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9 Alma Street,
White River,
1240

PRETORIA
321 Alpine Way,
Lynnwood, Pretoria,
0081

POLOKWANE
120 Marshall Street,
Polokwane,
0699



PG CONSULTING ENGINEERS
PASSIONATE ABOUT DAMS

Telephone: (Pretoria) 012 800 1346 (Polokwane) 015 291 1577

Mobiles: (Pieter) 082 337 6905 (Francois) 076 876 4185 (Janes) 060 723 8831

E-mails: pieter@pgconsulting.co.za / francois@pgconsulting.co.za / janis@pgconsulting.co.za

Website: www.pgconsulting.co.za

21 August 2024

The Technical Manager
Limpopo: Department of Agriculture and Rural Development (LDARD)
Private Bag X9487
Polokwane
0700

Attention: Mr. Douw Wessels
E-mail: wessels.douwg@limpopo.gov.co.za
Tel: 015 294 3348

PROJECT: TOM MITCHELL DAM PROPOSED UPGRADING AND BETTERMENT WORKS, DISTRICT OF VHEMBE, LIMPOPO PROVINCE

1. Introduction

The Tom Mitchell dam is situated on an unnamed tributary of the Mambedi River, on the farm Welgevonden 36 LT, approximately 30km south-east of Louis Trichardt, district of Vhembe, in the Limpopo Province. The dam is a zoned earthfill structure with a concrete side channel on the left bank. The embankment is approximately 21 meters high by 304 meters long, with an average crest width of 3.5 meters. The outlet system comprises of two 400mm-dia sluice gates, placed on different levels on the upstream face that were previously operated from the crest with hand-wheels and stainless-steel spindles. The outlet pipes are 400mm-dia A/C pipes.

The dam presently belongs to a Local Tribal Authority of which the legal ownership still has to be confirmed. The Limpopo Department of Agriculture and Rural Development (LDARD) currently acts as the custodian of the dam.

The dam was completed in September 1985 and was built by Marred Construction. The design Engineer was Mr. T.C. Mitchell (Pr Eng). A geological report on the dam was done by Prof. A. van Schalkwyk and attached with the first dam safety inspection report.

The center co-ordinates (WGS84 – Lo 31°) of the dam wall are Latitude **23° 08' 28.4"** and Longitude **30° 09' 14.9"**.

The dam had been classified as a Medium size, Category 2-dam, with a Significant hazard potential rating by DWS on 7 October 1992.

The existing dam embankment, after initial construction (in the 1985), is presently in a much-neglected condition and in need of betterment and upgrading work.

This report is about the following details and measures that need to be implemented which also covers most of the recommendations from previous and present dam safety inspection reports namely:

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- The trees still left on the embankment's upstream slope near the right bank side need to be cut, removed, and treated.
- Settlement beacons on the crest must be reinstalled at 50m intervals. After installation, the beacons must be surveyed and noted in an Operation and Maintenance Manual for future reference.
- Install new toe drains with v-notch measuring structure to assist with seepage control.
- Reinstall the dam's outlet works / system.

NOTE: All these implementation measures will be discussed in detail herewith.

It is anticipated that the upgrading works will commence after a contractor has been appointed by LDARD. If appointed, PG Consulting Engineers will assist with construction supervision while Mr. P.J. Gouws will act as APP. PG Consulting Engineers will also assist with the compilation of all the required documentation as well as an application for a License to Construct.

2. Proposed betterment and upgrading works

2.1. Cut and removal of remaining trees on upstream slope

During the inspection conducted in February 2024, a contractor was appointed to clear the dense vegetation and cut the large trees on the dam wall. The cut trees were treated with an anti-regrowth agent. This was done to facilitate a proper visual safety inspection of the dam embankment.

Unfortunately, due to time constraint and steep upstream slope near the right bank, a few large trees were left on the upstream slope as indicated in **Figure 1** below. These trees should still be cut, treated, and removed. The contractor to be appointed should take note of the relatively steep upstream slope in that area which makes proper access by machines difficult and should compensate for that.

The trees should be cut in manageable pieces and should be disposed at a site as agreed with the community leader where the community will have easy access to utilize the wood.

The cut tree stumps should be treated with an anti-regrowth agent, approved by the Engineer.

Contractor to take appropriate safety precautions to assure the safety of the workers.

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Figure 1: Remaining trees to be removed

2.2. Reinstall settlement beacons

Remains of settlement beacons previously installed on the dam wall crest section, at approximately 50m intervals, were found during the dam safety inspection conducted. Unfortunately, during the recent clearing of the dam wall most of these beacons have been damaged as the contractor was not aware of them. Subsequently the beacons (except for one "SB3") could not be surveyed for settlement purposes.

It is recommended that the settlement beacons on the crest shall be reinstated.

A number of ten (10) settlement beacons need to be reinstalled and numbered following the specifications and details provided in **Figure 2** below.

Figure 3 below shows a typical installed settlement beacon.

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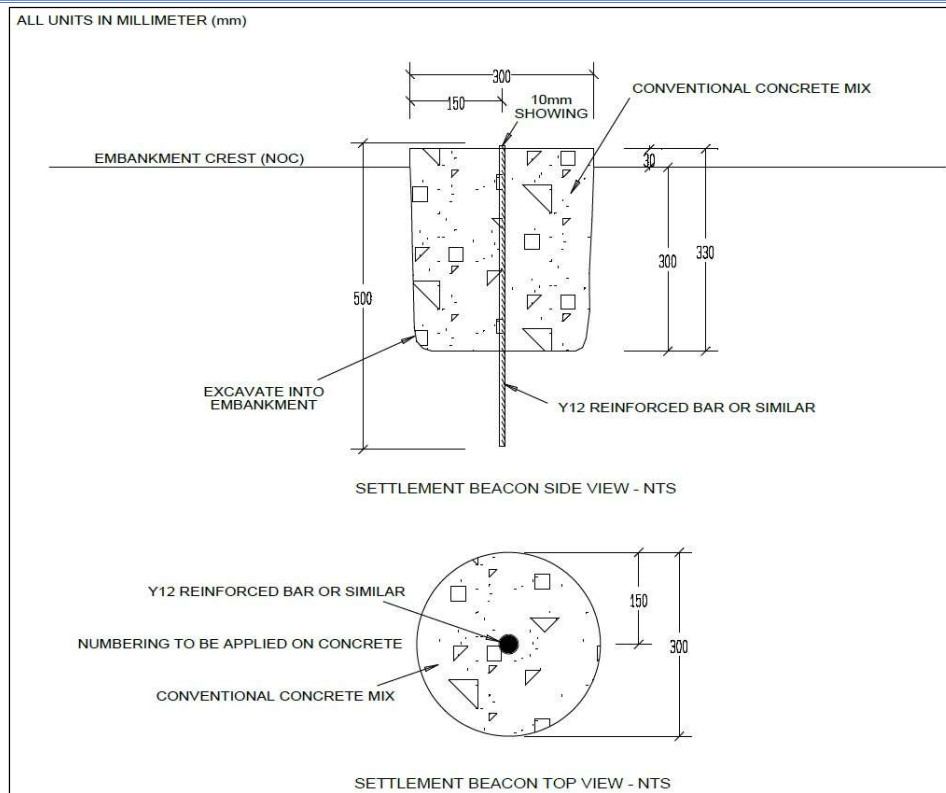


Figure 2: Schematic of a settlement beacon



Figure 3: Settlement beacon typical example

Company Registration Number: 2012/039090/07

Directors:

P.J. Gouws (Snr.) Pr Eng, APP; M.F. Joubert Pr Tech Eng, APP; P.J. Gouws (Jnr.) B Tech.



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2.3. Install toe drains and V-notch measuring structure

With reference to previous reports, the embankment is equipped with a rock toe at the lowest point downstream of the berm. In addition to the rock toe there are also two rock toe drains installed on either flank, equipped with brick masonry outlet structures.

The rock drainage system is still expected to function as designed and constructed for. However, the wet conditions observed at the toe line during the clearing of the vegetation is of concern. It is therefore concluded that the existing rock toe drains might not be sufficient and should be augmented by the installation of additional toe drains.

In addition, a proper V-notch measuring structure should also be constructed in order to manage and record the seepage on a regular basis.

The anticipated new toe drains length is measured as 140m. The toe drains will comprise of 110mm dia slotted Drainex drainpipes surrounded with 9mm stone and wrapped in AG200 bidim or similar approved. The drains will be installed within excavated trenches which is filled with approved graded filter sand. Refer to **Figure 4** below for detail.

The two toe drains will join at the deepest end at a V-notch measuring structure where seepage can be monitored and controlled. The details of the V-notch structure are presented in **Figure 5** below.

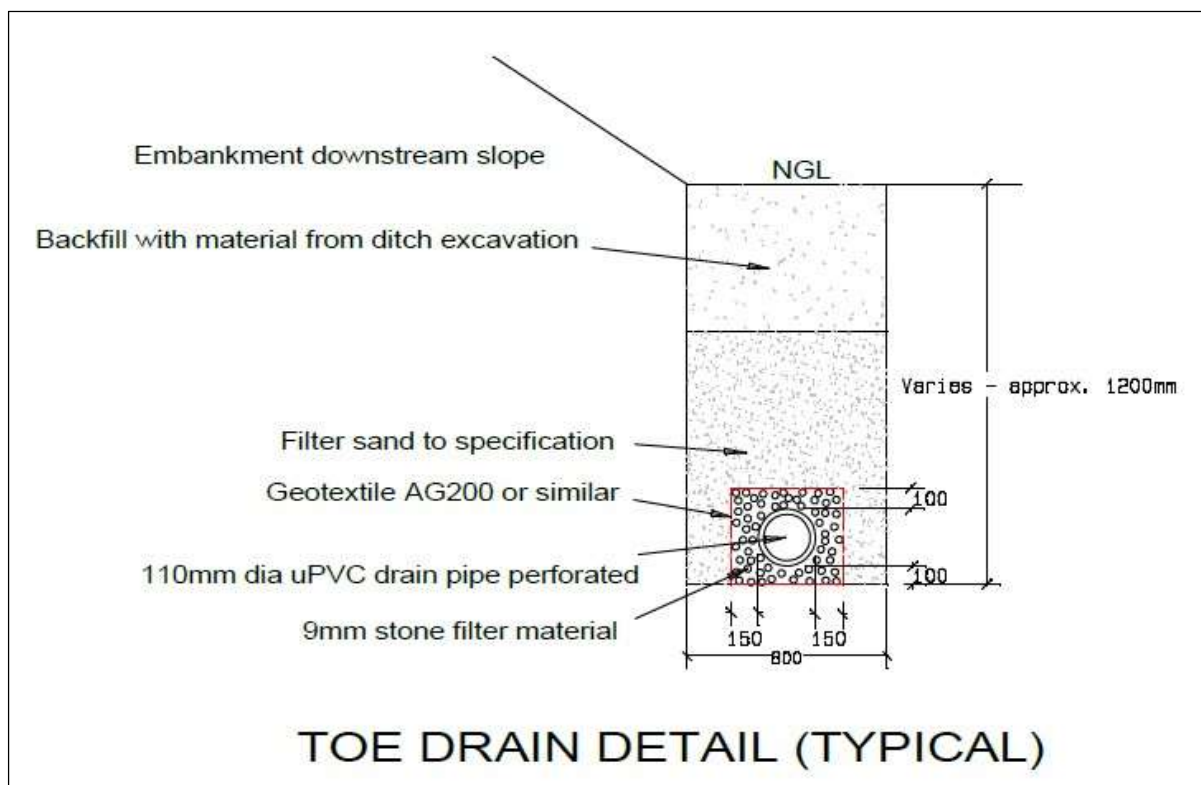


Figure 4: Schematic of a toe drain cross section

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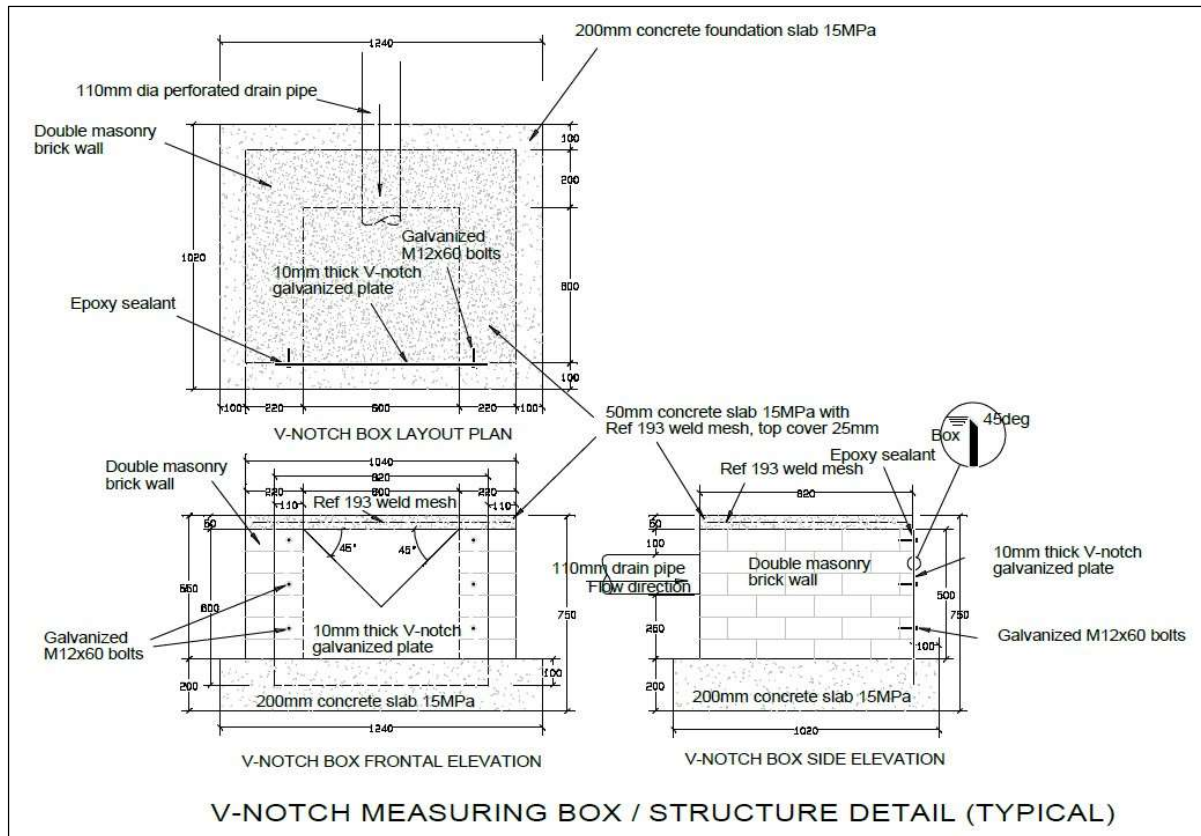


Figure 5: Schematic of a V-notch measuring structure

2.4. Reinstate the outlet works system

As per previous reports, “the outlet system comprises of two 400mm-dia sluice gates placed on different levels on the upstream face which were operated from the crest by means of hand-wheels and stainless-steel spindles located within concrete chambers on the crest.” The hand-wheels and spindles have been removed / vandalised prior to the second dam safety inspection in 2013.

The two outlet pipes are 400mm-diameter A/C pipes, each equipped with three concrete cut-off collars.

The outlet works are non-functional and out of commission and the upstream sluice gates appear to be in the closed position to avoid discharge from the dam.

In order to comply to current dam safety standards, the outlet works / system should be reinstated to allow for emergency drawdown during extreme flood conditions to safeguard the dam. It is furthermore of crucial importance that the outlet works shall be made operational again to allow for instream flow release in terms of DWS’s legislation, as and when required.

Proper inspection of the outlet works was not possible during the inspection; however, the following works is anticipated:

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- Refurbishment of the two upstream sluice gates (divers will be required). If the sluice gates are too damaged to be refurbished it should be replaced.
- Installation of two new stainless-steel raising spindles against upstream slope, anchored with brackets to the existing concrete casted inclined beams.
- Installation of two stainless-steel handwheels on the crest section.
- Safeguarding / securing of handwheel controls on the crest.
- Construction of two brick masonry headwalls where the two outlet pipes exit on the downstream slope side. Refer to **Figure 6** below for headwall details.
- Installation of two 400mm dia gate valves on the downstream side at the headwalls.

Note: APP to be consulted with regard to the reinstatement of the outlet works.

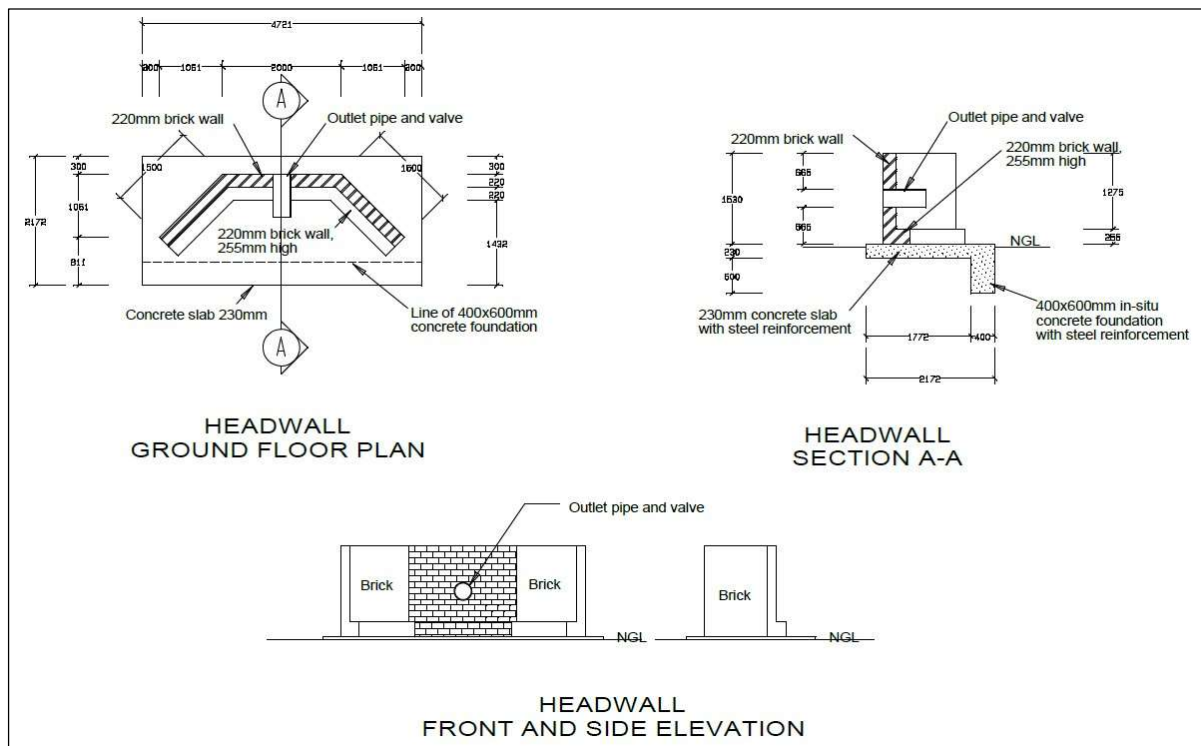


Figure 6: Schematic of an outlet pipe headwall structure

Pieter Gouws, Pr Eng, APP
Managing Director: PG Consulting Engineers (Pty) Ltd