



Verw: 1815DOV-S1

Datum: 06/06/2018

Messrs Grassroots Group  
Posbus 16  
GOUDA  
6821

Attention: Mr Niel Cox & Rikus Muller

**FEASIBILITY STUDY FOR THE PROPOSED NEW DAM ON FARM HARTEBEESKRAAL 88 PORTION 8,  
TULBAGH DISTRICT, GRASSROOTS GROUP**

Thank you for the trust you have put in us to serve you with advice and appropriate expertise. Our discussions regarding the feasibility of the proposed new dam on farm 88/8 near Gouda, refer.

**1. ATTACHMENTS**

- **Appendix A** ~ Locality Map
- **Appendix B** ~ *Benede-Bergrivier IB Listings*
- **Appendix C** ~ Scoping & Feasibility Evaluation
- **Appendix D** ~ Geological Map
- **Appendix E** ~ Biodiversity Map
- **Appendix F** ~ Title Deed Report
- **Appendix G** ~ Concept Drawing

**2. BACKGROUND**

This report is essentially a desktop study based on aerial photo's, contour maps, geological maps, regional hydrological data etc, with the purpose of highlighting strategic information regarding aspects such as alternatives, water availability, proposed positioning, applicable legislation, overall geology, potential storage as well as ballpark costing. The main purpose of this report is to serve as a discussion document and also for directive decision making before proceeding to the next stage as set out below.

A typical project of this nature comprise of 6 chronological stages with this report considered as the first stage of the following:

- S1 Scoping & Feasibility study
- S2 Preliminary Design
- S3 Final Design
- S4 Documentation and Tendering
- S5 Construction
- S6 Completion

The above stages also serve as milestones for purposes of invoicing or as otherwise agreed.

The site is located approximately 10km north-west from Gouda as the crow flies as shown on **Appendix A**.

### 3. ASSIGNMENT

The current assignment of the envisioned new dam entails the compilation of a condensed scoping and feasibility report.

To our knowledge no appointments have been made with regard to the submission of an application for a water use license neither for an environmental impact assessment in terms of applicable legislation. As soon as a decision is reached regarding the way forward, we suggest that these appointments be considered and activated as soon as possible given the fact that both can be time consuming exercises.

Our assignment, as understood from the discussion for the purposes of this report, comprises only the scoping or feasibility study regarded as the first stage of the overall design process. However, we have not received an instruction to proceed with any of the other related aspects such as water licensing and/or environmental assessment procedures etc.

### 4. SITE EVALUATION AND ALTERNATIVES

The focus and purpose of the investigation sprouts from the overall development planning of the concerned farming enterprise by way of storing listed winter water for use during the summer season. However, available options are limited on the concerned property due to limited suitable sites due to the relative flat topography of the property. Nevertheless, this initial investigation shows that the site appears to be able to accommodate only a portion of the envisaged or intended capacity which is in the order of ±150 000m<sup>3</sup> based on the allowable proportionate storage of listed winter water from the Berg river system as discussed below.

The potential storage characteristics of the site was obtained from a site survey done on 18 April 2018. The options on Farm 88 Portion 8 are limited to this one site which was evaluated with regard to potential storage capacity versus dam wall height and ball park costing.

**Appendix G** shows the location of the proposed new dam site.

Various options have been analysed for purposes of evaluation and comparison for optimising and planning, refer to **Appendix C & G** for detail.

**Table 1** below shows the comparison of key characteristics for the proposed new dam.

<b>Proposed New Dam</b>	<b>Stage 1</b>	<b>Stage 2</b>	<b>Stage 3</b>	<b>Stage 4</b>
Wall height (m)	4.9	5.3	5.7	6.0
Crest length (m)	143	160	168	174
Earthfill / Earthmoving (m <sup>3</sup> )	9,200	10,800	12,200	13,400
Gross Storage Capacity (m <sup>3</sup> )	<b>55,000</b>	<b>65,000</b>	<b>76,000</b>	<b>87,000</b>
Storage ratio (X : 1)	5.44	5.57	5.74	5.99
Flooded Area (ha)	2.40	2.6	2.9	3.2

The site evaluation also shows that there is not much variation in scale of economy based on the storage ratio's which normally increases substantially for larger scenarios. Dams with storage ratio values less than ±1,5 are generally considered extremely poor. Although considerably better, the proposed new dam has values slightly greater than the target storage ratio value of ±5 which is generally considered as economically viable.

In terms of dam safety legislation certain thresholds do apply based on the size and risk of the dam under consideration which in turn determines its classification. All dams with wall heights exceeding 5m AND storage capacities exceeding 50 000m<sup>3</sup> are to be registered and classified with the dam safety office (DSO). Category 1, 2 & 3 dams require different levels of technical expertise including accredited engineering input as and where specified. Based on these thresholds and requirements, all proposed options are considered above the applicable trigger levels subject to dam safety regulations except for the smallest option.

**Please note**, water use licenses (*WUL*) and environmental authorisations (*EA*) are not covered here but are governed by separate and independent legislation as discussed elsewhere.

## 5. WATER AVAILABILITY

All water usages are governed by the National Water Act (Act 36 of 1998) (*NWA*). The process of determining the availability of water for any kind of development involving the use of water also requires looking into and verifying the current water usage of the particular farming unit or development in order to understand the integration of such proposed new water usage to the existing for purposes of the Water Use License Application (*WULA*) to be considered.

Our understanding of the proposed development is that it does not include any new “takings” from the existing nearby source in terms of the *NWA*. In principle the aim is to secure an existing water use, which is current winter listings under the *Benede-Bergrivier Irrigation Board*, by increasing the capacity of the existing small dam on the property. **Note**, the application will mainly focus on reducing the risk of failure to be able to irrigate under dry or difficult conditions.

### Listed water with *Benede-Bergrivier Besproeiingsraad* ~ (*Appendix B1*)

Hartebeeskraal 88/8:	28.4 ha @ 7 000m <sup>3</sup>	= 198 800m <sup>3</sup>
<b>TOTAL:</b>		<b><u>= 198 800m<sup>3</sup></u></b>

In essence all existing water uses are tagged “*lawfulness to be determined*” until verified and validated in terms of the *NWA*. The Verification and Validation (V&V) process has recently been launched in certain catchment areas nationwide. The purpose of the said process is to evaluate and legalise historical and current water usages within a particular catchment based on aerial photographs as well as applicable and relevant documentation. In this case where the V&V process has been initiated, such action normally forms part of the water use license application (*WULA*) with Department of Water Affairs & Sanitation (*DWAS*). In principle the *WULA* will first have to prove that the current water usages are in order in terms of the water act awaiting the outcome of the V&V.

**Note**, since this application does not include any new “takings” and is solely based on scheduled water which is considered an existing lawful use (*ELU*) for purposes of this report, a water availability investigation is not considered relevant neither a requirement and no other *ELU*'s will be affected as such.

However, although not considered part of the lawful water use exercise above, we have done and also included the hydrological potential of the local catchment of the proposed dam showing a potential runoff (MAR) in the order of ±80 000m<sup>3</sup> based on the WRC model as presented in **Appendix B2**. This is however not a guaranteed volume but gives an idea of what could possibly be expected from runoff in average years as a potential saving against pumping from the river.

## 6. GEOLOGY

The proposed site is situated within the formations forming part of the Porterville Formation and the Malmesbury Series as shown by **Appendix D**.

The 1:250 000 Geological Map (3318Kaapstad) of South Africa describes the local and surrounding formations as follows:

- Npo** ~ *Phyllite shale, schist and greywacke with dark-grey limestone, sporadic quartzitic sandstone beds and conglomerate lenses*
- m** ~ *Alluvium*
- Qs** ~ *Lightgrey to pale-red sandy soil*

The geological overview further points out and positions the site right on the border between alluvium and shale/sandstone formations. When it comes to alluvial type formations, there will be a high risk of leakage depending on the cementing material within the matrix. Sealing these type of formations are often complex and expensive and should be considered with care for a dam of this size.

In addition to the variation in formations there are only a few geological features some distance away from the proposed site indicated on the map which only requires mentioning at this stage. At this stage we don't foresee any risk or interdependency between these features and the water tightness of the site. Depending on the exact position and alignment, these fault zones or features might also impact on the seismic requirements in the design.

No soil tests have been done as yet and this is just an overview of the global geology at the sites and it may be that the local geology or soil conditions are such that it might even have cost implications on both the final design as well as construction thereof.

## 7. STATUTORY REQUIREMENTS

The process regarding the construction of a dam typically involves three independent regulatory or legislative procedures namely, [A] Dam Design & Construction, [B] Environmental Impact Assessment (*EIA*), and [C] Water Use License (*WUL*). The latter also includes clarification of all existing lawful water uses with the Department Water & Sanitation.

Our office specializes and offer our services with regard to dam safety procedures in terms of dam safety legislation including design and construction supervision and as well as the compilation and submission of water use license applications. However, when it comes to environmental impact assessments, we can assist in obtaining quotes for the task as well as to assist with the appointment of independent consultants. Other legal aspects that might also have to be addressed in the process include issues such as BBBEE, roads- and other services authorities as and when applicable.

The main objective when building a dam or structure of this nature is to obtain a ***License to Construct*** from the Department Water & Sanitation (*DWS*). In order for such a license to be issued, proof is required that both the *Water Use License & Clarification* as well as the *Environmental Authorisation* are in place. Both of these actions are time consuming and overall planning should allow for anything between 1 and 2 years before a license to construct might be obtained. In order to achieve and satisfy these goals, the design process of the dam should proceed to the second stage of *Preliminary Design* mentioned above, which will then serve as backbone or addendum to both these applications. The purpose of the proposed works, including the intended use of the water, will also have to be clarified and motivated in these applications.

A factor that would trigger additional environmental aspects in this case is if any component of the dam comes within 32m from the riverbank.

## 8. SPECIALIST SERVICES

Depending on the final layout, intended size, water use requirements, etc, certain aspects might have to be investigated should the proposed dam trigger certain natural processes and/or cultural and historical aspects. Such services may include, biodiversity / botanical assessments, freshwater studies and/or archaeological / heritage studies unique to each project. Clarity on these issues will be acquired during the next stage of *Preliminary Design*.

## 9. COST ESTIMATE

A basic site survey was done and all quantity and volume related figures presented herein are based on information obtained and generated from this survey in combination with information from available sources such as contour maps, GIS information systems, etc which is considered to be accurate enough and acceptable for this purpose. In this case the surveyed information was superimposed over aerial photographs from which detailed contours were generated for the purpose of use in 3D topographical modelling.

All the volumetric and related estimates are based on the same principles giving opportunity to compare dam options on the same basis for decision making with reference to the magnitude of the proposed works rather than trying to present highly accurate figures at this early stage. Bulk earthworks tariffs derived from recent tender prices and information from similar projects was used for costing purposes including a percentage allowance for specials, overheads, fees, etc. See **Appendix C** for detail.

**Table 2** below shows the estimated bulk earthworks and related costing:

<u>Proposed New Dam</u>	<u>Stage 1</u>	<u>Stage 2</u>	<u>Stage 3</u>	<u>Stage 4</u>
Wall height (m)	4.90	5.30	5.70	6.00
Potential gross capacity (m <sup>3</sup> )	55,000	65,000	76,000	87,000
Earthmoving	9,200	10,800	12,200	13,400
Estimated Project Costs	R 620,000	R 727,000	R 823,000	R 901,000

Another aspect to keep in mind is the fact that foundation excavations of the core trench or sealing the dam can often be a costly item along with hidden surprises that can surface at the time of construction. For this reason proper foundation and geological exploration exercise will be required as part of the design process in order to eliminate such unwelcome and often costly surprises.

The site in general is relatively flat, however, it still results in fair storage ratio's being the prominent reason for the reasonable overall unit costs. Although not to a large degree, it is noted that the storage ratio does increase along with increase in the size of the dam.

However, the above are considered estimates based on certain assumptions at this stage which can differ substantially from the final costings which are to be based on more accurate site surveys which will also take into account the outcome of the site exploration works.

## 10. WAY FORWARD

This document serves as a discussion document for decision making regarding the way forward. In order to proceed we propose for the following to be addressed:

- Evaluate and choose between the proposed options with regard to the following:
  - ~ Optimum with regard to storage & benefits
  - ~ Dam safety and related issues
  - ~ Cost & risks factors regarding geological conditions
- Proceed with the preliminary design stage of the preferred option above, including
  - ~ Classification in terms of dam safety regulations
  - ~ Applicable dam safety regulations in terms of the National Water Act, 1998
  - ~ Appoint accredited engineer for the task, as required
- Activate the environmental impact assessment application accordingly, including
  - ~ Appointment of Environmental Consultants
  - ~ Apply for Environmental Authorisation in terms of NEMA procedures
  - ~ Specialist reports if required such as Aquatic, Historic & Cultural, etc.
- Activate the water use license application, including
  - ~ Appointment of Consultant
  - ~ Classify existing lawful water uses in terms of water use registrations with WARMS
  - ~ Section 27 motivation in terms of Article 27(1) of the National Water Act, 1998
  - ~ Consider Broad-Based Black Economic Empowerment, BBEEE
- Obtain and keep in hand all information required:
  - ~ Legal Ownership of Properties (Title Deeds) etc
  - ~ Business Registrations
  - ~ Applicable business agreements and/or arrangements etc

## 11. CONCLUSION & RECOMMENDATIONS

From the site survey it is concluded that the proposed new dam site can only accommodate ±55% of the envisaged storage capacity of ±150 000m<sup>3</sup> of the scheduled winter water.

However, when considering the smaller options limited by the buildings on the northern side, the storage ratio is considered reasonable from an economical point of view. We hereby conclude and recommend as follows:

- Consider appropriate sizing of the dam with respect to dam safety thresholds of 5m wall height or 50 000m<sup>3</sup> capacity, apply for classification if one of these thresholds is acceded,
- Appoint consultant for the EIA and align environmental application accordingly,
- Appoint consultant for the WULA and activate accordingly,
- Consider to proceed with the preliminary design stage for purposes of the EA & WULA requirements.

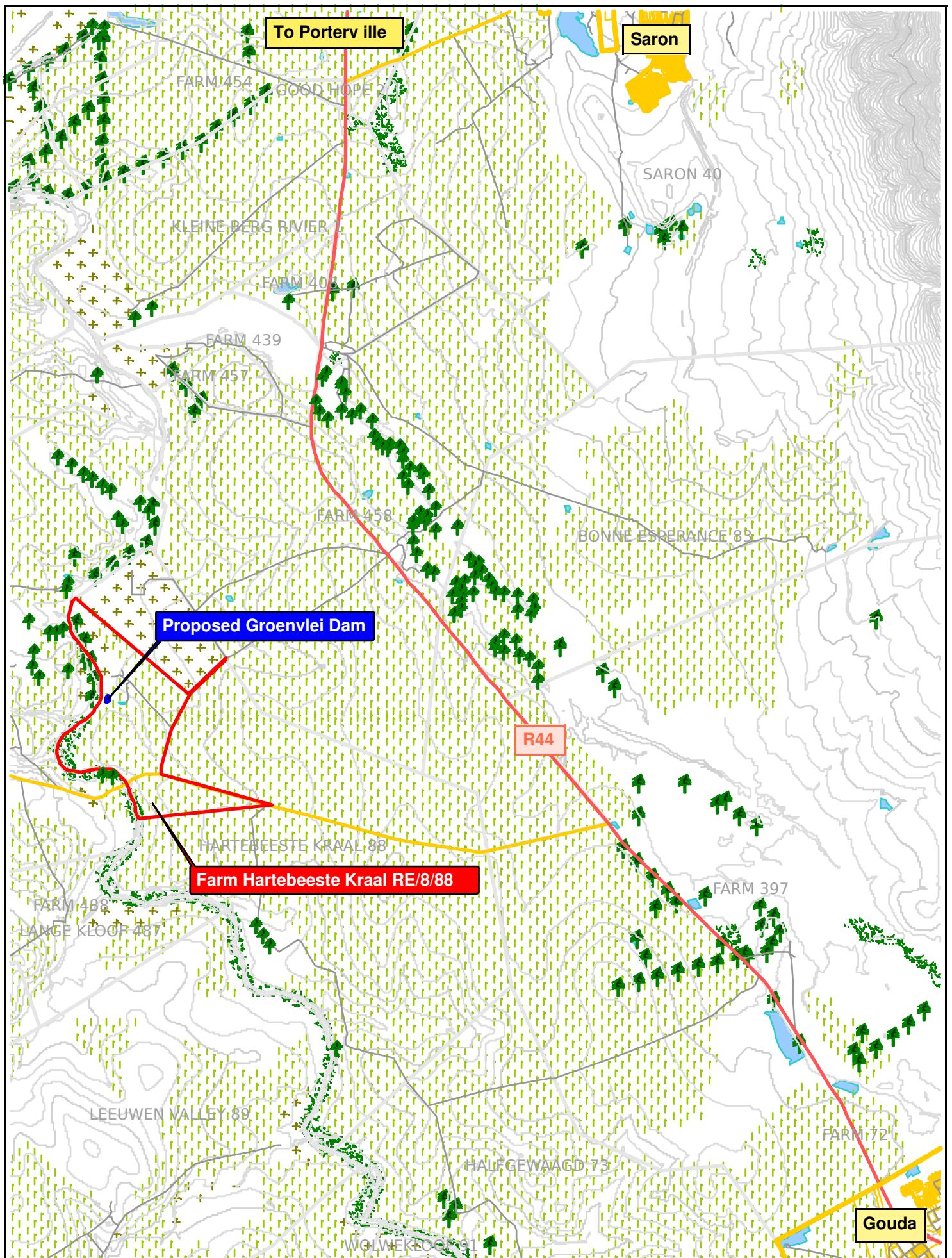
You are welcome to contact us for further information should there be any queries. We trust that you will find above in order and that we can expect a response in due time.

Yours faithfully



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M Charl Bester (Pr Ing)



**Client:** Grassroots Group (Pty) Ltd  
PO Box 16  
GOUDA  
6821

**Project:** Proposed Groenvlei Dam  
LOCALITY MAP

**Project Ref:**  
1815

**Map Ref:** 3318BB

**Scale:**  
1: 50 000

# BENEDE-BERGRIVIER BESPROEIINGSRAAD

SEL 072 900 3931  
FAKS 086 543 7021  
E-POS bbb@vodamail.co.za

POSBUS 214  
PORTERVILLE  
6810

01 Februarie 2017

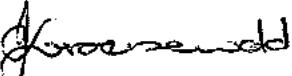
## WIE DIT MAG AANGAAN

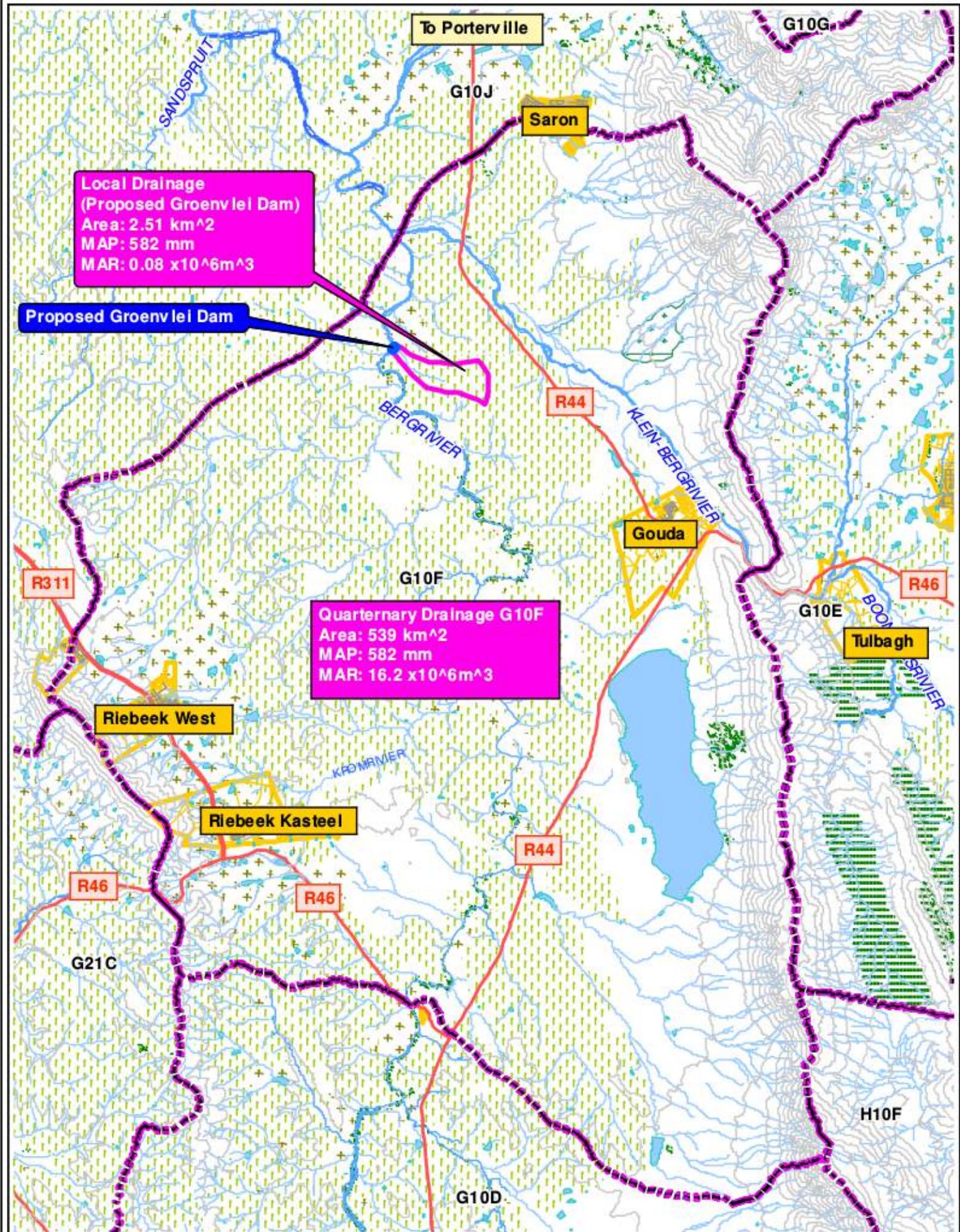
Hiermee bevestig die Benede-Bergrivier Besproeiingsraad dat die ondergemelde eiendomme se inlysting op die oomblik as volg is:

			Distrik	
GRONDBESKRYWING	NAAM	Data	Tulb	Grand Total
HARTEBEEKRAL 88 GED 8	Gravenholm Prop BK	Sum of Somer	31.6	31.6
		Sum of Winter	28.4	28.4
HARTEBEEKRAL 88 GED 8 Sum of Somer			31.6	31.6
HARTEBEEKRAL 88 GED 8 Sum of Winter			28.4	28.4
Total Sum of Somer			31.6	31.6
Total Sum of Winter			28.4	28.4

Die bogemelde eiendomme is geregtig om 7 000 kubieke meter water per hektaar per jaar uit die Bergrivier te gebruik vir landboubesproeiingsdoeleindes.

Die uwe

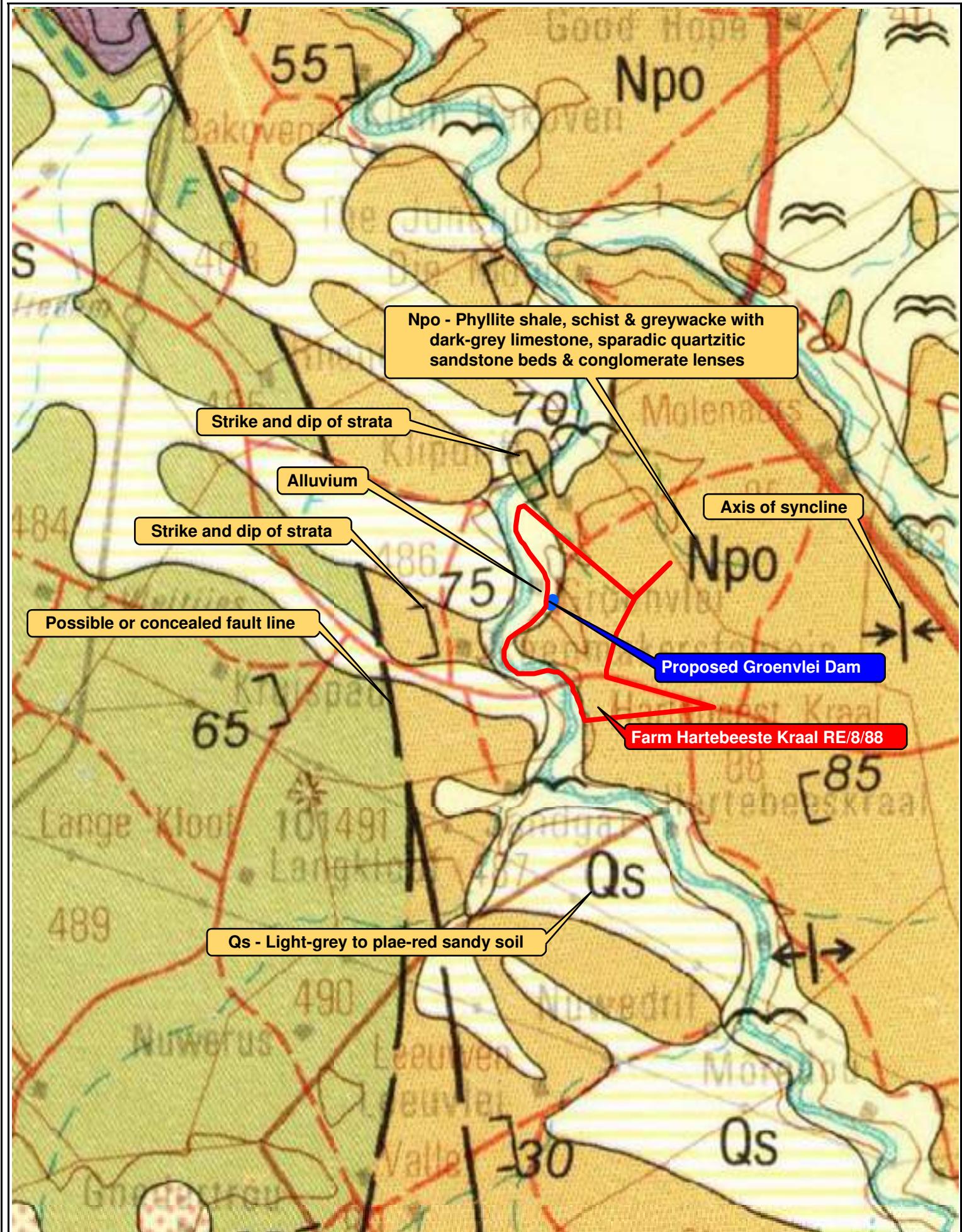
  
Corinne Groenewald  
ADMIN BEAMPTE



 <p><b>SAREL BESTER INGENIEURS BK</b>          Engineering Services Consulting Engineers          Architectural &amp; Structural Engineers          Geotechnical &amp; Environmental Engineers          Project Managers &amp; Project Managers          MC BESTER          Pr. Ing., LSAISI: 970598, LSACAP: T1218          Tel 023 312 2017 / Epos.sbr@telkomsa.net</p>	<p><b>Client:</b> Grassroots Group (Pty) Ltd          PO Box 16          Gouda          6821</p>	<p><b>Project:</b> Proposed Groenvlei Dam          HYDROLOGY MAP</p>	<p><b>Project Ref:</b>          1815</p>
		<p><b>Map Ref:</b> 3318BB</p>	<p><b>Scale:</b>          1: 150 000</p>

## **SCOPING EVALUATION REGARDING THE PROPOSED EARTH DAM: QUANTITIES AND COSTING**

Wall Design:	Design Assumptions:		Financial Assumptions:			
Crest width (m):	4.0	Cut-off depth (m):	4.00	Earthmoving cost (R/m³):	45.00	
Upstream slope 1:	3.0	Gross Usage (m³/ha):	8,500	Cost Fact [O/H, Outlet, Fees,...]:	1.50	
Downstream Slope 1:	2.0	Re-use Exist Fill (%):	0%			
Freeboard (m):	1.0	Re-use Exist Core (%):	0%			
Percentage of fill from dam basin:	50%					
<b>Description</b>	<b>Unit</b>	<b>Stadium / Wall position / Terrain</b>				
<b>EMBANKMENT</b>		Stadium 1	Stadium 2	Stadium 3	Stadium 4	Stadium 5
Length	m	50,000	60,000	70,000	80,000	0.00
Crest length	m	142.50	159.80	168.00	174.00	0.00
Tail Height	m	4.90	5.30	5.70	6.00	0.00
Base Width	m	28.50	30.50	32.50	34.00	0.00
Volume - excluding cut-off	m³	5,199	6,291	7,490	8,477	0.00
Cut-off trench excavation	m³	3,990	4,474	4,704	4,872	0.00
Total Earthmoving	m³	9,189	10,765	12,194	13,349	0.00
<b>STORAGE CAPACITY</b>						
Freeboard	m	1.00	1.00	1.00	1.00	1.00
Water depth	m	3.90	4.30	4.70	5.00	0.00
Water surface	ha	2.40	2.60	2.90	3.20	
Contour capacity	m³	50,000	60,000	70,000	80,000	
Potential gross capacity	m³	54,595	65,383	76,097	86,675	0.00
Potential irrigation	ha	6.42	7.69	8.95	10.20	0.00
Ratio (Storage : Earthworks)		5.44	5.57	5.74	5.99	0.00
<b>COSTING</b>						
Estimated Construction Cost	Rand	620,271	726,657	823,095	901,088	0.00
Estimation: Specialized Components	Rand	0	0	0		
<b>Estimated Project Cost</b>	<b>Rand</b>	<b>620,271</b>	<b>726,657</b>	<b>823,095</b>	<b>901,088</b>	<b>0.00</b>



**Client:** Grassroots Group (Pty) Ltd  
PO Box 16  
Gouda  
6821

**Project:** Proposed Groenvlei Dam  
**GEOLOGY MAP**

**Project Ref:**  
1815

**Map Ref:** 3318 – Cape Town

**Scale:** 1 : 50 000



Critical Biodiversity Areas &  
Ecological Support Areas  
**BIODIVERSITY MAP:**

**Legend**

**BSP ESA**

- ESA: Aquatic
- ESA: Terrestrial

**BSP CBA**

- CBA: Terrestrial
- CBA: Terrestrial (CT)
- CBA: Forest
- CBA: River
- CBA: Estuary
- CBA: Wetland
- CBA: Aquatic (CT)

Scale: 1:5 000

Date created: May 16, 2018



Western Cape  
Government

Agriculture

Estr. HERE, Garmin, © OpenStreetMap contributors, and the GIS user  
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS,  
communities

## WinDeed Database Deeds Office Property


  
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HARTEBEESTE KRAAL, 88, 8 (REMAINING EXTENT) (CAPE TOWN)

GENERAL INFORMATION	
Date Requested	2018/04/19 16:16
Deeds Office	CAPE TOWN
Information Source	WINDEED DATABASE
Reference	1815



PROPERTY INFORMATION	
Property Type	FARM
Farm Name	HARTEBEESTE KRAAL
Farm Number	88
Portion Number	8 (REMAINING EXTENT)
Local Authority	WITZENBERG DC
Registration Division	TULBAGH RD
Province	WESTERN CAPE
Diagram Deed	T69379/2007
Extent	165.7552H
Previous Description	-
LPI Code	C0750000000008800008

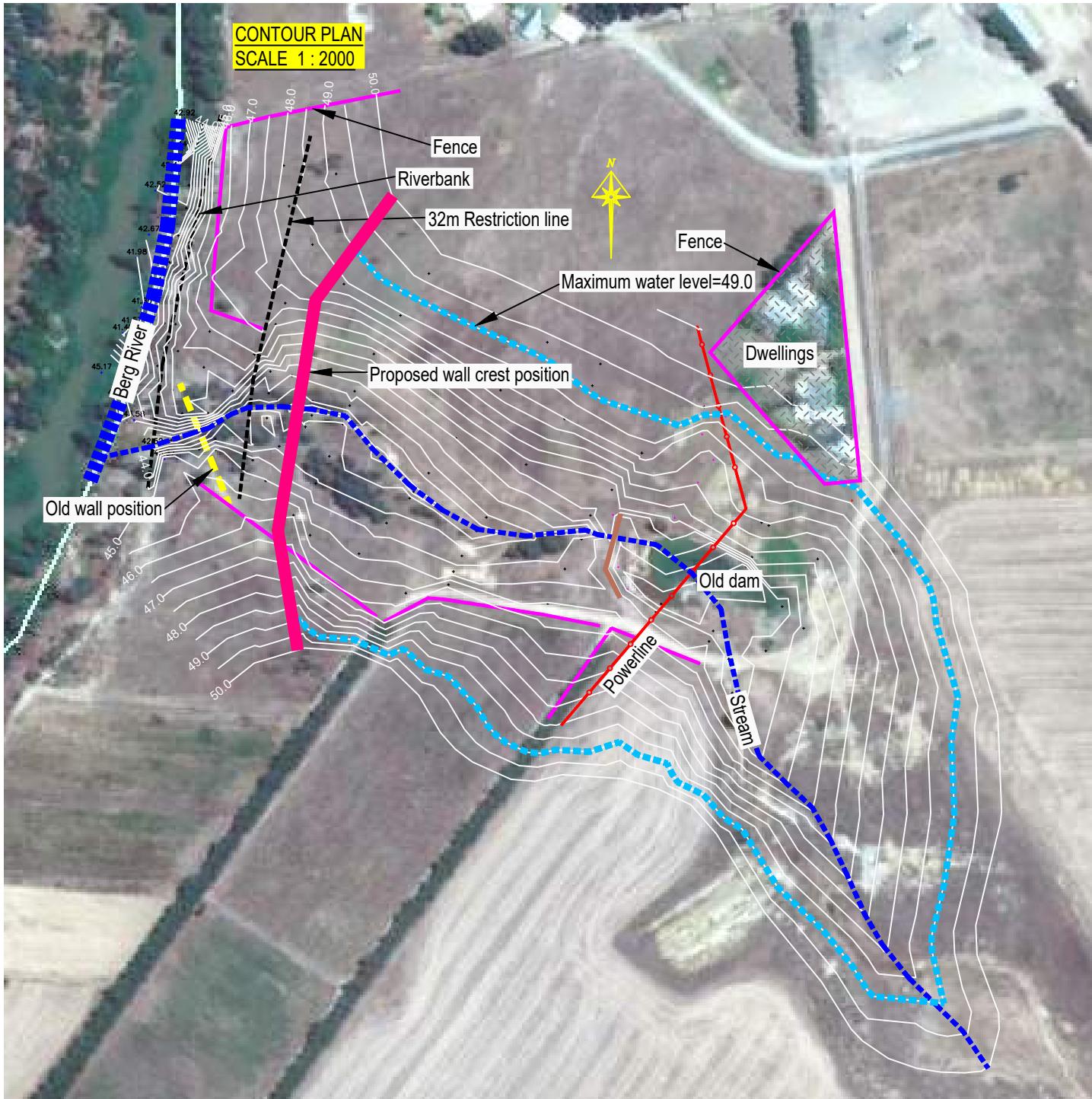
OWNER INFORMATION	
<b>Owner 1 of 1</b>	
Type	COMPANY
Name	GRAVENHOLM PROP PTY LTD
ID / Reg. Number	200102151407
Title Deed	T69379/2007
Registration Date	2007/08/30
Purchase Price (R)	CCT
Purchase Date	-
Share	0.00
Microfilm	2008 0529 3441
Multiple Properties	NO
Multiple Owners	NO

ENDORSEMENTS (7)				
#	Document	Institution	Amount (R)	Microfilm
1	B2259/2001	FIRSTRAND BANK LTD	600,000	2004 0656 5042
2	B49447/1998	FIRST NAT BANK OF SOUTHERN AFRICA LTD	1,000,000	2004 0656 5031
3	B50289/2004	FIRSTRAND BANK LTD	1,000,000	2004 0656 5057
4	B35082/2008	FIRSTRAND BANK LTD	2,000,000	2008 0529 3374
5	CONSOLIDATE FROM	TULBAGH RD , 88 ,	UNKNOWN	0000000*
6	B35899/2013	FIRSTRAND BANK LTD	2,000,000	-
7	B7766/2015	FIRSTRAND BANK LTD	4,500,000	-

HISTORIC DOCUMENTS (1)				
#	Document	Owner	Amount (R)	Microfilm
1	B82182/2007	-	455,000	2008 0777 5630

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<b>SAREL BESTER ENGINEERS</b>			
Consulting Civil Engineers Architectural Service			
Date: 25/5/2018			
MC BESTER			
Pr. Eng., B.Eng., MSAICE#970598, MSACAP-T1218			
P.O. Box 21, Lyell Street 62, CERES, 6835			
Ph: 023-312 2017 * Fax: 023-312 3802			
e-mail: admin@sbei.co.za			
CLIENT: Grassroots Group P.O. Box 16 GOUDA <u>6821</u>			
PROJECT:  PROPOSED DAM ON THE FARM GROENVLEI, GOUDA			
DETAIL:  Contour Plan (Aerial Photo)			
DRAWN	DATE	SCALE	SHEET
SC Hartzenberg	MAY 2018	as shown	1 of 1
SURVEYED	DESIGNED	DWG. NR.	REV.
SC Hartzenberg	N/A	1815-S1-01	
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