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7646
Email: jan@hagenbrink.co.za
28 March 2025
Our ref: DJH305-R01

Modderasrivier
PO Box 138
Tulbagh
6820

Attention: Mr Phil du Plessis

PROJECT NO. DJH305: MODDERASRIVIER

Dear Sir

LETTER REPORT ON THE PROPOSED ENLARGEMENT OF MODDERAS DAM

We refer to your request for us to report on the above.

1. INTRODUCTION AND BACKGROUND

The applicant, Modderasrivier Trust, appointed Hagen Brink Consulting Engineers (HBCE) to investigate the feasibility of enlarging Modderas Dam on Portion 1 of the Roode Zands Kloof Farm No. 66. The purpose of enlarging the existing dam is to store enlistment water that has already been confirmed as existing lawful use (ELU).

Modderas Dam is classified and registered by the Department of Water and Sanitation (DWS): Dam Safety Office (DSO) as a Category II, Medium size-dam with a Significant hazard potential rating (DWS ref. 12/2/G102/CD). It has a storage capacity of 200 000 m³ and a maximum wall height of 13.8 m. The dam is proposed to be enlarged to a maximum storage capacity of 310 000 m³ and a maximum wall height of about 15.1 m.

The aim of the additional storage is to increase the assurance of water supply on the farm while ensuring more effective and beneficial use of the existing lawful use.

The recent drought in the Western Cape and uncertainty about the impact of climate change are the primary reasons behind this project.

The enlarged Modderas Dam (if the application processes are authorised), will continue to be filled with surface water runoff from its catchment area.

The farm is located approximately 8 km north of Tulbagh in the Western Cape. Refer to the locality map in **Appendix C**.

2. EXISTING WATER RIGHTS

2.1 EXISTING LAWFUL USE

The DWS confirmed the farm's existing lawful use (ELU). A total taking of 421 470 m³ per annum was confirmed, consisting of 363 460 m³/a for surface water and 58 010 m³/a for groundwater as summarised in **Table 2-1**. The farm's total storage was confirmed as 231 000 m³. Also refer to **Appendix A**.

Table 2-1: Summary of ELU

Property	Size (ha)	Surface water taking (m³/a)	Additional surface water taking (m³/a)	Groundwater taking (m³/a)	Allowed to store (m³)
Farm 1/66	155.74	231 000	132 460	58 010	231 000

2.2 EXISTING DAMS

On Portion 1 of the Roode Zands Kloof Farm No. 66, there are two existing small dams: Modderas Dam (also known as D1 or Plaas Dam) and Dam D2. The dams' storage capacities are presented in **Table 2-2**.

Table 2-2: Existing dam on Farm 1/66

Property	Dam name	Existing storage capacity (m³)	Wall height (m)	Comment
Farm 1/66	Modderas Dam (D1 or Plaas Dam)	200 000	13.8	To be enlarged
	Dam D2	31 000	6.9	To be decommissioned
Total	**-**	**231 000**	**-**	**-**

The applicant has a total existing storage capacity of 231 000 m³, which is the existing Section 21b) water use.

The existing dams on the farm can be seen in **Figure 2-1**.

Figure 2-1: Existing dams on Farm 1/66

2.3 PROPOSED DAM CAPACITY

According to the applicant Dam D2 failed a few years ago and cannot store the 31 000 m³. As a result, the applicant intends to enlarge the Modderas Dam rather than repairing Dam D2. This involves transferring Dam D2 storage capacity into the Modderas Dam and storing 60% of the additional surface water taking of 132 460 m³ into the Modderas Dam.

The proposed storage capacity for the enlarged Modderas Dam consists of the combined volumes as summarised in **Table 2-3**.

Table 2-3: Proposed enlarged Modderas Dam storage capacity

Description	Volume (m³)	Comment
Existing storage of Modderas Dam	200 000	To be increased
Existing storage of Dam D2	31 000	Dam D2 must be decommissioned
60% of the additional surface water taking	79 476	60 % of 132 460 m³
Total	310 000	Rounded down

Based on the summary above, the applicant would need to apply for an additional storage of 79 000 m³.

2.4 SUMMARY OF WATER USE

The applicant already possesses a storage volume of 231 000 m³, which was confirmed as ELU and no new water taking is required.

The proposed enlarged Modderas Dam would have a gross storage capacity of 310 000 m³.

The Water Use License Application should include the followings:

- Section 21 (b) – storing of water to the amount of 310 000 m³ (79 000 m³ as new storage).
- Section 21 (c) – impending or diverting the flow of water in a watercourse.
- Section 21 (i) – altering the bed, banks, course, or characteristics of a watercourse

2.5 ECOLOGICAL WATER REQUIREMENTS (EWR)

The enlargement of Modderas Dam will not result in new water abstraction, as such the EWR is considered not applicable.

3. PROPOSED SCHEME

The project is proposed to include the following developments.

- Enlargement of Modderas Dam from 200 000 m³ (13.8 m wall high) to a gross storage capacity of 310 000 m³ (15.1 m wall high). The proposed total footprint area = 7.5 ha, which is only 2.2 ha of additional footprint area.
- Extension of the existing Ø200 mm Class 6 uPVC outlet pipe on the upstream side.
- Decommissioning of Dam D2.

The enlarged dam option and the location of the existing pump station are shown in **Figure 3-1**. Also, refer to Drawing DJH305-03 in **Appendix C**.

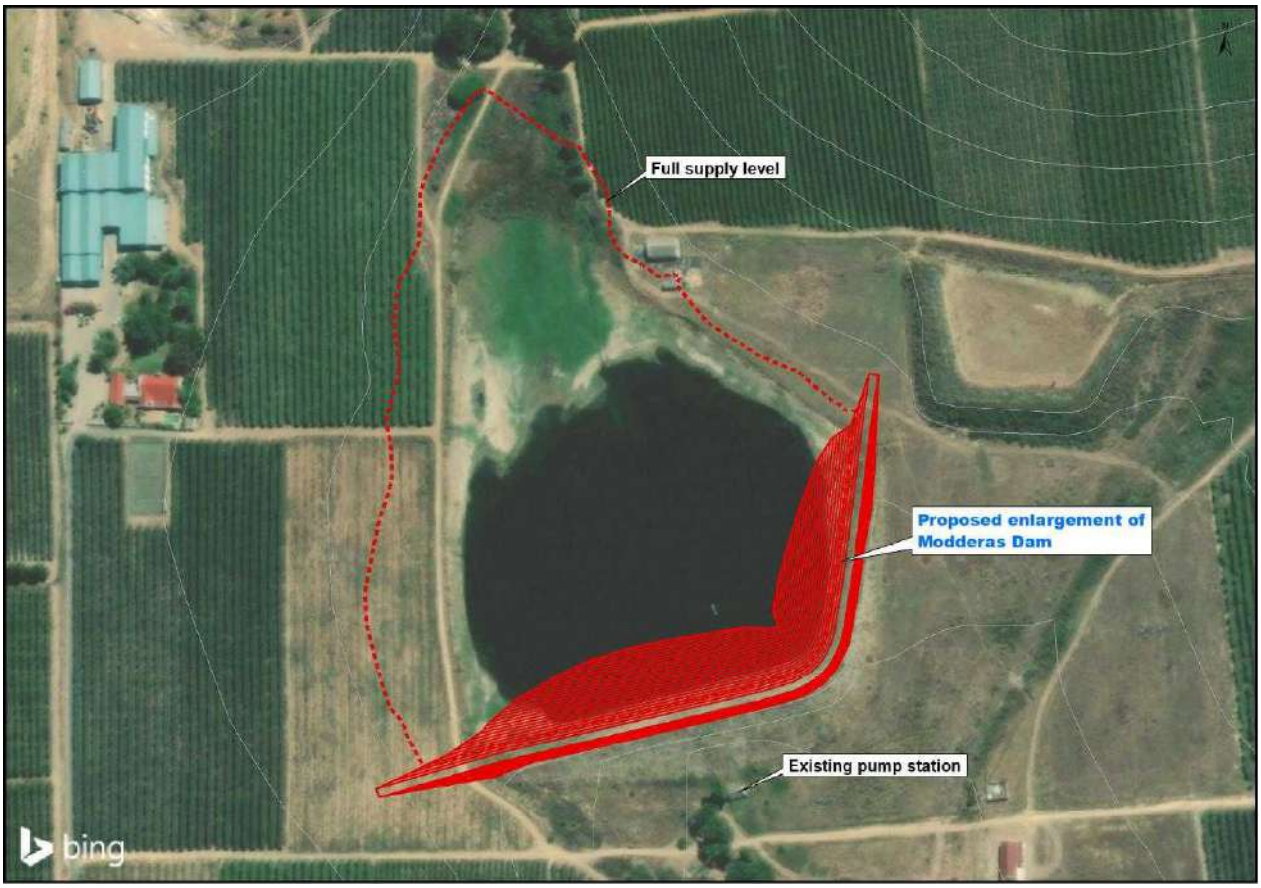

Figure 3-1: Enlarged embankment footprint

4. GEOTECHNICAL

4.1 REGIONAL GEOLOGY

According to the regional geology map (3319 WORCESTER, 1:250 000 series, RSA, 1973), the existing dam is underlain by scree and gritty sand (T-Qt) as well as phyllitic shale, fine-to medium-grained greywacke of the Porterville Formation (Npo) from the Malmesbury Group. Refer to **Figure 4-1**.

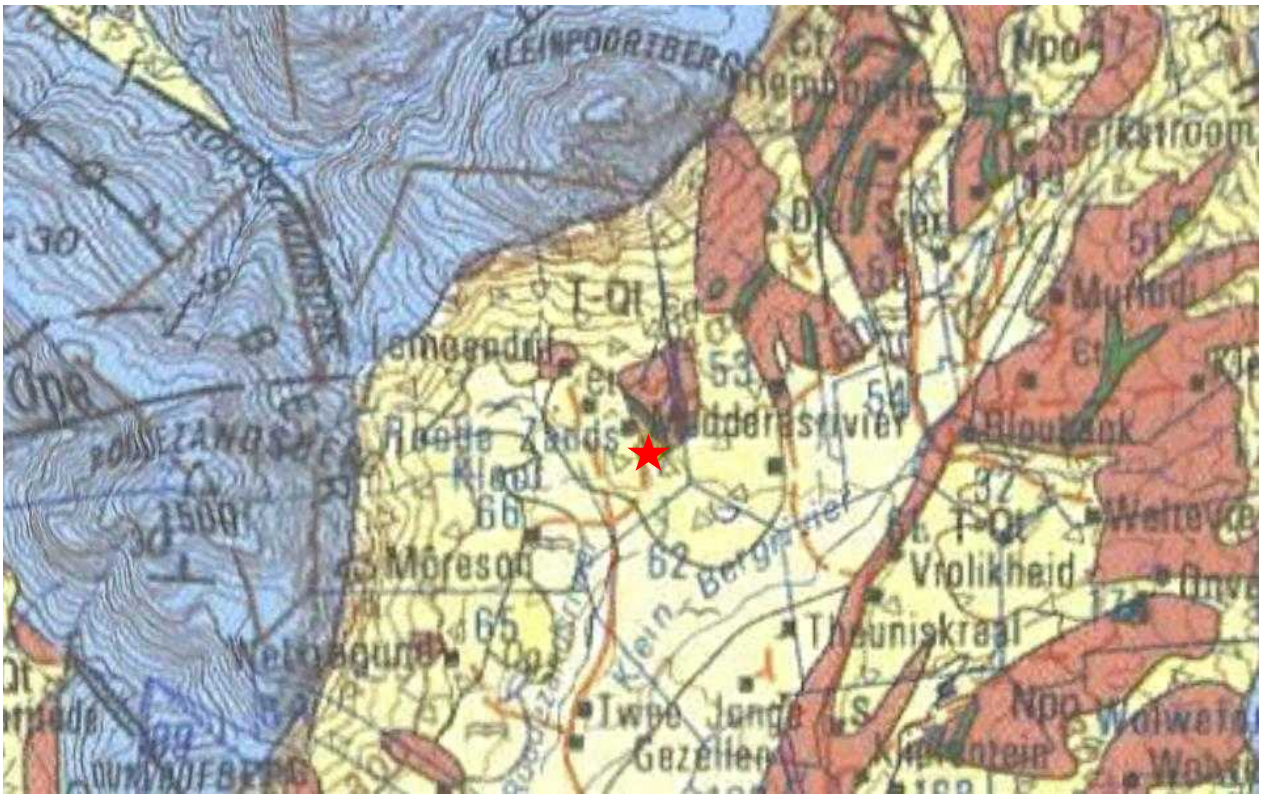

Figure 4-1: Regional geology at Modderas Dam (site indicated by the red asterisk)

4.2 FOUNDATION AND CONSTRUCTION MATERIALS

On the 4th of February 2025, seven test pits were excavated at the dam site at the locations shown in **Figure 4-2**. Three samples were collected for laboratory testing.

The test pits were excavated to assess the nature of the underlying foundation and to investigate available material's properties and determine the material's suitability for use in the proposed dam enlargement.

The soils underlying the dam site generally comprised of a thick layer of fine silty sand, which is underlain by a variable thickness of sandy lean clay, which grades to a weathered shale.

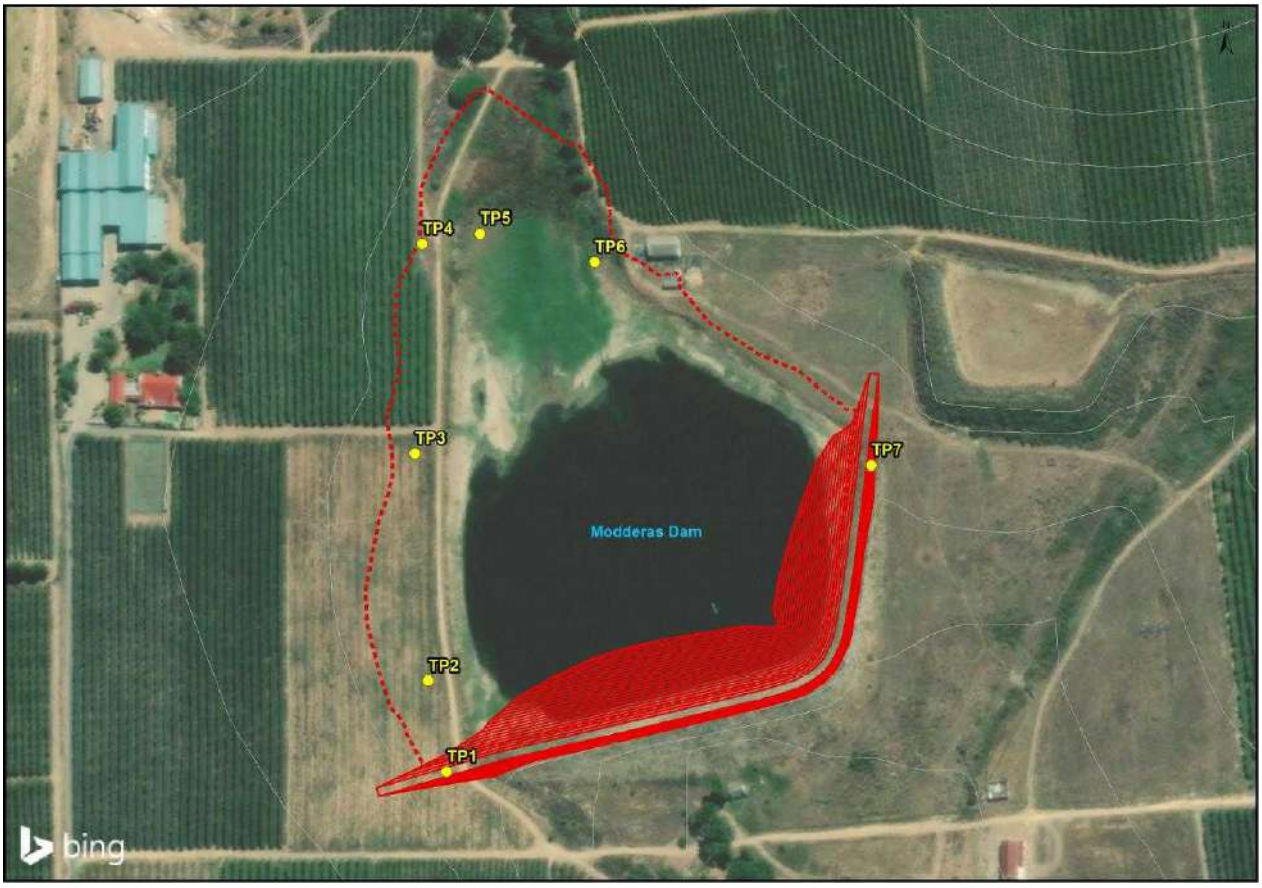

Figure 4-2: Test pit locations

The proposed dam enlargement will require a core trench on both flanks where the embankment is extended. The core trench is expected to be founded on weathered shale. According to the applicant, there is no seepage observed at the existing Modderas Dam, which indicates that the existing embankment's core trench was taken to a solid foundation.

The core trench should be excavated to a depth of ±6 m below ground level into an acceptable solid foundation. Soft, weak, coarse and organic materials must be removed during excavation, in order to reduce foundation seepage. The core trench will have to be backfilled and compacted with the most impervious material available on site.

Sandy lean clay, which is typically a good choice of core material, is available in the dam basin in TP2 and TP6. Refer to **Figure 4-3**, **Figure 4-4**.

Figure 4-3: Sandy lean clay at TP2

Figure 4-4: Sandy lean clay at TP6

Elastic silt material is present in TP4 and TP5. Refer to **Figure 4-5**. The elastic silt material can also be used as a core material when combined with other materials.

Figure 4-5: Elastic silt at TP4 and TP5 (note ground water in TP5)

TP2, TP4 and TP6 samples were tested in the laboratory for the suitability of core material. The results are enclosed in **Appendix B** and summarized in **Table 4-1**.

Table 4-1: Results of foundation indicator and dispersivity tests and soil

Sample Ref No	Atterberg Limits			Dispersivity %	Fines % (< 0,075 mm)	Grain Size Distribution (%)				Classification (in accordance with Unified Soil Classification System)	
	LL	PI	LS			Clay (<0.002) [1]	Silt (0.002-0.075) [2]	Sand (0.075-4.75) [3]	Gravel (>4.75) [4]		
TP2	35	14	6.5	91	62	4	58	32	6	CL	Sandy lean clay
TP4	53	19	8.9	86	86	17	69	13	1	CH	Elastic silt
TP6	35	13	6.2	0	53	11	42	35	12	CL	Sandy lean clay

1) Clay < 0.002 mm; Silt >0.002 mm and <0.075 mm; Sand >0.075 mm and <4.75 mm; Gravel >4.75 mm

The available core materials found at the dam site are considered acceptable core material based on the following properties in comparison to Druyts, 1988 guidelines:

- % Fines range from 53% to 86%
- % Clay ranges from 4% to 17%

- Plasticity Index ranges from 13 to 19
- Classifications of CL and CH is considered acceptable

The dispersivity of the proposed core material, which was determined with the SCS Double Hydrometer Test resulted in a range of dispersivity from 0 to 91% for the three test samples.

TP6 results indicate non-dispersivity; while TP2 and TP4's results indicate the material is highly dispersive.

The following mitigation is recommended due to the varying dispersivity of the tested material.

- Core compaction to a minimum 98% of the Standard Proctor maximum density at a moisture content between Optimum Moisture Content (OMC) and +3% OMC.

Permeability tests were conducted on all three samples at 98% Proctor density and the followings were achieved:

- TP2: 1.449 x 10^{-6} cm/s
- TP4: 3.887 x 10^{-7} cm/s
- TP6: 2.201 x 10^{-7} cm/s

The permeability tests at 98% Proctor density show that the samples are practically impervious with drainage being imperceptible.

All the materials required for the enlargement of Modderas Dam will be obtained for the basin. Additional rip-rap material would be sourced from the irrigation areas on the farm.

Further geotechnical testing (Proctor density, permeability, shear strength, etc) should be carried out during construction.

5. DAM OPTIONS

5.1 ALTERNATIVE DAM SITE LOCATION

Two alternatives were investigated. The first alternative (Alternative 1) was the repair and enlargement of Dam D2. This alternative would result in the loss of established orchards, which the applicant does not wish to lose. The small catchment area of this alternative would yield very little surface water runoff and thus filling the dam would be heavily reliant on pumping water into the dam. This alternative was considered to be unpractical and uneconomical and therefore it was discarded. Refer to **Figure 5-1**.

Alternative 2 is located further north and upstream of Modderas Dam. It would be a new on-channel dam. The site is situated within one of the mapped Critical Biodiversity Areas (CBA), which may result in a negative response from the Department of Environmental Affairs and Development Planning (DEA&DP). Past experience indicates that new on-channel dams are not favourable to the DWS for various reasons. Alternative 2 would have a significantly larger impact on the existing stream than the enlargement of the Modderas Dam, as such it was ruled out. Refer to **Figure 5-2**.

Figure 5-1: Alternative dam site 1

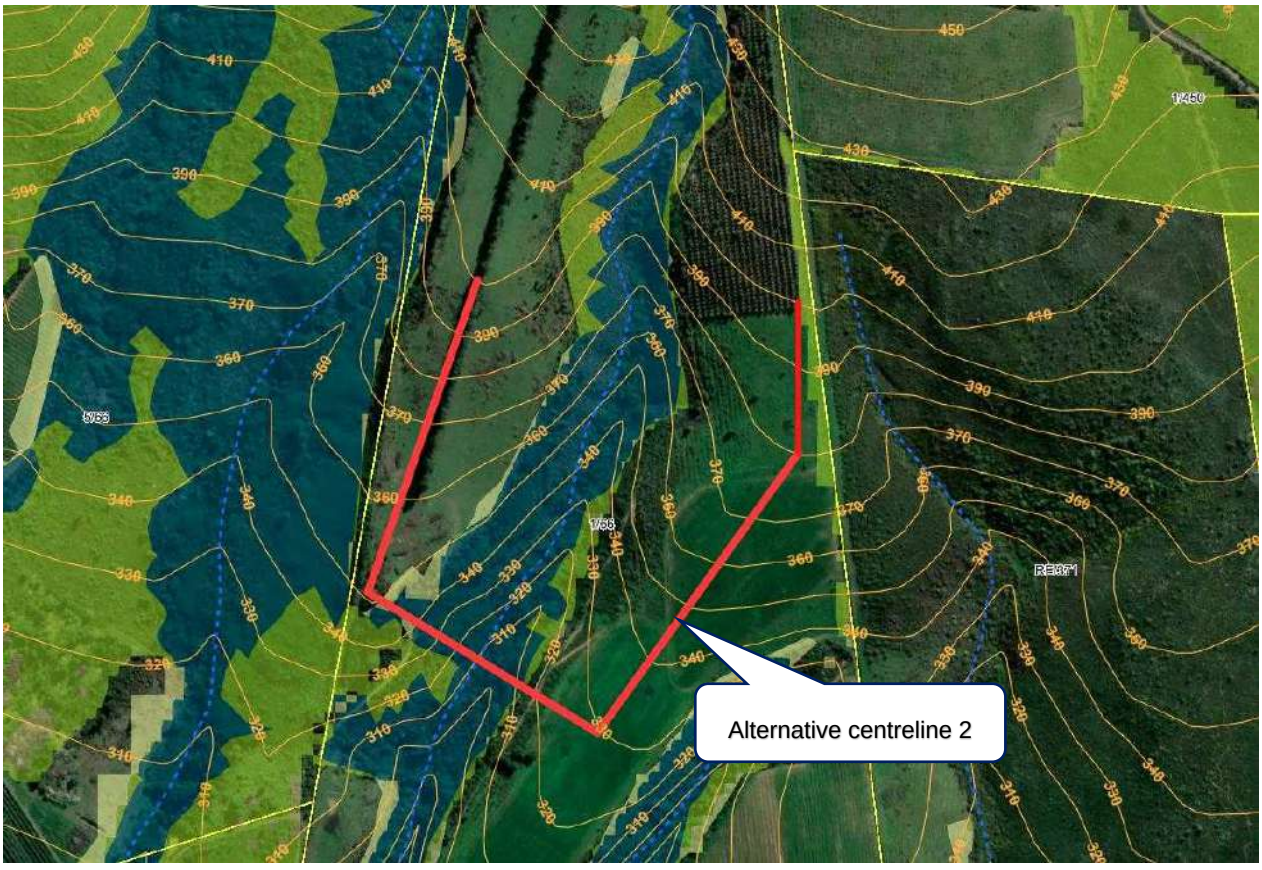

Figure 5-2: Alternative dam site 2

5.2 DAM OPTIMIZATION

The dam site was surveyed by Billy West in September 2024 and four dam options were designed and investigated by Hagen Brink Consulting Engineers for the required storage capacity of 310 000 m³. Refer to **Figure 5-3**.

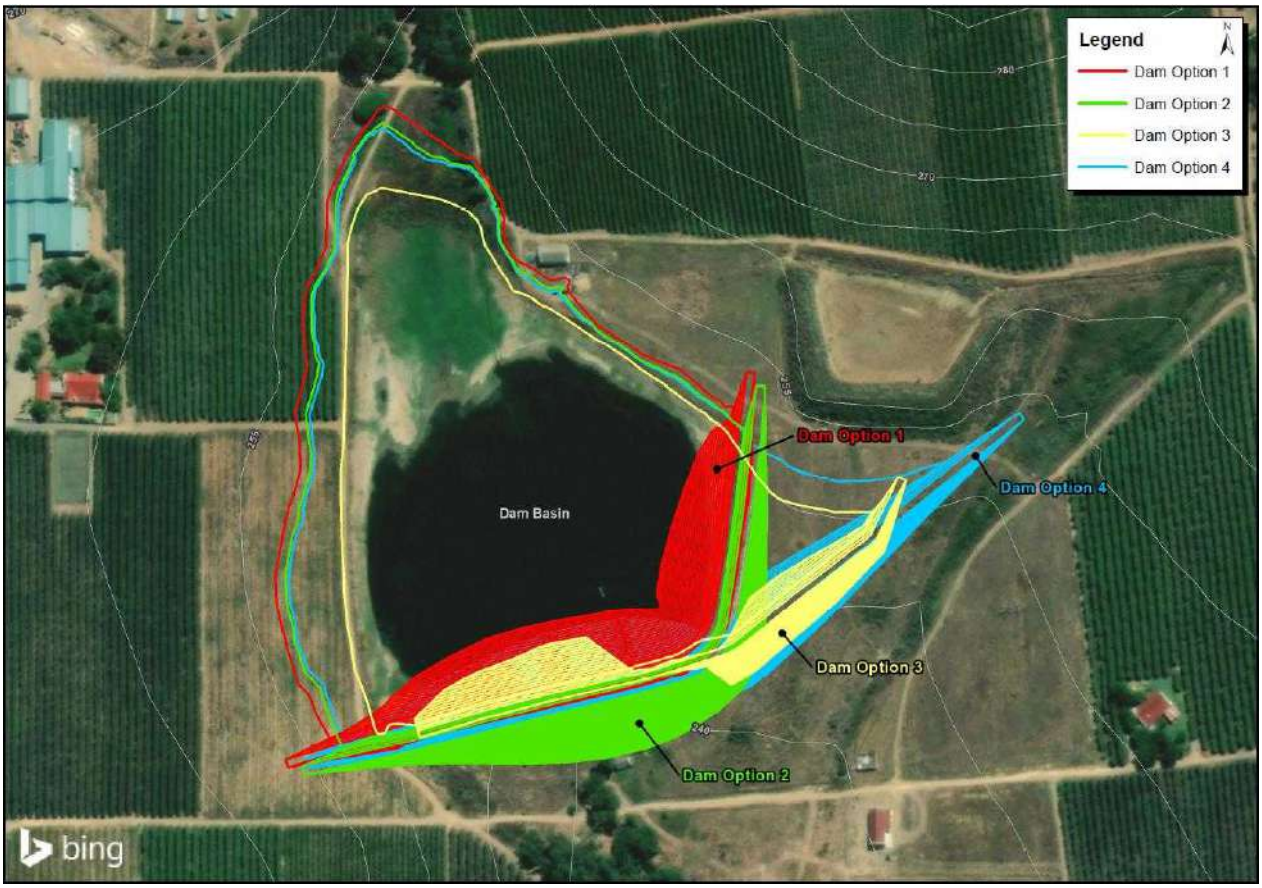

Figure 5-3: Dam options for the proposed Goree Dam

The water/wall ratio represents the volume of water gained per volume of fill required to construct the dam embankment. This is a good indication for selecting the most economical dam design alternative.

Dam Option 1 is an upstream embankment raising with the required storage capacity of 310 000 m³ and is the preferred dam option with the second-best water/wall ratio of 2.2.

Dam Option 2 is a downstream embankment raising with the required storage capacity of 310 000 m³ and is the most economical with a water/wall ratio of 4.5. Unfortunately, this dam option would involve the relocation of the existing pump station which is not considered feasible by the applicant.

Options 3 and 4 are less economical and considered more complex to construct compared to Option 1. These dam options were not considered further.

The statistics of the dam options are summarised in **Table 5-1** and the full statistics are provided in **Appendix D**.

Table 5-1: Statistics of evaluated dam options

Dam options	Storage capacity (m^3)	Freeboard (m)	Wall height (m)	Embankment crest length (m)	Surface area at FSL (ha)	Enlarged wall volume + core trench (m^3)	Water /wall ratio	R/m^3 storage
Option 1	310 000	1.5	15.1	387	5.5	44 400	2.20	14.92
Option 2	310 000	1.5	15.3	383	5.5	21 500	4.54	8.81
Option 3	224 300	1.3	13	309	4.8	25 100	0.47	13.50
Option 4	310 000	1.5	14.9	442	5.8	51 000	1.91	16.69

A layout drawing for the proposed dam Option 1 is included in **Appendix C**.

6. LEGAL REQUIREMENTS

6.1 ENVIRONMENTAL AUTHORIZATION

A BAR process for the environmental authorisation is required and it is currently being undertaken by Earth Grace Environmental Consultancy.

6.2 WATER USE LICENSE

An application for Section 21 b), c), and i) Water Use will be required. HDL Consulting has already started the required process.

6.3 DAM SAFETY

The required dam safety process will commence with the application for classification of the proposed enlarged dam. The current classification as a Category II Medium sized dam with a Significant hazard potential rating is expected to remain unchanged.

The detail design and application for a Licence to enlarge (from DWS) will follow when the authorisation processes are further advanced.

7. ADDITIONAL INFORMATION

A method statement for enlargement of Modderas Dam will be issued separately and will be compiled to provide professional engineering guidance to the dam construction process, once authorised.

8. PROJECT COST ESTIMATE

A provisional total project cost estimate is summarised in **Table 8-1**.

Table 8-1: Project cost estimate

Item no and description	Cost (million R, excl VAT)
1. Construction	
1.1. **Enlargement construction**	4.6
Sub-total	**4.6**
2. Professional costs	
2.1. **Engineering** fees	0.5
2.2. Environmental approval and Water Use Licencing fees	0.3
Sub-total	**0.8**
Total	**5.4**

Yours faithfully

Hagen Brink Consulting Engineers (Pty) Ltd

_____

Joseph Mbenga
Dam Eng. Technologist

_____

Wicus du Plessis
Pr Eng

References

CapeFarmMapper, 2025. Viewed 26 March 2025, https://gis.elsenburg.com/apps/cfm/.

Bailey A.K., Pitman W.V. (2015): Water Resources of South Africa, 2012 Study (WR2012). Water Research Commission, Pretoria, RSA.

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Howard, A.K., 1984. The Revised ASTM Standard on the Unified Classification System. Geotechnical Testing Journal, GTJODJ. Vol 7. No. 4: December 1984, pp. 216-222.

RSA, "National Water Act (No 36 of 1998): Dam Safety Regulations (R139 of 2012)," Republic of South Africa, Pretoria, 2012.

RSA. (1973). Geological Survey Maps. Republic of South Africa, 1973.

Appendix A

Provided information

2024

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

National Register of Water Use Registration Record 22043520

Water Use Registration Record 22043520 is issued in terms of the regulations requiring that a Water Use be registered, promulgated under Section 26(1)(c) of the National Water Act(Act 36 of 1998) to:

Applicant

Applicant Type:	COMPANY
Name:	MODDERAS RIVER
Enterprise Type	TRUST
Business Registration Number:	IT2501/1995
Postal Address:	PO BOX 138 TULBAGH 6820
VAT Registration Number:	4960260943

Water Management Area

Name:	BERG-OLIFANTS

Register Status

Status:	ACTIVE

Water Uses

See attached Annexure(s)

Water Use No.	Water Use	Volume	Volume Start Date	Volume End Date
1	21(a)	86 000 CUBIC METRES PER YEAR	1984/11/01	2022/01/31
1	21(a)	58 010 CUBIC METRES PER YEAR	2022/02/01	
3	21(b)		1998/10/01	2022/01/31
4	21(b)		2002/04/01	
6	21(b)		2002/04/01	
7	21(a)	350 000 CUBIC METRES PER YEAR	1984/11/01	2023/10/31
8	21(a)	13 460 CUBIC METRES PER YEAR	1984/11/01	2023/10/31
8	21(a)	363 460 CUBIC METRES PER YEAR	2023/11/01	

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

National Register of Water Use Registration Record 22043520

Water Use Registration Record 22043520 is issued in terms of the regulations requiring that a Water Use be registered, promulgated under Section 26(1)(c) of the National Water Act(Act 36 of 1998) to:

Office: WESTERN CAPE OFFICE

DEPT. OF WATER AND SANITATION
INSTITUTIONAL ESTABLISHMENT
CHIEF DIRECTOR
21 NOV 2023
PRIVATE BAG X16, SANLAMHOF, 7532
52 VOORTREKKER ROAD, BELLVILLE, 7530
DEPT. OF WATER AND SANITATION

Date stamp of issuing office

DISCLAIMER :

This Registration Record:

1 is not an acknowledgement of an entitlement to the registered water use;

2 may NOT be used to create the impression that it is proof of a water use entitlement. By virtue of section 22(1) of the National Water Act, the only documents that may be used as proof of a water use entitlement, are:

- 2.1 a licence;
- 2.2 an official document stating the extent of existing lawful water use pursuant to sections 33 or 35 of the National Water Act;
- 2.3 a general authorisation as published in the Gazette; or
- 2.4 Schedule 1 of the National Water Act.

Notes:

- If an entitlement for the specific water use referred to in this Registration Record has been confirmed by the Department, it may be indicated as such in this Registration Record.
- If the responsible authority has dispensed with the requirement for a licence for a specific water use, no water use entitlement is needed for that use under the National Water Act.

3 is issued without alterations or erasures and is invalid if it contains alterations not in conformity with the Department's official copy; and in substitution of any Registration Record the Department may have previously issued and the information is valid as at the date of issue.

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	1
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

Validation

Validation Status	FINALISED
Validation Status - Date Allocated	2023/10/16 15:18:34

Verification

Verification Status	FINALISED
Verification Status - Date Allocated	2023/10/16 15:18:34

Lawfulness Authentication

Finding:	LAWFUL
Finding Date:	2022/01/14
Finding Reason:	EXISTING LAWFUL WATER USE UNDER SECTION 35(4) OF THE NWA (ACT NO 36 OF 1998)
Finding Confirmed:	YES

Water Use Details

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION	
Source Type:	BOREHOLE	
Water Resource Name:	GROUNDWATER	
Point of Abstraction:	**Latitude** 33.2075° south	**Longitude** 19.12361° east
Datum Type:	WGS-84	
Quaternary Drainage Region:	G10E	

Registered Volumes

Start Date	End Date	Registered Volume (m^3)	Time Interval
1984/11/01	2022/01/31	86000	PER YEAR
2022/02/01		58010	PER YEAR

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	1
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

Property Where Water Use Occurs

Property Name:	ROODEZANDKLOOF
Property Number:	66
Portion of Property:	1
SG Cadastral Code:	C07500000000006600001
Deeds Office:	CAPE TOWN
Registration Division:	TULBAGH
Registration Division Province:	WESTERN CAPE
Surveyor General Office:	CAPE TOWN

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
1984/11/01	

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	1
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

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2.3 a general authorisation as published in the Gazette; or

2.4 Schedule 1 of the National Water Act.

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3 is issued without alterations or erasures and is invalid if it contains alterations not in conformity with the Department's official copy; and in substitution of any Registration Record the Department may have previously issued and the information is valid as at the date of issue.

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	7
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/11/17
Water Use Status:	CLOSED
Water Use Close Date:	2023/10/31
Water Use Close Reason:	SURRENDERED

Lawfulness Authentication

Finding:	LAWFULNESS STILL TO BE DETERMINED
Finding Date:	2023/11/11
Finding Reason:	UNVERIFIED
Finding Confirmed:	YES

Water Use Details

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION	
Source Type:	RIVER/STREAM	
Water Resource Name:	KLEIN BERG RIVER	
Point of Abstraction:	**Latitude** 33.2076° south	**Longitude** 19.12306° east
Datum Type:	WGS-84	
Quaternary Drainage Region:	G10E	

Registered Volumes

Start Date	End Date	Registered Volume (m^3)	Time Interval
1984/11/01	2023/10/31	350000	PER YEAR

Property Where Water Use Occurs

Property Name:	ROODEZANDKLOOF
Property Number:	66
Portion of Property:	1
SG Cadastral Code:	C07500000000006600001
Deeds Office:	CAPE TOWN
Registration Division:	TULBAGH
Registration Division Province:	WESTERN CAPE
Surveyor General Office:	CAPE TOWN

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
1984/11/01	

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	7
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/11/17
Water Use Status:	CLOSED
Water Use Close Date:	2023/10/31
Water Use Close Reason:	SURRENDERED

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	8
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/11/17
Water Use Status:	REGISTERED

Lawfulness Authentication

Finding:	LAWFULNESS STILL TO BE DETERMINED
Finding Date:	2023/11/11
Finding Reason:	UNVERIFIED
Finding Confirmed:	YES

Water Use Details

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION	
Source Type:	RIVER/STREAM	
Water Resource Name:	KLEIN BERG RIVER	
Point of Abstraction:	**Latitude** 33.2075° south	**Longitude** 19.12306° east
Datum Type:	WGS-84	
Quaternary Drainage Region:	G10E	

Registered Volumes

Start Date	End Date	Registered Volume (m^3)	Time Interval
1984/11/01	2023/10/31	13460	PER YEAR
2023/11/01		363460	PER YEAR

Property Where Water Use Occurs

Property Name:	ROODEZANDKLOOF
Property Number:	66
Portion of Property:	1
SG Cadastral Code:	C07500000000006600001
Deeds Office:	CAPE TOWN
Registration Division:	TULBAGH
Registration Division Province:	WESTERN CAPE
Surveyor General Office:	CAPE TOWN

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
1984/11/01	

National Register of Water Use Registration Record 22043520

Taking water from a water resource in terms of Section 21(a) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	8
Water Use Start Date:	1984/11/01
Water Use Status Date:	2023/11/17
Water Use Status:	REGISTERED

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National Register of Water Use Registration Record 22043520

Storing water in terms of Section 21(b) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	3
Water Use Start Date:	1998/10/01
Water Use Status Date:	2023/10/16
Water Use Status:	CLOSED
Water Use Close Date:	2022/01/31
Water Use Close Reason:	VERIFICATION

Storage of Raw Water

Total Number of Dams:	3
Water Course(s):	PLAASDAM

Dam Details

Name of Dam	Estimated/ Calculated	Measure For Movement of Aquatic Species	Volume Stored (m^3)
PLAASDAM	ESTIMATED	NO	370000.00

Property Where Water Use Occurs

Property Name:	ROODEZANDKLOOF
Property Number:	66
Portion of Property:	1
SG Cadastral Code:	C07500000000006600001
Deeds Office:	CAPE TOWN
Registration Division:	TULBAGH
Registration Division Province:	WESTERN CAPE
Surveyor General Office:	CAPE TOWN

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
1998/10/01	

National Register of Water Use Registration Record 22043520

Storing water in terms of Section 21(b) of the National Water Act

Water Use Identification

Register Number:	22043520
Water Use Number:	3
Water Use Start Date:	1998/10/01
Water Use Status Date:	2023/10/16
Water Use Status:	CLOSED
Water Use Close Date:	2022/01/31
Water Use Close Reason:	VERIFICATION

National Register of Water Use Registration Record 22043520

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22043520
Water Use Number:	4
Water Use Start Date:	2002/04/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

Validation

Validation Status	FINALISED
Validation Status - Date Allocated	2023/10/16 15:19:22

Verification

Verification Status	FINALISED
Verification Status - Date Allocated	2023/10/16 15:19:22

Lawfulness Authentication

Finding:	LAWFUL
Finding Date:	2022/01/14
Finding Reason:	EXISTING LAWFUL WATER USE UNDER SECTION 35(4) OF THE NWA (ACT NO 36 OF 1998)
Finding Confirmed:	YES

Water Use Details for Raw Water Dam

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION
Quaternary Drainage Region:	G10E

Dam Details

Dam Name:	PLAASDAM	
Name of Watercourse:		
Centre of Dam Wall:	**Latitude**	**Longitude**
	33° 12' 26" south	19° 7' 18" east
Datum Type:	CAPE (MODIFIED CLARKE 1880)	

Centre of River at the point where river crosses the Dam wall:

	Latitude	**Longitude**
Datum Type:		

Capacity:	200 THOUSAND CUBIC METRES
Billable Dam:	NO
Safety Risk Dam:	YES
Completed	YES
Date of Completion	1998/10/01
Water Use Sector(s)(i.e. Purpose(s) for Storing of Water):	AGRICULTURE: IRRIGATION

National Register of Water Use Registration Record 22043520

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22043520
Water Use Number:	4
Water Use Start Date:	2002/04/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

Property Where Water Use Occurs

Property Name:	ROODEZANDKLOOF
Property Number:	66
Portion of Property:	1
SG Cadastral Code:	C07500000000006600001
Deeds Office:	CAPE TOWN
Registration Division:	TULBAGH
Registration Division Province:	WESTERN CAPE
Surveyor General Office:	CAPE TOWN

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2002/04/01	

National Register of Water Use Registration Record 22043520

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22043520
Water Use Number:	6
Water Use Start Date:	2002/04/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

Validation

Validation Status	FINALISED
Validation Status - Date Allocated	2023/10/16 15:21:23

Verification

Verification Status	FINALISED
Verification Status - Date Allocated	2023/10/16 15:21:23

Lawfulness Authentication

Finding:	LAWFUL
Finding Date:	2022/01/14
Finding Reason:	EXISTING LAWFUL WATER USE UNDER SECTION 35(4) OF THE NWA (ACT NO 36 OF 1998)
Finding Confirmed:	YES

Water Use Details for Raw Water Dam

Water Use Sector(s)(i.e. Purpose(s) of Water Use):	AGRICULTURE: IRRIGATION
Quaternary Drainage Region:	G10E

Dam Details

Dam Name:	D2	
Name of Watercourse:		
Centre of Dam Wall:	**Latitude**	**Longitude**
	33.20843° south	19.124311° east
Datum Type:	WGS-84	
Centre of River at the point where river crosses the Dam wall:		
	Latitude	**Longitude**
Datum Type:		
Capacity:	31 THOUSAND CUBIC METRES	
Billable Dam:	NO	
Safety Risk Dam:	NO	
Completed	YES	
Date of Completion	1998/10/01	
Water Use Sector(s)(i.e. Purpose(s) for Storing of Water):	AGRICULTURE: IRRIGATION	

National Register of Water Use Registration Record 22043520

Storing water in terms of Section 21(b) of the National Water Act: Dam Registration

Water Use Identification

Register Number:	22043520
Water Use Number:	6
Water Use Start Date:	2002/04/01
Water Use Status Date:	2023/10/16
Water Use Status:	REGISTERED

Property Where Water Use Occurs

Property Name:	ROODEZANDKLOOF
Property Number:	66
Portion of Property:	1
SG Cadastral Code:	C07500000000006600001
Deeds Office:	CAPE TOWN
Registration Division:	TULBAGH
Registration Division Province:	WESTERN CAPE
Surveyor General Office:	CAPE TOWN

WUN/Property Relationship Details

Relationship Start Date	Relationship End Date
2002/04/01	

REVISED on Request

SG	C07500000000006600001	50	WARMS reg nr	22043520	
Farm Name	Registration Division		Farm Nr	Portion Nr	Property Extent (Ha)
ROODE ZANDS KLOOF	TULBAGH		66	1	175.7832
Name of Owner	ID/Business registration number				Title Deed Number
MODDERASRIVIER TRUST	IT2069/2000				T39680/2001

2001/05/29

DETERMINATION OF WATER DEMAND

WATER DEMAND FOR IRRIGATION

The SAPWAT values are used to determine maximum use:

Quat Nr	Grapes	Citrus	Fruit	Lucern	Potatoes	Vegetables	Grazing	Default
G10E	5800	5700	4800	8300	6400	5300	8300	6000

The actual use is determined by the water source volume available for irrigation: 421 470

The volume is capped to the lesser volume of SAPWAT or ACTUAL use .

SAPWAT	Quota	ACTUAL	Quota	SELECTED	Comment
289008	4800	421470	7000	7000	Only sources used

Irrigation fields identified					Max SAPWAT use		Actual use	
Field Nr	Irrigated	Crop type	Area (Ha)	% Rotation	Water use (	Volume	Water use (m3	Volume
C4	Y	Fruit	6.72	100	4800	32256	7000	47040
C8	Y	Fruit	23.17	100	4800	111216	7000	162190
C9	Y	Fruit	10.84	100	4800	52032	7000	75880
C10	Y	Fruit	4.53	100	4800	21744	7000	31710
C12	Y	Fruit	14.95	100	4800	71760	7000	104650
Applicant request quota of 7000 as originally registerd								
60.21	7000	421470						
			60.21		4800	289008		421470

FEED LOTS

Animal type	Nr Animals	Water use rate	LBO	Surface	Ground
		TOTAL	0	0	0

INDUSTRIAL USE

Type of Idustry	Detail of water use		LBO	Surface	Ground
		TOTAL	0	0	0

STREAMFLOW REDUCTION ACTIVITY

Field Nr	Type of trees	Plantation area (Ha)	Water use rate m3/ha/y	Volume
			0	0

EXISTING LAWFUL USE DETERMINATION	C07500000000006600001			
Water use Sector	Water Source			Total
	Surface	Groundwat	Irrigation Board	Volume (m3)
Irrigation Agriculture	363 460	58 010	0	421 470
No Irrigation: Feedlots	0	0	0	0
No Irrigation: Industrial	0	0	0	0
TAKING OF WATER	363 460	58 010	0	421 470
STORAGE OF WATER				231 000
STREAMFLOW REDUCTION ACTIVITY				0

WATER SOURCES		
IRRIGATION BOARD		0
SURFACE WATER VIA STORAGE		231 000
SURFACE WATER FROM STREAM		132 460
GROUND WATER		58 010
	TOTAL	421 470

STORAGE								231000
Dam Nr	Area	Cal/Surv	DSO Nr	Wall height	Crest length	Natural Sou	Other Sourc	Volume
D1	2.94		G102/CD					200 000
D2	0.72							31 000
					TOTAL	0	0	231 000

6.80
4.31

If there is storage on the property it must be determined what is the source of the stored water.

Natural run-off from catchment	Yes		No	
Pumped from river	Yes		No	
pipe or channel from off take weir	Yes		No	
Groundwater or spring	Yes		No	

Total Storage	Accepted	Comment
231000	231000	Catchment 150 Ha X 769mm Run off

Without storage the only other surface water source is taking from a source by pumping from or pipe from offtake weir. Only accept if there is detail submitted on abstraction method.

Source	Abstraction Method	Volume	Comment
Non Perenial streams	In and out of dam via river	132460	Applicant claim additional via stream
	TOTAL	132460	

GROUND WATER					
Nr B/Holes	Volume Claimed	Accepted Volume		Irrigation	Non Irri
1	86000	58010		58010	0
The amount of Groundwater that is used must be checked against a realistic delivery rate:					
Volume	Hrs/day	Days/W	Week/Y	Delivery l/s	Comment:
58010	12	5	52	5.2	

WATER BALANCE Compare the Water Requirement with the availability for final decision.						
Water available for Irrigation		Source Volume		Non Irr Volume		Balance Available
		421 470		0		421 470
IRRIGATION REQUIRMENT			AVALABLE		BALANCE	COMMENTS
Area	Quota	Volume	LBO	Other		
60.21	7000	421470	0	421 470	0	
SPECIAL COMMENTS:						
Applicant registered on WARMS nr 22043520 for 86 000m3 groundwater and 350 000 m3 Surface water for total of 436000m3.						

Legend

Cadastre

C07500000000006600001

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Registration Details of a Dam Registered in terms of Dam Safety Legislation in terms of Chapter 12 of the National Water Act (Act 36 of 1998)

(Please note that registration for dam safety legislation is not an entitlement for water use in terms of Chapter 4 of the National Water Act)

Enter No of dam	G102/CD	Column
No of dam	G102/CD	1
WARMS Dam ID	0	2
Name of dam	MODDERAS	3
Water management area	9	4
Quaternary Drainage Area	G10E	5
Latitude deg	33	6
Lat min	12	7
Lat sec	37.9	8
Longitude deg	19	9
Long min	7	10
Long sec	22.8	11
Town nearest	TULBAGH	12
Distance from Town	10	13
Name of farm	ROODE ZANDS KLOOF 66 PTN 1	14
District	TULBAGH	15
Province	WESTERN CAPE	16
DWS Provincial Office / Region	WESTERN CAPE	17
Completion date	2009	18
Completion date raised	0	19
River or Watercourse	ROODEZANDS TRB	20
Wall type	EARTHFILL	21
Wall height	13.8	22
Crest Length (m)	286	23
Spillway Type	OPEN CHANNEL	24
Capacity (1000 cub m)	200	25
Surface area (ha)	4.52	26
Catchment area (sq km))	0.8	27
Purpose	IRRIGATION	28
Owner Name	MODDERASRIVIER TRUST	29
Designer	VAN BREDA & ASSOCIATE	30
Contractor	0	31
Registration date	16/05/2008	32
Size	Medium	33
Hazard Potential	Significant	34
Category	2	35
Classification date	10/06/2008	36
Sector	A	37
Date Last DSE	03/03/2016	38
Number Last DSE	1	39
Target date next DSE	30/03/2021	40

Appendix B

Geotechnical information

STEYN-WILSON LABORATORIES
CIVIL ENGINEERING TESTING LABORATORIES

sanas Testing Laboratory T0835

11 Gooderson Road Blackheath
PO Box 58 Blackheath 7581
Tel: 021 905 0435
Fax: 086 499 9482
Email: info@steynwilson.co.za
Web: www.steynwilson.co.za

Client: **Modderasrivier Boerdery**

Project: Modderas Dam

Attention: Joseph Mbenga

Your Ref. No: -

Date Reported Wednesday, 12 February 2025

TEST REPORT REFERENCE NUMBER / JOB NUMBER : SWL40216

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

3 x FOUNDATION INDICATOR

3 x SCS DOUBLE HYDROMETER

Site Sampling and Materials Information

Sampling Method	*Specimens delivered to Steyn Wilson Laboratory.*
Environmental Condition	*Rainy*
Deviation from the prescribed test method	*No deviation from standard test method.*
Responsibility of information disclaimer	*The sample information was received from the customer. Results apply to the sample as received from the Customer.*

FINAL REPORT

We would like to take this opportunity to thank you for your valued support.
Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully
STEYN-WILSON LABORATORIES (PTY) LTD

Mr. R.Wilson
Technical Signatory

Remarks:

1. Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
2. Opinions & Interpretations are not included in our schedule of Accreditation.
3. The samples where subjected and analysed according to ASTM.
4. The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.
5. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of STEYN-WILSON LABORATORIES (PTY) LTD.
6. Measuring equipment is traceable to national standards (Where applicable).
7. Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
8. Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
9. The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.

STEYN-WILSON LABORATORIES
CIVIL ENGINEERING TESTING LABORATORIES

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Fax: 086 499 9482
Email: info@steynwilson.co.za
Web: www.steynwilson.co.za

Customer : **Modderasrivier Boerdery**

Attention : Joseph Mbenga

Project : Modderas Dam
Date Received : 05 February 2025
Date Reported : 12 February 2025
Req. Number : -
Date Sampled: 05 February 2025

FOUNDATION INDICATOR ASTM D422

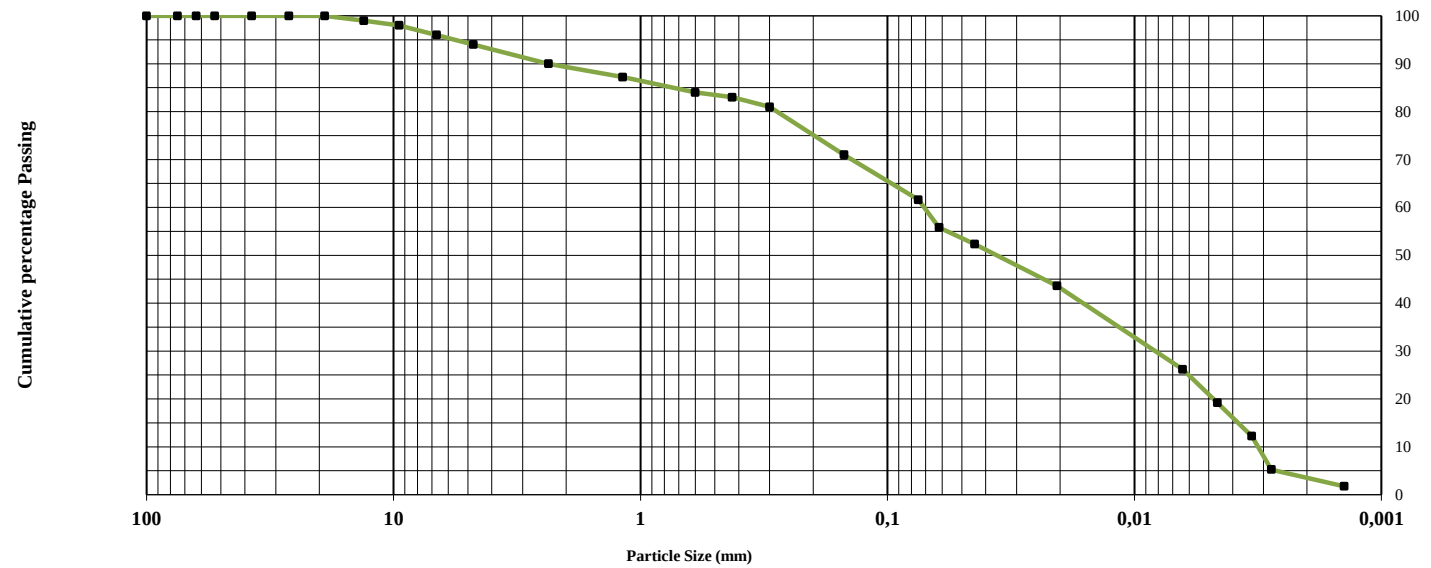
Material Description:	Light Yellowish Orange Sandy SILT	Sample Number:		40216 / 1		
Position:	TP2	Liquid Limit	Cassgranda SANS 3001 GR12	**34,8**	Linear Shrinkage	**6,5**
Depth:	-	Plasticity Index		**13,9**	Insitu M/C%	**18,5**

SCS (5µm)	**91**
SCS (2µm)	**90**

SG (TMH1 A12T)*	**2,512**

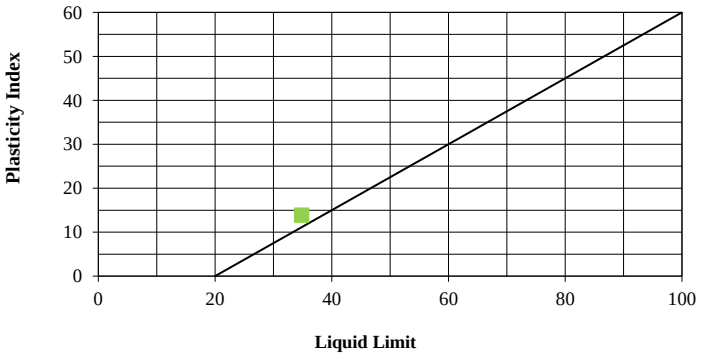
SIEVE ANALYSIS (TMH 1 A1a)*																		HYDROMETER ASTM D422							
100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,062	0,044	0,021	0,006	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	99	98	96	94	90	87,2	84	83	81	71	61,6	55,81	52,32	43,6	26,16	19,18	12,21	5,232	1,744
% Passing																									

Particle Size Distribution

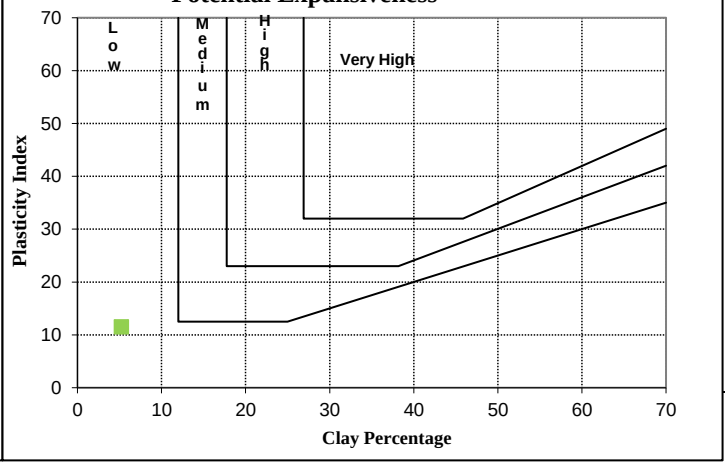


% Gravel	**6**	**% Sand**	**35**	**% Silt**	**54**	**% Clay**	**5**

Plasticity Chart
A Line



Potential Expansiveness



NOTE: All tests marked with (*) means that those test methods are not accredited.

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Web: www.steynwilson.co.za

Customer : **Modderasrivier Boerdery**

Project : Modderas Dam
Date Received : 05 February 2025
Date Reported : 12 February 2025
Req. Number : -

Attention : Joseph Mbenga

FOUNDATION INDICATOR ASTM D422

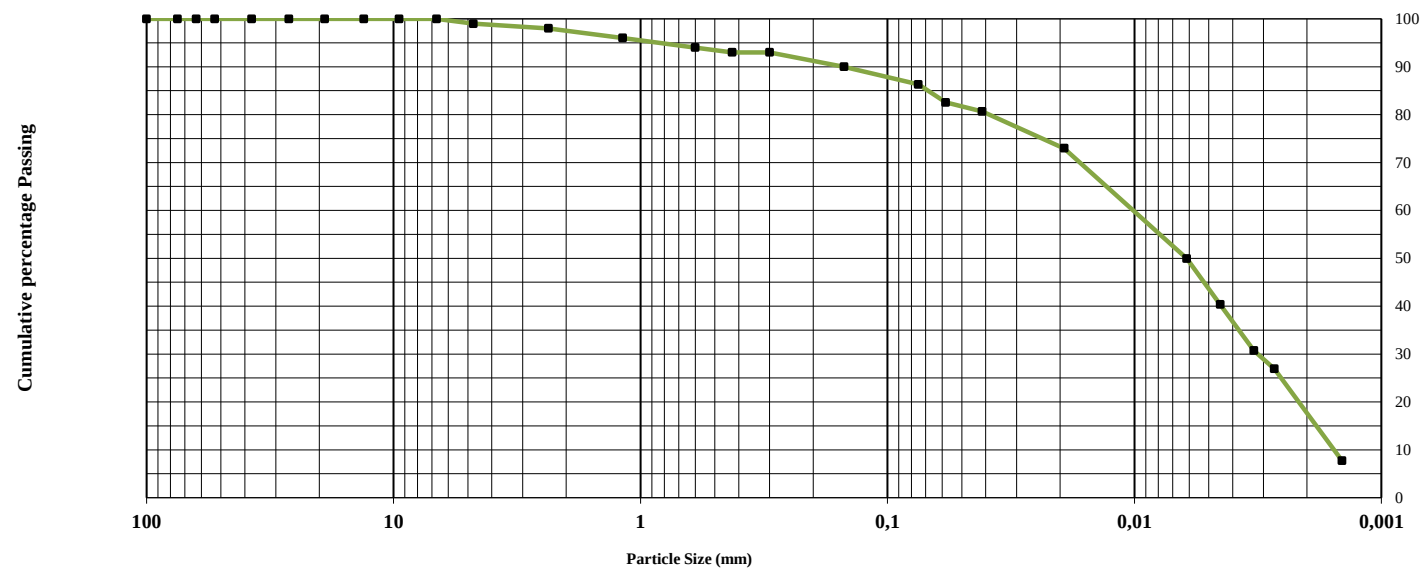
Material Description:	Light White Brown Sandy Clayey SILT	Sample Number:		40216 / 2		
Position:	TP4	Liquid Limit	Cassgranda SANS 3001 GR12	**52,8**	Linear Shrinkage	**8,9**
Depth:	-	Plasticity Index		**18,9**	Insitu M/C%	**29,7**

SCS (5µm)	**86**
SCS (2µm)	**71**

SG (TMH1 A12T)*	**2,403**

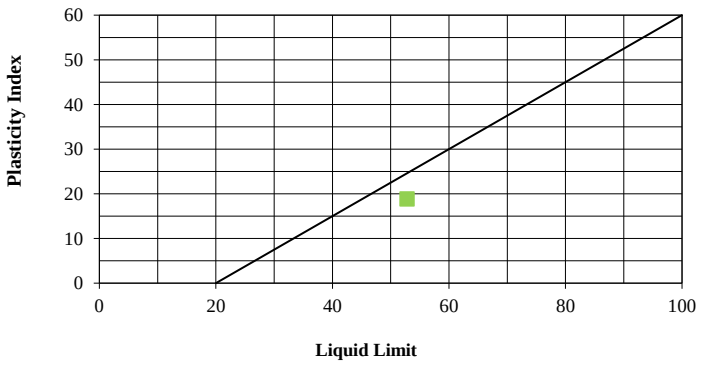
SIEVE ANALYSIS (TMH 1 A1a)*																		HYDROMETER ASTM D422							
100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,058	0,041	0,019	0,006	0,004	0,003	0,003	0,001
100	100	100	100	100	100	100	100	100	100	99	98	96	94	93	93	90	86,3	82,56	80,64	72,96	49,92	40,32	30,72	26,88	7,68
% Passing																									

Particle Size Distribution

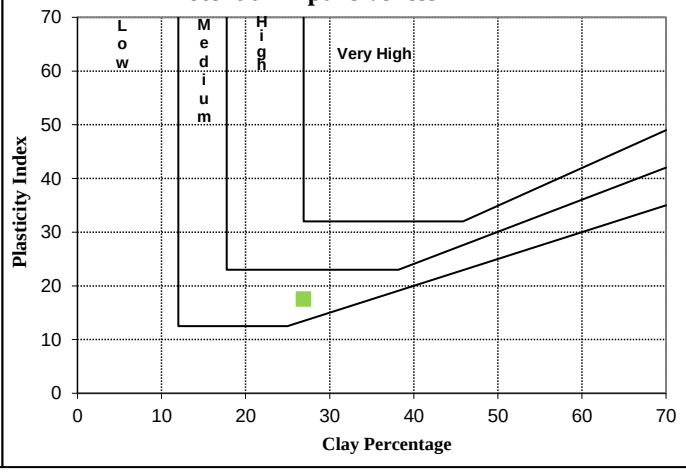


% Gravel	**1**	**% Sand**	**14**	**% Silt**	**58**	**% Clay**	**27**

Plasticity Chart
A Line



Potential Expansiveness



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Email: info@steynwilson.co.za
Web: www.steynwilson.co.za

Customer : **Modderasrivier Boerdery**

Project : Modderas Dam
Date Received : 05 February 2025
Date Reported : 12 February 2025
Req. Number : -

Attention : Joseph Mbenga

FOUNDATION INDICATOR ASTM D422

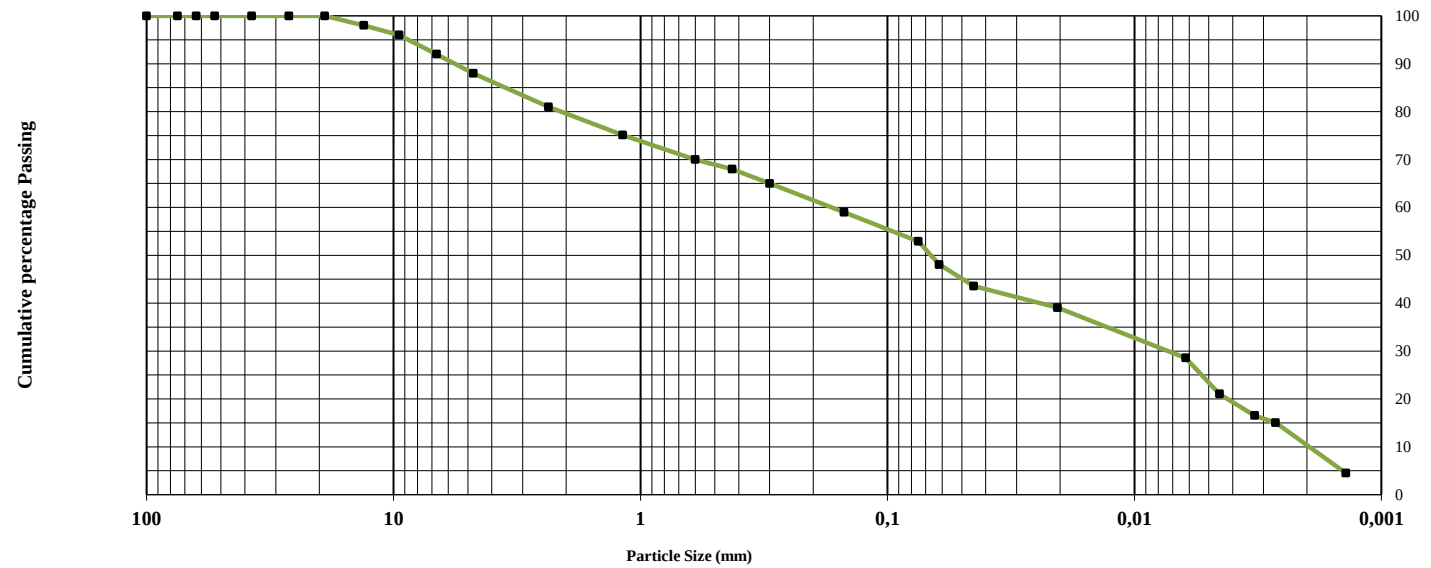
Material Description:	Light Yellowish Brown Gravelly Clayey Silty SAND	Sample Number:		40216 / 3	
Position:	TP6	Liquid Limit (Cassgranda SANS 3001 GR12)	**34,6**	Linear Shrinkage	**6,2**
Depth:	-	Plasticity Index	**13**	Insitu M/C%	**22,1**

SCS (5µm)	**0**
SCS (2µm)	**0**

SG (TMH1 A12T)*	**2,518**

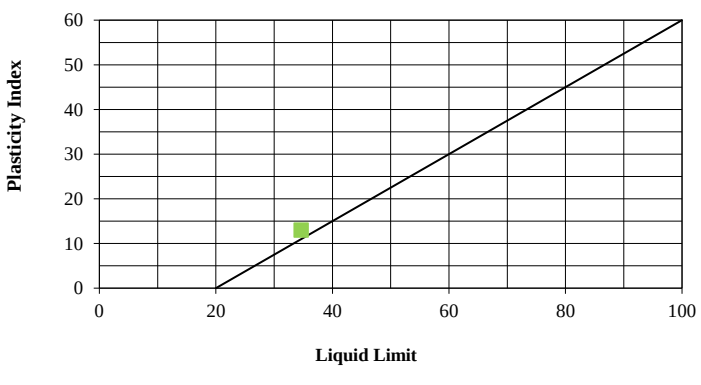
SIEVE ANALYSIS (TMH 1 A1a)*																		HYDROMETER ASTM D422							
100	75	63	53	37,5	26,5	19,0	13,2	9,5	6,7	4,75	2,36	1,18	0,60	0,425	0,300	0,150	0,075	0,062	0,045	0,020	0,006	0,005	0,003	0,003	0,001
100	100	100	100	100	100	100	98	96	92	88	81	75,1	70	68	65	59	52,9	48,06	43,56	39,05	28,54	21,03	16,52	15,02	4,506
% Passing																									

Particle Size Distribution

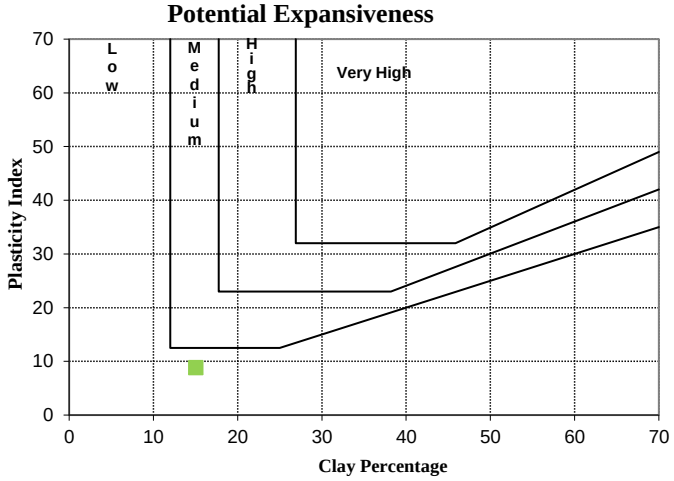


% Gravel	% Sand	% Silt	% Clay
12	37	36	15

Plasticity Chart
A Line



Potential Expansiveness



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Email: info@steynwilson.co.za
Web: www.steynwilson.co.za

Client: **Modderasrivier Boerdery**

Project: Modderas Dam

Attention: Joseph Mbenga

Your Ref. No: -

Date Reported Wednesday, 12 February 2025

TEST REPORT REFERENCE NUMBER / JOB NUMBER : SWL40216

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

3 x PROCTOR

Site Sampling and Materials Information

Sampling Method	*Sampled by CLIENT*
Enviromental Condition	*Rainy*
Deviation from the prescribed test method	*No deviation of the standard test method.*
Responsibility of information disclaimer	*The sample information was received from the customer. Results apply to the sample as received from the Customer.*

FINAL REPORT

We would like to take this opportunity to thank you for your valued support.
Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully
STEYN-WILSON LABORATORIES (PTY) LTD

Mr. R.Wilson
Technical Signatory

Remarks:

1. Information contained herein is confidential to STEYN-WILSON PTY LTD and the addressee
2. Opinions & Interpretations are not included in our schedule of Accreditation.
3. The samples where subjected and analysed according to SANS 3001.
4. The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.
5. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of STEYN-WILSON LABORATORIES (PTY) LTD.
6. Measuring equipment is traceable to national standards (Where applicable).
7. Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
8. Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
9. The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of STEYN-WILSON LABORATORIES (PTY) LTD.

STEYN-WILSON LABORATORIES
CIVIL ENGINEERING TESTING LABORATORIES

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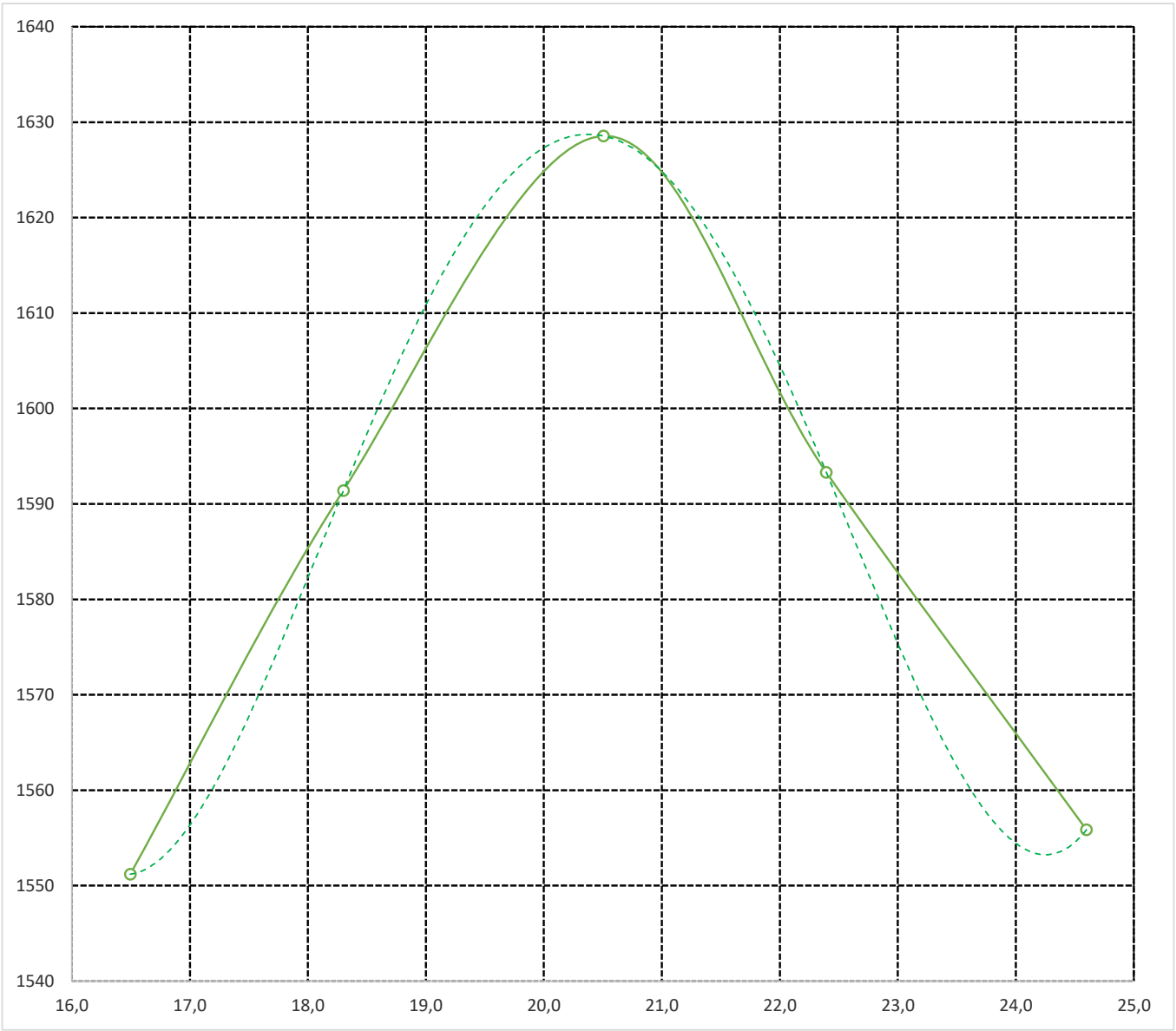
Fax: 086 499 9482
Email: info@steynwilson.co.za
Web: www.steynwilson.co.za

JOB NO:	SWL40216	REFERENCE NO:	-	DATE:	2025/02/12
CLIENT	Modderasrivier Boerdery			PROJECT	Modderas Dam
				POSITION / LAYER	TP2
				KM / SV	-
				SAMPLE NUMBER	40216 / 1
ATTENTION	Joseph Mbenga			MATERIAL DISCRIPTION	Yellowish Clayey Soil
				ENVIROMENTAL CONDITIONS	Rainy
SAMPLED BY	Client	Client		LABORATORY TESTER	Snoek, Happy
TEMP.'C INSIDE LABORATORY		24'C		SAMPLE METHOD	Sampled by CLIENT

PROCTOR Determination of Dry density and moisture content as per Specimen C of GR40. SANS 3001- GR30 / GR40 / GR20



Proctor Maximum Dry Density Kg/m³	**1629**
Optimum Moisture Content %	**20,5**

NOTE: All tests marked with (*) means that those test methods are not accredited.

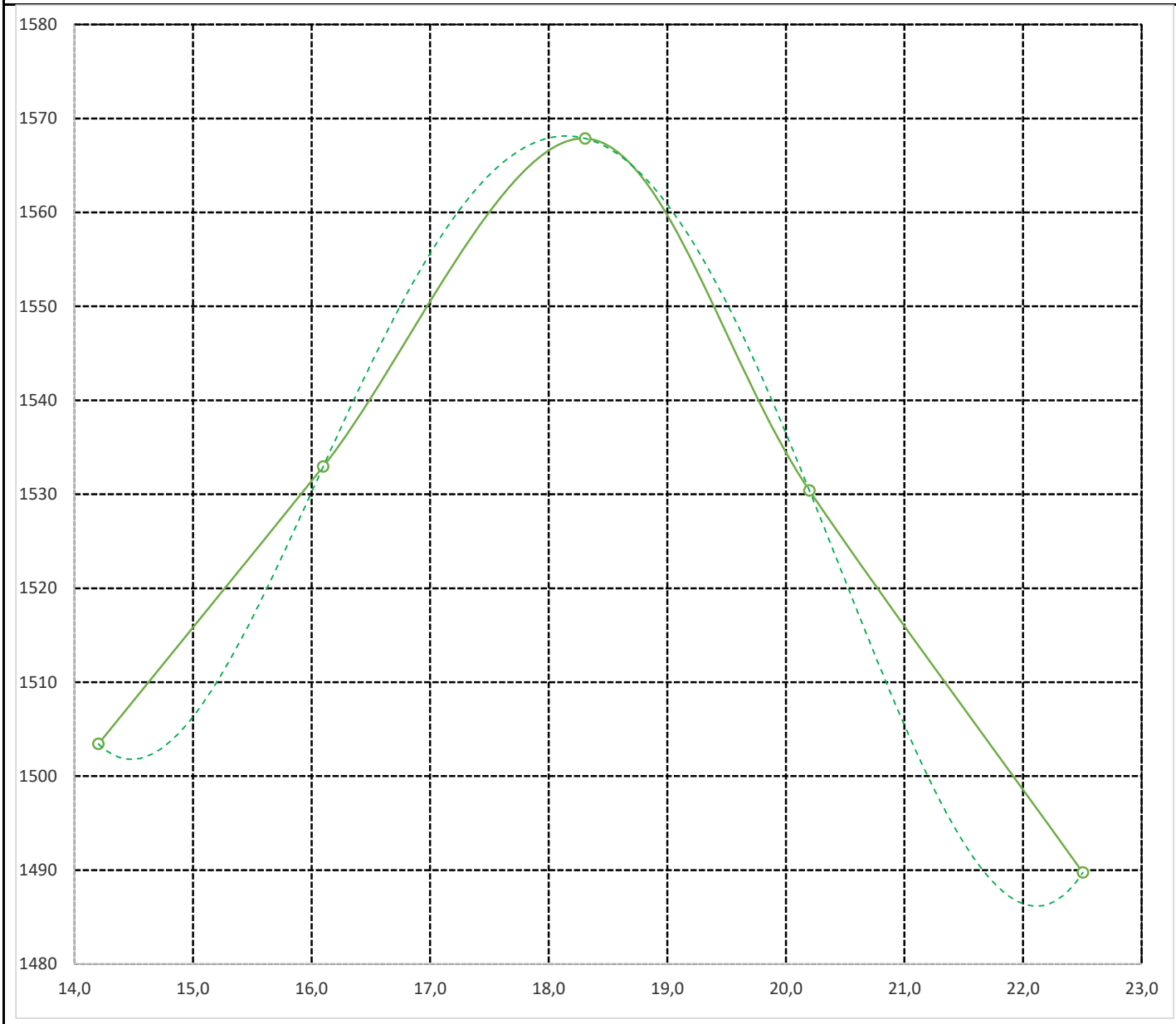
STEYN-WILSON LABORATORIES
CIVIL ENGINEERING TESTING LABORATORIES

sanas Testing Laboratory T0835

11 Gooderson Road Blackheath
PO Box 58 Blackheath 7581
Tel: 021 905 0435
Fax: 086 499 9482
Email: info@steynwilson.co.za
Web: www.steynwilson.co.za

JOB NO:	SWL40216	REFERENCE NO:	-	DATE:	2025/02/12
CLIENT	Modderasrivier Boerdery		PROJECT	Modderas Dam	
			POSITION / LAYER	TP4	
			KM / SV	-	
			SAMPLE NUMBER	40216 / 2	
ATTENTION	Joseph Mbenga		MATERIAL DISCRIPTION	Light Brown Clayey Soil	
			ENVIROMENTAL CONDITIONS	Rainy	
SAMPLED BY	Client	Client	LABORATORY TESTER	Snoek, Happy	
TEMP.'C INSIDE LABORATORY		24'C	SAMPLE METHOD	Sampled by CLIENT	

PROCTOR Determination of Dry density and moisture content as per Specimen C of GR40. SANS 3001- GR30 / GR40 / GR20



Proctor Maximum Dry Density Kg/m³	**1568**
Optimum Moisture Content %	**18,3**

NOTE: All tests marked with (*) means that those test methods are not accredited.

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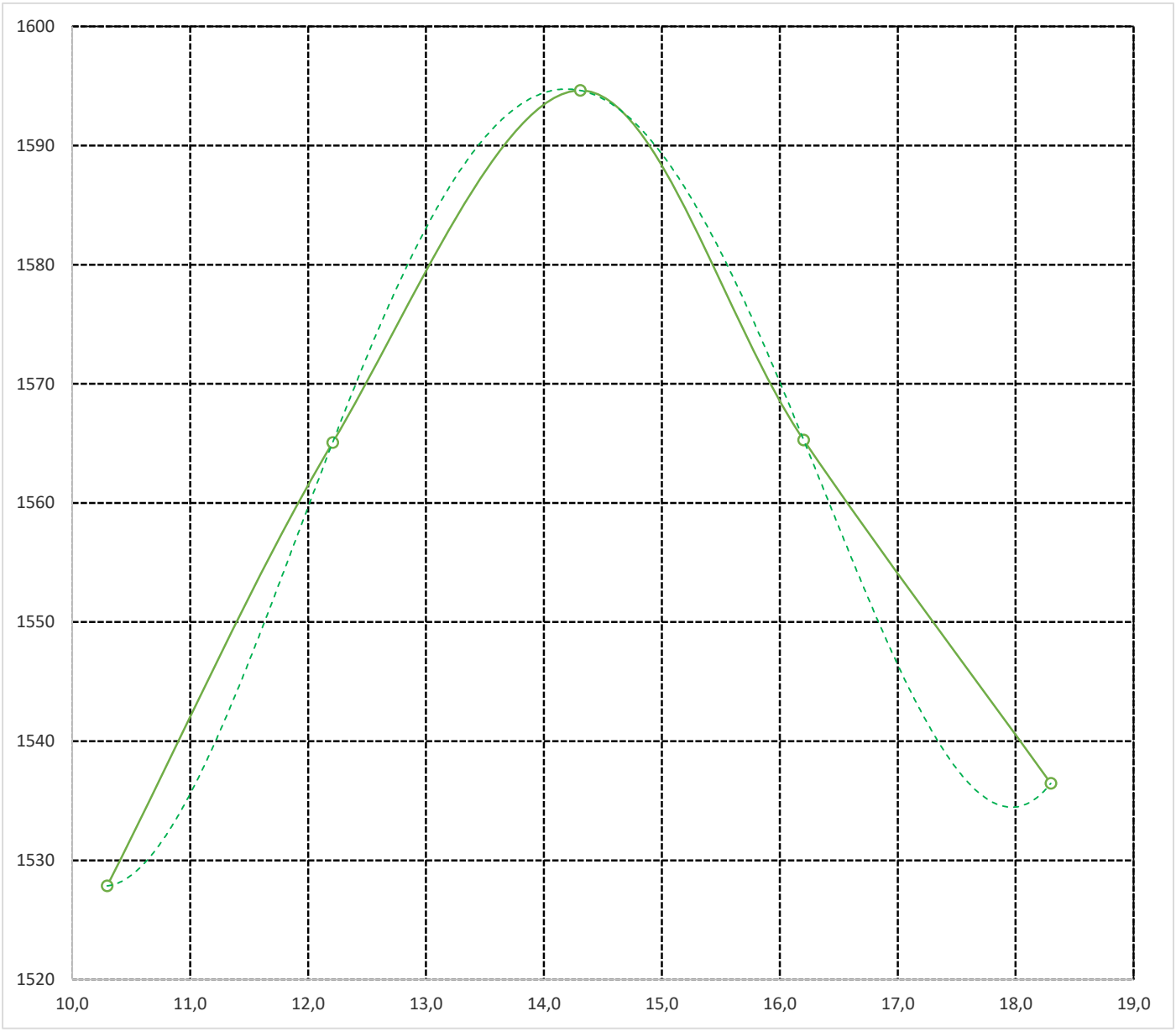
JOB NO:	SWL40216	REFERENCE NO:	-	DATE:	2025/02/12
CLIENT	Modderasrivier Boerdery		PROJECT	Modderas Dam	
			POSITION / LAYER	TP6	
			KM / SV	-	
			SAMPLE NUMBER	40216 / 3	
ATTENTION	Joseph Mbenga		MATERIAL DISCRIPTION	Yellowish Clayey Soil with Shale	
			ENVIROMENTAL CONDITIONS	Rainy	
SAMPLED BY	Client	Client	LABORATORY TESTER	Snoek, Happy	
TEMP.'C INSIDE LABORATORY		24'C	SAMPLE METHOD	Sampled by CLIENT	

PROCTOR Determination of Dry density and moisture content as per Specimen C of GR40. SANS 3001- GR30 / GR40 / GR20



Proctor Maximum Dry Density Kg/m³	**1595**
Optimum Moisture Content %	**14,3**

NOTE: All tests marked with (*) means that those test methods are not accredited.

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CIVIL ENGINEERING TESTING LABORATORIES

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11 Gooderson Road Blackheath
PO Box 58 Blackheath 7581
Tel: 021 905 0435
Fax: 086 499 9482
Email: geotech@steynwilson.co.za
Web: www.steynwilson.co.za

Client:	Moddasrivier Boerdery
Project:	Modderas Dam
Attention:	Mr J Mbenga
Address	Somerset West, 7129, South Africa
Contact No.:	-
Your Ref. No:	-
Date Reported	18/02/2025

TEST REPORT REFERENCE NUMBER / JOB NUMBER : SWL40216

Dear Sir / Madam

Herewith please find the original reports pertaining to the above mentioned project.

Test Requested

- *3 Falling Head Permeability Tests*
- *3 Crumb Tests*

Site Sampling and Materials Information

Sampling Method	Specimens delivered to Steyn Wilson Laboratories
Environmental Conditions	Sunny
Deviations from prescribed method	No deviation from standard test method
Responsibility of information disclaimer	The sample information was received from the customer. Results apply to the sample as received from the customer

FINAL REPORT

We would like to take this opportunity to thank you for your valued support.
Should you have any further enquiries please don't hesitate to contact me.

Yours Faithfully
Steyn Wilson Geotechnical

Frank Coetzee
Technical Signatory

Remarks:

1. Information contained herein is confidential to Steyn Wilson Geotechnical and the addressee
2. Opinions & Interpretations are not included in our schedule of Accreditation.
3 The results reported relate only to the sample tested, Further use of the attached information is not the responsibility or liability of Steyn Wilson Geotechnical.
4. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from a director of Steyn Wilson Geotechnical.
5. Measuring equipment is traceable to SI Units (Where applicable).
6 Should there be any deviation from the prescribed test method comments will be made thereof, pertaining to the test on the relevant materials report.
7 Uncertainty of measurement is calculated and corresponds to a coverage probability of approximately 95%. Available on request.
8. The decision rule states that the measurement of uncertainty can be applied by the customer to the test results, on request. It is not the responsibility or liability of Steyn Wilson Geotechnical.
9. All tests marked with (*) means that those test methods are not accredited.

FALLING HEAD PERMEABILITY TEST REPORT - TEST METHOD: ASTM D2434 & KH HEAD

Sample Details		Remould Details (Proctor)								Tests							
TP 2		Specified				Actual				Time							
Sample no.	Depth(m):	Dry Density:		%:	OMC:	Dry density:		%	Moisture Content:	Test:	H1 (mm):	H2 (mm):	h	m	s	Permeability (cm/s)	Permeability (m/s)
1	-	1629	kg/m^3	98	20,5	1596	kg/m^3	98,0	20,5	1	**1400**	**1172**	13	12	53	1,8678E-06	1,8678E-08
										2	**1172**	**885**	25	23	27	1,4746E-06	1,4746E-08
										3	**885**	**733**	23	47	55	1,0042E-06	1,0042E-08
													Average:			**1,4489E-06**	**1,4489E-08**

Sample Details		Remould Details (Proctor)								Tests							
TP 4		Specified				Actual				Time							
Sample no.	Depth(m):	Dry Density:		%:	OMC:	Dry density:		%	Moisture Content:	Test:	H1 (mm):	H2 (mm):	h	m	s	Permeability (cm/s)	Permeability (m/s)
2	-	1568	kg/m^3	98	18,3	1536	kg/m^3	98,0	18,3	3	**1400**	**1308**	13	12	53	7,2613E-07	7,2613E-09
										1	**1308**	**1240**	25	23	27	2,9401E-07	2,9401E-09
										2	**1240**	**1210**	23	47	55	1,4298E-07	1,4298E-09
													Average:			**3,8771E-07**	**3,8771E-09**

Sample Details		Remould Details (Proctor)								Tests							
TP 6		Specified				Actual				Time							
Sample no.	Depth(m):	Dry Density:		%:	OMC:	Dry density:		%	Moisture Content:	Test:	H1 (mm):	H2 (mm):	h	m	s	Permeability (cm/s)	Permeability (m/s)
3	-	1595	kg/m^3	98	14,3	1563	kg/m^3	98,0	14,3	2	**1400**	**1345**	25	18	55	2,2635E-07	2,2635E-09
										3	**1345**	**1293**	25	2	35	2,2373E-07	2,2373E-09
										1	**1293**	**1251**	22	11	54	2,1017E-07	2,1017E-09
													Average:			**2,2008E-07**	**2,2008E-09**

STEYN-WILSON GEOTECHNICAL
CIVIL ENGINEERING TESTING LABORATORIES

sanas Testing Laboratory T0835

Project	**Modderas Dam**
Client	Moddasrivier Boerdery
Jobfile	SWL-40216
Test Date	10/02/25

Coefficient of Permeability m/s (KH HEAD)

	k=1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}	10^{-10}	10^{-11}	10^{-12}
Drainage characteristics	GOOD						POOR		PRACTICALLY IMPERVIOUS				
Permeability classification	HIGH			MEDIUM		LOW		VERY LOW	PRACTICALLY IMPERMEABLE				
General soil type	GRAVELS		CLEAN SANDS		FISSURED & WEATHERED CLAYS				INTACT CLAYS				
						VERY FINE OR SILTY SANDS							

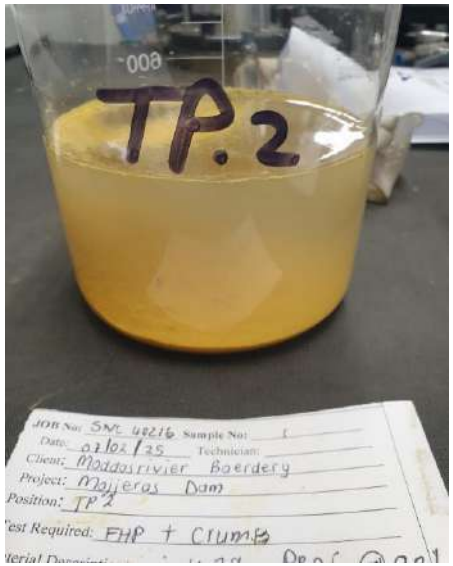
STEYN-WILSON GEOTECHNICAL
CIVIL ENGINEERING TESTING LABORATORIES

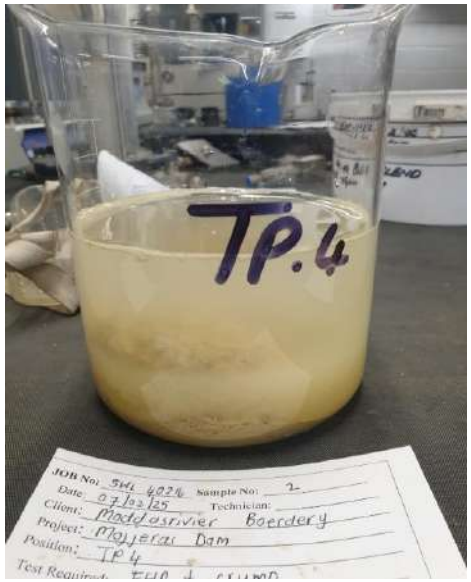
sanas Testing Laboratory T0835

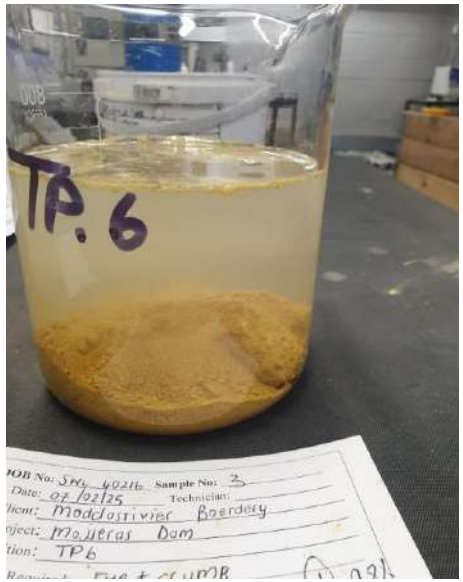
Project	**Modderas Dam**
Client	Moddasrivier Boerdery
Jobfile	SWL-40216
Test Date	10/02/25

CRUMB TEST ASTM D6572

Sample Details	*Depth (m):*	*Dispersive Classification*
TP 2	-	**Grade 4 -Highly-Dispersive**
TP 4	-	**Grade 4 -Highly-Dispersive**
TP 6	-	**Grade 1 - Non-Dispersive**







STEYN-WILSON GEOTECHNICAL
CIVIL ENGINEERING TESTING LABORATORIES

28/01/2021 Rev2 TR/GEO-SW0013 Compiled: M.Steyn Approved: R.Wilson

Project	**Modderas Dam**
Client	Moddasrivier Boerdery
Jobfile	SWL-40216
Test Date	12/02/25

HAGENBRINK
CONSULTING ENGINEERS
PASSION | EXCELLENCE | INNOVATION

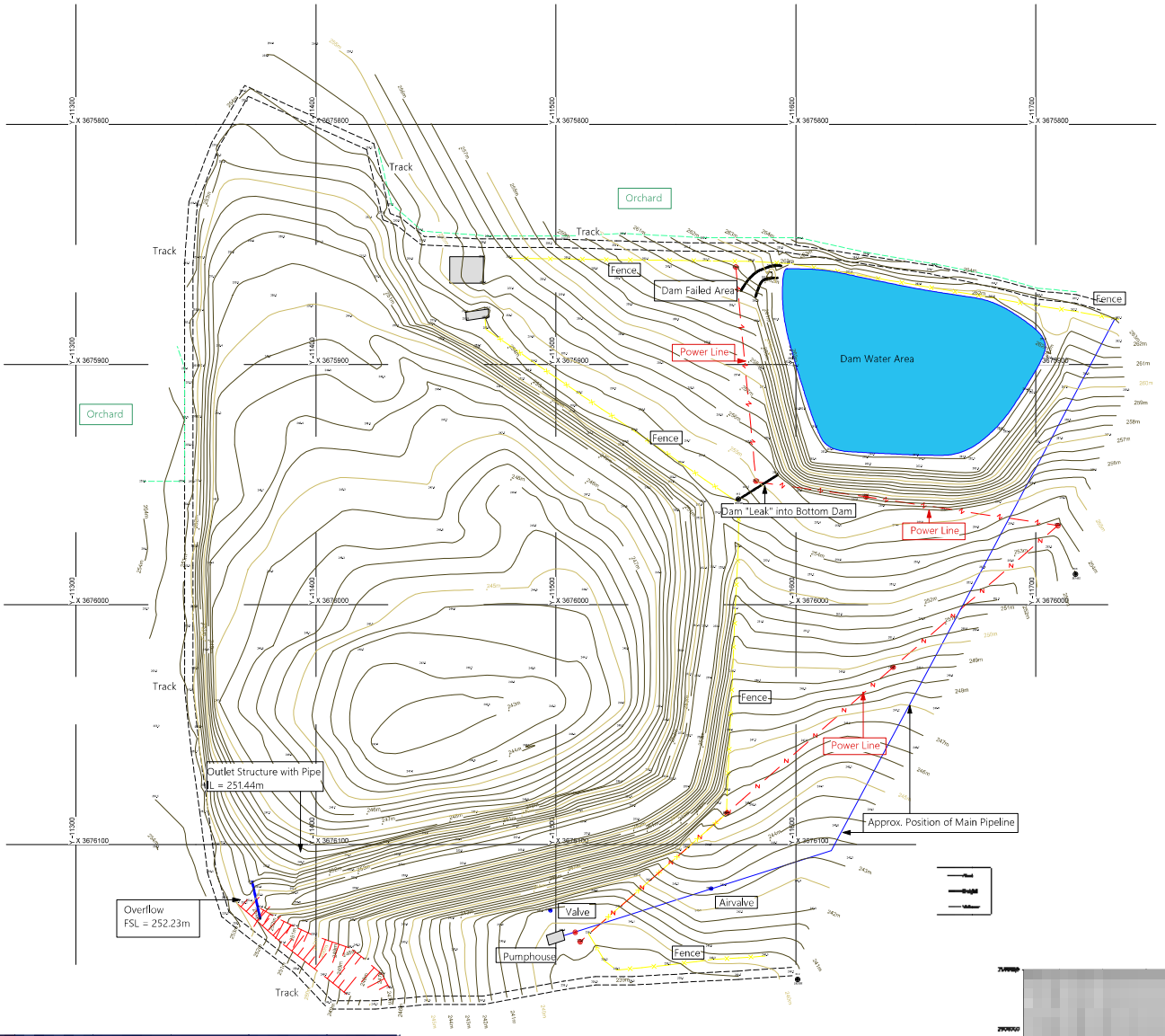
Results of foundation indicator and dispersivity tests and Soil Classification for Modderas Dam

Sample Ref No	Photo	Atterberg Limits			Dispersivity %	Permeability (cm/s)	Fines %(< 0,075 mm)	Grain Size Distribution (%)				Classification (in accordance with Unified Soil Classification System)	
		LL	PI	LS				Clay [1]	Silt [2]	Sand [3]	Gravel [4]		
TP2		35	14	6.5	91	1.449×10^{-6}	62	4	58	32	6	CL	Sandy lean clay
TP4		53	19	8.9	86	3.877×10^{-7}	86	17	69	13	1	CH	Elastic silt
TP6		35	13	6.2	0	2.201×10^{-7}	53	11	42	35	12	CL	Sandy lean clay

1) Clay < 0.002 mm; Silt >0.002 mm and <0.075 mm; Sand >0.075 mm and <4.75 mm; Gravel >4.75 mm

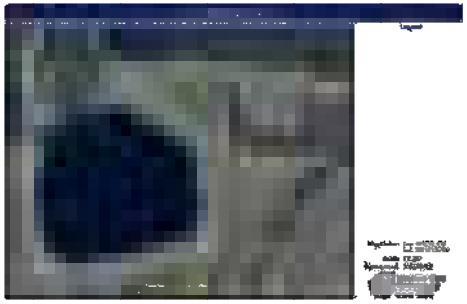
Appendix C

Drawings

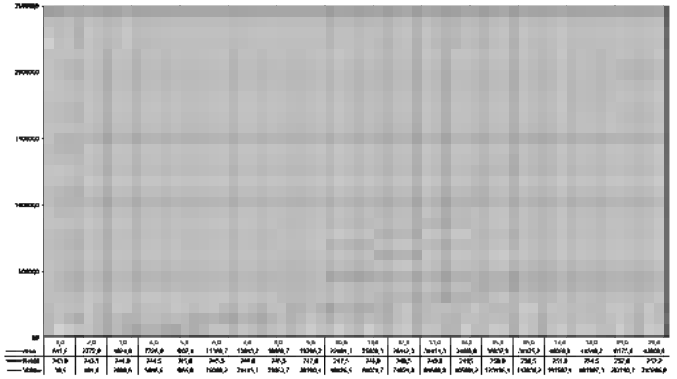


Volume Calculation Table			
[redacted]	242,83	m	
	252,23	m	
CONTOUR VALUE	AREA m²	TOTAL VOLUME	REMARK
243,0	643,5	30,5	
243,5	2772,9	884,1	
244,0	4924,9	1808,5	
244,5	2226,9	5846,5	
245,0	4907,8	4955,0	
245,5	11569,7	15099,2	
246,0	13993,7	39415,1	
246,5	15560,7	29053,7	
247,0	19766,2	38160,4	
247,5	22894,3	48825,5	
248,0	25930,3	60031,7	
248,5	28442,3	78604,8	
249,0	31434,3	87688,9	
249,5	34085,9	105964,2	
250,0	36037,9	123495,4	
250,5	38125,2	142036,2	
251,0	40059,8	161582,4	
251,5	41599,7	181997,3	
252,0	43173,6	203190,7	
252,2	43909,6	215285,9	
Full Supply Level [FSL]		252,2	m
Volume at FSL		[redacted]	m³
Area at FSL		43910	m²
Dam wall crest height		253,8	m
Dam wall toe height		240,3	m
Dam wall free board		1,57	m
Dam wall length		303,0	m

FSL =253 23



System WG 84/19 (local based Geoid) Bench Mark Coordinates				
Sta	Y	X	Z	Descrp
M 1	-11575.049	3675956.336	254.800	Ip
M 2	-11600.372	3676156.532	240.208	Ipc
M 3	-11716.249	3675987.743	253.432	Ipc



Legend

- Control Bench Mark (DK 1)
- Fence
- Track
- Sloot
- Trees
- Bush
- Canal
- Garden Crete Wall
- Edge Tare Road
- Centreline Tare Road
- Manhole
- Cadstral Boundary
- Embankment

Project Survey:

Farm 1/66

Description of Survey:

Topo Survey of Proposed Dam Area

Area:

Tulbagh

Coordinate System: WG 84/19

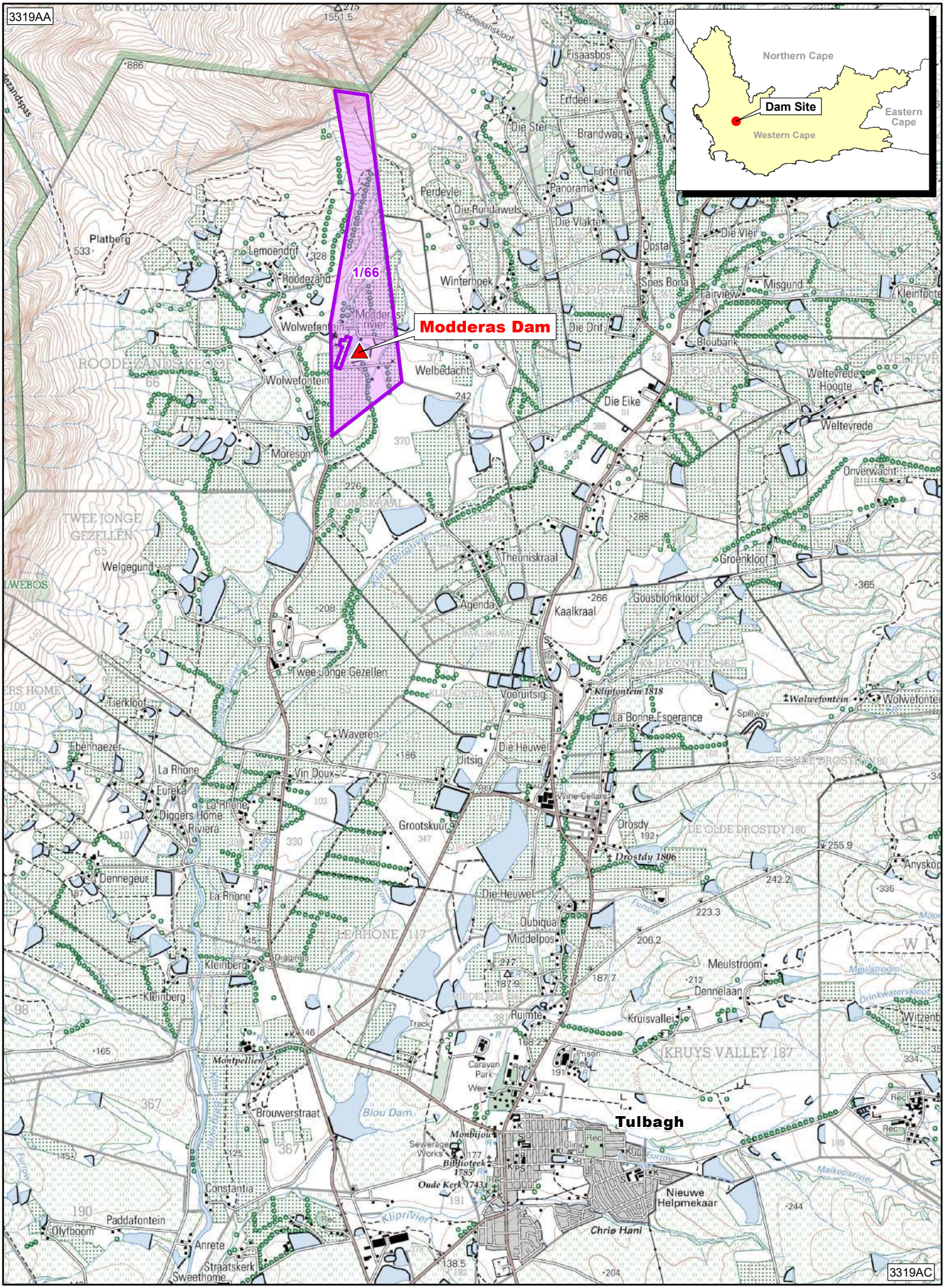
Survey Based on: WG 84/19 RL From: IPQ 1

Surveyor:	B. West
Compiled by:	B. West
Date:	Sept 2024
Drawing number:	ModR_01
Sheet Number:	1
Scale:	1 : 1 000

P.o. Box 383
WORCESTER
6849

Email:
bwsurveymobile@gmail.com

Phone: 083 398 3025



HAGENBRINK CONSULTING ENGINEERS **Modderas Boerdery**	**Modderas Dam**	800 400 0 800 m 1:50 000	A4
	Locality Map	DJH305 - Modderas Dam\09 GIS\mxd\02_LocalityMap.mxd	Drawing No. **DJH305 - 02**

PLAN LAYOUT
SCALE 1:1000

NOTES: MODDERAS DAM - OPTION 1

GENERAL:

1.	NON-OVERSPILL CREST LEVEL:	255,6 masl
2.	FULL SUPPLY LEVEL:	254,1 masl
3.	FREEBOARD:	1.5 m
4.	WATER SURFACE AREA AT FSL:	5,5 ha
5.	GROSS CAPACITY:	310 000 m³
6.	CREST LENGTH:	387 m
7.	CREST WIDTH:	4,0 m
8.	MAXIMUM WALL HEIGHT:	15,1 m
9.	UPSTREAM SLOPE:	1V:3H
10.	DOWNSTREAM SLOPE:	1V:2H
11.	MINIMUM BASIN LEVEL:	243,0 masl
12.	DOWNSTREAM TOE LEVEL:	240,5 masl

ADDITIONAL NOTES

A. ALL DIMENSIONS IN METRES UNLESS OTHERWISE SHOWN.
B. ALL LEVELS IN METRES ABOVE SEA LEVEL (masl)
C. CONTOUR INTERVAL 1 m
D. PROJECTION: WGS 84 - Lo19

ABBREVIATIONS

NGL	-	NATURAL GROUND LEVEL
FSL	-	FULL SUPPLY LEVEL
NOC	-	NON-OVERSPILL CREST
TP	-	TEST-PIT POSITION (i.e TP 2)
RDF	-	RECOMMENDED DESIGN FLOOD
SEF	-	SAFETY EVALUATION FLOOD
TBC	-	TO BE CONFIRMED

SURVEY BENCHMARKS CO-ORDINATES

NAME	Y	X	Z
M1	-11575.050	3675956.400	254.000
M2	-11600.370	3676156.530	240.208
M3	-11716.250	3675987.740	253.432

No.	DATE	REVISION DESCRIPTION	CONSULT. ENG.
A	28/03/2025	INFORMATION	HBCE

INFORMATION

GENERAL NOTES

NO DIMENSION OR LEVEL TO BE SCALED OFF THIS DRAWING

ALL DIMENSIONS AND LEVELS TO BE CONFIRMED ON SITE PRIOR TO MANUFACTURING AND CONSTRUCTION

THE POSITION OF ALL EXISTING SERVICES ARE TO BE OBTAINED FROM LOCAL AUTHORITIES AND/OR OWNER. IF UNKNOWN THE EXACT POSITION SHALL BE DETERMINED BY CAREFUL HAND EXCAVATION.

CLIENT:

MODDERAS BOERDERY

HAGENBRINK

ENLARGEMENT OF MODDERAS DAM

PLAN LAYOUT OF EMBANKMENT AND SPILLWAY

AS SHOWN | SCALE : | DRAWING SIZE : A1

APPROVED BY: - | PR.ENG. | SIGNATURE | DATE: -

DESIGNED BY: J. MBENGA | CHECKED BY: W du PLESSIS

DRAWN BY: J. MBENGA | DATE: 28/03/2025

PROJECT No: DJH305 | DRG No: DJH305-03 | REV No: A

Appendix D

Dam Quantities Summary

HAGENBRINK CONSULTING ENGINEERS
PASSION | EXCELLENCE | INNOVATION

Raising of Modderas Dam

	Existing	Option 1: Upstream raising + upstream core trench	Option 2: Downstream raising with no core trench	Option 3	Option 4
Proposed NOC (m)	253.5	255.6	255.3	253.5	255.2
Proposed FSL (m)	**252.2**	**254.1**	**253.8**	**252.2**	**253.7**
Freeboard	1.3	1.5	1.5	1.3	1.5
Maximum wall height (m)	13.00	15.1	15.3	13.0	14.9
Proposed Wall crest width (m)	±6	4.0	4.0	4.0	4.0
DS Dam wall Slope	1V:2H	1V:2H	1V:2H	1V:2H	1V:2H
US Dam wall Slope	1V:2.1H To 1V:4	1V:3H	1V:2.1H To 1V:4	1V:2.1H To 1V:4	1V:3H
New Wall Fill (m^3)		25 000	21 500	10 000	29 000
Wall length (m)	303	387	383	309	442
Crest length/height	23	26	25	24	30
Capacity without cut from basin (m^3)	212 421	286 515	289 288	214 306	285 256
Water surface area at FSL (m^2)	43 879	55 452	55 123	47 804	58 261
Water surface area at FSL (Ha)	4.4	5.5	5.5	4.8	5.8
Average excavation depth to FSL (m)	**0.0**	**0.5**	**0.4**	**0.2**	**0.5**
Total Capacity (m^3)	**212 400**	**310 000**	**310 000**	**224 300**	**310 000**
Increased Capacity (m^3)		**97 600**	**97 600**	**11 900**	**97 600**
Estimated average core trench width (m)	4.2	5.0	4.4	4.8	5.0
Estimated average core trench depth (m)		5.0	0.0	5.0	5.0
Estimated core trench volume (m^3)	0	19 400	0	15 100	22 000
		44%	0%	60%	43%
Total earthfill (m^3)	**0**	**44 400**	**21 500**	**25 100**	**51 000**
Water/Wall Ratio		**2.20**	**4.54**	**0.47**	**1.91**
Minimum basin level (m)	243.00	243.00	243.00	243.00	243.00
Downstream toe level (m)	240.50	240.50	240.00	240.50	240.30
Maximum Storage depth (m)	9.2	11.1	10.8	9.2	10.7
Preliminary & General	**R -**	**R 365 720.10**	**R 215 776.63**	**R 239 348.53**	**R 408 935.25**
Earthworks without diesel	**R -**	**R 2 086 800.00**	**R 1 010 500.00**	**R 1 179 700.00**	**R 2 397 000.00**
Dry rate (R/m^3)	R -	R 47.00	R 47.00	R 47.00	R 47.00
Diesel consumption per m^3 (liter)	R -	R 0.95	R 0.95	R 0.95	R 0.95
Diesel price (R/liter)	R -	R 19.45	R 19.45	R 19.45	R 19.45
Diesel costs	**R -**	**R 820 401.00**	**R 397 266.25**	**R 463 785.25**	**R 942 352.50**
Rebate (R/liter diesel)					
Minus rebate savings					
Outlet pipe (Pipe, concrete, specials and valves), estimated	**R -**	**R 750 000.00**	**R 750 000.00**	**R 750 000.00**	**R 750 000.00**
Total construction cost (excluding VAT)	**R -**	**R 4 022 921.10**	**R 2 373 542.88**	**R 2 632 833.78**	**R 4 498 287.75**
Allow for 15% contingency	R -	R 603 438.17	R 356 031.43	R 394 925.07	R 674 743.16
Professional fees, investigation phase (WULA & EIA)					
Professional fees, detail design and construction input					
		0.0%	0.0%	0.0%	0.0%
Project costs (VAT excluded)	**R -**	**R 4 626 359.27**	**R 2 729 574.31**	**R 3 027 758.84**	**R 5 173 030.91**
R/m3 fill		R 104.20	R 126.96	R 120.63	R 101.43
R/m3 storage	R -	R 14.92	R 8.81	R 13.50	R 16.69

Hagen Brink Consulting Engineers (Pty) Ltd
Reg No 2019/617584/07

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