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Verw: 2114DDR-S1

Datum: 04/06/2021

Messrs Cederberg Farming
P.O. Box 50
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Attention: Mr Jaco Tredoux

SCOPING REPORT REGARDING THE PROPOSED NEW WAVE DAM ON MELKBOOM 384 PORTION 101 & 168, VAN RHYNSDORP DISTRICT, CEDERBERG FARMING

Our assignment as well as subsequent discussions regarding the feasibility of a new dam with reference to the proposed dam site on the *Melkboom 384 portions 101 & 168* property, refers.

1) ATTACHMENTS

- ***Appendix A*** ~ Locality Map
- ***Appendix B*** ~ Site Plans
- ***Appendix C*** ~ Scoping Evaluation
- ***Appendix D*** ~ WUA Certificate of Scheduled water
- ***Appendix E*** ~ Hydrological Map
- ***Appendix F*** ~ Geological Map
- ***Appendix G*** ~ Bio Maps
- ***Appendix H*** ~ Drawings
- ***Appendix I*** ~ Documentation

2) BACKGROUND

Dam projects are normally very diverse in nature, each with its own unique features and challenges. For this reason, we start off with a scoping or feasibility report which is aimed at investigating any aspects which might have an impact on the project before initiating the design thereof.

This report is essentially a desktop study based on aerial photo's, contour maps, geological maps, regional hydrological data, etc, aiming to highlight strategic information regarding aspects such as possible alternatives, water availability, proposed positioning, applicable legislation, overall geology, potential storage and preliminary costing.

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

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

The site being evaluated is situated within the Van Rhynsdorp area along the lower part of the Olifants River, about 10km south of Klawer as the crow flies and as shown on ***Appendix A***.

This report then serves as a discussion document and also for directive decision-making in order to proceed to the next stage.

3) ASSIGNMENT

We do consider for it to be in the best interest of the intended project that different alternatives, including ballpark costing and geological issues, be investigated and confirmed in advance before any design work and/or licence applications are initiated. It is with this in mind that we have proposed to start with a *Scoping Report* based on a desk-top study. The report mainly focusses on legal requirements, water availability as well as site conditions with regard to the optimised positioning from a topographical, geotechnical and cost perspective.

The current assignment entails the feasibility study for the proposed *New Wave dam* with its accompanying components on farm Melkboom 384 portions 101 & 168. The concept entails the storing of water under an existing lawful water use (ELU) from the Olifants River, namely a listing under the *'Laer Olifantsrivier' Water User Association* (LOWUA). The proposed New Wave dam would serve a dual purpose, firstly as a storage dam for potting up existing winter water and secondly as a buffer dam during the summer irrigation season.

Initially a suitable site was identified in cooperation with *Messrs Boland Opmeting* whom have presented a few proposals along with accompanying figures, included as ***Appendix I***. Subsequently we have been asked and appointed to come on board with a potential package deal including the technical design, the WULA and the EIA requirements. This report then expands on the previous work with three alternative layouts or options with reasons discussed elsewhere for capacities ranging between 70 000m³ and 180 000 m³, at the sites shown in ***Appendix B***.

Note, the current understanding is that the dam would be connected to and filled via existing water works, hence no need for new abstraction works and pipelines from the Olifants River.

To our knowledge, neither of the environmental impact assessment (EIA) nor the submission of a water use licence application (WULA) have been activated for the proposed dam, awaiting basic information regarding the outcome of this scoping study. Given the fact that both of these can be time-consuming exercises, it would be best to run them simultaneously once a suitable and feasible option has been decided upon.

Apart from our appointment to assist in the compilation of information required mainly for the purposes of the environmental scoping report, we have not received any additional instruction as yet to proceed with the next stage which would be the preliminary design of the dam. Once the environmental impact study as well as the water use licence application have reached a stage of no-return, the final design of the dam will be considered.

4) SITE INVESTIGATION AND ALTERNATIVES

Although the preferred site was determined by a previous investigation, it is often required to include and motivate for or against possible alternatives. In this case three different or additional layouts have been investigated and assessed on the same site by looking at various aspects.

Cederberg Farming owns nine neighbouring properties in the Van Rhynsdorp district, namely Melkboom 384 portions 72, 101, 126, 127, 128, 129, 130,168 & 205 and since the properties are adjacent they are farmed as one unit. The topography of the properties are relatively flat located on the western banks of the Olifants River, refer ***Appendix B2***. Only the four properties bordering the river do have water listings under *Laer Olifantsrivier WUA,* refer ***Appendix D.***

For purposes of this report, each of the options have been assessed for different wall heights from a costing perspective in order to find the optimum solution as presented in ***Appendix C***. Storage capacities varying between 70 000 m³ - 180 000 m³ corresponds with wall heights ranging between 7-10m, with none of the options exceeding the 12m threshold which will probably put most, if not all, of the options in the category 1 bracket due to the low expected hazard rating.

When it comes to the environmental impact assessment, certain triggers do apply and the first prise will be to avoid all of them for purposes of a simplified application. However, in this case all the options do trigger the minimum footprint area as well as the minimum wall height. Based on discussions we had with environmental experts, extending the footprints into the 32m restriction zone will not make a difference nor complicate the application as such, hence being the reason for moving the footprints back and closer to the river bank and by doing so, optimising the land use.

Tables 1-3 below show the comparison of key characteristics of the investigated layouts.

NE W WAVE DAM	OPTION 1 (outside 32m restriction zone) (Kraaldam large volume)		
	Stage 1	*Stage 2*	*Stage 3*
Potential Irrigation @ 7000m³/ha	10.1	23.3	26.0
Crest Length (m)	320	635	640
Wall Height (m)	7.0	9.5	10.0
Earthmoving (m³)	24,400	57,000	66,000
Gross Storage Volume (m³)	**71,000**	**163,000**	**182,000**
Surface Area (ha)	2.50	3.40	3.70
Ratio (Storage : Earthworks)	2.91	2.85	2.76
Proposed Category	1	1	1

NEW WAVE DAM	OPTION 2 (Within 32m restriction zone) (Smallest footprint)		
	Stage 1	*Stage 2*	*Stage 3*
Potential Irrigation @ 7000m³/ha	13.6	15.2	17.1
Crest Length (m)	415	435	440
Wall Height (m)	7.5	7.8	8.0
Earthmoving (m³)	27,500	30,400	33,100
Gross Storage Volume (m³)	**73,000**	**82,000**	**92,000**
Surface Area (ha)	2.00	2.10	2.30
Ratio (Storage : Earthworks)	2.65	2.70	2.78
Proposed Category	1	1	1

NEW WAVE DAM	OPTION 3 (Within 32m restriction zone) (Longer crest)		
	Stage 1	*Stage 2*	*Stage 3*
Potential Irrigation @ 7000m³/ha	13.0	15.1	17.3
Crest Length (m)	360	370	375
Wall Height (m)	7.2	7.6	8.0
Earthmoving (m³)	29,500	33,300	37,700
Gross Storage Volume (m³)	**70,200**	**81,200**	**93,000**
Surface Area (ha)	2.40	2.45	2.60
Ratio (Storage : Earthworks)	2.38	2.44	2.47
Proposed Category	1	1	1

The site evaluation shows that there is rather little variation in the scale of economy based on the storage ratio's with limited variation between the different options with the typical increase from smaller to larger capacities up to an optimum point above which the ratio then decreases again as with Option 1 when it changes into a rather deep "kraaldam" scenario. However, storage ratio's less than 3 is often considered uneconomical under most circumstances especially when the dam under consideration will be contributing a relatively large portion of the overall storage which for obvious reasons requires careful consideration. Although very limited, the smaller dam size under Option 1 does have the highest storage ratio in the order of ±2.9 which would typically be considered the better and more economically viable option.

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 000m³ are to be registered and classified with the dam safety office (DSO) in terms of the dam safety legislation. 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 options considered will have to be registered and are expected to be within the category 1 range.

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

5) WATER AVAILABILITY

All forms of water usages are governed by the National Water Act (Act 36 of 1998) *(NWA)*. Aspects to be covered in such application is listed in clause 27(1)(a)-(k) of the NWA. The process of determining the availability of water for any kind of development, amongst other also requires looking into and verifying the current water uses of the particular farming unit or development in order to understand the integration of the proposed new water use in addition to the existing use for purposes of the Water Use Licence Application *(WULA)* to be considered.

Increasing the combined storage capacity to more than the total existing water use volumes, will be regarded as "new takings and storings" in terms of the NWA which will require a full licence application. Nevertheless, the aim is firstly to verify the existing lawful water uses (ELU's), which will include both groundwater (borehole & spring) and surface winter water. At present we have record of the listed water uses of four of the properties of Melkboom 384 portions 72, 101, 168 & 205 under the 'Laer Olifantsrivier' *Water User Association* equivalent to **42.0ha, 8.6ha, 9.5ha & 18.1ha** respectively and amounting to a total of **78.2ha @ 12 200m³/ha/a** totalling **954 040m³ r**efer ***Appendix D.*** According to our current understanding of the arrangements within the catchment area, only 50% of the allocated surface water can be abstracted and stored in dams during the winter season totalling **±477 020m³**.

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 had been launched in 2017 in the concerned catchment area forming part of a project conducted 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 and supposedly finalised, the outcome normally forms part of the water use licence application (WULA) with Department of Water Affairs & Sanitation *(DWS)*. 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.

Although the feasibility of any dam largely depends on the water availability, in this particular case the proposed dam is mainly intended for buffering purposes of existing water uses (ELU's) rather than the bulk storage thereof which currently is being pumped directly from the Olifants River during the irrigation season. Hence, there is no need to determine the availability of 'new' water for licensing purposes.

However, a downscaled hydrology study has been conducted for information purposes based on aerial photo contour maps in order to evaluate the sub-catchment with regard to its potential pro-rata contribution within the larger quaternary drainage area. Runoff calculations for the purposes of this report are based on figures obtained from the ***Water Resources of South Africa, WR2012,*** *by the Water Research Commission (WRC)* in conjunction with the *Elsenburg Delineation Tool* which has been customised for the Western Cape.

Table 4 below shows the local catchment information in relation to the quaternary drainage area:

	QUATERNARY E33G	SUB-CATCHMENT – ELSENBURG PROPOSED NEW DAM	
Area	894	0.54	km^2
MAP	186	195	mm
MAR	1	1.2	mm
Virgin Runoff	1%	1%	
MAR(Virgin)	0.93	0.0006	x10^{6}m^3

The table above summarises the hydrological potential of the small local catchment of the proposed dam site showing an insignificant runoff (MAR) based on the WRC model with detail presented in ***Appendix E***.

6) GEOLOGY

According to the Geological Survey of South Africa, the proposed dam site is situated on alluvium formation of the Tertiary System, surrounded by quartzitic sandstone and shale formations of the Table Mountain Series, part of the larger Cape System. Refer to ***Appendix F*** for more information as summarised below.

Q-r2	~ Calcareous and gypsiferous soil
Çs	~ Red aeolion sand
Nat	~ Graphitic and serictic schist; phyllite, greywacke, quarzite, impure dolimite, limestone and marble
Og	~ Thin-bedded red to purple sandstone, siltstone and shale, minor thick-bedded quarzose sandstone and matrix-supported conglomerate, vein-quartz gritstone
Op	**~** Light-grey, thick-bedded, quartzose sandstone, minor conglomerate and sandstone
m	~ Alluvium

The basin of the dam would mainly be on sandy alluvial formation within the flood plain of the river with the dam wall very close to the contact between this and the calcareous and gypsiferous soil. The formations and site conditions are not ideal from a sealing perspective and the overall permeability of the basin could be jeopardized when it comes to sealing with the typical core method, hence the reason behind a full scale HDPE liner, similar to the other dams on the farm. On the other hand, from a structural perspective, the underlying formation and material available on site for forming the embankment, is considered adequate and sufficient both in volume and strength and suitable for a dam of this nature and magnitude.

In addition to the variation in formations there are a few geological features including strikes & dips of strata further away from the proposed site as well as a fault line some distance away indicated on the map which only requires mentioning for now. At this stage we don't foresee any particular risk or interdependency between these features with regard to the dam site. Depending on the exact position and alignment, these fault zones or features might also impact on the seismic requirements in the design to be dealt with in the final design.

No soil tests have been done as yet and this is just an overview of the global geology and it may be that the local geology and site conditions are such that it might have cost implications on both the final design as well as the construction procedures. However, dams in the vicinity is constructed of similar material and their behaviour over time is considered consistent and stable giving confidence in the proposed works.

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 Licence *(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 licence 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 aspects such as biodiversity, BBBEE, roads- and other services, servitudes, etc, as and where applicable.

The main objective when building a registered dam or structure of this nature is to obtain a ***Licence to Construct*** from the Department Water & Sanitation *(DWS)*. In order for such a licence to be issued, proof is required that both the Water Use Licence & 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 licence 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 provide the basic technical design information required by 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.

When it comes to the environmental side of things, the footprint of some of the proposed layouts do extend into the 32m restriction zone alongside the river bank. When it comes to the biological sensitivity, the proposed footprints of the dam are however close to but do not encroach into the biologically sensitive areas as indicated in ***Appendix G***.

Another statutory process that has recently become a requirement from the Department of Labour is a Construction Work Permit:

The criteria to be met for projects that require a Work Permit is any one of the following:

> (a) when the construction period will be exceeding 365 days AND when involving more than 3600 person days of construction work (typical dam construction of 4 months equals approximately 1000-1500 person days); or
>
> (b) when Construction Industry Development Board (CIDB) grading equals grade level 7 or above (project costs amount to R40 mill or more)

The scale of the proposed project seems well below any of these thresholds and we don't foresee that a Work Permit be required.

Furthermore, besides a few farm roads and outbuildings there are no other structures or infrastructure to be incorporated into the design.

8) SPECIALIST SERVICES

Depending on the final site & 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*. At this stage we do not foresee any additional specialist studies except additional environmental studies that might be triggered if the restriction zone is applicable, which may also include a River Management Plan.

9) COST ESTIMATE

Typically the scoping study would be based on topographical information obtained from maps and GIS sources. However, in this case the site was surveyed by *Messrs Boland Opmeting* in Jan 2021. Hence, all quantity and volume related calculations and figures are based on information retrieved and/or generated from the site survey data.

All the volumetric and related estimates are based on the same principles giving opportunity to compare 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 ***Appendices C&H*** for detail.

Tables 5-7 below contains ballpark costings for gross storage capacities ranging between ±70 000m³ and 180 000 m³:

NEW WAVE DAM — OPTION 1 (Outside 32m restriction zone)

	Stage 1	*Stage 2*	*Stage 3*
Wall Height (m)	7	9.5	10
Gross Storage Volume (m³)	**71,000**	**163,000**	**182,000**
Earthmoving (m³)	24,400	57,200	66,000
Ratio (Storage : Earthworks)	2.91	2.85	2.76
Cost Estimate (R)	**R 2,971,100**	**R 5,641,500**	**R 6,384,200**
Unit Cost (R/m³ storage)	**R 45.8**	**R 37.6**	**R 38.0**

NEW WAVE DAM — OPTION 2 (Within 32m restriction zone)

	Stage 1	*Stage 2*	*Stage 3*
Wall Height (m)	7.5	7.8	8.0
Gross Storage Volume (m³)	**73,000**	**82,000**	**92,000**
Earthmoving (m³)	27,500	30,400	33,100
Ratio (Storage : Earthworks)	2.65	2.70	2.78
Cost Estimate (R)	**R 2,889,900**	**R 3,132,400**	**R 3,418,200**
Unit Cost (R/m³ storage)	**R 43.4**	**R 41.9**	**R 40.7**

NEW WAVE DAM — OPTION 3 (Within 32m restriction zone)

	Stage 1	*Stage 2*	*Stage 3*
Wall Height (m)	7.2	7.6	8.0
Gross Storage Volume (m³)	**70,200**	**81,200**	**93,000**
Earthmoving (m³)	29,500	33,300	37,700
Ratio (Storage : Earthworks)	2.38	2.44	2.47
Cost Estimate (R)	**R 3,242,800**	**R 3,515,200**	**R 3,882,200**
Unit Cost (R/m³ storage)	**R 50.6**	**R 47.2**	**R 45.5**

The storage ratios and unit costs above give a good indication of the economy of the various alternatives. All three options show a similar trend of being expensive especially for the smaller dams with limited benefit for the larger alternatives previously presented and included under Option 1 above. When dams of similar capacities are compared, for instance ±70 000m³, Options 2 seems to have hit the optimum as far as direct costing goes. From the above it can also be seen that the unit costs do come down for increased storage capacities at each of the sites ranging from ±R37 to ±R51 representing almost 37% difference in unit costs.

Given the target storage capacity in the order of ±70 000m³, say up to 90 000m³, Option 2 which has a more square footprint, came in with the lowest unit costs. Options 1 & 2 on the other hand are very similar with the main difference being location which impacts the available land for development around the dam.

Another aspect to keep in mind when it comes to the costing above, is the fact that due to unsuitable geological conditions, the core trench method of sealing the dam has been substituted for a full HDPE liner instead which comes at a price but at a reduced risk of leaking.

The above are considered estimates based on certain assumptions at this stage which can and most probably will differ from the final costings which would be based on more accurate assumptions and site surveys once the site exploration works are completed as part of the next stage.

10) CONCLUSION

This is merely a scoping exercise to compare and relate various aspects of different possibilities and alternatives by simplifying or reducing such properties or facts into comparable terms, groups or parameters. Hence, we hereby summarise, conclude and recommend as follows:

- The target storage capacity for the dam was set in the order of 70 000m³ to 80 000m³.
- All options evaluated have storage ratio's below the economical threshold value of three.
- *Option 2* has the smallest water surface area or footprint as the most economical solution.
- *Option 1* comes in second best purely from a cost perspective with *Option 3* having lower unit cost from an irrigation perspective.
- Even-though the economics of all sites do improve for larger storage capacities, the benefits remain limited and not much of a motivation for increasing the target storage volume.
- The nature of the project is such that it will have to meet the requirements of at least two authorities at this stage namely, *Department Water & Sanitation (DWS)* and *Department Environment, Forestry & Fisheries (DEFF)*.
- All the options discussed and presented above will most probably end up in the category 1 bracket as small dams with low hazard potential from adam safety perspective.
- The overall geology is not adequate for the typical cut-off trench and clay core sealing scenario, hence the need for a full scale HDPE liner on all the options.
- In summary ***Option 2*** seems to be scoring the highest overall recommended as the preferred option.

11) WAY FORWARD

This document serves as a discussion document in order to make decisions regarding the way forward. In order to proceed we propose and recommend that the following be addressed:

- Evaluate and decide on the final size from the proposed options with regard to the following:
  ~ Long term energy costs
  ~ Dam safety and related issues
  ~ Economic & Risk factors

- 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 licence application, including
  ~ Appointment of Consultant
  ~ Clarify 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

- Way-leaves
  ~ We do not foresee any way-leave applications at this stage.

- Works Permit
  ~ The project does not trigger such permit application.

- 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

- Obtain and keep in hand information required:
  ~ Legal Ownership of Properties (Title Deeds) etc
  ~ Business Registrations
  ~ Applicable business agreements and/or arrangements etc

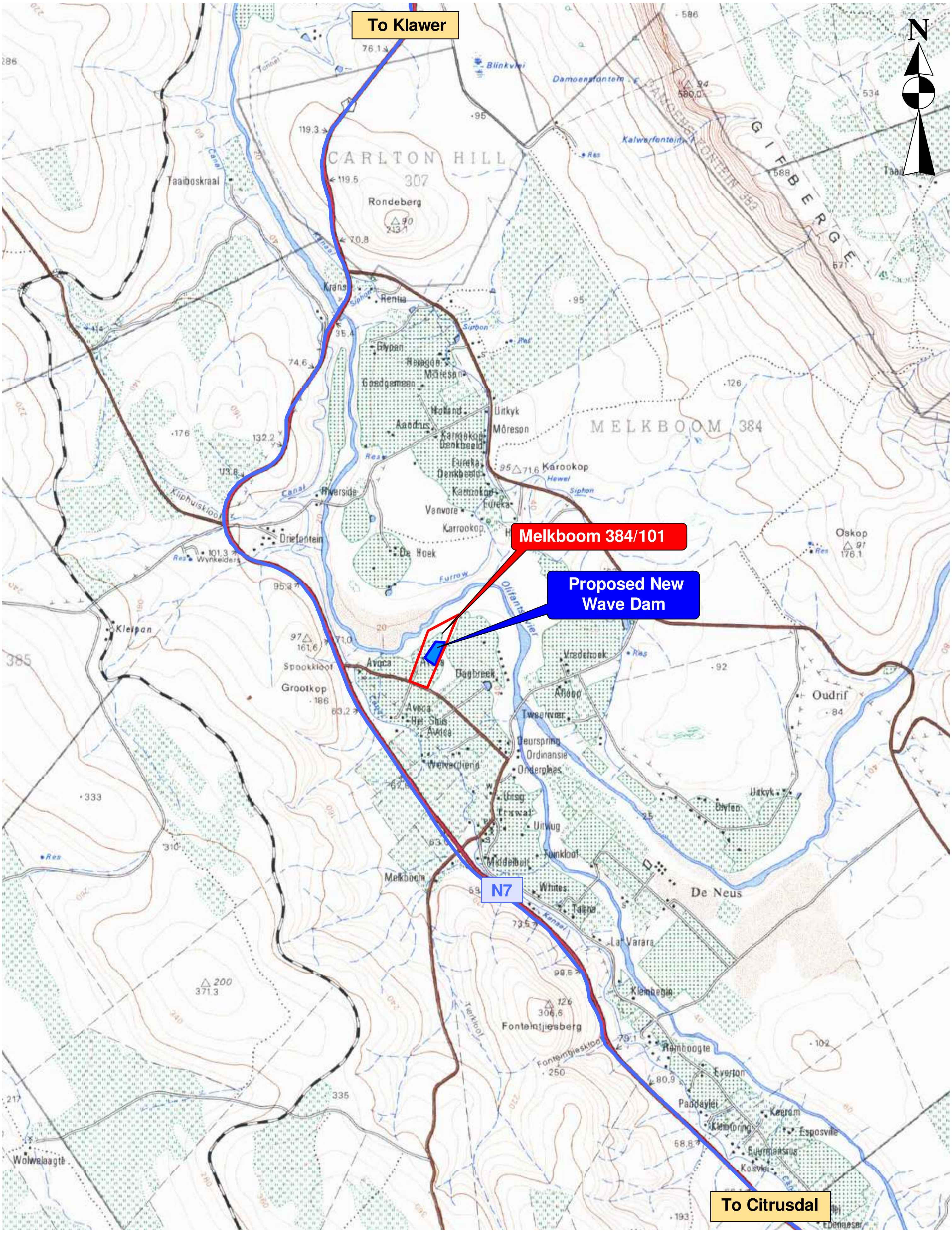
You are welcome to contact us for further information should there be any queries. We trust that you will find above in order and that we can expect a response soon.

Yours faithfully

M Charl Bester (Pr Ing)

Appendix A

Locality Map



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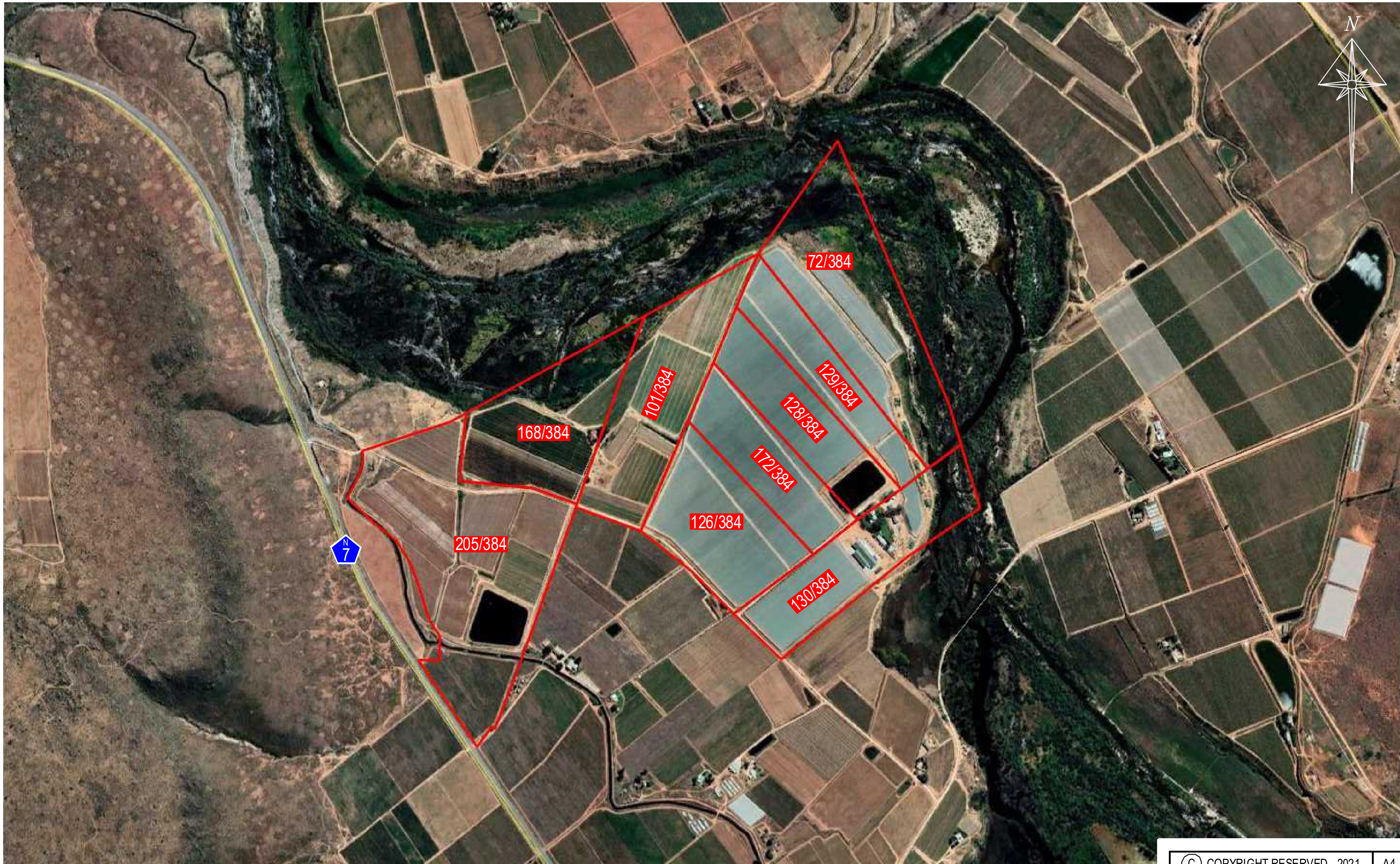
Client: Cederberg Farming PO Box 50 TRAWEL 8147	**Project:** Proposed New Wave Dam LOCALITY MAP	**Project Ref:** 2114	
	Map Ref: 3118DC	**Scale:** 1: 50 000	

Appendix B

Site Plans



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PROJECT:
PROPOSED NEW WAVE DAM ON THE FARM MELKBOOM 384, TRAWAL, CLANWILLIAM RD

DRAWN	DATE	SCALE	SHEET
R van der Merwe	MAY. 2021	N/A	1 of 2

DETAIL:
Site Map: Farming Unit Borders

SURVEYED	DESIGNED	DWG. NUMBER.	REV.
D Willemse MC Bester	Sarel Berster Engineers	2114-SM-01	

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PROJECT:
PROPOSED NEW WAVE DAM ON THE FARM
MELKBOOM 384, TRAWAL, CLANWILLIAM RD

DETAIL:
Site Map: Dam Options

DRAWN	DATE	SCALE	SHEET
R van der Merwe	MAY. 2021	N/A	2 of 2

SURVEYED	DESIGNED	DWG. NUMBER.	REV.
D Willemse MC Bester	Sarel Berster Engineers	2114-SM-02	

Appendix C

Scoping Evaluation

PRELIMINARY EVALUATION OF THE PROPOSED EARTH DAM: QUANTITIES AND COSTING

Client: Cederberg Farming
Address: P.O. Box 50, Trawal, 8147
Dam: New Wave Dam – Opt1
Notes: 1. Survey from Douw Willemse
2. Outside 32m restriction zone
3

Project Nr.: 2114
Annexure:
Date: 31-May-21

Version: *Apr 2020*
Report by: Charl Bester
SAREL BESTER ENGINEERS
P.O. Box 21, Ceres 6835
Ph: 023-312 2017

Design Parameters & Assumptions:

Crest width (m):	4.0	*Cut-off depth (m):*	0.00
Upstream slope 1:	3.0	*Cut-off base (m):*	0.00
Downstream Slope 1:	2.0	*Cut-off slope 1:*	0.00
Percentage of fill gaining capacity:	0%	*Application (m³/ha):*	7,000
		Capacity Yield Factor:	1.0

Financial Assumptions:

Earthmoving Cost (R/m³):	45.00
Basic Fees Scale (%):	7.5%
Fees Base Value (R):	R 11,500,000
Enlargement (Y/N):	N

Item	Description		Unit	Stadium 1	Stadium 2	Stadium 3	Stadium 4	Stadium 5
				Stadium / Wall position / Terrain				
1	**EARTHWORKS**			*<70 000>*	*<160 000>*	*<180 000>*		
1.1	Wall crest level		masl	31.00	33.50	34.00		
1.2	Lowest ground level beneath crest		masl	24.00	24.00	24.00		
1.3	Maximum wall height		m	7.00	9.50	10.00	#N/A	#N/A
1.4	Wall crest length		m	321.0	637.0	640.0		
1.5	Earthworks volume – excl cut-off		m³	24,400	57,200	66,000		
1.6	Cut-off trench excavation volume		m³	*0*	0	0	#N/A	#N/A
1.7	**Gross Earthworks**		**m³**	**24,400**	**57,200**	**66,000**	**#N/A**	**#N/A**
2	**STORAGE CAPACITY**							
2.1	Full supply level		masl	30.00	32.50	33.00		
2.2	Draw-off / Empty level		masl	26.00	22.50	22.50		
2.3	Total free-board		m	1.00	1.00	1.00	0.00	0.00
2.4	Max depth above draw-off level		m	4.00	10.00	10.50	0.00	0.00
2.5	Nett capacity from contour model		m³	71,000	163,000	182,000		
2.6	Capacity gain from excavations		m³	0	0	0	0	0
2.7	Capacity gain over existing dam		m³	0	0	0	0	0
2.8	**Potential gross capacity**		**m³**	**71,000**	**163,000**	**182,000**	**0**	**0**
2.9	Water surface		ha	2.50	3.40	3.70		
2.10	Potential gross (yield) irrigation		ha	10.14	23.29	26.00	0.00	0.00
2.11	Average water depth		m	2.84	4.79	4.92	#DIV/0!	#DIV/0!
2.13	Recommended pipe diameter		mm	150	200	200	150	150
3	**COSTING (Excl VAT)**							
3.1	Overhead & Preparation	10%	Rand	156,857	367,714	424,286	#N/A	#N/A
3.2	Earthworks (excavate & construct)	70%	Rand	1,098,000	2,574,000	2,970,000	#N/A	#N/A
3.3	Concrete & Outlet works	10%	Rand	156,857	424,600	489,923	#N/A	#N/A
3.4	Diverse & Unforeseen	10%	Rand	156,857	367,714	424,286	#N/A	#N/A
3.5	HDPE Liner @ ±R51/m²		Rand	1,402,500	1,907,400	2,075,700		
3.6	**Estimated Construction Cost**		**Rand**	**2,971,071**	**5,641,428**	**6,384,194**	**#N/A**	**#N/A**
3.7	Engineering Fees Percentage		%	*9.5%*	8.6%	8.3%	#N/A	#N/A
3.8	Engineers costs (ECSA Fees)		Rand	283,530	486,348	531,827	#N/A	#N/A
3.9	Engineers costs (Disbursements)		Rand					
3.10	**Estimated Engineers Costs**		**Rand**	**283,530**	**486,348**	**531,827**	**#N/A**	**#N/A**
3.11			Rand					
3.12			Rand					
3.13	**Total estimated project cost**		**Rand**	**3,254,602**	**6,127,776**	**6,916,022**	**#N/A**	**#N/A**
4	**INDICATORS**							
4.1	Ratio (Gained Storage : Earthworks)		>3	*2.91*	2.85	2.76	#N/A	#N/A
4.2	Cost per storage capacity gained		R/m³	*45.84*	37.59	38.00	#N/A	#N/A
4.3	Cost per irrigation hectare gained		R/ha	*320,876*	263,156	266,001	#N/A	#N/A

PRELIMINARY EVALUATION OF THE PROPOSED EARTH DAM: QUANTITIES AND COSTING

Client: Cederberg Farming
Address: P.O. Box 50, Trawal, 8147
Dam: New Wave Dam – Opt 2
Notes: 1. Survey from Douw Willemse
2. Within 32m restriction zone
3

Project Nr.: 2114
Annexure:
Date: 31-May-21

Version: *Apr 2020*

Report by: Charl Bester
SAREL BESTER ENGINEERS
P.O. Box 21, Ceres 6835
Ph: 023-312 2017

Design Parameters & Assumptions:

Crest width (m):	4.0	*Cut-off depth (m):*	0.00
Upstream slope 1:	3.0	*Cut-off base (m):*	0.00
Downstream Slope 1:	2.0	*Cut-off slope 1:*	0.00
Percentage of fill gaining capacity:	0%	*Application (m³/ha):*	7,000
		Capacity Yield Factor:	1.3

Financial Assumptions:

Earthmoving Cost (R/m³):	45.00
Basic Fees Scale (%):	7.5%
Fees Base Value (R):	R 11,500,000
Enlargement (Y/N):	N

Item	Description		Unit	Stadium / Wall position / Terrain				
				Stadium 1	Stadium 2	Stadium 3	Stadium 4	Stadium 5
1	**EARTHWORKS**			*<70 000>*	*<80 000>*	*<90 000>*		
1.1	Wall crest level		masl	30.50	30.80	31.00		
1.2	Lowest ground level beneath crest		masl	23.00	23.00	23.00		
1.3	Maximum wall height		m	7.50	7.80	8.00	#N/A	#N/A
1.4	Wall crest length		m	413.0	433.0	441.0		
1.5	Earthworks volume – excl cut-off		m³	27,500	30,400	33,100		
1.6	Cut-off trench excavation volume		m³	*0*	0	0	#N/A	#N/A
1.7	**Gross Earthworks**		**m³**	**27,500**	**30,400**	**33,100**	**#N/A**	**#N/A**
2	**STORAGE CAPACITY**							
2.1	Full supply level		masl	29.50	29.80	30.00		
2.2	Draw-off / Empty level		masl	25.50	25.50	25.50		
2.3	Total free-board		m	1.00	1.00	1.00	0.00	0.00
2.4	Max depth above draw-off level		m	4.00	4.30	4.50	0.00	0.00
2.5	Nett capacity from contour model		m³	73,000	82,000	92,000		
2.6	Capacity gain from excavations		m³	0	0	0	0	0
2.7	Capacity gain over existing dam		m³	0	0	0	0	0
2.8	**Potential gross capacity**		**m³**	**73,000**	**82,000**	**92,000**	**0**	**0**
2.9	Water surface		ha	2.00	2.10	2.30		
2.10	Potential gross (yield) irrigation		ha	13.56	15.23	17.09	0.00	0.00
2.11	Average water depth		m	3.65	3.90	4.00	#DIV/0!	#DIV/0!
2.13	Recommended pipe diameter		mm	150	150	150	150	150
3	**COSTING (Excl VAT)**							
3.1	Overhead & Preparation	10%	Rand	176,786	195,429	212,786	#N/A	#N/A
3.2	Earthworks (excavate & construct)	70%	Rand	1,237,500	1,368,000	1,489,500	#N/A	#N/A
3.3	Concrete & Outlet works	10%	Rand	176,786	195,429	212,786	#N/A	#N/A
3.4	Diverse & Unforeseen	10%	Rand	176,786	195,429	212,786	#N/A	#N/A
3.5	HDPE Liner @ ±R51/m²		Rand	1,122,000	1,178,100	1,290,300		
3.6	**Estimated Construction Cost**		**Rand**	**2,889,857**	**3,132,386**	**3,418,157**	**#N/A**	**#N/A**
3.7	Engineering Fees Percentage		%	*9.5%*	9.5%	9.5%	#N/A	#N/A
3.8	Engineers costs (ECSA Fees)		Rand	275,780	298,925	326,196	#N/A	#N/A
3.9	Engineers costs (Disbursements)		Rand					
3.10	**Estimated Engineers Costs**		**Rand**	**275,780**	**298,925**	**326,196**	**#N/A**	**#N/A**
3.11			Rand					
3.12			Rand					
3.13	**Total estimated project cost**		**Rand**	**3,165,637**	**3,431,310**	**3,744,353**	**#N/A**	**#N/A**
4	**INDICATORS**							
4.1	Ratio (Gained Storage : Earthworks)		>3	*2.65*	2.70	2.78	#N/A	#N/A
4.2	Cost per storage capacity gained		R/m³	*43.36*	41.85	40.70	#N/A	#N/A
4.3	Cost per irrigation hectare gained		R/ha	*233,503*	225,321	219,151	#N/A	#N/A

PRELIMINARY EVALUATION OF THE PROPOSED EARTH DAM: QUANTITIES AND COSTING

Client:	Cederberg Farming	*Project Nr.:*	2114	*Version:*	*Apr 2020*
Address:	P.O. Box 50, Trawal, 8147	*Annexure:*			
Dam:	New Wave Dam – Opt 3	*Date:*	31-May-21	*Report by:*	Charl Bester
Notes:	1. Survey from Douw Willemse				SAREL BESTER ENGINEERS
	2. Within 32m restriction zone				P.O. Box 21, Ceres 6835
	3				Ph: 023-312 2017

Design Parameters & Assumptions: / **Financial Assumptions:**

Crest width (m):	4.0	*Cut-off depth (m):*	0.00	*Earthmoving Cost (R/m³):*	45.00
Upstream slope 1:	3.0	*Cut-off base (m):*	0.00	*Basic Fees Scale (%):*	7.5%
Downstream Slope 1:	2.0	*Cut-off slope 1:*	0.00	*Fees Base Value (R):*	R 11,500,000
Percentage of fill gaining capacity:	0%	*Application (m³/ha):*	7,000	*Enlargement (Y/N):*	N
		Capacity Yield Factor:	1.3		

Item	Description		Unit	Stadium 1	Stadium 2	Stadium 3	Stadium 4	Stadium 5
				Stadium / Wall position / Terrain				
				<70 000>	*<80 000>*	*<90 000>*		
1	**EARTHWORKS**							
1.1	Wall crest level		masl	30.20	30.60	31.00		
1.2	Lowest ground level beneath crest		masl	23.00	23.00	23.00		
1.3	Maximum wall height		m	7.20	7.60	8.00	#N/A	#N/A
1.4	Wall crest length		m	361.0	367.0	374.0		
1.5	Earthworks volume – excl cut-off		m³	29,500	33,300	37,700		
1.6	Cut-off trench excavation volume		m³	*0*	0	0	#N/A	#N/A
1.7	**Gross Earthworks**		**m³**	**29,500**	**33,300**	**37,700**	**#N/A**	**#N/A**
2	**STORAGE CAPACITY**							
2.1	Full supply level		masl	29.20	29.60	30.00		
2.2	Draw-off / Empty level		masl	23.00	23.00	23.00		
2.3	Total free-board		m	1.00	1.00	1.00	0.00	0.00
2.4	Max depth above draw-off level		m	6.20	6.60	7.00	0.00	0.00
2.5	Nett capacity from contour model		m³	70,200	81,200	93,000		
2.6	Capacity gain from excavations		m³	0	0	0	0	0
2.7	Capacity gain over existing dam		m³	0	0	0	0	0
2.8	**Potential gross capacity**		**m³**	**70,200**	**81,200**	**93,000**	**0**	**0**
2.9	Water surface		ha	2.40	2.45	2.60		
2.10	Potential gross (yield) irrigation		ha	13.04	15.08	17.27	0.00	0.00
2.11	Average water depth		m	2.93	3.31	3.58	#DIV/0!	#DIV/0!
2.13	Recommended pipe diameter		mm	150	150	150	150	150
3	**COSTING (Excl VAT)**							
3.1	Overhead & Preparation	10%	Rand	189,643	214,071	242,357	#N/A	#N/A
3.2	Earthworks (excavate & construct)	70%	Rand	1,327,500	1,498,500	1,696,500	#N/A	#N/A
3.3	Concrete & Outlet works	10%	Rand	189,643	214,071	242,357	#N/A	#N/A
3.4	Diverse & Unforeseen	10%	Rand	189,643	214,071	242,357	#N/A	#N/A
3.5	HDPE Liner @ ±R51/m²		Rand	1,346,400	1,374,450	1,458,600		
3.6	**Estimated Construction Cost**		**Rand**	**3,242,829**	**3,515,164**	**3,882,171**	**#N/A**	**#N/A**
3.7	Engineering Fees Percentage		%	*9.5%*	9.0%	9.0%	#N/A	#N/A
3.8	Engineers costs (ECSA Fees)		Rand	309,464	316,834	349,914	#N/A	#N/A
3.9	Engineers costs (Disbursements)		Rand					
3.10	**Estimated Engineers Costs**		**Rand**	**309,464**	**316,834**	**349,914**	**#N/A**	**#N/A**
3.11			Rand					
3.12			Rand					
3.13	**Total estimated project cost**		**Rand**	**3,552,293**	**3,831,999**	**4,232,086**	**#N/A**	**#N/A**
4	**INDICATORS**							
4.1	Ratio (Gained Storage : Earthworks)		>3	*2.38*	2.44	2.47	#N/A	#N/A
4.2	Cost per storage capacity gained		R/m³	*50.60*	47.19	45.51	#N/A	#N/A
4.3	Cost per irrigation hectare gained		R/ha	*272,475*	254,111	245,034	#N/A	#N/A

Appendix D

WUA Certificate

SERTIFIKAAT VAN INLYSTING

LAER OLIFANTSRIVIER WGV
PRIVAATSAK X1
VREDENDAL
8160
09/02/2021

Tel nr: (027) 2132043/4
Faks nr: (027) 2133519

Eienaar: CEDERBERG FARM TRAWAL EIEND BPK

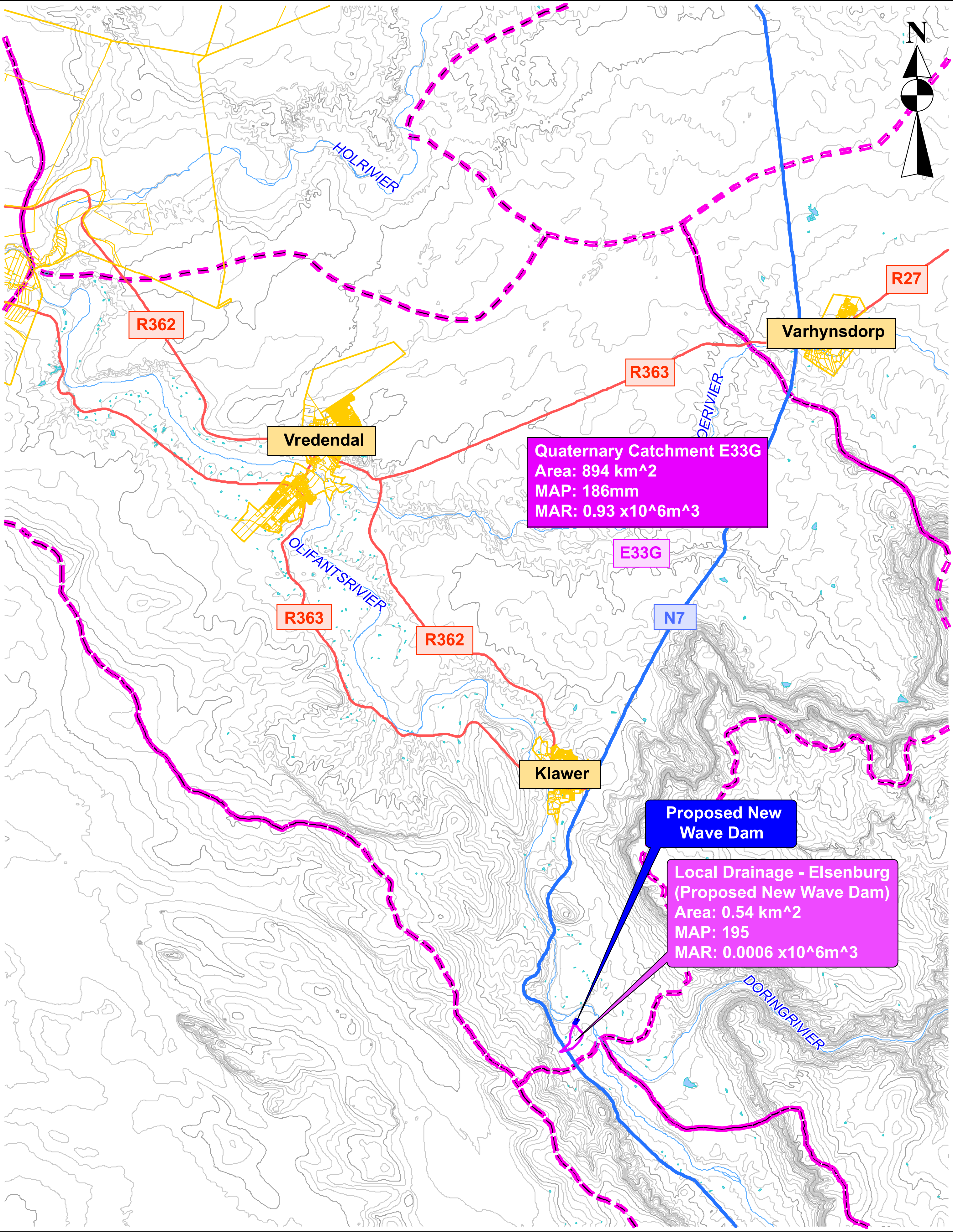
Sked no	ID	Plaasnaam	Grondbeskrywing	Grootte (ha)	Inlysting (ha)
491	L22A		GED 72 VAN MELKBOOM NO 384	74.4101	42.0000
493	L23		GED 101 VAN MELKBOOM NO 384	14.8197	8.6000
495A	L23/3		168 VAN MELKBOOM 384	13.2793	9.5000
496	L23A		GED 205 VAN MELKBOOM NO 384	27.9000	18.1000
Totaal				**130.4091**	**78.2000**

HOOF BESTUURDER

LORWGV
SKEMA BESTUURDER
PRIVAATSAK / PRIVATE BAG X1
08 FEB 2021
SCHEME MANAGER
VREDENDAL 8160
LORWUA

Appendix E

Hydrological Map



SAREL BESTER INGENIEURS BK
MC BESTER
Pr. Ing., LSAISI: 970598, LSACAP: T1218
Tel 023 312 2017 / Epos sbri@telkomsa.net

Client: Cederberg Farming PO Box 50 TRAWEL 8147	**Project:** Proposed New Wave Dam HYDROLOGY MAP	**Project Ref:** 2114
	Map Ref: 3118DC	**Scale:** 1: 200 000

Appendix F

Geological Map

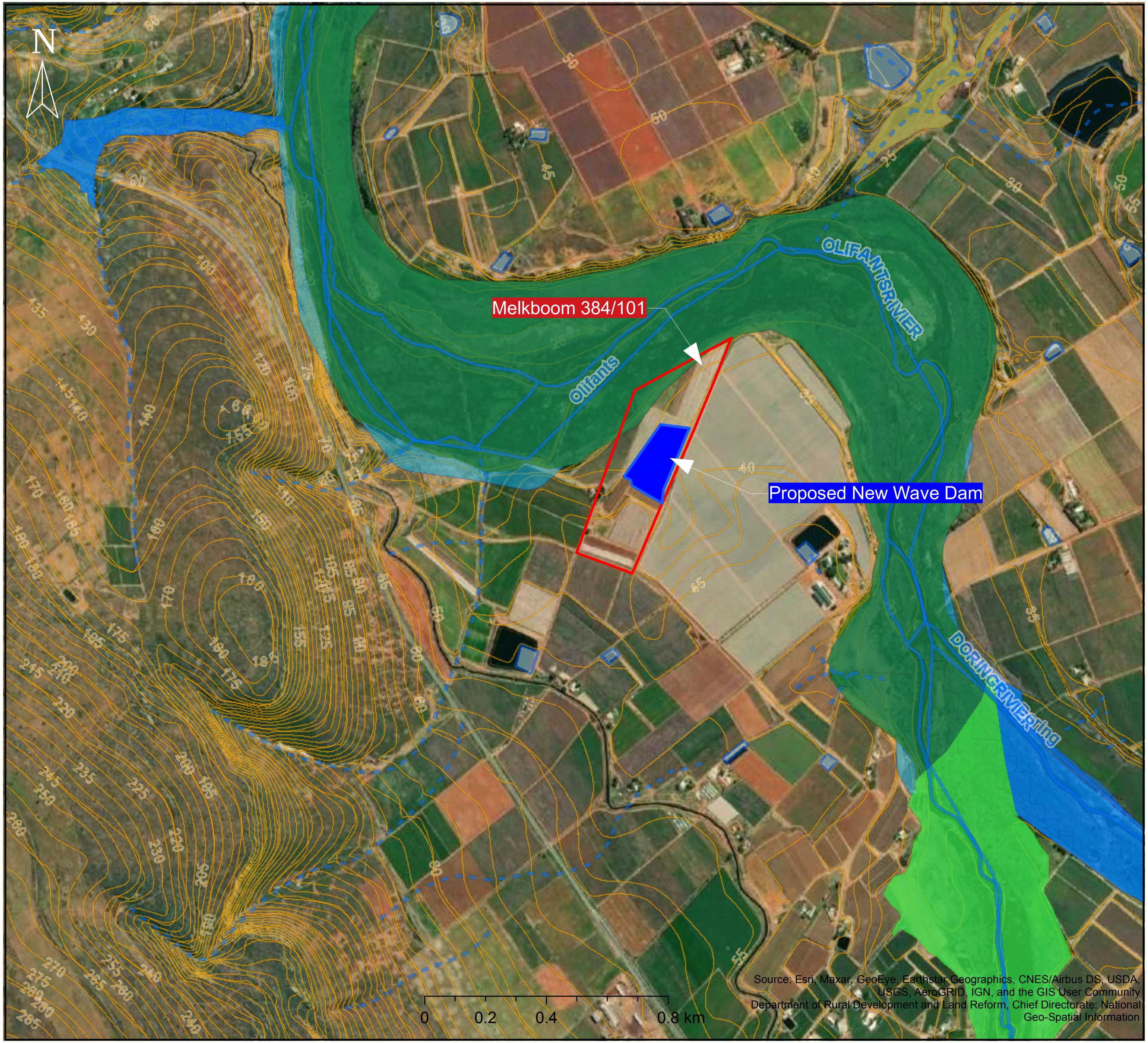
SAREL BESTER INGENIEURS BK
MC BESTER
Pr. Ing., LSAISI: 970598, LSACAP: T1218
Tel 023 312 2017 / Epos sbri@telkomsa.net

Client: Cederberg Farming PO Box 50 TRAWEL 8147	**Project:** Proposed New Wave Dam GEOLOGY MAP		**Project Ref:** 2114
	Map Ref: 3118 Calvinia		**Scale:** 1: 50 000

Appendix G

Bio Maps

Cape Farm Mapper: *Proposed New Wave Dam*



Legend

Rivers
- Perennial
- Non-Perennial

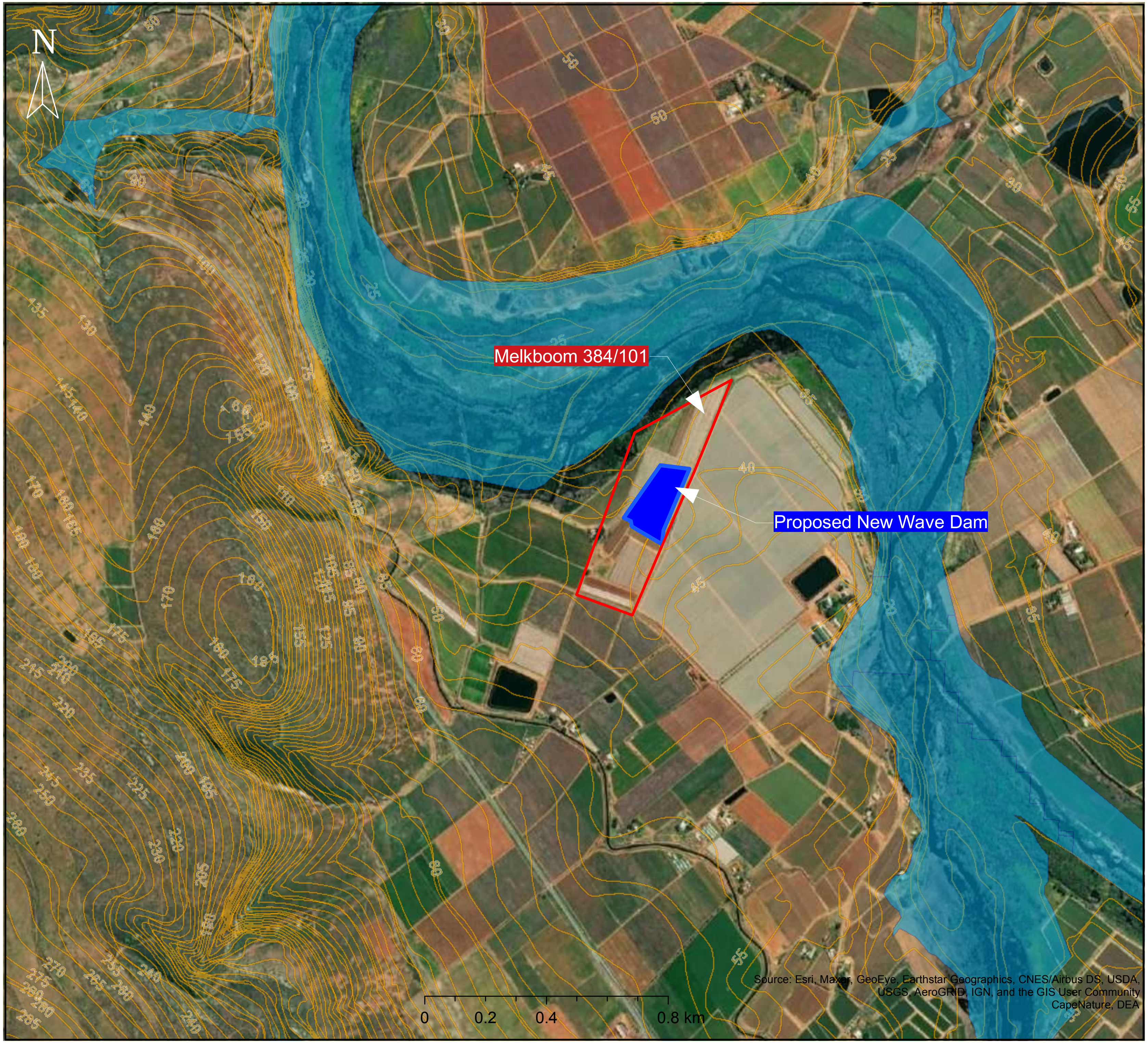
Rivers (DWS)
- Perennial
- Dams

Wetlands (NWM5)
- Channelled valley-bottom wetland
- Floodplain wetland
- River
- Seep wetland
- Unchannelled valley-bottom wetland

Wetlands (NFEPA)
- Natural
- Contours 5m
- Contours 20m

Scale: 1:20 000
Date created: May 7, 2021

Western Cape Government
Agriculture



Critical Biodiversity Areas & Ecological Support Areas Biodiversity Map: *Proposed New Wave Dam*

Legend

BSP ESA: Restore

ESA2: Restore from plantation or high density IAP

ESA2: Restore from other land use

BSP ESA

ESA: Aquatic

BSP CBA

CBA: Terrestrial

CBA: River

CBA: Wetland

Scale: 1:20 000

Date created: May 7, 2021

Western Cape Government

Agriculture

Appendix G

Drawings

2114-S1-02 ~ Option 1
2114-S1-03 ~ Option 2
2114-S1-04 ~ Option 3

CONTOUR LAYOUT PLAN (AERIAL PHOTO) SCALE 1:1500

REVISION

SAREL BESTER ENGINEERS
Consulting Civil Engineers
Architectural Services

.... Date:14/4/2021
MC BESTER
Pr. Eng., B.Eng., MSAICE:970598, SACAP:T1218

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CERES, 6835

Ph: 023-312 2017
Fax: 023-312 3802
e-mail: admin@sbri.co.za

OWNER

Cedarberg Farming
P.O. Box 50
TRAWAL
8147

PROJECT

PROPOSED NEW WAVE DAM ON THE FARM
MELKBOOM 384, TRAWAL, CLANWILLIAM RD

DETAIL

Contour Layout Plan (Aerial Photo)

DRAWN	DATE	SCALE	SHEET
SC Hartzenberg	APRIL 2021	as shown	2 of 2

SURVEYED	DESIGNED	DWG. NUMBER	REV.
D Willemse C Bester	Sarel Bester Engineers	2114-S1-02	

 A3

CONTOUR LAYOUT PLAN (AERIAL PHOTO) SCALE 1:1500

REVISION

SAREL BESTER ENGINEERS

Consulting Civil Engineers
Architectural Services

.... Date:28/5/2021
MC BESTER
Pr. Eng., B.Eng., MSAICE:970598, SACAP:T1218

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CERES, 6835

Ph: 023-312 2017
Fax: 023-312 3802
e-mail: admin@sbri.co.za

OWNER
Cedarberg Farming
P.O. Box 50
TRAWAL
8147

PROJECT
PROPOSED NEW WAVE DAM ON THE FARM MELKBOOM 384, TRAWAL, CLANWILLIAM RD (OPTION 2)

DETAIL
Contour Layout Plan (Aerial Photo)

DRAWN	DATE	SCALE	SHEET	
SC Hartzenberg	MAY 2021	as shown	2 of 3	
SURVEYED	DESIGNED	DWG. NUMBER		REV.
D Willemse C Bester	Sarel Bester Engineers	2114-S1-03		

 A3

CONTOUR LAYOUT PLAN (AERIAL PHOTO) SCALE 1:1500

REVISION

SAREL BESTER ENGINEERS

Consulting Civil Engineers
Architectural Services

.... Date:28/5/2021

MC BESTER

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e-mail: admin@sbri.co.za

OWNER

Cedarberg Farming
P.O. Box 50
TRAWAL
8147

PROJECT

PROPOSED NEW WAVE DAM ON THE FARM MELKBOOM 384, TRAWAL, CLANWILLIAM RD (OPTION 3)

DETAIL

Contour Layout Plan (Aerial Photo)

DRAWN	DATE	SCALE	SHEET
SC Hartzenberg	MAY 2021	as shown	3 of 3

SURVEYED	DESIGNED	DWG. NUMBER	REV.
D Willemse C Bester	Sarel Bester Engineers	2114-S1-04	

 A3

Appendix G

Documentation

(Boland Opmeting)

25 Januarie 2021

Cederberg Farming
Posbus 50
Trawal
8147

Aandag: Mnr Jaco Tredoux

BEPLANNING VAN NEW WAVE DAM

Die terrein is opgemeet en die beplanning van die dam is gedoen soos versoek

Drie modelle is beplan om 'n keuse te bied volgens die opgarings-behoefte en die opgarings lisensie wat toegestaan kan word
Die volgende kapasiteite is verkry:
Fase 1: 62 000 m3
Model A: 105 000 m3 en
Model B: 134 000 m3

Fase 1 se ontwerp maak voorsiening dat die dam 1 meter verhoog kan word deur die wal aan die buitekant aan te bou. Sodoende hoef die HDPE voering nie opgetel te word nie
Die dam se kapasiteit sal dan verhoog tot 82 000 m3

Aangeheg is die spesifikasies en planne vir elke model
Sien ook Fase 1, aangedui op Google earth

Dit word aanvaar dat die dam met 'n voering afgedig moet word
As dit na die grawe van toetsgate blyk dat 'n pitsloot suksesvol sal wees, sal die ontwerp sodanig gewysig word

Die inligting kan aan ander konsultante voorsien word wanneer nodig

Ek vertrou dat die beplanning van waarde sal wees en lewer graag verdere diens

Vriendelike groete

Douw Willemse

SPESIFIKASIES VAN DIE VOORGESTELDE NEW WAVE DAM

NOTAS

Relatiewe hoogtes (RH) is lokaal gekies en gekoppel aan die verwysingspenne soos uitgesit (STA tot STG)

Die volgende penne se ko-ordinate is soos volg bepaal vir plasing op Google earth:

STB	31° 52' 09,2" S	18° 37' 51,4" E
STE	31° 52' 06,4" S	18° 37' 46,5" E
STG	31° 52' 05,6" S	18° 37' 40,3" E

Die totale area (Footprint) van die modelle is soos volg:

Fase 1: 3,04ha, Model A: 4,20ha en Model B: 4,43ha

Dreiinerings- en reënwater sal onder deur die dam geneem word mbv 'n afvoerpyp

ONTWERP

1. Damwal			2. Oorloop:
Kruinwydte 4,0m	Stroomop helling	1 : 3	Pyp-oorloop
Grondvul uit damkom	Stroomaf helling	1 : 2	Vryboord 1,0m

SPESIFIKASIES

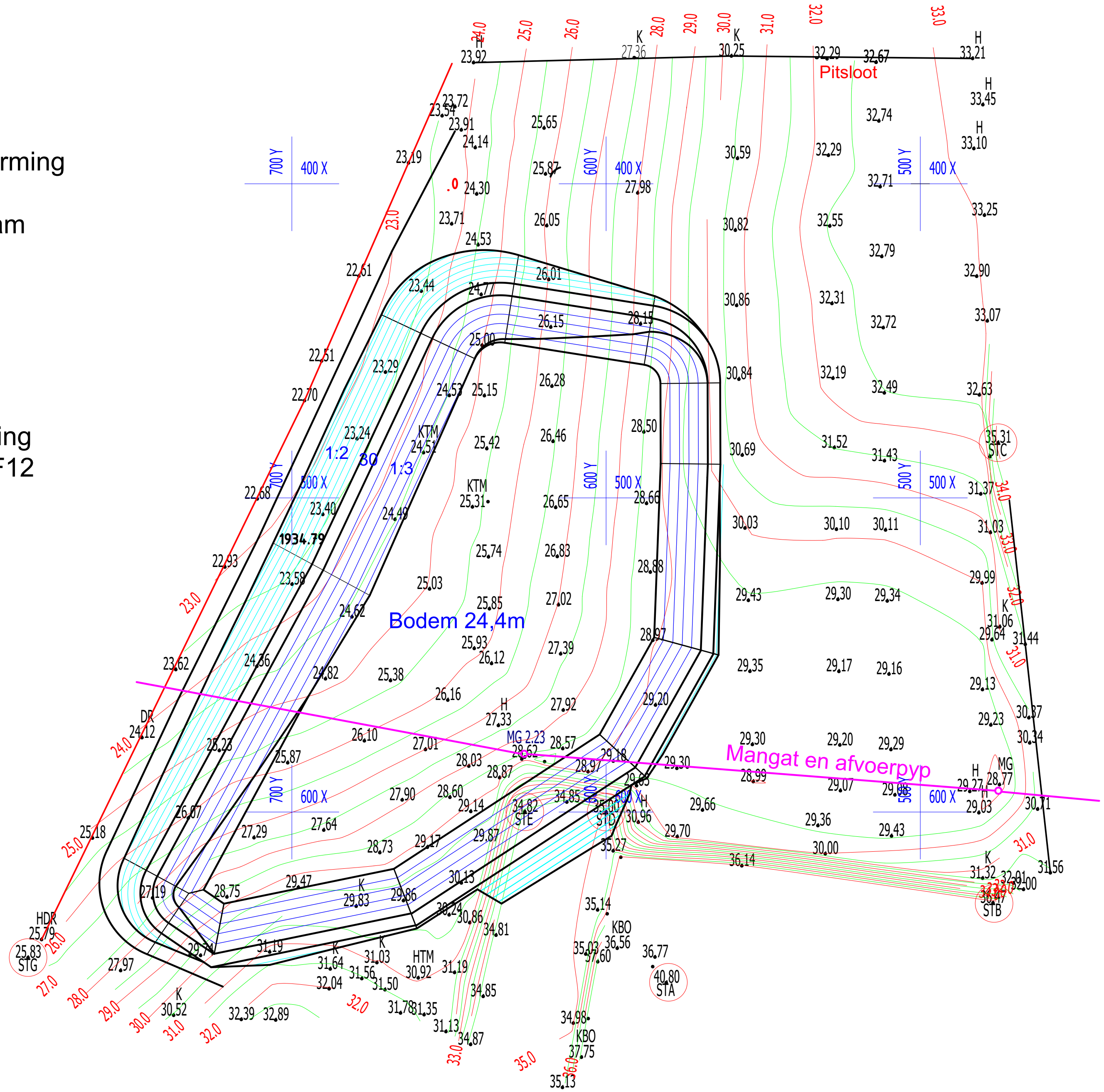
Item	Beskrywing	Eenheid			
1	Algemeen:		Fase 1	Model A	Model B
1.1	Wallengte: Hoofwal	m	335	395	415
1.2	Bo-wal	m	--	122	154
1.2	Walkruin RH	m	30,0	31,0	32,0
1.3	Waltoon RH	m	22,8	22,6	22,6
1.4	Maksimum walhoogte	m	7,2	8,4	9,4
1.5	Volvoorraad RH	m	29,0	30,0	31,0
1.6	Dambodem RH	m	24,4	24,5	24,5
1.7	Maksimum waterdiepte	m	4,6	5,5	6,5
1.8	Volvoorraad oppervlak	m^2	20 400	28 500	30 000
1.9	Totale kapasiteit	m^3	62 000	105 000	134 000
2	Konstruksie hoeveelhede:				
2.1	Walvolume: Hoofwal	m^3	24 000	40 540	51 700
2.2	Walvolume: Bo-wal	m^3	--	1 300	3 050
2.3	Pypbed uitgrawing	m^3	420	480	540
2.4	Totale grondwerk	m^3	24 420	42 320	55 290
3	Ander items				
3.1	Uitlaatpyp lengte	m	42	48	54
3.2	Voering area	m^2	25 000	33 700	36 000

Cederberg Farming

New Wave Dam
Fase 1

Boland opmeting
Verw 21/CFTF12
Jan 2021

Skaal 1:2000



N

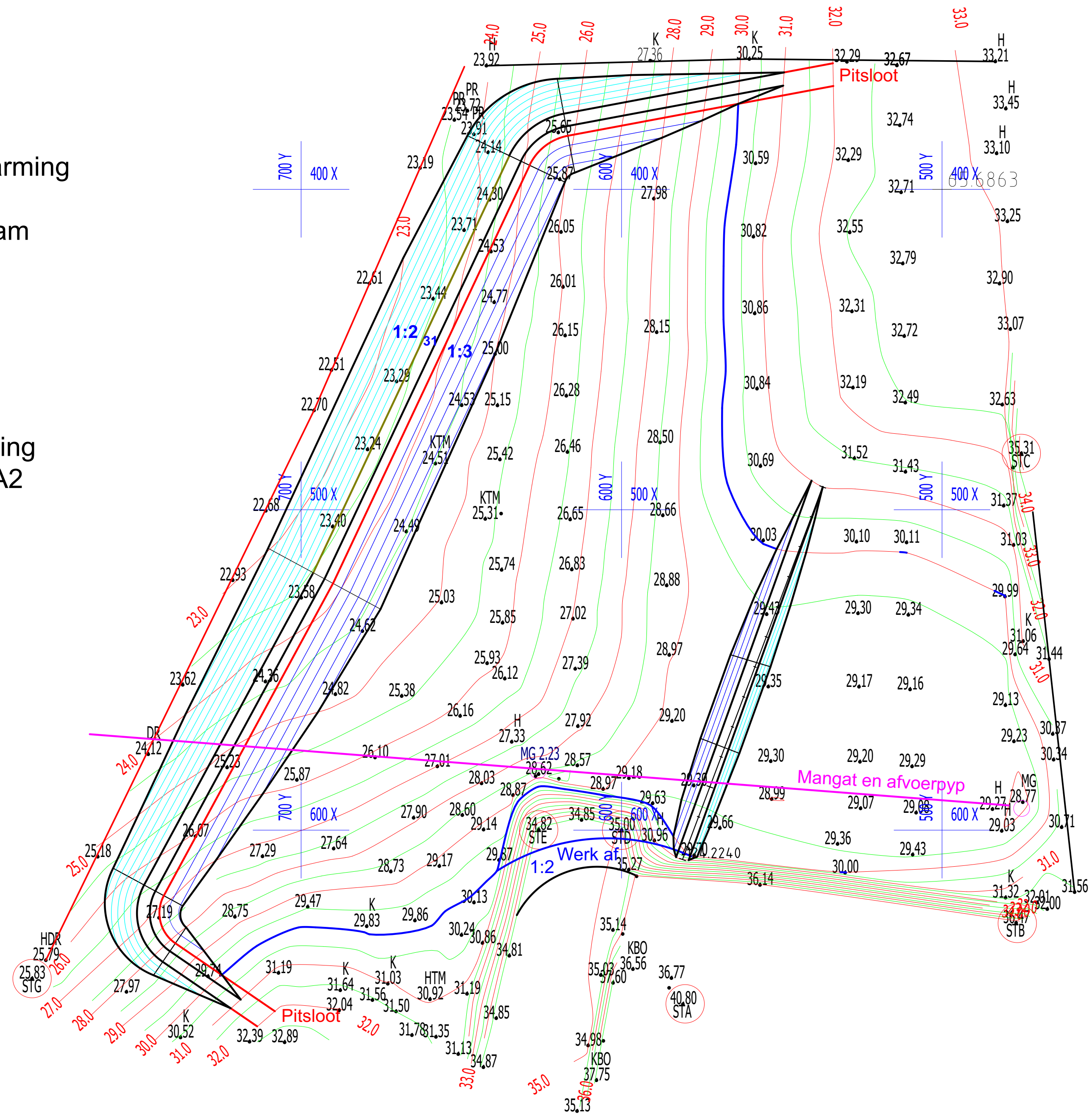
Cederberg Farming

New Wave Dam
Model A

Boland opmeting
Verw 21/CFTA2
Jan 2021

Skaal 1:2000

N



Cederberg Farming

New Wave Dam
Model B

Boland opmeting
Verw 21/CFTB2
Jan 2021

Skaal 1:2000

N