DJ HAGEN & ASSOCIATES

DAM ENGINEERING SPECIALISTS

PASSION | EXCELLENCE | INNOVATION

Reference No: DJH239-R01-Rev 4

24 August 2024

Erin de Vigne Pty (Ltd)

Botrivier

7185

Attention: Mr. Ted Adam

PROJECT NO. DJH239: THE CONSTRUCTION OF A NEW DAM AND ENLARGEMENT OF AN EXISTING DAM ON PORTION 3 OF FARM 781, BOTRIVIER

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

1 Introduction and background

Erin de Vigne Pty (Ltd), the applicant and farm owner, appointed DJ Hagen & Associates to undertake an investigation into feasible dam options for the construction of new dams and/or the enlargement of their existing dams on Portion 3 of Farm 781, Botrivier.

The project will include the construction of a new dam and the enlargement of an existing dam with maximum wall heights of 4.9 m and 4.2 m respectively. Their proposed storage capacities would be 2 000 m^3 and 67 000 m^3 and the dams will be used to store registered water from the Huiskloof River, for irrigation of the planned vineyards.

Water will be gravity fed to the dams via an existing 200 mm diameter HDPE pipeline from the diversion weir on the Huiskloof River.

The water use license application will be submitted in terms of Section 21 (b) of the National Water Act. (Refer to **Section 2**).

The recent drought in the Western Cape and the uncertainties of the impact of climate change are the major drivers for this project.

The farm is located approximately 5 km south of Botrivier in the Western Cape. Refer to the locality map in **Figure 1-1** and **Appendix B**.

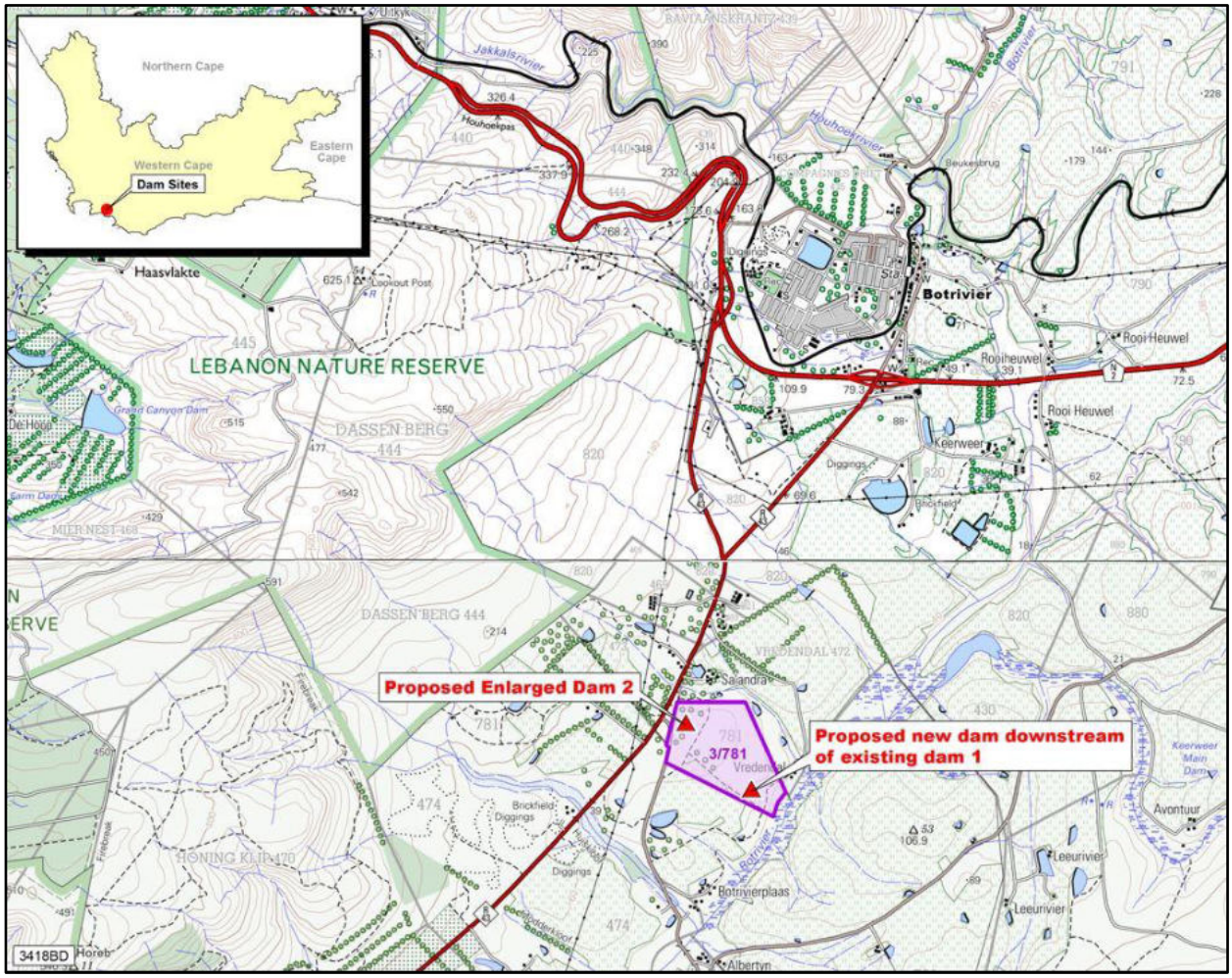

Figure 1-1: Locality Map

2 Existing Water Allocations

2.1 Existing registrations

The farm's verification of the Existing Lawful Use (ELU) was confirmed by the Breede Olifants Catchment Management Agency (BOCMA) is provided in **Appendix A**. Erin de Vigne (Pty) Ltd has an ELU of 130 000 m^3 per annum for taking water for Portion 3 of Farm 781, from the Huiskloof River, and 25 000 m^3 for storage.

2.2 Existing dams

On Farm 781, there are three existing dams, and the total storage capacity are 34 000 m^3. Refer to **Table 2-1**. (Also refer to **Appendix A**)

Table 2-1: Existing dam on Farm 344

Property	Map Reference (V&V)	Existing storage capacity (m^3)
Farm 781 (Portion 3)	Dam 1	6 000
	Dam 2	25 000
	Dam 3	3 000
Total		**34 000**

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

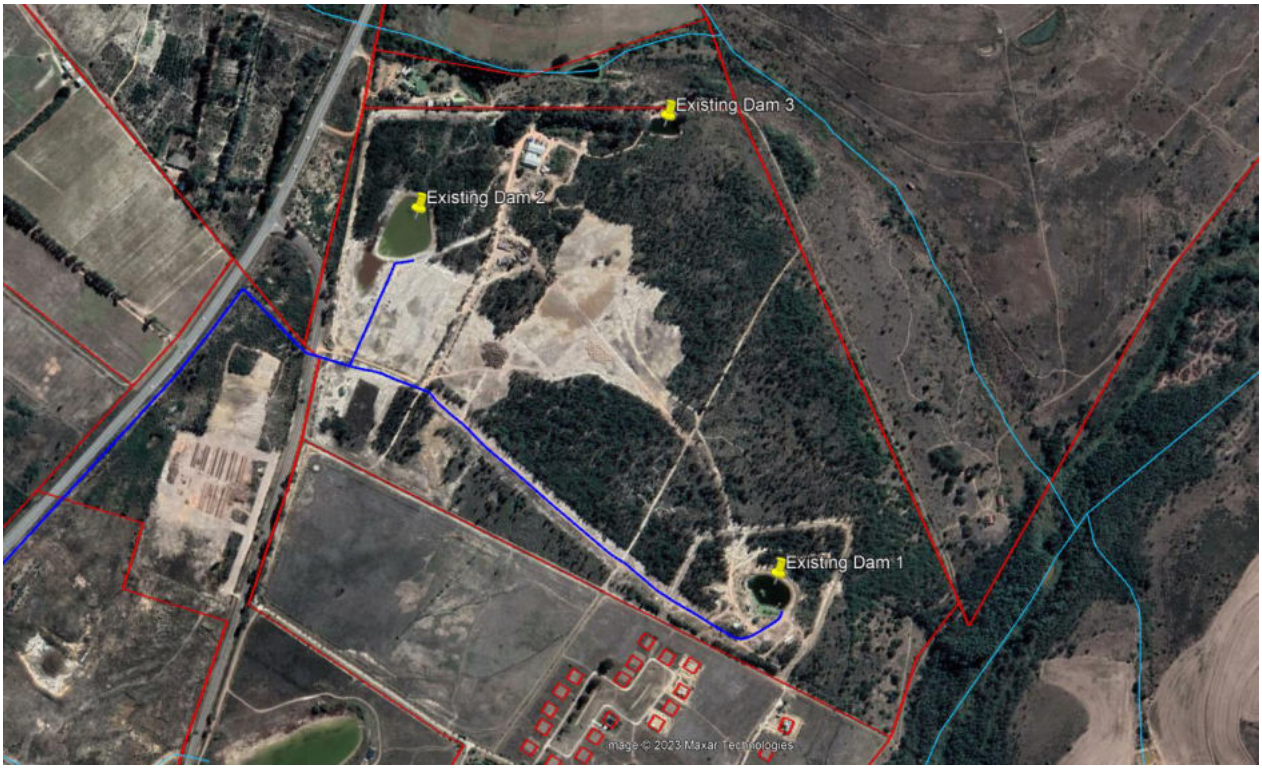

Figure 2-1: Existing dams on Farm 781

2.3 Summary of water use

According to the BOCMA, the farm total allowable water that can be taken from the Huiskloof River is 130 000 m^3/a, and allowable storage is 25 000 m^3. Currently, only a portion of this water (130 000 m^3/a) is being abstracted, and the total existing storage on the farm is 34 000 m^3.

The proposed new dam located downstream of existing Dam 1 would have a gross storage capacity of 2 000 m^3 and the existing Dam 1 will remain unaltered at 6 000 m^3. The proposed enlarged Dam 2 would have a gross storage capacity of 67 000 m^3 and Dam 3 would also remain unaltered with a storage capacity of 3 000 m^3. The proposed total storage of water on the farm would then be 78 000 m^3, which is only 60% of the taking.

As a result, an additional water for storage is required: 78 000 – 25 000 = 53 000 m^3/a.

The Water Use License Application should include the following:

- Section 21 (b) – storing of water to the amount of 53 000 m^3/a (additional)

3 Available surface water

The farm is located in quaternary catchment G40G. Existing Dam 2 is an enclosed dam which has no catchment area, and the proposed new dam located directly downstream of existing dam 1 will only have a catchment area of less than 0.02 km ^{2}, The dam basin run-off can therefore be regarded as negligeable. (Refer to **Figure 3-1**). The dams will only be filled through the existing pipeline from the diversion weir as indicated on **Figure 4-1.**

Figure 3-1: Topographical layout of Erin de Vigne farm showing rivers and wetlands (CapeFarmMapper, 2022)

4 Proposed scheme

The project is proposed to include the following developments.

4.1 Dam 1

- Construction of a new dam located directly downstream of existing dam 1 with a storage capacity of 2000 m^3. The dam will have a 4.9 m wall height and a total footprint area of 0.15 ha.
- Excavation of a new open channel spillway on the embankment left flank.

4.2 Dam 2

- Construction of the enlarged 67 000 m^3 storage capacity Dam 2 with a new core and cut-off trench. The dam will have a 4.2 m wall height and a total footprint area of 2.5 ha.
- Proposed 250 mm dia HDPE outlet pipe Class PE100 PN10.
- Proposed 315 mm dia HDPE overflow spillway pipe.

The Erin de Vigne scheme is shown in **Figure 4-1.**

Figure 4-1: Scheme Layout of the farm

5 Geotechnical

5.1 Regional geology

According to the regional geology map (3319 WORCESTER, 1:250 000 series, RSA, 1973), the dam sites are underlain by shale and arenaceous shale (C2S3). Refer to **Figure 5-1** below.

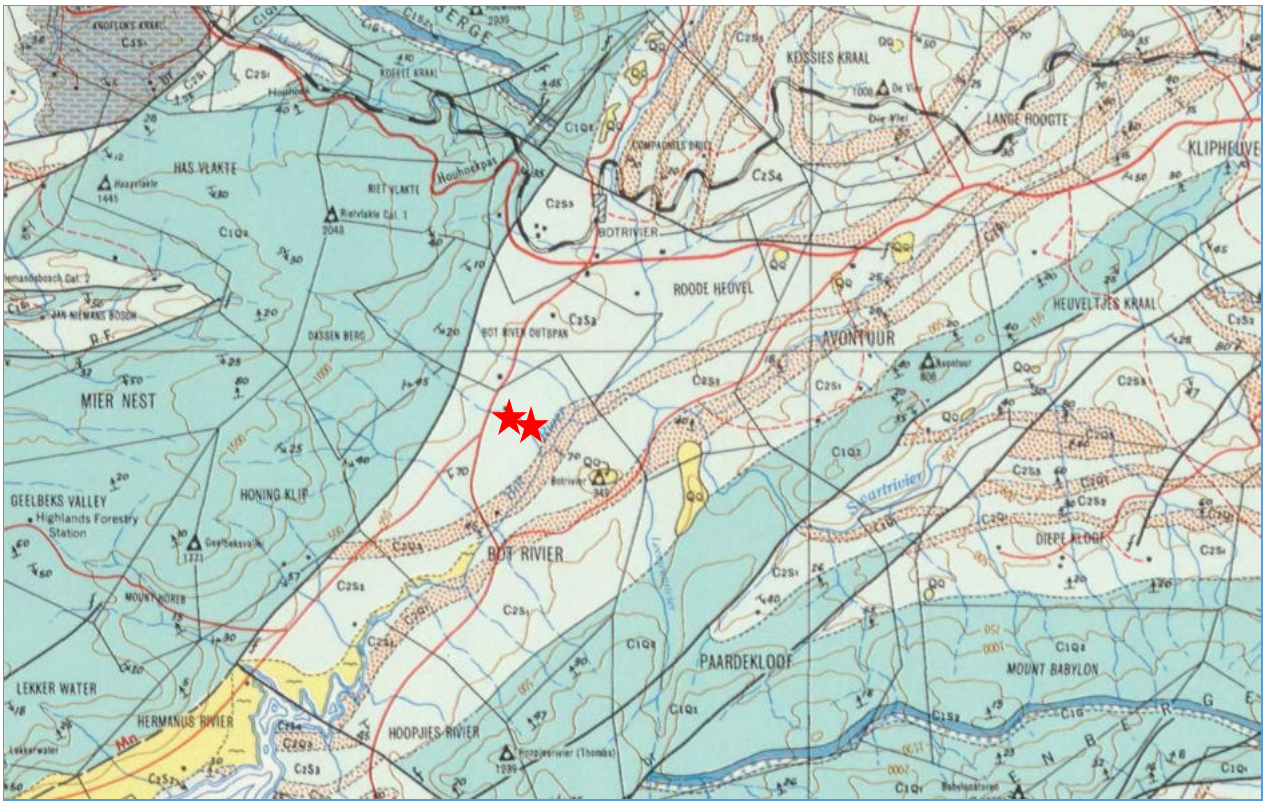

Figure 5-1: Regional geology at Erin de Vigne farm (dam sites indicated by the red asterisk)

5.2 Foundation and construction materials

No test pitting was done at the proposed dam sites. The existing dams were constructed with the in-situ clayey material available from their basins and founded on the shale foundation. The proposed enlargements will be done similarly. The dams will have an upstream core with cut-off trench, estimated to be around 4.0 m deep.

6 Dam Options

Both existing dams were surveyed by Geomatics Africa and the surveys were used by DJ Hagen & Associates to determine the existing storage capacities of the respective dams and to complete conceptual designs for possible raising and/or enlargements.

6.1 Dam Optimization (Dam 1)

Five enlarged dam options were investigated for the existing dam 1 with storage capacities ranging from between 19 500 m^3 to 45 000 m^3.

Refer to **Figure 6-1** for the options that were considered at Dam 1.

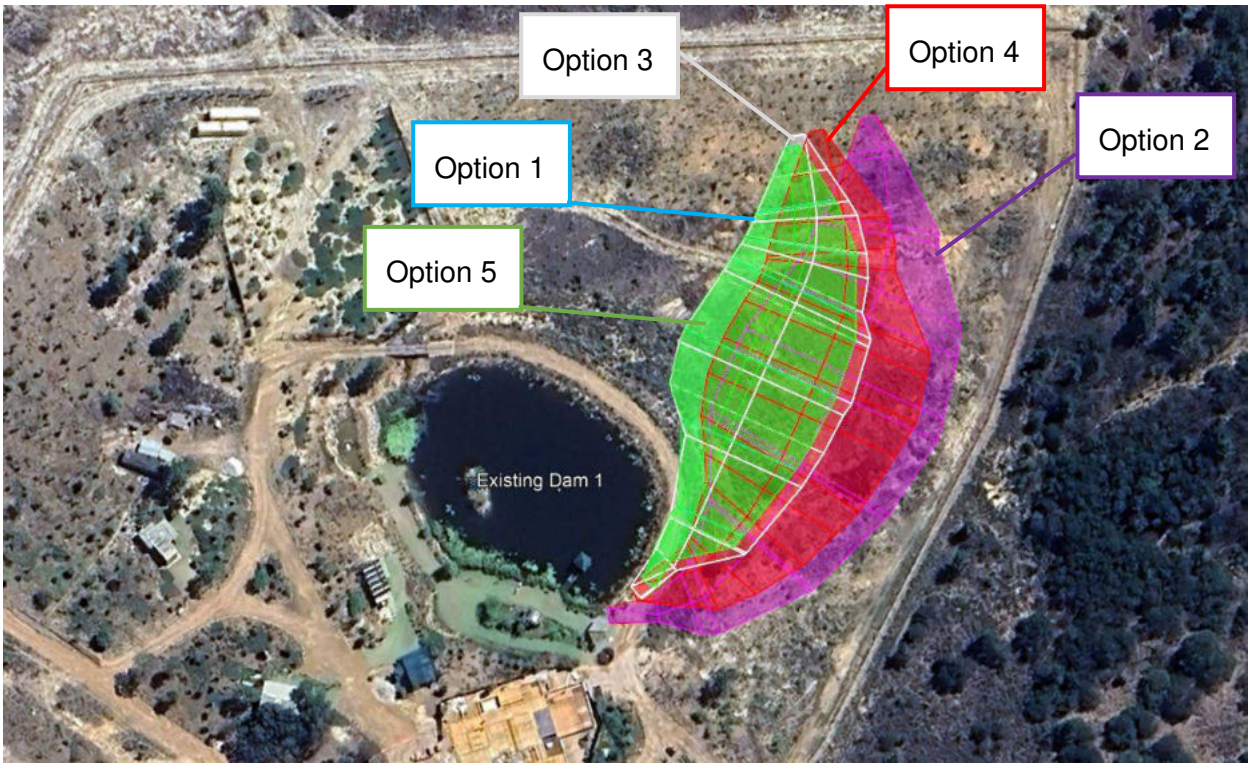

Figure 6-1: Dam Enlargement Options for existing Dam 1

Critically endangered micro frogs were found in the existing dam as reported in the faunal assessment report. Therefore, the possibility to enlarge the existing dam can no longer be considered. The construction of a new dam, located directly downstream of the existing dam with a storage capacity of only 2000 m^3 and a maximum wall height of 4.9 m was considered to meet the requirements for an Environmental Impact & Basic Assessment Process. Refer to **Figure 6-1** for the proposed dam option 6.

Figure 6-2: Erin de Vigne Dam 1 - Proposed dam (Option 6)

Refer to **Table 6-1** below for the proposed dam statistics.

Table 6-1: Proposed dam statistics

Dam options	Storage capacity (m^3)	Freeb-oard (m)	Wall height (m)	Embankment crest length (m)	Surface area at FSL (ha)	Total earth fill (m^3)	Water/ wall ratio	R/m^3 storage
Option 6	2 000	0.5	4.9	62	0.07	2 640	0.8	397

The water/wall ratio represents the volume of water gained per volume of fill required to construct the dam embankment. The water/wall ratio of Option 6 is only 0.8. However, option 6 is the only alternative to avoid the disturbance of the endangered micro frogs, without having to alter the existing Dam 1.

6.2 Dam Optimization (Dam 2)

Three enlarged dam options were investigated for the existing dam 2 with option 1 being a downstream raising while option 2 & 3 are central raisings that can accommodate new upstream core cut-off trench. The dam will also be enlarged towards the east for better cut/fill balance.

Refer to **Figure 6-3** for the options that was considered for Dam 2.

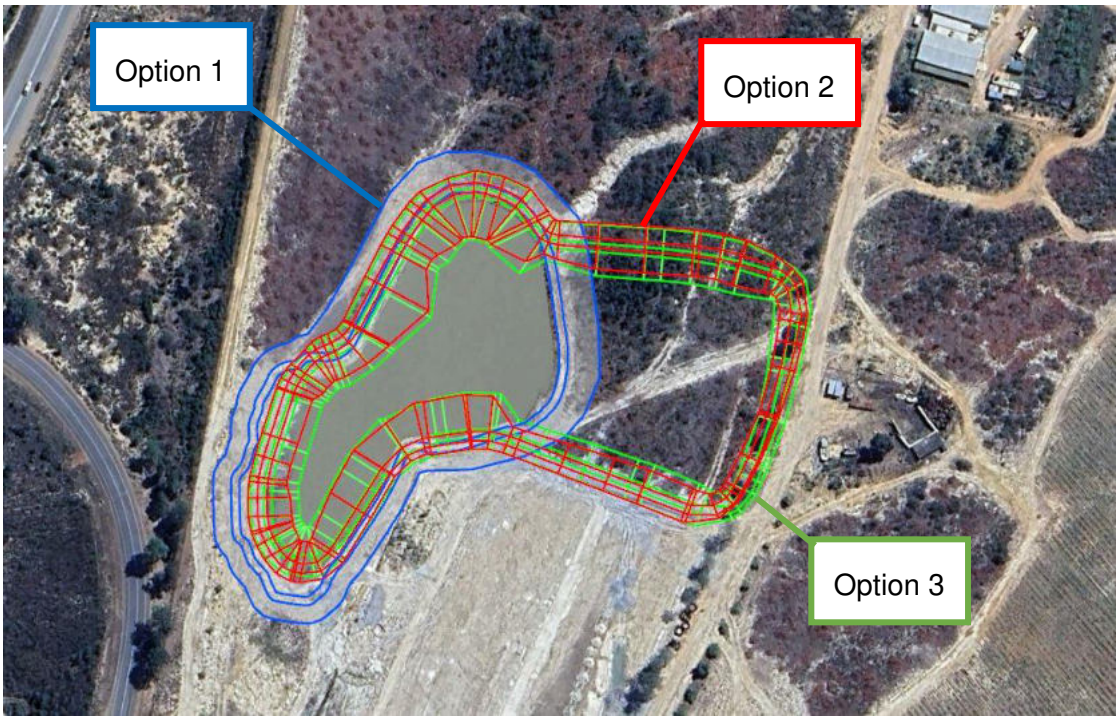

Figure 6-3: Dam enlargement options for existing Dam 2

The downstream raising option 1 was done without a proper survey of the area around the dam. For the detail design of this dam, it is recommended that Geomatics Africa do an extended survey of the area outside the dam, around the perimeter.

Refer to **Table 6-2** below for the option statistics for the enlargement of Dam 2.

Table 6-2: Dam Options

Dam options	Storage capacity (m^3)	Freeboard (m)	Wall height (m)	Embankment crest length (m)	Surface area at FSL (ha)	Total earthfill (m^3)	Water/wall ratio	R/m^3 storage
Option 1	50 000	1.0	4.5	500	1.1	18 700	1.34	82.78
Option 2	50 000	1.0	3.7	655	1.68	28 700	0.87	53.68
Option 3	67 000	1.0	4.2	647	1.64	36 700	1.14	47.40

Option 1 has the best water/wall ratio of 1.34 compared to the other two options. Keep in mind that option 1 was completed without a detailed survey of the area downstream of the existing dam. Option 3 has a water/wall ratio of 1.14 and a rand per cubic meter of storage nearly half of that of option 1 due to the larger achieved storage capacity and a larger basin area for borrowing of material. Option 3 is therefore the most feasible option.

7 Legal requirements

7.1 Environmental Authorization

The development described in this report do include listed activities and therefore require a BAR Environmental Authorization process.

7.2 Water Use License

An application for Section 21 (b) water use will be required. Paul Slabbert from PHS Consulting will embark on the process.

7.3 Dam safety

Due to the wall heights of both proposed enlarged dams being less than 5 m, the dams are not considered a dam with a safety risk and therefore, the dam safety regulations would not be triggered.

8 Project cost estimate

A provisional cost for the project 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. Construction of a new small dam	0.5
1.2. Enlargement of Erin de Vigne Dam 2	3.2
1.3. Pump station	0.3
2. Professional costs	
2.1. Engineering	0.3
2.2. Authorisation processes	0.1
Total	**4.4**

Yours faithfully

DJ Hagen & Associates

A Mohamed
Pr Tech Eng

References

CapeFarmMapper, 2022. Viewed Sept 2022, 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.

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

Corner Mountain Mill Drive & East Lake Way, Worcester 6850, Private Bag X3055 Worcester 6850

Jan van Staden
(023) 346 8000
C01300000000078100003

Erin de Vigne (Pty) Ltd
PO Box 806
Milnerton
7435

seashore@hermanus.co.za

Dear Water User

APPLICATION FOR THE VERIFICATION OF EXISTING LAWFUL WATER USE IN TERMS OF THE NATIONAL WATER ACT, 1998 (ACT 36 OF 1998): CONFIRMATION OF EXISTING LAWFUL WATER USE IN TERMS OF SECTION 35(4)

PROPERTY DESCRIPTION: C01300000000078100003, 3/781, 68.87ha

You are hereby informed that the lawfulness and extent of your water use on the above-mentioned property has been determined by the responsible authority, as delegated by the Minister of Water and Sanitation, in terms of Section 35(4) of the National Water Act, 1998 (Act 36 of 1998) (NWA) as follows:

Section of NWA	Type of Water Use	Existing Lawful Water Use		
		Volume (m^3/annum)*	Source	Irrigation Board or Water User Association Scheme
21(a)	Taking of water for irrigation purposes	130 000	Surface water	
21(b)	Storage of water	25 000		

* In the case of **Storage of water**, the Existing Lawful Water Use is in m^3

In terms of Section 35(4) of the NWA, this determination is also the extent of the Existing Lawful Water Use as contemplated in Section 32(1) for this property, which may be continued with under Section 34(1) subject to any existing conditions or obligations related to the water use.

Reliability of Water Resource: DRY DURING CERTAIN SEASONS

Water Use Sector

Sector: AGRICULTURE: IRRIGATION
AR Division: RAW WATER
Billing Frequency: BI-ANNUALLY
RPF (Resource Poor Farmer) Subsidy Related: No
Quaternary Drainage Region: G40G

Registered Volume(s):

Start Date	*Volume (m^3)*	*Time Interval*	*Transmission Losses %*
2003/04/01	130000	PER YEAR	

Estimated Water Abstraction Pattern is:

Method(s) of Abstraction:

District Municipality

District Municipality: OVERBERG DISTRICT MUNICIPALITY

Office Use

Part 2 Submission Date:

Existing Authorisation

Existing Permit Information:

Permit Number	*Permit Date*

Does water use take place in terms of General Authorisation? No

If an Authorisation has Been Issued Under Other Legislation:

Irrigated Field and Crop Information

Crop Details:

Field Number	*Crop*	*Area*	*Planting Date (mm/dd)*	*Growing season (days)*	*Rotation factor %*	*Irrigation system*
1	FESCUE-GRAZING	14	12/30		100%	SPRINKLER: PERMANENT

Description of any irrigation scheduling methods used:

Describe any other methods to

No water use in excess of the Existing Lawful Water Use as set out herein may be used on this property without authorisation by the responsible authority.

In terms of Section 148(1)(e) of the NWA, you may appeal against any decision on the verification of these water use(s) to the Water Tribunal within 30 (thirty) days from the date of this letter. The Registrar of the Water Tribunal is Mr. Luyanda Xuba, and his contact details are:

Postal Address	**Contact**
The Registrar	Tel: 012 336 8186
Water Tribunal	
Private Bag X316	Email: XubaL@dws.gov.za
Pretoria	
0001	

A copy of the appeal must be submitted to this office.

Your water use registration will be amended to reflect the above details. A new registration certificate will then be issued to you. If an appeal is lodged, your registration certificate may be amended again depending on the outcome of the appeal.

Yours faithfully,

JAN VAN STADEN
CHIEF EXECUTIVE OFFICER (ACTING)

Date: 05 August 2024

DJ HAGEN & ASSOCIATES
DAM ENGINEERING SPECIALISTS
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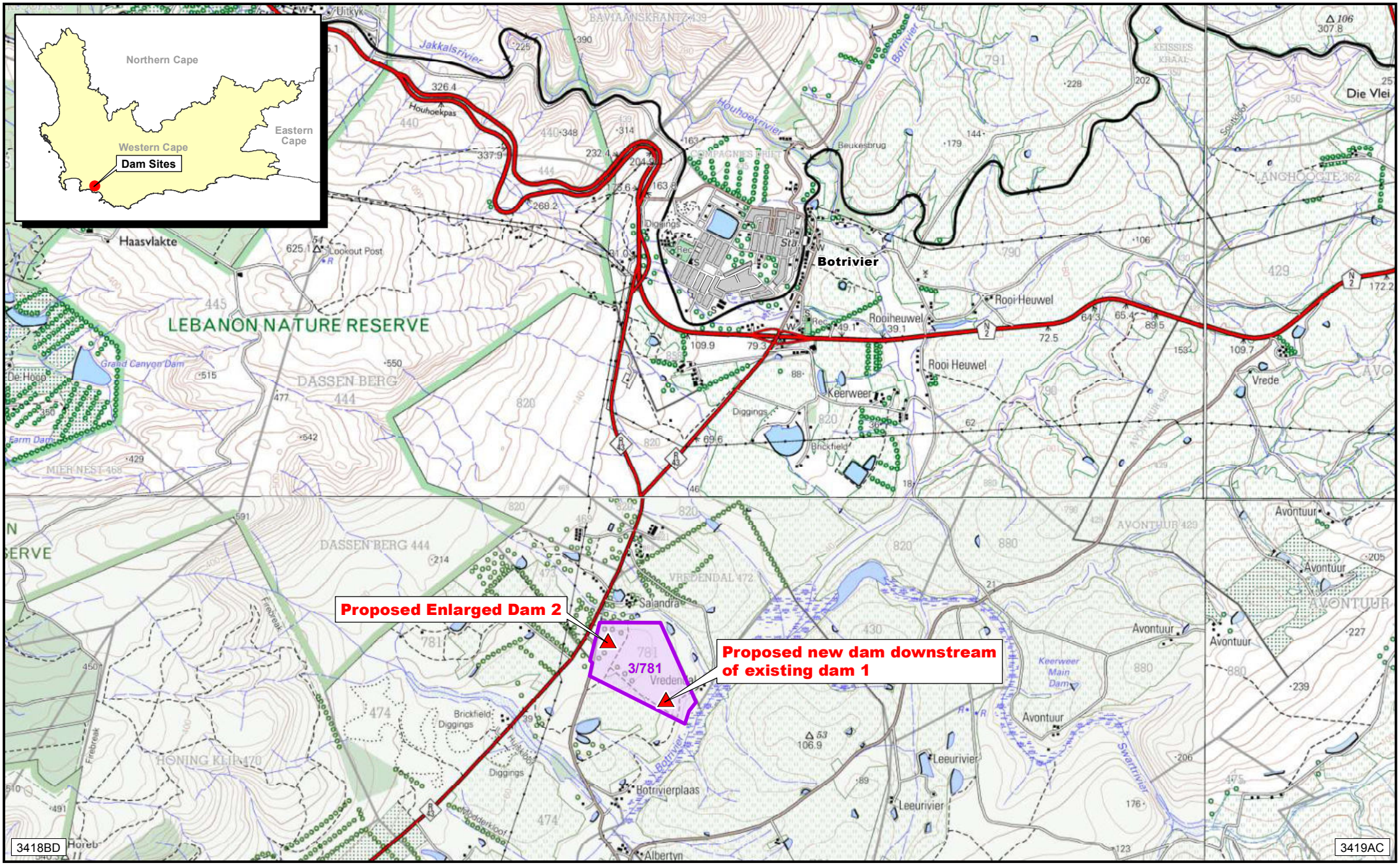
Erin de Vigne Options

	DAM 1						DAM 2		
	Option 1	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**	**Option 1**	**Option 2**	**Option 3**
Proposed NOC (m)	75	75,5	75,5	75,5	75	67	99	98,2	99
Proposed FSL (m)	74,5	75	75	75	74,5	66,5	98	97,2	98
Freeboard	**0,5**	**0,5**	**0,5**	**0,5**	**0,5**	**0,5**	**1**	**1**	**1**
Existing Dam Capacity at FSL	6000	6000	6000	6000	6000	0	25000	25000	25000
Maximum wall height (m)	10,0	13,5	11,0	12,5	10,0	4,9	4,5	3,7	4,2
Proposed Wall crest width (m)	3,5	3,5	3,5	3,5	3,5	3,5	3,5	4	3,5
DS Dam wall Slope	1V:2H	1V:2H	1V:2H	1V:2H	1V:2H	1V:2H	1V:2H	1V:2H	1V:2H
US Dam wall Slope	1V:3H	1V:3H	1V:3H	1V:3H	1V:3H	1V:3H	1V:3H	1V:3H	1V:2,7H
New Wall Fill above NGL (m^3)	9 000	21 000	11 500	15 000	9 000	1 440	7 500	14 300	22 300
Wall length (m)	114	148	120	130	114	62	500	655	647
Crest length/height	11	11	11	10	11	13	111	177	154
Capacity without cut from basin (m^3)	13 000	24 000	16 500	20 000	9 000	560	17 500	35 700	44 700
Water surface area at FSL (m^2)	6 840	9 650	7 600	8 700	6 840	650	11 000	16 815	16 380
Water surface area at FSL (ha)	0,68	0,97	0,76	0,87	0,68	0,07	1,10	1,68	1,64
Basin area (m^2)	6 000	8 000	7 000	7 400	3 000	500	8 000	12 760	11 400
Estimated excavation depth (m)	1,5	2,6	1,6	2,0	3,0	2,9	0,9	1,1	2,0
% earthfill from dam basin	100%	100%	100%	100%	50%	100%	100%	100%	100%
Additional Capacity (m^3)	22 000	45 000	28 000	35 000	13 500	2 000	25 000	25 000	42 000
Total Capacity (m^3) - Rounded	**22 000**	**45 000**	**28 000**	**35 000**	**19 500**	**2 000**	**50 000**	**50 000**	**67 000**
Estimated average core trench width (m)	4,1	4,4	4,2	4,3	4,1	3,6	4,4	4,3	4,4
Estimated average core trench depth (m)	4,0	4,0	4,0	4,0	4,0	3,0	3,0	3,0	3,0
Estimated core trench volume (m3)	3 700	5 000	3 900	4 300	3 700	1 200	11 200	14 400	14 400
Total earthfill (m3)	**12 700**	**26 000**	**15 400**	**19 300**	**12 700**	**2 640**	**18 700**	**28 700**	**36 700**
Wall Water Ratio (m^3)	**1,73**	**1,73**	**1,82**	**1,81**	**1,06**	**0,76**	**1,34**	**0,87**	**1,14**
Minimum basin level (m)	69,50	68,00	69,50	68,50	69,50	64,40	89,50	89,50	89,50
Minimum downstream level (m)	65,00	62,00	64,50	63,00	65,00	62,10	94,50	94,50	94,80
Maximum Storage depth (m)	5,0	7,0	5,5	6,5	5,0	2,1	8,5	7,7	8,5
P&G'S	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**	**R 300 000,00**
Earthworks Cost (without diesel)	**R 444 500,00**	**R 910 000,00**	**R 539 000,00**	**R 675 500,00**	**R 444 500,00**	**R 92 400,00**	**R 654 500,00**	**R 1 004 500,00**	**R 1 284 500,00**
Dry Rate (R/m)	R 35,00	R 35,00	R 35,00	R 35,00	R 35,00	R 35,00	R 35,00	R 35,00	R 35,00
Diesel consumption per m3 (liter)	R 0,90	R 0,90	R 0,90	R 0,90	R 0,90	R 0,90	R 0,90	R 0,90	R 0,90
Diesel Rate (R/liter)	R 19,82	R 19,82	R 19,82	R 19,82	R 19,82	R 19,82	R 19,82	R 19,82	R 19,82
Diesel Cost	**R 226 542,60**	**R 463 788,00**	**R 274 705,20**	**R 344 273,40**	**R 226 542,60**	**R 47 092,32**	**R 333 570,60**	**R 511 950,60**	**R 654 654,60**
Outlet works (Single pipe with specials - estimate)	**R 500 000,00**	**R 500 000,00**	**R 500 000,00**	**R 500 000,00**	**R 500 000,00**	**R -**	**R 500 000,00**	**R 500 000,00**	**R 500 000,00**
Total construction cost (excl. VAT)	**R 1 471 042,60**	**R 2 173 788,00**	**R 1 613 705,20**	**R 1 819 773,40**	**R 1 471 042,60**	**R 439 492,32**	**R 1 788 070,60**	**R 2 316 450,60**	**R 2 739 154,60**
15% contingencies	R 220 656,39	R 326 068,20	R 242 055,78	R 272 966,01	R 220 656,39	R 65 923,85	R 268 210,59	R 347 467,59	R 410 873,19
Professional fees									
BAR en water license application									
Project cost (excl. VAT)	**R 1 691 698,99**	**R 2 499 856,20**	**R 1 855 760,98**	**R 2 092 739,41**	**R 1 691 698,99**	**R 505 416,17**	**R 2 056 281,19**	**R 2 663 918,19**	**R 3 150 027,79**
R/m3 fill	R 133,20	R 96,15	R 120,50	R 108,43	R 133,20	R 191,45	R 109,96	R 92,82	R 85,83
R/m3 storage	R 76,90	R 55,55	R 66,28	R 59,79	R 125,31	R 252,71	R 82,25	R 106,56	R 75,00

Appendix B

Drawings



DJ HAGEN & ASSOCIATES **Erin de Vigne (Pty) Ltd**	**Erin de Vigne Farm Dams**	1 0.5 0 1 Km 1:50 000 N	A4
	Locality Map	DJH239\09 GIS\mxd\01_LocalityMap.mxd	Drawing No. **DJH239 - 01**

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