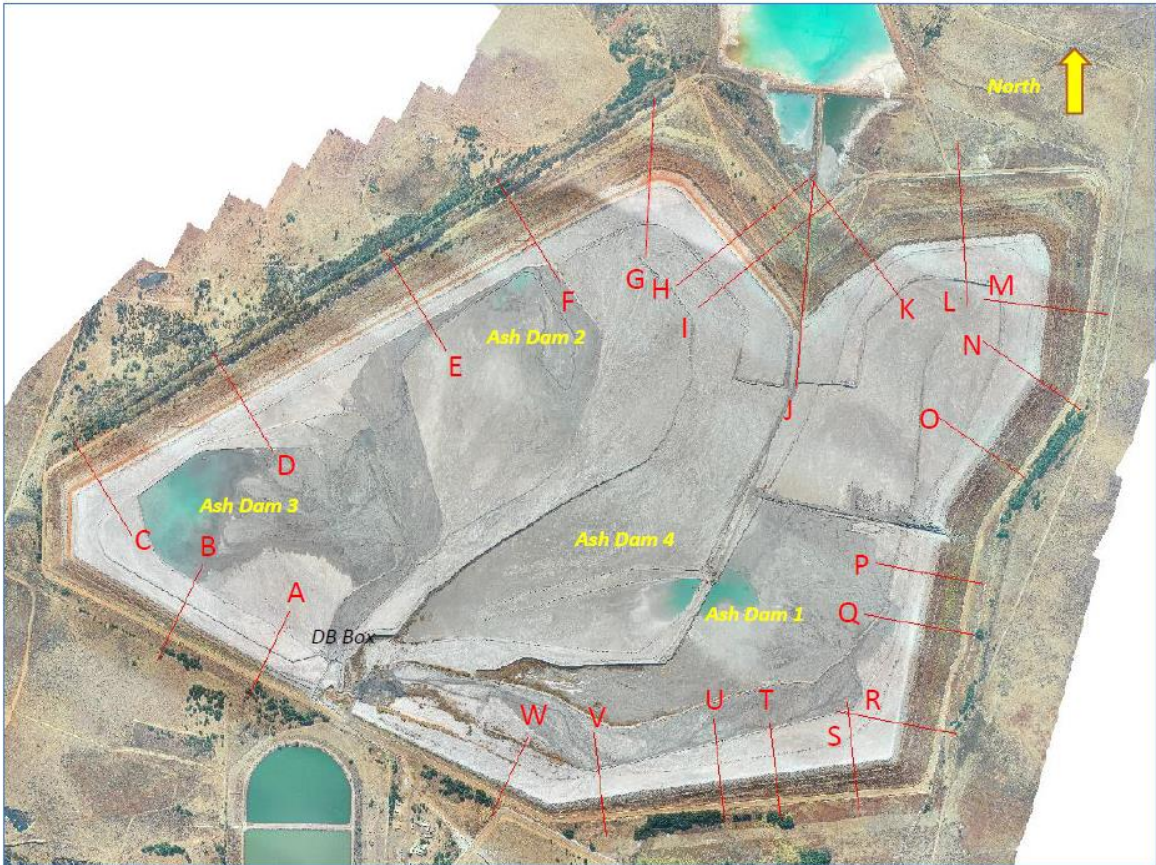


## Appendix B: Piezometer Sections Layout Plan

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