APPENDIX 4B

SITE PHOTOS

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

SITE PHOTOS OF PROPOSED PIGGERY

Map where photos were taken:

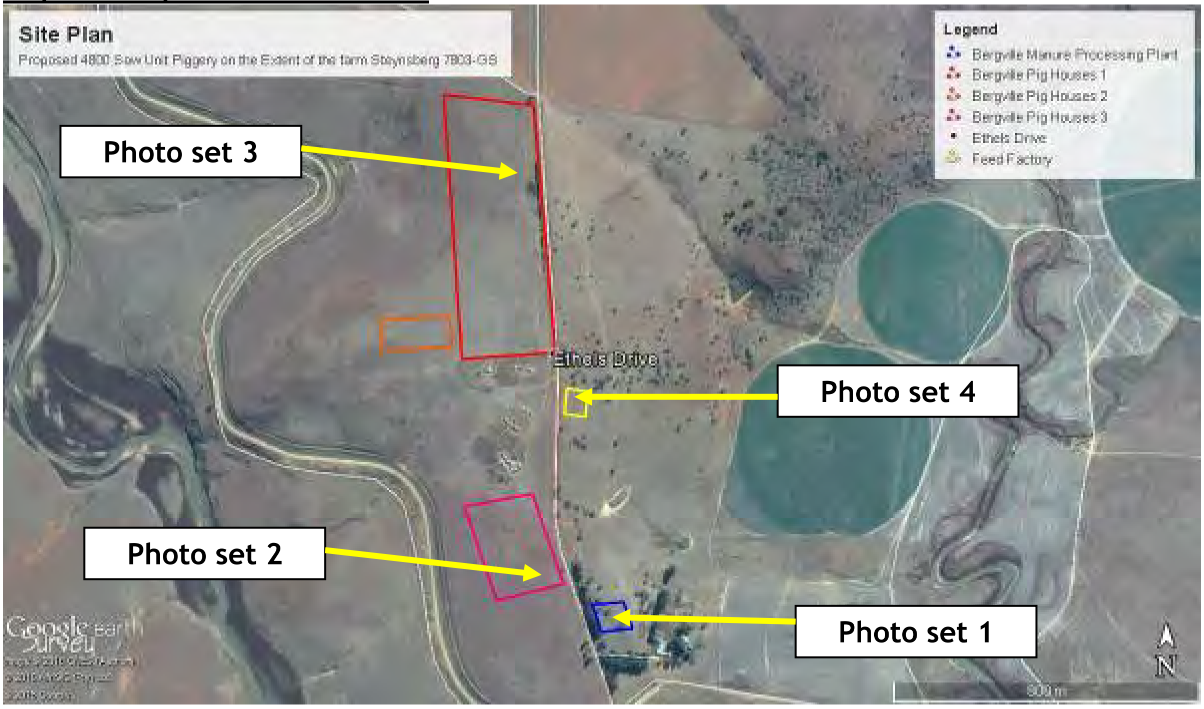


Photo set 1:

View to the Northeast

View to the East

View to the Southeast

View to the South

View to the Southwest

View to the West

View to the Northwest

Photo set 2:

View to the North


View to the Northeast


View to the East


View to the Southeast


View to the South


View to the Southwest


View to the West

View to the Northwest

Photo set 3:

View to the North

View to the Northeast

View to the East

View to the Southeast

View to the South

View to the Southwest

View to the West

View to the Northwest

Photo set 4:

View to the North


View to the Northeast


View to the East


View to the Southeast


View to the South

View to the Southwest

View to the West

View to the Northwest

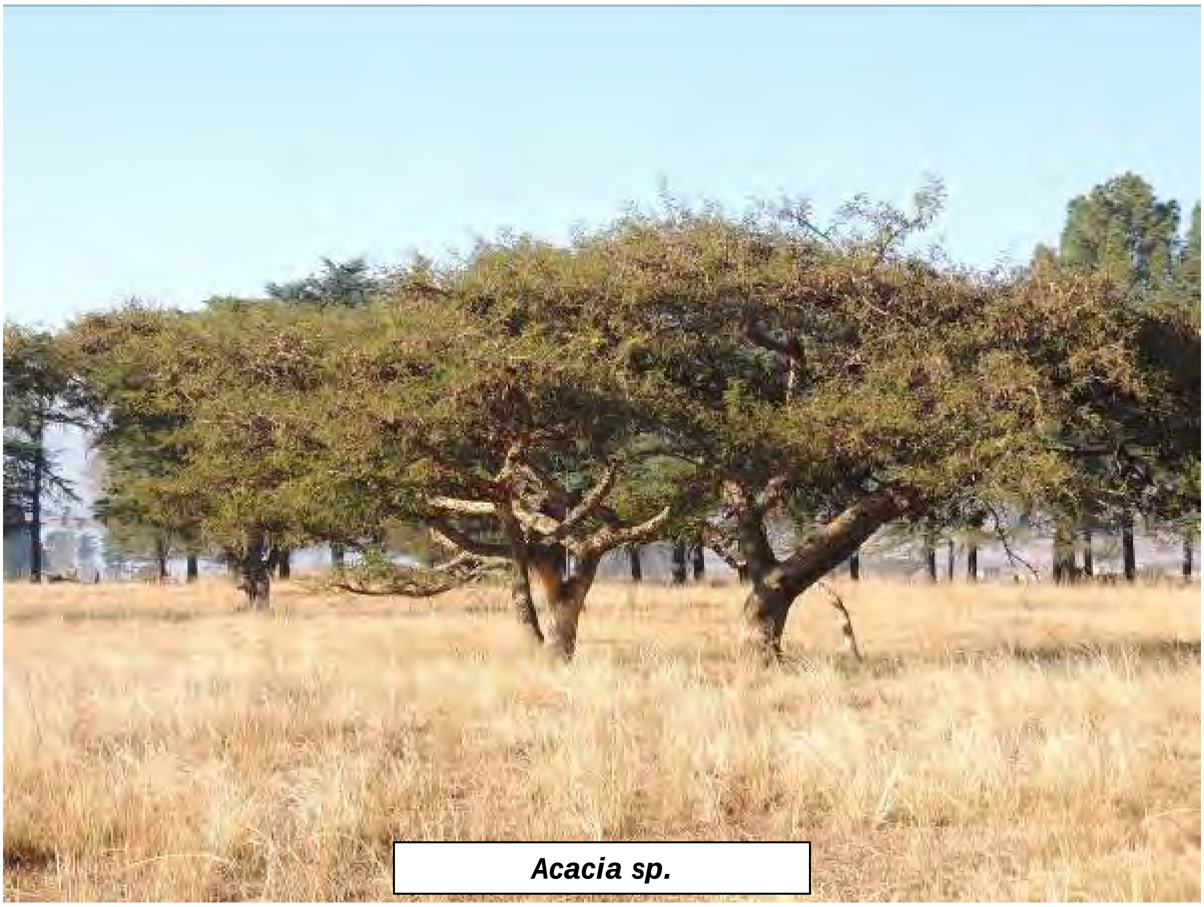
Exiting Structures and Tall Vegetation:

Access road

Farm structures

Farm house

Pipeline



Acacia sp.

Pinus sp.

Melia azedarach

Acacia mellifera

Powerlines

APPENDIX 5A

BACKGROUND INFORMATION DOCUMENT

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

ROCK ENVIRONMENTAL CONSULTING (PTY) LTD

BACKGROUND INFORMATION DOCUMENT

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL

THIS BACKGROUND INFORMATION DOCUMENT SERVES TO INFORM THE PUBLIC OF THE APPLICATION LODGED IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT 107 OF 1998 (NEMA) AS AMENDED.

APPLICANT:	**ENVIRONMENTAL CONSULTANT:**
Steynsburg Pork and Abattoir (Pty) Ltd.	ROCK ENVIRONMENTAL CONSULTING (PTY) LTD
Mr Joos Solms	Mr. Rowan van Tonder/
PO Box 280	Mr Pieter van der Merwe
Winterton	P.O. BOX 40541
3340	MORELETA PARK
Tel: 082 561 1218	0044
E-Mail: plantkor@plantkor.co.za	Tel: (012) 997 4742 Fax: (012) 997 0415
	E-mail: rock.rowan@lantic.net

13 JUNE 2016

1. PURPOSE OF THIS BACKGROUND INFORMATION DOCUMENT

The purpose of this document is to:

- Notify the identified Interested and Affected Parties (I&APs) of the Environmental Impact Assessment (EIA) Regulations in accordance with stipulations made in Government Notice R. 982 of 4 December 2014 published in terms of chapter 6 of the National Environmental Management Act (Act No. 107 of 1998) as amended.
- Present stakeholders with an overview of the perceived environmental, biophysical and social impacts of the proposed development.
- Provide I&APs with a Locality Map (Appendix 1) indicating the proposed development.
- Obtain issues and concerns from the I&APs regarding the environmental assessment process and proposed development, which will be addressed for the planning, construction and operational phases of the proposed development.
-

2. INTRODUCTION AND STATEMENT OF INDEPENDENCE

2.1 INTRODUCTION

Rock Environmental Consulting (Pty) Ltd was appointed by Mr. Joos Solms of Steynsburg Pork and Abattoir (Pty) Ltd., for the Environmental Impact Assessment and application process in terms of the National Environmental Management Act (Act 107 0f 1998), pertaining to the proposed 4800 sow unit piggery to be established 21 km northwest of Bergville, KwaZulu-Natal.

The public participation process aims to provide an opportunity for I&APs to comment on the proposed activity, such that relevant information exchanges will enable the EIA process to focus the study on reasonable and relevant issues, predominantly relating to environmental impacts that the proposed activity may have. The Environmental Impact Assessment Report to be compiled by Rock Environmental Consulting (Pty) Ltd (REC) will focus on the possible issues and impacts associated with the proposed development, and where negative impacts are identified, recommendations will be made to mitigate such impacts.

REC and its environmental assessment practitioners have no connection with the applicant. REC is not a subsidiary, legally or financially of the applicant. Remuneration for services pertaining to this assessment and application is not linked to approval by decision-making authorities responsible for authorizing the proposed activities. REC and its environmental assessment practitioners have no interest in secondary or downstream developments as a result of the authorisation of the proposed activities.

3. KEY LEGISLATION APPLICABLE TO THIS NOTICE

3.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT 108 OF 1998 AS AMENDED

Listed activity triggered in the 2014 NEMA regulations:

R. 983, 4 DECEMBER 2014- Basic assessment Activities	
Activity No	**Listed Activity Description:**
4	The development and related operation of facilities or infrastructure for the concentration of animals for the for the purpose of commercial production in densities that exceed: iii) 8 square metres per small stock unit and; a) More than 1000 units per facility excluding pigs where b will apply; b) More than 250 pigs per facility excluding piglets that is not yet weaned.
27	The clearance of an area of 1 ha or more but less than 20 ha of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for – i) the undertaking of a linear activity; or ii) maintenance purposes undertaken in accordance with a maintenance management plan.

3.2 NATIONAL WATER ACT 36 OF 1998

Notice is also herewith given in terms of section 21 of the National Water Act, 1998 (Act 36 of 1998) with regards to the application for a Water Use License and/or Registration of the water use activities associated with the proposed development, which includes:

- Section 21(a): taking water from a water resource;
- Section 21(b): storing water;
- Section 21(c): impeding or diverting the flow of water in a watercourse;
- Section 21(e): engaging in a controlled activity (irrigation);
- Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(i): altering the bed, banks course or characteristics of a watercourse

4. PROJECT INFORMATION

4.1 PROPOSED ACTIVITY

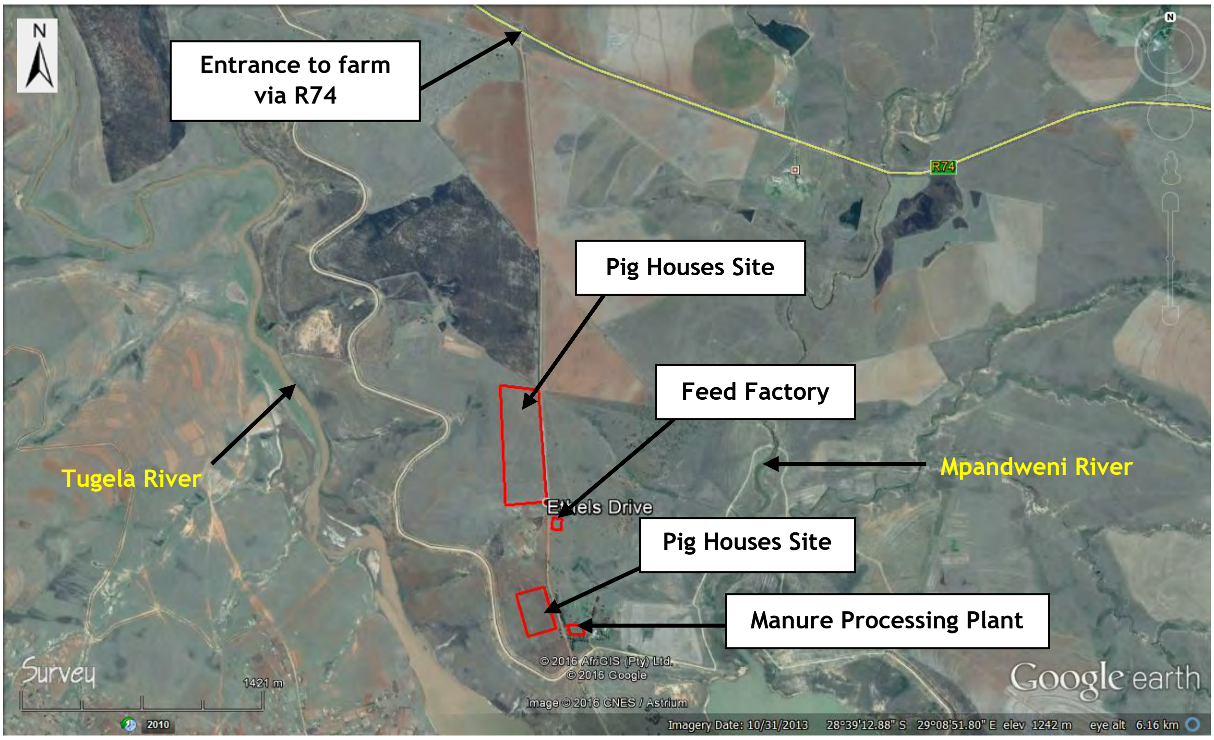
Proposed 4800 sow unit piggery to be established 21 km northwest of Bergville on the Remaining Extent of the farm Steynsburg 7803-GS, KwaZulu-Natal.

4.2 BASIC PROJECT DESCRIPTION

The project will consist of a pig housing complex on sites 1, 2 & 3 plus the manure processing facility and the feed factory. The different piggery complex components and taking into account that the construction footprint is usually somewhat more than it is predicted, the site will cover an area of 15.6 ha. Site 1 will cover in the order of 4 ha; site 2 will cover an area of 1.7 ha; site 3 will cover 7.7 ha; the feed factory and the manure processing plant will cover an area of 3.3 ha.

4.3 LOCALITY

From Bergville BP filling station, in a westerly direction, on the R74, the turnoff to the farm is about 24.5 km on your left hand side. The detailed locality plan is presented in Appendix 1 of this notice.



4.4 CONSIDERATION OF ALTERNATIVE SITES

The only feasible alternatives that can be considered at this stage is for the location and layout. Technology wise, only the most current state of the art technology in the pig industry will be used.

5. ENVIRONMENTAL STUDY PROCESS

The Environmental Impact Assessment process consists of two main components, namely (i) the technical/biophysical process and (ii) the public participation process.

The technical process includes, but is not limited to, the following aspects:

- Terrain assessment & detail technical project assessment;
- Pre-application meeting with the KZN Department of Agriculture Environmental Affairs and Rural Development;
- Specialist studies in terms of vegetation, animal (faunal) life and heritage impact assessment;
- Descriptions and considerations of alternatives;
- Environmental description of the proposed development terrain;
- Assessment and evaluation of potential environmental impacts;
- Public Participation Process (Refer to below);
- Integrate and address comments through a comment and response report;
- Conduct specialist studies where relevant and include in the reporting;
- Compile the draft Basic Assessment Report for comments to Interested and Affected Parties;
- Compile the final Basic Assessment Report for submission to KZN Department of Agriculture Environmental Affairs and Rural Development; and
- Compile the relevant Environmental Management Program.

The public participation process includes:

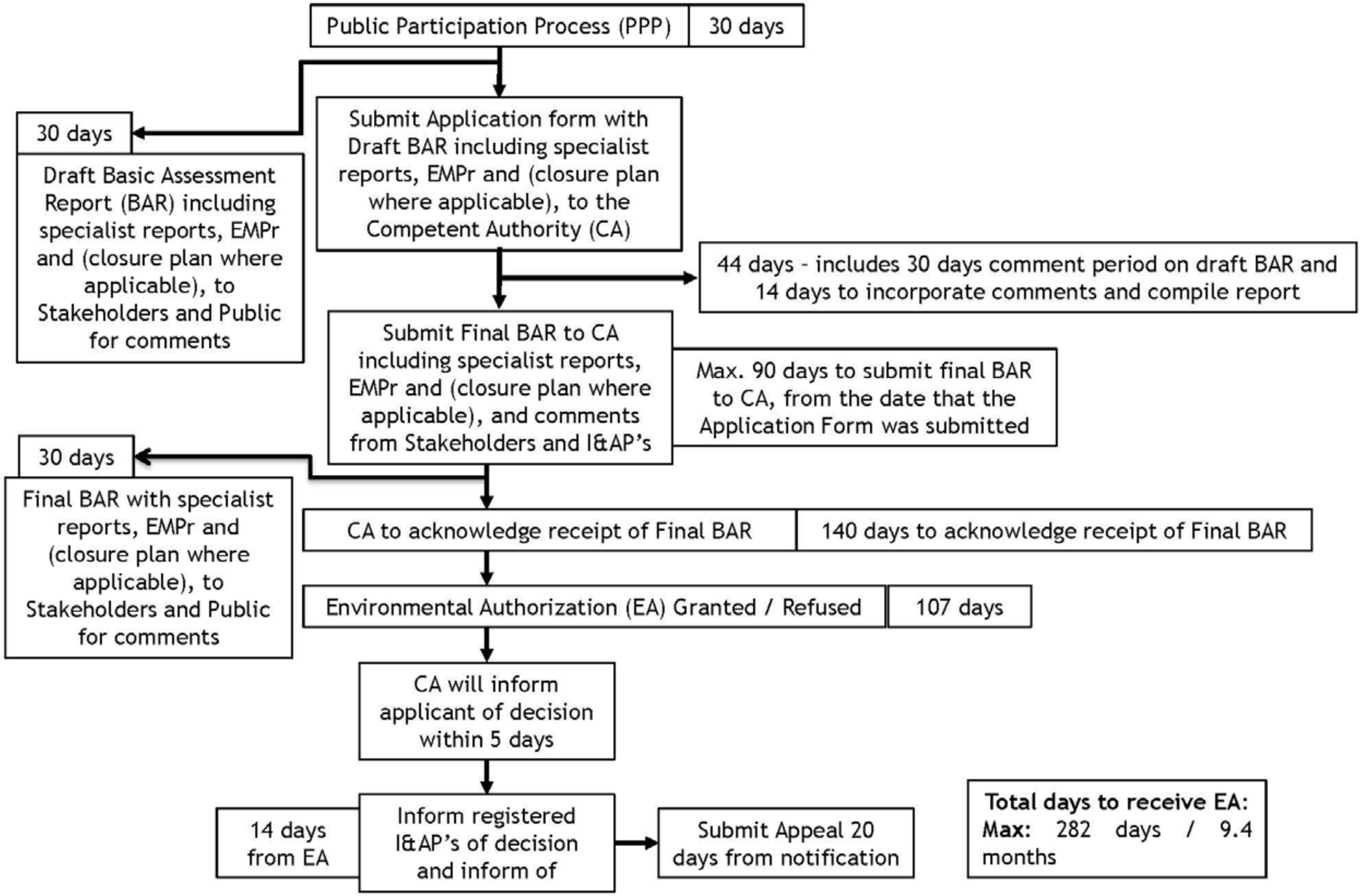
- Compile and distribute a Background Information Document (BID) to adjacent landowners and the local authority and other key identified Interested and Affected Parties (I&AP's);
- Advertisement in local or regional newspaper and provide a BID to any entity which register as such;
- Placement of a site notice and providing photographic proof thereof;
- Personal and telephonic interviews with possible additional I&AP's if necessary;

- Conduct an open day with interested and affected parties and view the project details at a central venue. If there are limited I&AP registration and limited comments or objections received a public open day will not be held;
- Reporting on issues and concerns in the form of any comments and response report is required in the Regulations; and
- Arrange a feedback opportunity on the report contents to I&AP's by making the Draft Basic Assessment Report available for comments.

The public participation process is conducted in parallel with the Environmental Impact Assessment process (technical/biophysical process). The public participation process does not aim to promote agreement amongst I&APs or quell possible opposition against a project. The process is made open and transparent to all those involved. Additionally, it is considered important to involve I&APs as early in the Environmental Impact Assessment process as possible, to ensure informed decision-making and effective participation throughout the study.

The Environmental Impact Assessment Process contains the following steps (Basic Assessment):

The Basic Assessment Process and time frames



6. PRELIMINARY ENVIRONMENTAL RELATED ISSUES IDENTIFIED

The following steps are identified on a preliminary basis:

- Dust generation from construction during construction phase.
- Possible hazardous (Diesel, oil) fluids being spilled during construction phase.
- Removal of vegetation (natural and alien).
- Traffic Safety during construction phase.

7. COMMENTS / OBJECTIONS

Kindly submit the attached Registration and Comment Sheet, to register as an Interested and Affected Party, with possible issues and concerns relating to the proposed development, as well as any additional I&APs that you would like to be involved in the process, to the **Environmental Consultant** (refer to the contact details given above).

The Registration and Comment Sheet should reach us no later than 30 days (excluding public holidays) from the date of this BID.

8. PUBLIC OPEN DAY

A PUBLIC OPEN DAY WILL BE HELD ON 24 JUNE 2016:

- AT: BINGELELA RESTAURANT B & B
- TIME: 10:00 TO 19:00
- WEBSITE FOR DIRECTIONS TO VENUE: http://www.bingelela.co.za/map-directions/

We thank you for your interest and for taking the time to read through this document.

REGISTRATION AND COMMENT SHEET:

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

Please complete and return as soon as possible, but no later than 18 July 2016 to:

Mr. Rowan van Tonder, PO Box 40541, Moreleta Park, 0044

Tel: (012) 997 4742 Fax: (012) 997 0415 e-mail: rock.rowan@lantic.net

---

Title___________Initials__________Surname______________________________

Organisation/Firm/Position/Nature of Involvement in the project e.g. property owner:

____

Street / Physical Address:

____

Postal address:

____

Postal Code: __________________

Telephone Work: __________________ Telephone Home:___________________

Cell phone: __________________ Fax: ___________________

E-mail: __________________

COMMENTS:

It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary concerns faced by you/ your community/ your organisation with regards to the proposed development?

____

____

____

____

____

2. Are you in favour of or against the proposed project? Please provide a reason for your answer.

Thank you for your participation

Appendix 1: Locality Maps

NEXT PAGE


N
Sterkfontein Dam
Kilburn Dam
R74
Bergville Piggery
Proposed Piggery Site:
GPS Coordinates:
-28.658883˚ S
29.142586˚ E
Mkukwini
R74
R616
R616
Bergville
Spioenkop Dam
Woodstock Dam
Lesotho
Survey
12.5 km
Image © 2016 CNES / Astrium
Image © 2016 DigitalGlobe
© 2016 Google
© 2016 AfriGIS (Pty) Ltd.
Google earth
Imagery Date: 11/20/2015 lat -28.661888° lon 29.185624° elev 1246 m eye alt 53.85 km

APPENDIX 5B

ACKNOWLEDGEMENT OF RECEIPT OF THE BACKGROUND INFORMATION DOCUMENT

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

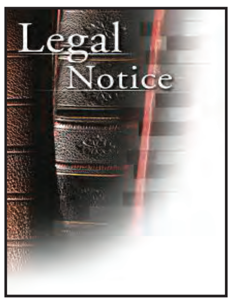
PROOF OF RECEIPT-BID: 13 June 2016

DATE	I&AP'S NAME / DESIGNATION / ORGANISATION	ADDRESS	TEL. / CELL NO.	FAX. NO.	EMAIL ADDRESS	SIGNATURE
14/6/16	Andre Olwagen.	ATKV Drakensville.	082341 2289.		andreo@ atkv.org.za.	
14/6/16	MP Bodenhorst	Natalheim Plaas	0364386704 0824533783	0364386704	admin@natalheim.co.za	pp.
14/6.	Eleanor Page	Amphitheatre Backpackers Lodge	076822 7508.	086574 3963	amphibackpackers @worldonline. co.za.	
14/6.	Sharon v Reenen.	Cameeldrai	083290 2266.			
14/6	Prince Mabizela (Worker)	Maroxdweni Trust Bergville	—	086 6629900 —	admin@vanreenenfarm.co.za —	X Prince
14/6.	Encl. E-T Ngebenya	P Bag 567. Bergville	073621 5050	—		
15/06	Cllr M.P. Vilakazi	P.O. Box 71 B/Ville	0849665705 0749097753	N/A	mxolisip.vilakazi@ gmail.com	M.P. Vilakazi
	S.D Sibande	Okhahlamba Local	0768181118	N/A	sdsibande1@gmail.com	

APPENDIX 5C

COPY OF THE PRESS ADVERTISEMENT

Legal notices



OKHAHLAMBA LOCAL MUNICIPALITY

KWAZULU-NATAL PLANNING & DEVELOPMENT ACT No. 6 of 2008 AND THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT NO. 16 OF 2013: INVITATION TO COMMENT

The Okhahlamba Local Municipality has received an application in terms of Chapter 3 of the KwaZulu-Natal Planning and Development Act No. 6 of 2008 for:

1. The Subdivision of Portion 7 (of 1) the Farm Lot 5 Zand Spruit No.14123, Registration Division - GS, Okhahlamba Local Municipality, Province of KwaZulu-Natal.

A copy of the application is available for inspection between 08h00 and 16h00 at 259 Kingsway Street, Bergville, 3350 (New Municipal Offices).

Comments on the application, which may be submitted by fax or mail, must be submitted to the Town Planner: Social and Economic Development Department, Mr M.L Mlotshwa, Tel: 036 - 448 8000/25, Fax: 036 - 448 1986, P.O Box 71, Bergville 3350 and Mongezi.Mlotshwa@Okahlamba.org by 18 July 2016 at 16h00.

Please note that the Okhahlamba Municipality may refuse to accept comments submitted after the closing date and that persons who did not comment on the application will not have a right of appeal against the decision of the municipality.

S.D SIBANDE
MUNICIPAL MANAGER
OKHAHLAMBA LOCAL MUNICIPALITY

NOTICE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

Notice is hereby given in terms of Regulation 41 of the Regulations published in Government Notice 982 of 4 December 2014 - Chapter 6 of the National Environmental Management Act, 1998 (Act no. 107 of 1998), for an application submitted for the following activity:

PROPOSED ACTIVITY:

Government Notice No.	Activity Numbers
R 983 of 4 December 2015 (Listing 1)	4
R 983 of 4 December 2015 (Listing 1)	27

Notice is herewith given in terms of section 21 of the NWA, 1998 (Act 36 of 1998) with regards to the application for a Water Use Licence and/or Registration of the water use activities associated with the proposed development, which includes:

- Section 21(a): taking water from a water resource;
- Section 21(b): storing water;
- Section 21(c): impeding or diverting the flow of water in a watercourse;
- Section 21(e): engaging in a controlled activity (irrigation);
- Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
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PROJECT DESCRIPTION:

The project will consist of a pig housing complex on sites 1, 2 & 3 plus the manure processing facility and the feed factory. The different piggery complex components and taking into account that the construction footprint is usually somewhat more than it is predicted, the site will cover an area of 15.6 ha. Site 1 will cover in the order of 4 ha; site 2 will cover an area of 1.7 ha; site 3 will cover 7.7 ha; the feed factory and the manure processing plant will cover an area of 3.3 ha.

PROJECT LOCATION:

From Bergville BP filling station, in an westerly direction, on the R74, the turnoff to the farm is about 24.5 km on your left hand side.

APPLICANT:

Steynsburg Pork and Abattoir (Pty) Ltd

ENVIRONMENTAL CONSULTANT:

Rock Environmental Consulting (Pty) Ltd
PO Box 40541, Moreleta Park, 0044
Tel: (012) 997 4742
Fax: (012) 997 0415
Email: rock.rowan@lantic.net
Contact Person (s): Rowan van Tonder / Pieter van der Merwe

In order to register as an interested and/or affected party, or to obtain more information on the proposed development, please submit your name, contact details and interest in the matter within 30 days of the date of the site notice.

Placement of the site notices: 13 June 2016
Handing out of background information documents: 13 June 2016
PUBLIC OPEN DAY: 24 June 2016 at Bingelela Restaurant B & B from 10am to 7pm.

NOTICE

In the estate of the Late Suthesan Manikan Pillay, Identity No: 3610025077085, Date of Birth: 1936-10-02, Date of Death: 2015-06-29, Estate No: 005523/2016. Notice is hereby given that copies of the First and Final Liquidation and Distribution Account will lie open for inspection for all persons interested therein, for a period of twenty one (21) days as and from the date of publication at the office of The Master of the High Court of Pietermaritzburg and the Magistrate of Ladysmith. Should no objection be lodged within the prescribed period, the Executor will proceed to make payment in accordance therewith. Dated at LADYSMITH this 9th day of June 2016. R G Powell & Co, P O Box 95, LADYSMITH, 3370, Agent for the Executor.

NOTICE

IN THE ESTATE OF THE LATE GERT JOHANNES JANSEN OBERHOLZER, IDENTITY NUMBER 4810275587085 AND SURVIVING SPOUSE URSULA OBERHOLZER, IDENTITY NUMBER 500616 0130 086, MARRIED IN COMMUNITY OF PROPERTY TO EACH OTHER OF 4 HEUWELSIG CRESCENT, WINTERTON, 3340 WHO DIED AT LADYSMITH ON THE 25TH APRIL 2015. ESTATE NO. 7292/2015/PMB. NOTICE IS HEREBY GIVEN that copies of the First and Final Liquidation and Distribution Account in the above Estate have been filed with the Master of the High Court, Pietermaritzburg and the Magistrate, Estcourt where same will lie for inspection for all persons concerned for a period of TWENTY ONE (21) DAYS from date of publication hereof. Should no objection be lodged with the Master during the period of inspection, the Executor will proceed to make payment in accordance therewith. Dated at LADYSMITH on this 1st day of JUNE 2016. MACAULAY & RIDDELL, Attorneys for Executor, 126 Murchison Street, LADYSMITH, 3370, Ref: J Wright/ms

NOTICE

Please take notice that MAHOMED FAIZAL PEER (ID No. 590727 5179 08 4) intends making application to the Commissioner of CIPC of the Re-Instatement of E M H INVESTMENTS CC - Registration Number: 1990/008092/23. Any objection to the application must be lodged with the Commissioner of CIPC within twenty one (21) days of the date of publication hereof. BAKER KHARVA, PO BOX 69, LADYSMITH, 3370.

AUCTION

IN THE MAGISTRATE'S COURT FOR THE DISTRICT OF KLIP RIVER HELD AT LADYSMITH. CASE NO: 1424/2015 In the matter between: OMNIOIL AGENCIES CC (PLAINTIFF) And MILLENNIUM TOWING SERVICES PIETERMARITZBURG CC (1ST DEFENDANT) SOOBIAH NAIDOO (2ND DEFENDANT) KRIBASHNI NAIDOO (3RD DEFENDANT) NOTICE OF SALE In pursuance of a judgment in the above Honourable Court on the 21/01/2016 And Warrant of Execution, the goods listed hereunder will be sold in execution on Tuesday, the 05th July 2016, at the Sheriff's Sales Room at 10 HUNTER ROAD, LADYSMITH, at 10:00. GOODS 1 x Ford Ranger Bakkie 2.2 White Registration No. NKR 20521. TAKE FURTHER NOTE THAT: 1. This sale is a Sale in Execution pursuant to a judgment obtained in the above Honourable Court. 2. The Rules of this auction are available 24 hours before the Auction at the office of the Sheriff for Ladysmith, 10 Hunter Road, Ladysmith. 3. Registration as a buyer is a prerequisite subject to specific conditions inter alia. a). Directive of the Consumer Protection Act 68 of 2008: (url http://www.info.gov.za/view/downloadfileaction?id-99961) b). Fica-Legislation i.r.o. proof of identity and address particulars. c). Payment of Registration deposit of R500.00 in cash or bank guaranteed cheque. d). Registration of conditions. 4. The Office of the Sheriff for Ladysmith will conduct the sale with auctioneer R Rajkumar (Sheriff) and/or Ram Pandoy. 5. Advertising costs at current publication rates and sale costs according to court rules apply. DATED at LADYSMITH this 08th day of June 2016. MACAULAY & RIDDELL, 126 Murchison Street, P O Box 107, LADYSMITH, 3370, Tel: 036 637 2151, Fax: 036 631 1116, REF: JH PITOUT/km-DV0124

Directive of the Consumer Protection Act 68 of 2008. (U R L http://www.info.gov.za/view/DownloadFileAction?id=99961) B) FICA - legislation i.r.o proof of identity and address particulars. C) Payment of a Registration Fee of R10 000.00 in cash or bank guaranteed cheque. D) Registration conditions of the Consumer Protection Act 68 of 2008. E) Advertising costs at current publication rates and sale costs according to court rules apply. The aforesaid sale shall be subject to the Conditions of Sale which may be inspected at the office of the SHERIFF LADYSMITH, 10 HUNTER ROAD, LADYSMITH, during normal office hours Monday to Friday, Tel: 036 631 2579, or at the offices of the attorneys acting for the Execution Creditor/Plaintiff: SMIT SEWGOOLAM INC., 12 AVONWOLD ROAD, CNR JAN SMUTS AVENUE, SAXONWOLD, JOHANNESBURG, TEL 011 646 0006 (REF: JE/CDP/LG/MAT19129). SIGNED at JOHANNESBURG on this 30th day of MAY 2016. SMIT SEWGOOLAM INC., 12 AVONWOLD ROAD, CNR JAN SMUTS AVENUE, PRIVATE BAG 836, SAXONWOLD, JOHANNESBURG, TEL: 011 646 0006, JOHANNESBURG, REF: JE/CDP/LG/MAT19129

NOTICE

NOTICE OF SALE OF ABANDONED VEHICLES PLEASE TAKE NOTICE that the following vehicles are to be collected by their registered owners within thirty days of the publication of this notice failing which they will be sold to defray repair and storage costs : Audi A4, 2002 model, NUZ 21117, owner Mr SW Mbhele, June 2013. Volkswagen Golf 5, 2005 model, WHR441GP, owner Mr RN Motala, September 2011. Volkswagen Sharan, 2006 model, NUF 16892, owner Mr Parak, February 2010. Enquiries Mr Norman Hills SERVICE MANAGER LADYSMITH AUTOHAUS 70 Murchison Street Ladysmith Tel : 036 631 1252

ESTATE NOTICE

In the Estate of the LATE LUTCHMEE BUDHAL, Identity Number 371007 0096 08 7, a widow, formerly of 3 Lucknow Lane, Ladysmith, 3370, and who died at Johannesburg on the 11th April 2016. MASTER'S REFERENCE: 003584/2016. Notice is hereby given to all Debtors and Creditors who have claims against the abovementioned Estate to lodge their claims with and settle their debts with the Executor concerned within thirty (30) days from publication of this notice. DATED AT LADYSMITH ON THIS THE 20TH DAY OF MAY 2016. SIBRAN, NKABINDE INC. 9 POORT ROAD, P O BOX 639, LADYSMITH, 3370. TEL NO. 036-637 5688/631 0715 REF: MR SIBRAN/rr/B.413

AUCTION

IN THE HIGH COURT OF SOUTH AFRICA, KWAZULU-NATAL DIVISION, PIETERMARITZBURG. CASE NUMBER: 2015/275. In the matter between: ABSA BANK LIMITED, (PLAINTIFF) and MAGUZA WILMOT LANGA N.O. (DEFENDANT). In his capacity as duly appointed executor in terms of Section 13 and 14 of the Administration of Estates Act, No 66 of 1965 (as amended) in the deceased estate of SINIKIWE ANGEL LANGA (ID NO: 790830 0675 086) (ESTATE NUMBER: 9964/2012/PMB). NOTICE OF SALE IN EXECUTION. TAKE NOTICE that in pursuance of a Judgment of the above Honourable Court in the above case on 31 MARCH 2015 and in execution of a Writ of Execution of immovable property, the following property will be sold by the Sheriff of the High Court for the district of LADYSMITH on 30 JUNE 2016 at 10:00 at 10 HUNTER ROAD, LADYSMITH, to the highest bidder without reserve: CERTAIN: ERF 9340 LADYSMITH (EXTENSION 48), REGISTRATION DIVISION G.S., PROVINCE OF KWAZULU-NATAL. MEASURING: 325 (THREE HUNDRED AND TWENTY FIVE) SQUARE METRES; HELD: Under Deed of Transfer T7485/2011. SITUATED: 35 MILKWOOD ROAD, LADYSMITH EXTENSION 48; ZONING: SPECIAL RESIDENTIAL (NOTHING GUARANTEED); IMPROVEMENTS: The following information is furnished but not guaranteed: The property situated at 35 MILKWOOD ROAD, LADYSMITH EXTENSION 48 consists of: 1 X LOUNGE, 1 X BATHROOM, 2 X BEDROOMS, 1 X GARAGE , 1 X KITCHEN (The nature, extent, condition and existence of the improvements are not guaranteed); The Purchaser shall in addition to the Sheriff's commission, which is 6% (Six Percent) on the proceeds of the sale up to a price of R30 000.00 (Thirty Thousand Rand) and thereafter 3.5% (Three Comma Five Percent) up to a maximum fee of R10 777.00 (Ten Thousand Seven Hundred and Seventy Seven Rand) and a minimum fee of R542.00 (Five Hundred and Forty Two Rand), pay a deposit of 10% of the purchase price, in cash or bank guarantee cheque or EFT into the Sheriff's trust account immediately upon closing of the bid and the balance against the transfer which shall be secured by a Bank guarantee in a form acceptable to Plaintiff's conveyancers, which guarantee shall be delivered by the Purchaser to the Sheriff within (21) days from the date of the sale and shall provide for the payment of the full balance and any such interest payable as provided for hereunder. The Rules of this auction are available 24 hours before the auction at the office of the SHERIFF LADYSMITH, 10 HUNTER ROAD, LADYSMITH. The SHERIFF LADYSMITH will conduct the sale WITH AUCTIONEERS R. RAJKUMAR and/or RAM PANDOY. Registration as a buyer is a pre-requisite subject to conditions, inter alia: A)

APPENDIX 5D

Copy of the Site Notice and Supporting Photographs

SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

NOTICE: ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

Notice is hereby given in terms of Regulation 41 of the Regulations published in Government Notice 982 of 4 December 2014 - Chapter 6 of the National Environmental Management Act, 1998 (Act no. 107 of 1998), for an application submitted for the following activities:

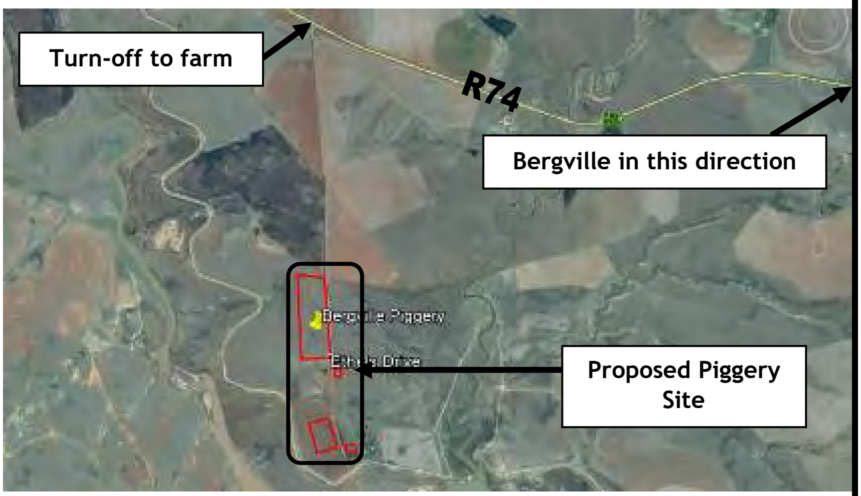
Government Notice No.	Activity Numbers
R 983 of 4 December 2015 (Listing 1)	4 & 27

Notice is herewith given in terms of section 21 of the NWA, 1998 (Act 36 of 1998) with regards to the application for a Water Use License and/or Registration of the water use activities associated with the proposed development, which includes:

- Section 21(a): taking water from a water resource;
- Section 21(b): storing water;
- Section 21(c): impeding or diverting the flow of water in a watercourse;
- Section 21(e): engaging in a controlled activity (irrigation);
- Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(i): altering the bed, banks course or characteristics of a watercourse

PROJECT DESCRIPTION:
The project will consist of a pig housing complex on sites 1, 2 & 3 plus the manure processing facility and the feed factory. The different piggery complex components and taking into account that the construction footprint is usually somewhat more than it is predicted, the site will cover an area of 15.6 ha. Site 1 will cover in the order of 4 ha; site 2 will cover an area of 1.7 ha; site 3 will cover 7.7 ha; the feed factory and the manure processing plant will cover an area of 3.3 ha.

PROJECT LOCATION:
From Bergville BP filling station, in a westerly direction, on the R74, the turnoff to the farm is about 24.5 km on your left hand side.



APPLICANT:
Steynsburg Pork and Abattoir (Pty) Ltd.

ENVIRONMENTAL CONSULTANT:
Rock Environmental Consulting (Pty) Ltd
PO Box 40541, Moreleta Park, 0044
Tel: (012) 997 4742
Fax: (012) 997 0415
Email: rock.rowan@lantic.net
Contact Person (s): Rowan van Tonder / Pieter van der Merwe

REC
ROCK ENVIRONMENTAL CONSULTING (PTY) LTD

In order to register as an interested and/or affected party, or to obtain more information on the proposed development, please submit your name, contact details and interest in the matter within 30 days of the date of this notice: **13 June 2016**

Handing out of background information documents: 13 June 2016
PUBLIC OPEN DAY: 24 June 2016 at Bingelela Restaurant B & B from 10am to 7pm.

<u>Proof of Site Notice</u>

APPENDIX 5E

COMMENT AND REGISTRATION SHEETS RECEIVED FROM I&AP'S

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

DLUDLU ATTORNEYS

131-133 Clarkroad,
Glenwood
Durban (KZN) S.A. 4001
E-mail: info@dludluattorneys.co.za

P.O. Box 217
Durban
4001

Tel: (+27) 031 301 1865
Fax1: (+27) 031 301 6551
Fax: (+27) 031 301 0609
Vat: 4240260648

Our ref: S059/14 **08TH FEBRUARY 2017**

TO: Ms NONJABULO MBATHA

"Without prejudice "

PER EMAIL: nonjabulo@steynburgpork.co.za

Dear Madam

RE: MKHIPHENI SHEMBE &OTHERS // STEYNBURG FARM

The above matter refers.

Kindly be advised that on 22nd January 2017, we had a meeting with clients & Department officials to discuss the relocation of clients from Steynburg farm. Thereafter the meeting we communicated with your Ms M Mbatha to advised her about the position of our clients.

In our discussion with clients it appeared that clients are minable to relocate provided that they would relocate to a portion of land which is adjacent to the piece of land pointed out by you and Mr Vickus (farm owner).

The proposal presented to them wili stand and advised that they would have move from the farm when the houses have been completed.

It is further our instructions that before they commit to any agreement the portion of land where they will relocate to be inspected for confirmation of boundaries.

Your prompt response in this regard will be highly appreciated and please advise our office of your suitable date for *inspection in loco* in the farm.

We hope that you will find the above in order.

Yours Faithfully

DLUDLU ATTORNEYS

REGISTRATION AND COMMENT SHEET:

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

Please complete and return as soon as possible, but no later than 18 July 2016 to:

Mr. Rowan van Tonder, PO Box 40541, Moreleta Park, 0044

Tel: (012) 997 4742 Fax: (012) 997 0415 e-mail: rock.rowan@lantic.net

---

Title MR Initials PD Surname VAN REENEN

Organisation/Firm/Position/Nature of Involvement in the project e.g. property owner: TRUSTEE OF CAMEELDRAAI TRUST & GRANSMOOR TRUST

Street / Physical Address: CAMEELDRAAI FARM, BERGVILLE, KZN

Postal address: PO BOX 248, BERGVILLE 3350

Postal Code: 3350

Telephone Work: 083 290 2266 Telephone Home: 0832902266

Cell phone: 083 4699111 Fax: 0866009900

E-mail: admin@vanreenenfarming.co.za

COMMENTS:

It would be useful if you could answer the questions below but please feel free to provide any comments you would like to raise. Please continue on additional paper if required.

1. What are the primary concerns faced by you/ your community/ your organisation with regards to the proposed development?

APPENDIX 5F

COMMENTS & RESPONSES REPORT AND OPEN DAY AND MINUTES OF PUBLIC MEETINGS

REC SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL

REC SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

COMMENTS & RESPONSE SHEET

Name & Surname	Designation / Organisation	Physical & Postal Address	Contact Details	Comments	Response
Councillor Mxolisi Peter Vilakazi	Okhahlamba Local Municipality Ward 10	PO Box 71 Bergville 3350 259 Kingsway St. Bergville 3350	Tel: 036 448 8000 Cell: 084 966 5705 Email: mxolisi.vilakazi@gmail.com	**Primary concerns** 1. What are the dangers of the project? 2. "We like projects because they opened job opportunities and when on our terms in office is completed we hope than even those who will come in after the local municipal elections will take it forward." 3. Negotiations between Okhahlamba Local Municipality and the relevant dwellers already took place. 4. Is there training that will be provided to people who will make the piggery feeds. 5. If the project kick starts, what is the estimate of the employment? The meeting agreed that during the recruitment of people, the recruitment should go across	1. No real dangers. Possible noise and odour pollution is foreseen. Surface and ground water pollution is possible if no mitigation measures are in place. 2. Noted. 3. Local dwellers does not want to be relocated, but discussions with their legal representative (Mr Zweli Ngcobo) & Dluldu Attorneys has heeled the following results: On 22nd of January 2017 meeting with clients & Department officials, to discuss the relocation of dwellers on-site from Steynburg farm, was held (see Minutes attached to this document).

Name & Surname	Designation / Organisation	Physical & Postal Address	Contact Details	Comments	Response
				wards 8, 9 and 10.	The following conclusion was reached: • Rural Development and Land reform to physically measure the current farm to determine how many hectors • To measure the proposed farm by Investor (79 ha) and households and determine if it's feasible to combine the communities. Must be noted that Five families made it clear that they do not want to combined with unaffected families. • To identify another farm of similar or bigger size proposed by investors to relocate the families to. • Innocent, Mr. Xulu and Zweli to visit the proposed farm this coming next week. Farm dwellers have the idea of the farm that they feel it could be suitable for them. • After the visit, the team

Name & Surname	Designation / Organisation	Physical & Postal Address	Contact Details	Comments	Response
					amend the proposal and submit to Investors. The letter from the attorneys (see Letter attached to this document) conveyed that: "…In our discussion with clients it appeared that clients are minable to relocate provided that they would relocate to a portion of land which is adjacent to the piece of land pointed out by you and Mr Vickus (farm owner). The proposal presented to them will stand and advised that they would have move from the farm when the houses have been completed. It is further our instructions that before they commit to any agreement the portion of land where they will relocate to be inspected for confirmation of boundaries…"

Name & Surname	Designation / Organisation	Physical & Postal Address	Contact Details	Comments	Response
					4. Yes. 5. 50 to 70 new job opportunities.

Rowan van Tonder

From:	REC Services (Pty) Ltd - Nadia Dedekind <rockec@lantic.net>
Sent:	Monday, October 24, 2016 4:19 PM
To:	'Joos Solms'
Cc:	innocent@tikzn.co.za; Rowan van Tonder
Subject:	Bergville 4800 Piggery

Dear Joos

Following our conversation this morning and the meeting I had yesterday with representatives of the 5 families on the land subject to our application, I kindly would like to inform you as follows.

The meeting took place at 10h00 yesterday morning and I have explained the purpose of the meeting which is merely to record issues and problems the families are having with regards to the project.

The communication was done through a very competent interpreter however the congregation constantly referred me to their representing lawyer namely Mr Ngcobo and they were not prepared to discuss any matter with me.

We have tried several times to request attendance with myself and Mr Innocent Hlongwana, however he is currently on leave, therefore in light of the timelines of our application, I recommend the following:

1. An urgent meeting with Mr Ngcobo in KZN where we can establish from him the different issues and matters raised by his client (The 5 Families on the land)
2. We have to establish the status of the apparent legal process that is continuing on the matter.
3. Express the need to reach an agreement before the matter goes to court.

The main concern is that the delay in progressing on the matter will jeopardize the EIA process.

We are continuing with our process according to timelines, however the risk is that after submission of the application (Final Basic Assessment Report) the Department of Agriculture, Environmental Affairs and Rural Development will request the matter to be resolved and may reject the application which will have several negative implications for the project, I therefore urge an urgent meeting with Mr Ngcobo in the presence of any party or person you may find relevant in this regard.

Please revert to us asap.

Kind Regards,

REC SERVICES (PTY) LTD
t/a ROCK ENVIRONMENTAL CONSULTING

NADIA DEDEKIND
PA of the Director
PIETER VAN DER MERWE
Environmental Management B. Sc. (Hons)
c: 0824127571 t: 0129974742 f: 0129970415
P.O. Box 40541, Moreleta Park, 0044
601 Rubenstein Dr, Moreleta Park, 0181
rockec@lantic.net † www.rockeco.co.za

Rowan van Tonder

From: Nadia Dedekind <rockec@lantic.net>
Sent: Wednesday, February 8, 2017 9:30 AM
To: Rowan van Tonder
Subject: FW: 22 January 2017 Meeting Feedback with Farm Dwellers

From: Michael Tetzlaff [mailto:mt@teli.dk]
Sent: Monday, 06 February 2017 3:38 PM
To: rockec@lantic.net
Subject: Fwd: 22 January 2017 Meeting Feedback with Farm Dwellers

Dear Pieter,

Very nice talking to you - as promised pls see below letter from Innocent Hlongwana TIKZN!

Let me hear if you find it sufficient for the time being !

Best Regards

Michael Tetzlaff

DK +45 40 96 17 82
SA +27 (82) 3255 242

Start på videresendt besked:

> **Fra:** Innocent Hlongwana <innocent@tikzn.co.za>
> **Emne: 22 January 2017 Meeting Feedback with Farm Dwellers**
> **Dato:** 25. jan. 2017 07.32.57 CET
> **Til:** Michael Tetzlaff <mt@teli.dk>
> **Cc:** Bo Nielsen <bo.nielsen@steynsburgpork.co.za>, Nonjabulo Mbatha <nonjabulo@steynsburgpork.co.za>
>
> Dear Steynburg Piggery and Pork team
> Trust you are well. I would like to provide the following feedback with regards to teh meeting took place on the 22nd of January 2017 with Farm dwellers at in Bergville.
>
> Present: Attorney Zweli Ngcobo – Legal Representative for the farm dwellers;
> :Mr. Xulu – Rural Development & Land Reform area manager
> :Mr. Jomo Ntuli – Rural Development & Land Reform Senior Manager
> : Mr. Mafu – Farm dwellers advisor
> :Innocent Hlongwana – Investment facilitator for the project (Acting General Manager- Investment Promotion)
> : 5 families – Farm dwellers

The purpose of the meeting was categorised into the following (1) Mafu to clarify his role within this project, (2) Innocent Hlongwana to explain various options of land available for the project (2) To discuss the way forward regarding the proposal presented by Innocent Hlongwana from Investors.

Mr. Mafu Explained his role as the adviser to the farm dwellers and indicated that he has worked with them over 20 years and he has no objection to the project as he has wrote it on the letter. Unfortunately due to heated debate around his influence to the dwellers and roles , Mr Mafu opted to leave the meeting and indicated that the farm dwellers will come to him if they need his assistance.

Innocent Hlongwana explained the process that was taken to identify the current farm and how it was arrived to the decision of selecting the farm and scientific results such as biosecurities and suitability. Also presented the proposal from investors.

Jomo Ntuli outlined the importance of the project and the rights of the farm dwellers. Provided the example of similar situation where Eskom build a dam and relocated farm dwellers to another area with good incentive. Together with his colleague provided a good explanation of their role and rights for the farm dwellers. Also the possible outcomes if the matter goes to court.

Zweli Ngcobo provided the a detailed explanation of what application to the court they have submitted to the court on behalf of the Dwellers . however that application is about the recognition of the labour tenant farm dwellers since they have been to the farm over 20 years.

The following conclusion was reached:

- Rural Development and Land reform to physically measure the current farm to determine how many hectors
- To measure the proposed farm by Investor (79 ha) and households and determine if it’s feasible to combine the communities. **Must be noted that Five families made it clear that they do not want to combined with unaffected families.**
- To identify another farm of similar or bigger size proposed by investors to relocate the families to.
- Innocent, Mr. Xulu and Zweli to visit the proposed farm this coming next week. Farm dwellers have the idea of the farm that they feel it could be suitable for them.
- After the visit, the team amend the proposal and submit to Investors.

This captures the engagement of the 22 January 2017 with Farm dwellers.
Many thanks and looking forward to provide with feedback on the next site visit and submitting an amended proposal.

Innocent Hlongwana
Acting General Manager: Investment Promotion
Trade and Investment KwaZulu-Natal

Direct Line:	+27 (0) 31 368 9655
Fax:	+27 (0) 31 368 5888
Cell :	+27 (0) 78 802 9764
E-mail:	innocent@tikzn.co.za
Website:	www.tikzn.co.za

REC
SERVICES (PTY) LTD
t/a ROCK ENVIRONMENTAL CONSULTING
PO Box 40541
Moreleta Park, 0044
601 Rubenstein Drive
Moreleta Park, 0181
www.rockeco.co.za

BERGVILLE 4800 SOW UNIT PIGGERY BASIC ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

MINUTES OF THE WARD COMMITTEE MEETING OF 15 JULY 2016

MEETING VENUE:	**MUNICIPAL HR BOARDROOM OKHAHLAMBA MUNICIPAL OFFICE BERGVILLE**
DATE:	**15 JULY 2016**
TIME:	**12:00**
PURPOSE OF THE MEETING:	**MEETING WITH RELEVANT WARD COMMITTEE MEETING AS PART OF THE PUBLIC PARTICPTION PROCESS**

Tel: +27 12 997 4742
Fax: +27 12 997 0415
Email: rockec@lantic.net
Reg no: 2016/310652/07
Director: PN van der Merwe | B Sc(Hon) B Sc(Hon)

Opening:

The Chair person for the meeting is Councilor M.P. Vilakazi opened the meeting officially and welcome all present members.

The members forming the meeting as per the completed attendance register, were:

- Jenefer Mbatua from Ward 8
- Thuli Mlangeni from Ward 8
- Amon Dlamini from Ward 8
- Doris Khumalo from Ward 8
- Mthokozisi Mhlanga from Ward 10
- Mkavuleni Shembe from Ward 10
- Thamsanga Twala from Ward 8
- Fikile Ndlovu from Ward 9
- Melusi Hlongwane from Ward 8
- Councillor Peter Vilakazi from Ward 10 (Chairman)
- Pieter van der Merwe (REC Services (Pty) Ltd)

Announcement by the chairman:

The chairman thanks everyone for attending the meeting regarding the proposed piggery to be established in the area of Ward 10. He explained the outline of the project and stated that it will contain several components including a facility of the processing of the pig manure and a facility for the production of feed for the piggery. The water component will be used for the irrigation of fields.

The chairman explained that the meeting was convened to update or inform the adjacent communities about the project so that they may have questions and proposals moving forward. The communities like Zwelisha, which is ward 9, Oliviershoek, Moyeni and Reserve which are areas of Ward 8 to participate in the EIA process pertaining the proposed piggery project. He once again mentioned the feed factory and the fact that the project will house approximately 48 000 (4 800 sow unit).

Pieter van der Merwe of REC Services (Pty) Ltd gives a presentation of the project and its applicable elements along with an explanation of the Basic Environmental Impact Assessment process.

If there were questions from the community Mr van der Merwe from REC Services (Pty) Ltd said that it will be proper if they would receive written comments from the community. There is a 30-day period for comment and the comments can be sent to REC Services (Pty) Ltd. Background Information Documents with Registration and Comment sheets were provided to the members attending the meeting.

Questions and comments raised:

1. What are the dangers of the project?
2. "We like projects because they opened job opportunities and when on our terms in office is completed we hope than even those who will come in after the local municipal elections will take it forward."
3. Negotiations between Okhahlamba Local Municipality and the relevant dwellers already took place.
4. Is there training that will be provided to people who will make the piggery feeds.
5. If the project kick starts, what is the estimate of the employment? The meeting agreed that during the recruitment of people, the recruitment should go across wards 8, 9 and 10.

One of the community members wishes the project all the best and to be a success. We say thanks to those who sees a necessity to bring such a project at Bergville near us.

Pieter van der Merwe said that there are usually spinoffs of a number of jobs and he express his thanks to all who came to the meeting and participate providing a contribution. This means a lot to him.

The meeting was adjourned at 13h30.

APPENDIX 5G

COPY OF ATTENDANCE REGISTER OF THE PUBLIC OPEN DAY AND PUBLIC MEETING

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

REC

ROCK ENVIRONMENTAL CONSULTING (PTY) LTD

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

ATTENDANCE REGISTER
OPEN DAY – BINGELELA RESTAURANT B & B

Date: 24 June 2016

Name	Address	Telephone Number / Fax Number	E-mail address/ Postal Address	Signature
L. Vickers	Box 609 Bergville 3350	083-6311654	admin@ fultamin.co.za	
J. Joubert	P.O. Box 5. Bergville.	083 6400743	Bingelela@mweb.co.za	

ROCK ENVIRONMENTAL CONSULTING (PTY) LTD

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

ATTENDANCE REGISTER
MEETING WITH WARD COMMITTEES

Date: 14 July 2016

Name	Address	Telephone Number / Fax Number	E-mail address/ Postal Address	Signature
Melusi Hlongwane	Moyeni Ward 08	0713536869	PO Box 473 Bergville 3350	[illegible]
Phille Mollon	Zwelisha Ward 09	078 445 3836	P.O. Box 1666 3350	[illegible]
Thamsanqa N Tsoarte	Ogade ward 8	0728947220	Private Bag 1658	[illegible]
Mhlonhlosi N Mhlongo	Embendweni ward 10	0810794767	PO Box 571	[illegible]
MKHAWULENI SHEMBE	EMPANDWENI WARD 10	0603729339	P.O. Box 87	[illegible]

REC

ROCK ENVIRONMENTAL CONSULTING (PTY) LTD

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

ATTENDANCE REGISTER
MEETING WITH WARD COMMITTEES

Date: 14 July 2016

Name	Address	Telephone Number / Fax Number	E-mail address/ Postal Address	Signature
Doris Khumalo	Moteni Ward 08	0782777951		DorisKhumalo
Thuli Mlangeni	Ogade Ward 08	Private Bag X1658 Bergville 3350	076 3039217	TgMlangeni
Jennifer L Mbatha	Reserve A Ward 8	P. 0835154103	P. Box 404 Bergville 3350	
Amon Dlamini	Bhalekisi Ward 8	0786233509		A.Dlamini
Mxolisi Vilakazi	Ridale area Ward 10	084 9665 705 0	mxolisip.vilakazi@gmail.com	Vilakazi

REC

ROCK ENVIRONMENTAL CONSULTING (PTY) LTD

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL.

ATTENDANCE REGISTER
MEETING WITH WARD COMMITTEES

Date: 14 July 2016

Name	Address	Telephone Number / Fax Number	E-mail address/ Postal Address	Signature
Pro Ubne	REC Moreleta Park Pta	9974742 / 0824127571	vockec@lantic.net	[signature]

APPENDIX 6

EAP CV

Curriculum Vitae

Contact Details
Cell: 082 879 4218
Tell: 012 997 4742
Fax: 012 997 0415
E-mail: rock.rowan@lantic.net

Rowan Conrad van Tonder

Personal Information	Date of Birth: 21 May 1981 Marital status: Married Gender: Male Nationality: South African Age: 35 Place of Birth: Polokwane/Pietersburg ID Number: 810521 5099 085
MASTERS DEGREE	M.Sc. Botany (University of Limpopo) – Conservation Management
Dissertation	THE BIOLOGY, ECOLOGY AND CONSERVATION OF *EUPHORBIA GROENEWALDII* AN ENDANGERED SUCCULENT OF THE LIMPOPO PROVINCE
HONOURS DEGREE	B. Sc. Physical Geography (Environmental Sciences)
Subjects	Research Project 702 Honours Presentations 703 Geography: Its Evolution 710 Southern African Geomorphology / Arid Environments 782 / 795 Environmental Impact & Auditing 785 Environmental Change 789

DEGREE	B. Sc. Environmental Sciences
Education	Pietersburg High School
Highest Grade Passed	Grade 12

Subjects

Afrikaans	HG
English	HG
Accountancy	HG
Physical Science	HG
Mathematics	HG
Computer Science	HG

Languages

Home Language: Afrikaans
Other Language: English

Accreditations and Licenses

Driver's Licence: Sedan + Trailor (CODE 8)

<u>EMPLOYMENT HISTORY</u>

COMPANY	:	Rock Environmental Consulting (REC)
PERIOD	:	**March 2008 to Present**
POSITION	:	Environmental Practitioner
DUTIES	:	EIA & Basic Assessment (BA) process management, Compilation of EIA & BA reports, EMP's for development and mining purposes, Mining Right and Mining Permit applications to DME, Section 24G Applications.
REPORTING TO	:	Director of REC

COMPANY	:	University of Limpopo (Polokwane)
PERIOD	:	**October 2005 to February 2007**
POSITION	:	Research Assistant
DUTIES	:	Field work on the breeding biology of birds and the spatial distribution of Copepods (parasites) on Sharks.
REPORTING TO	:	Prof. Derek Engelbrecht and Prof. Susan Dippenaar

EMPLOYMENT RECORD

Mr. Van Tonder is currently involved with various applications for activities under the National Environmental Management Act (NEMA) (Act 107 of 1998), Mineral and Petroleum Recourses Development Act 2002 (Act No. 28 of 2002), and National Environmental Management: Waste Act, 2008 (Act 59 of 2008).

MARCH 2008 - PRESENT	**ROCK ENVIRONMENTAL CONSULTING (PTY) LTD.**
POSITION	Environmental Consultant, Environmental Control Officer & Projects Coordinator
DUTIES	• Project coordination • Environmental Impact Assessments & ECO • EIA Reports compilation & review • Environmental Management Programmes & Plans • Terrain assessments or field work • Public Participation processes • Prospecting -, Mining Right & Permit applications • Mine Closure applications • Waste water treatment works licensing • Environmental Management Systems • Integrated Environmental Management Plans • Risk Management and Assessments
2005 - 2007	**UNIVERSITY OF LIMPOPO**
POSITION	Research Assistant
DUTIES	• Symbiotic siphonostomatoids and Arid zone bird studies

EXPERIENCE RECORD

At Rock Environmental Consulting (since 2008) i.e. 9 years' experience:

BASIC ASSESSMENT PROCESS

Township / Office Developments

Wonderboom Residential Township Development (Pretoria, Gauteng, South Africa). March 2008 – August 2008: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (A Oosthuizen).

Mckay Residential Township Development (Meyerton, Gauteng, South Africa). March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Radius Projects (Pty) Ltd).

Proposed Eco-Residential development on Portion 64, Klipkop 396-JR (near Pretoria, Gauteng, South Africa) March 2008 – July 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Rohirrm Estates (Pty) Ltd.).

Proposed Office Development (Monavoni, Gauteng, South Africa) December 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of

Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Titanium Builders CC).

Proposed Township Establishment on Holding 50, Spitskop Small Holdings (Bloemfontein, Free State, South Africa) September 2008 – October 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Mimi Preller).

Proposed Township Establishment on Portion 224 (A Portion of Portion 43) of the Farm Rietfontein 485-Jq (Meerhof Ext. 6) (Hartbeespoort, North-West, South Africa). March 2008 – Present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the North-West Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Chestnut Hill Investments 35 (Pty) Ltd.)

Proposed Residential Township (Bronberg Ext. 19) on Portion 4 of Holding 28 Olympus AH (Pretoria East, Gauteng, South Africa). November 2008 – October 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (J & O Beleggings Trust (Pty) Ltd).

Smaller Developments

Guest House / Boutique Hotel, Restaurant and Hydro Health Spa Establishment (Broederstroom, North-West, South Africa). January 2011 – Present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the North-West Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Duelco Investments 34 (Pty) Ltd).

Nursery and a Tea Garden / Coffee Shop Establishment (Broederstroom, North-West, South Africa). March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the North-West Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Gary Pahl and Lynn Rene Pahl).

The proposed establishment of sport, conference and accommodation facilities on portion 50, 75 and 129 on the farm Donkerhoek 365-JR (Pretoria, Gauteng, South Africa) March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Magnum Archery Pietersburg cc 1998/037486/23 Plot 129 Donkerhoek; Magnum Archery Potgietersrus cc 1998/036957/23 Plot 50 donkerhoek; Magnum Archery Bowhunting Academy cc 1998/036862/23 Plot 75 Donkerhoek).

Stormwater Structures

Stormwater channel in Winterveld, Soshanguve (Pretoria, Gauteng, South Africa) March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (City of Tshwane Metropolitan Municipality).

Subdivisions

Subdivision on the Farm Kleinfontein (Bronkhortspruit, Gauteng, South Africa) March 2008 – August 2008: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng

Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Evening Shade Properties (Pty) Ltd).

Subdivision on the Farm Mooiplaats Portion 10 (Pretoria, Gauteng, South Africa) March 2008 – January 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (J & O Beleggings Trust 8760/06).

Subdivision on the Farm Mooiplaats Portion 12 (Pretoria, Gauteng, South Africa) March 2008 – January 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Dr. G Meyer).

Subdivision on the Farm Mooiplaats Portion 278 (Pretoria, Gauteng, South Africa) March 2008 – August 2008: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Dr. L.B. Wolfaardt).

Subdivision on the Farm Zwavelpoort Portion 77/78 (Pretoria, Gauteng, South Africa) March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Salestalk 154 (Pty) Ltd.).

Subdivision on the Farm Mooiplaats Portion 106 (Pretoria, Gauteng, South Africa) March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Solar Spetrum Trading 64 (Pty) Ltd.).

Subdivision on the Farm Mooiplaats Portion 196 (Pretoria, Gauteng, South Africa) March 2008 – August 2008: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Swallow Valley Farm (Pty) Ltd.).

Subdivision on the Farm Mooiplaats Portion 198 (Pretoria, Gauteng, South Africa) March 2008 – October 2009: Authorization Denied. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Andre van der Merwe).

Sewage Works

Proposed Upgrading of the Sewage Works at Macadamia Patrol Base (Komatipoort, Mpumalanga, South Africa) March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Mpumalanga Department of Agriculture and Land Administration. The project is a Basic Assessment process. (Ruwacon (Pty) Ltd).

Roads & Pipelines

Nkomazi Service Access Road (Malelane, Mpumalanga, South Africa) August 2008 – March 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Mpumalanga Department of Agriculture and Land Administration. The project is a Basic Assessment process. (Topcoats Investments (Pty) Ltd).

K71 Phase 2 road upgrade (Centurion, Gauteng, South Africa) October 2008 – November 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a Basic Assessment process. (Gauteng Dept. of Public Transport, Roads and Works).

Proposed Construction of a Water Pipeline Across The Sandrivier (SAPS Base Kruger National Park, Mpumalanga, South Africa) March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Dept. of Environmental Affairs and Tourism. The project is a Basic Assessment process. (Ruwacon (Pty) Ltd).

Farming Sector

Boekenhoutskloof Por.9: Egg production facility (near Moloto, Gauteng, South Africa) July 2010 – Project cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture and Rural Development. The project is a Basic Assessment process. (Adonai Farm Lodge (Pty) Ltd.).

Elandsfontein Por.109: Egg production facility (near Bapsfontein, Gauteng, South Africa) March 2011 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture and Rural Development. The project is a Basic Assessment process. (Gert van Wyk Ondernemings (Pty) Ltd.).

Elandsfontein Por.120: Chicken broiler facility (near Bapsfontein, Gauteng, South Africa) March 2011 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture and Rural Development. The project is a Basic Assessment process. (For Real Chicks (Pty) Ltd.).

Underground Storage Structures

Construction of underground tanks for Continental Inks(Durban, KZN, South Africa) February 2011 – June 2011: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the KZN Department of Agriculture, Environmental Affairs and Rural Development. The project is a Basic Assessment process. (Continental Inks).

NEM WA PROCESS – Waste license

Upgrade of the Wastewater Treatment Works at Waterval Prison (Waterval, KwaZulu-Natal, South Africa). April 2011 – November 2011. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEM WA to the Dept. of Environmental Affairs. The project was a Basic Assessment process. (Dept. of Public Works).

Geluk Prison waste water treatment works & bulk water supply, repair, maintenance and operation (Bethal, Mpumalanga, South Africa). October 2011 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEM WA to the Dept. of Environmental Affairs. The project was a full EIA process. (Dept. of Public Works).

Chicken manure storage facility (cement slabs) and mortality pits on portion 109, a portion of portion 66 of the farm ELANDSFONTEIN 412-JR (Elandsfontein, Gauteng, South Africa). January 2012 –June 2012. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEM WA to the Gauteng Dept. of Agriculture and Rural Development. The project was a Basic Assessment process. (Gert van Wyk Ondernemings (EDMS) BPK).

Establishment of a dairy farm (Estina Mohoma Mobung Dairy) near the town of Vrede (Vrede, Free State, South Africa). January 2013 – ongoing. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEM WA to the Dept. of Environmental Affairs. The project is a full EIA process. (Estina (PTY) Ltd.).

Development of a piggery for MANALLEEN Boerdery CC. The treatment of pig slurry. (Hoopstad, Free State, South Africa). July 20111 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEM WA to the Dept. of Environmental Affairs. The project was a Basic Assessment process. (Manalleen Boerdery CC).

FULL EIA PROCESS

Residential Township Establishments

Residential Township Establishment on the Farm Rooikopjes (Rayton, Gauteng, South Africa). March 2008 – Cancelled. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a full EIA process. (Angel Five Developers (Pty) Ltd).

Bestwood Residential Development (Kathu, Northern Cape, South Africa). March 2008 – November 2008: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Northern Cape Department of Tourism, Environment and Conservation. The project is a full EIA process. (Katu Property Developers (Pty) Ltd).

Proposed Development of Phase 2 of Cashan Ext 8 (Rustenburg, North-West, South Africa). March 2008 – November 2010: Authorisation denied. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the North-West Department of Agriculture, Conservation and Environment. The project is a full EIA process. (Burrie Smit Ontwikelaars (Pty) Ltd.)

Sewage Treatment Systems

Upgrading of the sewage treatment system, Beitbridge (Beibridge, Limpopo, South Africa) May 2008 – June 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Limpopo Department of Economic Development, Environment and Tourism. The project is a full EIA process. (VIRTUAL BURO).

Underground Storage Structures

Construction of structures & infrastructure for the underground storage of a dangerous goods (Edenvale, Gauteng, South Africa) March 2008 – June 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a full EIA process. (Hi-Tech Inks).

Roads

K86 road construction (Daveyton, Gauteng, South Africa) August 2008 – July 2011: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a full EIA process. (Ekurhuleni Metropolitan

Municipality).

Proposed Construction of The Phokeng Western Bypass Road (Phokeng, Northwest Province, South Africa) March 2008 – October 2008: Consulted on. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Northwest Department of Agriculture, Conservation and Environment. The project is a full EIA process.

Filling Stations

Proposed Construction of A Filling Station on Portion 356 (A Portion of Portion 44) of the Farm GROOTVLEI 272-JR (Petronella, Gauteng, South Africa) October 2009 – June 2011: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a full EIA process. (Organic Coral Investments).

Proposed Construction of A Filling Station on Portion 479 (A Portion of Portion 316) of the Farm ZWAVELPOORT 373-JR (Pretoria East, Gauteng, South Africa) October 2009 – November 2011: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Gauteng Department of Agriculture, Conservation and Environment. The project is a full EIA process. (Organic Coral Investments).

Solar Farms

Bestwood Residential Development's Solar farm (Kathu, Northern Cape, South Africa). June 2010 – Present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under NEMA to the Northern Cape Department of Tourism, Environment and Conservation. The project is a full EIA process. (Kathu Property Developers (Pty) Ltd).

MINING RIGHT APPLICATIONS

Mining Right Application for Bon Accord Mine Quarry (Pretoria, Gauteng, South Africa). March 2008 – July 2009: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under MPRDA read with NEMA to the Gauteng Department of Minerals and Energy. (City of Tshwane Metropolitan Municipality).

Mining Right Application for Stellenberg Quarry (Pretoria, Gauteng, South Africa). February 2009 – April 2010: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under MPRDA read with NEMA to the Gauteng Department of Minerals and Energy. (City of Tshwane Metropolitan Municipality).

Mining Right Application for Mabopane Quarry (Mabopane, Gauteng, South Africa). February 2011 – Present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under MPRDA read with NEMA to the Gauteng Department of Minerals and Energy. (City of Tshwane Metropolitan Municipality).

Mining Right Application for Rietgat Quarry (Mabopane, Gauteng, South Africa). February 2009 – January 2011: ROD. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under MPRDA read with NEMA to the Gauteng Department of Minerals and Energy. (V & V Consulting Engineers).

Mining Right Closure Application for Mamelodi Quarry (Mamelodi, Gauteng, South Africa).

February 2010 – Present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under MPRDA read with NEMA to the Gauteng Department of Minerals and Energy. (City of Tshwane Metropolitan Municipality).

Mining Right Application for Stinkwater Quarry (near Mokone, Gauteng, South Africa). September 2010 – Present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included an application for certain activities under MPRDA read with NEMA to the Gauteng Department of Minerals and Energy. (City of Tshwane Metropolitan Municipality).

PROSPECTING RIGHT APPLICATIONS

List of successful prospecting right applications launched with DMR:

- Prospecting Rights done for INSA Coal (Pty) Ltd. in the Mpumalanga, Gauteng and Kwa-Zulu Natal area. The following codes and farm names are shown per application:
    - Mooimeisiesfontein
    - Katspruit
    - Groothoek
    - IC 1580
    - IC 1605
    - IC 1590
    - IC 1580
    - IC 1595
    - IC 1610
    - IC 1680
    - IC 1655
    - IC 1685
    - IC 1675
    - IC 1070
    - IC 1730
    - IN 1715
    - IC 1670
    - IC 1665
    - IC 050
    - IC 920
    - IC 960
    - IC 660

S24G APPLICATIONS

Golf Course Development (Swartberg, Limpopo, South Africa). June 2009 – 2010: Completed. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included a 24G application for certain activities under NEMA to the Limpopo Department of Economic Development, Environment and Tourism. The project is a section 24 G application process. (Night Fire Investment 163 (Pty) Ltd.).

Potlog Storage and Workshop (Bapsfontein, Gauteng, South Africa). May 2010 – January 2011: Completed. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included a 24G application for certain activities under NEMA to the Gauteng Department of Agriculture, and Rural Develpoment. The project is a section 24 G application process. (Amoretta Investments CC).

ENVIRONMENTAL MONITORING

Environmental Monitoring of Kameeldrift 298 JR portion 9, etc residential development (Pretoria, Gauteng, South Africa) March 2008 – July 2008. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Lebra Developments (Pty) Ltd.).

Environmental Monitoring of Serengeti Golf and Wildlife Estate (Benoni, Gauteng, South Africa) March 2008 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (African Kingdom Holdings (Pty) Ltd.).

Environmental Monitoring of the implementation of water pipes to a rural settlement (Mmakau, Gauteng, South Africa) March 2008 – September 2008. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Bigen Africa Consulting Engineers).

Environmental Monitoring of the construction of road K71 (Centurion, Gauteng, South Africa) March 2008 – May 2010. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Patula Construction (Pty) Ltd.).

Environmental Monitoring of the fence construction of Bryntirion Estate (Pretoria, Gauteng, South Africa) April 2008 – August 2010. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Khalema (Pty) Ltd.).

Environmental Monitoring of the Nkomazi Filling Stations (Malelane, Mpumalanga, South Africa) July 2008 – March 2009. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Topcoats Investments (Pty) Ltd.).

Environmental Monitoring of The Kingdom Resort (near Pilansberg, North West, South Africa) January 2009 – April 2009. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Ian Hayes-Hill).

Environmental Monitoring of the Nkomazi Filling Stations Access Road (Malelane, Mpumalanga, South Africa) June 2009 – September 2009. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Topcoats Investments (Pty) Ltd.).

Environmental Monitoring of the Construction of road K29 (Cosmo City, Gauteng, South Africa) March 2009 – April 2009. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (VIAPLAN CONSULTING ENGINEERS INC (Pty) Ltd.).

Environmental Monitoring of the Construction of the Phokeng Western By-pass Road. (Rustenburg, North-West, South Africa) February 2009 – July 2010. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Africon (Pty) Ltd.).

Environmental Monitoring of the Construction of the Katlehong Northern Access Road. (Katlehong, Gauteng, South Africa) June 2009 – June 2010. *Environmental Specialist.* Acting as the Environmental Control Officer to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (V&V Consulting Engineers (Pty) Ltd.).

Environmental Monitoring of the Beit Bridge Port of Entry: Upgrading of the Wastewater Treatment Works. (Beit Bridge, Limpopo, South Africa) September 2009 – present. *Environmental Specialist.* Acting as the Environmental Control Officer to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (New Heights 66 (Pty) Ltd.).

Environmental Monitoring of the construction of road K71 ph.2 (Centurion, Gauteng, South Africa) February 2011 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Vela VKE (Pty) Ltd.).

Environmental Monitoring of the construction of a Piggery (Meisjesvlei, Limpopo, South Africa) July 2010 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Walt Landgoed (Pty) Ltd.).

Environmental Monitoring of the construction of a Cemetery (Kempton Park, Gauteng, South Africa) September 2010 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Ekurhuleni Municipality).

Environmental Monitoring of the construction of the Bestwood Residential Development (Kathu, Northern Cape, South Africa) October 2010 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Kathu Property Developers (Pty) Ltd.).

Environmental Monitoring of the construction of Fibre Optic Cable from Pretoria to Empangeni (Across Provinces, South Africa) September 2010 – February 2011. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Plessey (Pty) Ltd.).

Environmental Monitoring of Serengeti Golf and Wildlife Estate Curro School (Benoni, Gauteng, South Africa) July 2011 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (MNK Projects (Pty) Ltd.).

Environmental Monitoring of the construction of a Piggery (Vaalwater, Limpopo, South Africa) June 2011 – present. *Environmental Specialist.* Acting as the Environmental Consultant to the project. This included regulating and upholdment of the Environmental Management Plan on site on a monthly basis. (Vus'ithemba Project Solutions CC).

APPENDIX 7

Motivation – Need And Desirability

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

Steynsburg P&A
Strategy.

Business Plan

Project NATAL

-

Making Steynsburg P&A
The preferred pork supplier.

WRITER

Bo Ewald Nielsen,
CEO- Steynsburg P&A

Release Steynsburg P&A's Potential

The project NATAL will fulfil the Steynsburg P&A's strategy by focusing on expanding activities into the void in the production of pork products in South Africa. The farming and production facility to be constructed in KZN, the best area for pig production in RSA and close to main feeding facilities - will be innovative in its market approach and production cost efficiency.

With new technology in place Steynsburg P&A will address current market constraints by securing product margins and setting the pace in the category. The Steynsburg P&A strongholds will be even more prominent and distinguish Steynsburg P&A from competitors allowing Steynsburg P&A to take the position as the preferred supplier by South African consumers, butcheries, retailers and the value added industry.

The production facility in KZN will be supplied by pigs from its own farm in Bergville KZN. The product portfolio from the new facility will be bone-in cuts split from the carcasses offering out of ratio products to an increasingly sophisticated market, a first for South Africa.

A fully integrated farming and production facility is a natural step for the Steynsburg P&A, creating value through the entire production cycle.

Introduction and background

Vision, skills and sufficient funding allows Steynsburg P&A to develop the company value proposition. Steynsburg P&A will prove its value in the market, by offering a new genetic set up in the development of pigs, utilizing Danish knowhow in both farming and in production. Steynsburg P&A are able to benefit from the new, 2018, legislation regarding pig farming in South Africa. It will attain a strong market position and capitalize on the established farms leaving the market due to cost constraints, converting to the new market situation.

Concept & rationale

The business concept and rationale are to keep Steynsburg P&A ahead of the market by building a new pig farm and pork production facility in a geographical beneficial position close to Gauteng, Natal, Export Port, Mozambique & Eastern Cape. By building it in Bergville/Ladysmith KZN, the company will also benefit from being in the heart of the Maize producing areas, benefitting the feed supply. The farm and production facilities will create a value chain allowing Steynsburg P&A to become a full service and cost efficient meat supplier. The new facility is contracted and planned with internationally acknowledged and competent suppliers building sustainable, highly efficient and specialised farm processing equipment and production facilities.

The NATAL project follows a 4 step process:

- An evaluation of market potentials is conducted and a recommendation to proceed
- Budget & timing - getting management approval to proceed
- Qualifying and deciding on contractor to deliver a turn- key Pork Farm at the land in Bergville and an abattoir in Ladysmith
- Setting up project organization to manage the construction and plan sales

All 4 processes have been achieved

Competitive advantage, cost efficiency and market relevance

Steynsburg P&A will benefit from new and tested technology and be cost efficient to meet company profit expectations and as importantly customer and market expectations. The new Steynsburg P&A facility will introduce innovative & new processing and production methods to South Africa. The new methods enhance cost efficiency and bring innovation to the entire Pork category. This will ensure Steynsburg P&A relevance to both customers and consumers – which makes NATAL a project with a long term strategic approach.

By constructing a new farm and production facility Steynsburg P&A address current market constraints in the pork industry, by taking strategic action. By managing the entire value chain from farm to retailers the margins in every link of the value chain belongs to Steynsburg P&A. Being the proud owner of the entire value chain Steynsburg P&A are able to set the direction and pursue business opportunities as they appear – domestically and internationally

Job creation and local impact – additional pig supply from outside vendors.

The expansion of business will demand an increased supply of pigs. Steynsburg P&A will take action to supply the pig farmers with solutions to increase their production. This approach will create jobs, secure the income for local farmers, provide education and strengthen the whole sector. As a result the production of quality pigs will increase and secure supply.

Project management & control

The project will be managed under daily management by Bo Nielsen & Michael Tetzlaff
The appointed contractor's chosen to build the farm & processing plant will have a permanent office at Steynsburg P&A building site.

A. Project members

Role in Project	Name	Position	Responsibility
Project Owner	Steynsburg P&A	Owner	Financial support
Project leader	Michael Tetzlaff	Consultant/shareholder	Day to day project management/investor relations
Co-leader	Bo Nielsen	CEO	General Management/investor relations
Project member	Tor Nordic	Abattoir Turn-key provider	Building/design/implementation
Project member	Plankor	Farm Turn-key provider	Building/design./implementation
Important Danish suppliers	Skiold/Skov	Farm equipment	Working through Plankor

B. Project phases and flow diagram

See drawings provided in business case by Tor-Nordic & Plankor

C. Project communication plan

Communication	Media	Content	Participants
Project group	Meetings	1 time a week – duration full day	All project members and key stake holders
Project Owner	Status report	Report on progress, timing and budget, general management, marketing, sales planning	Steynsburg P&A management (selected key stake holders and advisors)

Sustainability/CSR

EIA in progress through REC Services

Market

By expanding the business area to include a high value and efficient farm and production line Steynsburg P&A will take action and address the current market situation in South Africa.

Key areas of opportunities:

- Government initiatives on employment
- Decline in disposable income
- Household consumption expenditure declining
- Annual increases in minimum wages
- Increases in utility prices (electricity and fuel)

YK

All of this is compounding the cost price squeeze in all the meat value chains. This will strain further expansion in the beef & lamb market due to prices.

Total meat consumption continues to increase. However consumers are currently experiencing difficult economic conditions that are constraining growth in consumption of beef, lamb and seafood. The price advantage of pork as the second cheapest protein, bar poultry, will continue to shift more consumers into to pork products. Continued class mobility (i.e. households moving into the middle class) will benefit the industry in the long run due to consumers' tastes and preferences that are changing. Recent years have seen significant increase in pork consumption due to price competitiveness against beef and lamb. Current levels of consumption is about 5 kgs per person per annum. If that increase by just 1 kgs during the next 3-5 years, it will mean a short fall in the market of 60.000 MT. that's approximately a short fall of 20000 producing sows. We are ideally positioned to fill this void.

The consumer acceptance of the meat category is rapidly increasing. Due to religion and superstition pork has not always been enjoyed by a majority of the population, but price is a great motivator and consumption is expected to increase substantially during the next decade.

Project goals

a) To release the Steynsburg P&A potential - by creating the most sustainable & efficient farming and production line in South Africa.

b) To become the no. 1 Pork supplier in customer satisfaction and profit earnings in Sub-Sahara Africa.

c) Prepare the business for further expansion in export markets and further value added products.

d) building world class pig facility at the land in Bergville KZN

e) Build a modern automated abattoir in Ladysmith KZN to process the pigs from the Bergville Farm

Critical factors:

- Scope of the business potential: Market evaluation price, pack, place, product &volumes
- Product portfolio in order to scale / plan the processing plant to suit market demands
- Timing – from construction start to first shipment of finished goods
- Educating & provide skilled labour for the processing plant
- Supply of sows to farm facility

fc

- Investor funds

Consistent supply of high quality Pork:

- Establish unified quality in the farm genetics (Danish/Canadian)
- Optimizing the feeding systems, supply of feed to secure quality and consistency
- Unique education, training, technology and management model
- Unique supervision model
- Contracting and educating local producers to produce additional back up supply
- Technical input
- Stables, water supply and feeding stations
- Supply of administration tools
- IT & finance control

Steynsburg P&A processing plant:

- 1500 sqm
- 400 pigs/day capacity, single shift
- 25 employees
- QA 2 employees
- General Manager
- 1 Ass manager
- 1 admin staff

Steynsburg Farm:

- 4 production areas – sows, weaners, growers and feeding mill
- 4800 sows, producing an average of 26-30 piglets per annum
- 60-70 employees
- QA 2 employees
- General Manager
- 1 Ass Manager
- 2 admin staff

Steynsburg Pork & Abattoir (Pty) Ltd
72A Oxford Road, Riviera, Gauteng, 2193
Tel: 011 646 0290 Fax: 011 486 0122
VAT Reg No: 4610275937
Co. Reg No: 2015/411990/07

Owner Structure:

Danish	:	51 pct
South African	:	49 pct (black empowerment)
Total investment	:	ZAR 450 million

APPENDIX 8A

AQUATIC ECOSYSTEM DELINEATION

REC
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Aquatic ecosystem delineation

for

BERGVILLE PIGGERY ON THE REMAINDER OF THE FARM STEYNSBURG 7803

September 2016

Compiled by: Mr Bertus Fourie (M.Sc. Aquatic Health, Cert. Sci. Nat)
Report reviewed by: Antoinette Bootsma (Pr.Sci.Nat)

DECLARATION OF INDEPENDENCE

I, **<u>Bertus Fourie</u>,** declare that -

- I am subcontracted as specialist consultant by Galago Environmental cc. for the aquatic ecosystem delineation.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity; I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Bertus Fourie
SACNASP Reg. No: 300025/13

DECLARATION OF INDEPENDENCE OF REVIEWER

Bertus Fourie is a trained wetland/riparian delineator and wetland impact assessor as in line with the Gauteng Department of Agriculture and Rural Development (GDARD) and he is registered as a Certificated Natural Scientist (Ecological Science) with the S.A. Council for Natural Scientific Professions. This communication serves to verify that the wetland report compiled by Mr Fourie has been prepared according to the DWA guidelines and I have verified and reviewed the contents thereof.

I, **Antoinette Bootsma,** declare that I:

- I abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the fields of wetlands and Botany
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed development as described above.
- have no financial interest in the proposed development other than remuneration for work performed
- neither have nor will have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client, and the competent authority, any material information that has or may have the potential to influence decisions by the competent authority as required in terms of the Environmental Impact Assessment Regulations, 2014.

AB Bootsma

Antoinette Bootsma (Pr.Sci.Nat)

Ecologist/Botanist

SACNASP Reg. No. 400222-09

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Glossary of terms:

Buffer zone- The area of land next to a body of water, where activities such as construction are restricted in order to protect the water.

Detritus- Decaying organic matter found in the top layer of soil or mixed with wetland waters; a food source for many small wetland organisms.

Endangered species- Any species of plant or animal that is having trouble surviving and reproducing. This is often caused by loss of habitat, not enough food, or pollution. Endangered species are protected by the government in an effort to keep them from becoming extinct.

Ecosystem- A network of plants and animals that live together and depend on each other for survival.

Emergent- Soft stemmed plants that grow above the water level.

Erosion- Process in which land is worn away by external forces, such as wind, water, or human activity.

Freshwater- Water without salt, like ponds and streams.

Gleyed soil- Mineral wetland soil that is or was always wet; this results in soil colours of grey, greenish grey, or bluish grey.

Habitat- The environment in which an organism lives.

Hydric soil- Soil that is wet long enough for anoxic (oxygenless) conditions to develop. The water in the soil forces air out. This soil type is found in wetlands.

Hydrocarbon Oils, fuels and paints made using fossil fuels (including crude oils, coal etc.)

Hydrophyte- A plant, which grows in water.

Mesotrophic soil- Soils with a moderate inherent fertility. An indicator of soil fertility is its base status, which is expressed as a ratio relating the major nutrient cations (calcium, magnesium, potassium and sodium) found there to the soil's clay percentage.

Organic material- Anything that is living or was living; in soil it is usually made up of nuts, leaves, twigs, bark, etc.

Organism- A living thing.

Peat- Organic material (leaves, bark, nuts) that has decayed partially. It is dark brown with identifiable plant parts, and can be found in peatlands and bogs.

Pollution- Waste, often made by humans, that damages the water, the air, and the soil.

Precipitation- Rain, sleet, hail, snow.

Riparian- Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas

Redoximorphic conditions- a soil property, associated with wetness, which results from the reduction and oxidation of iron and manganese compounds in the soil after saturation with water and desaturation, respectively. Mottling are common redoximorphic features of soils.

Runoff- Rainwater that flows over the land and into streams and lakes; it often picks up soil particles along the way and brings them into the streams and lakes.

Salinity- The amount of salt in water.

Saturation-The condition in which soil contains as much water as it can hold.

Silt- One of three main parts of soil (sand, silt, and clay); silt is small rock particles that are between .05 mm and .002 mm in diameter.

Submerged aquatic vegetation- Plants that live entirely under water.

Top soil- The top layer of soil; it is full of organic material and good for growing crops.

Water table- The highest level of soil that is saturated by water.

Watershed - All the water from precipitation (rain, snow, etc.) that drains into a particular body of water (stream, pond, river, bay, etc.)

Wetland- Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Acronyms:

AECO	Aquatic Environmental Control Officer
ASPT	Average Score Per Taxon
CERM	Comprehensive Ecological Reserve Methodology
DSS	Decision Support System
DWA	Department of Water Affairs
DWS	Department of water and sanitation
EC	Ecological Category
ECO	Environmental control officer
EIS	Ecological Importance and Sensitivity
EWR	Environmental Water Requirements

FRAI	Fish Response Assessment Index
FROC	Fish reference of occurrence
GSM	Gravel, Sand, Mud
GDARD	Gauteng Department of Agriculture and Rural Development
IERM	Intermediate Ecological Reserve Methodology
IHAS	Invertebrate Habitat Assessment System
IHI	Index of Habitat Integrity
MIRAI	Macro-Invertebrate Response Assessment Index
MVIC	Marginal Vegetation in Current
MVOOC	Marginal Vegetation out of Current
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
REC	Recommended Ecological Category
REMC	Recommended Ecological Management Class
RERM	Rapid Ecological Reserve Methodology
RHP	River Health Programme
SASS5	South African Scoring System (Version 5)
SIC	Stones in current
SOG	Soap, oil and grease
SOOC	Stones out of current
TPH	Total petroleum hydrocarbons
TWQR	Target water quality range
VEGRAI	Vegetation Response Assessment Index
Wetland IHI	Wetland index of habitat integrity tool
WMA	Water Management Area
WUL	Water use licence (approved license)
WULA	Water use licence application (license application)

1. Introduction

Galago Environmental CC was appointed to delineate possible edges of aquatic ecosystems (including riparian and wetland areas) on the Remainder of the farm Steynsburg 7803 (henceforth known as the “study site”), scheduled for the establishment of a piggery. The investigation into the possible occurrence of wetlands on the neighbouring properties (up to 500 meters extended study area (ESA)) as in terms of General Notice 1199 of the National Water Act, 1998 (Act No. 36 of 1998) was also done (albeit desktop derived). Also included in the scope of work is to propose mitigation measures to ensure that aquatic ecosystem integrity and functionality is kept at optimum.

An aquatic ecosystem is defined as “an ecosystem that is permanently or periodically inundated by flowing or standing water or which has soils that are permanently or periodically saturated within 0.5m of the soil surface” (Ollis *et al.* 2013). This term is further defined by the definition of a watercourse. In the National Water Act, 1998 (Act No. 36 of 1998) a watercourse is defined as:

(a) A river or spring;

(b) A natural channel in which water flows regularly or intermittently;

(c) A wetland, lake or dam into which, or from which, water flows; and

(d) Any collection of water which the Minister may, by notice in the *Gazette*, declare to be a watercourse and a reference to a watercourse includes, where relevant, its bed and banks;

Different inland (freshwater) watercourses occur in South Africa and are defined by their topographical location, water source, hydroperiod, soils, vegetation and functional units (Ollis, *et al*., 2013). The following illustration presents the types and typical locations of different inland aquatic systems found in South Africa (Figure 1).

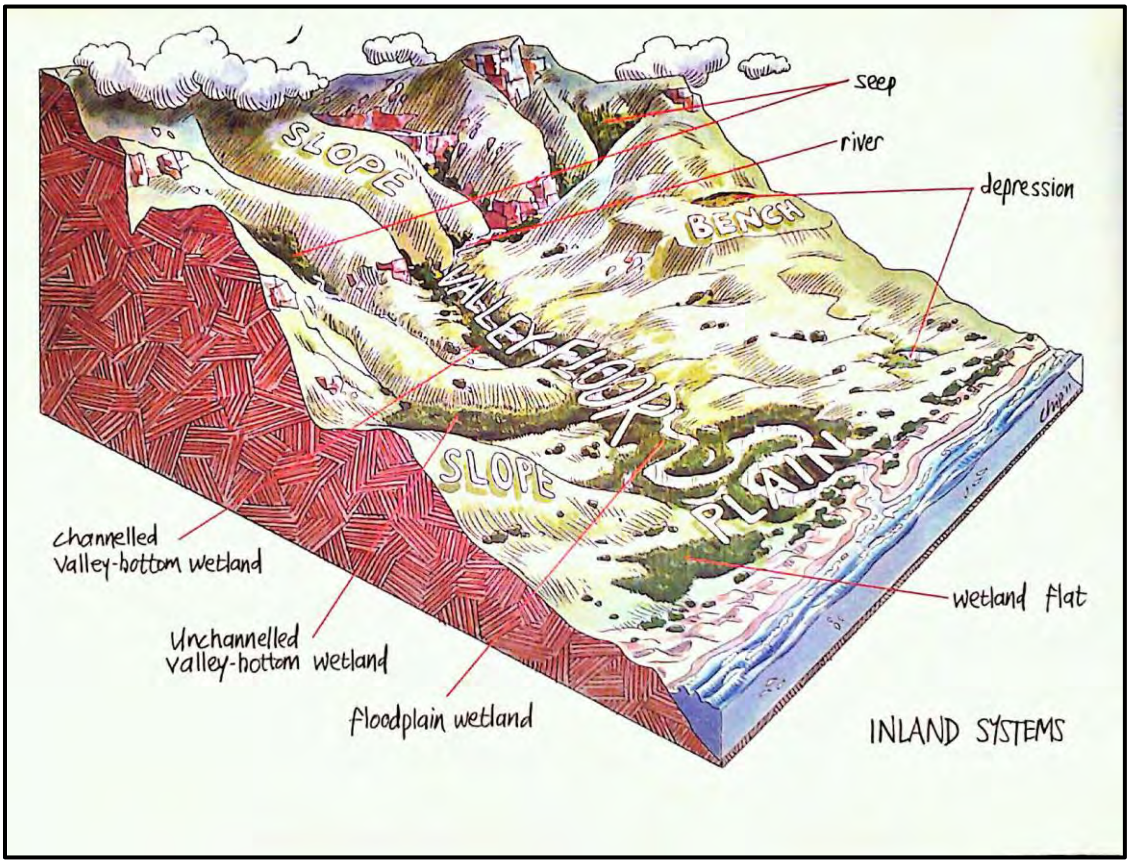


FIGURE 1: THE TYPES AND LOCATION OF INLAND AQUATIC ECOSYSTEMS (OLLIS, *ET AL.*, 2013)

This definition of a watercourse is important especially if an area of increased hydrological movement is found, but cannot be classified as either a wetland or riparian area. Important to note is that according to the National Water Act, 1998 (Act No. 36 of 1998), wetlands are defined as: *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

It is very important that this definition is applied to both natural and manmade wetlands. Wetlands are very important in South Africa. Almost 50% of wetlands have been lost in South Africa and the conservation of the remaining wetlands is very important (WRC 2011) Wetlands provide many services to the ecosystem they are located in (Kotze, *et al*. 2007). One of the most important services provided by wetlands is that of the impeding and holding back of floodwater to be released more constantly as well as slow water release through dry periods (Collins, 2005). Other very important functions that wetlands provide are as a source of habitat to many different species of fauna and flora. Wetlands also lead to an increase in the overall biodiversity of the area and ecological functioning (Collins, 2005).

Wetland conditions are formed when the prolonged saturation of water in the soils create different niche conditions for various fauna and flora. The source of water feeding into a wetland is very important, as it is an indication of the type and in many cases can provide an indication of the condition of the wetland.

As South Africa is a signatory of the Ramsar Convention for the conservation of important wetlands, we are committed to the conservation of all our wetlands. The Convention on Wetlands came into force for South Africa on 21 December 1975. South Africa presently has 21 sites designated as Wetlands of International Importance, with a surface area of 554,136 hectares (www.ramsar.org).

Although the term wetland describes the main *functions* provided by the wetland, there are actually many different hydrogeomorphic *types* of wetlands in South Africa.

The word “riparian” is drawn from the Latin word “riparious” meaning “bank” (of the stream) and simply refers to land adjacent to a body of water or life on the bank of a body of water (Wagner & Hagan, 2000).

The National Water Act, 1998 (Act No. 36 of 1998) also defines riparian areas as: “Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas”

The delineation of the riparian edge does not follow the same methodology, as is the case with wetlands. The riparian edge is demarcated using the physical structure of the vegetation found in the riparian area, as well as the micro topographical location of the riparian characteristics. In riparian areas, the increased water available to the plants (living in this area) has created a habitat with greater vegetation growth potential. This boundary of greater growth is used to delineate the riparian edge (Figure 2).

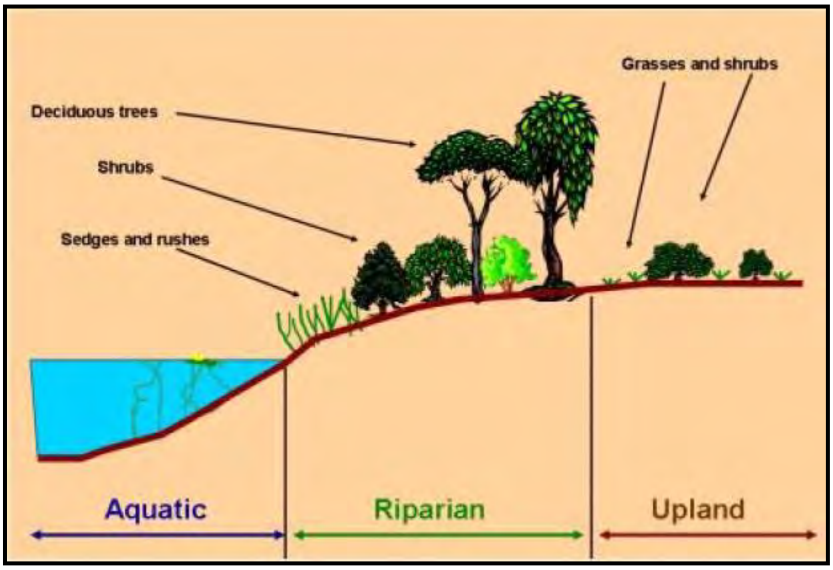


FIGURE 2: SKETCH INDICATING A CROSS SECTION OF RIPARIAN ZONATION COMMONLY FOUND IN SOUTH AFRICA – WWW.EPA.GOV/

The delineation guideline, Department of Water Affair's: Practical field procedure for identification and delineation of wetlands and riparian areas, Edition 1 September 2005, and revision 2 of 1998 was used. **The site visit was conducted in September 2016.** This identification and delineation of possible wetlands and riparian habitat is also done to mitigate any possible future contraventions of the National Water Act, 1998.

It is also important to note that when working within the Gauteng province, reports are written in line with the Gauteng Department of Agriculture and Rural Development's (GDARD) minimum requirements for biodiversity assessments. This document provides guidelines for the minimum mitigation measures when development is proposed for all biodiversity assessments, including wetlands. **Although the site falls within KwaZulu Natal, the GDARD minimum requirements are used as a guide.**

1.1. Buffers as per GDARD guidelines

The Minimum requirements for Biodiversity Assessments, 2014 of the Gauteng Department of Agriculture and Rural Development (GDARD, 2014) state that different buffers must be applied to sites inside and outside the urban edge (Table 1).

TABLE 1: BUFFER REQUIREMENTS AS PER GDARD, 2014

	Wetlands	**Riparian areas**
Inside urban edge	30 meters	32 meters
Outside urban edge	50 meters	100 meters

Buffer areas are seen as part of the aquatic ecosystem and may not be developed or affected in any way by the construction activities and is rated the same sensitivity as the system. Buffers are a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area. Buffers are in essence a fabricated ecotone. This ensures the wetland functioning is kept at an optimum and the services provided by wetlands are maintained. To ensure the buffer is maintained it must be fenced off prior to the physical construction of the site and the building contractors of the site contractually bound to the conservation of the area.

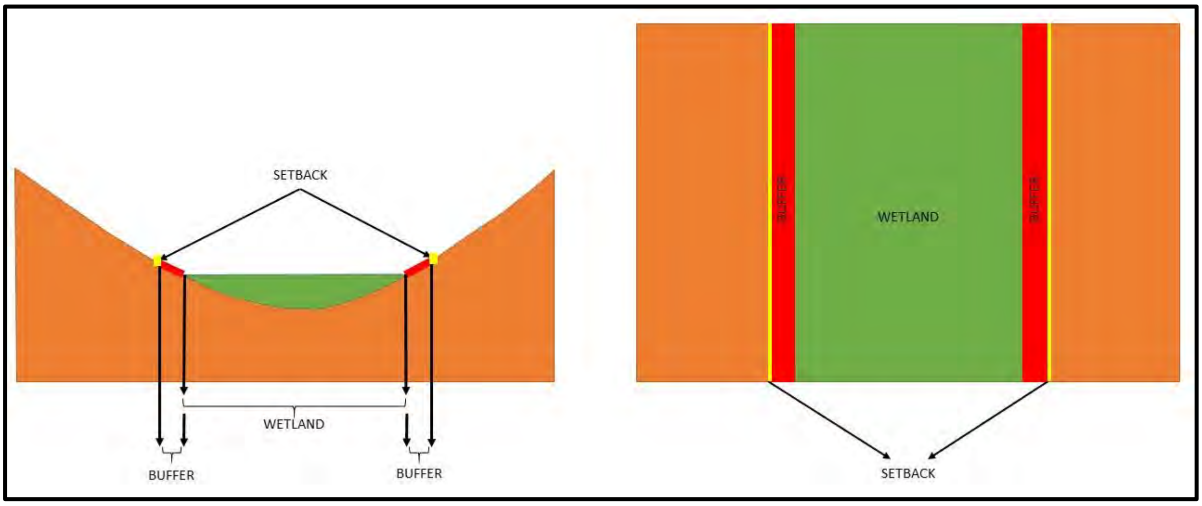


FIGURE 3: LAYOUT OF A TYPICAL BUFFER AROUND A WETLAND WITH THE SETBACK LINE CLEARLY DEFINED

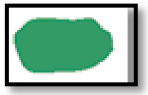
It must be noted that in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the EIA Regulations of 2014: Section 12 of Regulation 983, buildings or infrastructure exceeding 100m^2 that occurs within 32 meters of a wetland must be authorised through a Basic Assessment process. Thus, the 32 meters can be used as a buffer guide for developments in provinces that does not give clear minimum guidelines for biodiversity assessments.

Although the term wetland describes the main *functions* provided by the wetland, there are actually many different hydrogeomorphic *types* of wetlands in South Africa. The following table (Table 2) from Kotze, et al. 2007 illustrates the type of wetland as well as the hydrological source of the wetland. Important is Table 3 concerning the regulatory benefits provided by the wetland types.

TABLE 2: THE WETLAND HYDROGEOMORPHIC (HGM) TYPES TYPICALLY SUPPORTING INLAND WETLANDS IN SOUTH AFRICA (FROM KOTZE, *ET AL.* 2007)

Hydrogeomorphic (HGM) types		Description	Source of water maintaining wetland	
			Surface	Subsurface
Floodplain		Valley bottom areas with a well-defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel		Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes	***	*/***
Hillslope seepage linked to a stream		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defines stream channel connecting the area directly to a stream channel.	*	***

Hydrogeomorphic (HGM) types		Description	Source of water maintaining wetland	
			Surface	Subsurface
channel				
Isolated hillslope seepage		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel	*	***
Depression (including Pans)		A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/***	*/***



Precipitation is an important water source and evapotranspiration an important output in all of the above settings.

indicates wetland

Water source:

* Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

*/ *** Contribution may be small or important depending on the local circumstances.

TABLE 3: THE REGULATORY BENEFITS POTENTIALLY PROVIDED BY WETLANDS (FROM KOTZE ET AL. 2007)

Wetland Hydrogeomorphic types (HGM)	Regulatory benefits potentially provided by wetland							
	Flood Attenuation		Stream-flow regulation	Enhancement of Water Quality				
	Early Wet Season	Late wet season		Erosion control	Sediment Trapping	Phosphates	Nitrates	Toxicants
Floodplain	**	*	0	**	**	**	*	*
Valley bottom- channelled	*	0	0	**	*	*	*	*
Valley bottom unchannelled	*	*	*?	**	**	*	*	**
Hillslope seepage connected to a stream	*	0	*	**	0	0	**	**
Isolated hillslope seepage	*	0	0	**	0	0	**	*
Pan/ Depression	*	*	0	0	0	0	*	*

Rating: 0 Benefit unlikely to be provided to any significant level

* Benefit likely to be present as least to some degree

** Benefit very likely to be present (and often supplied to a high level)

1.2. Scope of work

The scope of this project is:

- Delineation of aquatic ecosystems,
- Determine where possible the present ecological score (PES) of the aquatic systems,
- Assessment of the impacts ratings,
- Recommend mitigation measures

2. Assumptions and limitations

To determine the riparian or wetland boundary, indicators (as discussed above) are used. If these are not present during the site visit, it can be assumed that they were dormant or absent and thus if any further indicators are found during any future phases of the project, the author cannot be held responsible due to the indicators variability. Even though every care was taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time, and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bona fide* information sources, as well as deductive reasoning. No biomonitoring or physical chemical aspects of water found on the study were done. The safety of the delineator is of priority and thus in areas deemed, as unsafe limited time was spent.

If the location of the study site is on and near underlying granitic geology the possible presence of cryptic wetlands must be investigated by a suitably qualified soil scientist with field experience.

Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage.

The condition, quantity, and quality of the water found in the study site were not established as it is outside the scope and extent of the study. As aquatic systems are directly linked to the frequency and quantity of rain it will influence the systems drastically. If during dry months or dry seasons studies are done, the accuracy of the report's findings could be affected.

Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

3. Site location and description

The study site lies east of the R74, near the upper reaches of the Woodstock dam on Ethels Drive, near Bergville, KwaZulu-Natal (Figure 4).

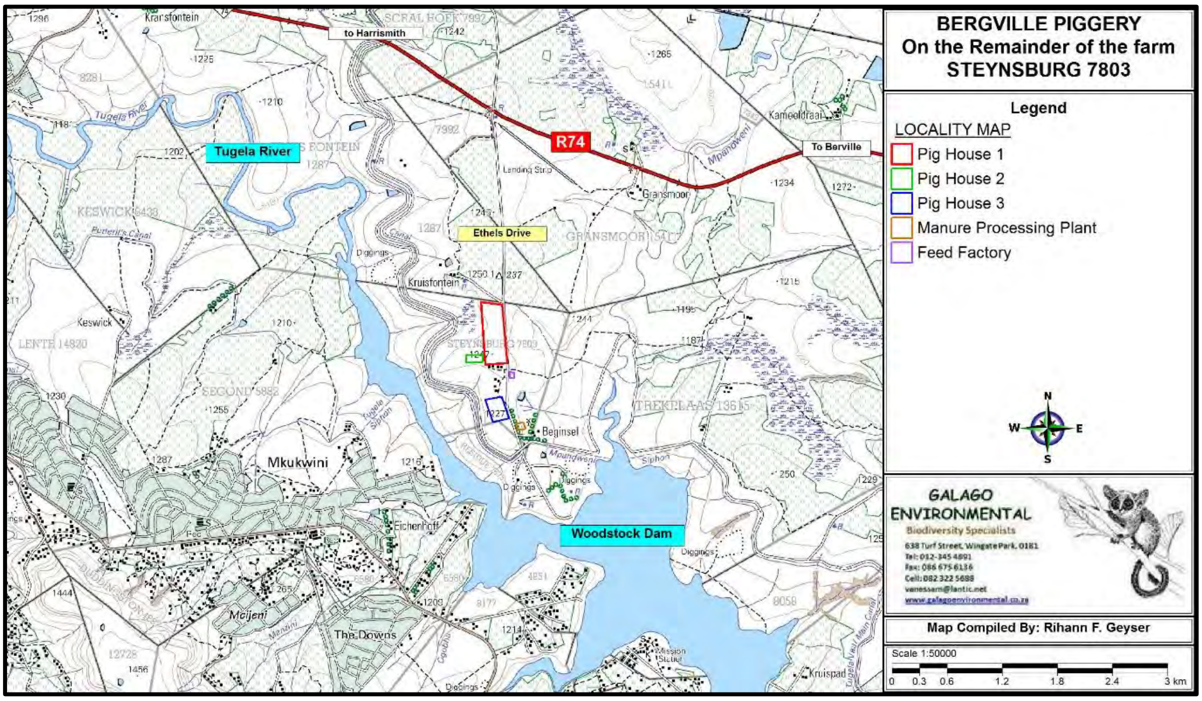


FIGURE 4: STUDY SITE LOCATION

3.1. Proposed Activities

The proposed development for the site is the establishment of three piggeries, one feed processing plant and one manure processing plant.

3.2. Regional description and vegetation

Mucina & Rutherford (2006) classified the area as Northern KwaZulu-Natal moist grassland (Figure 5).

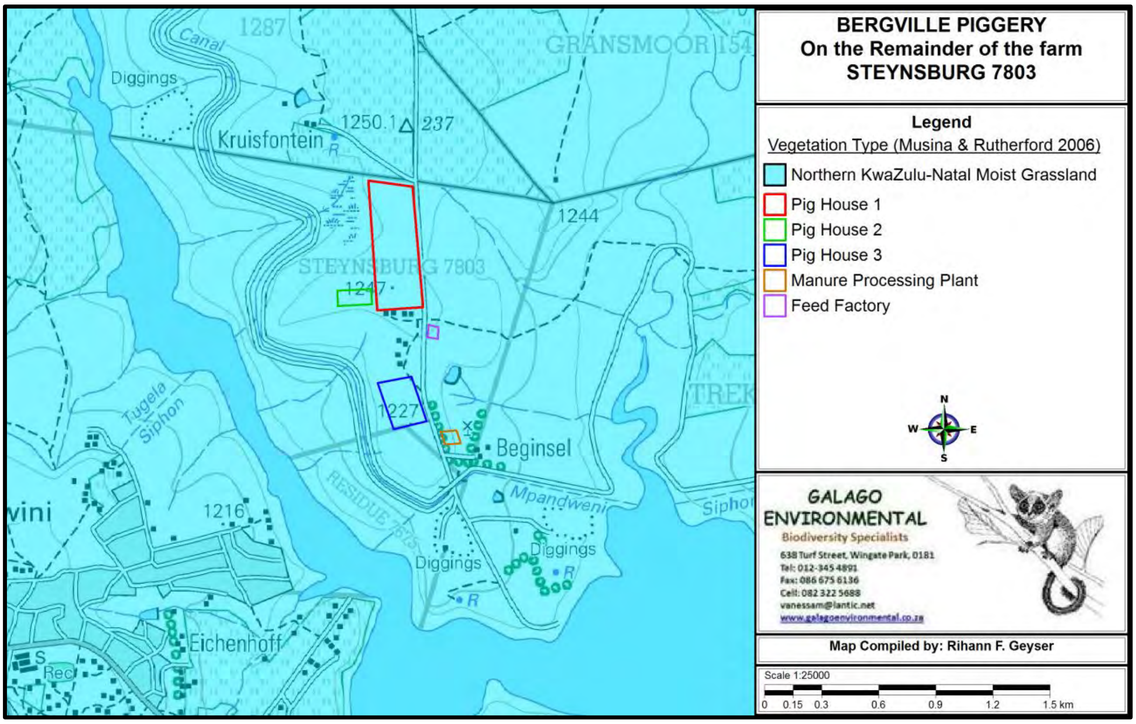


FIGURE 5: THE VEGETATION TYPES OF THE STUDY AREA

3.3. Ecoregion description

The study area falls in the North Eastern Uplands water management area (WMA no 14) (Figure 6) as described in the Level 1 Ecoregions by the Department of Water Affairs and Forestry (DWAF, 2005):

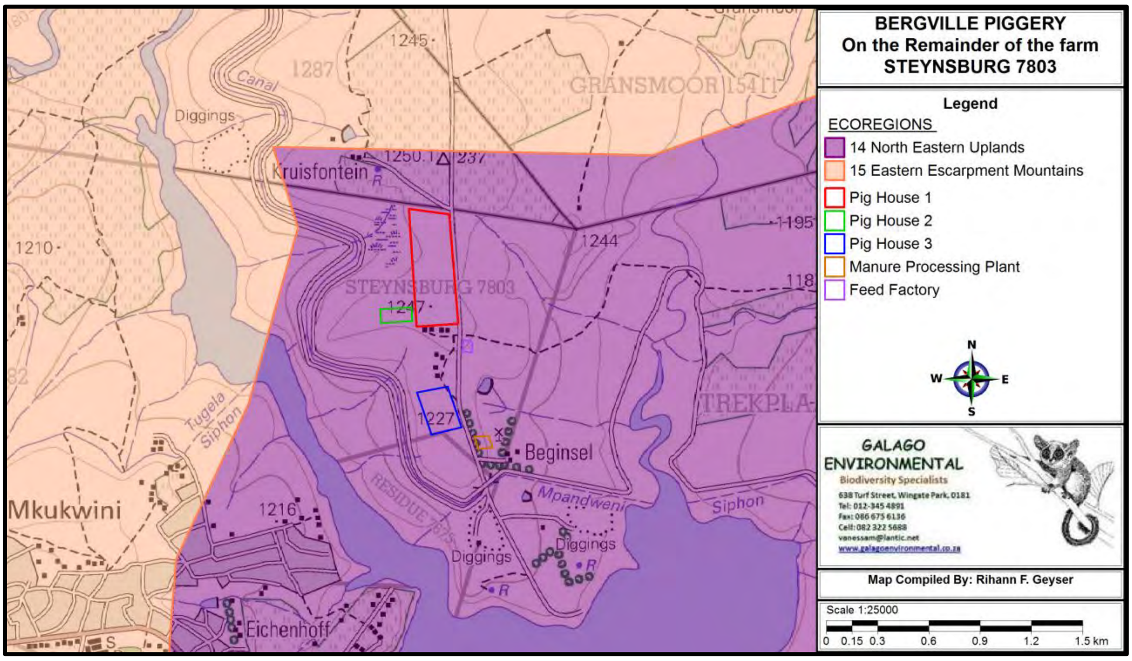


FIGURE 6: ECOREGIONS OF THE STUDY SITE

The ecoregion is defined by very diverse with lowlands, hills and mountains with moderate and high relief, as well as closed hills and mountains with moderate and high relief, being the defining characteristics. Large rivers such as the Thukela, Mooi, and Buffalo traverse this region while the Mhlatuze have its source in the region.

- Mean annual precipitation: Moderate to moderately high.
- Coefficient of variation of annual precipitation: Moderately low to moderate
- Drainage density: From west to east, it varies from low, medium to high.
- Stream frequency: Generally varying from east to west from low/medium, medium/high to very high
- Slopes <5%: Varying from west to east; 50-80%, 20-50% and <20%.
- Median annual simulated runoff: Varying from moderate to moderately high.
- Mean annual temperature: Moderate to high.

3.4. Catchment description

The site lies in quaternary catchment V11D has a mean annual precipitation of 644.37mm and mean annual runoff of 23.6%. The study site drains to the Vaal River. See Figure 7 below for the Google Earth description of the site, as provided by the Department of Water Affair's Resource Quality Services (RQS) department.

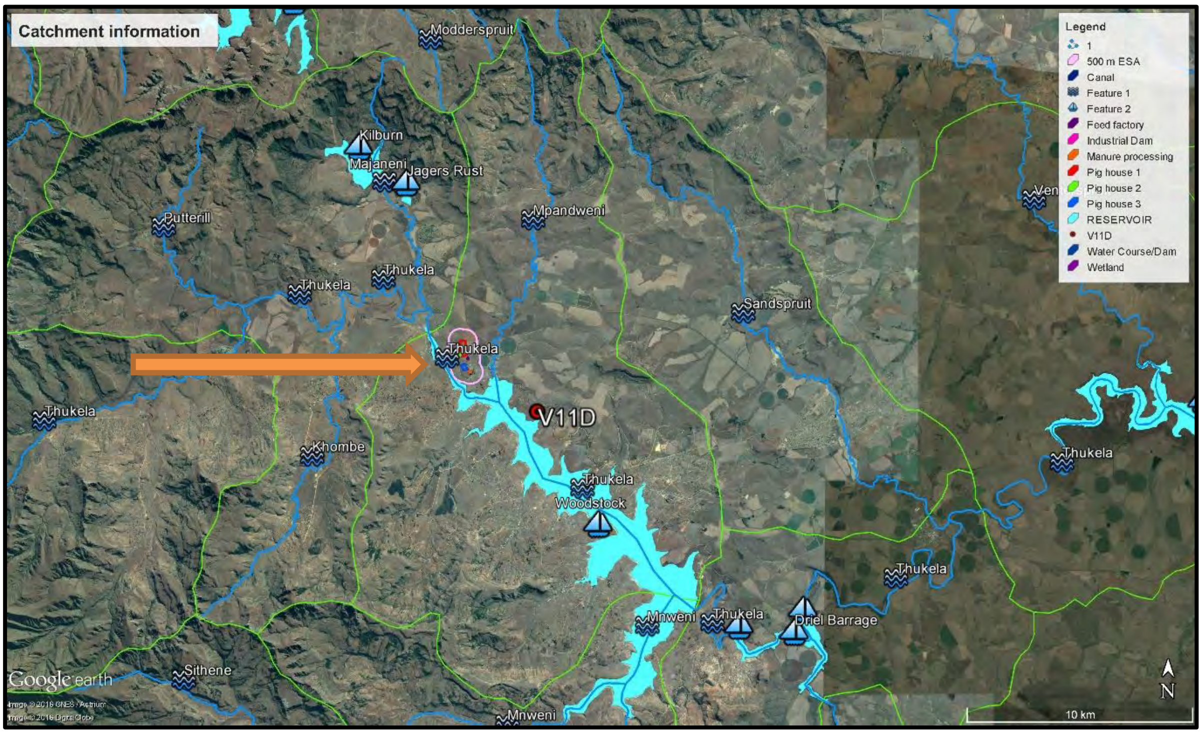


FIGURE 7: THE CATCHMENT AND HYDROLOGICAL DATA FOR THE STUDY SITE, AS AVAILABLE FROM DWA RQS SERVICES.

3.5. Geology and land types

Land type information for the site was obtained through the Department of Agriculture's Global Information Service (AGIS[1]). The study site lies within the Ab208 land type (Figure 8). The AB land type is characterised by freely drained, red and yellow, dystrophic/mesotrophic, apedal soils comprise >40% of the land type (yellow soils <10%)

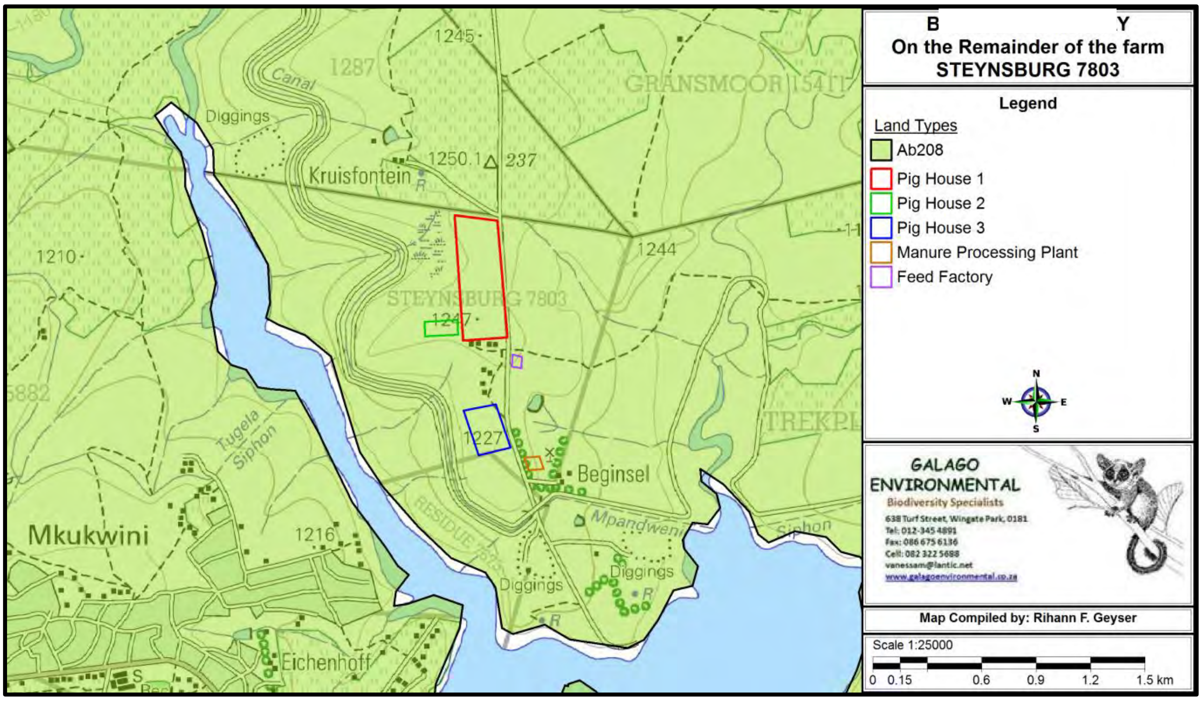


FIGURE 8: LAND TYPES OF THE STUDY SITE

3.6. Catchment condition assessment

Wetlands in South Africa with its high evapo-transpiration rates (which are usually nearly double the regional rainfall) (Schultze 1997), depend on catchments to provide runoff and groundwater flows. Catchments of wetlands can be defined as the action of collecting water in an area, from the highest topographical point to the lowest collection point (and in the case of the wetland found on site, a valley bottom wetland and isolated hillslope seepage system) (SANBI, 1999). The condition of a wetland's catchment thus has a profound impact on the nature of the flows entering the wetland. Therefore the extent of the catchment is determined and its condition assessed by identifying possible impacts and sources of pollution. The wetland and riparian area of the study site forms part of a larger HydroGeomorphic (HGM) drainage network and thus share a larger catchment (Table 4 for the catchment use descriptions and proportional percentage).

[1] Data obtained January 2014. www.**agis**.agric.za/

TABLE 4: THE PERCENTILE LAND USE OF THE CATCHMENT OF THE STUDY SITE

Catchment land use	
Agriculture	50
Housing	10
Industrial	-
Roads	5
Natural (disturbed)	25
Natural (reference condition)	10
Total	**100**

4. Methods for classification of aquatic ecosystem, the delineation and Present Ecological State (PES) calculation

4.1. Classification of aquatic ecosystems

To determine the classification of aquatic ecosystems is a very important aspect of the delineation process as wetlands and riparian systems require different delineation methods. To classify the systems the dichotomous key as found in the "Classification system for wetlands and other aquatic ecosystems in South Africa" (Ollis, *et al.,* 2013) is used. Four keys have been developed for the classification of aquatic ecosystems:

- Landscape Units (Key 1)
- Hydrogeomorphic Units (Key 2)
- Hydrological regime
- Key 3a for river flow types and,
- Key 3b for hydroperiod category

4.2. Wetland Delineation methods

To delineate *any* wetland the following criteria are used as in line with Department of Water Affairs (DWA): A practical field procedure for identification and delineation of wetlands and riparian areas, Edition 1 September 2005. These criteria are:

a) **Wetland (hydromorphic) soils** that display characteristics resulting from prolonged saturation such as grey horizons, mottling streaks, hard pans, organic matter depositions, iron and manganese concretion resulting from prolonged saturation,
b) The presence, at least occasionally, of **water loving plants (hydrophytes)**,
c) A **high water table** that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil, and
d) **Topographical location** of the wetland in relation to the landscape.

Also read with the guide is a draft updated report of the abovementioned guideline. The draft is used, as it provides a guideline to delineation of wetland areas: *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas,* prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. DWA (2008) Draft report. These criteria will mainly indicate a systematic as well as functional change in the aquatic ecosystem.

Wetlands occur throughout most topographical locations, with even the small depression wetlands occurring on the crest of the landscape. The topographical location of possible wetlands is purely an indication of the actions and movement of water in the landscape and is not a definitive delineator (Figure 9).

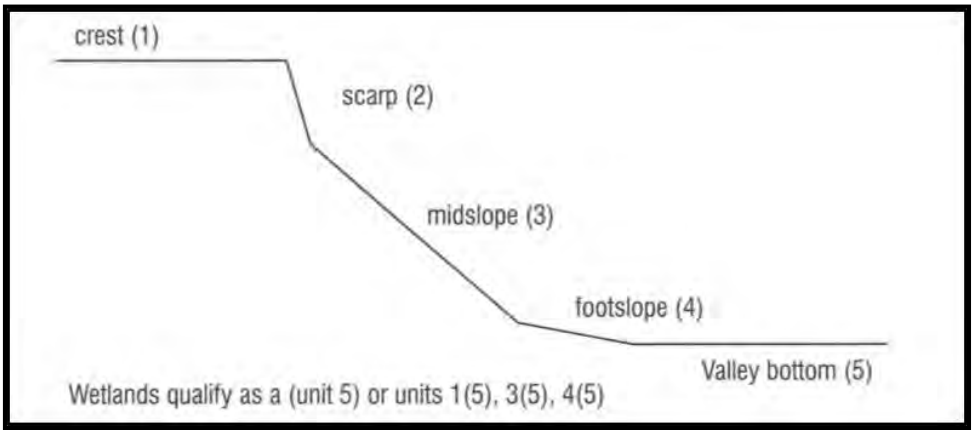


FIGURE 9: DESCRIPTION OF THE TOPOGRAPHY OF AN AREA (FROM DWAF, 2005)

Changes in the presence and frequency of mottling in the soils are the main methods of delineation. This is, as mottles are usually not influenced by short-term changes in the hydrology and vegetation of the wetland (Figure 10). Mottling is formed when anaerobic conditions (increased water saturation) lead to redoximorphic conditions (iron is leached from the soil) and is precipitated in the increased saturation areas of the soil profile.

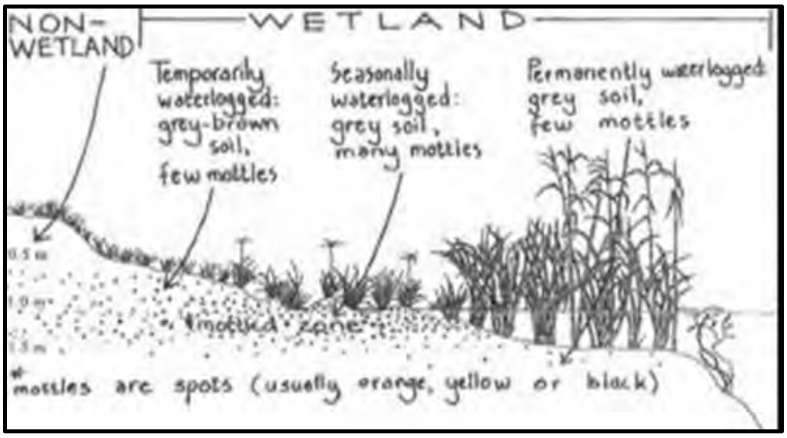


FIGURE 10: CROSS SECTION THROUGH A WETLAND WITH SOIL WETNESS AND VEGETATION INDICATORS. SOURCE: DONOVAN KOTZE, UNIVERSITY OF KWAZULU NATAL (FROM WWW.WATERWISE.CO.ZA)

4.3. Delineation of riparian edge

To delineate *any* riparian area the following criteria are used as in line with Department of Water Affairs (DWA) requirements: *A practical field procedure for identification and delineation of wetlands and riparian areas, DWA Edition 1 September 2005.*

Also read with the guide is a draft updated report of the abovementioned guideline. The draft is used, as it provides a guideline to delineation of riparian areas with specific emphasis on recent alluvial deposits: "*Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas",* prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare., DWA (2008) (Draft report).

These criteria mainly used will indicate a system as well as individual change in the riparian area. The delineation process requires that the following be taken into account and deliberated:

- topography associated with the watercourse;
- vegetation; especially changes in the composition of communities found on site,
- alluvial soils and deposited materials.

Also of importance are the changes in the catchment of the area. Any changes in the use, extent of use as well as alien vegetation changes will influence the river condition and the riparian characteristics. Historical imagery, Google Earth as well as the site visit is used to detect and enumerate any changes. The outer boundary of the riparian area is defined as: "the point where the indicators are no longer discernible" (DWA, 2008). Using the desktop delineation GPS points, sampling took place firstly to truth if the desktop GPS points did in fact represent a riparian area. Secondly using vegetation and topographic indicators, the riparian vegetation was identified and demarcated. A second delineation of the non-riparian area was done.

4.4. Wetland Present Ecological State (PES) calculation method

The present ecological state (PES) of the wetland was determined using the methodology as described by Macfarlane DM, *et al.* 2007. The method encompasses the use of two aspects to determine the PES. Firstly, a site visit where all possible impacts are noted and the scale of the impacts area measured. The information along with the delineation of the wetland is then collated and calculated into three Level 2 suites of WET-Health Microsoft Excel programs.

These suites of programs then provide the PES in the form of Health category ratings from A (best) to F (worst). See the tables below for a layout and description of the category ratings per assessment (Macfarlane *et. al.* 2007).

4.5. Riparian Present Ecological State (PES) calculation method

The South African River Health Program (RHP) under the Department of Water Affairs has developed a suite of programs to allow for the calculation of the ecological category for river and riparian areas. Included in this suite of programs is VEGRAI (Riparian Vegetation Response Assessment Index in River Eco classification as developed by Kleynhans *et al* (2007). This program is Microsoft Excel driven, and allows for two levels of calculations. For the study site, it was chosen to conduct a level 3 assessment[2]. The program does not give an indication on the impacts itself, but rather an indication on the *extent* of the impacts on the riparian areas. The program provides results in ranges and allows results to be allocated a Present Ecological State (PES) category. See Table 5 below.

[2] Level 3 assessment is a basic assessment of the riparian vegetation composition, structure and impacts. The upper and lower marginal zones are combined in level 3 whereas the level 4 the zones are separately assessed.

TABLE 5: THE DESCRIPTION OF THE HEALTH CATEGORY

DESCRIPTION	IMPACT SCORE RANGE	HEALTH CATEGORY
Unmodified/ natural	0-0.9	**A**
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	**B**
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	**C**
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	**D**
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	**E**
Modifications have reached a critical level and the ecosystem processes have been modifiedcompletely with an almost complete loss of natural habitat and biota.	8 – 10	**F**

4.6. Wetland Ecological Services (WET-EcoServices)

To determine and assess the ecological goods and services provided by a wetland, WET-EcoServices (Kotze *et al*., 2007) be used to assess the goods and services that individual wetlands provide, thereby aiding in formed planning and decision making.

It is designed for a class of wetlands known as palustrine wetlands (marshes, floodplains, vleis or seeps). The tool provides guidelines for scoring the importance of a wetland in delivering each of 15 different ecosystem services (including flood attenuation, sediment trapping and provision of livestock grazing). The first step is to characterise wetlands according to their hydro-geomorphic setting (see Table 1).

The program then entails two aspects assessed namely: Level 1, based on existing knowledge or at Level 2, based on a field assessment of key descriptors. The wetland goods and services are also determined by the topographical location and hydrological inputs and regimes of the system (Table 2).

4.7. Ecological importance and sensitivity (EIS) calculation

EIS calculations are compiled to determine how important a specific wetland system is as well as give an indication of the sensitivity of the system. The method was originally designed for floodplain systems, but is being applied for other aquatic ecosystems. Ecological importance is defined as “an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales”. Ecological sensitivity is defined as “the system’s ability to resist disturbance and its capability to recover from disturbance once it has occurred” (Duthie *et al*., 1999). The Ecological Importance and sensitivity (EIS) provides a guideline for determination of the Ecological Management Class (EMC)

In the method outlined here, a series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median score for the biotic and habitat determinants is interpreted and translated into a recommended ecological management class (REMC) as indicated in Table 6. Although the method was designed for floodplain wetlands, it is generally widely applied to all wetland types.

TABLE 6: EIS INTERPRETATION GUIDE

Ecological Importance and Sensitivity Category (EIS)	Range of Median	Recommended Ecological Management Class
Very high Aquatic ecosystems that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	**>3 and <=4**	**A**
High Aquatic ecosystems that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	**>2 and <=3**	**B**
Moderate Aquatic ecosystems that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	**>1 and <=2**	**C**
Low/marginal Aquatic ecosystems that is not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	**>0 and <=1**	**D**

4.8. Historical aerial imagery

National Geo-spatial Information (NGI) is the government component (Department of Rural Development and Land Reform) responsible for aerial photography and has an archive of aerial photographs dating back to the 1930's. The user, although unable to make accurate measurements on the photograph, is able to perform his or her own interpretation of what exists on the ground. Aerial photographs are also an historic record of what existed at the time the photograph was taken.

The photography is at a variety of scales and has provided complete coverage of the country since the 1950's. These are all vertical aerial photographs taken from aircraft. Photography is continuously re-flown to provide new photography for ongoing map revision and for sale to users. The data set was obtained from the department in 2012.

The photos are divided into job numbers, strings (or line numbers) and finally photo numbers.

5. Results

During the site visit the various proposed site locations was assessed. No wetland or riparian conditions were observed in any of the locations, but within the 500 m ESA other wetland types was observed and delineated (Figure 11). The site lies close to the Woodstock dam and a concrete lined irrigation channel. The Woodstock dam is directly fed by the Thukela River and is found to the west of the site. The Mpandweni River feeds into the Woodstock dam from the north, and is close to the eastern boundary of the study site.

During the site visit, it was clear that the prolonged drought in the area has affected the wetland systems, with many of the systems where previous springs (or eyes) have dried up. The wetlands are all impacted by grazing. The channelled valley bottom wetlands are all impounded. Interesting to note is that Ethels Drive creates a catchment divide on site, with the two separate wetland types to the west and east.

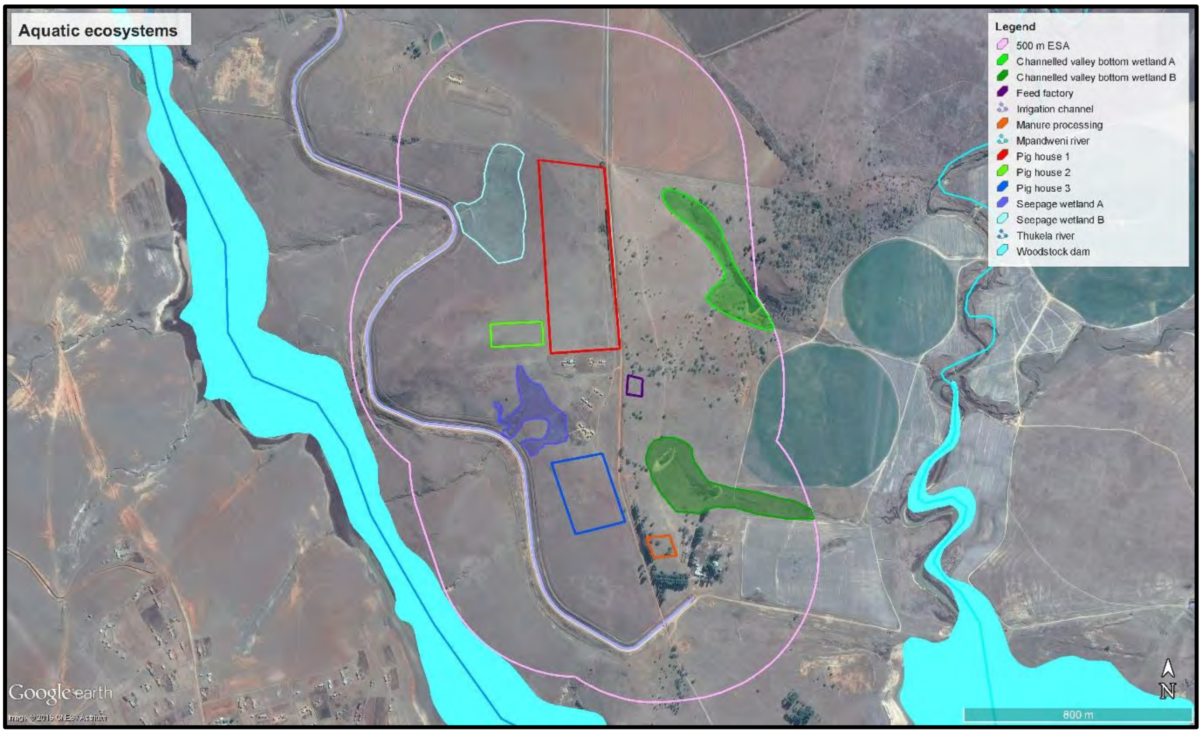


FIGURE 11: THE AQUATIC ECOSYSTEMS OF THE STUDY SITE

Redoximorphic conditions were observed in all the wetlands. Light grey to brown soils was observed in all the wetlands. Increased vegetation density was the primary indicator of wetland conditions but hydrophytes were limited due to intensive grazing of the site-observed species included *Imperata cylindrica* and *Helichrysum aureonitens.*

5.1. Aquatic ecosystem classification (Ollis *et al* 2013)

The classification of the system was done using the dichotomous key in Ollis *et al.* (2013) (Table 7) with the services provided by the aquatic ecosystems found on site in Table 5.

TABLE 7: SUMMARY OF THE APPLICATION OF LEVELS 1 TO 5 OF THE AQUATIC ECOSYSTEM CLASSIFICATION IN ACCORDANCE WITH THE DICHOTOMOUS KEY FROM OLLIS *ET AL.* 2013

Watercourse	**Level 3**		**Level 4:** HGM Unit			**Level 5**				
	Key 1 Landscape Unit		**Key 2**			**Key 3a** River Flow types		**Key 3b** Hydroperiod		
	Level 3a (Figure 9)	**Level 3b**	**Level 4a** HGM Type	**Level 4b** River zonation/ Landform/ Outflow drainage	**Level 4c** River Flow type	**Level 5a**	**Level 5b**	**Level 5 a** Inundation period	**Level 5b** Saturation period	**Level 5 c** Inundation depth class
Channelled valley bottom wetland	Valley floor (no 5)	Hilltop	Channelled valley bottom		-			**Seasonal** inundated	Permanently saturated	
Seepage wetland	Hilltop (no 1)	Saddle	Seep	With/ channeled outflow				**Seasonal** inundated	Permanently saturated	

5.2. Historical and Current use of the property

Google Earth's Timeline function was used as reference imagery (Accessed September 2016). Google Earth imagery from 2008 (Figure 12) to early 2013 (Figure 13) is available and was used to determine the historical land use and whether the site was extensively altered in the past or to detect large changes in the land use of the catchment. The maps are also used to identify areas where possible aquatic ecosystems occur).

FIGURE 12: THE OLDEST USABLE GOOGLE EARTH IMAGE OF THE SITE FROM 2008

FIGURE 13: GOOGLE EARTH IMAGE FROM 2013

5.2.1. Impacts

The list of impacts to the wetland on the study site and adjacent areas follows:

- Grazing,
- Frequency of fire events,
- Excavations,
- Water abstraction,
- Impoundments (dams).

5.3. Seepage wetlands

The seepage wetlands are located to the east of the study site and are all draining to the west (Figure 14). The wetlands are hillslope seepage areas and signs of excavations for water abstraction is clear in both wetland systems (Figure 15).

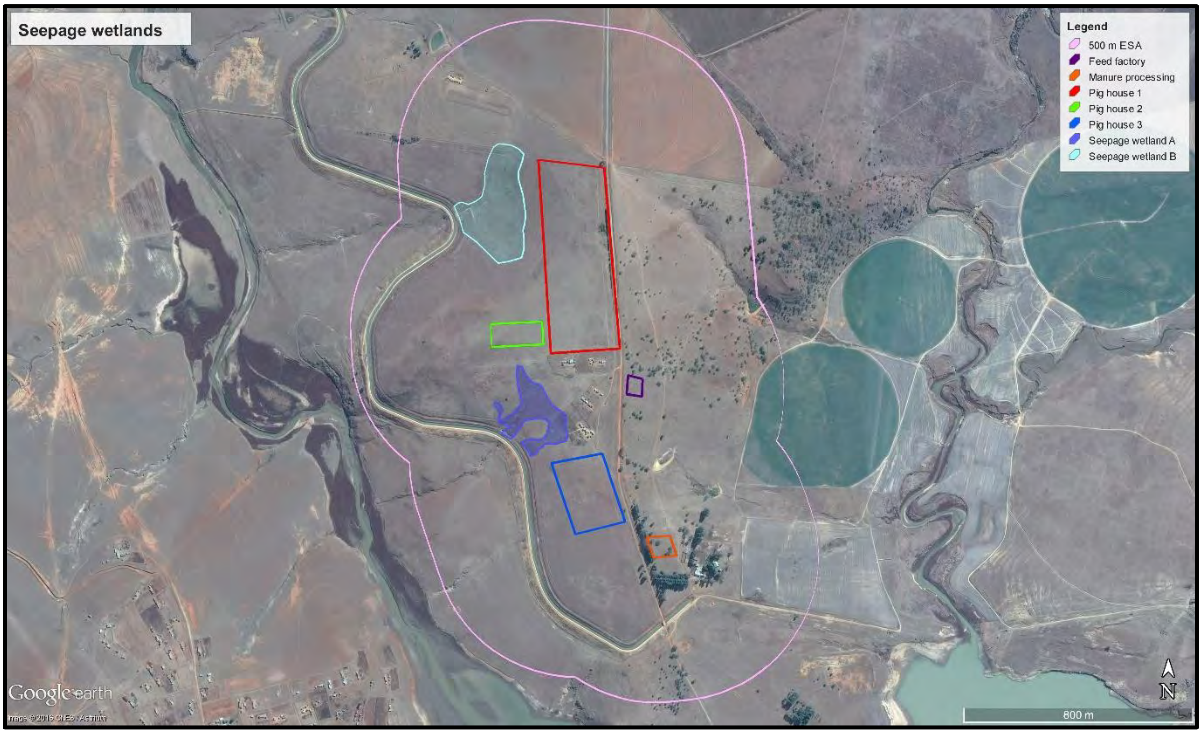


FIGURE 14: LOCATION OF THE SEEPAGE WETLANDS

FIGURE 15: EXCAVATIONS IN THE SEEPAGE WETLANDS FOR WATER ABSTRACTION FOR WATER PROVISION TO DOMESTIC ANIMALS.

5.3.1. Seepage wetlands Wethealth PES score

The calculations results for the PES calculations are presented in Table 8 below. As is clear to see the systems are very similar but anthropogenic activities are reducing the PES of the system and degrading. The wetland systems are expected to further degrade over time due if interventions do not occur, mitigating impacts.

TABLE 8: THE SEEPAGE WETLAND PES RESULTS USING WETHEALTH METHOD

	Vegetation PES	Hydrology PES	Geomorphology PES	Overall PES
Seepage wetland A	C	B	C	C
	Impacted by grazing and cultivation of the wetland	Mostly natural with impacts of surface water abstraction for domestic animals. Alteration of Water quality possible but not tested	Affected by cultivation of upper catchment. Wetlands degraded by openings for water abstraction. Sedimentation regime in the system is altered	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact
Seepage wetland B	A	B	C	B
	Mostly natural with a diverse flora component. Alien vegetation reduced in the system	Affected by erosion channel formation in the middle of the wetland. Increased velocity will alter water quality.	Erosion channel formation in the system is degrading the PES aspect.	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.

5.3.2. Ecological Importance and Sensitivity

EIS for the seepage wetlands were calculated in Table 11. The wetland found within the extended study area can be considered to be of moderate ecological management class. The REMC was calculated to be in ***Moderate*** condition "Aquatic ecosystems that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers".

TABLE 9: THE COMBINED EIS SCORE OF THE SEEPAGE WETLAND AND REMC CLASSIFICATION (0 INDICATES NO IMPORTANCE AND 4 INDICATES VERY HIGH IMPORTANCE)

Determinant	Score	Confidence	Discussion
PRIMARY DETERMINANTS			
Rare & Endangered Species	1	3	None observed but possible due to close proximity of the Drakensberge to the west
Populations of Unique Species	2	4	
Species/taxon Richness	3	3	Diverse flora with less fauna, mostly small rodents etc.
Diversity of Habitat Types or Features	2	2	More diverse due to location of the wetlands including increased vegetation densities in the wetlands creating more habitat.
Migration route/breeding and feeding site for wetland species	1	2	Reduced due to concrete channel effectively disjointing habitat movement
Sensitivity to Changes in the Natural Hydrological Regime	2	3	See Table 2 and Table 3 above
Sensitivity to Water Quality Changes	2	3	
Flood Storage, Energy Dissipation & Particulate/Element Removal	2	2	
MODIFYING DETERMINANTS			
Protected Status	1	3	Not protected and impacted
Ecological Integrity	2	3	System remains functioning
TOTAL	18		
MEAN (Total / 10)	1.8		
Recommended Ecological Management class (REMC) (Table **6)**	**Moderate**		

5.4. Channelled valley bottom wetland

The channelled valley bottom wetlands are all located to the east of the study site, and drains to the Mpandweni River. The systems are all impacted by artificial impoundments.

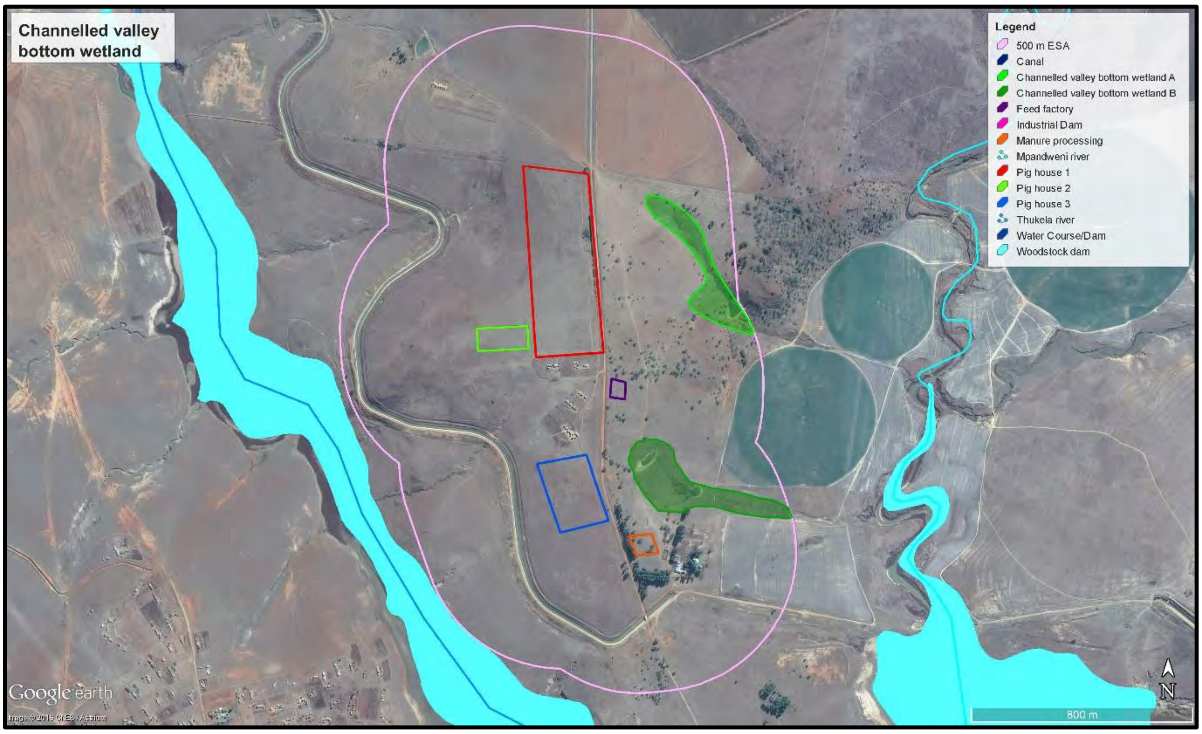


FIGURE 16: THE LOCATION OF THE CHANNELLED VALLEY BOTTOM WETLANDS

5.4.1. Wetland IHI results

The WetHealth results are presented in Table 8.

TABLE 10: THE CHANNELLED VALLEY BOTTOM WETLAND PES RESULTS USING WETHEALTH METHOD

	Vegetation PES	Hydrology PES	Geomorphology PES	Overall PES
Channelled valley bottom wetland A	**B**	**C**	**C**	**C**
	More natural but also impacted by grazing	Impacted due to impoundment and channel being eroded	Degraded due to channel erosion and incisions	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact

	Vegetation PES	Hydrology PES	Geomorphology PES	Overall PES
Channelled valley bottom wetland B	**B**	**C**	**C**	**C**
	Intact but impacted by grazing	Impacted due to impoundment and channel being eroded	Degraded due to channel erosion and incisions	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact

5.4.2. Ecological Importance and Sensitivity

EIS was calculated in Table 11. The REMC was calculated to be in ***Moderate*** condition "Aquatic ecosystems that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers".

TABLE 11: THE EIS SCORE OF THE CHANNELLED VALLEY BOTTOM WETLANDS AND REMC CLASSIFICATION (0 INDICATES NO IMPORTANCE AND 4 INDICATES VERY HIGH IMPORTANCE)

Determinant	Score	Confidence	Discussion
PRIMARY DETERMINANTS			
Rare & Endangered Species	1	3	Possible. Limited to feeding habitat within wetlands.
Populations of Unique Species	2	3	
Species/taxon Richness	2	3	Diverse flora, limited fauna.
Diversity of Habitat Types or Features	3	3	Diverse due to channel and impoundments
Migration route/breeding and feeding site for wetland species	3	2	Possible, but for shorter duration
Sensitivity to Changes in the Natural Hydrological Regime	2	3	See Table 2 and Table 3 above
Sensitivity to Water Quality Changes	1	4	
Flood Storage, Energy Dissipation & Particulate/Element Removal	2	2	
MODIFYING DETERMINANTS			
Protected Status	0	2	Not protected and utilised
Ecological Integrity	1	4	Intact even with impacts from anthropogenic sources.
TOTAL	17		
MEAN (Total / 10)	1.7		
Recommended Ecological Management class (REMC) (Table 6)	**Moderate**		

6. Discussion, Impact assessment and general mitigation measures

The aquatic ecosystems found in the study area is in average condition with the REMC/EIS of the system calculated to Moderate. See Table 12 for all the scores.

TABLE 12: THE PES AND REMC/EIS OF THE WETLANDS FOUND ON SITE

	Vegetation PES	Hydrology PES	Geomorphology PES	Overall PES	REMC/ EIS
Seepage wetland A	**C**	**B**	**C**	**C**	**1.8**
Seepage wetland B	**A**	**B**	**C**	**B**	
Channelled valley bottom wetland A	**B**	**C**	**C**	**C**	**1.7**
Channelled valley bottom wetland B	**B**	**C**	**C**	**C**	

The proposed activities on site are the establishment of piggeries and includes the feed production and manure reticulation. The proposed planning of the piggery is outlined by Joos Solms Managing Director of PLANTKOR[3] (Plantkor, 2016). Important aspects outlined by the document is the following:

- *All designs are based on the latest SARPO and the European Union's new pig regulations and legislation. We have exceeded these requirements due to our personal objectives of animal welfare and to the environmental responsibilities.*
- *All the buildings and equipment are designed with the above objectives in mind. The pigs will be free at all times except during lactations.*
- *Each production centre has a special care centre for sick or injured animals. The hygiene in the units is paramount and will be administered to prevent any disease spread. All humans will be required to shower and be disinfected when entering and leaving the units.*
- ***The effluent from the units is all organic and will be sold as organic fertiliser and organic liquid. The effluent will be stored under the houses in slurry pits***

[3] Plantkor: J Soloms (036) 468 1309. plantkor@plantkor.co.za

and flushed every 14 days to prevent any ammoniac developing. No water will be required to flush the organic effluent from the buildings.

- ***The effluent will be piped to an effluent separation sections to prevent any contact with soil, or the nearby surroundings****.*
- *The organic solids will be separated from the liquid by means of a separation press. The dry matter will be stored for selling to the surrounding farms and the organic liquid will be stored in a lined dam for fertigation through the nearby centre pivots. The above organic fertiliser will be used on 1200 ha of maize and soya fields.*
- *Water will be harvested from all the 65,000 sq/m roofs for use in the piggery. This will amount to ±50,000 cub/m a year, which is about 40% of the requirement of the farm.*
- *The farm will also make use of solar energy for the heating of all the water for washing purposes.*

Concerning on site is the area is located on ridges, and large amounts of levelling is required to ensure the piggeries are located on flat areas (Figure 17 and Figure 18).

FIGURE 17: SITE 1 INDICATING AREAS WHERE CUT (RED) AND FILL (GREEN) IS REQUIRED.

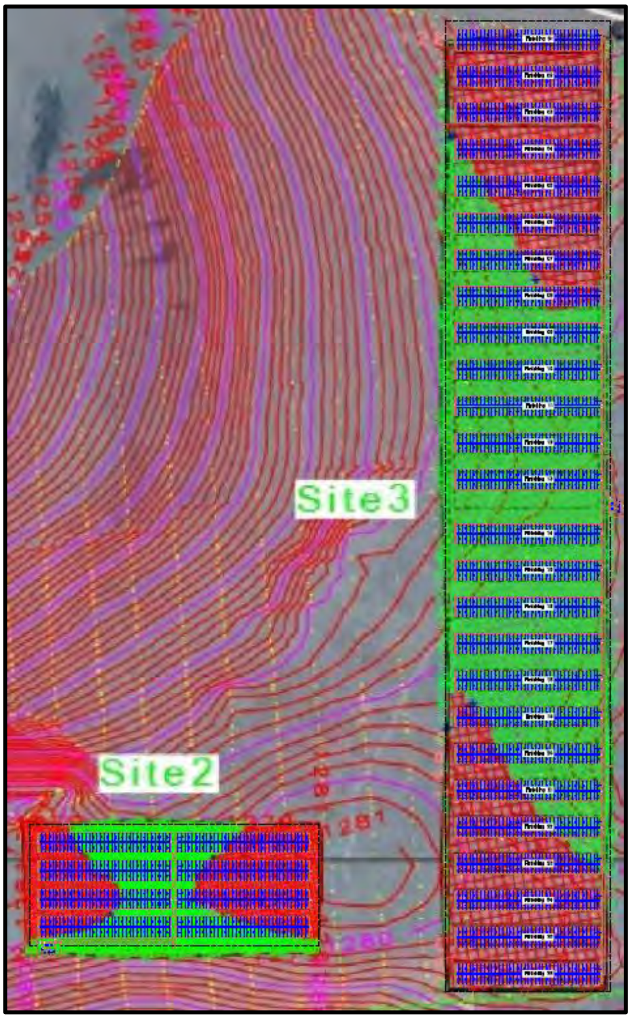


FIGURE 18: SITE 2 AND 3 INDICATING AREAS WHERE CUT (RED) AND FILL (GREEN) IS REQUIRED.

6.1. Impact assessment

The proposed development of the site can be divided into different periods with different impacts especially on flooding and erosion after development. See the rating scale in Table 13 and the calculations of the impact in Table 14. **The calculations determine the impact score to 5.5 (Moderate): "The project can be authorised but with conditions and routine inspections".**

TABLE 13: THE IMPACT SIGNIFICANCE BEFORE MITIGATION RATING SCALE

Descriptors	Definitions	Rating
None	The project can be authorised	< 3
Low	The project can be authorised with a low risk to of environmental degradation	3 - 4
Moderate	The project can be authorised but with conditions and routine inspections	5 – 8
High	The project can be authorised but with strict conditions and high levels of compliance and enforcement in respect of the impact in question	9 – 15
Fatally Flawed	The project cannot be authorised	> 15

TABLE 14: THE IMPACT RATING FOR THE DEVELOPMENT* FOR *IN SITU* PRE-MITIGATED CONDITIONS (* GREEN FILLED RATING SCALES ARE APPLICABLE TO THE SITE)

Criteria	Duration descriptors	Definitions	Rating	Score total
Nature	Positive Negative Neutral	This is an evaluation of the type of effect the construction, operation and management of the proposed development would have on the affected environment.		
Scale/ Extent	Site	Site-specific, affects only the development footprint.	1	**2**
	Local	Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius).	2	
	Regional	The impact footprint includes the greater surrounding area within which the site is located	3	
	National	The scale/ extent of the impact is applicable to the Republic of South Africa	4	
	Global	The scale / extent of the impact is global (or world-wide)	5	
Duration	Construction/ Decommissioning period only	The impact endures for only as long as the Construction/ Decommissioning period of the proposed activity. This implies the impact is fully reversible.	1	**5**
	Short term	The impact continues to manifest for a period of between 3 – 10 years. The impact is reversible.	2	
	Medium term	The impact continues to manifest for a period of 10-30 years. The impact is reversible with relevant and applicable mitigation and management actions.	3	
	Long term	The impact continues for a period in excess of 30 years. However, the	4	

Criteria	Duration descriptors	Definitions	Rating	Score total
		impact is still reversible with relevant and applicable mitigation and management actions.		
	Permanent	The impact will continue indefinitely and is irreversible.	5	
Intensity or severity of the impact	**Descriptors: potential consequence (negative)**			
	High	Human health morbidity/ mortality. Loss of species	16	**2**
	Moderate-high	Reduced faunal populations, loss of livelihoods, individual economic loss,	8	
	Moderate 2	Reduction in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	4	
	Moderate-low	Nuisance	2	
	Low	Negative change – with no other consequences	1	
	Descriptors: potential consequence (positive)			
	Moderate-high	Net improvement in human welfare	8	**2**
	Moderate	Improved environmental quality – air, soil, water. Improved individual livelihoods	4	
	Economic development	Moderate-low	2	
	Low	Positive change – with no other consequences	1	
Score total				**11**
Likelihood/ Probability (the likelihood of the impact occurring)	Improbable	The possibility of the impact occurring is negligible and only under exceptional circumstances.	0.1	**0.5**
	Unlikely	The possibility of the impact occurring is low with a less than 10% chance of occurring. The impact has not occurred before.	0.2	
	Probable	The impact has a 10-40% chance of occurring. Only likely to happen once every three or more years.	0.5	
	Highly Probable	It is most likely that the impact will occur. A 41 – 75% chance of occurring.	0.75	
	Definite	More than 75% chance of occurrence. The impact occurs regularly.	1	
Impact significance before mitigation (Table 13)				
(Extent + Duration + Potential Intensity) x Probability/ Likelihood			**=11x0.5**	
Impact rating			**=5.5 (Moderate)**	

6.2. Ecological risk assessment

Risk assessment of the development is mainly based on a basic perceived risk and rating scale for the development. This is based on previous experience working on other similar projects as well as guiding documentation. A simple equation is used to quantify the perceived ecological risk:

$$ER\ (Ecological\ risk) = (Magnitude + duration + scale)\ \times Probability$$

The risk assessment scaling is given in Table 15. Using the information from the equation the score is then used to quantify the following:

ER >75 High ecological risk;

ER 30 to 75 Moderate ecological risk

ER <30 Low ecological risk

The main possible risks to the system are calculated in Table 16. From the calculations, it is clear to see that the proposed activities have on average a low (average 9.5) ecological risk profile. This is in line with the low impact of the proposed development on the aquatic ecosystems.

TABLE 15: RISK ASSESSMENT SCALING

Magnitude		Duration		Scale		Probability	
10	Very High/ Unclear	5	Permanent	5	International	5	Definite/ don't know
8	High	4	Long term (impact ceases after closure)	4	National	4	High Probability
6	Moderate	3	Medium term (5-15 years)	3	Regional	3	Medium probability
4	Low	2	Short term (0-5 years)	2	Local	2	Low probability
2	Minor	1	Transient	1	Site only	1	Improbable
1	None					0	None

TABLE 16: ECOLOGICAL RISK ASSESSMENT CALCULATION

Ecological aspect at risk	Risk score of impact				Probability	Ecological Risk (ER)	ER >75 High ecological risk; ER 30 to 75 Moderate ecological risk ER <30 Low ecological risk
	Magnitude	Duration	Scale	Total			
Flow	2	1	2	**5**	2	**10**	**Low significance**
Sediment regime	2	1	1	**4**	1	**4**	**Low significance**
Water quality	2	1	2	**5**	1	**5**	**Low significance**
Geomorphology	6	1	1	**8**	3	**24**	**Low significance**
Habitat	2	1	1	**4**	1	**4**	**Low significance**
Biota	2	1	2	**5**	2	**10**	**Low significance**
MEAN/ AVERAGE	**3**	**1**	**2**	**5**	**1**	**9,5**	**Low significance**

6.3. Authorisation assessment

To determine if a General authorisation or Water use licence is required, Notice 509 of 2016 of Government Gazette no 40229 (pg. 105) is used to determine the level of authorisation required. Using this information the risk assessment for general authorisations in terms of Section 39 of the National Water Act, 1998 (Act No 36 of 1998), for water uses as outlined in Section 21 (c) or Section 21 (i) as from 26 August 2016 is used. Overall risk scores of less than 66 will indicate a general authorisation application in terms of Section 21 (c and i) of the National Water Act, 1998.

A basic rapid assessment for the perceived impacts was completed in Table 17 below. Various scores were achieved, and only the average score for all the aspects will be used. An average score of 75 (medium risk) was calculated and thus a water use licence is required.

TABLE 17: THE RISK ASSESSMENT FOR THE STUDY SITE

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating 1 – 55 (L) Low Risk 56-169 (M) Moderate Risk 170-300 (H) High risk
1	Construction	Increased sediments	Increases in fines materials not the same as the alluival matrials currentl in the system. Powedery substance rather than alluvial fiens	WQ alteration	1	5	3	3	3	1	2	6	1	1	1	3	6	36	L
2	Construction	concrete works	possible polluton by concrete into the aqautic ecosystem	pollution	1	5	1	3	2,5	1	2	5,5	1	1	1	1	4	22	L
3	Construction	Road creation on slopes	Vegetation disturbance	Clearing of vegetation (terrestrial, hydophytes and ecotone)	2	3	4	2	2,75	1	3	6,75	4	3	1	1	9	60,75	M
4	Cosntruciton	Levelling for piggery construction	Alertation of cathemnt areas, and flow patterns due to leveling of soil (Figure 17 and 18)	Aletration of hydrology, vegetation clearing	4	4	4	2	3,5	1	2	6,5	1	1	1	4	7	45,5	L
	Operational	Stochastic events impacting water flow	Water flow altered due to surface hardening (access roads) and cut and fill for levelling the piggery	Alteration of flow	5	1	2	1	2,25	2	3	7,25	1	1	5	5	12	87	M
	Operational	Stochastic events impacting water quality	Impacts to water quality from the piggery including alteration of nitrates and nitrites, phosphates and other chemical spills	WQ alteration	5	5	3	3	4	3	4	11	1	1	5	5	12	132	
	All phases	Flow alteration	flow patterns altered	flow	5	3	3	3	3,5	2	3	8,5	2	2	1	1	6	51	
	All phases	alteration of natural vegetation	disturbance of the ecotone between terrestrial and aqautic ecosystems by pipeline	physical distrubance	3	5	5	5	4,5	2	2	8,5	5	3	5	1	14	119	M
	All phases	Habitat alteration	excavation will alter flows of water into the study stie	WQ, habitat, flows, geomorphology	3	3	5	5	4	3	3	10	3	3	5	1	12	120	M
Average					**3**	**4**	**3**	**3**	**3**	**2**	**3**	**8**	**2**	**2**	**3**	**1**	**9**	**75**	**M**

6.4. Mitigation of potential impacts

The mitigation of the impacts to the system is based on the perceived impacts for the proposed activities.

6.4.1. Site specific mitigation measures

- Although no manure will be released into the natural environment, the handling of the manure must occur with care. Transfer of manure between transport vehicles must be done on a bunded area, with a dedicated dirty water trap.
- Piping and storage of manure must be regularly inspected (weekly) to ensure no leaks occur in the systems,
- Road infrastructure must avoid being adjacent to wetland and associated buffer areas. This is to prevent hard surfaces from the roads increasing water velocities into the wetland and creating other erosion areas,
- The use of natural vegetation barriers around buffer areas to ensure phytoremediation is increased,
- Storm water management on site must take cognisance of possible pollution arising from the site, with emphasis on hydrocarbon and manure pollution. This must also include the mitigation of speeds of storm water entering the wetland from the study site. strong attenuation must be included where possible,
- Signage must also be included to increase awareness of the wetland found on site and the impact of customers on the wetland.

6.4.2. Mitigation of impacts using buffers

The study site is located in KwaZulu-Natal and the buffer requirements are up to the discretion of the specialist. For the study, site a buffer of 50 meters is proposed (as in line with the GDARD guidelines). This is acceptable as the impacts from the development are expected to be minimal and can be managed through monitoring and immediate interventions. It must be noted that none of the proposed developments fall within any of the wetland and or buffer areas. Clarity is however sought for impacts in terms of geohydrology of the proposed development on the water feeding into the wetlands. The irrigation channel did not receive a buffer as it is not a natural system.

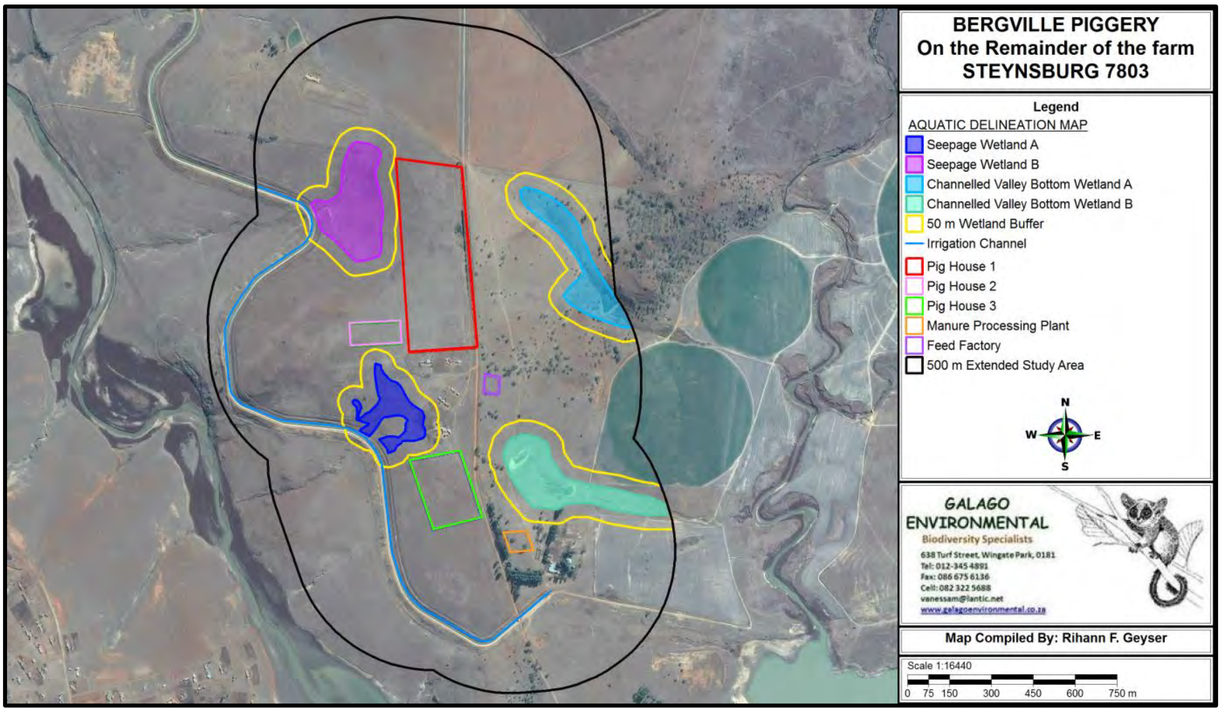


FIGURE 19: PROPOSED BUFFERS OF THE STUDY SITE.

6.5. General mitigation measures

The following general mitigation measures are proposed[4]:

- An alien vegetation eradication programme should be implemented on the site to remove the alien vegetation from the wetland areas.
- An environmental control officer (ECO), specialising in aquatic systems (AECO) must be appointed throughout the project to ensure the longevity of the impacted aquatic system.
- The use of cement lined channels must be avoided at all costs and lining must be done with Loffel stones (or Amourflex stones) or similar products. This is to prevent the loss of habitat to aquatic organisms living in the system.
- The ramps for the in- and out flows from the construction site must be lined with Reno mattresses and or gabions to prevent structure undermining and to ensure flow is dispersed and mitigated. Vertical steps should not exceed 200 mm, to ensure aquatic fauna movement and migration.
- The use of gabion structures, well keyed into the surrounding bank walls and secured to the ground is recommended.
- If any construction activity must occur within the riparian areas then it must commence from upstream proceeding downstream with proper sedimentation

[4] The contractor appointed for construction must be contractually bound to the requirements and mitigating measures listed in this document and any other documents relating to the construction (ecological management plan, rehabilitation plant etc.).

barriers in place to prevent sediments and pollution moving downstream from the site. This includes non-perennial systems.

- The removal and translocation of impacted hydrophytes must be done prior to construction commencing.
- Due to the perennial nature of the system, construction should preferably commence during the dry months.
- All sensitive areas together with the associated buffer zones should be fenced during the construction phase to prevent any human activity from encroaching onto these areas. Monitoring of the fences is of paramount importance to ensure no infringement of the fences occurs.
- Removal of debris and other obstructing materials from the site must take place and erosion-preventing structures must be constructed. This is done to prevent damming of water and increasing flooding danger.
- Removed soil and stockpiling of soil must occur outside the extent of the watercourse to prevent siltation and increased runoff during construction. This includes the buffer zones and 1:100 year flood lines.
- Proper toilet facilities must be located outside the sensitive areas: The impact of human waste on the system is immense. Chemical toilets must be provided which should always be well serviced and spaced as per occupational health and safety laws, and placed outside the buffer and 1:100 year flood lines.
- Spill kits must be stored on site: In case of accidental spills of oil, petroleum products etc., good oil absorbent materials must be on hand to allow for the quick remediation of the spill. The kits should also be well marked and all personnel should be educated to deal with the spill. Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat. The use of a product such as Sunsorb is advised.
- No plant machinery may be stored or left near the aquatic areas, when not in use.
- Frequent inspection of the site must be done to ensure that no harmful practices occur on site.
- A photo collection must be taken from fixed demarcated spots to detect changes in the construction area over time. These photographs must be dated and should include the entire site.
- No construction personnel are allowed to collect, harvest or kill any species of fauna and flora on the site.
- Any species of fauna encountered during the construction phase should be moved to a safe location where no harm can be bestowed on the species.
- If water is sprayed on the construction surface for any reason during the construction process, utmost care must be taken to ensure the runoff water does

not pollute the system or any of the associated catchment areas. A storm water cut-off drain should be constructed between the construction area and the aquatic system to ensure that storm water flowing through the construction area cannot flow into the aquatic system. The water from the cut-off drain must be collected in a sedimentation pond before entering the aquatic system.

- Any new erosion gullies must be remediated immediately.
- Construction should commence during the dry season or when flows are at their lowest where reasonably possible.
- Regular inspection of erosion preventing devices is needed.
- Construction camps: Plant parking areas and material stockpiles must be located outside the extent of the wetland.
- Access routes should be demarcated and located properly so that no damage to the system can occur. These roads must be adhered to at all times. A large turning place must be provided for larger trucks and machinery. No grading of temporary access roads is allowed as this will create dust and water runoff problems.
- Increased runoff due to removal of vegetation and increased soil compaction must be managed to ensure the prevention of siltation and the maximum stream bank stability.
- The velocity of storm water must be attenuated and spread. As far as possible the link between the stream and the local environment must be maintained. This is to ensure water movement into the soils and ensuring the survival of associated vegetation.
- Storm water leaving the site downstream must be clean and of the same quality as in situ before it enters the construction site (upstream). Preconstruction measures must be in place to ensure sediments are trapped.
- The overall alluvial characteristics of the drainage line (balance between sand, gravel, and stone) must be similar to before construction to ensure natural systems of flooding and sedimentation deportation and conveyance occur.

7. Conclusion and recommendations

During the site visit four distinct wetland systems was observed within the study area (**FIGURE 20**), with most of the systems in average condition. The REMC/EIS of the systems were also moderate (1.8 and 1.7). The activities proposed on site include the raising of pigs, feed production, and manure processing. It is important to note that none of the manure will be released on site, but rather stored for use elsewhere. This combined with the fact that the development is not going to occur over any wetland and or buffer areas reduced the risk posed by the proposed development. It is a concern that if any stochastic events do occur, the impact of the proposed development on the aquatic ecosystem, in light of the Woodstock dam will be detrimental. The impact assessment calculations determined the impact score to **5.5 (Moderate): "The project can be authorised but with conditions and routine inspections".**

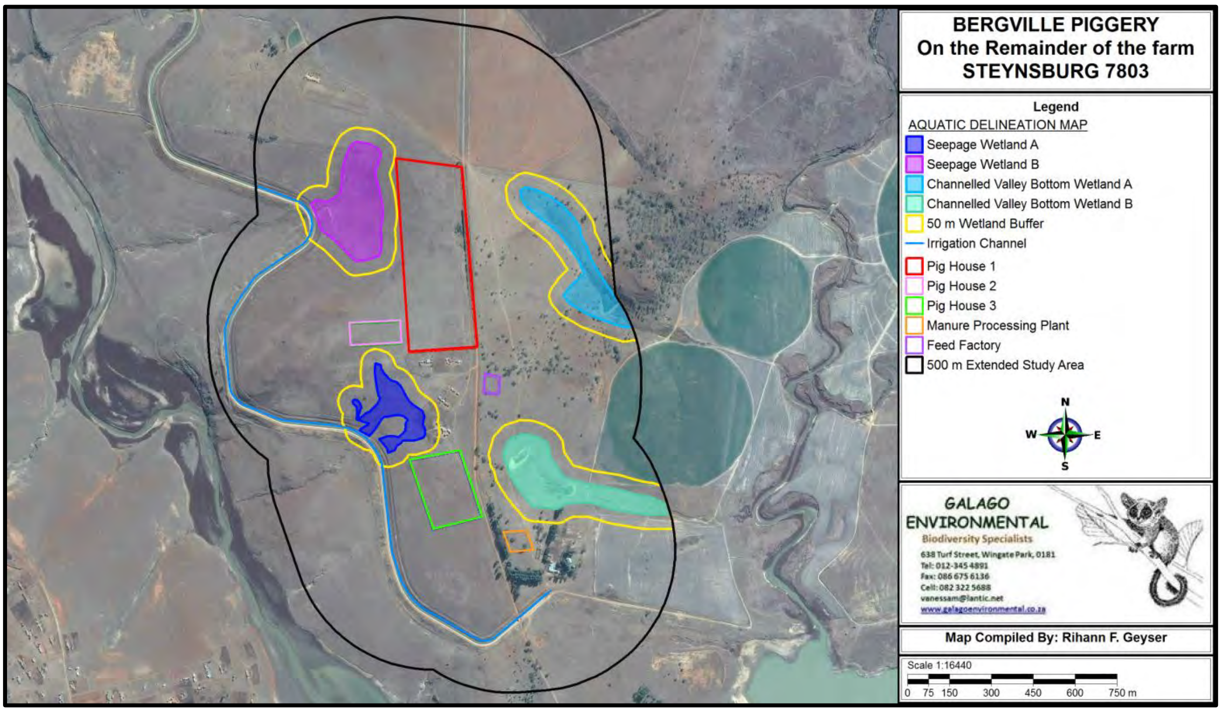


FIGURE 20: THE AQUATIC ECOSYSTEM DELINEATION MAP OF THE STUDY SITE

All environmental assessments (including biodiversity assessments) must always be based on the three main aspects of the National Environmental Management Act, 1998 (Act No. 107 of 1998). These main aspects are the social, the economic, and the environmental aspects of the proposed development. It is also of concern that these aspects must be in balance and that if one outweighs another, good reasoning be sought to ensure the balance is restored.

A buffer of 50 meters must be applied to the aquatic ecosystem found on the study site (see section 1.1 above and **Figure 21** below).

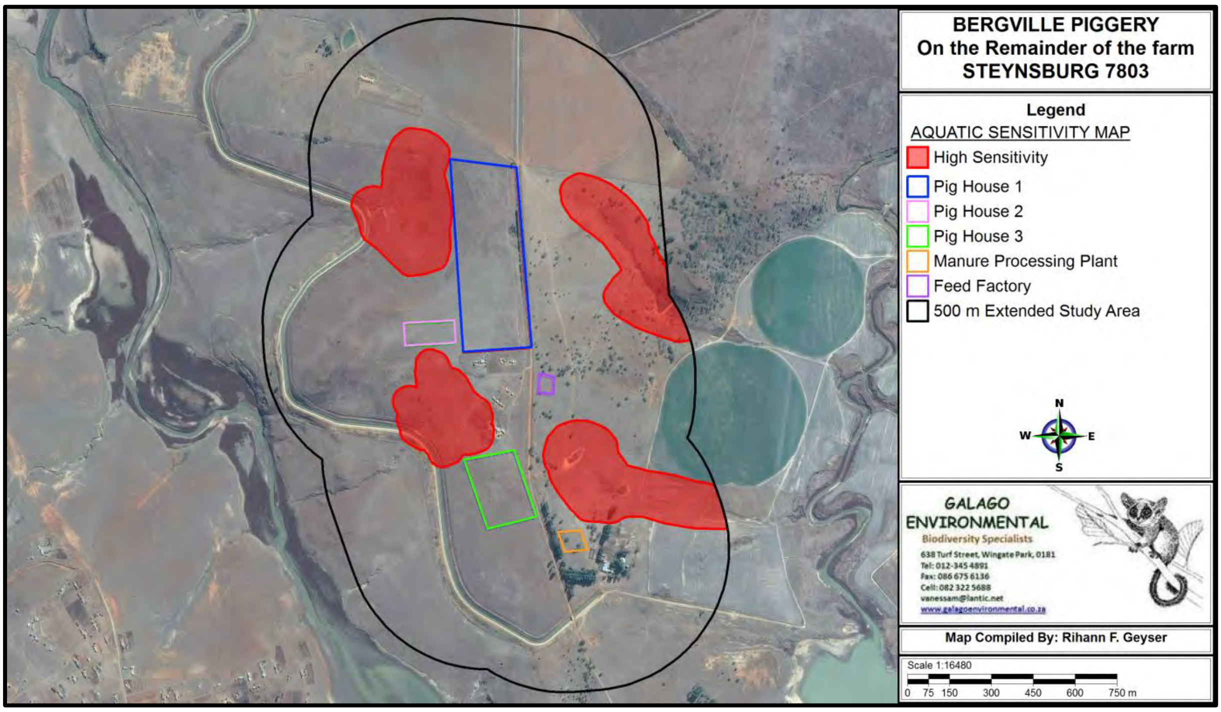


FIGURE 21: THE AQUATIC SENSITIVITY MAP OF THE STUDY SITE

The determination if a General authorisation or Water use licence is required for the proposed activities on site was done. Notice 509 of 2016 of Government Gazette no 40229 (pg. 105) was used. An average score of 75 (medium risk) was calculated and thus a water use licence is required. It must be clearly noted that any development on the study site will have an impact on the aquatic ecosystems and must be authorised in terms of Section 21 of the National Water Act (1998). A summary of findings is given in **Table 18**.

TABLE 18: SUMMARY OF FINDINGS

Aquatic ecosystem classification (Ollis et al. 2013)	Seepage wetland Channelled valley bottom wetland
Present Ecological Score (PES)	Seepage wetland A:C Seepage wetland B: B Channelled valley bottom wetland: C Channelled valley bottom wetland: C
Recommended Ecological Management Class (EIS/REMS)	Seepage wetland: 1.8 Moderate Channelled valley bottom wetland: 1.7 Moderate
Ecological risk assessment	9.5 Low significance
Buffers	50 meters for all wetlands
Notice 509 GA or WUL average score	75 - Moderate risk- Water use license application is required

Sensitivity of aquatic ecosystems	High (red) (**FIGURE 21**)
Does the specialist support the development?	Yes as the impacts can be kept outside the buffer and wetland areas and as the mitigation of stochastic events are easily achieved
Major concerns	- Manure reticulation, - Surface hardening, - Storm water management, - Stochastic events

7.1. Environmental laws

The following environmental laws could be applicable to the study site. These are only recommendations and to ensure compliance, a lawyer specialising in environmental law should be consulted:

- National Environmental Management Act, 1998 (Act No. 107 of 1998)
- The National Water Act, 1998 (Act No. 36 of 1998) with specific reference paid to Section 21 of the National Water Act, 1998 (Act No.36 of 1998)
- The National Water Act, 1998 (Act No. 36 of 1998) General Notice 1199 - development within 500 meters of a wetland
- The National Water Act, 1998 (Act No. 36 of 1998) General Notice 1198 - Rehabilitation of a wetland area
- Regulation No. 543 – 545, 2010 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)
- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003);
- National Environment Management Waste Act, 2008 (Act No. 59 of 2008);
- National Veld and Forest Fire Act, 1998 (Act No.101 of 1998);
- Mountain Catchment Act, 1970 (Act No. 63 of 1970);
- National Heritage Recourses Act, 1999 (Act No. 25 of 1999);
- World Heritage Convention Act, 1999 (Act No. 49 of 1999);
- Municipal Systems Act, 2000 (Act No. 32 of 2000);
- Integrated Coastal Management Act, 2008 (Act No. 24 of 2008);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Land Use Planning Ordinance 15 of 1985 and the planning ordinances depending on the province in South Africa where construction will take place

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APPENDIX 8B

HERITAGE IMPACT ASSESSMENT

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

PROPOSED 4800 SOW UNIT PIGGERY TO BE ESTABLISHED 21 KM NORTHWEST OF BERGVILLE ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL PROVINCE

Leonie Marais-Botes
Heritage Practitioner

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BA (Cultural History and Archaeology) (UP), BA (Hons) Cultural History (UP), Post Grad Dip Museology (UP), Cert Conservation of Traditional Buildings (Univ of Canberra) Post Grad Dip: Heritage (Wits)

Accredited member: SA Society for Cultural History (CH002)

For:

REC SERVICES (PTY) LTD t/a ROCK ENVIRONMENTAL CONSULTING
P.O. BOX 40541
MORELETA PARK
0044

September 2016

DISCLAIMER:

Although all possible care is taken to identify/find all sites of cultural importance during the initial survey of the study area, the nature of archaeological and historical sites are as such that it is always possible that hidden or sub-surface sites could be overlooked during the study. Leonie Marais-Botes Heritage Practitioner will not be held liable will not be held liable for such oversights or for the costs incurred as a result thereof.

ACKNOWLEDGEMENTS

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ABOUT THIS REPORT

The heritage report must reflect that consideration has been given to the history and heritage significance of the study area and that the proposed activities is sensitive towards the heritage resources and does not significantly alter or destroy the heritage significance of the study area.

The heritage report must refer to the heritage resources currently in the study area.

The opinion of an independent heritage consultant is required to evaluate if the proposed work generally follows a good approach that will ensure the conservation of the heritage resources.

The National Heritage Resources Act (Act 25 of 1999), the National Environmental Management Act (Act 107 of 1998), Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended) are the guideline documents for a report of this nature.

Leonie Marais-Botes was appointed by REC Services (Pty) Ltd t/aRock Environmental Consulting to carry out a Phase 1 Heritage Impact Assessment (HIA) for the proposed 4800 Sow Unit Piggery to be established 21 km north west of Bergville on the Remaining Extent of the Farm Steynsburg 7803-GS KwaZulu-Natal Province. The site visit took place on 10 September 2016.

DEFINITION OF TERMS:

''alter'' means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or other decoration or any other means.

"archaeological'' means—
(a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
(b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
(c) wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; and
(d) features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

''conservation'', in relation to heritage resources, includes protection, maintenance, preservation and sustainable use of places or objects so as to safeguard their cultural significance.

''cultural significance'' means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

''development'' means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of a heritage authority in any way result in a change to the nature, appearance or physical nature of a place, or influence its stability and future well-being, including—
(a) construction, alteration, demolition, removal or change of use of a place or a structure at a place;
(b) carrying out any works on or over or under a place;
(c) subdivision or consolidation of land comprising, a place, including the structures or airspace of a place;
(d) constructing or putting up for display signs or hoardings;
(e) any change to the natural or existing condition or topography of land; and
(f) any removal or destruction of trees, or removal of vegetation or topsoil; object that is specifically designated by that state as being of importance.

''grave'' means a place of interment and includes the contents, headstone or other marker of such a place, and any other structure on or associated with such place.

''heritage resource'' means any place or object of cultural significance.

''heritage resources authority'' means the South African Heritage Resources Agency, or in respect of a province, a provincial heritage resources authority.

''heritage site'' means a place declared to be a national heritage site by SAHRA or a place declared to be a provincial heritage site by a provincial heritage resources authority.

''improvement'', in relation to heritage resources, includes the repair, restoration and rehabilitation of a place protected in terms of Act 25 of 1999.
''living heritage'' means the intangible aspects of inherited culture, and may include—
(a) cultural tradition;

(b) oral history;
(c) performance;
(d) ritual;
(e) popular memory;
(f) skills and techniques;
(g) indigenous knowledge systems; and
(h) the holistic approach to nature, society and social relationships.

''local authority'' means a municipality as defined in section 10B of the Local Government Transition Act, 1993 (Act No. 209 of 1993).

''management'', in relation to heritage resources, includes the conservation, presentation and improvement of a place protected in terms of Act 25 of 1999.

''meteorite'' means any naturally-occurring object of extraterrestrial origin.

''object'' means any movable property of cultural significance which may be protected in terms of any provisions of Act 25 of 1999, including—
(a) any archaeological artefact;
(b) palaeontological and rare geological specimens;
(c) meteorites; and
(d) other objects.

''palaeontological'' means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trance.

''place'' includes—
(a) a site, area or region;
(b) a building or other structure which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure;
(c) a group of buildings or other structures which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures;
(d) an open space, including a public square, street or park; and
(e) in relation to the management of a place, includes the immediate surroundings of a place.

''presentation'' includes—
(a) the exhibition or display of;
(b) the provision of access and guidance to;
(c) the provision, publication or display of information in relation to; and
(d) performances or oral presentations related to, heritage resources protected in terms of Act 25 of 1999.

''public monuments and memorials'' means all monuments and memorials—
(a) erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or
(b) which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual.

''site'' means any area of land, including land covered by water, and including any structures or objects thereon.
''structure'' means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.
''victims of conflict'' means—

(a) certain persons who died in any area now included in the Republic as a direct result of any war or conflict as specified in the regulations, but excluding victims of conflict covered by the Commonwealth War Graves
Act, 1992 (Act No. 8 of 1992);
(b) members of the forces of Great Britain and the former British Empire who died in active service in any area now included in the Republic prior to 4 August 1914;
(c) persons who, during the Anglo-Boer War (1899-1902) were removed as prisoners of war from any place now included in the Republic to any place outside South Africa and who died there; and
(d) certain categories of persons who died in the ''liberation struggle'' as defined in the regulations, and in areas included in the Republic as well as outside the Republic.

EXECUTIVE SUMMARY

Leonie Marais-Botes Heritage Practitioner was requested by REC Services (Pty) Ltd t/a Rock Environmental Consulting to carry out a Phase 1 Heritage Impact Assessment (HIA) for the proposed 4800 Sow Unit Piggery to be established 21 km north west of Bergville on the Remaining Extent of the Farm Steynsburg 7803-GS KwaZulu-Natal Province.

A field survey was conducted after which a survey of literature was undertaken.

It should be noted that the sub-surface archaeological and/or historical deposits and graves are always a possibility. Care should be taken during any work in the entire area and if any of the above is discovered, an archaeologist/heritage practitioner should be commissioned to investigate.

1. INTRODUCTION

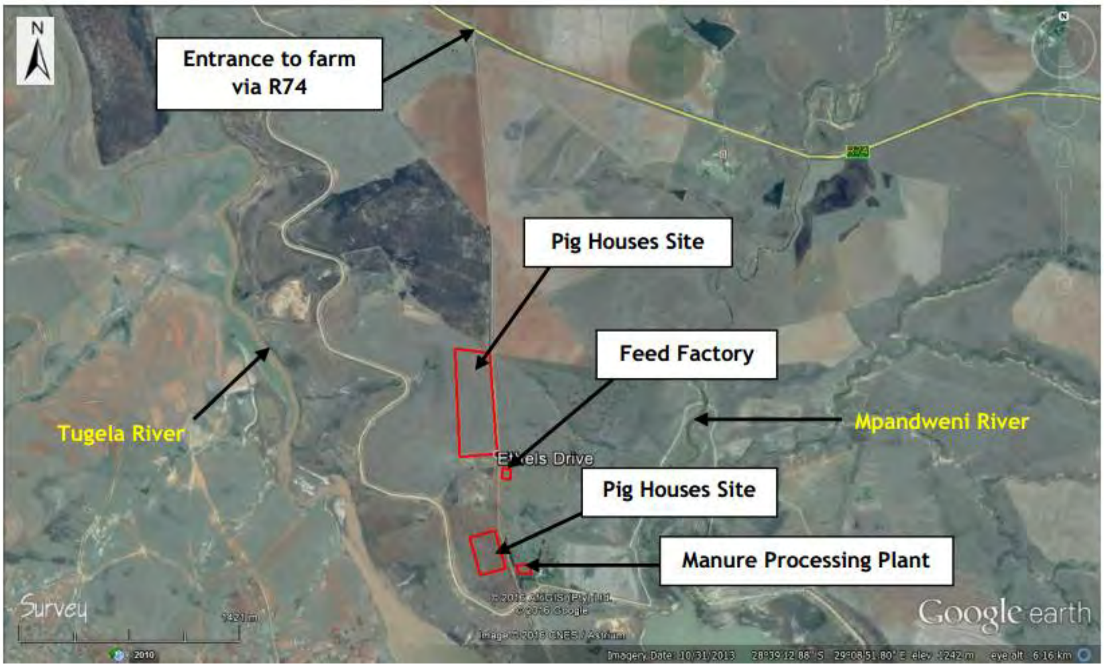

Figure 1: Sites earmarked for development.

The project will consist of a pig housing complex on sites 1, 2 & 3 plus the manure processing facility and the feed factory. The different piggery complex components and taking into account that the construction footprint is usually somewhat more than it is predicted, the site will cover an area of 15.6 ha. Site 1 will cover in the order of 4 ha; site 2 will cover an area of 1.7 ha; site 3 will cover 7.7 ha; the feed factory and the manure processing plant will cover an area of 3.3 ha.

1.1 WHY A PHASE 1 HERITAGE IMPACT ASSESSMENT IS REQUIRED?

This project may potentially impact on any types and ranges of heritage resources that are outlined in Section 3 of the National Heritage Resources Act (Act 25 of 1999). Subsequently a Phase 1 Heritage Impact Assessment (HIA) was commissioned by REC Services (Pty) Ltd t/a Rock Environmental Consulting and conducted by Leonie Marais-Botes.

1.1.1 METHOD

The objective of this Phase 1 Heritage Impact Assessment (HIA) was to gain an overall understanding of the heritage sensitivities of the area and indicate how they may be impacted on through development activities. The site survey took place on 10 September 2016.

In order to establish heritage significance the following method was followed:

- Investigation of primary resources (archival information)
- Investigation of secondary resources (literature and maps)
- Physical evidence (site investigation)
- Determining Heritage Significance.

1.2 HISTORIY OF THE STUDY AREA

The greater Drakensberg study area is an area well known for its cultural heritage. It includes various areas of natural and geological significance. Literature consulted refers mainly to the heritage of the greater study area in terms of San rock art, but the greater study area also contains other categories of cultural significance as per Section 3 of the National Heritage Resources Act (Act 25 of 1999).

The area has had several different cultural groups associated with it, from the San to the southern Sotho, the Zulu-speaking and Xhosa-speaking groups, and, more recently, the Griqua, English and Boer descendants.

Sites from the Early, Middle and Late Stone Age as well as the Iron Age and the Historical period have been identified in the greater study area.

1.3 LOCATION AND PHOTOGRAPHIC RECORD OF STUDY AREA

Figure 2: Location map

PIG HOUSING FACILITY 1

Figure 3: Site characteristics Pig Housing Facility 1

Figure 4: Site characteristics Pig Housing Facility 1


Figure 5: Site characteristics Pig Housing Facility 1


Figure 6: Site characteristics Pig Housing Facility 1

PIG HOUSING FACILITY 2

Figure 7: Site characteristics Pig Housing Facility 2 (Homestead not threatened by development)

Figure 8: Site characteristics Pig Housing Facility 2


Figure 9: Site characteristics Pig Housing Facility 2


Figure 10: Site characteristics Pig Housing Facility 2

PIG HOUSING FACILITY 3

Figure 11: Site characteristics Pig Housing Facility 3 (Homestead not threatened by development)

Figure 12: Site characteristics Pig Housing Facility 3

Figure 13: Site characteristics Pig Housing Facility 3

Figure 14: Site characteristics Pig Housing Facility 3

FEED FACTORY

Figure 15: Site characteristics Feed Factory

Figure 16: Site characteristics Feed Factory

MANURE PROCESSING PLANT

Figure 17: Site characteristics Manure Processing Plant

Figure 18: Site characteristics Manure Processing Plant

2. FINDINGS

2.1 PRE-COLONIAL HERITAGE SITES

Possibilities: Greater study area taken into account.

Stone Age

The Stone Age is the period in human history when stone material was mainly used to produce tools. In South Africa the Stone Age can be divided in three periods;

- Early Stone Age 2 000 000 – 150 000 years ago
- Middle Stone Age 150 000 – 30 000 years ago
- Late Stone Age 40 000 years ago - +/- 1850 AD

Iron Age

The Iron Age is the period in human history when metal was mainly used to produce artefacts. In South Africa the Iron Age can be divided in three periods;

- Early Iron Age 250-900 AD
- Middle Iron Age 900-1300 AD
- Late Iron Age 1300-1840 AD

The following sites associated with the Late Iron Age/Early Historical Period were identified in the study area:

Figure 19: Google Earth Image with clear Late Iron Age/Early Historical characteristics (Pig Housing Facility 3)

Figure 20: Section of one of the circular enclosures as seen in Figure 19 (Pig Housing Facility 3)

Figure 21: Grinding Stone (Pig Housing Facility 3) (S 28º 39' 55.5"; E029º 08' 32.8")


Figure 22: Grave site (Pig Housing Facility 3) (S 28º 39’ 55.0”; E029º 08’ 33.0”)

2.2 HISTORICAL PERIOD HERITAGE SITES

Possibilities: Greater study area taken into account.

- Pioneer sites;
- Sites associated with early mining;
- Structures older than 60 years;
- Graves (Graves younger than 60 years, graves older than 60 years, but younger than 100 years, graves older than 100 years, graves of victims of conflict or of individuals of royal descent).

The following sites associated with the historical period were identified in the study area:


Figure 23: Old farm entrance gate near site referred to as Feed factory site (S 28º 39’ 40.6”; E029º 08’ 39.8”)

Figure 24: "Kraal" (S 28º 40' 01.7"; E029º 08' 46.8") situated near the site referred to as the Manure Processing Plant

Figure 25: Grave situated on site earmarked for development referred to as the Manure Processing Plant (S 28º 40' 03.8"; E029º 08' 47.3")

2.3 ORIGINAL LANDSCAPE

Although some areas of the original landscape are still evident in the study area, farming and other infrastructure development have altered the original landscape in the greater study area.

2.4 INTANGIBLE HERITAGE

The intangible heritage of the greater study area can be found in the stories of past and present inhabitants.

3 CATEGORIES OF HERITAGE VALUE (ACT 25 OF 1999)

The National Heritage Resources Act (Act 25 of 1999) identifies the following categories of value under section 3(1) and (2) of the Act under the heading "National Estate":

"3 (1) For the purpose of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.

(2) Without limiting the generality of subsection (1), the national estate may include-
- (a) places, buildings, structures and equipment of cultural significance;
- (b) places which oral traditions are attached or which are associated with living heritage;
- (c) historical settlements and townscapes;
- (d) landscapes and natural features of cultural significance;
- (e) geological sites of scientific or cultural importance;
- (f) archaeological and palaeontological sites;
- (g) graves and burial grounds, including-
  - (i) ancestral graves;
  - (ii) royal graves and graves of traditional leaders;
  - (iii) graves of victims of conflict;
  - (iv) graves of individuals designated by the Minister by notice in the Gazette
  - (v) historical graves and cemeteries; and
  - (vi) other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- (h) sites of significance relating to the history in South Africa;
- (i) movable objects, including-
  - (i) objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
  - (ii) objects to which oral traditions are attached or which are associated with living heritage;
  - (iii) ethnographic art and objects;
  - (iv) military objects
  - (v) objects of decorative or fine art;
  - (vi) objects of scientific or technological interests; and
  - (vii) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section I (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

(3) Without limiting the generality of the subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of-
- (a) It is importance in the community, or pattern of South Africa's history;
- (b) Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- (c) Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

(d) Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural objects;
(e) Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
(f) Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
(g) Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
(h) Its strong or special association with the life and work of a person, group or organisation of importance in the history of South Africa; and
(i) Sites of significance relating to the history of slavery in South Africa."

3.1 HERITAGE VALUE OF WEIGHED AGAINST CULTURAL SIGNIFICANCE CATEGORIES

3.1.1 Spiritual value

During the site visit/field work no indication of any spiritual activity was observed on/near the proposed site.

3.1.2 Scientific value

No sites of scientific value were observed on or near the site earmarked for development.

3.1.3 Historical value

No historical value associated with the site could be found in primary and secondary sources.

3.1.4 Aesthetic value

No heritage item with exceptional aesthetic (architectural) value was identified in the study area.

3.1.5 Social value

Social value is attributed to sites that are used by the community for recreation and formal and informal meetings regarding matters that are important to the community. These sites include parks, community halls, sport fields etc. None of the said evident in the immediate study area.

3.2 SPECIFIC CATEGORIES INVESTIGATED AS PER SECTION 3 (1) AND (2) OF THE NATIONAL HERITAGE LEGISLATION (ACT 25 OF 1999)

3.2.1 Does the site/s provide the context for a wider number of places, buildings, structures and equipment of cultural significance?

The study area does provide context for a wider number of places, buildings, structures and equipment of cultural significance. The findings as describe in 2.1 and 2.2 emphasise this.

3.2.2 Does the site/s contain places to which oral traditions are attached or which are associated with living heritage?

Places to which oral traditions are attached or associated with living heritage are usually find in conjunction with traditional settlements and villages which still practises age old traditions. Near Pig Housing Facility 2 and 3 traditional settlements are situated.

3.2.3 Does the site/s contain historical settlements?

No historical settlements are located on or near the proposed site.

3.2.4 Does the site/s contain landscapes and natural features of cultural significance?

Due to infra-structure development and farming activities the original character of the landscape has been altered in the study area. The immediate study area does not contain natural features of cultural significance.

3.2.5 Does the site/s contain geological sites of cultural importance?

Geological sites of cultural importance include meteorite sites (Tswaing Crater and Vredefort Dome), fossil sites (Karoo and Krugersdorp area), important mountain ranges or ridges (Magaliesburg, Drakensberg etc.). The proposed site is not located in an area known for sites of this importance.

3.2.6 Does the site/s contain a wide range of archaeological sites?

The study area (Pig Housing Facility 3) does contain archaeological sites and material.

The possibility of sub-surface findings always exists and should be taken into consideration in the Environmental Management Plan.

If sub-surface archaeological material is discovered work must stop and a heritage practitioner preferably an archaeologist contacted to assess the find and make recommendations.

3.2.7 Does the site/s contain any marked graves and burial grounds?

The study area does contain marked graves and burial grounds.

The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management Plan.

It is important to note that all graves and cemeteries are of high significance and are protected by various laws. Legislation with regard to graves includes the National Heritage Resources Act (Act 25 of 1999) whenever graves are 60 years and older. Other legislation with regard to graves includes those when graves are exhumed and relocated, namely the Ordinance on Exhumations (no 12 of 1980) and the Human Tissues Act (Act 65 of 1983 as amended).

If sub-surface graves are discovered work should stop and a professional preferably an archaeologist contacted to assess the age of the grave/graves and to advice on the way forward.

3.2.8 Does the site/s contain aspects that relate to the history of slavery?

This is not an area associated with the history of slavery like the Western Cape Province.

3.2.9 Can the place be considered as a place that is important to the community or in the pattern of South African history?

In primary and secondary sources the proposed site is not described as important to the community or in the pattern of South African history. This may be

3.2.10 Does the site/s embody the quality of a place possessing uncommon or rare endangered aspects of South Africa's natural and cultural heritage?

The proposed site does not possess uncommon, rare or endangered aspects of South Africa's natural and cultural heritage. These sites are usually regarded as Grade 1 or World Heritage Sites.

3.2.11 Does the site/s demonstrate the principal characteristics of South Africa's natural or cultural places?

The proposed site does not demonstrate the principal characteristics of South Africa's natural or cultural places. These characteristics are usually associated with aesthetic significance.

3.2.12 Does the site/s exhibit particular aesthetic characteristics valued by the community or cultural groups?

This part of the greater study area does not exhibit particular aesthetic characteristics valued by the community or cultural groups. The reason being the low density of heritage buildings and structures located in the greater study area.

3.2.13 Does the site/s contain elements, which are important in demonstrating a high degree of creative technical achievement?

The site does not contain elements which are important in demonstrating a high degree of creative technical achievement. Reason being none of the above are evident on site.

3.2.14 Does the site/s have strong and special associations with particular communities and cultural groups for social, cultural and spiritual reasons?

The proposed site does not have a strong or special association with particular communities and cultural groups for social, cultural and spiritual reasons. No comment in this regard was received during the public participation period.

3.2.15 Does the site/s have a strong and special association with the life or work of a person, group or organisation?

No indication of the above could be found in primary and secondary research sources.

4. RECOMMENDATIONS

- It is recommended that an Archaeological Impact Assessment (AIA) be conducted on the Pig Housing Facility 3 site to determine archaeological significance and mitigation.
- It is recommended that graves are preserved *in situ*. If this best practice scenario cannot be achieved the correct processes and procedures must be adhered to in regard to exhumation, relocation and reinternment of skeletal remains.
- All structures older than 60 years are protected by the National Heritage Resources Act (Act 25 of 1999). If structures older than 60 years are to be demolished the necessary permission must be obtained from the provincial heritage authority.
- The discovery of subsurface archaeological and/or historical material as well as graves must be taken into account in the Environmental Management Programme. See 3.2.6 and 3.2.7.

5. WAY FORWARD

Submit this report as a Section 38 application in terms of the National Heritage Resources Act (Act 25 of 1999) to Amafa AKwazulu-Natali (Provincial Heritage Resources Authority of Kwazulu-Natal.

APPENDIX 8C

VEGETATION HABITAT ASSESSMENT

REC SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

VEGETATION AND FLORA IMPACT ASSESSMENT

VEGETATION AND FLORA ASSESSMENT FOR THE PROPOSED 4800 SOW UNIT PIGGERY ON THE REMAINING EXTENT OF THE FARM STEYNSBURG 7803-GS, KWAZULU-NATAL

DATE: 22 NOVEMBER 2016

Report by

Enviflora

Contact: arno@enviflora.co.za

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1 INTRODUCTION

A renewable plant and stockpile yard is planned at the proposed site, KwaZulu-Natal. The study site is 5 ha in extend and will include the stockpile area.

1.1 Terms of Reference

The terms of reference for the Vegetation Assessment are as follows:

- Describe the affected floristic environment from available literature and by means of a desktop study to identify a list of possible floral species that are likely to occur on site.
- List and record endangered, red data and protected plant species found on site.
- List exotic and invasive plant species found on site.
- List plants found on site with medicinal properties
- List species endemic to the study area found on site.
- Identification of anticipated impact of the proposed project on the vegetation and ecosystem services.
- Provide proposals for mitigation of identified impacts.
- Draw up a sensitivity map indicating all sensitive areas, transformed areas and buffers of 30 metres around sensitive features.

Enviflora was appointed Steynsburg Pork and Abattoir (Pty) Ltd to undertake a specialist vegetation and flora survey of the proposed piggery. The findings of the study are based on a desktop assessment of the study area, analysis of aerial imagery and a field survey of the site. The field surveys of the site were undertaken on 10 September 2016.

1.2 Assumptions, limitations and gaps in knowledge

The study was carried out during September 2016. To target flowering seasons of plant species of interest that may occur onsite the study should include a site visit when rain has fallen and the field was allowed to recover. The study area was still very dry and reflected in the species composition recorded.

Red and orange list species are, by their nature, very rare and difficult to locate. No suitable habitat for listed plant species exist. It is important to note that, although the predicted impacts are mostly concerned with Red Data species, any sensitive non-Red Data species will also benefit from the proposed mitigation measures as they share the same habitat and face the same potential impacts as the Red Data species.

1.3 Importance of / Reasoning behind Proposed Development

The study site has been identified for a piggery. The piggery will have a big impact in terms of the local GDP and will aid the applicant economically.

1.4 Study Approach

The study approach for the study site was to identify potential sensitive areas via a desktop study and to concentrate on these areas for evaluation in the field. A comprehensive plant list was compiled, as well as plants listed as Alien and invasive species.

2 METHODOLOGY

In order to describe the overall site characteristics, Google earth imagery and 1:50 000 topographical maps were used and examined. Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the impacts of a proposed project often requires evaluating the conservation value of the site relative to other natural areas of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site and the species found within it includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?
- Is the site modified/disturbed in any way?

Thus, the general approach and angle adopted for this type of study is to identify any potential flora species that may be affected by the proposed development. This means that the focus of this report will be on rare, threatened, protected and conservation-worthy species. Thus, the general approach adopted for this type of study is to **identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place**, i.e. to specifically f**ocus on red flags and/or potential fatal flaws**. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species.

Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which is most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources.

2.1 Red data plants

South Africa has adopted the IUCN Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo et al. 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (http://redlist.sanbi.org/). According to the website of the Red List of Southern African Plants (http://redlist.sanbi.org/), the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: *http://www.iucnredlist.org.* The South African assessment is used in this study. An explanation of the conservation categories is provided in Table 1.

The purpose of listing Red List plant species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African

National Biodiversity Institute (http://posa.sanbi.org) for the quarter degree square/s within which the study area is situated (2629AC). Habitat information for each species was obtained from various published sources. The probability of finding any of these species will then be assessed by comparing the habitat requirements with those habitats that occur on site.

Table 1: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well-known, not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient
LC	Least Concern	Least Concern

For all listed plant species that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given in Table 2 below:

Table 2: Rating of likelihood of occurrence

Rating of likelihood	Definition
LOW	No suitable habitats occur on site / habitats on site do not match habitat description for species;
MEDIUM	Habitats on site match general habitat description for species (e.g. grassland), but detailed microhabitat requirements (e.g. rocky grassland on shallow soils overlying dolomite) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
HIGH	Habitats found on site match very strongly the general and microhabitat description for the species (e.g. rocky grassland on shallow soils overlying dolomite);
DEFINITE	Species found on site.

2.2 Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on site and surrounding the site was checked against the list provided. The protected species list was also referenced against historical recorded data for the quarter degree grit cell to see if any of the species have been recorded historically.

2.3 Other protected species

Although the KwaZulu-Natal Nature Conservation Amendment Act, which prescribes the law relating to the protection of flora and fauna, has been passed, until such time as regulations necessary to supplement the Amendment Act are finalised the Amendment Act will not be enacted and the law enforcement provisions are still dealt with by the remaining sections of the Natal Nature Conservation Ordinance 15 of 1974 and the KwaZulu Nature Conservation Act, 1992. Once the Amendment Act is put into operation the above mentioned Ordinance and the KwaZulu Nature Conservation Act, 1992 will be entirely repealed.

2.4 Protected Ecosystems

A literature review was conducted to investigate previous vegetation classification studies carried out on / near the study site. These studies were investigated before the field visit. To describe broad vegetation patterns within the study area, Mucina and Rutherford (2006) were used.

To describe the conservation status of the vegetation units occurring within the study area, Mucina and Rutherford (2006), The National List of Ecosystems that are in need of Protection (NEMBA, 2004) and the method described in Strelitzia 17 (Driver et al., 2005) is used. This method classifies vegetation types into four categories, according to the percentage of untransformed natural habitat remaining (Figure 1).

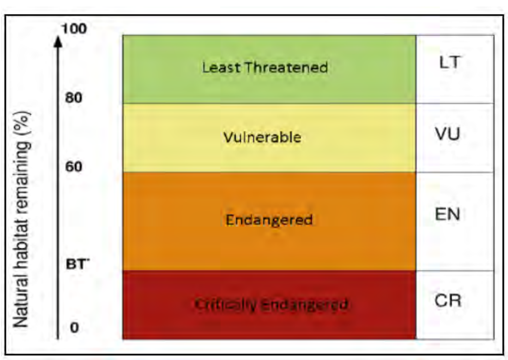


Figure 1: Classifications of vegetation types in accordance with their ecological status (Driver et al., 2005).

A survey was conducted on rare and protected plants that might possibly occur in the study area. For this investigation the South African National Biodiversity Institute (SANBI), PRECIS and SIBIS websites and databases were consulted. The possible and actual presence of rare and protected species were recorded during the field visit.

A field assessment was conducted to classify vegetation zones, identify rare and protected species and identify sensitive habitats. This was done by doing a survey of the site as a whole. Vegetation communities were identified during the survey and a vegetation assessment was carried out at sites within each vegetation zone. Nomenclature for plant names were used from Plant of Southern Africa (POSA) version 3.0.

2.5 Sensitivity Analysis

The location of potentially sensitive features in the study area was determined by taking the following into consideration:

- Satellite imagery/Google Earth imagery was used to determine natural state of land cover against areas already transformed.
- Habitat in which sensitive plants occur was deemed as sensitive.

Sensitivity rating intensities are given in Table 3 below. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 3: Explanation of sensitivity ratings.

Rating	Factors contributing to sensitivity	Examples of qualifying features
VERY HIGH	Indigenous natural areas that are highly positive for any of the following: • Presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • High conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act,	• CBA 1 areas. • Remaining areas of vegetation type listed in Ecosystem List of NEM: BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species.

	Mountain Catchment Areas Act, Lake Areas Development Act)	
HIGH	Indigenous natural areas that are positive for any of the following: • High intrinsic biodiversity value (moderate/high species richness and/or turnover). • Presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • Moderate ability to respond to disturbance (moderate resilience, dominant species of intermediate age). • Moderate conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). • Moderate to high value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). • Protected habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)	• CBA 2 "critical biodiversity areas". • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare). • Habitat containing individuals of extreme age. • Habitat with low ability to recover from disturbance. • Habitat with exceptionally high diversity (richness or turnover). • Habitat with unique species composition and narrow distribution. • Ecosystem providing high value ecosystem goods and services.
MEDIUM -HIGH	Indigenous natural areas that are positive for one or two of the factors listed above, but not a combination of factors.	• CBA 2 "corridor areas". • Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	N/A
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation. May also include secondary vegetation in an advanced stage of development in which habitat is still ecologically functional.	N/A
LOW	No natural habitat remaining.	N/A

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH. The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the **VERY HIGH** class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.

2. Areas classified into the **HIGH** class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 "irreplaceable biodiversity areas" would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.

3. Areas classified into the **MEDIUM-HIGH** sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.

2.6 Impact Assessment Methodology

The potential environmental impacts can be identified and evaluated according to their severity, duration, extent and significance. The following sections will describe the various aspects in detail.

2.6.1 Impact Significance = Consequence x Likelihood

Environmental Significance (Impact)	Description
L (1 – 4.9)	**Low** environmental significance
LM (5 - 9.9)	**Low to medium** environmental significance
M (10 – 14.9)	**Medium** environmental significance
MH (15 – 19.9)	**Medium to high** environmental significance
H (20 – 25)	**High** environmental significance. Likely to be a fatal flaw.

The confidence level (the specialist's degree of confidence in the predictions and/or the information on which it is based will be ranked Low, Medium or High.

The consequence can be determined as follows:

$$\textbf{Consequence}\ (C) = \frac{(\text{Severity} + \text{Duration} + \text{Extent})}{3}$$

2.6.2 Severity Assessment and Rating

Rating	Description
1	Negligible / non-harmful / minimal deterioration (0 – 20%)
2	Minor / potentially harmful / measurable deterioration (20 – 40%)
3	Moderate / harmful / moderate deterioration (40 – 60%)
4	Significant / very harmful / substantial deterioration (60 – 80%)
5	Irreversible / permanent / death (80 – 100%)

2.6.3 Duration Assessment and Rating

Rating	Description
1	Less than 1 month / quickly reversible
2	Less than 1 year / quickly reversible
3	More than 1 year / reversible over time
4	More than 10 years / reversible over time / life of project or facility
5	Beyond life of project of facility / permanent

2.6.4 Extent Assessment and Rating

Rating	Description
1	Within immediate area of activity
2	Surrounding area within project boundary
3	Beyond project boundary
4	Regional / provincial
5	National / international

$$\text{Likelihood (L)} = \frac{(\text{Frequency} + \text{Probability})}{2}$$

2.6.5 Frequency Assessment and Rating

Rating	Description
1	Less than once a year
2	Once in a year
3	Quarterly
4	Weekly
5	Daily

2.6.6 Probability Assessment and Rating

Rating	Description
1	Almost impossible
2	Unlikely
3	Probable
4	Highly likely
5	Definite

3. THE STUDY SITE

3.1 Locality

From Bergville BP filling station, in a westerly direction, on the R74, the turnoff to the farm is about 24.5 km on your left hand side opposite the turnoff to the ATKV Drankensville Holiday resort (Figure 2).

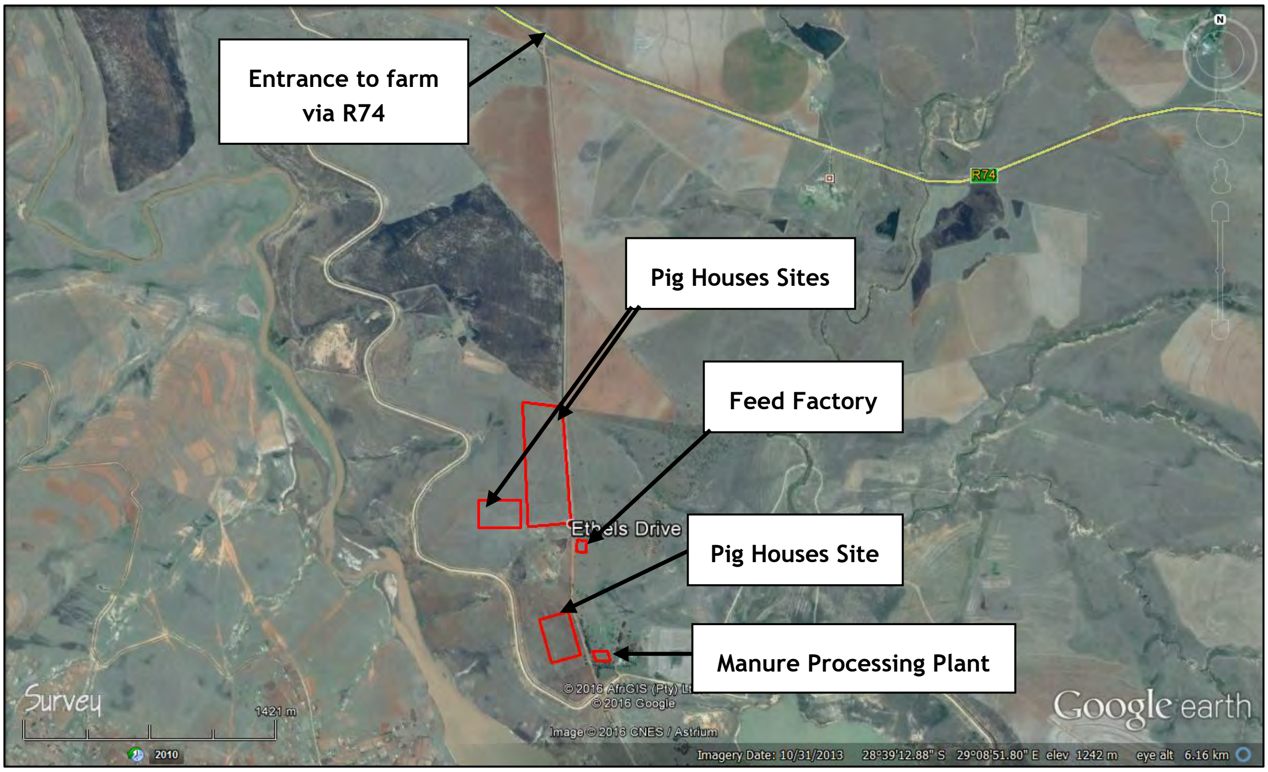


Figure 2: Study site indicated in red (Source: © Google Earth, Image ©CNES/Astrium 2016)

3.2 Current Land Use

The study area is situated within a grassland setting. A portion of the study site has been historically altered by factors such as cultivation and transformation due to homesteads and associated gardens and infrastructure.

Figures 3 below indicate the real time surrounding land uses and give a general idea of the site and its surroundings.

Figure 3: Photos illustrating the site characteristics.

3.3 Regional Vegetation and Environmental Parameters

The study area falls within the Grassland Biome. The entire site falls within the Northern KwaZulu-Natal Moist Grassland, within the Sub escarpment Grassland Bioregion group (See Figure 4) as described by Mucina and Rutherford (2006).

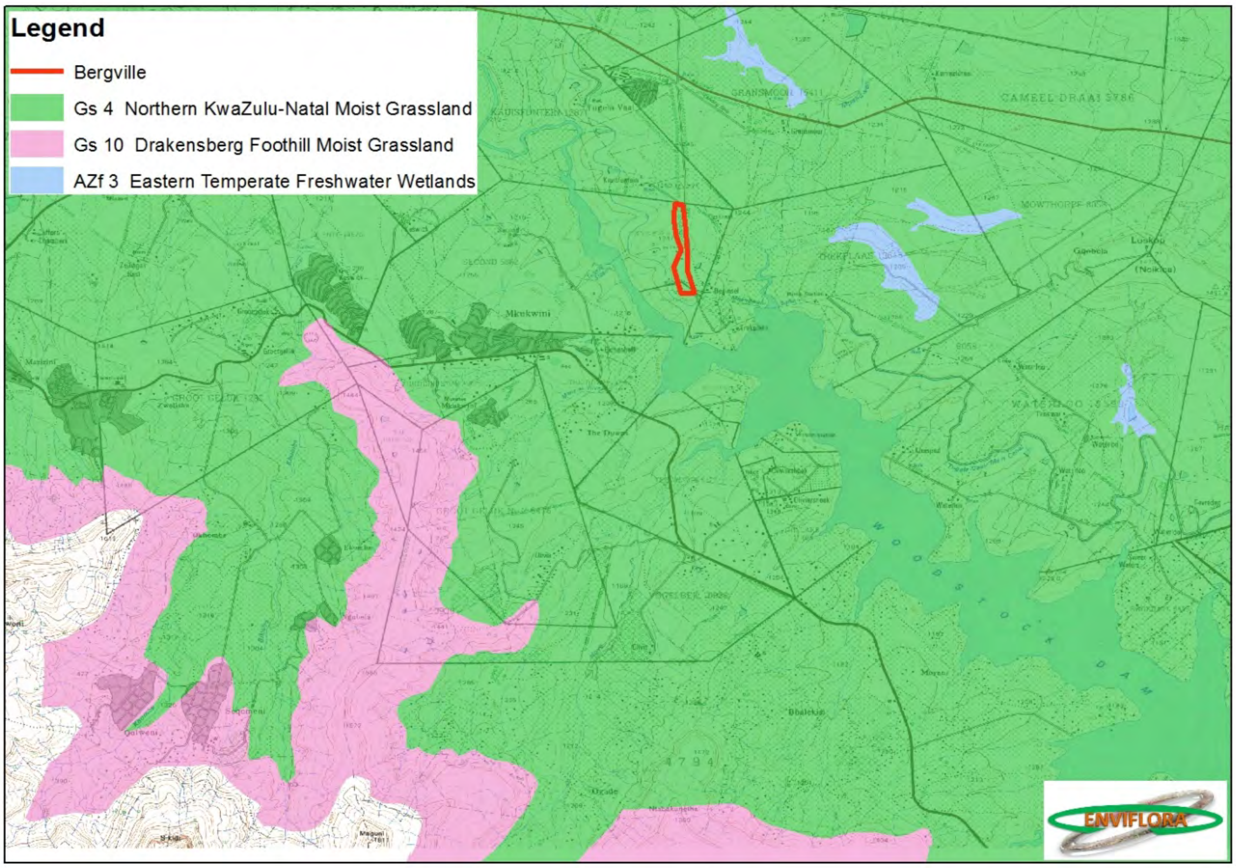


Figure 4: Vegetation Unit of the study site from Mucina and Rutherford (2006).

3.3.1 Regional Vegetation

Hilly and rolling landscapes supporting tall tussock grassland usually dominated by *Themeda triandra* and *Hyparrhenia hirta*. Open *Acacia sieberiana* var. *woodii* savannoid woodlands encroach up the valleys, usually on disturbed (strongly eroded) sites.

3.3.2 General Climate

Summer rainfall, with overall MAP of 840 mm (710– 1 120 mm; Camp 1999a), mainly as summer thunderstorms. Mist occurs frequently on hilltops in spring and early summer, but summer droughts are also frequent. Summers are warm to hot, with maximum temperature recorded in the hottest month of

January (Bergville MAT 27.8°C). MAT is around 16°C, but some localities may reach 17°C. Frosts are severe and occur about 20 days per year. Mean annual evaporation recorded at Bergville is 1 895 mm**3.3.3**

Terrain Morphology and Geology

Mudstones, sandstones and shales of the Beaufort and Ecca Groups of the Karoo Supergroup predominate and are intruded by dolerites of Jurassic age. Land types Bb, Ac, Fa and Ca.

3.3.4 Conservation Status

Vulnerable. Target 24%. Only about 2% statutorily conserved in the uKhahlamba Drakensberg Park as well as in the Chelmsford, Spioenkop, Moor Park, Wagendrift, Ncandu Nature Reserves. More than a quarter has already been transformed either for cultivation, plantations and urban sprawl or by building of dams (Chelmsford, Driel, Kilburn, Mtoti, Wagendrift, Windsor and Woodstock). Alien *Acacia dealbata*, *Rubus, Eucalyptus* and *Populus* are invasive in places. Bush encroachment is common. Erosion very low (53%), low (2%) and moderate (20%).

3.4 Legislative Requirements

National Environmental Management Act (NEMA), 107 of 1998

NEMA requires that:

- "development must be socially, environmentally, and economically sustainable",
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied", and
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions"

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage".

National Environmental Management: Biodiversity Act (NEMBA), 10 of 2004

In terms of NEMBA, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations),
- Promotion of the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity, and
- Limiting further loss of biodiversity and conserving endangered ecosystems.
- Adhering to all regulations and legislation promulgated as a result of the National Environmental Management: Biodiversity Act (NEMBA), 10 of 2004.

Furthermore, a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued as per Chapter 7 of NEMBA.

Alien and Invasive Species Regulations, 2014 (NEMBA)

Alien and Invader plant species in South Africa are categorised according to one of the following categories:

- Prohibited Species: May not be introduced into the country.
- Category 1a Listed Invasive Species: those species that must be combatted or eradicated.
- Category 1b Listed Invasive Species: those species that must be controlled.
- Category 2 Listed Invasive Species: those species that require a permit to carry out a restricted activity within an area, as specified in the act / regulations.
- Category 3 Listed Invasive Species: those species that are subject to certain exemptions and prohibitions, as specified in the act / regulations.

National Water Act, 36 of 1998

The National Water Act provides for the protection of water resources, including protecting aquatic and associated ecosystems and their biodiversity and reducing and preventing pollution and degradation of water resources.

The *Natal* Nature Conservation Ordinance 15 of 1974 and the Kwa-Zulu Nature Conservation Act, 1992.

The ordinances guides any form of contact with indigenous and specially protected indigenous plants. Plants that need to be removed which are part of this list would need a permit application to the relevant authority.

4 RESULTS AND EVALUATION

4.1 Broad vegetation types

According to this most recent vegetation map of the country, the study area falls entirely within one main vegetation type ***Northern KwaZulu-Natal Moist Grassland*** which falls into the Grassland Biome. Hilly and rolling landscapes supporting tall tussock grassland usually dominated by *Themeda triandra* and *Hyparrhenia hirta*. A list of expected common and dominant species in undisturbed ***Northern KwaZulu-Natal Moist Grassland*** *includes* the following (those with a "d" are considered to be dominant):

Graminoids: *Alloteropsis semialata subsp. eckloniana (d), Aristida congesta (d), Cynodon dactylon (d), Digitaria tricholaenoides (d), Elionurus muticus (d), Eragrostis patentissima (d), E. racemosa (d), Harpochloa falx (d), Hyparrhenia hirta (d), Themeda triandra (d), Tristachya leucothrix (d), Abildgaardia ovata, Andropogon appendiculatus, A. eucomus, A. schirensis, Aristida junciformis subsp. galpinii, Brachiaria serrata, Cymbopogon caesius, C. pospischilii, Cynodon incompletus, Digitaria monodactyla, D. sanguinalis, Diheteropogon amplectens, D. filifolius, Eragrostis chloromelas, E. plana, E. planiculmis, E. sclerantha, Festuca scabra, Heteropogon contortus, Hyparrhenia dregeana, Melinis nerviglumis, Microchloa caffra, Panicum natalense, Paspalum scrobiculatum, Setaria nigrirostris, Sporobolus africanus*

Herbs: *Acanthospermum australe (d), Argyrolobium speciosum (d), Eriosema kraussianum (d), Geranium wakkerstroomianum (d), Pelargonium luridum (d), Acalypha peduncularis, Chamaecrista mimosoides, Dicoma anomala, Euryops transvaalensis subsp. setilobus, Helichrysum caespititium, H. rugulosum, Hermannia depressa, Ipomoea crassipes, Pearsonia grandifolia, Pentanisia prunelloides subsp. latifolia, Sebaea grandis, Senecio inornatus, Thunbergia atriplicifolia, Zaluzianskya microsiphon.*

Geophytic Herbs: *Chlorophytum haygarthii (d), Gladiolus aurantiacus (d), Asclepias aurea, Cyrtanthus tuckii var. transvaalensis, Gladiolus crassifolius, Hypoxis colchicifolia, H. multiceps, Moraea brevistyla, Zantedeschia rehmannii.*

Succulent Shrub: *Euphorbia pulvinata.*

4.2 Vegetation of the Study Area

The entire study area is situated within *Northern KwaZulu-Natal Moist Grassland* vegetation zone which has a conservation status of Vulnerable in accordance with data from Mucina and Rutherford (2006). The vegetation type is not listed in the 2011 national list of ecosystems that are threatened and in need of protection (GN. No. 1002 of 2011). The study site was found to comprise lots of untransformed **natural vegetation** and disturbances where visible in the northern parts. Vegetation observed during the field visit (on and around the study site) may be divided into the following types as per Figure 5, namely:

- Historically cultivated land
- Other transformed areas
- Remaining grassland vegetation

A species list was developed for the site. Transformed areas were classified as such, based on transformation of the vegetation due to infrastructure (roads), dwellings and historically cultivated land.

As part of the natural vegetation surrounding the site, *Hyparrhenia* and Eragrostis mixed grassland was identified as the main vegetation type on the site and surrounds. The grassland generally had 60 to 80% cover, except in areas of transformation. The grassland was overall in a degraded / disturbed condition, as a result of grazing.

The *Hyparrhenia hirta* and *Eragrostis* grass species dominated the herbaceous layer across large parts of the grassland. Most of the grassland appeared to be in a disturbed / degraded state as it is dry and grazed. Species composition reflects species encountered within the 200 m buffer zone as the entire study is transformed and composes of historical cultivated lands that have signs of pioneer species and cover.

50 species were identified during the site visit (See Table 4 for a list). Grass species composition of the natural grassland area (as indicated as remaining grassland area in Figure 5) generally fitted the description of *Northern KwaZulu-Natal Moist Grassland*. 13 of the 50 plant species identified were exotics and / or invasive plant species amounting to 28% of species found on and around the site.

Table 4: Provisional checklist of species found onsite during September 2016

GROWTH FORM	SCIENTIFIC NAME	COMMENT(S)
Trees	Acacia mearnsii	Category 2
	Acacia sieberiana var. woodi	
	Pinus elliottii	
	Pinus Patula	Category 2
	Eucaluptus grandus	Category 2
	Eucalyptus macarthurii	
	Grevillea robusta	Category 1b
Herbs and shrubs	*Ambrosia artemisiifolia*	Common ragweed
	Argemone ochrolleuca subsp. ochrolleuca	Category 1b
	Bidens pilosa	
	Cirsium vulgare	Category 1b
	Conyza bonariensis	
	Conyza canadensis	
	Datura stramonium	Category 1b
	Gazania sp.	
	Gnidia kraussiana	Lesser yellow Head
	Helichrysum setosum	Yellow everlasting
	Kohautia amatymbica	Tremble tops
	Oxalis obliquifolia	Oblique leaved sorrel
	Pseudognaphalium luteo-album	Jursey cudweed
	Pyracantha angustifolia	Category 1b
	Rubus cuneifolius	Category 1b
	Rumex crispa	
	Schistostephium heptalobum	
	Senecio madagascarensis	
	Senecio sp.	
	Solanum linnaeanum	Category 1b
	Solanum mauritianum	Category 1b
	Tagetes minuta	
	Taraxacum officionale	Common dandelion
	Verbena bonariensis	Category 1b
	Yucca sp.	
Geophytic herb	*Cheilanthes deltoidea*	
	Watsonia pillansii	
Fern	*Pellaea sp.*	*Cliffbrakes*
Succulents	*Agave Americana*	
Grasses, Reeds and Sedges	*Aristida junciformis subsp. galpinii*	
	Cyperus laevigatus	
	Echinochloa pyramidalis	
	Eragrostis chloromelas	
	Eragrostis curvula	
	Eragrostis plana	
	Hyparrhenia hirta	
	Juncus effusus	
	Panicum natalense	
	Pennisetum clandestinum	Category 1b
	Themeda triandra	Associated with Grassland

4.3 Protected plants and trees

4.3.1 Red and Orange data plants

Red and Orange data Plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute (www.sanbi.org) and POSA checklist 3.0.

Species of conservation concern that have historically been recorded from the area were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration (within the quarter degree grid cell), there are one Endangered and two near threatened species that have a high probability of occurring on site (see Appendix 1). The threatened species include the following:

- *Schizoglossum peglerae (Endangered)*
- *Eucomis bicolor (Near threatened)*
- *Anemone fanninii (Near threatened)*

Table 5: Red data species historically in 2829CA.

Taxon	Family	Distribution relevant to study area	Global IUCN (3.1) category*	Likelihood of occurrence
Schizoglossum peglerae	Apocynaceae	Durban, Pietermaritzburg and Ozwatini in the Ndwedwe district.	Endangered	**Low-** Out of distribution area
Eucomis bicolor	Hyacinthaceae	Populations are well protected within inaccessible areas in the high Drakensberg along the KwaZulu-Natal-Lesotho border. Well-drained, grassy mountain slopes, sometimes in forests, along watercourses and on rocky cliffs, generally at higher altitudes up to 2800 m.	Near Threatened	**Medium-** Well drained grassy mountain slopes
Anemone fanninii	Ranunculaceae	Moist depressions near streams and along drainage lines and seeps, generally on east-facing slopes from the coast to 2100 m	Near Threatened	**Medium-** Depressions, no seepage, no drainage lines.

4.3.2 Protected trees

No protected trees occur on the site, nor have they been previously recorded in the quarter degree grids that include the study area. No protected trees are therefore considered likely to occur on site.

4.4 Alien and Invasive plant species

The list of Alien and Invasive plant species are presented. A total of 6 plants were identified on and around the site that is listed in the Alien and Invasive Species Regulations of 2014 (NEMBA) which is in need of management.

- 10 NEMBA Category 1b plants were identified and must be controlled.
- 3 NEMBA Category 2 plants were identified and must be controlled and if not eradicated, require a permit to carry out a restricted activity within an area, as specified in the act / regulations.

5 IDENTIFICATION OF POTENTIAL IMPACTS

Potential issues relevant to potential impacts on the ecology of the study area include the following:

- **Impacts on biodiversity**: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- **Impacts on sensitive habitats**: this includes impacts on any sensitive or protected habitats, including indigenous forest, fynbos and wetland vegetation that leads to direct or indirect loss of such habitat.
- **Impacts on ecosystem function**: this includes impacts on any processes or factors that maintain ecosystem health and character

5.1 Description of potential impacts

- ***Impact 1: Loss or fragmentation of indigenous natural vegetation***

Nature: Construction of infrastructure may lead to direct loss of vegetation.

This may lead to localised or more extensive reduction in the overall extent of vegetation. There are factors that may aggravate this potential impact. For example, where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation). Consequences of the potential impact of loss of indigenous natural vegetation occurring may include:

1. Negative change in conservation status of habitat (Driver et al. 2005);
2. Increased vulnerability of remaining portions to future disturbance;
3. General loss of habitat for sensitive species;
4. Loss in variation within sensitive habitats due to loss of portions of it;
5. General reduction in biodiversity;
6. Increased fragmentation (depending on location of impact);
7. Disturbance to processes maintaining biodiversity and ecosystem goods and services; and
8. Loss of ecosystem goods and services.

The vegetation types on site is ***KwaZulu-Natal Moist Grassland***,, which is classified as Vulnerable in Mucina and Rutherford (2006) and which is not mentioned in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).

- ***Impact 2: Loss of individuals of threatened plants***

Nature: Plant species are especially vulnerable to development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed development is located where it will impact on such individuals or populations. Consequences may include:

1. Fragmentation of populations of affected species;
2. Reduction in area of occupancy of affected species; and
3. Loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of the species. There are a few Vulnerable and near threatened species that are likely to occur on site. This impact is therefore assessed further.

- ***Impact 3: Establishment and spread of declared weeds and alien invader plants***

Major factors contributing to invasion by alien invader plants includes *inter alia* high disturbance (such as clearing for construction activities) and negative grazing practices. Exotic species are often more prominent near infrastructural disturbances than further away. Consequences of this may include:

1. Loss of indigenous vegetation;
2. Change in vegetation structure leading to change in various habitat characteristics;
3. Change in plant species composition;
4. Change in soil chemical properties;
5. Loss of sensitive habitats;
6. Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. Fragmentation of sensitive habitats;
8. Change in flammability of vegetation, depending on alien species;
9. Hydrological impacts due to increased transpiration and runoff; and
10. Impairment of wetland function.

There are a number of alien species that may become problematic in the study area. There is therefore the potential for alien plants to spread or invade following disturbance on site.

5.2 Assessment of Impacts

Mitigation measures are proposed to ensure that the rating of significance could be reduced into a more acceptable rating.

Table 6: Impact Assessment before mitigation:

Impact	Severity	Duration	Extent	Consequence (S + D + E / 3)	Frequency	Probability	Likelihood (F + P / 2)	Significance (C*L)
Impact on Indigenous Natural Vegetation	4	4	2	3.33	5	4	4.5	14.85 **Medium**
Loss of individual or threatened plants	4	4	2	3	4	1	2.5	7.5 **Low**
Establishment and spread of declared weeds and alien invader plants	5	5	2	4	5	5	5	20 **High**

Mitigation measures for Impact on Natural vegetation:

- Unnecessary impacts on surrounding natural vegetation must be avoided.
- The construction impacts must be contained within the footprint of the infrastructure.
- Disturbed areas beyond the footprint of the infrastructure must be rehabilitated as quickly as possible.

Mitigation measures for Loss of individual or threatened plants:

- Unnecessary impacts on surrounding natural vegetation must be avoided.
- The construction impacts must be contained within the footprint of the development. Disturbed areas beyond the footprint of the development must be rehabilitated as quickly as possible.

Mitigation measures for establishment and spread of declared weeds and alien invader plants:

- Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible once construction is completed.
- Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil.
- Any alien plants must be immediately controlled.
- An on-going monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Table 7: Impact Assessment after Mitigation:

Impact	Severity	Duration	Extent	Consequence (S + D + E / 3)	Frequency	Probability	Likelihood (F + P / 2)	Significance (C*L)
Impact on Indigenous Natural Vegetation	3	4	1	2.66	5	2	3.5	9.81 **Low**
Loss of individual or threatened plants	4	4	2	3	4	1	2.5	7.5 **Low**
Establishment and spread of declared weeds and alien invader plants	3	3	2	2.66	5	5	5	13.3 **Medium**

6 SENSITIVITY ANALYSIS

Within this section, the sensitivity of the study area is determined and discussed. The sensitivity assessment determines which parts of the study area have a high conservation value and / or may be sensitive to disturbance caused by the proposed project.

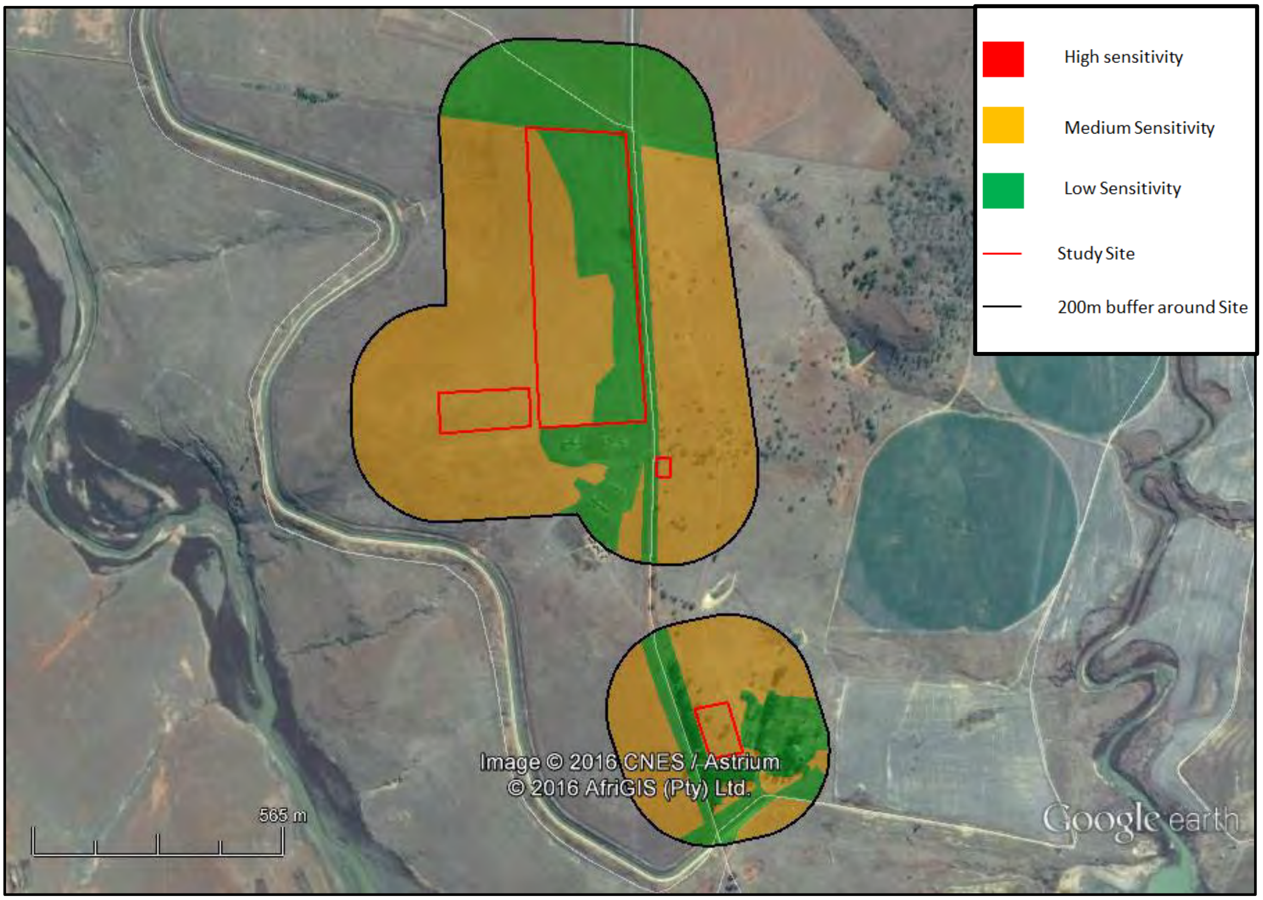
Areas containing untransformed natural vegetation of conservation concern, high diversity, habitat complexity, red list organisms and / or systems vital to sustaining ecological function are considered sensitive. In contrast, areas that are transformed and have little importance for ecological functioning are considered to be of low sensitivity.

For the sensitivity analysis, the following is of importance:

- The study site is not situated in any centres of endemism (Van Wyk and Smith, 2001).
- The study site is not located within a provincial protected area.
- None of the protected tree species are present on site.
- The study area is situated inside the Northern *KwaZulu-Natal Moist Grassland* which is Vulnerable in terms of Vegetation type analysis
- Areas already transformed by historical activities within the proposed footprint area are a result of:
    - Roads
    - Historically cultivated land
    - Houses and other dwellings

Using the methodology as indicated in Table 3 in Section 2.5, a sensitivity rating of **Medium sensitivity** was given.

6.1.1 Sensitivity map



7 CONCLUSION

Information obtained from POSA checklist 3.0 and the South African National Biodiversity Institute (www.sanbi.org) indicated red and orange data plants species historically recorded within the 2829CA quarter degree grid cell.

Species of conservation concern that have historically been recorded from the area were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration (within the quarter degree grid cell), there are species that have a MEDIUM probability of occurring on site (see Appendix 1). The threatened species include the following:

- *Schizoglossum peglerae (Endangered)*
- *Eucomis bicolor (Near threatened)*
- *Anemone fanninii (Near threatened)*

For the site visits conducted, no orange or red data species were encountered on the study site and 200m buffer area.

A **medium** sensitivity was awarded for the study site based on the methodology described in Section 2.5 of this report.

A total of 13 plants were identified on and around the site that is listed in the Alien and Invasive Species Regulations of 2014 (NEMBA) which is in need of management.

- 10NEMBA Category 1b plants were identified and must be controlled.
- 3 NEMBA Category 2 plants were identified and must be controlled and if not eradicated, require a permit to carry out a restricted activity within an area, as specified in the act / regulations.

8 RECOMMENDATIONS

The following recommendations are made with regards to the proposed development:

(i) An Environmental Control Officer must be appointed to oversee mitigation measures during construction and will be responsible for the monitoring and auditing of the contractor's compliance with the conditions of the Environmental Impact Management Plan/ Programme.

(ii) Areas deemed of medium significance must be mitigated as far as possible by implementing the measures indicated in this report.

(iii) Areas to be disturbed by construction activity as well as areas for ancillary activities such as stock piles, storage yards or site offices must be clearly demarcated in already disturbed areas or areas where they will cause minimal disturbance.

(iv) The extent of the areas must be minimised and demarcated by preferably using steel droppers and nylon rope between the markers. Construction activities and materials must at all times be contained within the demarcated sites.

(v) Alien invasive species have to be controlled before and after construction commences for the 12 recorded alien and invasive plant species recorded on site.

(vi) All mitigation measures described in this report has to be adopted into a legal Environmental Management Programme to be used during construction of the planned project.

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APPENDIX 8D

MAMMAL STUDY

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Mammal Species and Habitat Assessment

of

The Remainder of the Farm Steynsburg 7803 (KwaZulu-Natal)

September 2016

Report author: I.L. Rautenbach (Ph.D., T.H.E.D., Pr.Sci.Nat.)

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FIGURES:

TABLES:

Declaration of Professional Standing and Independence:

I, Ignatius Lourens Rautenbach (421201 5012 08 8) declare that I:

- hold a Ph.D. in the biological sciences, which allowed registration by SACNASP (SA Council for National Scientific Professions) as a Professional Zoologist and sanction me to function independently as a specialist scientific consultant
- declare that as per prerequisites of the Natural Scientific Professions Act No. 27 of 2003 this project was my work from inception and reflects exclusively my observations and unbiased scientific interpretations, and executed to the best of my ability
- abide by the Code of Ethics of the SACNASP
- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate opportunities to learn through constructive criticism and debate, I reserve the right to form and hold my own opinions within the constraints of my training and experience, and therefore will not submit willingly to the interests of other parties or change my statements to appease them
- am subcontracted as a specialist consultant by Galago Environmental CC for the project entitled "Mammal Species and Habitat Assessment of the Remainder of the Farm Steynsburg 7803 (KwaZulu-Natal)", as described in this report
- have no financial interest in the proposed development other than remuneration for the work performed
- do not have, and will not have in the future, any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client(s) as well as to the competent authority any material information that may have the potential to influence any decisions by the competent authority, as required in terms of the Environmental Impact Assessment Regulations, 2014
- reserve the right to only transfer my intellectual property contained in this report to the client(s), (party or company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, I recognise that written consent from the client will be required for me to release any part of this report to third parties.
- In addition, remuneration for services provided by Galago Environmental CC is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

I.L. Rautenbach

1. INTRODUCTION

Galago Environmental CC. was appointed to assess the mammal species richness and evaluate the habitat(s) of 225 hectares on the Remainder of the Farm Steynsburg 7803 in the Bergville District, Kwazulu-Natal. It is planned to establish a modern piggery on the property.

This report focuses on the reigning status of threatened and sensitive mammals likely to occur on the proposed development site, and whose conservation status should be considered in the decision-making process. Special attention was paid to the qualitative and quantitative habitat conditions for Red Data species deemed present on the site, and mitigation measures to ameliorate the effect of the development that is suggested. The secondary objective of the investigation was to gauge which mammals might still reside on the site and compile a complete list of mammal diversity of the study area.

This assignment is in accordance with the 2014 EIA Regulations emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

2. SCOPE AND OBJECTIVES OF THE STUDY

- To identify and qualitatively / quantitatively assess the significance of the mammal habitat components and current general conservation status of the property;
- Identify and comment on ecological sensitive areas;
- Comments on connectivity with natural vegetation and habitats on adjacent sites;
- To provide a list of mammals which occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the mammals of the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

Presently study site is used to graze cattle and sheep (Figures 3 and 8), with some irrigated fields on adjoining land (Figure 2). In order to facilitate modern pork production five modest-sized facilities are planned (Figures 4 – 8), positioned along a tertiary gravelled road (Figures 1 and 2).

The site falls in the Northern KwaZulu-Natal Moist Grassland (Mucina and Rutherford, 2006). Stock farming implies that veld fires are avoided to maximize production, and during the early-spring site visit the basal cover of sour grassland was indeed in good condition. Generally the grass cover was short but dense, as such providing excellent cover for small terrestrial mammals, whose population densities appear to be at a nadir. The grassland has at places been invaded by alien trees (conifers planted at the homestead, wattles, willows, poplars); indigenous mature *Acacia sieberiana* (paperbark) trees dot the rolling landscape, and it would appear that none will be sacrificed when the piggery facilities are constructed. However, the stand of indigenous thorn trees is too scattered to function as arboreal habitat.

The site overlooks the Woodstock Dam, but at such a distance that no wetland mammal species can be expected to venture onto the five construction sites.

Terrestrial habitat (in the form of sour grasslands) is the only mammal habitat. No rocky ridges providing nooks and crannies for rupiculous mammals for bats were recorded, nor any caves suitable for cave-dwelling bats.

The substrate is a reddish-brown soil, generally compacted. Termitaria are scarce, although it should be noted that many termitaria has for some reason been entirely destroyed.

The district is rural in character, although traditional villages are scattered throughout. As such traditional hunting with dogs exert heavy attrition on game and medium-sized mammal populations such as hares and porcupines.

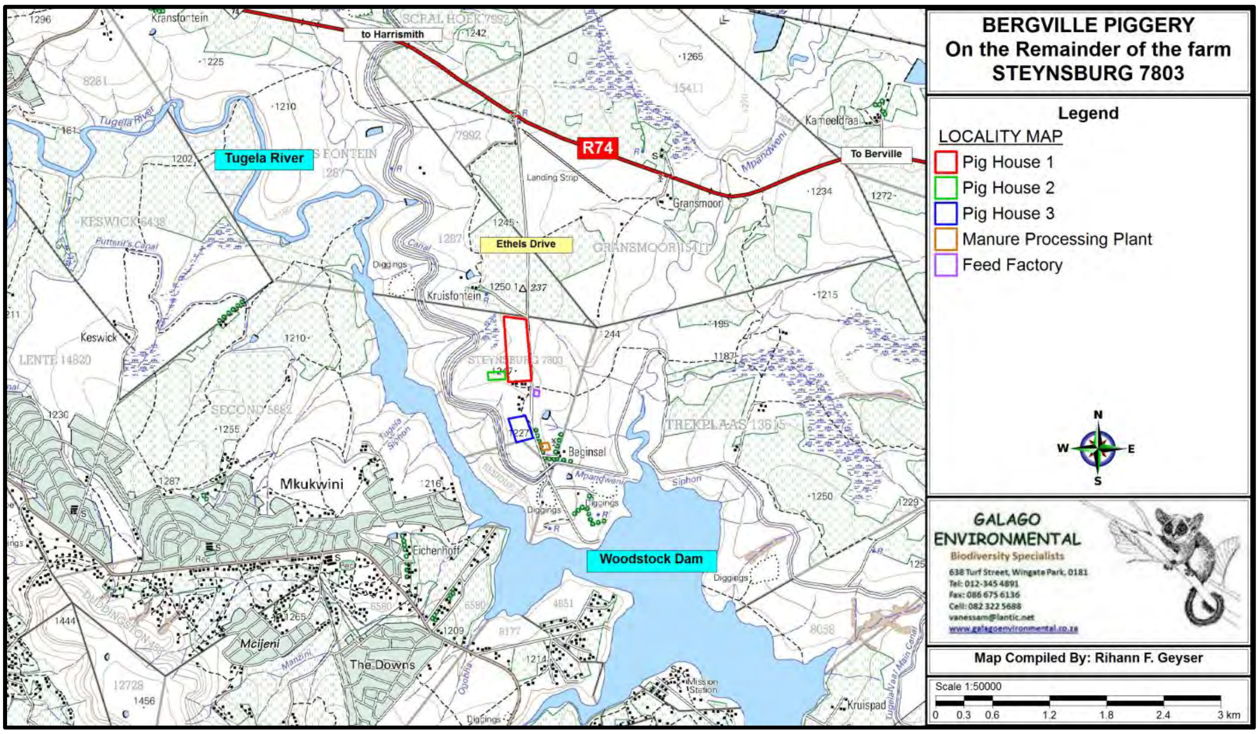

Figure 1: A topocadastral locality map illustrating the outlay and position of the facilities.

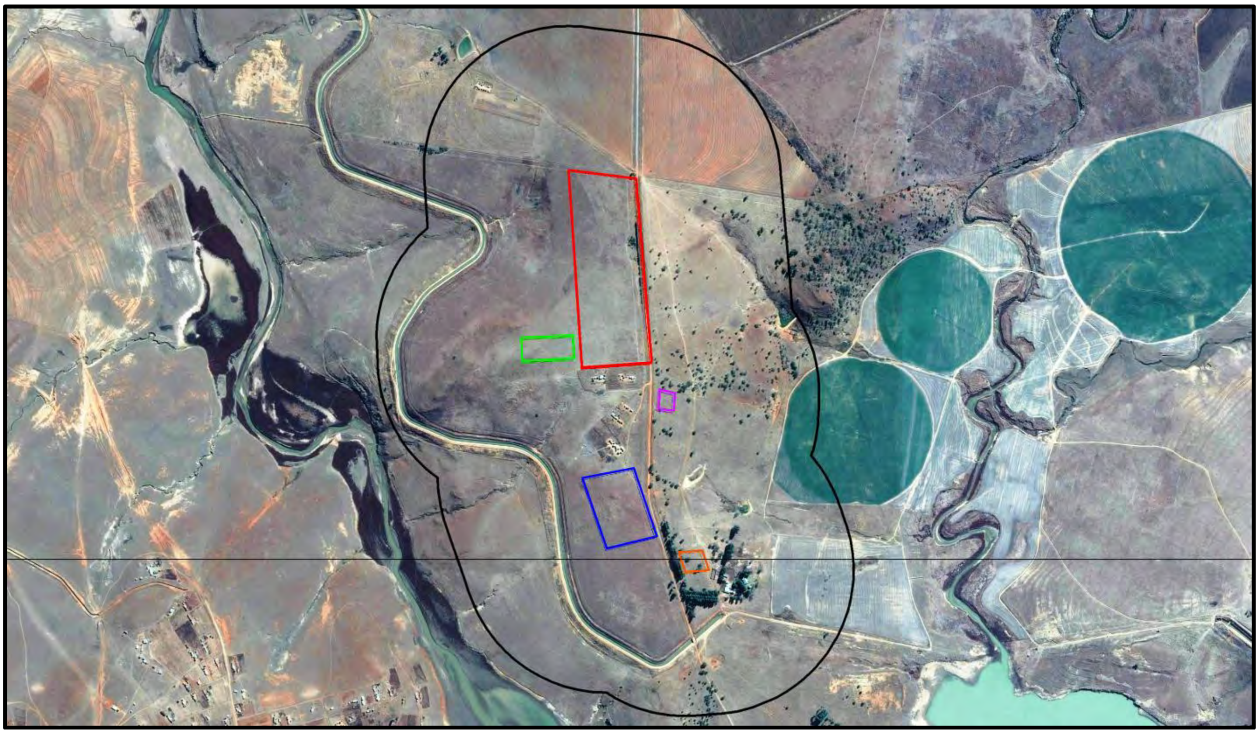

Figure 2: Aerial photo of the study site (courtesy Google Earth).

Figure 3: A view from near the development setting over the Woodstock Dam. The developmental site is presently grazed by cattle and sheep.

Figure 4: The terrain where the manure processing plant will be constructed. The GPS coordinates in the middle of the terrain are 28º 40’ 0.2”S; 29º 08’ 44.1”E.

Figure 5: A northerly view of the site scheduled for the construction of Pig House 3. The site is adjacent and west to a tertiary gravel road, with centrally GPS coordinates 28º 39’ 53.8”S; 29º 08’ 324.9”E. In the left-front is a destroyed termitarium.

Figure 6: The small site earmarked for the food factory to the east of the road. Coordinates at the centre of the site are 28º 39' 42.6"S; 29º 08' 40.9"E.

Figure 7: A southerly view over the terrain earmarked for Pig House 1 with coordinates towards the centre 28º 39' 27.1"S; 29º 08' 33.8"E. The site is west and adjacent to the road visible to the right of the image. The trees on the site are wattle saplings.

Figure 8: A westerly view over the small site proposed for Pig House 2 at 28º 39’ 36.3”S; 29º 08’ 25.7”E.

Figure 9: An active Highveld gerbil burrow on the terrain earmarked for Pig House 1.

4. METHODS

An eight hour site visit was conducted on 17 September 2016. During this investigation the observed and derived presence of mammals associated with the recognized habitat types of the study site, were recorded. This was done with due regard to the well recorded global distributions of Southern African mammals, coupled to the qualitative and quantitative nature of recognized habitats.

The 500 meters of adjoining properties was scanned for important fauna habitats.

4.1 Field Surveys

During the site visit mammals were identified by visual sightings through random transect walks. No trapping or mist netting was conducted, as the terms of reference did not require such intensive work. In addition, the presence of mammals was also identified by means of spoor, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

Three criteria were used to gauge the probability of occurrence of mammals on the study site. These include known distribution range, habitat preference and the qualitative and quantitative presence of suitable habitat.

4.2 Desktop Surveys

As the majority of mammals are secretive, nocturnal, hibernators, migrators and/or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season. During the field work phase of the project, this derived list of occurrences is audited.

The probability of occurrences of mammal species was based on their respective geographical distributional ranges and the suitability of on-site habitat. In other words, *high* probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.

Medium probability pertains to a mammal species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is also taken into consideration. Species categorised as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.

A *low* probability of occurrence will mean that the species' distributional range is peripheral to the study site <u>and</u> habitat is sub-optimal. Furthermore, some mammals categorised as *low* are generally deemed rare.

4.3 Specific Requirements

During the visit the site was surveyed and assessed for the potential occurrence of Red Data and/or wetland-associated species such as Juliana's golden mole (*Neamblosomus juliana*), Highveld golden mole (*Amblysomus septentrionalis*), Rough-haired golden mole (*Chrysospalax villosus*), African marsh rat (*Dasymys incomtus*), Angoni vlei rat (*Otomys angoniensis*), Vlei rat (*Otomys irroratus*), White-tailed rat (*Mystromys albicaudatus*), a nember of shrews such as the Forest shrew (*Myosorex varius*), Southern African hedgehog *(Atelerix frontalis), a number of bats such as the* Short-eared trident bat (*Cloeotis percivali*), African clawless otter (*Aonyx capensis*), Spotted-necked otter (*Lutra maculicollis*), Marsh mongoose (*Atilax paludinosus*), Brown hyena (*Parahyaena brunnea*), etc.

5. RESULTS

5.1 Mammal Habitat Assessment

The local occurrences of mammals are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges.

Only the terrestrial major habitat type is represented on the site. The rolling landscape does not offer well-defined ridges or boulders offering nooks and crannies as refuge for rupiculous mammals such as Namaqua rock rats, rock elephant shrews, rock dormice, rock rabbits or dassies. Indigenous trees are represented by scattered paperbark thorns at a density too low to support arboreal mammals such as tree rats, bushbabies, etc. Functionally an arboreal habitat is therefore deemed absent. The site is a few hundred meters from the Woodstock Dam; hence neither wetland vegetation nor moisture-reliant small mammals can be expected on-site (viz. vlei rats, cane rats, mash mongooses).

The footprints of the five buildings are on sour grassland (Figures 4 - 8). Although the basal cover offer good refuge and nourishment, populations were judged to be low as can be expected at the end of winter as well as the attrition of traditional hunting.

The five sites are entirely undeveloped and no structures or buildings / structures are present, other than ESCOM power supply lines (Figures 5 and 6).

5.2 Expected and Observed Mammal Species Richness

All large mammals (viz. elephant, buffalo, black wildebeest, plain's zebra, lion, and spotted hyena) have a century or more ago been hunted out for sport, commercial gain or to maximise farming practices. More recently progressively intensive land-use practices (including persistent and indiscriminant hunting with dogs) systematically displaced medium-sized mammals such as baboons (although baboons were seen on a private reserve in the district), vervet monkeys, pangolin, aardwolf, caracal and others. Some species are assumed to be on the edge of disappearing from the site such as the pervasive porcupine, black-backed jackal, duiker and steenbok that are by now probably mere vagrants and are listed in Table 2 under the precautionary principle. Good connectivity from all directions can be expected to still support the presence of these species (as well as those judged to be presently absent but listed contingent on immigrations), but the benefits of connectivity is countered by the attrition caused by hunting pressure.

All rupiculous, arboreal and wetland-reliant mammals were *a priori* omitted from the list of possible occurrences since these habitats are absent, particularly where the facilities are to be erected.

Of the 37 mammal species expected to occur or be vagrants to the study site (Table 2), the presence of three (scrub hares, rodent moles and Highveld gerbils) were confirmed during the site visit (Table 3). It should be noted that potential occurrences is interpreted as to be possible over a period of time as a result of environmentally induced expansion and contractions of population densities and ranges which stimulate migration.

Table 2 lists the mammals that were observed or deduced to occupy the site, or to be occasional visitors. All feral mammal species expected to occur on the study site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these cannot be considered when estimating the conservation value or ranking of the site.

Most of the species of the resident diversity (Table 2) are common and widespread. With the possible exception of the dwarf shrew, all the species listed in Table 1 are robust (some with strong pioneering capabilities). The reason for their survival success is predominantly seated in their remarkable reproduction potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets and mongooses). The two mongoose species and two genet species are very resilient and have a remarkable ability to persist, even close to human settlement. The key to their persistence lie in their reticent nature and in the case of the genets also their nocturnal lifestyles.

The farm manager reported a few reedbuck persisting along the dam shore; it is possible that individuals wander onto one of the development sites, although these are located outside the preferred habitat of this antelope. A burrow of the Highveld gerbil was located, constructed on a demolished termitarium (Figure 9). The greater dwarf shrew is under the precautionary principle included in the list of possible inhabitants, in spite of the dearth of moribund termitaria preferred by this minuscule insectivore.

No indications of the presence of aardvarks or of springhares were found. The compacted soil is entirely unsuitable for golden moles, fat mice and quite likely also for springhares and aardvarks. Population densities of all occupants are low; even signs of the ubiquitous rodent mole and scrub hare are scarce.

The listed tomb bat, free-tailed bat and vesper bats show remarkable adaptivity by expanding their population numbers significantly by capitalizing on the roosting opportunities offered by manmade structures such as at the homestead. However, there are no caves or any other structure, manmade or natural, available for daytime roosts for cave-dwelling bats such as horse-hoe bats, slit-faced bats and leaf-nosed bats.

The species richness seems to be low, which is ascribed to only one habitat being available, restricted site size, attrition as a consequence of hunting and a below par quality of directed conservation resulting in species displacement.

5.3 Threatened and Red Listed Mammal Species Flagged

By the Scientific Community:
White-tailed rats are habitat-sensitive with a predilection for pristine grassland; given the good grass cover present on the area where the development is planned, it is submitted that *Mystromys albicaudatus* is a likely occupant in the vicinity.

The ecology and population dynamics of "Data Deficient" (DD) small mammal species listed in Table 1 have not been adequately studied to provide quantitative field data to empirically assign a conservation ranking, and are thus as a precaution considered as 'Data Deficient' Red Data species. The four shrews and the African weasel listed in Table 1 operate at the apex of the food pyramid via an invertebrate trophic sublevel, which means that their population numbers are significantly lower than that of their prey species in order to maintain sustainable prey population levels. Because of the diet of shrews, they are furthermore not readily trapped with conventional bait or traps, which may mean that their numbers are under-estimated. Specimen collection of shrews using drift fences and pitfalls invariable yield better acquisition results than live-trapping, which reiterate the sentiment that shrews numbers are more often than not under-estimated and that many species' conservation status are misconstrued. African weasels are too slender to be contained by conventional carnivore traps, and require small gauge traps.

Hedgehogs are 'Near Threatened' as a result of interference by humans and their pets. Under natural conditions, the passive defence mechanisms of these rather docile insectivores are sufficient to maintain breeding populations in a healthy condition. Considering the size of the district and unimpaired connectivity towards especially the south and east it is considered possible that a small population of hedgehogs persists.

The 'Near Threatened' brown hyena is traditionally persecuted by stock farmers, but they manage to persist as result of their cryptic nature and nocturnal lifestyle. Although their numbers are probably under-estimated, these animals are nevertheless under survival threat and will further decline on their way to local extinction in the face of burgeoning regional urbanization.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

By the Biodiversity Act No 10 of 2004
Protected Species: African hedgehog
Brown hyena

The Kwazulu-Natal Nature Conservation Management Act (No. 9 of 1997) closely follows the findings of a panel of specialists (Friedman and Daly [Eds.] 2004).

Formally Prohibited Invasive and Prohibited Species
Nil.

Table 1: Mammal species diversity observed or deduced to occupy the site.

	SCIENTIFIC NAME	ENGLISH NAME
	Order Lagomorpha	
	Family Leporidae	
√	*Lepus saxatilis*	Scrub hare
	Order Rodentia	
	Family Bathyergidae	
√	*Cryptomys hottentotus*	African mole rat
	Family Hystricidae	
?	Hystrix africaeaustralis	Porcupine
	Family Muridae	
√	*Rhabdomys pumilio*	Four-striped grass mouse
√	*Mus minutoides*	Pygmy mouse
√	*Mastomys natalensis*	Natal multimammate mouse
√	*Mastomys coucha*	Southern multimammate mouse
√	*Aethomys ineptus*	Tete veld rat
√	*Gerbilliscus brantsii*	Highveld gerbil
En?	*Mystromys albicaudatus*	White-tailed mouse
*	*Saccostomus campestris*	Pouched mouse
√	*Dendromus melanotis*	Grey pygmy climbing mouse
√	*Dendromus mesomelas*	Brants' climbing mouse
√	*Dendromus mystacalis*	Chestnut climbing mouse
?	*Steatomys pratensis*	Fat mouse
	Order Eulipotypha	
	Family Soricidae	
DD?	*Myosorex cafer*	Dark-footed forest shrew
DD?	*Suncus lixus*	Greater dwarf shrew
DD√	*Crocidura cyanea*	Reddish-grey musk shrew
DD√	*Crocidura hirta*	Lesser red musk shrew
	Family Erinaceidae	
NT?	*Atelerix frontalis*	Southern African hedgehog
	Order Chiroptera	
	Family Embalonuridae	
?	*Taphozous mauritianus*	Mauritian tomb bat
	Family Molossidae	
*	*Tadarida aegyptiaca*	Egyptian free-tailed bat
	Family Vespertilionidae	
√	*Neoromicia capensis*	Cape serotine bat
√	*Scotophilus dinganii*	African yellow house bat
√	*Scotophilus viridis*	Greenish yellow house bat
	Order Carnivora	
	Family Hyaenidae	
NT?	*Parahyaena brunnea*	Brown hyena
	Family Felidae	
*	*Felis silvestris*	African wild cat
	Family Viverridae	
√	*Genetta genetta*	Small-spotted genet
√	*Genetta tigrina*	SA large-spotted genet
	Family Herpestidae	
√	*Cynictis penicillata*	Yellow mongoose
√	*Galerella sanguinea*	Slender mongoose
?	*Ichneumia albicauda*	White-tailed mongoose
	Family Canidae	
*	*Canis mesomelas*	Black-backed jackal

	SCIENTIFIC NAME	ENGLISH NAME
	Family Mustelidae	
DD?	*Poecilogale albinucha*	African weasel
*	*Ictonyx striatus*	Striped polecat
	Order Ruminanta	
	Family Bovidae	
*	*Sylvicapra grimmia*	Common duiker
*	*Raphicerus campestris*	Steenbok

(Systematics and taxonomy as proposed by Bronner et.al [2003], Skinner & Chimimba [2005], Apps [2012] and Stuart & Stuart [2015]).

√ Definitely present or have a high probability to occur;
* Medium probability to occur based on ecological and distributional parameters;
? Low probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 2: Mammal species positively confirmed from the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
L. saxatilis	Scrub hare	Faecal pellets	Short grassveld
C. hottentotus	African mole rat	Tunnel systems	Universal
G. brantsii	Highveld gerbil	Tunnel systems	Sandy grassland

Scrub hares and mole rats are outstandingly widespread in the Subcontinent and common within their distribution ranges. Both are reproductively fecund. The scrub hare thrive on short grass (which is normally the result of overgrazing or environmental manipulation), and is rarely seen since they are nocturnal and are exceptionally cryptic during day where they lie up in forms constructed at the base of grass clumps or shrubs. The subterranean life-style of rodent moles renders them virtually untouchable by humans unless specialised traps are deployed. Highveld gerbils are fairly common in sandy veld where they can excavate colonial tunnel systems; they are often encountered at the edges of tilled fields. In this instance the burrow was constructed in fairly compacted soil (Figure 9).

6. FINDINGS AND POTENTIAL IMPLICATIONS

The collective footprint of the proposed development will be modest and its impact will be equally small, especially when measured against the expanse of the undisturbed areas in the neighbourhood.

Species richness: This ecological facet is concluded to be presently in a downwards spiral as result of reigning conditions and it is anticipated that more species will become lost in time (viz. brown hyena, black-backed jackal, duiker and steenbok). It is not anticipated that the proposed development will exacerbate this decline. The remaining species are robust and some in fact has the potential to invade established gardens or become house pests.
Endangered species: It is contended that the *Crocidura* and *Myosorex* species are *de facto* not endangered and they are often found in lush gardens. If indeed dwarf shrews are present on the site, they will *in situ* be displaced in the face of the proposed development.
Sensitive areas: No sensitive area or ecological sensitive system will be affected.
Habitat(s) quality and extent: Functionally the to-be affected terrestrial habitat is deemed as functional for small mammals, irrespective of its history of transformation (fields) or ecological disturbance (heavy grazing).
Impact on species richness and conservation: The proposed development will to a limited extent enlarge the development footprint in the area, and commensurate with that population densities will suffer marginally.
Connectivity: In spite of the gravel road, ecological connectivity is near natural. In view of the impact of traditional hunting it is submitted that this ecological mechanism plays an important role in allowing migration.
Management recommendation: Nil.

7. LIMITATIONS, ASSUMPTIONS AND GAPS INFORMATION

The Galago Environmental team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on a site visit. In instances where doubt exists, a species is assumed to be a possible occupant (viz. *Suncus* species); -this approach renders the conclusions to be robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely whether an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

8. RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed by the specialist

- Should hedgehogs be encountered during the construction phase of the proposed development, these should be relocated to natural grassland areas in the vicinity.
- The contractors must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- The proprietors must be contractually bound to implement the Environmental Management Plan (EMP) (the latter primarily dealing with manure management) and Record of Decision (ROD) during the operational phase of the development should be informed of their responsibilities in terms of the EMP and ROD.
- The owners should implement an ongoing monitoring and eradication program for all invasive and weedy plant species growing in the operational terrain (*sensu lato*).
- A comprehensive surface runoff and storm water management plan should be compiled, indicating how all surface runoff generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. This plan should form part of the EMP.

9. CONCLUSIONS

Contemporary pork production is conducted strictly in specialised buildings and no grazing on the veld is tolerated. Other than manure management, the impact of this form of farming is spatially limited but *in situ* entirely destructive. Given the declared planning for manure processing plant it is assumed that the risk of environmental contamination of the environment will be contained and that avoiding this risk will be conditional to the ROD.

The proposed development will progressively displace the mammals recorded from the building sites, but such a loss will be restricted to five small construction and operational facilities. The effect of the new development will not exceed the current environmental attrition by traditional hunting.

The five operational developments are very small and will intrinsically be isolated from surrounding natural areas. It is accepted that the highest risk to the environment (environmental contamination from accumulated pig manure) will be strictly managed according to statutory requirements and industry standards.

No reasonable objection can be offered to the implementation of the proposed development. Not only will the impact of the development not be overly high, but it will be small and contained within a large rural district. Copious amounts of nutrient-rich manure could pose an environmental risk and it is submitted that this facet of risk management must be conditional to the ROD.

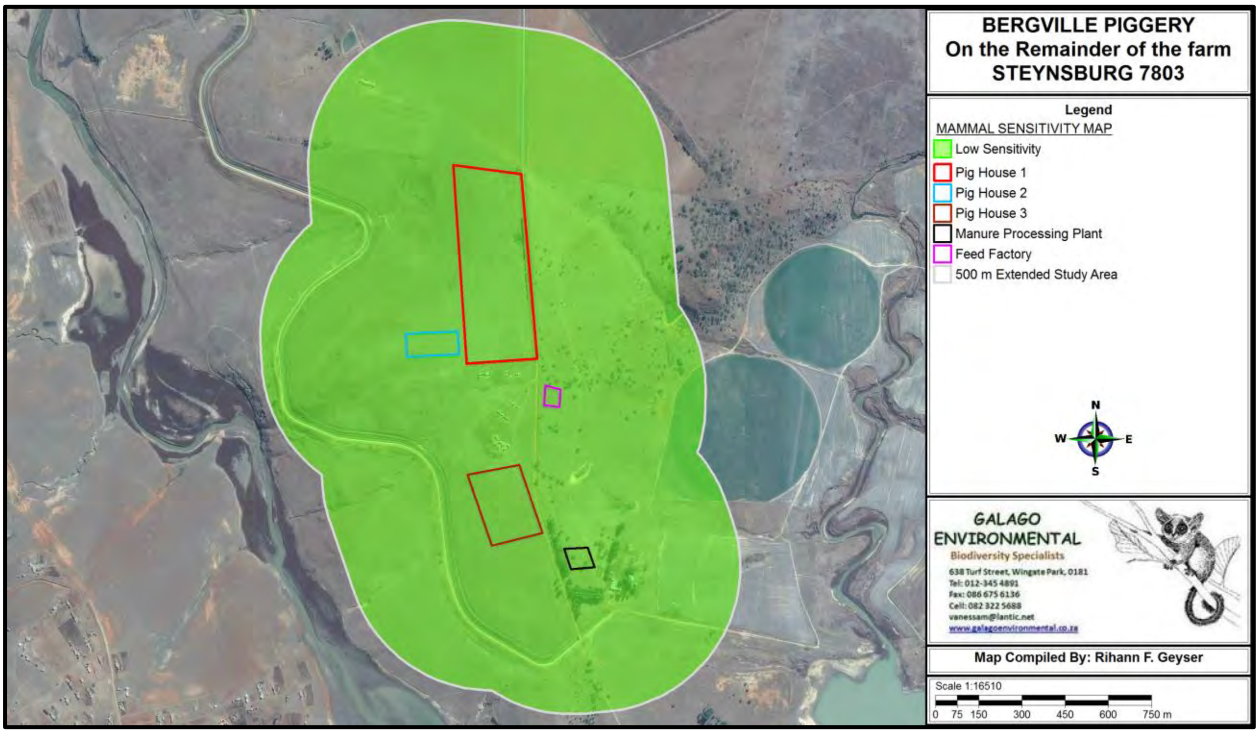

Figure 10: Mammal sensitivity map

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APPENDIX 8E

HERPETOFAUNAL STUDY

REC
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Herpetofaunal Habitat Assessment

of

Bergville Piggery on the Remainder of the Farm Steynsburg 7803

September 2016

Report author: **Mr. J.C.P van Wyk** (Pr.Sci.Nat: M.Sc)

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Declaration of Independence:

I, Jacobus Casparus Petrus van Wyk (68080450410845) declare that I:

- hold an MSc in the Biological Sciences, which allows registration by SACNASP (SA Council for National Scientific Professions) as a Professional Zoologist and sanctions me to function independently as a specialist scientific consultant
- as per prerequisite of the Natural Scientific Professions Act No. 27 of 2003, present this project as my work from inception and reflects exclusively my observations and unbiased scientific interpretations, executed to the best of my ability
- abide by the Code of Ethics of the SACNASP
- am committed to biodiversity conservation but concomitantly recognise the need for economic development. Even though I appreciate the opportunity to learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the field of Zoology
- am subcontracted as specialist consultant by Galago Environmental CC for the project “Herpetofauna Habitat Assessment of Bergville Piggery, KwaZulu-Natal Province” described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- have or will not have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client as well as the competent authority any material information that have or may have the potential to influence the decision of the competent authority required in terms of the Environmental Impact Assessment Regulations, 2014
- Our intellectual property in this report will only be transferred to the client (the party/ company that commissioned the work) on full payment of the contract fee. Upon transfer of the intellectual property, we recognise that written consent of the client will be required for release of any part of this report to third parties.

J.C.P. van Wyk

1. INTRODUCTION

Galago Environmental CC. was appointed to undertake a Herpetofaunal Habitat Assessment on the Remainder of the farm Steynsburg 7803, scheduled for the establishment of the Bergville piggery.

This report focuses on the reigning status of threatened and sensitive reptiles and amphibians (herpetofauna) likely to occur on the proposed development site and whose conservation status should be considered in the decision-making process. Special attention was paid to the qualitative and quantitative habitat conditions for Red Data species deemed present on the site, and mitigation measures to ameliorate the effect of the proposed development. The secondary objective of the investigation was to gauge which herpetofauna might still reside on the site and comment on the herpetofauna diversity of the study area.

This assignment is in accordance with the 2014 EIA Regulations emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

2. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the Herpetofaunal habitat components and current general conservation status of the property;
- Identify and comment on ecological sensitive areas;
- Comments on connectivity with natural vegetation and habitats on adjacent sites;
- To provide a list of herpetofauna which occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the herpetofauna of the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

This study site lies in the quarter degree grid cell 2829CA (Oliviershoek) south of the R74 Road. The entire area is about 225.3 hectares in extent and consists of five parts which lie on both sides of a gravel road, Ethel's Drive. Pig House 1 is spatially more accurately defined by 28°39'27.1141"S; 29°8'33.8077"E. Pig House 2 is spatially more accurately defined by 28°39'36.2903"S; 29°8'25.6996"E. Pig House 3 is spatially more accurately defined by 28°39'53.8307"S; 29°8'34.8663"E. The Manure Processing Plant is spatially more accurately defined by 28°40'0.2215"S; 29°8'44.2667"E. The Feed Factory is spatially more accurately defined by 28°39'42.1574"S; 29°8'40.9708"E. South-east of the study site lies the Woodstock Dam, which forms part of the Tugela-Vaal Water Scheme, which provides water for the Vaal Dam and Gauteng Province. West of the study site is a water canal which takes water to the Sterkfontein Dam, an important part of the Tugela-Vaal Water Scheme (Figure 1).

No important topographical features occur on the actual sites, but near the study sites are several drainage lines which flow into the Tugela River (underneath the canal) or the Woodstock Dam. Most of the study site slopes towards these drainage lines.
The sites have been altered by extensive grazing (Figure 2), fences (Figure 3), veld fires, invasive plants and power lines. Most of the terrestrial habitat is currently used for grazing by

cattle or goats. Near the sites there are several buildings and the water canal to the west of the study site, acting as a huge barrier for herpetofaunal movement (Figure 3).

The study site lies inside the Northern KwaZulu-Natal Moist Grassland (Gs 4) vegetation type (Mucina & Rutherford, 2006).

Only a few indigenous trees (*Acacia sieberiana*) grow on the site. Exotic plants on or near the site include *Pinus* trees, syringa, weeping willow, poplar, wattle trees and kikuyu. The substrate is mostly red sandy soil.

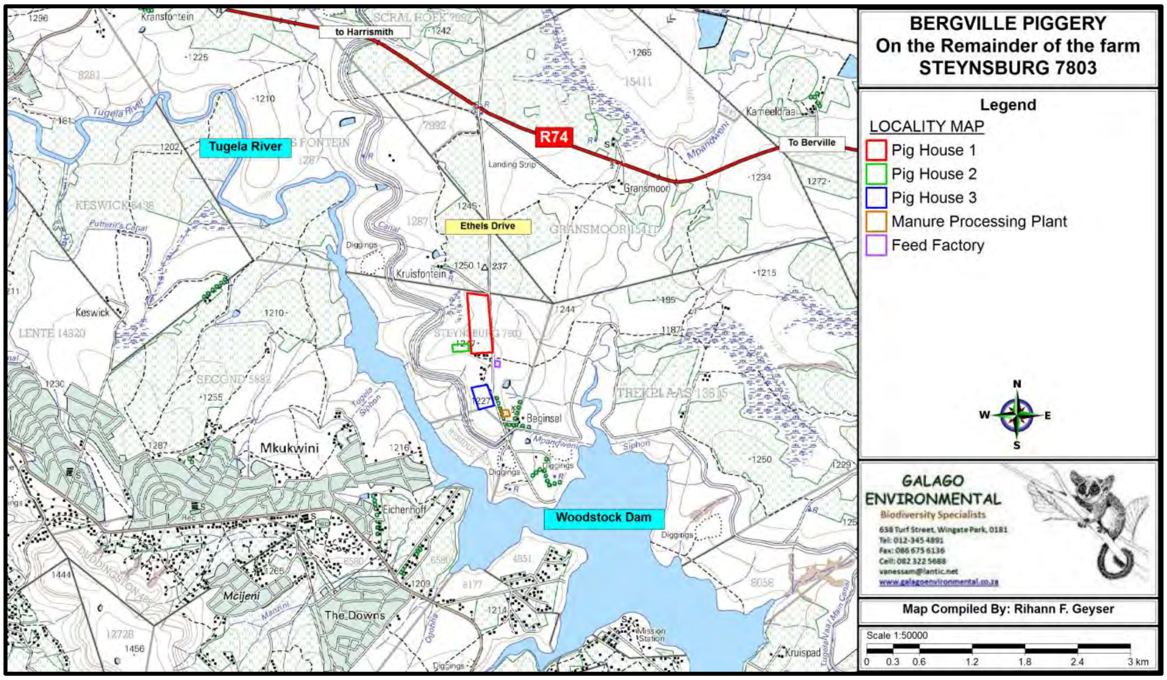

Figure 1: Locality map of the study area

Figure 2: Cattle grazing on the study site of Pig House 3

Figure 3: A south-westerly view of the study site of Pig House 1. Note the fence on the left-hand side of the photograph and the fire break.

Figure 4: The water canal west of the study site of Pig house 3

4. METHOD

The site visit was conducted on 17 September 2016. During this visit the observed and derived presence of reptiles and amphibians associated with the recognised habitat types of the study site was recorded. This was done with due regard to the well-recorded global distributions of Southern African herpetofauna, coupled with the qualitative and quantitative nature of recognised habitats.

The 500 meters of adjoining properties were scanned for important fauna habitats.

4.1 Field Surveys

During the site visits, reptiles and amphibians were identified by visual sightings through random transect walks. Amphibian diversity was also established by means of acoustic identification. No trapping was conducted, as the terms of reference did not require such intensive work.

4.2 Desktop Surveys

As the majority of reptiles and amphibians are secretive, nocturnal and/or poikilothermic or seasonal, distributional ranges and the presence of suitable habitats were used to deduce the presence or absence of these species based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

The probability of the occurrence of reptile and amphibian species was based on their respective geographical distributional ranges and the suitability of on-site habitats. In other words, *high* probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common to the area, i.e. normally occurring at high population densities.

Medium probability pertains to a herpetofaunal species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is taken into consideration. Species categorised as *medium* normally do not occur at high population numbers, but cannot be deemed as rare.

A *low* probability of occurrence would imply that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some reptiles and amphibians categorised as low are generally deemed to be rare.

Based on the impressions gathered during the site visit, as well as publications, such as FitzSimons' Snakes of Southern Africa (Broadley, 1990), Field Guide to Snakes and other Reptiles of Southern Africa (Branch, 1998), A Guide to the Reptiles of Southern Africa (Alexander and Marais, 2007), Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates, Branch, Bauer, Burger, Marias, Alexander & De Villiers, 2014), Amphibians of Central and Southern Africa (Channing 2001), Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (Minter, et al, 2004) and A Complete Guide to the Frogs of Southern Africa (Du Preez & Carruthers, 2009), a list of species which may occur on the site was compiled. The latest taxonomic nomenclature was used and the vegetation type was defined according to the standard handbook by Mucina and Rutherford (eds) (2006).

4.3 Specific Requirements

During the visit the site was surveyed and assessed for the potential occurrence of Red Data species in KwaZulu-Natal Province (Alexander & Marais, 2007; Minter, *et al*, 2004, Du Preez & Carruthers, 2009 and Bates, *et al*, 2014) such as:

- Loggerhead Turtle (*Carette caretta*);
- Green Turtle (*Chelonia mydas*);
- Hawksbill Turtle (*Eretmochelys imbricate*);

- Olive Ridley Turtle (*Lepidochelys olivacea*);
- Leatherback Turtle (*Dermochelys coriacea*);
- Nile Crocodile (*Crocodylus niloticus*);
- Cottrell's Mountain Lizard (*Tropidosaura cottrelli*);
- Coppery Grass Lizard (*Chamaeasaura aenea*);
- Large-Scaled Grass Lizard (*Chamaeasaura macrolepis*);
- Lang's Crag Lizard (*Pseudocordylus langi*);
- Spiny Crag Lizard (*Pseudocordylus spinosus*);
- Giant Dragon Lizard (*Smaug giganteus*);
- Breyer's Long-Tailed Seps (*Tetradactylus breyeri*);
- Variable Legless Skink (*Acontias poecilus*);
- African Coral Rag Skink (*Crytoblepharus africanus*);
- Bourquin's Dwarf Burrowing Skink (*Scelotes bourquini*);
- Durban Dwarf Burrowing Skink (*Scelotes inornatus*);
- Umlalazi Dwarf Chameleon (*Bradypodion caeruleogula*);
- Drakensberg Dwarf Chameleon (*Bradypodion dracomontanum*);
- KwaZulu Dwarf Chameleon (*Bradypodion melanocephalum*);
- Qudeni Dwarf Chameleon (*Bradypodion nemorale*);
- Ngome Dwarf Chameleon (*Bradypodion ngomeense*);
- Midlands Dwarf Chameleon (*Bradypodion thamnobates*);
- Forest Thread Snake (*Leptotyphlops sylvicolus*);
- Gaboon adder (*Bitis gabonica*);
- Striped Harlequin Snake (*Homoroselaps dorsalis*);
- KwaZulu-Natal Black Snake (*Macrelaps microlepidotus*);
- Pygmy Wolf Snake (*Lycophidion pygmaeum*);
- Cream-Spotted Mountain Snake (*Montaspis gilvomaculata*);
- Eastern Green Mamba (*Dendroaspis angusticeps*);
- Spotted Shovel-Nosed Frog (*Hemisus guttatus*);
- Natal Leaf-Folding Frog (*Afrixalus spinifrons*);
- Pickersgill's Reed Frog (*Hyperolius pickersgilli*);
- Long-Toed Tree Frog (*Leptopelis xenodactylus*);
- Bilbo's Rain Frog (*Breviceps bagginsi*);
- Whistling Rain Frog (*Breviceps sopranus*);
- Misbelt Moss Frog (*Arthroleptella ngongoniensis*);
- Poynton's Caco (*Cacosternum poyntoni*);
- Striped Caco (*Cacosternum striatum*);
- Kloof Frog (*Natalobatrachus bonebergi*);
- Plain Stream Frog (*Strongylopus wageri*);

5. RESULTS

The vegetation types of the site were analysed according to Mucina and Rutherford (2006).

Herpetofaunal Habitat Assessment:

The local occurrences of reptiles and amphibians are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges. From a herpetological habitat perspective, it was established that only the terrestrial habitat is naturally present on the study site. In the 500 metre surrounding area there is arboreal and wetland-associated vegetation cover.

Most of the study site consists of transformed grassland. The natural grasslands have been transformed for agricultural purposes such as grazing but also by other anthropogenic influences such as foot paths, veld fires, power lines, fences and invasive plants. The study site is thus ecologically disturbed in many parts. Moribund termitaria were recorded on the study site (Figure 5). These structures are good indicators of the occurrence of small herpetofauna. Accordingly, it is estimated that the reptile and amphibian population density for the study site is higher. At the time of the site visit the basal cover was poor in many places and would not provide adequate cover for small terrestrial herpetofauna.

Figure 5: A moribund termitarium on the study site of Pig House 3.

There are no natural rupicolous habitats on the study site, but excellent manmade rupicolous habitat exists in the form of buildings near some of the sites (Figure 6).

Figure 6: Manmade rupicolous habitat just east of the Manure Processing Plant. Note the exotic kikuyu grass and pine trees in the photograph.

A few trees provide arboreal habitat and most of them grow just north of the Feed Factory (Figure 7). Near the Manure Processing Plant there are dead logs of exotic trees, which could provide shelter and food for some herpetofauna.

Figure 7: A north-easterly view from the Feed Factory. Note the arboreal habitat near the northern border of the study site.

There are a few manmade dams near some of the study sites. Some of the dams are temporary (Figure 8) and others are permanent (Figure 9). Several drainage lines occur near the study site which flow into the Tugela River (underneath the canal) (Figure 9) or the Woodstock Dam. These water sources would provide habitat for all water-dependent herpetofauna.

Figure 8: A temporary dam in a drainage line north-east of the Manure Processing Plant.

Figure 9: A permanent dam in a drainage line north-east of the border of the Manure Processing Plant. Note the Woodstock Dam in the background.

Figure 10: A drainage line underneath the water canal west of the study site of Pig House 3.

Except for the water canal west of the study site, connectivity is fair to good, especially to the east and north of the study site. Real opportunities for migration exist along the drainage lines.

Sight records were also used to compile this herpetofauna report.

Threatened and Red listed Reptile and Amphibian Species:
The study site fall outside the natural range of the Loggerhead Turtle; Green Turtle; Hawksbill Turtle; Olive Ridley Turtle; Leatherback Turtle; Nile Crocodile; Large-Scaled Grass Lizard; Variable Legless Skink; African Coral Rag Skink; Bourquin's Dwarf Burrowing Skink; Durban Dwarf Burrowing Skink; Umlalazi Dwarf Chameleon; KwaZulu Dwarf Chameleon; Qudeni Dwarf Chameleon; Ngome Dwarf Chameleon; Midlands Dwarf Chameleon; Forest Thread Snake; Gaboon adder; KwaZulu-Natal Black Snake; Pygmy Wolf Snake; Eastern Green Mamba; Spotted Shovel-Nosed Frog, Natal Leaf-Folding Frog; Pickersgill's Reed Frog; Long-Toed Tree Frog; Bilbo's Rain Frog; Whistling Rain Frog; Mistbelt Moss Frog; Poynton's Caco; Striped Caco and Kloof Frog. These species should not occur on the study site.

The study site do not have the natural rupicolous habitat of the Drakensberg mountain range, with crevices at the escarpment edge, cliffs or outcrops and species such as Cottrell's Mountain Lizard, Lang's Crag Lizard and Spiny Crag Lizard should not occur on the study site.

Species such as the Cream-Spotted Mountain Snake and Plain Stream Frog inhabit mountain streams and vleis in high altitude grassland and/or mistbelt forests at lower altitudes. Both habitat types do not occur on site and these species should not occur on any of the sites.

There are no confirmed records of natural populations of the Giant Dragon Lizard in KwaZulu-Natal Province (Armstrong, 2011) and this species should not occur on the study site.

Breyer's Long-Tailed Seps (*Tetradactylus breyeri*) is found in montane and Highveld grasslands of the Grassland Biome at altitudes of 1400-2000 metres above sea level (Bates, 2014). There is a very small chance that this species could occur on site.

Drakensberg Dwarf Chameleon (*Bradypodion dracomontanum*) is found mainly in small forest patches, but can extend into grassland, generally above 1500m (Tolley, 2014). There is very small chance that this species could occur on site.

A few moribund termitaria, where the Striped Harlequin Snake (*Homoroselaps dorsalis*) is most likely to be found, are present on the study site. It is very difficult to confirm whether this cryptic snake is present on any study site, but there is a small chance that this species could occur on these particular study sites.

The coppery grass lizard prefers pristine grassveld and most of the study sites are over grazed, but some areas near Pig House 1 and 3 have better quality grassveld. This species might occur on these areas.

Expected and Observed Herpetofauna Species Richness:

Of the 38 reptile species which may occur on the study site (Table 1), one was confirmed during the site visit (Table 2) and of the 15 amphibian species which may possibly occur on the study site (Table 1); none were confirmed during the site visit (Table 2).

Table 1 lists the reptiles & amphibians which were observed on or deduced to occupy the site.

The American red-eared terrapin (*Trachemys scripta elegans*) and the Brahminy blind snake (*Ramphotyphlops braminus*) are the only two feral reptile or amphibian species known to occur in South Africa (De Moor and Bruton, 1988; Picker and Griffiths, 2011), but with only a few populations, they are not expected to occur on this particular site.

The species assemblage is typical of what can be expected of habitat that is severely disturbed, but with sufficient habitat to sustain populations. Most of the species of the resident diversity (Table 1) are fairly common and widespread (viz. the common house snake, mole snake, speckled rock skink, Van Son's gecko, guttural toad, Boettger's caco, common platanna and the common river frog).

The species richness is fair due to the three habitat types occurring on or near the study site.

Table 1: The Reptile and Amphibian species observed on or deduced to occupy the site

	SCIENTIFIC NAME	ENGLISH NAME
	CLASS: REPTILIA	**REPTILES**
	Order: TESTUDINES	**TORTOISES & TERRAPINS**
	Family: Pelomedusidae	**Side-necked Terrapins**
?	*Pelomedusa subrufa*	Marsh Terrapin
	Order: SQUAMATA	**SCALE-BEARING REPTILES**
	Suborder:LACERTILIA	**LIZARDS**
	Family: Gekkonidae	**Geckos**
√	*Pachydactylus vansoni*	Van Son's Gecko
	Family:Lacertidae	**Old World Lizards or Lacertids**
√	*Nucras lalandii*	Delalande's Sandveld Lizard
?	*Pedioplanis burchelli*	Burchell's Sand Lizard
	Family: Cordylidae	
NT*?*	*Chamaesaura aenea*	Coppery Grass Lizard
?	*Chamaesaura anguina anguina*	Cape Grass Lizard
	Family: Gerrhosauridae	**Plated Lizards**
?	*Gerhosaurus flavigularis*	Yellow-throated Plated Lizard
NT*?*	*Tetradactylus breyeri*	Breyer's Long-Tailed Seps
	Tetradactylus seps	Short-Legged Seps
	Family: Scincidae	**Skinks**
?	*Afroablepharus wahlbergii*	Wahlberg's Snake-Eyed Skink
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis punctatissima*	Speckled Rock Skink
√	*Trachylepis varia*	Variable Skink
	Family: Varanidae	**Monitors**
√	*Varanus niloticus*	Nile Monitor
	Family: Chamaeleonidae	**Chameleons**
NT*?*	*Bradypodion dracomontanum*	Drakensberg Dwarf Chameleon

	SCIENTIFIC NAME	ENGLISH NAME
?	*Chamaeleo dilepis dilepis*	Common Flap-Neck Chameleon
	Family: Agamidae	**Agamas**
√	*Agama aculeate*	Ground Agama
	Suborder: SERPENTES	**SNAKES**
	Family: Typhlopidae	**Blind Snakes**
*	*Afrotyphlops bibronii*	Bibron's Blind Snake
	Family: Leptotyphlopidae	**Thread Snakes**
√	*Leptotyphlops scutifrons*	Peter's Thread Snake
	Family: Viperidae	**Adders**
√	*Brits arietans*	Puff Adder
√	*Causus rhombeatus*	Rhombic Night Adder
	Family: Lamprophiidae	
NT?	*Homoroselaps dorsalis*	Striped Harlequin Snake
?	*Homoroselaps lacteus*	Spotted Harlequin Snake
√	*Boaedon capensis*	Common House Snake
?	*Lamprophis guttatus*	Spotted Rock Snake
?	*Lycodonomorphus inornatus*	Olive Ground Snake
?	*Lycodonomorphus laevissimus*	Dusky-Bellied Water Snake
√	*Lycodonomorphus rufulus*	Brown Water Snake
?	*Lycophidion capense*	Cape Wolf Snake
√	*Psammophis crucifer*	Cross-Marked Grass Snake
√	*Psammophylax rhombeatus*	Spotted Grass Snake
?	*Amplorhinus multimaculatus*	Many-Spotted Snake
?	*Duberria lutrix*	Common Slug Eater
√	*Pseudaspis cana*	Mole Snake
	Family: Elapidae	**Cobras, Mambas and Others**
√	*Hemachatus haemachatus*	Rinkhals
	Family: Colubridae	
√	*Crotaphopeltis hotamboeia*	Red-Lipped Snake
√	*Dasypeltis scabra*	Rhombic Egg Eater
?	*Philothamnus natalensis occidentalis*	Western Natal Green Snake
	CLASS: AMPHIBIA	**AMPHIBIANS**
	Order: ANURA	**FROGS**
	Family: Pipidae	**Clawed Frogs**
√	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	**Toads**
√	*Amietaophrynus gutturalis*	Guttural Toad
*	*Vandijkophrynus gariepensis*	Karoo Toad
√	*Schismaderma carens*	Red Toad
	Family: Hyperoliidae	**Reed Frogs**
√	*Kassina senegalesis*	Bubbling Kassina
?	*Semnodactylus wealli*	Rattling Frog
	Family: Microhylidae	**Rain Frogs**
?	*Breviceps adspersus*	Bushveld Rain Frog
?	*Breviceps mossambicus*	Mozambique Rain Frog

	SCIENTIFIC NAME	ENGLISH NAME
	Family: Pyxicephalidae	
√	*Amietia angolensis*	Common River Frog
*	*Amieta fuscigula*	Cape River Frog
?	*Strongylopus grayii*	Clicking Stream Frog
?	*Ptychdena porosissima*	Striped Grass Frog
√	*Cocosternum boettgeri*	Boettger's Caco
√	*Cocosternum nanum nanum*	Bronze Caco
√	*Tomopterna natalensis*	Natal Sand Frog

Systematic arrangement and nomenclature according to Branch (1998), Alexander & Marais (2007), Minter, *et.al* (2004), Du Preez & Carruthers (2009) and Bates, *et.al* 2014.

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103..In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, *et.al*, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 2: Reptile and Amphibian species positively confirmed on the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Trachylepis punctatissima	Speckled Rock Skink	Sight record of a single adult	Manmade rupicolous habitat near the Manure Processing plant

The speckled rock skink listed in Table 2, should be abundant on and near the study sites and elsewhere in their range.

6. FINDINGS AND POTENTIAL IMPLICATIONS

Although the general area is sensitive and included a World Heritage Site, Nature Reserves and important catchment dams, no important topographical features occur on the actual area. Near the study sites there are several drainage lines which flow into the Tugela River (underneath the canal) or the Woodstock Dam. The study sites and their 500 metre surrounding areas contain three natural herpetofaunal habitats, namely terrestrial, arboreal and wetlands. The sites have been altered by extensive grazing, fences, invasive plants and power lines. Most of the terrestrial habitat is currently used for grazing by cattle or goats. Near the sites there are several buildings and the water canal to the west of the site study sites, acting as a huge barrier for herpetofaunal movement.

<u>Species richness</u>: Due to the presence of three of the four habitat types, the study area should have a fair number of species. It must be emphasised that the species richness is for the general area and <u>NOT</u> for the study site itself.
<u>Endangered species</u>: The possibility exists that at least some individuals of Breyer's long-tailed seps, Drakensberg dwarf chameleon, coppery grass lizard and striped harlequin snake occur on the study site.
<u>Sensitive species and/or areas (Conservation ranking)</u>: The drainage lines and dams in the 500 metre surrounding area are sensitive ecological systems. The study site falls in the Northern KwaZulu-Natal Moist Grassland (Gs 4) vegetation type, which is considered vulnerable (Mucina and Rutherford, 2006).

Habitat(s) quality and extent: The terrestrial habitat is currently used for grazing by cattle or goats. Near the sites there are several buildings and the water canal to the west of the study site acting as a huge barrier for herpetofaunal movement.

Impact on species richness and conservation: The proposed development will have a significant and lasting effect on species richness and conservation, because of the construction of buildings and new roads carrying more vehicles. These structures, buildings and roads will form an even larger barrier for herpetofaunal movement and it will result in a decrease in connectivity.

If the development should go ahead, a very important indirect effect would be the likely impact that the proposed development might have on the water quality of the drainage lines due to the waste water and surface water runoff. This could have a negative impact on the herpetofauna.

Connectivity: Except for the water canal west of the study site, connectivity is fair to good, especially to the east and north of the study site. Real opportunities for migration exist along the drainage lines.

Management recommendation: Measures will have to be taken to stop water pollution of the drainage lines and dams.

General: The integrity of the drainage lines and dams should not be jeopardised in any way by the development.

7. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

Galago Biodiversity and Aquatic Specialists are committed to the conservation of biodiversity but concomitantly recognise the need for economic development. Even though we appreciate the opportunity to learn through the processes of constructive criticism and debate, we reserve the right to form and hold our own opinions and therefore will not willingly submit to the interest of other parties or change statements to appease them.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. To some extent, conclusions are drawn and proposed mitigation measures suggested based on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. Galago Biodiversity and Aquatic Specialists can therefore not accept responsibility for conclusions drawn and mitigation measures suggested in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

8. RECOMMENDED MITIGATION MEASURES

Protection of the Drainage lines and dams:

- Every effort should be made to retain the linear integrity, flow dynamics and water quality of the drainage lines and dams.

The following mitigation measures are proposed by the specialist:

- If the Breyer's long-tailed seps, Drakensberg dwarf chameleon, coppery grass lizard and striped harlequin snake or any herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. This remediation requires the employment of a herpetologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment).
- The contractor must ensure that no herpetofaunal species are disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Alien and invasive plants must be removed.
- During the construction phase there will be increased surface runoff and a decreased water quality (with increased silt load and pollution). Completing construction during the winter months would mitigate the environmental impact.

9. CONCLUSION

Although the general area is sensitive and includes a World Heritage Site, Nature Reserves, and important catchment dams, no important topographical features occur on the study area.

The drainage lines and dams occur in the 500 metre surrounding area and should be considered as ecologically sensitive.

The possibility exists that at least some individuals of species with Red Data status such as Breyer's long-tailed seps, Drakensberg dwarf chameleon, coppery grass lizard and striped harlequin snake may occur on the study site.

Measures will have to be taken to prevent development near the drainage lines and dams and to monitor water pollution of these water bodies.

If the development should go ahead, a very important indirect effect would be the likely impact that the proposed development might have on the water quality of the drainage lines due to the waste water and surface water runoff. This could have a negative impact on the herpetofauna.

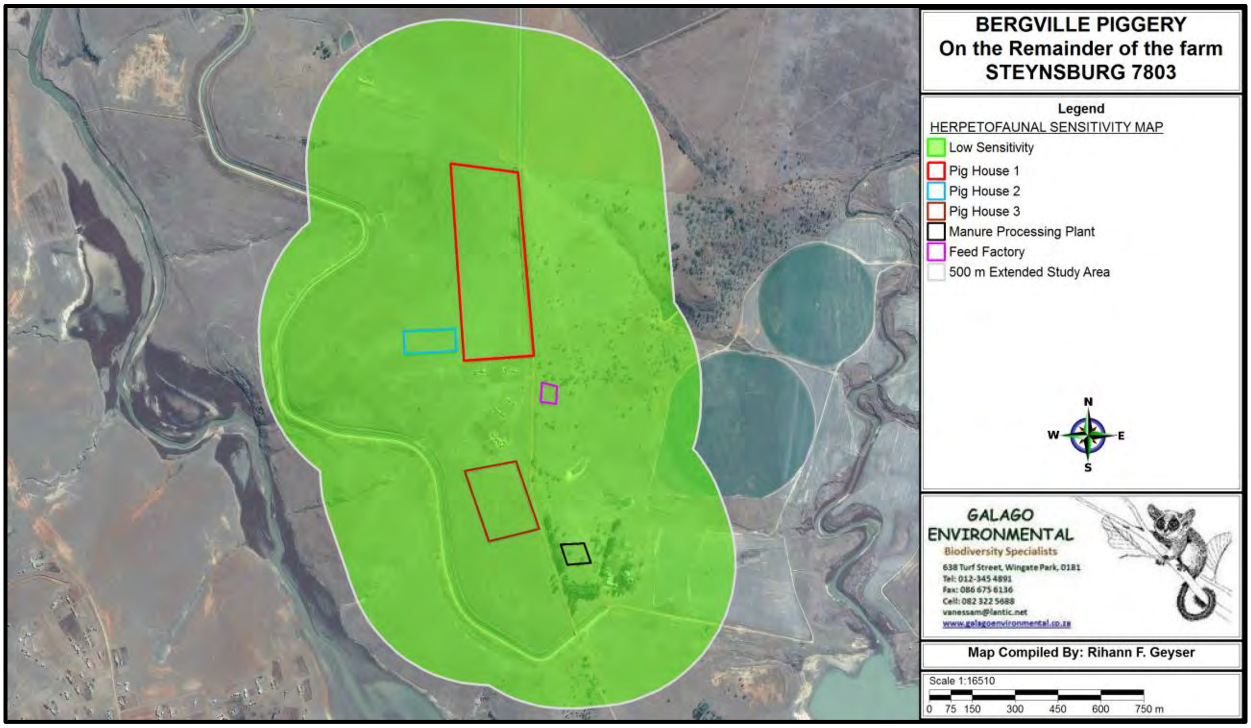

Figure 11: Herpetofaunal Sensitivity Map

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APPENDIX 8F

AVIFAUNAL STUDY

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

GALAGO ENVIRONMENTAL
Biodiversity & Aquatic Specialists

638 Turf Street
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Avifaunal Habitat Assessment

of

BERGVILLE PIGGERY ON THE REMAINDER OF THE FARM STEYNSBURG 7803

September 2016

Report author: Mr. Rihann F. Geyser
Report verified/reviewed by: Dr. A.C. Kemp (Ph.D., Pr.Sci. Nat. (Zoology & Ecology))

DECLARATION OF INDEPENDENCE:

I, Rihann Frans Geyser (690304 5248 084), declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- act as an independent specialist consultant in the field of ornithology
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Plantkor Bergville Piggery on the Remainder of the farm Steynsburg 7803 development described in this report
- have no financial interest in the proposed development other than remuneration for work performed
- neither have nor will have any vested or conflicting interests in the proposed development
- undertake to disclose to Galago Environmental CC and its client, and the competent authority, any material information that has or may have the potential to influence decisions by the competent authority as required in terms of the Environmental Impact Assessment Regulations, 2014.

Rihann F. Geyser

VERIFICATION STATEMENT

Mr Rihann F. Geyser is not registered as a Professional Natural Scientist with the S.A. Council for Natural Scientific Professions. This communication serves to verify that the avifaunal report compiled by Mr Rihann F. Geyser has been prepared under my supervision, and I have verified the contents thereof.

Declaration of Independence: I, Alan Charles Kemp (4405075033081), declare that I:

- am committed to biodiversity conservation but concomitantly recognize the need for economic development. Whereas I appreciate the opportunity to also learn through the processes of constructive criticism and debate, I reserve the right to form and hold my own opinions and therefore will not willingly submit to the interests of other parties or change my statements to appease them
- abide by the Code of Ethics of the S.A. Council for Natural Scientific Professions
- act as an independent specialist consultant in the fields of zoology and ecology
- am subcontracted as specialist consultant by Galago Environmental CC for the proposed Plantkor Bergville Piggery on the Remainder of the farm Steynsburg 7803 described in this report
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Dr. A.C. Kemp

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FIGURES:

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1. INTRODUCTION

Galago Environmental CC. was appointed to undertake an avifaunal habitat survey for the proposed Plantkor Bergville Piggery on the Remainder of the farm Steynsburg 7803 (hereinafter referred to as the study site). This is in accordance with the 2014 EIA Regulations emanating from Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998). The study site and the 500 m extended study area (e.s.a.) are hereafter referred to as the study area.

The primary objective was to determine the presence of Red Data avifaunal species and to identify suitable habitat for these species. Direct observations and published data apart, qualitative and quantitative habitat assessments were used to derive the presence /-absence of Red Data avifaunal species. A list of avifaunal species likely to be affected by the new development is compiled.

2. SCOPE AND OBJECTIVES OF THE STUDY

- To qualitatively and quantitatively assess the significance of the avifaunal habitat components, and current general conservation status of the property;
- To comment on ecologically sensitive areas;
- To comment on connectivity with natural vegetation and habitats on adjacent sites;
- To provide a list of avifauna that occur or that are likely to occur, and to identify species of conservation importance;
- To highlight potential impacts of the proposed development on the avifauna of the study site, and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

3. STUDY AREA

3.1 Locality

The study sites, ±225.3340 ha in extent (combined) is situated between Harrismith and Bergville and directly north of the Woodstock Dam within the KwaZulu-Natal province (Figure 1). Spatially the study site is defined by GPS coordinates (all measured in the centre of the study site) as follows:

- Pig House 1: 28º39’27.1141” S 29º8’33.8077” E
- Pig House 2: 28º39’36.2903” S 29º8’25.6996” E
- Pig House 3: 28º39’53.8307” S 29º8’34.8663” E
- Manure Processing Plant: 28º40’0.2215” S 29º8’44.2667” E
- Feed Factory: 28º39’42.1574” S 29º8’40.9708” E

Furthermore the study area is situated within the 2829CA quarter degree grid cell (q.d.g.c.) and more specifically within the 2835_2905 pentad (SABAP2 protocol Figure 2). The study site is situated at an altitude of between 1 215 and 1 240 metres above sea level (m a.s.l.).

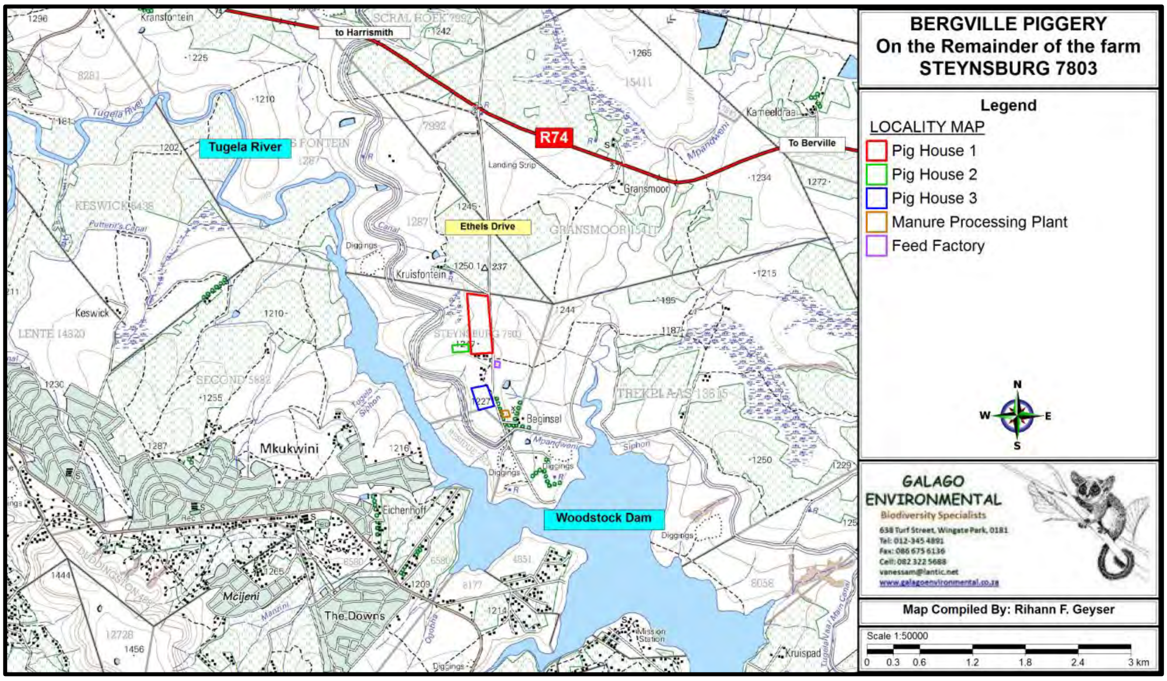

Figure 1: Locality map of the study area

3.2 Land Use

The study site consists of a farming area mainly used for livestock grazing.

3.3 Biophysical Information

3.3.1 Vegetation type and landscape

The study site is situated within the Sub-Escarpment Grassland Bioregion of the Grassland Biome, more specifically within the **Northern KwaZulu-Natal Moist Grassland** (Gs 4) vegetation type according to Mucina and Rutherford (2006).

The landscape consists of hilly and rolling landscape supporting tall tussock grassland usually dominated by *Themeda triandra* and *Hyparrhenia hirta*. Open *Acacia sieberiana* var. *woodii* savannoid woodland encroach up the valleys, usually on disturbed (strongly eroded) sites (Mucina and Rutherford, 2006).

3.3.2 Climate

The study site is situated in a summer-rainfall region with a Mean Annual Precipitation of about 840 mm (710 – 1 120 mm; Camp 1999a), mainly as summer thunderstorms. Mist occurs frequently on hilltops in spring and early summer, but summer droughts are also frequent. Summers are warm to hot, with maximum temperature recorded in the hottest month of January (Bergville mean annual temperature is 27.8°C). The mean annual temperature is around 16°C, but some localities may reach 17°C. Frost are severe and occur about 20 days per year. The mean annual evaporation recorded at Bergville is 1 895 mm.

3.3.3 Conservation status of habitat

This habitat type is considered vulnerable. Only 2% is statutorily conserved in the uKhahlamba Drakensberg Park as well as in the Chelmsford, Spioenkop, Moor Park, Wagendrift and Ncandu Nature Reserves. More than a quarter has already been transformed either for cultivation, plantations and urban sprawl or by building of dams. Alien *Acacia dealbata*, *Rubus*, *Eucalyptus* and *Populus* are invasive in places. Bush encroachment is common. Erosion is very low (53%), low (2%) and moderate (20%) (Mucina and Rutherford, 2006).

4. METHODS

An eight-hour site visit was conducted on 17 September 2016 to record the presence of avifaunal species associated with the habitat systems on the study site and within the study area and to identify possible sensitive areas. During this visit the observed and derived presence of avifaunal species associated with the recognized habitat types of the study site, were recorded. This was done with due regard to the well recorded global distributions of Southern African avifauna, coupled to the qualitative and quantitative nature of recognized habitats.

4.1 Field Surveys

Avifaunal species were identified visually, using 10X42 Bushnell Legend binoculars and a 20X-60X Pentax spotting scope, and by call, and where necessary were verified from Sasol Birds of Southern Africa (Sinclair *et al*., 2011) and Southern African Bird Sounds (Gibbon, 1991).

The 500 m of adjoining properties or extended study area was scanned or surveyed for important avifaunal species and habitats.

During the site visit, avifaunal species were identified by visual sightings or aural records along random transect walks. No trapping or mist netting was conducted, since the terms of reference did not require such intensive work. In addition, avifaunal species were also identified by means of feathers, nests, signs, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

4.2 Desktop Surveys

The presence of suitable habitats was used to deduce the likelihood of presence or absence of avifaunal species, based on authoritative tomes, scientific literature, field guides, atlases and databases. This can be done irrespective of season.

The likely occurrence of key avifaunal species was verified according to distribution records obtained during the Southern African Bird Atlas Project 1 (SABAP1) period from 1981 to 1993 (Harrison *et al.* 1997) and the most recent avifaunal distribution data were obtained from the current SABAP2 project which commenced on 1 July 2007.

The likely occurrence of key avifaunal species was verified according to distribution records obtained during the Southern African Bird Atlas Project 1 (SABAP1) period from 1981 to 1993 (Harrison *et al.* 1997). Earlier records of only Red Data avifaunal species were obtained from the period between 1974 and 1987 according to Tarboton *et al.* (1987). The most recent avifaunal distribution data were obtained from the current SABAP2 project which commenced on 1 July 2007.

The occurrence and historic distribution of likely avifaunal species, especially all Red Data avifaunal species recorded for the q.d.g.c. 2829CA, were verified from SABAP1 (southern Africa Bird Atlas Project 1) data (Harrison *et al.* 1997), Tarboton *et al.* (1987) and the current SABAP2 project (SABAP2 data for the 2829CA q.d.g.c. and for the

2835_2905 pentad). The reporting rate for each avifaunal species likely to occur on the study site, based on Harrison *et al*. (1997), was scored between 0 – 100% and was calculated as follows: Total number of cards on which a species was reported during the Southern African Bird Atlas SABAP1 and, Red Data species only, the current SABAP2 project period X 100 ÷ total number of cards for the particular q.d.g.c. (Harrison *et al*., 1997) and pentad(s) (SABAP2). It is important to note that a q.d.g.c. (SABAP1 Protocol) covers a large area: for example, q.d.g.c. 2829CA covers an area of ±27 X 25 km (±693 km²) (15 minutes of latitude by 15 minutes of longitude, 15' x 15') and a pentad (SABAP2 Protocol) and area of ±8 X 7.6 km (5 minutes of latitude by 5 minutes of longitude, 5' x 5') (Figure 2) and it is possible that suitable habitat will exist for a certain Red Data avifaunal species within this wider area surrounding the study site. However, the specific habitat(s) found on site may not suit the particular Red Data species, even though it has been recorded for the q.d.g.c. or pentad. For example, the Cape Vulture occurs along the Magaliesberg but will not favour the habitat found within the Pretoria CBD, both of which are in the same q.d.g.c. Red Data bird species were selected and categorised according to Barnes (2000).

2829CA

2830_2900	2830_2905	2830_2910
2835_2900	**2835_2905**	2835_2910
2840_2900	2840_2905	2840_2910

Figure 2: The 2829CA q.d.g.c. (15 minutes of latitude by 15 minutes of longitude, 15' x 15') is divided in nine smaller grids (5 minutes of latitude by 5 minutes of longitude, 5' x 5') of which each represent a pentad. The pentad in red represents the pentad in which the study site is situated.

An avifaunal biodiversity index (ABI), which gives an indication of the habitat system on the study site that will hold the richest avifaunal species diversity, was calculated as the sum of the probability of occurrence of bird species within a specific habitat system on site. For each species and habitat, the probability of occurrence was ranked as: 5 = present on site, 4 = not observed on site but has a high probability of occurring there, 3 = medium probability, 2 = low probability, 1 = very low probability and 0 = not likely to occur.

5. RESULTS

5.1 Avifaunal Habitat Assessment

Four major avifaunal habitat systems were identified within the study area. These habitat systems are as follows:

- Wetlands consisting of drainage lines, man-made channels and impoundments (dams)
- Open grassland
- *Acacia* dominated savanna woodland
- Disturbed and transformed areas consisting of agricultural croplands, exotic trees and other disturbed and transformed areas such as buildings and roads.

Table 1 indicates the habitat system composition of the study area in terms of surface area and percentage.

Table 1: Avifaunal habitat composition of the study area

Avifaunal Habitat Systems	Area (ha)	%
Wetlands	2.9751	1
Open Grassland	179.4081	79
Acacia dominated woodland savanna	16.3343	7
Disturbed and transformed	29.6792	13
Total surface Area:	**±228.3967**	

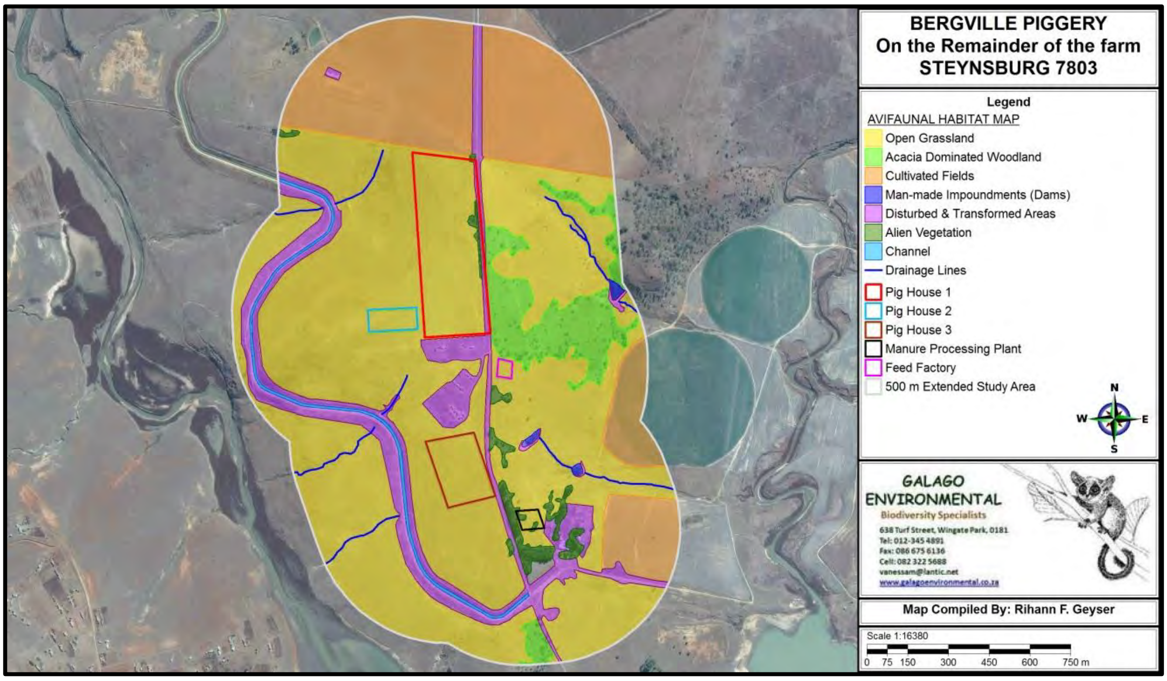

Figure 3: **Avifaunal species habitat systems identified on the study site and within the study area**

A short description of each habitat systems follows, ranked from most to least important.

Wetlands

Approximately 1% of the total surface area of the study area consists of drainage lines and man-made impoundments and channels.

The drainage lines are all seasonal, draining water from the higher lying areas to the lower lying Woodstock dam and Tugela River that surrounds the southern portion of the study area. In areas the banks of the drainage lines are eroded (Figure 4)

Figure 4: Drainage lines in the center of the photo that drains water from the higher lying areas to the lower lying Woodstock dam. Note the erosion on the banks of the drainage lines

Three small man-made impoundments are spread over the study area (Figure 3). These dams are small dams with or without trees or aquatic vegetation (Figure 5). The vegetation around these dams is mainly severally trampled by livestock. All these impoundments have been constructed within the drainage lines in the site area.

Figure 5: One of the man-made impoundments in the study area

The Tugela – Vaal Main channel (Figure 6) runs along the south-eastern portion of the study site (Figure 3). This channel is flanked with steep walls

Figure 6: The Tugela – Vaal main channel east of the study site

Although the wetland areas described above is a source of water for the general avifauna within the study area it does not offer suitable habitat for any of the Red Data species recorded for the 2829CA q.d.g.c.

Open grassland:
Approximately 79% of the total surface area of the study area consists of open grassland (Figure 7) and represents the largest surface area on the study site.

The largest portion of the study site consists of grassland that varies between patches with natural grassland and areas where the natural grassland areas has been disturbed by past and present human activities, trampling and over grazing by livestock such as the grassland areas surrounding farm buildings, kraals and laborer’s houses. The grassland areas further away from the disturbed area are more sensitive grassland in terms of Red Data avifaunal species that occur or that are likely to occur within the study area. There are also large areas surrounding the study area that offer more suitable habitat for Red Data avifaunal species.

Figure 7: Open grassland within the study area

Open grassland is the most important habitat type for South Africa's threatened bird species in the region with a proportional importance of 27%. The highest diversity of threatened bird species occur within this grassland habitat, many of which are under the highest categories of threat (Barnes 2000 & Taylor *et al* 2015).

The presence and abundance of bird species in this habitat will vary from season to season - lush and green in summer after summer rains and dry, brown, frosted or burnt during winter. The habitat favours ground-living bird species, such as lapwings, francolins, pipits, longclaws, larks and chats. These birds hunt for insects and/or breed on the ground, in burrows in the ground, or between the grasses. Weavers and widowbirds make use of such habitat for feeding on ripe seeds during late summer and early winter when the grass is not burnt, and widowbirds and cisticolas will also breed in the tall grass during summer. Species such as weavers and bishops that breed in the wetland habitat during summer will also make use of the open grassland habitat for feeding during winter after the grasses have seeded. Aerial feeding birds such as martins, swifts and swallows will also hunt for insects over the grasslands.

There are also rocky outcrops within the grassland, that give the typical impression of rocky highveld grassland, and they also protect some low woody plants from fire. Although small in area, they might favour such species as Wailing Cisticola *(Cisticola lais)*, chats and Bokmakierie *(Telophorus zeylonus)*.

***Acacia* savanna dominated woodland**

Approximately 7% of the total surface area of the study area consists of *Acacia sieberiana* var. *woodii* dominated savannoid woodland. According to Mucina & Rutherford (2006) these trees are encroaching up the valleys, usually in disturbed (strongly eroded) areas.

Figure 8: Savannoid grassland with *Acacia sieberiana* var. *woodii* on the study site

Patches of these *Acacia sieberiana* var. *woodii* savannoid woodland occurs in isolated areas, especially in the western and southern parts of the study area (Figure 3).

The avifaunal species diversity in this habitat system generally includes a variety of arboreal passerines, such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers, and arboreal non-passerines, such as doves, cuckoos barbets, hoopoes, hornbills and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. *Acacia* trees generally attract many insects and in turn attract a good diversity of typical “Bushveld” bird species.

The ground cover between the trees consists mainly of short overgrazed grass interspersed with shrubs and Acacia trees.

None of the Red Data species listed in the Eskom Red Data Book of Birds of Southern Africa, Lesotho and Swaziland (Barnes 2000 & Taylor *et al* 2015) are likely to make use of this habitat system on a permanent basis.

Disturbed and Transformed Areas:
The rest of the study area, ±13% is disturbed and has been transformed by past and present human activities. These areas include farm houses, exotic and alien vegetation, agricultural cropland and other disturbed and transformed areas.

Only the more common avifaunal species that are able to adapt to areas changed by man will make use of this habitat system. None of these species that occur within these habitat systems are threatened.

5.2 Observed and Expected Species Richness

Of the 284 avifaunal species recorded for the 2829CA q.d.g.c. during the SABAP1 period (Harrison *et al.* 1997) and the current SABA2 period, 166 (58 %) are likely to occur on the study site and 72 (43 %) of these avifaunal species were actually observed within the study area during the time of the survey.

A total of 269 avifaunal species were recorded for the q.d.g.c. during the current SABAP2 project to date compared with 209 species recorded during the SABAP1 period. A total of 181 species were recorded for the 2835_2905 pentad in which the study area is situated.

Of all the avifaunal species that occur or that are likely to occur within the study area 13% (n=21) of the species indicate a decrease in reporting rate, 83% (n=138) an increase in reporting rate and 4 % (n=7) remains stable (Table 1)

The avifaunal biodiversity index (ABI) indicates that the largest avifaunal species diversity is likely to occur within the Acacia dominated savanna woodland habitat system on and within the study area with an avifauna biodiversity index (ABI) of 476, followed by the disturbed and transformed areas (ABI 460), the wetland habitat system (ABI 357) and the open grassland (ABI 341) however the open grassland is the most sensitive habitat system despite the lowers number of avifaunal biodiversity.

The avifaunal species listed in Table 1 are in the species order according to *Roberts - Birds of Southern Africa* VIIth edition (Hockey *et al*, 2005). These comprise the 166 species that are likely to occur within the specific habitat systems on and within 500 m extended study area, with those actually observed in **bold**. This does not include overflying birds or rare vagrants. The reporting rate for each species is the percentage for the q.d.g.c. according to the SABAP 1 atlas (Harrison *et al.* 1997) and is represented by colour codes as follows: Yellow = Very Low, Light Orange = Low, Dark Orange = Medium and Red = High. The colour codes of the SABAP2 reporting rate indicate the following; Red = decrease in reporting rate, Green = increase in reporting rate and Yellow = stable reporting rate compared to the SABAP1 data. The habitat preference scores for each species are shown under the recognised habitat types on site: **WT = Wetlands, OG = Open Grassland, AS = *Acacia* dominated savanna** and **DT = Disturbed and Transformed areas,** with their possibility of occurrence in these specific habitats rated as 5 = present, 4 = High, 3 = Medium, 2 = Low, 1 = Very low and 0 = Not likely to occur.

Table 1: Avifaunal species observed and that are likely to occur within the study area.

SCIENTIFIC NAMES	ENGLISH NAMES	Reporting Rate(%)		Habitat preference			
		SABAP1	SABAP2	WL	OG	AS	DT
Pternistis swainsonii	**Swainson's Spurfowl**	16	27	4	5	4	4
Coturnix coturnix	Common Quail	3	2	0	4	3	0
Numida meleagris	**Helmeted Guineafowl**	34	45	4	5	4	4
Dendrocygna viduata	White-faced Whistling Duck	8	6	2	0	0	0
Alopochen aegyptiaca	**Egyptian Goose**	22	60	5	1	0	4
Plectropterus gambensis	**Spur-winged Goose**	14	19	5	4	3	5
Anas undulata	**Yellow-billed Duck**	20	34	5	0	0	2
Anas erythrorhyncha	Red-billed Teal	3	5	2	0	0	0
Jynx ruficollis	**Red-throated Wryneck**	6	25	2	0	5	4
Dendropicos fuscescens	**Cardinal Woodpecker**	3	20	0	0	5	4
Tricholaema leucomelas	Acacia Pied Barbet	2	8	2	0	2	2
Lybius torquatus	Black-collared Barbet	0	36	2	0	4	4
Trachyphonus vaillantii	Crested Barbet	2	26	2	0	4	4
Bucorvus leadbeateri	Southern Ground-Hornbill (VU/EN)	3	3	1	1	1	0
Upupa africana	African Hoopoe	5	29	1	2	2	3
Phoeniculus purpureus	**Green Wood-Hoopoe**	3	30	1	0	4	5
Halcyon albiventris	Brown-hooded Kingfisher	2	12	2	0	4	4
Colius striatus	Speckled Mousebird	8	46	3	0	4	4
Urocolius indicus	Red-faced Mousebird	0	2	1	1	2	3

SCIENTIFIC NAMES	ENGLISH NAMES	Reporting Rate(%)		Habitat preference			
		SABAP1	SABAP2	WL	OG	AS	DT
Cuculus solitarius	Red-chested Cuckoo	11	12	0	0	3	4
Chrysococcyx caprius	Diderick Cuckoo	11	16	4	4	4	4
Centropus burchellii	Burchell's Coucal	0	3	1	0	1	2
Cypsiurus parvus	**African Palm Swift**	0	16	5	4	5	5
Apus apus	Common Swift	0	3	2	2	2	0
Apus barbatus	**African Black Swift**	22	16	4	5	4	2
Apus affinis	Little Swift	6	11	4	4	4	4
Apus horus	Horus Swift	2	3	2	1	0	0
Apus caffer	White-rumped Swift	14	21	4	4	4	4
Tyto alba	Barn Owl	0	3	1	1	2	3
Bubo africanus	Spotted Eagle-Owl	2	3	1	1	3	3
Columba livia	Rock Dove	0	8	3	1	1	3
Columba guinea	**Speckled Pigeon**	45	67	4	5	4	5
Columba arquatrix	African Olive-Pigeon	14	19	0	0	1	2
Streptopelia senegalensis	**Laughing Dove**	63	46	5	4	5	5
Streptopelia capicola	**Cape Turtle Dove**	64	83	5	4	5	5
Streptopelia semitorquata	**Red-eyed Dove**	20	68	5	4	5	5
Turtur chalcospilos	Emerald-spotted Wood Dove	0	1	0	0	2	0
Eupodotis caerulescens	Blue Korhaan (**NT/LC**)	5	0	0	1	0	0
Eupodotis senegalensis	**White-bellied Korhaan (VU/VU)**	0	7	0	5	4	1
Balearica regulorum	Grey Crowned Crane (**VU/EN**)	5	12	1	1	1	0
Anthropoides paradiseus	Blue Crane (**VU/NT**)	5	2	1	1	1	0
Gallinula chloropus	Common Moorhen	6	11	3	0	0	0
Fulica cristata	Red-knobbed Coot	20	36	3	0	0	0
Tringa glareola	Wood Sandpiper	0	2	3	0	0	0
Actitis hypoleucos	Common Sandpiper	3	3	3	0	0	0
Burhinus capensis	**Spotted Thick-knee**	0	4	3	4	5	4
Charadrius tricollaris	**Three-banded Plover**	2	8	5	4	0	0
Vanellus armatus	**Blacksmith Lapwing**	22	47	5	4	3	4
Vanellus senegallus	**African Wattled Lapwing**	2	13	4	5	4	3
Vanellus coronatus	**Crowned Lapwing**	3	10	3	5	4	4
Elanus caeruleus	**Black-shouldered Kite**	52	43	3	5	4	5
Milvus aegyptius	**Yellow-billed Kite**	0	19	4	4	4	5
Gyps coprotheres	**Cape Vulture (VU/EN)**	16	27	0	5	4	0
Circus maurus	Black Harrier (**NT/EN**)	5	1	0	1	1	0
Polyboroides typus	African Harrier-Hawk	3	4	0	0	1	2
Accipiter rufiventris	Rufous-chested Sparrowhawk	0	2	0	0	1	1
Accipiter melanoleucus	Black Sparrowhawk	0	7	1	2	4	4
Buteo vulpinus	Common Buzzard	11	13	3	4	4	4
Buteo rufofuscus	**Jackal Buzzard**	45	44	2	4	5	4
Lophaetus occipitalis	Long-crested Eagle	0	2	1	0	1	2
Sagittarius serpentarius	Secretarybird (**NT/VU**)	8	6	0	3	2	0
Falco rupicolus	Rock Kestrel	22	5	1	2	2	1
Falco amurensis	Amur Falcon	14	26	3	4	4	2
Falco biarmicus	Lanner Falcon (**NT/VU**)	0	13	0	0	2	1
Falco peregrinus	Peregrine Falcon (**NT/LC**)	0	1	0	0	1	0
Tachybaptus ruficollis	Little Grebe	5	16	4	0	0	0
Phalacrocorax africanus	**Reed Cormorant**	17	48	5	0	0	0
Egretta garzetta	Little Egret	0	3	2	0	0	0
Ardea cinerea	Grey Heron	8	18	3	0	0	0
Ardea melanocephala	**Black-headed Heron**	36	40	5	5	4	3

SCIENTIFIC NAMES	ENGLISH NAMES	Reporting Rate(%)		Habitat preference			
		SABAP1	SABAP2	WL	OG	AS	DT
Bubulcus ibis	**Western Cattle Egret**	**58**	**63**	4	5	4	5
Scopus umbretta	Hamerkop	**17**	**15**	4	0	0	0
Bostrychia hagedash	**Hadeda Ibis**	**42**	**78**	5	5	4	5
Geronticus calvus	Southern Bald Ibis (**VU/VU**)	**9**	**35**	0	3	3	4
Threskiornis aethiopicus	African Sacred Ibis	**14**	**48**	4	0	0	3
Ciconia ciconia	White Stork	**5**	**4**	1	2	2	1
Oriolus larvatus	Black-headed Oriole	**2**	**6**	0	0	3	3
Dicrurus adsimilis	**Fork-tailed Drongo**	**33**	**58**	1	0	5	5
Terpsiphone viridis	**African Paradise-Flycatcher**	**8**	**24**	0	0	5	4
Nilaus afer	**Brubru**	0	**17**	0	0	4	3
Dryoscopus cubla	Black-backed Puffback	**6**	**8**	0	0	4	2
Tchagra senegalus	Black-crowned Tchagra	0	**4**	0	0	2	1
Laniarius ferrugineus	Southern Boubou	**14**	**43**	0	0	3	4
Telophorus zeylonus	Bokmakierie	**27**	**47**	2	2	4	4
Malaconotus blanchoti	Grey-headed Bush-Shrike	**2**	0	0	0	2	1
Batis molitor	**Chinspot Batis**	0	**6**	0	0	5	1
Corvus capensis	**Cape Crow**	**53**	**63**	4	5	5	4
Corvus albus	**Pied Crow**	**22**	**45**	5	4	5	5
Corvus albicollis	White-necked Raven	**27**	**43**	2	2	2	1
Lanius collaris	**Southern Fiscal**	**78**	**81**	3	4	5	4
Parus niger	Southern Black Tit	0	**12**	0	0	3	0
Riparia paludicola	**Brown-throated Martin**	**3**	**23**	5	5	0	0
Riparia cincta	Banded Martin	**13**	**14**	1	4	3	0
Hirundo rustica	Barn Swallow	**31**	**35**	4	4	4	4
Hirundo albigularis	**White-throated Swallow**	**16**	**33**	5	4	4	5
Hirundo cucullata	**Greater Striped Swallow**	**41**	**53**	5	5	4	5
Hirundo abyssinica	Lesser Striped Swallow	**6**	**3**	4	4	4	4
Hirundo spilodera	**South African Cliff-Swallow**	**13**	**16**	4	5	5	4
Hirundo fuligula	Rock Martin	**22**	**22**	1	2	2	2
Delichon urbicum	Common House-Martin	0	**3**	2	2	2	2
Psalidoprocne holomelaena	**Black Saw-wing**	**3**	**16**	4	4	4	5
Pycnonotus tricolor	**Dark-capped Bulbul**	**48**	**83**	4	3	5	5
Stenostira scita	**Fairy Flycatcher**	0	**10**	0	0	5	3
Sylvietta rufescens	Long-billed Crombec	0	**2**	0	0	1	0
Phylloscopus trochilus	Willow Warbler	**2**	**4**	0	0	4	4
Turdoides jardineii	**Arrow-marked Babbler**	**6**	**30**	0	0	4	5
Zosterops virens	**Cape White-eye**	**27**	**57**	2	0	5	5
Cisticola chiniana	Rattling Cisticola	0	**3**	0	0	2	0
Cisticola tinniens	**Levaillant's Cisticola**	**19**	**50**	5	4	0	0
Cisticola fulvicapilla	**Neddicky**	**28**	**33**	2	1	5	5
Cisticola juncidis	Zitting Cisticola	**14**	**33**	2	4	3	4
Cisticola textrix	Cloud Cisticola	**3**	**7**	0	4	2	0
Cisticola ayresii	Wing-snapping Cisticola	**6**	**15**	0	4	2	0
Prinia subflava	Tawny-flanked Prinia	**2**	**9**	3	1	3	3
Prinia hypoxantha	Drakensberg Prinia (**END**)	0	**29**	1	2	3	2
Apalis thoracica	Bar-throated Apalis	**16**	**17**	0	0	2	1
Mirafra africana	**Rufous-naped Lark**	**9**	**30**	2	5	4	5
Chersomanes albofasciata	Spike-heeled Lark	**2**	**2**	0	3	2	0
Calandrella cinerea	**Red-capped Lark**	**5**	**10**	0	5	3	5
Psophocichla litsitsirupa	Groundscraper Thrush	**3**	**23**	2	3	4	4
Turdus libonyanus	Kurrichane Thrush	0	**3**	0	0	3	4

SCIENTIFIC NAMES	ENGLISH NAMES	Reporting Rate(%)		Habitat preference			
		SABAP1	SABAP2	WL	OG	AS	DT
Turdus olivaceus	Olive Thrush	6	19	0	0	2	4
Melaenornis pammelaina	Southern Black Flycatcher	0	7	0	0	4	3
Sigelus silens	Fiscal Flycatcher	2	24	0	0	2	3
Muscicapa striata	Spotted Flycatcher	0	3	0	0	4	4
Cossypha caffra	**Cape Robin-Chat**	30	64	0	0	4	5
Saxicola torquatus	**African Stonechat**	64	75	4	5	3	5
Oenanthe monticola	Mountain Wheatear	5	3	0	1	2	1
Cercomela familiaris	Familiar Chat	19	42	0	0	2	2
Myrmecocichla formicivora	**Ant-eating Chat**	17	22	1	5	3	0
Onychognathus morio	**Red-winged Starling**	66	66	2	0	3	4
Lamprotornis nitens	**Cape Glossy Starling**	14	38	3	2	5	4
Cinnyricinclus leucogaster	Violet-backed Starling	2	3	0	0	3	3
Spreo bicolor	**Pied Starling**	66	73	4	5	5	5
Acridotheres tristis	**Common Myna (INT)**	13	47	5	4	3	5
Chalcomitra amethystina	**Amethyst Sunbird**	9	28	0	0	5	5
Nectarinia famosa	Malachite Sunbird	13	18	0	0	2	3
Cinnyris chalybeus	Southern Double-collared Sunbird	9	11	0	0	2	3
Cinnyris afer	**Greater Double-collared Sunbird**	20	42	0	0	5	4
Ploceus capensis	Cape Weaver	13	33	3	2	3	4
Ploceus velatus	**Southern Masked Weaver**	20	63	4	4	5	5
Ploceus cucullatus	**Village Weaver**	0	24	4	3	4	5
Quelea quelea	Red-billed Quelea	3	15	4	4	4	4
Euplectes orix	**Southern Red Bishop**	27	44	5	5	4	4
Euplectes albonotatus	White-winged Widowbird	20	9	3	2	1	1
Euplectes progne	**Long-tailed Widowbird**	52	55	4	5	4	0
Amblyospiza albifrons	Thick-billed Weaver	0	9	2	0	3	4
Sporaeginthus subflavus	**Orange-breasted Waxbill**	3	5	5	4	0	0
Amadina erythrocephala	Red-headed Finch	3	1	1	1	2	2
Estrilda astrild	Common Waxbill	11	37	4	4	3	4
Vidua macroura	**Pin-tailed Whydah**	45	39	5	4	5	5
Vidua funerea	Dusky Indigobird	2	1	2	1	2	2
Passer domesticus	**House Sparrow**	23	46	0	0	0	5
Passer melanurus	**Cape Sparrow**	20	32	5	5	4	5
Passer diffusus	**Southern Grey-headed Sparrow**	17	50	5	4	5	5
Motacilla capensis	**Cape Wagtail**	31	74	5	1	0	4
Macronyx capensis	**Cape Longclaw**	38	47	4	5	4	4
Anthus cinnamomeus	**African Pipit**	6	17	1	5	5	5
Anthus leucophrys	Plain-backed Pipit	2	2	1	2	2	2
Anthus vaalensis	Buffy Pipit	0	3	1	2	1	1
Anthus similis	Long-billed Pipit	8	8	0	0	1	0
Anthus brachyurus	Short-tailed Pipit (VU/VU)	0	3	0	1	0	0
Serinus canicollis	**Cape Canary**	33	27	4	3	5	5
Crithagra mozambicus	**Yellow-fronted Canary**	2	23	4	2	5	5
Crithagra atrogularis	**Black-throated Canary**	2	11	4	4	5	4
Crithagra gularis	Streaky-headed Seedeater	6	16	0	0	4	4
	Avifaunal Biodiversity Index:			357	341	476	460

*Red data status according to Barnes (2000)/Red Data status according to Taylor *et al* (2015)
Latest bird names according to BirdLife South Africa Checklist of Birds in South Africa (2016)
**The reporting rate of SABAP1 and SABAP2 is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell.
The reporting rate for each species is the percentage for the q.d.g.c. according to the SABAP 1 atlas (Harrison *et al.* 1997) and is represented by colour codes as follows: Yellow = Very Low, Light Orange = Low, Dark Orange = Medium

and Red = High. The colour codes of the SABAP2 reporting rate indicate the following; Red = decrease in reporting rate, Green = increase in reporting rate and Blue = stable reporting rate compared to the SABAP1 data.
Red Data avifaunal species categories: **EX**= Extinct (regionally), **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened, **LC** = Least Concern, **DD** = Data Deficient, **NR** = Not Recognised by BirdLife International, **NA** = Not Assessed (Taylor *et al* 2015).

5.3 Threatened and Red Listed Bird Species

The following Red Data avifaunal species were recorded for the 2829CA q.d.g.c. according to the SABAP1 data (Harrison *et al.* 1997) and the SABAP2 data for the 2829CA q.d.g.c. and more specifically the 2835_2905 pentad in which the study area is situated (sabap2.adu.org.za September 2015) (Table 2).

Table 2: Red Data avifaunal species recorded for the 2829CA q.d.g.c.

SCIENTIFIC NAMES	ENGLISH NAMES	Reporting Rate(%)		
		SABAP1	SABAP2	Pentad
Bucorvus leadbeateri	Southern Ground-Hornbill (**VU/EN**)	3	3	0
Coracias garrulus	European Roller (**LC/NT**)	2	0	0
Alcedo semitorquata	Half-collared Kingfisher (**NT/NT**)	0	1	0
Tyto capensis	African Grass Owl (**VU/VU**)	3	0	0
Neotis denhami	Denham's Bustard (**VU/VU**)	0	2	4(n=1)
Eupodotis caerulescens	Blue Korhaan (**NT/LC**)	5	0	0
Eupodotis senegalensis	White-bellied Korhaan (**VU/VU**)	0	7	15(n=4)
Balearica regulorum	Grey Crowned Crane (**VU/EN**)	5	12	12(n=3)
Anthropoides paradiseus	Blue Crane (**VU/NT**)	5	2	0
Vanellus melanopterus	Black-winged Lapwing (**NT/LC**)	0	3	0
Gypaetus barbatus	Bearded Vulture (**EN/CR**)	5	1	0
Gyps coprotheres	Cape Vulture (**VU/EN**)	16	27	19(n=5)
Circus ranivorus	African Marsh Harrier (**VU/EN**)	5	4	4(n=1)
Circus maurus	Black Harrier (**NT/EN**)	5	1	0
Aquila verreauxii	Verreauxs' Eagle (**LC/NT**)	6	2	0
Stephanoaetus coronatus	Crowned Eagle (**NT/VU**)	2	1	0
Sagittarius serpentarius	Secretarybird (**NT/VU**)	8	6	4(n=1)
Falco biarmicus	Lanner Falcon (**NT/VU**)	0	13	19(n=5)
Falco peregrinus	Peregrine Falcon (**NT/LC**)	0	1	0
Geronticus calvus	Southern Bald Ibis (**VU/VU**)	9	35	35(n=9)
Ciconia nigra	Black Stork (**NT/VU**)	3	2	0
Schoenicola brevirostris	Broad-tailed Warbler (**NT/LC**)	0	5	0
Lioptilus nigricapillus	Bush Blackcap (**NT/VU**)	5	3	0
Mirafra cheniana	Melodious Lark (**NT/LC**)	2	1	0
Anthus chloris	Yellow-breasted Pipit (**VU/VU**)	2	0	0
Anthus crenatus	African Rock Pipit (**LC/NT**)	0	2	0
Anthus brachyurus	Short-tailed Pipit (**VU/VU**)	0	3	0
	TOTAL:	18	23	8

*Red data status according to Barnes (2000)/Red Data status according to Taylor *et al* (2015)
Latest bird names according to BirdLife South Africa Checklist of Birds in South Africa (2016)
**The reporting rate of SABAP1 and SABAP2 is calculated as follows: Total number of cards on which a species was reported X 100 ÷ total number of cards for a particular quarter degree grid cell.
The reporting rate for each species is the percentage for the q.d.g.c. according to the SABAP 1 atlas (Harrison *et al.* 1997) and is represented by colour codes as follows: Yellow = Very Low, Light Orange = Low, Dark Orange = Medium and Red = High. The colour codes of the SABAP2 reporting rate indicate the following; Red = decrease in reporting rate, Green = increase in reporting rate and Blue= stable reporting rate compared to the SABAP1 data.
Red Data avifaunal species categories: **EX**= Extinct (regionally), **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened, **LC** = Least Concern, **DD** = Data Deficient, **NR** = Not Recognised by BirdLife International, **NA** = Not Assessed (Taylor *et al* 2015).

A total of 27 Red Data avifaunal species have been recorded within the 2829CA q.d.g.c. during the SABAP1 period (Harrison *et al*. 1997) and the current SABAP2 period, 18 during the SABAP1 period , 23 during the current SABAP2 period and 8 for the pentad (SABAP2) in which the study area is situated (sabap2.adu.org.za September 2016)(Table 2).

A total of 52% (n=14) of the Red Data Species recorded for the 2829CA q.d.g.c. indicate a decrease in reporting rate, 44% (n=12) an increase in reporting rate and 4% (n=1) remains stable.

5.4 SUMMARY OF THE RED DATA AVIFAUNAL SPECIES

Table 3 provides a list of the Red Data avifaunal species recorded for the 2829CA q.d.g.c. according to the SABAP1 data (Harrison *et al.* 1997) and the current SABAP2 data and an indication of their likelihood of occurrence within the study area based on actual sightings, habitat and food availability.

Table 3: Red Data avifaunal species assessment for the study site and study area according to the SABAP1 and SABAP2 data for the 2829CA q.d.g.c.

SPECIES NAME**	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
Bucorvus leadbeateri (Southern Ground-Hornbill) (**VU/EN**)	Yes: Southern Ground Hornbill will forage in any woodland, savanna, grassland and farming land but are unable to reside and breed in areas without nest sites (Fry *et al.* 1988). Within Kwazulu-Natal it occurs in open grassland in the vicinity of evergreen forest, savanna woodland and exotic trees, usually in small parties (Cyrus & Robson 1980).	Unlikely Although some of the habitat systems offer suitable foraging habitat for this species there are no suitable breeding sites for this species and they are only likely to move through the area on rare occasions
Coracias garrulus (European Roller) (**LC/NT**)	Closed to very open savanna. Most common in open, broadleaved and *Acacia* woodlands with grassy clearings; least common in areas with less-developed woody cover.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Alcedo semitorquata (Half-collared Kingfisher) (**NT/NT**)	None: Requires fast-flowing streams, rivers and estuaries, usually with dense marginal vegetation (Maclean, 1993), especially perennial streams and smaller rivers with overhanging riparian vegetation on their banks. Nests in sand/earth banks (Tarboton *et al*. 1987) and requires riverbanks in which to excavate nest tunnels (Harrison *et al.* 1997a). Most typically occurs along fast-flowing streams with clear water and well-wooded riparian growth, often near rapids. It most frequently favours broken escarpment terrain and requires at least 1 km up and down stream of undisturbed river and riparian vegetation while breeding. It occurs from sea-level to 2000 m a.s.l. in southern Africa. Usually perches low down on the banks of rivers and streams, often on exposed roots, as well as exposed rock and low overhanging tree branches.	Highly unlikely Due to a lack of suitable habitat

SPECIES NAME**	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
Tyto capensis (African Grass Owl) (**VU/VU**)	None on site: Occurs predominately in rank grass, typically but not always at fairly high altitudes. Breeds mainly in permanent and seasonal vleis, which it vacates while hunting or during post-breeding although it will sometimes breed in any area of long grass, sedges or even weeds (Van Rooyen, pers comm.) and not necessarily associated with wetlands (Tarboton *et al*. 1987) although this is more the exception than the rule. Foraging mainly confined to tall grassland next to their wetland vegetation and rarely hunts in short grassland, wetlands or croplands nearby (Barnes, 2000). Mainly restricted to wet areas (marshes and vleis) where tall dense grass and/or sedges occur. Prefers permanent or seasonal vleis and vacates the latter when these dried up or are burnt. Roosts and breeds in vleis but often hunt elsewhere e.g. old lands and disturbed grassland although this is suboptimal habitat conditions (Tarboton *et al*. 1987). May rarely occur in sparse *Acacia* woodland where patches of dense grass cover are present (Harrison *et al*. 1997a).	Highly unlikely No suitable breeding, roosting and foraging habitat were identified within the study area
Neotis denhami (Denham's Bustard) (**VU/VU**)	Yes: In the grassland biome, its habitat is high-rainfall open, exposed, hilly, sour grassland during its breeding season (Tarboton *et al.* 1987). They move into cultivated pastures and cereal cropland in the nonbreeding season, where they prefer harvested fields; ploughed fields and fields with growing cereal crops are avoided (Herhold 1988; Allan 1993).	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Eupodotis caerulescens (Blue Korhaan) (**VU/LC**)	Yes: Occurs in flat undulating terrain in grassland and Nama Karoo, where rainfall 300-1 000 mm /a. Often on damp ground; sometimes attracted to burnt areas. Favours short vegetation; 61 % of 141 groups where vegetation ≤ belly height. At Wakkerstroom, Mpumalanga, abundance positively correlated with altitude, flat topography and burnt grassland. In Nama Karoo, 96% of 88 groups in natural vegetation, 2% in fallow fields, 1% in cultivated grass and pastures and 1% in lucerne pastures. At De Aar, Northern Cape, near western edge of range, only found close to large lucerne fields. Remains < 1 km from water (Hockey *et al*., 2005).	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Eupodotis senegalensis (White-bellied Korhaan) (**VU/VU**)	Yes: Occurs in fairly tall, dense grassland, especially sour and mixed grassland, in open or lightly wooded, undulating to hilly country. In winter, occasionally on modified pastures and burnt ground (Harrison *et al.* 1997a).	**Confirmed** Observed in the grassland areas to the west and south west of the study site which offers suitable habitat for this species.
Balearica regulorum Grey Crowned Crane (**VU/EN**)	Yes: The Grey Crowned Crane requires mixed wetland-grassland habitat and typically nest within or on the edges of permanent or temporary marches and wetlands (Barnes 2000).	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.

SPECIES NAME**	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
Anthropoides paradiseus (Blue Crane) (**VU/NT**)	Yes: Midlands and highland grassland, edge of karoo, cultivated land and edges of vleis (Maclean, 1993). Nests in both moist situations in vleis which have short grass cover and in dry sites far from water, usually exposed places such as on hillsides; forages in grassland and cultivated and fallow lands; roosts communally in the shallow water of pans and dams (Tarboton *et al*. 1987). Short dry grassland, being more abundant and evenly disturbed in the eastern "sour" grassland, where natural grazing of livestock is the predominant land use. Prefers to nest in areas of open grassland (Barnes, 2000) In the fynbos biome it inhabit cereal croplands and cultivated pastures and avoids natural vegetation. By contrast, it is found in natural vegetation in the Karoo and grassland biomes, but it also feeds in crop fields (Harrison *et al*. 1997a).	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Vanellus melanopterus (Black-winged Lapwing) (**NT/LC**)	Yes: Occurs in open short grassland, fallow lands, pastures, airfields, playing fields and race courses.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Gypaetus barbatus (Bearded Vulture) (**EN/CR**)	None: Alpine and mixed grasslands on rugged mountains and escarpments .	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Gyps coprotheres (Cape Vulture) (**VU/EN**)	They mostly occur in mountainous country, or open county with inselbergs and escarpments; less commonly as visitors to savannah or desert (Maclean, 1993). Forage over open grassland, woodland and agricultural areas; usually roosts on cliffs, but will also roost on trees and pylons (Barnes, 2000). It is reliant on tall cliffs for breeding but it wanders widely away from these when foraging. It occurs and breeds from sea level to 3 100 m.a.s.l. Current distribution is closely associated with subsistence communal grazing areas characterised by high stock losses and low use of poisons and, to a lesser extent, with protected areas (Harrison *et al*. 1997a), but their presence is ultimately dependent on the availability of food.	**Confirmed** This species was seen flying over the study site probably on the lookout for carrion due to the high density of livestock in the area. The proposed piggery could be beneficial for this species.
Circus ranivorus (African Marsh Harrier) (**VU/EN**)	None on site: Almost exclusively inland and coastal wetlands (Hockey *et al*. 2005). Wetland and surrounding grasslands. Most highveld wetlands > 100 ha support a breeding pair (Tarboton & Allan 1984). Nests in extensive reed beds often nigh above water. Forages over reeds, lake margins, floodplains and occasionally even woodland. Almost entirely absent from areas below 300 mm of rainfall (Harrison et al., 1997a). Marsh, vlei, grassland	Highly unlikely There are no suitable foraging, breeding or roosting habitat for this species on the study site.

SPECIES NAME**	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
	(usually near water); may hunt over grassland, cultivated lands and open savanna (Maclean, 1993). Dependant on wetlands, particularly permanent wetlands for breeding, roosting and feeding. May utilise small wetlands 1-2 ha in extent for foraging, but larger wetlands are required for breeding (Barnes, 2000).	
Circus maurus Black Harrier (**NT/EN**)	Yes: Black Harriers hunts over dry and damp grasslands, fynbos and karoo. It also exploits cultivated lands. The known range of the Vlei Rat *Otomys irroratus* coincides accurately with its present distribution (Harrison *et al.,* 1997).	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site. .
Aquila verreauxii (Verreaux's Eagle) (**LC/VU**)	None: Mountains and rocky areas with cliffs.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site. .
Stephanoaetus coronatus (African Crowned Eagle) (**NT/VU**)	No: Occurs in dense indigenous forest, including riverine gallery forest; may range far from forest to hunt.	Highly unlikely Due to a lack of suitable habitat
Sagittarius serpentarius (Secretarybird) (**NT/VU**)	Yes: Open grassland with scattered trees, shrubland, open *Acacia* and *Combretum* savanna (Hockey *et al*. 2005). Restricted to large conservation areas in the region. Avoids densely wooded areas, rocky hills and mountainous areas (Hockey *et al*. 2005 & Barnes, 2000). Requires small to medium-sized trees with a flat crown for nesting, and often roosts in similar locations. Nesting density only about 150 km^2/pair (n = 4, Kemp, 1995).	Likely The open grassland areas deemed as sensitive in the avifaunal sensitivity map should be regarded as very sensitive since it offers suitable foraging habitat for this species. However there large areas surrounding the study area that offers suitable despite their low reporting rate.
Falco biarmicus (Lanner Falcon) (**NT/VU**)	Yes: Most frequent in open grassland, open or cleared woodland, and agricultural areas. Breeding pairs generally favour habitats where cliffs are available as nest and roost sites, but will use alternative sites such as trees, electricity pylons and building ledges if cliffs are absent (Hockey *et al*. 2005). Mountains or open country, from semi desert to woodland and agricultural land, also cities (Maclean, 1993), even on forest-grassland ecotones. Generally a cliff nesting species and its wider distribution is closely associated with mountains with suitable cliffs. Able to breed on lower rock faces than Peregrine Falcon *Falco peregrinus* and also utilises	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.

SPECIES NAME**	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
	the disused nests of other species, such as crows, other raptors and storks, on cliffs, in trees and on power pylons, and also quarry walls (Tarboton *et al*. 1987). Generally prefers open habitats e.g. alpine grassland and the Kalahari, but exploits a wide range of habitats – grassland, open savanna, agricultural lands, suburban and urban areas, rural settlements – in both flat and hilly or mountainous country. Also breeds in wooded and forested areas where cliffs occur (Harrison *et al*. 1997a).	
Falco peregrinus (Peregrine Falcon) (**NT/LC**)	Yes/None on site/: Resident *F. p. minor* mostly restricted to mountainous riparian or coastal habitats, where high cliffs provides breeding and roosting sites. Breeding pairs prefer habitats that favour specialised, high speed, aerial hunting, e.g. high cliffs overhanging vegetation with raised and/or discontinuous canopy (e.g. forest, fynbos, woodland), or expanses of open water. Also uses quarries and dam walls, and frequents city centres, e.g. Cape Town, where tall buildings substitute for rock faces. Migrant *F. p. calidus* in more open country, often coastal, even roosting on ground on almost unvegetated salt flats.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Geronticus calvus (Southern Bald Ibis) (**VU/VU**)	None on site: High-altitude (1 200 – 1 850 m), high-rainfall (>700 mm/yr.), sour and alpine treeless grasslands, characterised by short, dense grass swards; favours recently burnt, ploughed, mowed or heavily grazed fields, also cultivated land with short grass or stubble. Almost exclusively in grassland early in wet season, moving to pastures during winter. On Polokwane plateau and in ne KwaZulu-Natal, in lightly wooded and relatively arid country (Hockey *et al*. 2005)	Likely The agricultural croplands offers suitable foraging habitat for this species.
Ciconia nigra (Black Stork) (**NT/VU**)	None on site: Dams, pans, flood plains, shallows of rivers, pools in dry riverbeds, estuaries and sometimes on marshland and flooded grassland; uncommon at seasonal pans lacking fish. Associated with mountainous regions (Hockey *et al*., 2005) where they nest (Maclean, 1993) on cliffs (Harrison *et al*. 1997a). Feeds in shallow water, but occasionally on dry land, in streams and rivers, marshes, floodplains, coastal estuaries and large and small dams; it is typically seen at pools in large rivers.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Schoenicola brevirostris (Broad-tailed Warbler) (**NT/LC**)	None: Occurs is vleis, marshy grassland, moist grassy hillsides, boggy drainage lines, coarse high grassland.	Highly unlikely Due to a lack of suitable habitat
Mirafra cheniana (Melodious Lark) (**NT/LC**)	Yes: Occurs in grassland dominated by *Themeda triandra* grass in South Africa. Occasionally in planted pastures of *Eragrostis curvula* and *E. tef*. Avoids wet lowlands, favouring fairly short grassland (< 0.5 m), with open spaces between tussocks, at 550 – 1 750 m.a.s.l. with annual rainfall of between 400 – 800 mm p/a (Hockey *et al*., 2005).	Unlikely Due to the over grazed state of the open grassland area on the study site. However, proper veld management practices could favour this species

SPECIES NAME**	PRESENCE OF SUITABLE HABITAT AND HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE ON STUDY SITE
		and other grassland species in general despite Melodious Lark being downgraded to Least Concern.
Anthus chloris (Yellow-breasted Pipit) (**VU/VU**)	Yes/No: Breeds in lush montane grasslands > 1 400 m (usually > 2 000 m in Mpumalanga), favouring flat or gently sloping topography. Prefers grass 150-300 mm high. In none-breeding season, in lower altitude grasslands and fallow lands or bush savanna; unlike most pipits, is not attracted to burnt areas.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site.
Anthus crenatus (African Rock Pipit) (**LC/NT**)	Yes/No Mountains, Karoo hills, and escarpment, favouring open areas with rocky outcrops, grass clumps, and low bushes. In east of range, usually > 1 000 m, up to 3 000 m in Lesotho.	Highly unlikely Due to a lack of suitable habitat
Anthus brachyurus (Short-tailed Pipit) (**VU/VU**)	Yes/No: Fairly short, open grassland, usually on hill slopes when breeding. Winters in or adjacent to seasonally flooded grassland. In Zambia, prefers sandy soils with sparse or recently burned vegetation. Breeds from 300-1 850 m in KwaZulu-Nata l.	Unlikely Might only pass through the area on rare occasions to and from more suitable habitat surrounding the study site

**Red data status according to Barnes (2000)/Red Data status according to Taylor *et al* (2015)
Latest bird names according to BirdLife South Africa Checklist of Birds in South Africa (2016)
Red Data avifaunal species Categories : **EX**= Extinct (regionally), **CR** = Critically Endangered **EN** = Endangered, **VU** = Vulnerable, **NT** = Near-threatened, **LC** = Least Concern, **DD** = Data Deficient, **NR** = Not Recognised by BirdLife International, **NA** = Not Assessed (Taylor *et al* 2015).

6. FINDINGS AND POTENTIAL IMPLICATIONS

6.1 Red Data avifaunal species confirmed from the study area for which suitable foraging, breeding and roosting habitat was confirmed:

White-bellied Korhaan (*Eupodotis senegalensis*):

Criteria for IUCN threatened category: Status: Least Concern
Red Data Status according to Barnes (2000): Vulnerable.
Red Data Status according to BirdLife SA: Regionally: **Vulnerable**, Globally: Least Concern
Habitat and breeding biology: According to Barnes (2000) it inhabits relatively tall vegetation, typically fairly dense grassland in either open or lightly wooded regions. It seems to be most abundant in hilly areas at the interface between the grassland and savanna biomes (Tarboton *et al.* 1987). They occur in low abundance in severely grazed and recently burnt sites (Barnes 2000). Breeds in hilly or undulating open grassland, or in very sparsely wooded savanna, favouring areas with relatively tall grass (300-500 mm high); in optimum habitat breeding pairs occur at densities of about 1 pair/100 ha. The eggs are laid on the ground, in small clearings between grass tufts, sometimes in a shallow, unlined scrape. Nests are not easy to find as they are usually hidden in grass that is sufficiently tall to conceal the incubating bird and to screen the female from view

when approaching or leaving the nest. If the nest is approached, the incubating bird usually leaves unobtrusively, long before one is aware of her presence. The male does not assist with incubation, but remains in the general vicinity of the nest while the female incubates, and accompanies her when she leaves the eggs to feed. Egg laying months is mainly in November (Oct-Jan) with an incubation period of 23 days (Tarboton 2001 & Tarboton 2011).

Threats: Habitat loss through crop farming, overgrazing, unsuitable burning practices and high human densities, agriculture, afforestation (invasive alien vegetation and timber plantations), urban developments and other habitat modifications as a result of growing human populations is the main reasons for the population decline of this species. Even where suitable habitat exits, it is often modified by inappropriate fire regimes and grazing practices (Barnes 2000 & Taylor *et al* 2016). The genetic integrity of this species may be threatened as a result of severely fragmented distribution (Barnes 2000). Clancey (1972) in Taylor *et al* (2015) mentioned fires as a threat to chicks, but this is unlikely to constitute a major threat during the breeding season in the summer rainfall area. The loss of habitat to bush encroachment poses a threat to White-bellied Korhaans, although the species appears to be adaptable to low levels of woody cover in grasslands (Taylor et al 2015). Apart from habitat loss, the threat of subsistence hunting and poaching, due to high human densities, also needs to be considered. Collisions with power-lines have a low impact on this species compared to larger bustard species (Shaw 2009 in Taylor *et al* 2015). There is only a single record of a male killed by collisions with powerlines according to Allan 2005i in Taylor *et al (*2015).

On site conclusion: This species was observed on and surrounding the study area on the open grassland habitat system during the time of the survey (pers obs) and from the surrounding area and personal observation from the study area (Fourie pers comm). This species indicate a reporting rate of 15% with 4 observations made since 1 July 2007 which indicated a low reporting rate or sporadic occurrence. This species was not recorded for the 2829CA q.d.g.c. during the SABAP1 period. The open grassland area does offer suitable foraging habitat for this species and due to the overgrazed state of the grassland they are unlikely to breed. The lack of biomass also indicates that the grassland area is being burnt every year or just being overgrazed year round. Extraction of livestock and proper veld management practises could result that the open grassland will become favourable for breeding purposes for White-bellied Korhaan. There is suitable habitat surrounding the study area that will favour this species. The development, if kept within the development footprint area, will not have a negative effect on this species.

Cape Vulture (*Gyps coprotheres*):

Criteria for IUCN threatened category: Status: Endangered
Red Data Status according to Barnes (2000): Vulnerable.
Red Data Status according to Taylor et al (2015): Regionally: **Endangered**, Globally: Endangered

Habitat: Cape Vulture occurs in a wide range of habitats up to ca 3 000 m closely linked to subsistence communal-grazing areas, where stock losses are high. They forage over open grassland and woodland and depend on cliffs for breeding.

Threat: The main threat to Cape Vulture is the reduction of this species food supply (Jarvis *et al.* 1974; Boshoff & Vernon 1980; van Heerden 1980).

Numerous unnatural mortality factors impact Cape Vulture. Bone abnormalities in nestlings are the most important factor causing mortality in young birds (3% of nestlings at Kransberg; Benson 1997).

Other threats include bone abnormalities in nestlings and electrocution, drowning, shooting, poisoning and disturbance at nesting sites under adult birds.

On site conclusion: A small group of Cape Vulture was observed roaring over the study site probably on the lookout for carrion due to the high level of livestock within the study area. Cape Vultures are unlikely to make use of the habitat systems within the study area but they are likely to feed on carrion if available. No suitable cliffs occur on site that favours this species for breeding purposes. It is unlikely that the development will have a negative effect on Cape Vultures. Cape Vultures could benefit from the proposed piggery through the establishment of a vulture feeding area where all the dead pigs from the piggery and other dead livestock could be dumped. This feeding area should be placed as far as possible from any human disturbance or activities to prevent disturbance to this species. The reporting rate for Cape Vulture has increased from 16% (SABAP1) to 27% (SABAP1). The reporting rate for the 2835_2905 pentad is 19% with 5 observations made since 1 July 2007.

6.2 Red Data avifaunal species for which suitable foraging, breeding and/or roosting habitat was confirmed from the study site:

The habitat systems within the study area does offer suitable foraging habitat for other grassland dependent Red Data avifaunal species mentioned in Table 3 above but these Red Data avifaunal species are unlikely to make use of the habitat systems on a permanent basis and more likely to move through the area on rare occasion to and from more suitable habitat systems surrounding the study area.

7. LIMITATIONS, ASSUMPTIONS AND GAPS IN KNOWLEDGE

The Galago Environmental team has appropriate training and registration, as well as extensive practical experience and access to wide-ranging data bases to consider the derived species lists with high limits of accuracy. In this instance the biodiversity of all Alignments has to a greater or lesser extent been jeopardized, which renders the need for field surveys unnecessary. In instances where uncertainty exists regarding the presence of a species it is listed as a potential occupant, which renders the suggested mitigation measures and conclusions more robust.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.
The on-site bird survey was done at the start of the main breeding season of most species and during the time when all Palaearctic and intra-African migrants are still on the southern migration to southern Africa. This, however, will not have an effect on recording Red Data species, since most Red Data species are resident to South Africa and the few Red Data species that are Palaearctic migrants are mainly threatened in their northern hemisphere distribution ranges.

The site surveys was done during several hours in one day and not on a regular basis during several season over a period of time thus the avifaunal biodiversity could change slightly as more species are confirmed from the various habitat system within the study area. The time of the day and weather condition also as has an effect on the number of species recorded in the study area during the site visit.

The general assessment of species rests mainly on the 1997 SABAP1 atlas data (Harrison et al. 1997) for comparison with the current SABAP2 atlas, so any limitations in either of those studies will by implication also affect this survey and conclusions.

Furthermore the number of atlas cards received and the diversity of habitat systems surveyed for avifaunal species within a q.d.g.c. or pentad or lack thereof could also have an effect on the avifaunal diversity that could potentially occur on the study site. A total of 64 atlas cards were received for the 2829CA q.d.g.c. over the SABAP1 project period and to date, 120 cards for the entire 2829CA q.d.g.c. over the current SABAP2 project period and 26 cards for the 2835_2905 pentad (in which the study site is situated) since 1 July 2007.

8. RECOMMENDED MITIGATION MEASURES

The following mitigation measures are proposed by the specialist:

- The development should be restricted to the proposed footprint area of the study site and should take place in areas that has already been disturbed through past human activities.
- Copious amounts of nutrient-rich manure from the piggery into fresh water systems such as the Woodstock dam could pose an environmental risk and proper measures should be implemented to prevent these pollutants from entering the fresh water systems.
- No surface stormwater and manure generated as a result of the development may be channelled directly into the Woodstock Dam. A series of stormwater, manure settling ponds and flood retention ponds should be constructed as part of the management plan for surface runoff and storm and waste water. This management plan should be applied outside of the demarcated wetland buffer/flood zone and should not impact on the natural hydrology and morphology of the dam.
- Since special care needs to be taken to prevent surface stormwater rich in sediments and other pollutants such as nutrient-rich manure generated from the piggery from entering the dam, mechanisms are required to prevent erosion and dissipate water energy, such as drainage diversions and berms.
- Measures should be implemented to prevent soil erosion as a result of storm water down flow.
- All powerlines that form part of the infrastructure of the development should be fitted with anti-collision devices to prevent birds from colliding with the powerlines.
- No plants not indigenous to the area, or exotic plant species, especially lawn grasses and other ground-covering plants, should be introduced in the landscaping of the proposed development, as they might spread into the areas of natural vegetation and into the wetland;
- The cultivation of trees and shrubs in gardens proven to be advantageous to birds should be encouraged. The area does not support indigenous trees and shrubs; however woody garden plants are accepted as a given and exotics will result in an influx of common garden bird species.
- Entrance by vehicles, especially off-road cars and bakkies, off-road bicycles and quad bikes to the areas to be excluded should be prohibited, both during the construction phase and during the lifespan of the project.
- The areas earmarked for exclusion from development must be fenced off during the construction phase to ensure that the developer and his contractors do not damage these areas or do not cover them with soil, builders’ rubble or waste.

- Prior to commencement of the construction phase the wetland system and the proposed buffer zones must be properly fenced off and machinery and staff must be banned from entering the fenced areas.
- No development should be allowed within the wetland areas and the adjacent grassland areas on site, and these areas should be left as natural as possible.
- Proper veld management practises should be implemented with respect to grazing, burning and control of woody invasions.
- Where possible, **work should be restricted to one area at a time**, as this will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- Where possible the construction of the proposed development should take place during the winter months during the time when most avifaunal species are not breeding.
- **No vehicles should be allowed to move in or across the wet areas or drainage lines and possibly get stuck.** This leaves visible scars and destroys habitat, and it is important to conserve areas where there are tall reeds or grass, or areas where there is short grass and mud.
- The contractor must ensure that no fauna is disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- It is suggested that where work is to be done close to the drainage lines, these areas **be fenced off during construction,** to prevent heavy machines and trucks from trampling the plants, compacting the soil and dumping in the system.
- During the construction phase, noise must be kept to a minimum to reduce the impact of the development on the fauna residing on the site.
- Alien and invasive plants must be removed.

9. CONCLUSIONS

It is unlikely that the proposed development will have any negative effects on any Red Data species recorded for the 2829CA q.d.g.c. provided that all mitigation measures are strictly adhered to. Settling pond constructed to control runoff water and manure will attract more avifaunal species to the area.

The grassland area in Figure 9 indicated as high sensitivity should be left undisturbed and undeveloped to ensure habitat for Red Data avifaunal species. Medium sensitive areas should also be kept free from any development to ensure future avifaunal biodiversity on the study site.

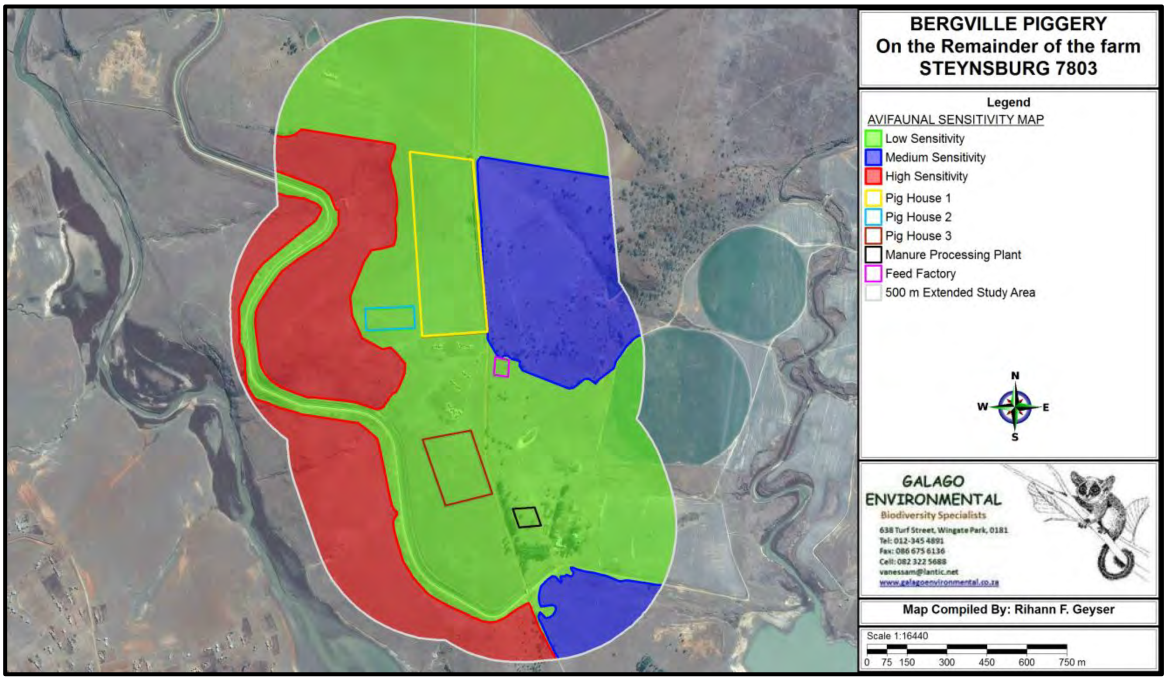

Figure 9: Avifaunal sensitivity map

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APPENDIX 8G

GEOHYDROLOGICAL STUDY

SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

GEOHYDROLOGICAL ASSESSMENT STUDY FOR THE DEVELOPMENT OF FACILITIES FOR BERGVILLE 4800 PIGGERY TO BE LOCATED ON REMAINING EXTENT, FARM STEYNSBURG 7803 GS.

Prepared for

Bergville 4800 Piggery

PO Box 40541

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by

GEO - LOGIC Hydrogeological Consultants cc

Report No: G2016/020

November 2016

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EXECUTIVE SUMMARY

This document presents the results of a Hydrogeological Investigation study aimed at establishing a groundwater resource for the piggery and to serve as baseline reference of hydrogeological data to form part of a WULA (Water Use Licence Application).

The development portion, Remaining Extent of Farm Steynsburg 7803 GS is located 42 km directly south of Harrismith on the southern side of the R74 main road. Refer to Figure 1.

The planned development land is 500ha in extent. The water demand for the sow unit will be 73 000m^3/a or 200m^3/d which needs to be satisfied.

Geo-logic Hydro Geological Consultants cc was appointed by Rock Environmental Consulting (Pty) Ltd, to do a geohydrological assessment study for the farm development.

A desk study was performed to gather relevant geological and hydrogeological information. A hydro-census followed the desk study to establish borehole information in the region of the site. The purpose of this survey was to gather relevant hydrogeological information to study the groundwater regime, current groundwater use and borehole coordinates in the area. One existing borehole and six newly drilled boreholes are located on the development portion. Four existing boreholes could be located around the proposed development site. The existing boreholes are located few and far between.

A geological walk over study was done of the site to study the in-situ geology. A geophysical study was done to establish new drill sites for water boreholes. Six new boreholes were drilled. Four of the six boreholes were submitted to borehole yield testing procedures. Two of the boreholes were reported as drilled dry during the drilling program. Four boreholes were reported to deliver low yielding volumes. The aquifer in which the boreholes were established was found to be a low yielding aquifer which shows serious signs of dewatering. A groundwater resource could not be established for the proposed development site due to the low groundwater ability of the groundwater regime on which the site is located.

During the hydrogeological study the following conclusions could be made:

- The hydro-census data gives a broad picture that groundwater volumes abstracted in the area around the planned Bergville site is low. This is due to the low groundwater potential in the area.
- A number of boreholes in the area are reported to be dried up.
- After drilling six boreholes which delivered low yields the aquifer can be regarded as a low yielding aquifer. (Aquifer with low Transmisivity values)
- The most cumbersome is that the yield tests showed that the boreholes is not only low yielding but also very fast dewatering the aquifer. (Aquifer with low Storativity values)

- From the chemical and bacteriological analyses it is clear that the groundwater at the Bergvill site is of high quality. The water from borehole BH 6 can be chemically and bacteriologically categorized as Class 0, which can be used for domestic purposes without treatment.

The following recommendations are made:

- Boreholes BH 5 and BH 6 can be used for domestic purposes without treatment.
- It is recommended that surface water be used to supply in the water demand for the planned piggery site.
- Storm water originating from the piggery site must be treated as dirty water.
- Clean water and dirty water systems must be separated.
- Storm water must be directed away and around the piggery site.
- All water retention structures, including storm water dams, retention ponds etc. should be constructed to have adequate freeboard to be able to contain water from 1:50 year rain events.

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1. INTRODUCTION

1.1 Background

This document presents the results of a Hydrogeological Investigation study aimed at establishing a groundwater resource for the piggery and to serve as baseline reference of hydrogeological data to form part of a WULA (Water Use Licence Application).

The development portion, Remaining Extent of Farm Steynsburg 7803 GS is located 42 km directly south of Harrismith on the southern side of the R74 main road. Refer to Figure 1.

The planned development land is 500ha in extent. The water demand for the sow unit will be 73 000m^3/a or 200m^3/d which needs to be satisfied.

Geo-logic Hydro Geological Consultants cc was appointed by Rock Environmental Consulting (Pty) Ltd, to do a geohydrological assessment study for the farm development.

1.2 Scope of Investigation

The Hydrogeological assessment study will consist of the following actions:

1) Desk study to study the geology and groundwater regime.
2) Hydro census of boreholes on and around the site.
3) Site establishment of at least four water borehole drill sites and at least one alternative drill site.
4) Drilling and drilling supervision of water boreholes.
5) Borehole yield testing and testing supervision of four production boreholes.
6) Taking of surface and borehole water samples for water quality analyses.
7) Calculate the sustainability of the planned water abstraction for the proposed development.
8) Categorize the water quality analyses according DWA drinking water standards.
9) Recommendations on monitoring protocol for long term monitoring purposes
10) Compilation of a Category A hydrogeological – and contamination risk assessment report.

1.3 Water Use License Application

To abstract water from an aquifer on a large scale for commercial farming activities, a water use license will be needed. A Regional - Initial calculation is done to determine the amount of information necessary for each new Water Use license application for groundwater abstraction.

The calculations are based on the following:

- Size of the property ($Area_{prop}$). Surface area of Portions is estimated to be 500ha or 5.0Km^2.

- Recharge – HP (RE). Preliminary groundwater recharge taken as 75mm per annum. (Vegter groundwater recharge map, Vegter 1995)
- Existing use volumes (ABS_{ex}). None.
- New use volumes (ABS_{new}). Provision is made for 200m^3/d or 73 000 m^3/a.
- Scale of abstractions (ABS_{scale})

Calculations: -

Groundwater Recharge

$Area_{prop\ x}$ RE			=	RE $_{area}$ (m^3/a)
$Area_{prop}$	=	5.0Km^2	=	5 000 000m^2
RE			=	75mm/annum
5 000 000m^2 x (0.075m)			=	**375 000 m^3/a or 1027m^3/d**

Groundwater Demand

ABS_{ex} + ABS $_{new}$	=	ABS total (m^3/a)
0 m^3/day + 200 m^3/day	=	**73 000m^3/a**

Scale of Abstraction

ABS_{scale}	=	(ABS $_{total}$ / RE $_{Area}$) x 100
	=	(73 000 m^3/a / 375 000 m^3/a) x 100
	=	**10 %**

Based on the calculations for the property size only (ignoring water use considerations) the abstraction is classified as Category A – Small Scale Abstraction (<60%) of recharge on property. The proposal set out below is therefore to complete a Category A study. The Category A study requirements are taken from the Water Use License Application Requirements of the Department of Water Affairs and Forestry:

Category A

- Volume and purpose of the water required.
- Detail borehole census on the property in question. Information to be collected should include pump depth / borehole depth, depth to water level, yield of the borehole, volume abstracted (daily, weekly, monthly).
- Proximity to surface water discharges (springs, seeps, wetlands streams, rivers, lakes) and groundwater dependent ecosystems.

- Geo-referenced map of the property in question, with boreholes, physical structures (houses, stores, irrigation equipment) and current pollution sources (septic tanks, pit latrines, petrol/diesel tanks, irrigation areas) depicted.
- Monitoring programme - monthly water levels, monthly rainfall.

The Department of Water Affairs and Forestry recommends that the following measures be taken when testing bore holes for sustainable yields and to provide the following information:

- Refer to test procedures in the South African National Standards Code No.: SANS 10299.
- Perform a three (3) hour stepped draw down test to determine the discharge rate of the intended constant rate test OR;
- The constant discharge test should be done at approximately $^{2}/_{3}$ of the blow yield of the bore hole.
- For **HOUSEHOLD** use it as recommended that a 8 hour constant rate test be performed with the draw down and the recovery measured.
- For **IRRIGATION** it as recommended that a 24 constant rate test should be performed while the draw down and the recovery is measured. This test could also be performed for intended **BULK WATER SUPPLY** for a volume of up to 150 000 m^3 per annum.
- For **BULK WATER SUPPLY** in excess of 150 000 m^3 per annum it as recommended that a 72 hour constant rate test should be performed while the draw down and the recovery of the bore hole is measured.
- All data as obtained above should be attached to the relevant Water Use License Application forms, together with an analysis of the data (including draw down curves) and recommendation for the sustainable yield of the borehole(s), by a qualified Geo-hydrologist.

Figure 1: Regional locality map showing the position of the proposed development area. The quaternary sub-catchments is shown in blue

Figure 2: Detail locality map of Remaining Extent of the Farm Steynsburg 7803 GS

2. METHODOLOGY

A desk study was performed to gather relevant geological and hydrogeological information. A hydro-census followed the desk study to establish borehole information in the region of the site. The purpose of this survey was to gather relevant hydrogeological information to study the groundwater regime, current groundwater use and borehole coordinates in the area. One existing borehole and six newly drilled boreholes are located on the development portion. Four existing boreholes could be located around the proposed development site. The existing boreholes are located few and far between.

A geological walk over study was done of the site to study the in-situ geology. A geophysical study was done to establish new drill sites for water boreholes. Six new boreholes were drilled. Four of the six boreholes were submitted to borehole yield testing procedures. Two of the boreholes were reported as drilled dry during the drilling program. Four boreholes were reported to deliver low yielding volumes. The aquifer in which the boreholes were established was found to be a low yielding aquifer which shows serious signs of dewatering. A groundwater resource could not be established for the proposed development site due to the low groundwater ability of the groundwater regime on which the site is located.

3. FIELD WORK

3.1 Desk study and Hydro-Census Data

During the desk study the geology of the area were studied. During the hydro-census one existing borehole was found on the development portion and four boreholes located around the site could be visited. Refer to Table 1 on page 9 for detail information of the boreholes visited. Refer to Figure 3 for the positions of the boreholes.

Six boreholes were drilled of which four delivered low yields. Water level depths could be measured in seven of the eleven boreholes visited during the study. The water level depth, measured in the boreholes located on the development portion range from 0.02mbgl to 17.50mbgl. The water level depths, measured in the boreholes located outside the development portion range from 10.62mbgl to 17.11mbgl.

Groundwater is used for domestic and small scale farming purposes. No large scale irrigation is done from boreholes. The water level depth measurements show that none of the boreholes can be regarded as over used.

Figure 3: Hydro-census map. BH 1 is the existing borehole. Borehole BH 2 to BH 7 is newly drilled boreholes

TABLE 1: Borehole hydro-census details

Borehole number	Co- ordinates		Water level (mbgl)	Groundwater Elevation (mamsl)	Remarks
	Latitude And Longitude	Ground Elevation (mamsl)			
Boreholes located on Portion24 of the farm Uitzicht alias Rietvalley 314 JR					
BH 1	-28.66666° 029.14646°	1222	10.00	1212	Existing borehole. Submersible pump. Pipe line is 65mm. Borehole located near home.
BH 2	-28.654703° 029.140447°	1236	---	---	Newly drilled borehole. Dry.
BH 3	-28.662739° 029.140430°	1223	---	---	Newly drilled borehole. Dry.
BH 4	-28.665483° 029.144117°	1232	16.41	1216	Newly drilled borehole. Drilled skew. Cannot install pump.
BH 5	-28.65840° 029.14820°	1218	0.02	1218	Newly drilled borehole.
BH 6	-28.65677° 029.14725°	1226	0.30	1226	Newly drilled borehole.
BH 7	-28.66655° 029.14654°	1221	17.50	1203	Newly drilled borehole. Depth 100 m
Boreholes located on land outside the proposed development area					
H/BH 1	-28.64091° 029.14625°	1246	---	---	Exiting borehole in house. Cannot measure WL. BH dry according farmer.
H/BH 2	-28.64295° 029.15877°	1219	Dry	---	Existing BH Dry. Only 5 m deep. Was equipped with windmill.
H/BH 3	-28.63933° 029.15818°	1226	17.11	1209	Submersible pump with 40mm. Pump to 5000l tank to feed small village of 5 houses.
H/BH 4	-28.65217° 029.13934°	1245	10.62		Monotype pump. Very old pump. Existing borehole. Not working

3.2 Geophysical Study (Establishment of drill site positions)

Part of the scope of work was to site establish groundwater exploration targets for water borehole drilling purposes. Groundwater occurs in weathered or fractured host rock in the area. To be able to place a drilling position for groundwater exploration purposes the geology and more specifically the condition (state of weathering) of the host rock must be understood. A geophysical study is the measuring of certain parameters such as electrical conductivity and magnetic susceptibility of the in-situ geology. A number of geophysical methods do exist to measure these parameters.

For the geophysical study the Magnetic method and the Direct Current Continuous Vertical Electrical Sounding method (DC CVES) method were used to conduct the survey. The two geophysical methods are explained below.

3.2.1 Magnetic method

The magnetic method attempts to differentiate between lateral differences in the earth's magnetic field. These differences or anomalies indicate to different types of underlying rock formations and/or variations in depth of these different formations. The magnetic surveys are normally done in a linear pattern or traverse and found application in the following geohydrological regimes.

a) tracing of intrusive dolerite or diabase dykes or sills,

b) tracing of contact zones between different formations, and

c) Tracing of possible fault zones.

3.2.2 Direct Current Continuous Vertical Electrical Sounding method (DC CVES)

The resistivity method requires the measurement of resistance of the soil substrata. This is usually done by injecting a current into the ground using two electrodes and measuring the resulting potential across another two electrodes. The exploration depth that the measurement applies to depend on the electrode separation, thus a picture of resistance with depth can be derived by systematically increasing the electrode separation. This process is known as a vertical electrode sounding. A series of such soundings adjacent to each other provides a continuous vertical electrical sounding or CVES.

Purpose-built instruments are available for automatically collecting CVES data. The instrument that was used is an ABEM Lund set. Depending on the requirement different electrode configurations and separations can be programmed.

The resistivity data sets were processed using RES2DINV. RES2DINV automatically interprets the resistivity variations of the ground by fitting internally-generated model data to the field data through several iterations. Prior to inverting, obviously noisy or spurious data points are manually eliminated from the data sets. After the first interpretation pass of up to five iterations, further editing is carried out to remove data that are outliers compared with the computer-generated model readings. A final cycle of modelling then followed.

Anomalies are recognised in the model by virtue of a higher or lower resistance relative to the surrounding material.

3.3 Geological desk study

A desk study consisting of a geological interpretation of available information was conducted. The 2828 Harrismith 250 000 geological map indicate that the area of interest is underlain by the Adelaide Formation (Pa) which is part of the Beaufort Group. The Adelaide Formation consists of grey mudstone, dark grey shale, siltstone and sandstone. According the map a large portion of the site is covered by a dolerite sheet (Jd). This sheet proofed to be very thin or absent at the largest part of the site. Refer to Figure 6. Groundwater occurrence is only in the weathered dolerite or dolerite mudstone contact zones. The mudstone Formation can basically be regarded as a very low yielding aquifer or in some cases an aquaclude.

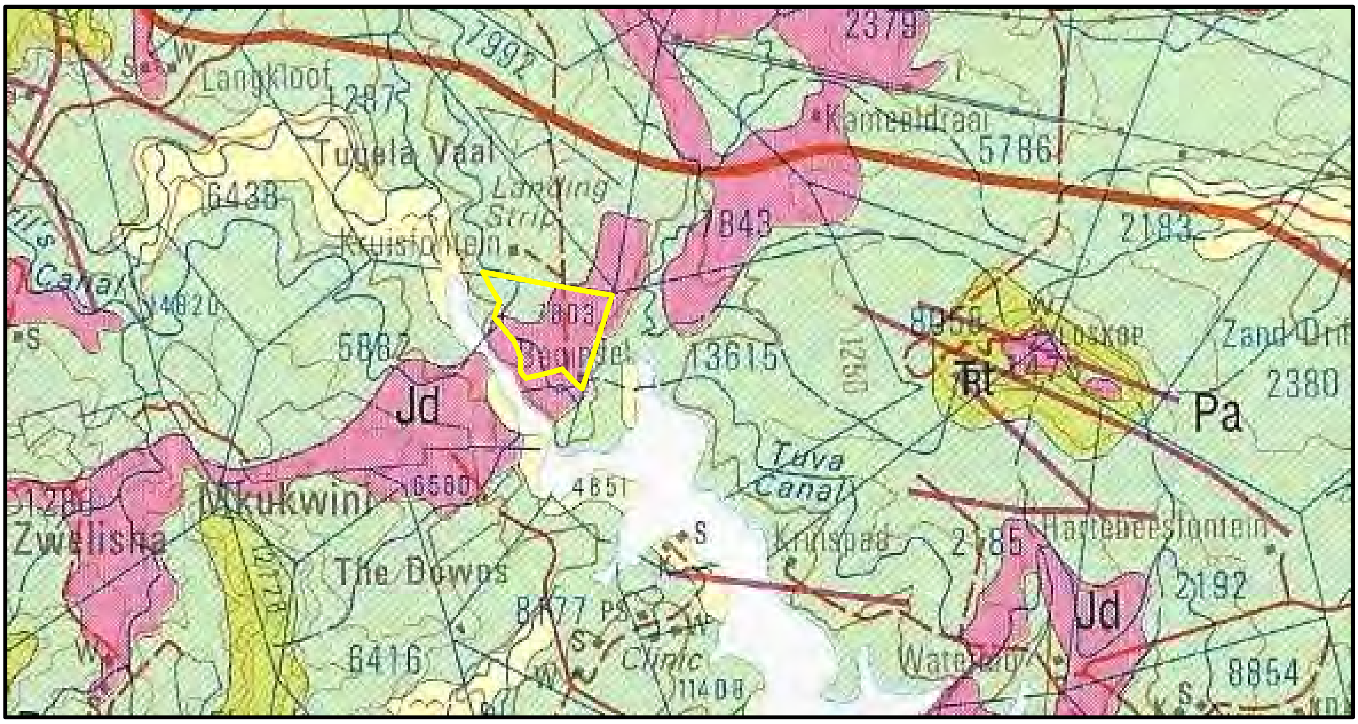

Figure 4: Geological Map 2828 Harrismith 1: 250 000

3.4 Field survey

Two traverses were laid out to cover the contact zones of the dolerite with the mudstone according the geology map. The Geophysical data however show that the dolerite is very thin or absent and does not form a sustainable aquifer. Refer to Figure 5.

The two traverses were covered with the two geophysical methods explained above. The positions of the traverses and the recommended drill positions can be seen on Figure 5. The traverse data is explained below.

3.5 Recommended drill positions

The geological model for the site is a layered earth model where most of the site is covered with mudstone. The topography of the site is very steep which means that weathered material is removed continuously with un-weathered mudstone and dolerite left on site as a result. Groundwater cannot form a deeply weathered groundwater regime.

The DC CVES method was expected to be the best tool to site drilling positions for water exploration boreholes due to the layered earth model. The aim was to find conductive zones, if they exist, that is deep enough to be a productive aquifer. The Magnetic method was used as indicative tool for magnetic intrusive material. The two geophysical traverses are explained below.

Traverse 1

The resistivity data show a two layer earth model with a resistive layer on top ("warm" or orange to red colors) on top with more conductive material ("cold" or green to blue colors) in depth. The blue colors represent the more conductive or weathered material. At 300 metres on Traverse 1 a broad conductive zone coincide with the drainage on the line. This means that the weathered material stretch to depth and can represent a weathered intrusive diabase structure. Borehole BH 2 was drilled on this position. Refer to Figure 6.

Traverse 2

The resistivity data also shows a two layer earth model with a thin but resistive layer on top. Below this thin layer is a thin conductive layer which follows through the entire traverse. A third more resistive layer then follows which is very resistive from 0 to 150 metres on the traverse. This layer is not as resistive from 150 to the end of the traverse. Borehole BH 3 was placed on this transitional zone at 165 metres on the traverse which may be a geological contact zone. Refer to Figure 7. The following positions were recommended to be drilled for water exploration purposes in Table 2 below.

Table 2: Recommended drill positions placed on geophysical study information.

Traverse Number	Recommended Drill position	Coordinates	Drilling Priority
1	300m (BH 2)	-28.654703° 29.140447°	1
2	165m (BH 3)	-28.662739° 29.140430°	2

Figure 5: Geophysical traverse positions and borehole drilling positions.

Traverse 1

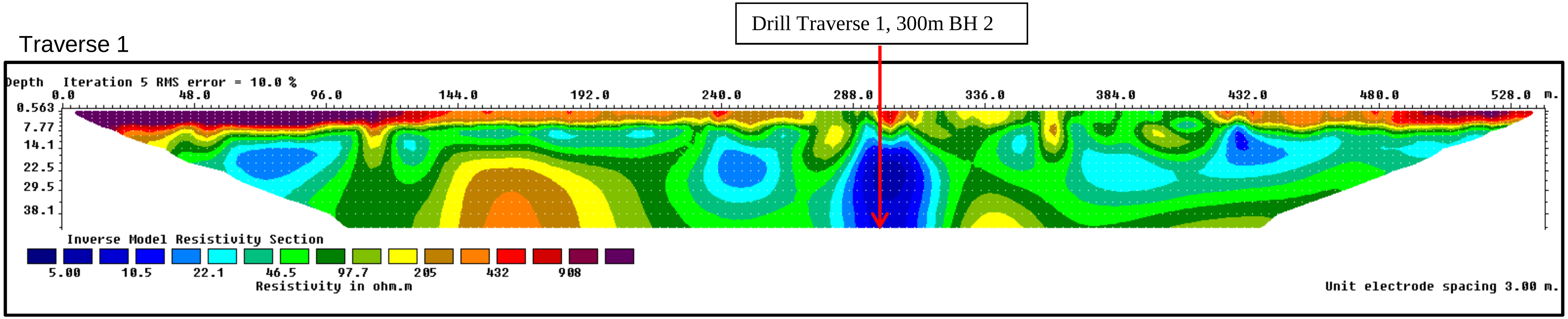

Figure 6

Traverse 2

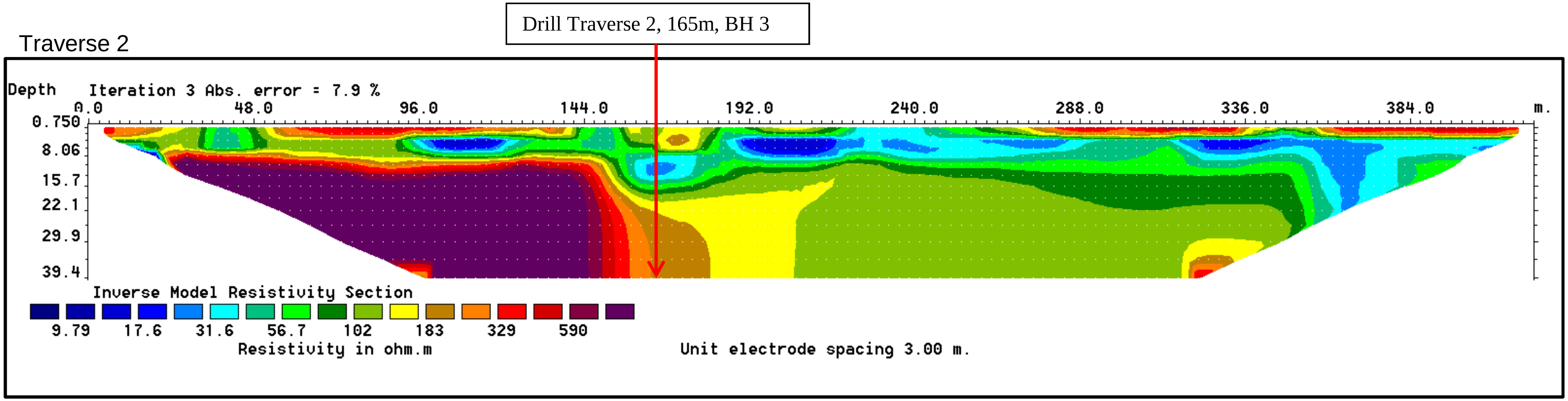

Figure 7

3.6 Borehole drilling

Borehole drilling supervision was done to be able to gather the hydrogeological information regarding the water strikes and lithology of the borehole. The borehole drill position was determined by the geophysical methods as described above.

The borehole was drilled with a 205mm drill bit, until the host rock was confirmed to be solid. The boreholes were then finished with a 165mm bit to depth. Casing was placed to depths to stabilize the side walls of the boreholes. The two boreholes BH 2 and BH 3 supervised during the drilling process were both confirmed to be dry. The drilling of the four boreholes BH 4 to BH 7 was not supervised. Limited information of these four boreholes is available.

Refer to the locality map, Figure 5, for the borehole positions of BH 2 and BH 3. More information, such as the borehole construction and lithology, can be found in Appendix A and Table 2 below.

Table 3: Borehole drilling information

BH number	Coordinates	Drilling position	Borehole depth	Water level depth	Blow out yield
BH 2	S -28.654703° E 029.140447°	Traverse 1 at 300m	150	---	<0.1 ℓ/s
BH 3	S -28.662739° E 029.140430°	Traverse 2 at 165m	120	---	<0.1 ℓ/s
BH 4	S -28.66548° E 029.14409°	Geological siting	160	16.41	1.4 ℓ/s
BH 5	S -28.65842° E 029.14821°	Geological Siting	150	0.00	3.3 ℓ/s
BH 6	S -28.65678° E 029.14725°	Geological Siting	120	0.3	2.8 ℓ/s
BH 7	S -28.66655° E 029.14654°	Geological Siting	100	17.5	0.6 ℓ/s

3.7 Test pumping of existing boreholes

Three of the six newly drilled boreholes located on the development area were submitted to borehole yield testing procedures during the study. The yield tests were done to be able to calculate the aquifer parameters Transmisivity and Storativity and to be able to calculate safe abstraction volumes for the individual boreholes.

The boreholes were submitted to Step and Constant Discharge Tests with recovery tests to follow the constant yield tests. The borehole yield tests were conducted according to the standards laid down in the publication of the Department of Water Affairs and Forestry, ***"Minimum Standards and guidelines for Groundwater Resource Development for the Community Water Supply and Sanitation Programme".***

A **Step Test** or calibration test consists of pumping a borehole at different rates for sixty minutes per step, until the maximum rate the borehole can deliver. The water level is constantly monitored and noted during each step. This gives an indication of the possible yield the borehole can sustain for a Constant Discharged Test. A step test also gives an indication of the potential of the aquifer in the immediate area around the borehole.

The **Constant Discharge Test** consist of pumping a borehole at a specific rate for a duration of 24 hours, with a sudden switch off of the pump after the pump cycle, with a recovery test following immediately afterwards. The Constant Discharge Curves was analysed by using the Basic FC, FC inflection point, Cooper-Jacob and Barker/Bangoy methods, to give an indication of Transmisivity and Storativity values.

Below is detail information of each test done on the individual three boreholes.

Borehole **BH 4** is 158 metres deep with a static water level at 16.41 metres below ground level. The pump equipment could not be installed into the borehole due to casing that obstructs the borehole. The borehole could not be submitted to yield test.

Borehole **BH 5** is 150.00 metres deep with a static water level at 0.00 metres. The borehole was pumped for two steps of 60 minutes at rates of 0.50 and 1.02 ℓ/s. A third step was pumped for 5 minutes at a rate of 2.03 ℓ/s. The water level draw down was measured constantly during these steps. The water level draw down after each step measured 10.20, 35.90 and 61.26 metres below the original static water level. The water level reached pump inlet after 5 minutes in the third step. A maximum inflow of 0.92 ℓ/s could be measured during the step test. The pump was switched of and the water level allowed recovering for 440 minutes. The water level recovered to 5.20 metres below the original static in the allowed 440 minutes.

The borehole was then submitted to a constant discharge test with duration of 8 hours at a rate of 0.61l/s. The pump was switched off after 480 minutes or 8 hours. The final water level draw down after 480 minutes was measured at 61.26 metres below the original static water level. A maximum inflow of 0.5 ℓ/s could be measured at the end of the constant yield test. The borehole was allowed to recover for 2280 minutes or 36 hours. The water level did recover to 7.51 metres below the original static water level in the allowed 2280 minutes. This can be regarded as very poor recovery rate. This is a sign that the aquifer feeding borehole BH 5 is de-watering at an alarming rate.

Borehole **BH6** is 120 metres deep with a static water level at 0.3 metres below ground level. The borehole was pumped for three steps of 60 minutes at rates of 0.51, 1.02, and 2.05 l/s. The water level draw down was measured constantly during these steps. The water level draw down after each step measured 5.18, 33.25, and 61.25 metres below the original static water level. The water level reached pump inlet after 15 minutes in the third step. A maximum inflow of 0.73 l/s could be measured during the step test. The pump was switched of and the water level allowed recovering for 440 minutes. The water level did recover to 0.98 metres below the original static water level in the allowed 440 minutes.

The borehole was then submitted to a constant discharge test with duration of 24 hours at a rate of 0.60l/s. The pump was switched off after 1440 minutes or 24 hours. The final water level draw down after 1440 minutes was measured at 36.81 metres below the original static water level. The borehole was allowed to recover for 1440 minutes or 24 hours. The water level recovered back to 0.22 metres below the original static water level. This can be regarded as a relative slow recovery rate.

Borehole **BH7** is 100 metres deep with a static water level at 17.40 metres below ground level. The borehole was pumped for three steps of 60 minutes at rates of 0.41, 0.82, and 1.50 l/s. The water level draw down was measured constantly during these steps. The water level draw down after each step measured 5.15, 36.20, and 57.20 metres below the original static water level. The water level reached pump inlet after 7 minutes in the third step. A maximum inflow of 0.36 l/s could be measured during the step test. The pump was switched of and the water level allowed recovering for 440 minutes. The water level did recover to 1.94 metres below the original static water level in the allowed 440 minutes.

The borehole was not submitted to a constant discharge test due to the low yield of the borehole and the dewatering of the aquifer feeding the borehole.

Table 3 below gives more information on the yield test of the boreholes submitted to yield testing procedures.

TABLE 4: Test pumping results

BH No. BH Depth & Static Water Level	Step Test				Constant Discharge Test			Comment on the Water Level Recovery Rate of the Constant Discharge Test
	Step No.	Rate (l/s)	Dur. (min)	D/D (m)	Rate (l/s)	Dur. (min)	D/D (m)	
BH4 S -28.66548° E 029.14409° Depth: 158m Static water level:16.41m		---	---	---	---	---	---	Pump equipment could not be installed into borehole due to casing failure.
BH5 S -28.65840° E 029.14820° Depth: 150m Static water level:0.02m	1 2 3	0.50 1.02 2.03	60 60 05	10.20 35.90 61.26	0.61	480	61.26	87.7% in 2280 min
BH6 S -28.65678° E 029.14725° Depth: 120m Static water level:0.30m	1 2 3	0.51 1.02 2.05	60 60 15	5.18 33.25 61.25	0.60	1440	36.81	99.4% in 1440 min
BH7 S -28.66655° E 029.14654° Depth: 100m Static water level:17.40m	1 2 3	0.41 0.82 1.50	60 60 07	5.15 36.20 57.20	---	---	---	Very slow recovery rate for step test
ST - Step Test CDT - Constant Discharge Test SWL - Static Water Level in metres below ground level					Dur. – Duration D/D – Draw down			

3.8 Recommended borehole abstraction figures

The Constant Discharge Curves of the tests were analysed by utilizing the Basic FC, FC inflection point, Cooper-Jacob, Theis and Barker/Bangoy methods, to give an indication of Transmisivity and Storativity values. The average abstraction rate (based on a 24 hour duty cycle) of these methods were taken to calculate the yield for 12 hours per day. Please refer to the summary sheets for more detailed borehole recommendations. Refer to Appendix A at the back of this report.

The abstraction rate for the borehole is given for each individual method described above. The average recommended (Interpreted from all data available) abstraction rate for the borehole is given in Table 4 below. It is important to understand that the abstraction figure given below in Table 4 only make provision for the aquifer parameters of the borehole tested. These figures do not make provision for borehole interference with other boreholes in the area, groundwater recharge that may or may not be enough or groundwater catchment size limitations. These abstraction figures below use assumptions such as a limitless catchment area size and no interference or abstraction from other boreholes in the area.

A summary of the methods used for the abstraction rates and the Graphical presentations of the draw down curves and recovery curves can be found in Appendix A. Table 3 listed above, gives a summary of the pump test data.

TABLE 5: Recommended abstraction schedule for production boreholes (FC method)

Borehole No.	Recommended Abstraction Rate		Dynamic water Level (mbcl)	Comments
	For 12h/d	in m^3/d		
BH 1	---	---	---	Borehole not submitted to yield testing
BH 4	---	---	---	Borehole in a collapsing state. Borehole not to be used.
BH 5	0.3 for 4h/d	4.3	---	Severe dewatering of aquifer.
BH 6	0.4 for 12h/d	17.3	30	Slight dewatering of aquifer.
BH 7	Not to be used	---	---	Low yielding borehole
Total volume available		**21.6**		

The aquifer can be regarded as a low yielding aquifer prone to dewatering. The aquifer will be submitted to seasonal dry periods during which the aquifers may be not even be able to deliver low yields.

3.9 Water quality

Only one water samples was taken to be analysed for water quality purposes. The water sample was preserved and delivered to Aquatico Laboratories, an accredited water laboratory, to be analysed for water quality purposes. The analyses include the major cation and anions, Total Coliform Bacteria count and E. Coli count. The results of the chemical and bacteriological analyses performed on the groundwater samples are presented in Table 5. The quality of water is classified according to the SANS 241-1 and 2: 2011 as in the Publication “South African National Standard” Part 1 and Part 2, SABS. Please refer to Appendix B for the original analyses from Aquatico Laboratories. The chemical and bacteriological quality of the water is described below.

Chemical Water Quality

Borehole BH 6 show good water quality with EC level of 21.0mS/m. The TDS levels are very low at 141mg/l. The Chloride level is very low at 1.89mg/l. None of the chemical determinants are above the standard limits set. The water from borehole BH 6 can be chemically categorized as Class 0, which can be used for domestic purposes without treatment.

Bacteriological Water Quality

The E.coli and Total coliform count for the borehole is below the standard limits which show no bacteriological contamination. The water can be used for domestic purposes and animal use without treatment.

Table 6: Water quality of borehole BH 6.

Determinant	Unit	Risk	Standard limits	BH 6
pH value at 25 C	pH units	Operational	≥ 5 to ≤ 9.7	8.34
Electric Conductivity at 25 C	mS/m	Aesthetic	≤ 170	21.0
Total Dissolved Solids	mg/ℓ	Aesthetic	≤ 1200	141
Total alkalinity	Mg CaCO3/l			137
Chloride as Cl	mg/ℓ	Aesthetic	≤ 300	1.89
Sulphate as SO4	mg/ℓ	Acute health - 1	≤ 500	<0.141
Nitrate (NO3) mg/ℓ N	mg/ℓ	Acute health - 1	≤ 50	0.347
Ammonia as N	mg/ℓ	Aesthetic	≤ 1.5	0.074
Orthophosphate (PO4) as P	mg/ℓ			<0.005
Fluoride as F	mg/ℓ	Chronic health	≤ 1.5	0.726
Calcium as Ca	mg/ℓ			21.3
Magnesium as Mg	mg/ℓ			6.2
Sodium as Na	mg/ℓ	Aesthetic	≤ 200	24.6
Potassium as K	mg/ℓ			0.541
Aluminium as Al	mg/ℓ	Operational	≤ 0.3	<0.002
Iron as Fe	mg/ℓ	Chronic health	≤ 2	<0.004
Manganese as Mn	mg/ℓ	Chronic health	≤0.5	<0.001
E.coli	CFU/100mℓ	Acute health – 1	Not detected	<1
Total coliform	CFU/100mℓ	Acute health - 2	≤10	<1
Total hardness	$mgCaCO_3/ℓ$			79

4. HYDROGEOLOGICAL ASSESSMENT

4.1 Aquifer's ability to supply in the water demand

Grey mudstone covers the largest portion of the site. Mudstone weathers to mud which is an exceptional poor aquifer, delivering very low yielding boreholes. Mudstone rarely forms fractures due to the pliability of mudstone when submitted to stress. The weathering product forms a very dense and solid mud with high capillary forces that prohibit the release of water in the aquifer.

The diabase material is mainly intruded into the mudstone as sheets, forming large thick covers on top of the mudstone. The topography in the area is very steep which ensure that sheet wash plays a very important role in the weathering process. This means that weathered material is constantly and quickly removed and does not accumulate to form a thick enough aquifer that delivers groundwater on a sustainable way. The geological situation is not in favour to form a productive and sustainable aquifer.

5. CONCLUSIONS

During the hydrogeological study the following conclusions could be made:

- The hydro-census data gives a broad picture that groundwater volumes abstracted in the area around the planned Bergville site is low. This is due to the low groundwater potential in the area.
- A number of boreholes in the area are reported to be dried up.
- After drilling six boreholes which delivered low yields the aquifer can be regarded as a low yielding aquifer. (Aquifer with low Transmisivity values)
- The most cumbersome is that the yield tests showed that the boreholes is not only low yielding but also very fast dewatering the aquifer. (Aquifer with low Storativity values)
- From the chemical and bacteriological analyses it is clear that the groundwater at the Bergvill site is of high quality. The water from borehole BH 6 can be chemically and bacteriologically categorized as Class 0, which can be used for domestic purposes without treatment.

6. RECOMENDATIONS

The following recommendations are made:

- Boreholes BH 5 and BH 6 can be used for domestic purposes without treatment.
- It is recommended that surface water be used to supply in the water demand for the planned piggery site.
- Storm water originating from the piggery site must be treated as dirty water.
- Clean water and dirty water systems must be separated.
- Storm water must be directed away and around the piggery site.
- All water retention structures, including storm water dams, retention ponds etc. should be constructed to have adequate freeboard to be able to contain water from 1:50 year rain events.

REFERENCES

1. American Geological Institute, **Glossary of Geology**, (Robert L. Bates and Julia A. Jackson, Ed), 1980.
2. Department of Water Affairs and Forestry, **SOUTH AFRICAN WATER QUALITY GUIDELINES** - Volume 1 DOMESTIC USE, Second Edition 1996.
3. Department of Water Affairs and Forestry, **Groundwater Harvest Potential of the Republic of South Africa**, (Alan Seymour and Paul Seward), 1996.
4. Department of Mineral and Energy Affairs, **Stratigraphy of South Africa, Handbook 8**, (The South Africa Committee for Stratigraphy), 1980.
5. Johnson MR, Anhaeusser CR and Thomas RJ, **The Geology of South Africa**, 2006.
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7. SABS, **Specification for water for domestic supplies**. 241 - 1999.

APPENDIX A

Borehole yield testing information

Cooper-Jacob method

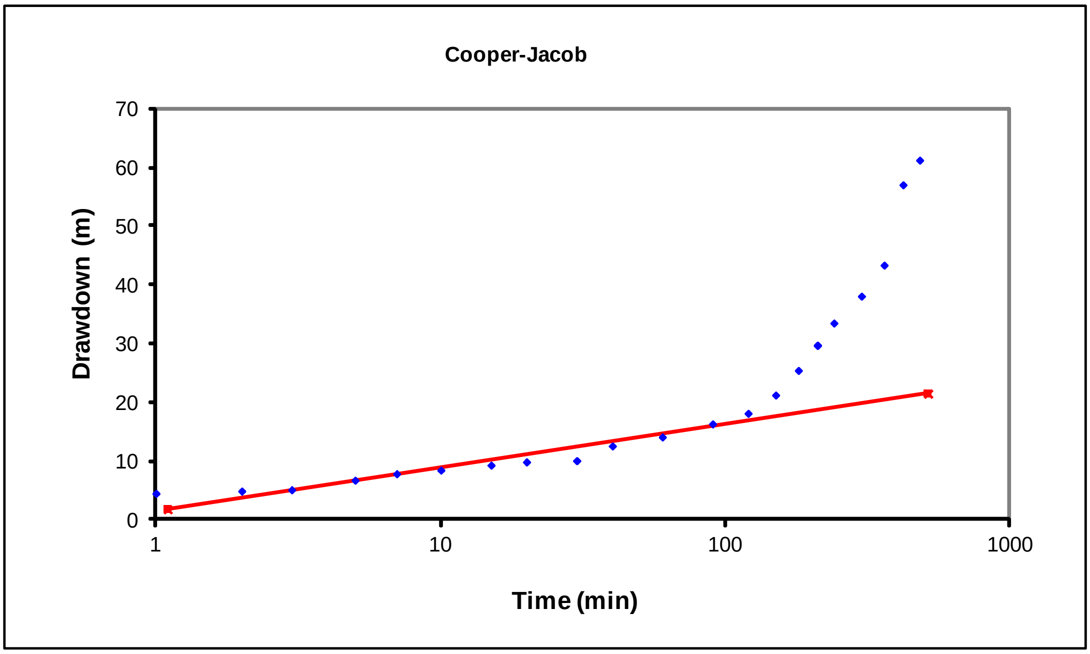
Main | Theis | Cooper-Jacob 2

BH 5

T(m²/d) =	1.3	r_e (m)=	1.52	1.52
S =	5.46E-04	Q (l/s) =	0.6	

	No boundaries	1 no-flow	2 no-flow	Closed
Q_sust	0.78	0.39	0.26	0.20
Avg. Q_sust =		0.41	std. dev =	0.26

including influence of bh's

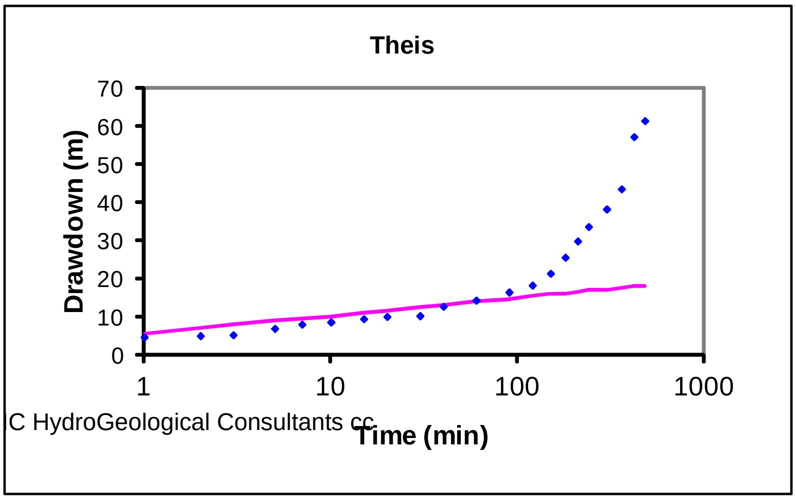


x0	y0	x1	y1
1.1	1.8	514	21.5

Theis

T (m2/d)	S	r
2	1.00E-05	5.00

Top



Summary

Main

BH 5

Applicable	Method	Sustainable yield (l/s)	Std. Dev	Early T (m^2/d)		Late T (m^2/d)		S	AD used
☑	**Basic FC**	0.05	0.04	1		0.1		3.30E-03	60.0
☐	**Advanced FC**			1		0.1		1.00E-03	60.0
☐	**FC inflection point**	0.14	0.08						5.5
☑	**Cooper-Jacob**	0.41	0.26			1.3		5.46E-04	60.0
☐	**FC Non-Linear**	2.49	2.20			34.0		5.06E-03	60.0
☑	**Barker**	0.30	0.50	K_f =	11138		S_s =	1.00E-07	60.0
	Average Q_sust (l/s)	**0.25**	**0.18**	b =	0.01	Fractal dimension n =		1.79	

Recommended abstraction rate (L/s)		**0.25**	for 24 hours per day
Hours per day of pumping	**12**	**0.35**	L/s for 12 hours per day

Amount of water allowed to be abstracted per month	**648**	m^3
Borehole could satisfy the basic human need of	**864**	persons
Is the water suitable for domestic use (Yes/No)	**Y**	

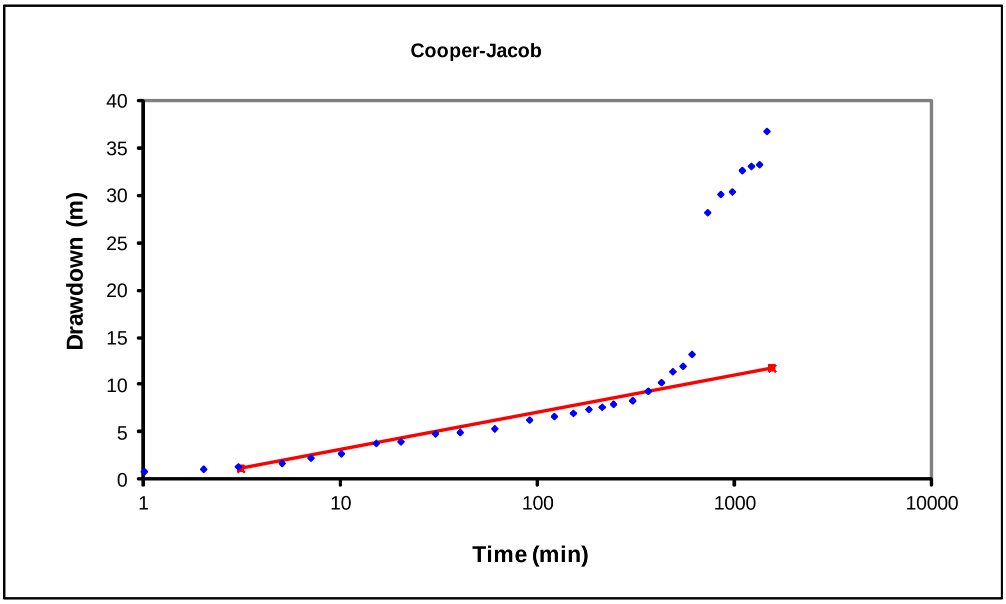
Cooper-Jacob method

Main | Theis | Cooper-Jacob 2

BH 6

$T(m^2/d)$ =	2.4	r_e (m)=	1.52	1.52
S =	2.51E-03	Q (l/s) =	0.6	

	No boundaries	1 no-flow	2 no-flow	Closed	
Q_sust	1.31	0.65	0.43	0.33	including influence of bh's
Avg. Q_sust =	0.68	std. dev =	0.44		

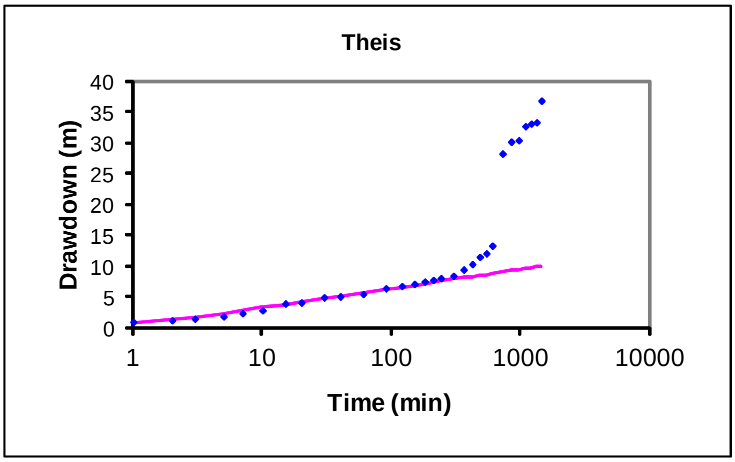


x0	y0	x1	y1
3.1	1.2	1534	11.8

Theis

T (m2/d)	S	r
3	2.00E-04	5.00

Top



GEO

Cooper-Jacob 2: Distance drawdown

Top

	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5	Obs 6
Distance r (m)						
Drawdown (m)						
Time (minutes)						

Summary | Main | BH 6

Applicable	Method	Sustainable yield (l/s)	Std. Dev	Early T (m^2/d)		Late T (m^2/d)		S	AD used
☑	Basic FC	0.05	0.04	3		0.1		2.75E-03	50.0
☐	Advanced FC			3		0.1		1.00E-03	50.0
☐	FC inflection point	0.14	0.08						5.5
☑	Cooper-Jacob	0.68	0.44			2.4		2.51E-03	50.0
☐	FC Non-Linear	2.49	2.20			34.0		5.06E-03	50.0
☑	Barker	0.29	0.49	K_f =	11138		S_s =	1.00E-07	50.0
	Average Q_sust (l/s)	0.34	0.32	b =	0.02	Fractal dimension n =		1.75	

Recommended abstraction rate (L/s)		0.30	for 24 hours per day
Hours per day of pumping	12	0.42	L/s for 12 hours per day

Amount of water allowed to be abstracted per month	777.6	m^3
Borehole could satisfy the basic human need of	1037	persons
Is the water suitable for domestic use (Yes/No)	Y	

APPENDIX A

Original water quality analyses from Aquatico laboratories (Pty) Ltd

Test Report **Page 1 of 1**

Client:	Henk Kruidenier	**Date of certificate:**	11 November 2016
Address:	25ste laan, 327, Villieria, Pretoria, 0186	**Date accepted:**	04 November 2016
Report no:	34686	**Date completed:**	11 November 2016
Project:	Geo-Logic	**Revision:**	0

Lab no:			22972
Date sampled:			03-Nov-2016
Sample type:			Water
Locality description:			Bergville
Analyses	**Unit**	**Method**	
A pH @ 25°C	pH	ALM 20	8.34
A Electrical conductivity (EC) @ 25°C	mS/m	ALM 20	21.0
A Total dissolved solids (TDS)	mg/l	ALM 26	141
A Total alkalinity	mg CaCO3/l	ALM 01	137
A Chloride (Cl)	mg/l	ALM 02	1.89
A Sulphate (SO_4)	mg/l	ALM 03	<0.141
A Nitrate (NO_3) as N	mg/l	ALM 06	0.347
A Ammonium (NH_4) as N	mg/l	ALM 05	0.074
A Orthophosphate (PO_4) as P	mg/l	ALM 04	<0.005
A Fluoride (F)	mg/l	ALM 08	0.726
A Calcium (Ca)	mg/l	ALM 30	21.3
A Magnesium (Mg)	mg/l	ALM 30	6.20
A Sodium (Na)	mg/l	ALM 30	24.6
A Potassium (K)	mg/l	ALM 30	0.541
A Aluminium (Al)	mg/l	ALM 31	<0.002
A Iron (Fe)	mg/l	ALM 31	<0.004
A Manganese (Mn)	mg/l	ALM 31	<0.001
A E.coli	CFU/100ml	ALM 40	<1
A Total coliform	CFU/100ml	ALM 40	<1
A Total hardness	mg CaCO3/l	ALM 26	79

A = Accredited N = Non accredited O = Outsourced S = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine
The results relates only to the test item tested.
Results reported against the limit of detection.
Results marked 'Not SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory.
Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation.

Chemical and bacteriological water quality analyses from borehole BH 6

APPENDIX 8H

STORMWATER MANAGEMENT PLAN (SWMP)

REC
SERVICES (PTY) LTD
T/A ROCK ENVIRONMENTAL CONSULTING

Storm Water Management Plan

FARM:

STEYNSBURG 7803-GS

Date: 2016/07/13 Ref:

Project Name:	BERGVILLE PIGGERY STORMWATER MANAGEMENT PLAN
Project Number:	
Report for:	BERGVILLE PIGGERY : Farm: STEYNSBURG 7803-GS

REVISIONS

Revision #	Date	Change Overview	Prepared by	Reviewed by
00	2016/07/13	None	Jean van Wyk	Johnnie Strydom

ISSUE REGISTER

Distribution List	Date Issued	Number of Copies

IDS COMPANY DETAILS

IDS Consulting Pty LTD
Pretoria East office

Email: info@idsconsulting.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY

IDS consulting was appointed to conduct a storm water assessment for the farm *STEYNSBURG 7803-GS*. For the proposed future operations of Bergville piggery. Proposed new development to the site requires a storm water management plan to be submitted and implemented. The post development operational areas are estimated at 200 000 square meters. This is estimated by adding 25% to the 15.6Ha estimate for site disturbance. And a Runoff factor of 0.7 is used over this area that resembles CBD/Industry type coverage. There is currently no operation on the farm, and the SWMP will therefore be solely on new buildings and operations.

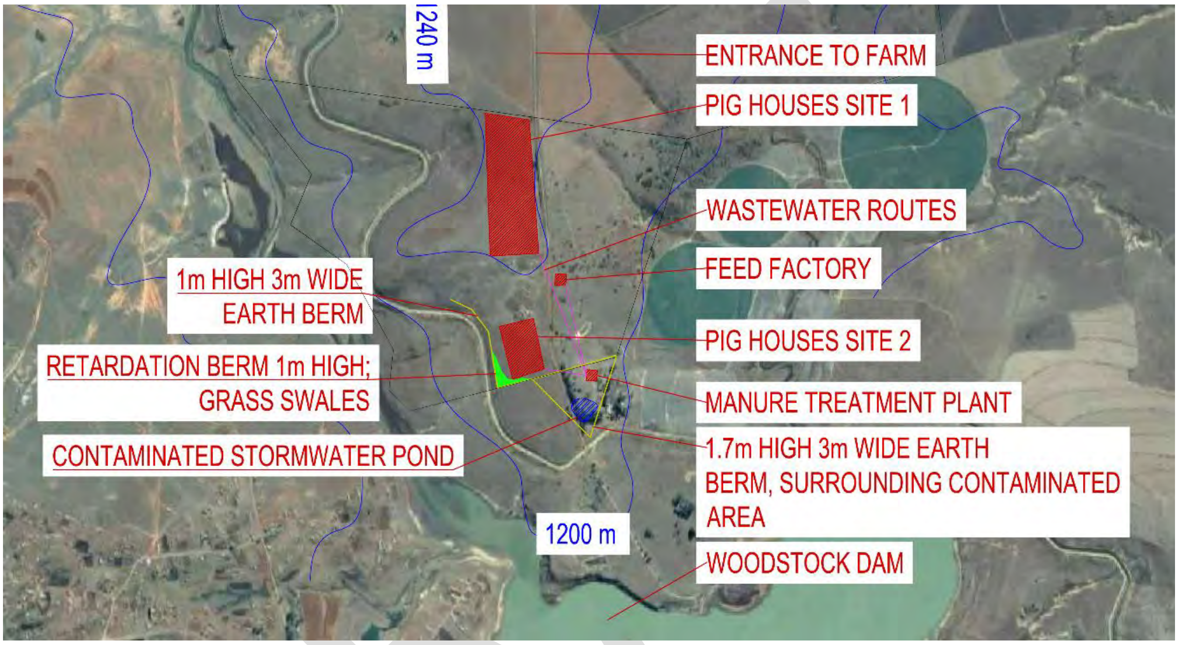


FIGURE 6.1: Northern Operational areas and Waste collection and treatment on the southern perimeter, enclosed by earth berm.

The entire site (STEYNSBURG 7803-GS) is situated on a topographical crest, the operational areas of the farm are therefore elevated so that no overland flow travels through the contaminated areas

The purpose of any discharge and volume calculations would be to determine the maximum volume of rainwater that would accumulate within the enclosed "contaminated area" and also the increase in runoff due to the additional operations areas depicted on the site layout that will now have a runoff coefficient reflecting that of an industry/CBD type coverage.

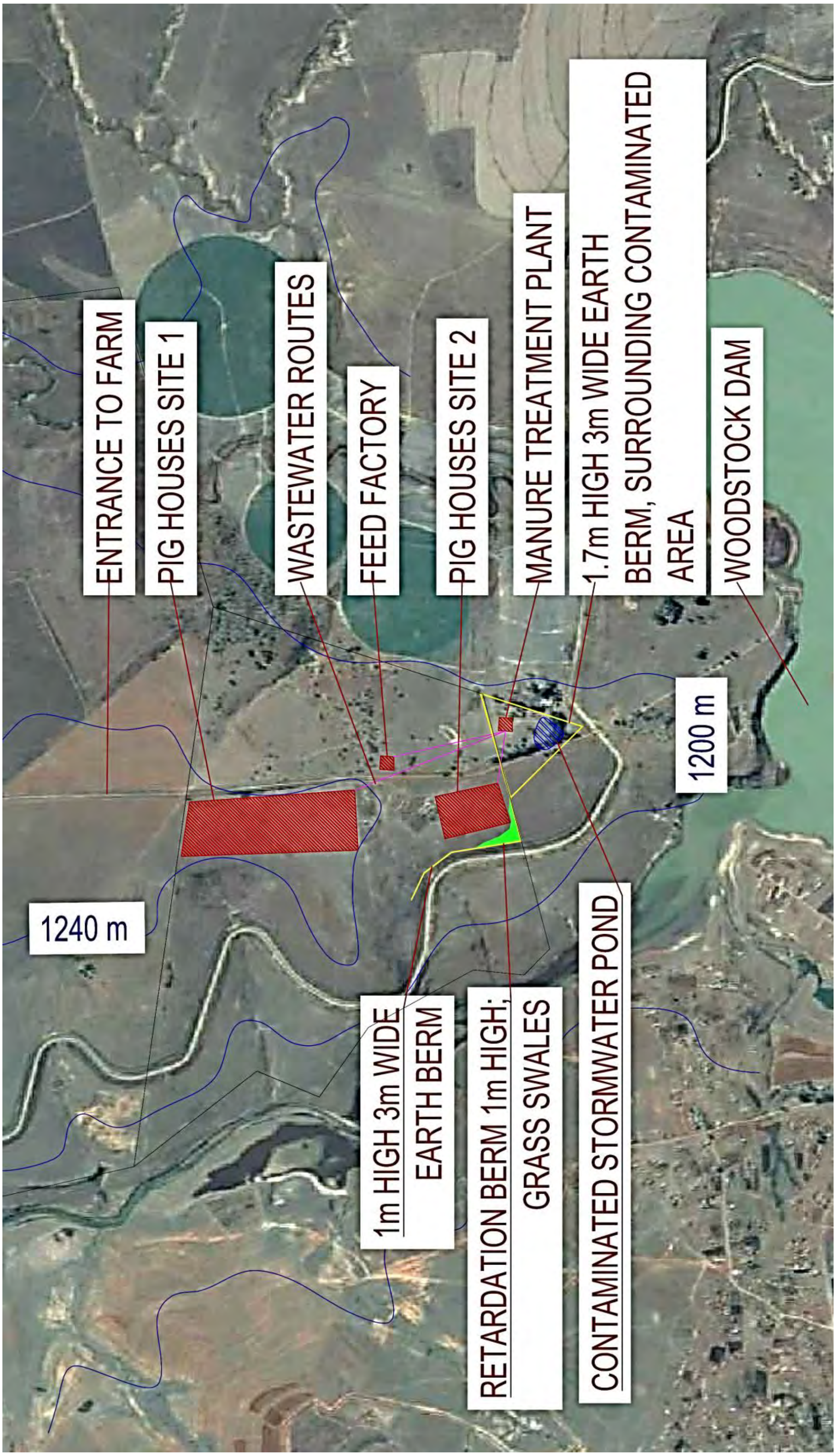


FIGURE 8.1: OPERATIONS LAYOUT: ARIEL PHOTO

INCREASE IN STORMWATER RUNOFF DUE TO PROPOSED ADDITIONS

The increase in stormwater runoff for the localized area yielded:

10 year	50 year
$Q_{change} = Q_{post} - Q_{pre}$ $Q_{change} = 5.18 - 2.207 = 2.973\ \mathrm{m^3/s}$	$Q_{change} = Q_{post} - Q_{pre}$ $Q_{change} = 8.33 - 3.573 = 4.757\ \mathrm{m^3/s}$

Increase in volume of water during design storm duration:

10 year	50 year
$\mathrm{V} = \frac{1}{2} Q_{change} \times \mathrm{t_d} \times 60$ $\mathrm{V} = \frac{1}{2} 2.973 \times 15 \times 60 = 1337\ \mathrm{m^3}$	$\mathrm{V} = \frac{1}{2} Q_{change} \times \mathrm{t_d} \times 60$ $\mathrm{V} = \frac{1}{2} 4.757 \times 15 \times 60 = 2140\ \mathrm{m^3}$

The above volumes are that of a design storm duration of 15 minutes

FIGURE 15.1: PROPOSED ISOLATION OF CONTAMINATION ZONE

This report yields a number of important implementations that need to be made on the site in order to keep pollutants from entering the surrounding natural flood routes. Pre and post development runoff calculations for the additions along the south-east part of the operations yielded the required temporary storage for the increase in runoff due to new facilities on previously undeveloped land.

Section 15 of this report focuses on the isolation of pollutants within a controlled catchment area, where the area is enclosed by means of a 3m wide and 1.7m earth berm, keeping the pollutants safely isolated from possible flash floods coming down the directly adjacent flood routes that pass through the site.

Firstly, to revert back to solving the increase in runoff due to the additions mentioned above, it would be safe to assume that by surrounding the waste treatment area with earth berms and retaining all stormwater entering this area by means of precipitation, will amply catch and retain the at least half the volume caused by the increase in runoff calculated in section 14. In order to attenuate an additional volume of water to decrease the site runoff due to development, another earth berm is placed on the south-western boundary, and planted with grass swales to retard the overland flow and assist in water infiltration.

Furthermore, new ponds should be built with adequate waterproof linings as per specialist, in order to restrict ingress of pollutants into natural underground water sources. Figure 15.1 shows the proposed area to be enclosed with an earth berm, this berm should disallow overland flow into the waste treatment area, and also bar any stormwater and untreated effluent from exiting this area.

All proposed measures in this report strictly depend on the design requirements that all waste collection tanks and waste transportation conduits be closed such that no waste could ever contaminate overland flow passing through the operational areas.

Infrequent maintenance of these conduits could result in over spilling of contaminants. It is therefore crucial that the systems that transport waste products be maintained by means of an official maintenance schedule at appropriate intervals. The maintenance schedule should include a weekly system check in order to ensure that design operation of the waste management is strictly adhered to.

1. INTRODUCTION

IDS consulting was appointed to conduct a storm water assessment for the farm *STEYNSBURG 7803-GS*. For the proposed future operations of Bergville piggery. Proposed new development to the site requires a storm water management plan to be submitted and implemented.

There is currently no operation on the farm, and the SWMP will therefore be solely on new buildings and operations.

2. SCOPE OF WORK

The purpose of the Storm Water Management Plan (SWMP) is to protect the environment against negative influences as a result of the erection and operations of this piggery. An SWMP addresses storm water run-off from a management perspective rather than from a development perspective. As such protective measure will be put in place to enhance the natural health of the surrounding environment.

The protective measures will take into account the following aspects:

- Stabilize the entire site

- Protect slopes and channels

- Protect receiving (incoming) water from pollution

- Adopt pollution prevention measures in the site operation and maintenance

- Identify pollutants and pollution sources and mitigate.

3. APPLICABLE GUIDELINES AND LEGISLATION

The following documentation is of importance and provides specific guidelines according to which the drafting of this SWMP has been based:

- *The National Water Act (Act No 36, 1998);*
- *The National Building Regulations and Building Standards Act (Act 103 of 1977);*
- *The Town Planning and Townships Ordinances;*
- *National Environmental Management Act (Act No 107 of 1998);*
- *Guidelines for the provision of engineering services and amenities in residential township*
- *development, ("The Red Book");*
- *Legal implications of urban stormwater drainage SAICE (1984)*
- *Drainage Manual. SANRAL, 2006, Pretoria , Kruger, E (ed).*
- *Georgia Stormwater Management Manual Volume 1: Stormwater Policy Guidebook- First*
- *Edition – August 2001*
- *Guidelines for stormwater from service stations & fuel dispensing areas, Brisbane City,*
- *Version 2, September 2007*
- *SANS 10089*

4. SITE STORMWATER DATA

The nearest rainfall station is at 29 deg 37 min latitude and 30 deg 30 min longitude. The figures are as follows:

LATDEG	LATMIN	LONGDEG	LONGMIN	SC	DC	RP	CODE	M5	M10	M15	M30	M45	M60	M90	M120	M240	M360
29	37	30	30	3	12	2	M	11.3	15.2	18	22.8	26.1	28.8	33	36.4	42.3	46.3
29	37	30	30	3	12	5	M	16.5	22.1	26.2	33.1	38	41.9	48	53	61.7	67.4
29	37	30	30	3	12	10	M	20.8	27.9	33.1	41.8	48	52.9	60.6	66.8	77.8	85.1
29	37	30	30	3	12	20	M	25.8	34.6	41	51.8	59.5	65.5	75.2	82.8	96.5	105.4
29	37	30	30	3	12	50	M	33.8	45.2	53.6	67.8	77.8	85.7	98.3	108.3	126.1	137.9
29	37	30	30	3	12	100	M	41.1	55	65.2	82.4	94.5	104.1	119.4	131.7	153.3	167.6

FIGURE 4.1: Rainfall data for closest rainfall station.

5. STORMWATER MANAGEMENT APPROACH

Design of the operational areas should be such as to screen incoming rainwater from entering contaminated wastewater/waste products. For areas that consist of multiple buildings where pigs are transported between buildings; consideration should be made with regards to waste generated in these "in-between" areas as well. In order to completely isolate the rainwater that falls within an area, collection trenches in and around these areas should be installed as to ensure that no contaminated runoff from the operational buildings and areas leave the operational areas from any other than the designed wastewater transportation channel/pipe.

This study will assume that the above practice will be implemented in all operational areas on the site.

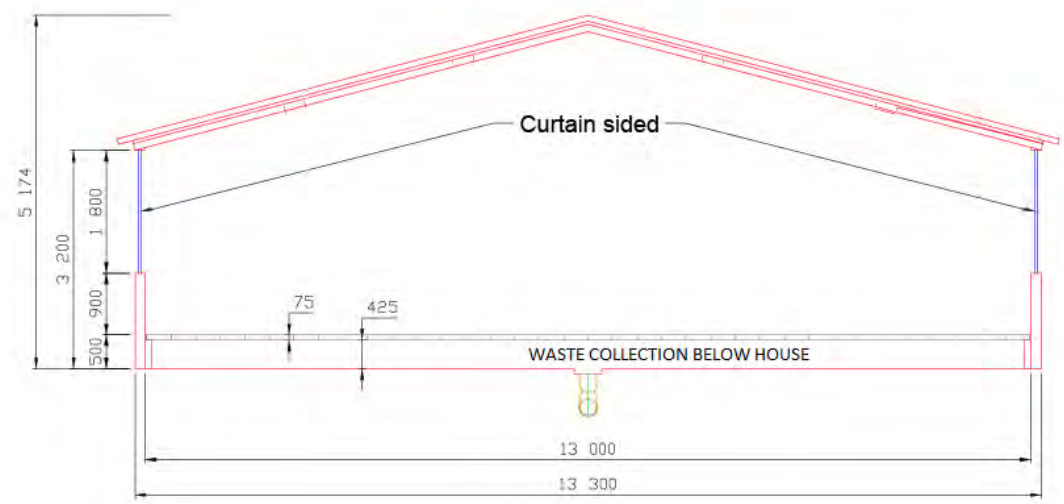


FIGURE 5.1: Typical pig house where contaminated waste is collected below

5.1. METHODS TO MITTIGATE CONTAMINATED RUNOFF

This site has its highest area approximately in the middle of the farm, and it slopes from the center towards the east, south and west.:

-Stop clean "upstream" stormwater running through contaminated areas. In this case, the pig houses must be built in such a way as depicted in figure 5.1 such that areas where wastewater is generated are roofed and rainwater would pass over and past these areas. Should rainwater fall within these areas, this would unnecessarily increase the wastewater volume, therefore rendering the waste treatment design inadequate.

-Attenuate the rainwater falling onto contaminated areas and retain the water for filtering and cleaning before effluent is discharged into the natural surrounding areas. Effluent such as this should be treated as per specialist and applicable legal composition, and the quality of this should be tested regularly, before being discharged or exposed to natural water bodies.

4. ACCESS TO THE SITE

Access to the relevant site portion is through its entrance via the R74, the site entrance road continues through the site southwards past the "contaminated area" towards the southernmost perimeter of the farm.

5. PROPOSED SITE DEVELOPMENT

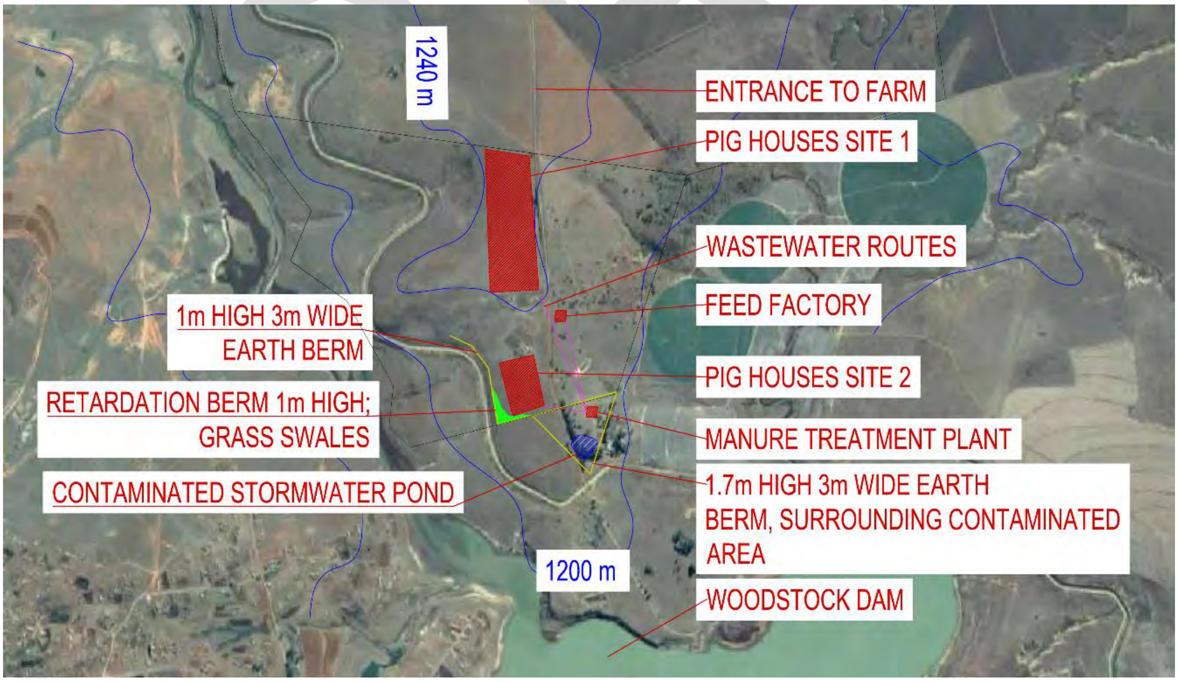


FIGURE 6.1: Northern Operational areas and Waste collection and treatment on the southern perimeter, enclosed by earth berm.

6. MITTIGATION METHODS FOR STORMWATER CONTAMINATION WITHIN THE ENCLOSED CONTAMINATED AREA

6.1. FOCUS AREAS

This site slopes from its center to south, east and west. The proposed contaminated area lies at the lowest southernmost edge of the site. The most important concept in mitigating contamination in stromwater runoff on this site as depicted in Figure 6.1

-Again as for the Operational areas: Stop clean "upstream" stormwater running through contaminated areas. This could be done by means of either stormwater trenches that re-directs clean stormwater to flow around instead of through the contaminated area, or by constructing earth berms in order to split clean and contaminated areas to reduce risk of runoff mixing.

-Attenuate the rainwater falling onto contaminated areas and retain the water for filtering and cleaning before effluent is discharged into the natural surrounding areas. This could be done by constructing earth berms preceded by grass swales to filter the contaminated runoff naturally, or by constructing water attenuation tanks that would need to be filtered mechanically on regular intervals.

This implies that the waste collection and waste-operations area should be "quarantined" as such. This would mean that the waste collection pond on site, after being constructed and evaluated to specialist standard linings and subgrade penetration prevention measures, should be encompassed by either an earth berm or trench in order to retain rainwater that falls in this area, and also to direct overland stormwater around this area.

This contamination area consists of the waste collection pond, effluent treatment area, sedimentation drying pans and all waste operation areas. Therefore, rainwater entering this zone naturally (now excluding re-directed overland flow) will also be treated as wastewater and contained within this area.

6.2. RETENTION METHODS FOR INCREASE IN STORMWATER RUNOFF

The development area of the site is approximately 200 000 square meters. This will increase the stormwater runoff from the site, as less rainwater now penetrates the natural topsoil due to roofing/paving and other impermeable site coverages. This increase, by natural regulation, needs to be retained or attenuated for slow discharge, so that the entire future stormwater runoff equals or is less than that of the pre-developed stormwater runoff.

Various cost effective methods exist that could be used to retain the runoff from the site and these are listed below:

- *Creation of "rain gardens";*
- *Constructions of "grassed swales" to contain the water for a while;*
- *Construction of "bio-retention basins";*
- *Installation of "rain barrels";*
- *Installation of a piped and underground storage system.*

6.2.1. RAIN GARDENS

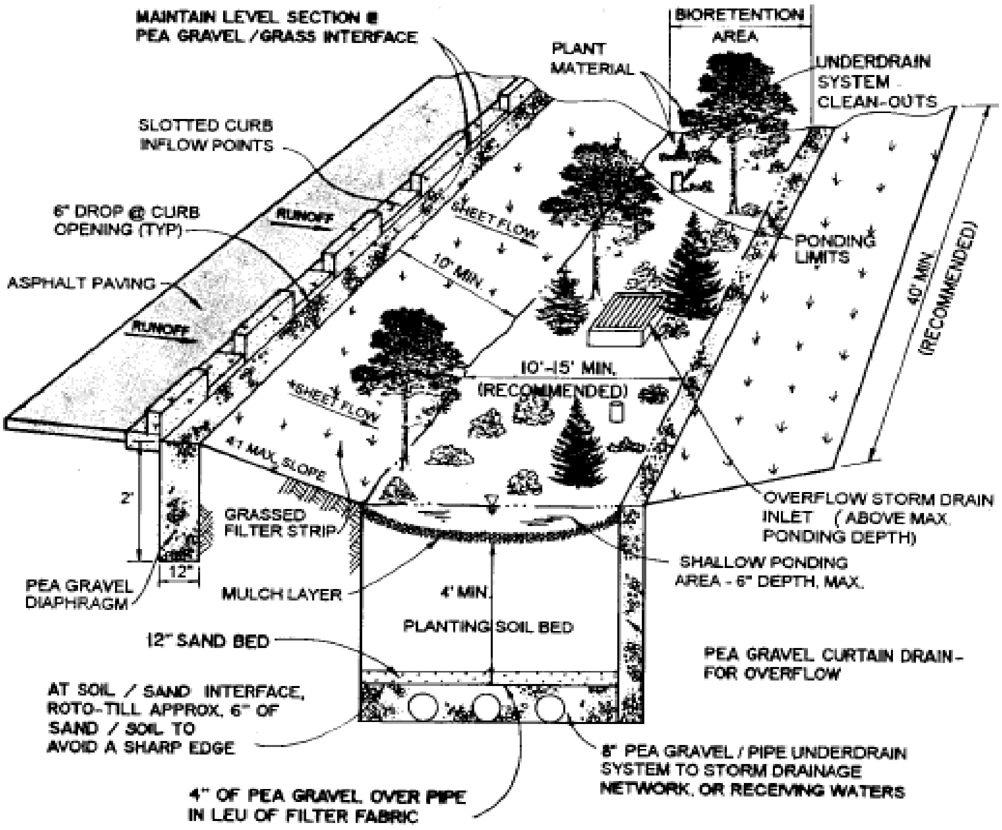
Rain gardens are gardens containing flowering plants and grasses that can survive in soil soaked with water from rain storms. However, they are not gardens that have standing water. Rain Gardens collect and slow stormwater run-off and increase its infiltration into the soil. "rain gardens" could be developed round the landscaped sections of the site where the paved areas drain towards these lower lying garden beds.

6.2.2. "GRASSED SWALES" TO CONTAIN WATER FOR A WHILE

Grassed swales are vegetated channels designed to treat and attenuate stormwater runoff for a specified water quality volume. As stormwater runoff flows through the channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. These swales function in the same way as the rain gardens and could replace rain garden areas for this development. Swales could however be developed all over the site to contain the rain water and to minimize the risk of an increase in stormwater runoff that could result in damage to property.

6.2.3. CONSTRUCTION OF "BIO-RETENTIOON BASINS"

Filter strips are gently sloping, vegetated areas adjacent to impervious surfaces. They are intended to reduce impacts of sheet flow and velocity of stormwater and help improve its water quality. Sometimes referred to as vegetated filter strips, grassed filter strips, grassed filters, or buffer strips, they help remove sediments, other pollutants and increase infiltration.



SOURCE: ADAPTED FROM PRINCE GEORGE'S COUNTY. DESIGN MANUAL FOR THE USE OF BIORETENTION IN STORMWATER MANAGEMENT, 1993

The site does not comply with the requirements for filter strips as required in terms of the guidelines and manuals for stormwater control management. The paved areas could however be shaped and kerbing installed in a way that stormwater runoff from the driveways and roofs are contained in filter strips or small swales direct adjacent to the kerb lines.

Figure 7.1 : Bio Retention Basin

6.2.4. INSTALLATION OF RAIN BARRELS

Rain barrels (sometimes called cisterns) are above ground water storage vessels that capture water runoff from a building's roof using the gutter and down pipe system. The following notes are provided on rain barrels:

- Divert water from storm drain systems and thus reduce pollutants and the velocity of water entering local rivers and streams;
- Store high quality water for gardens;
- Direct overflow water away from building foundations to more desired locations;
- Reduce water and sewer bills, as well as electrical bills from sump pump usage;
- Rain barrels can be purchased from a number of suppliers (a more expensive option) or be a make-at-home project (a cheaper, more labour-intensive option);
- Rain barrels Vary in size. Choice of size depends how much water needs to be stored;
- The wide array of choices allows for creativity when fitting barrels into garden landscapes and buildings' architecture;
- Are easily integrated into rain gardens, vegetable, flower, rock, or other gardens and green spaces;
- Adding additional rain barrels can increase the quantity of water stored. Overflow from the first barrel can be passed to a second barrel by securely connecting its overflow hose to the next barrel. Remember that the additional barrels must also be securely placed;
- Rain barrels can be used to gravity feed water to a garden.

It would appear from this system that the runoff from the roofed areas could also be limited thus reducing the volume runoff from the site and could be considered for implementation. The size of the "rain barrels" that may be required could however not be acceptable from an aesthetic point of view. The developer is advised to investigate the installation of these barrels with the purpose to use the water contained in these as "grey" water to be used toilets and watering of gardens.

7. METHOD TO CALCULATE RUNOFF OUTFLOW AND VOLUME IN CONTAMINATED AREA

STEP 1: IDENTIFY THE DESIGN RAINFALL DATA FOR THE SITE

LATDEG	LATMIN	LONGDEG	LONGMIN	SC	DC	RP	CODE	M5	M10	M15	M30	M45	M60	M90	M120	M240	M360
29	37	30	30	3	12	2	M	11.3	15.2	18	22.8	26.1	28.8	33	36.4	42.3	46.3
29	37	30	30	3	12	5	M	16.5	22.1	26.2	33.1	38	41.9	48	53	61.7	67.4
29	37	30	30	3	12	10	M	20.8	27.9	33.1	41.8	48	52.9	60.6	66.8	77.8	85.1
29	37	30	30	3	12	20	M	25.8	34.6	41	51.8	59.5	65.5	75.2	82.8	96.5	105.4
29	37	30	30	3	12	50	M	33.8	45.2	53.6	67.8	77.8	85.7	98.3	108.3	126.1	137.9
29	37	30	30	3	12	100	M	41.1	55	65.2	82.4	94.5	104.1	119.4	131.7	153.3	167.6

FIGURE A.1: Rainfall data for closest rainfall station.

STEP 2: DEMARK THE AREA OF THE CATCHMENT IN QUESTION

Demark the area of the catchment/erf in question, with contours and boundary information, where the longest watercourse, types of coverage and outflow boundary could be determined.

STEP 3: TIME OF CONCENTRATION, COURSE LENGTH AND SLOPE

Time of concentration, the time of concentration of a storm determines the time it takes for the entire catchment (furthest point/longest path) to contribute to the outflow. When a storm reaches this time, the maximum outflow will have been reached. This is done by the Kerby equation:

$$t_c = K(L \times r)^{0.467} S^{-0.235}$$

$t_c =$ Time of concentration (minutes)
$K =$ 1.44 For SI units
$L =$ Length of longest watercourse (m)
$S =$ Average Slope of longest watercourse
$r =$ Roughness constant of ground/flow surface

Ground Cover	**Kerby Retardance Coefficient, r (Chin, 2000)**
Conifer timberland, dense grass	0.80
Deciduous timberland	0.60
Average grass	0.40
Poor grass, bare sod	0.30
Smooth bare packed soil, free of stones	0.10
Smooth pavements	0.02

STEP 4: PRECIPITATION INTENSITY CALCULATION

Using the interpolated values provided, the intensity could be determined.

$$I_l = \frac{P_T^t}{t_c}$$

$I_l =$ Precipitation intensity (mm/min)

STEP 5: CALCULATE WEIGHTED RUNOFF COEFFICIENT FROM DWA COEFFICIENTS

For complex catchment areas, consisting of different land uses, slopes and ground cover, a more systematic approach than a simple table lookup is required. Such a method has been developed by the South African Department of Water Affairs (DWA). It consists of calculation sheets that enable the analyst to determine the runoff coefficient in a systematic and consistent way.

PRE/URBAN Runoff Coefficient		
URBAN	%	
Lawn Sandy < 2%	0%	0.08
Lawn Sandy > 7%	0%	0.18
Lawn Sandy < 2%	0%	0.15
Lawn Sandy > 7%	0%	0.30
Residential Single	0%	0.50
Flats/Dense Townships	0%	0.60
Industry, Light	0%	0.65
Industry, Heavy	0%	0.70
Business Local	0%	0.60
Business CBD	0%	0.85
Streets/Roofs	0%	0.95
	100%	**0.15**
AREA WEIGHTING FACTORS		
	%	DWA
RURAL	0%	0.00
URBAN	100%	0.15
LAKES	0%	0.00
Cdesign	0%	**0**

STEP 7: CONVERT PRECIPITATION INTENSITY FROM mm/min to m/s

$$\boldsymbol{i} = I_l \times 1/60000$$

STEP 8: CALCULATE OUTFLOW

The rational formula is a globally used formula, due to its simplicity. Due to the assumption of a stationary storm in this equation it works to a great accuracy on smaller catchment areas.

$$Q = C \times i \times A$$

$Q =$ Flood discharge (m^3/s)
$\boldsymbol{i} =$ Precipitation intensity (m/s)
$A =$ Drainage Area (m^2)
$C =$ Run-off coefficient

8. PRE DEVELOPMENT DISCHARGE CALCULATION

The Pre developed site consists almost entirely of undisturbed open field, with the exception of what appears to be a few small houses on the site.

The entire site (STEYNSBURG 7803-GS) is situated on a topographical crest, the operational areas of the farm are therefore elevated so that no overland flow travels through the contaminated areas

The purpose of any discharge and volume calculations would be to determine the maximum volume of rainwater that would accumulate within the enclosed "contaminated area" and also the increase in runoff due to the additional operations areas depicted on the site layout that will now have a runoff coefficient reflecting that of an industry/CBD type coverage.

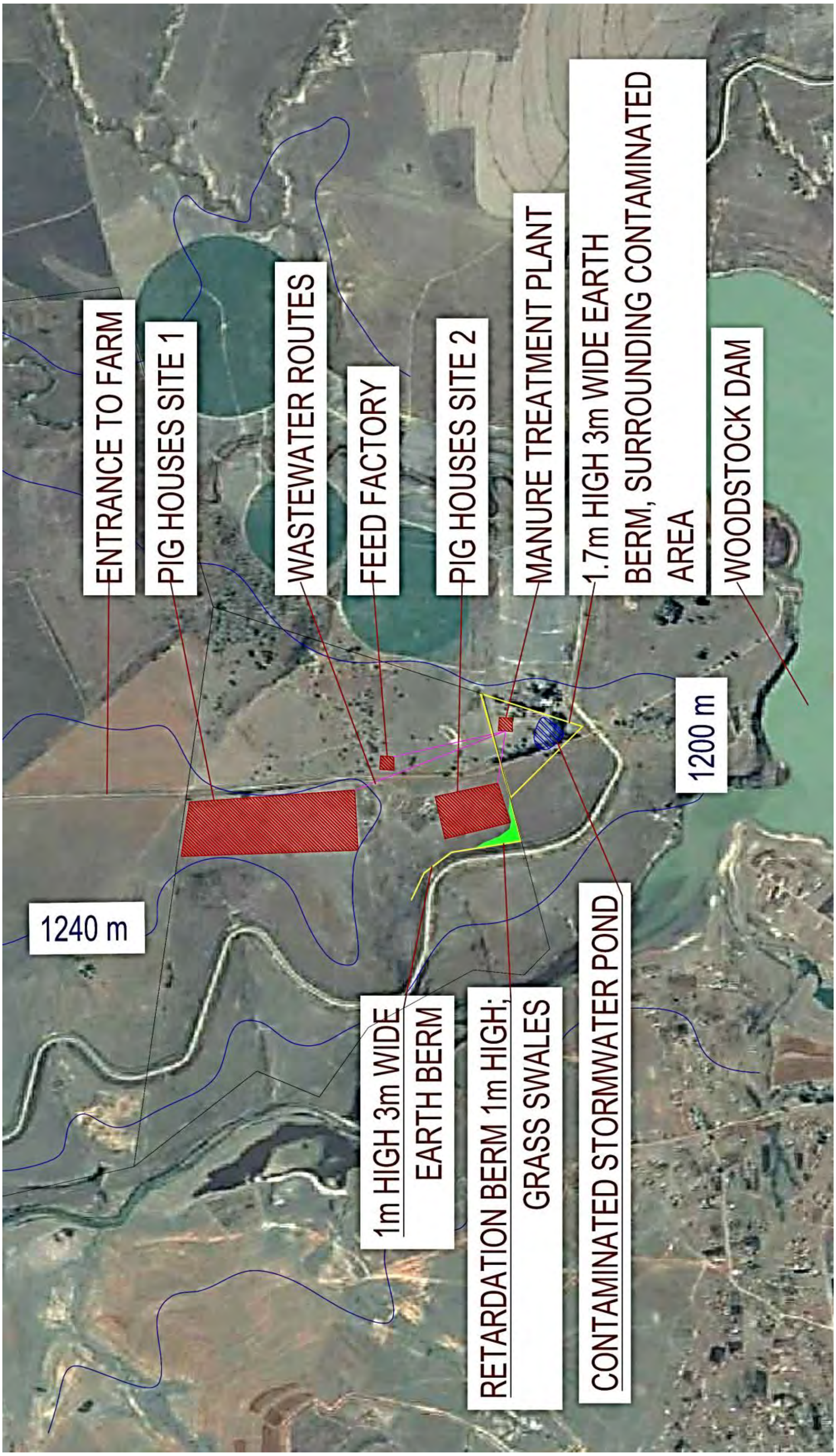


FIGURE 8.1: OPERATIONS LAYOUT: ARIEL PHOTO

STEP 1: IDENTIFY THE DRAINAGE BASIN FROM SITE LOCATION

For continuity purposes the localized areas where the additions will be built is isolated in order to determine a pre development runoff from this area.

STEP 2: DEMARK THE AREA OF THE CATCHMENT IN QUESTION

The square additions area as depicted in Figure 9.1 yields a catchment area of 200000 square meters.

The site coverage, runoff factor and average slope is as follows:

TYPE COVERAGE	RUNOFF FACTOR	AREA m^2	AVERAGE SLOPE	KERBY r
Natural field with moderate vegetation and foliage	0.3	200 000 15.6 HA + 25%	0.095	0.3

STEP 3: TIME OF CONCENTRATION, COURSE LENGTH AND SLOPE

For the determined catchment area, the time of concentration will be set to 15min:

$t_d =$ Storm duration (min); =15 minutes

STEP 4: DETERMINE POINT PRECIPITATION DEPTH P_T^t

The Point precipitation for available catchment data gives:

$T =$ Recurrence interval; (years) and =10 years, 50 years
$P_T^t =$ Precipitation depth of a storm (mm) (Read off rainfall data table)

$P_T^t = 33.1$ mm (10 years)
$P_T^t = 53.6$ mm (50 years)

STEP 5: PRECIPITATION INTENSITY CALCULATION

$$I_l = \frac{P_T^t}{t_c}$$

$I_l =$ Precipitation intensity (mm/min)

10 year	50 year
$\frac{P_T^t}{t_c} = 132.4$ mm/h	$\frac{P_T^t}{t_c} = 214.4$ mm/h

STEP 6: CALCULATE WEIGHTED RUNOFF COEFFICIENT FROM DWA COEFFICIENTS

One single runoff type, done in outflow calculation

1533.

Runoff Coefficients	
TYPE	FACTOR
Lawn Sandy < 2%	0.08
Lawn Sandy > 7%	0.18
Lawn Sandy < 2%	0.15
Lawn Sandy > 7%	0.30
Residential Single	0.50
Flats/Dense Townships	0.60
Industry, Light	0.65
Industry, Heavy	0.70
Business Local	0.60
Business CBD	0.85
Streets/Roofs	0.95

STEP 7: CONVERT PRECIPITATION INTENSITY FROM mm/min to m/s

$$\boldsymbol{i} = I_l \times 1/60000$$

10 year	50 year
$\frac{P_T^t}{t_c} = 132.4$ mm/h $i = 3.67e - 5$ m/s (divide by 3600000)	$\frac{P_T^t}{t_c} = 214.4$ mm/h $i = 5.95e - 5$ m/s (divide by 3600000)

STEP 8: CALCULATE OUTFLOW

The rational formula is a globally used formula, due to its simplicity. Due to the assumption of a stationary storm in this equation it works to a great accuracy on smaller catchment areas.

$$Q = C \times i \times A$$

$Q =$ Flood discharge (m^3/s)
$\boldsymbol{i} =$ Precipitation intensity (m/s) =Respective return periods intensities
$A =$ Drainage Area (m^2) =200 000 square meters
$C =$ Run-off coefficient =0.3 Unimproved areas grass

10 year	50 year
$Q = 2.207$ m3/s	$Q = 3.573$ m^3/s

9. POST DEVELOPMENT STORMWATER DISCHARGE

For this segment, the post development discharge is calculated, considering the proposed buildings of coverage 15.6 Ha, plus a 25% compaction and site disturbance. This as used above comes to 200 000 square meters.

STEP 1: IDENTIFY THE DRAINAGE BASIN FROM SITE LOCATION

For continuity purposes the localized area where the additions will be built is isolated in order to determine a post development runoff from this area.

The storm duration is again set to 15mins

The site coverage, runoff factor and average slope is as follows:

TYPE COVERAGE	RUNOFF FACTOR	AREA m^2	AVERAGE SLOPE	KERBY r
High density buildings, surrounded by pathways of bare packed soil and paving	0.7	200 000	0.095	0.05

STEP 3: TIME OF CONCENTRATION, COURSE LENGTH AND SLOPE

$t_d =$ Storm duration (min); =15 minutes

Time of concentration is again set to 15mins, this is the optimal Tc for high intensity low duration storms.

STEP 4: DETERMINE POINT PRECIPITATION DEPTH P_T^t

The Point precipitation for available catchment data gives:

$T =$ Recurrence interval; (years) and =10 years, 50 years
$P_T^t =$ Precipitation depth of a storm (mm) (Read off rainfall data table)

$P_T^t = 33.1$ mm (10 years)
$P_T^t = 53.6$ mm (50 years)

STEP 5: PRECIPITATION INTENSITY CALCULATION

$$I_l = \frac{P_T^t}{t_c}$$

$I_l =$ Precipitation intensity (mm/min)

10 year	50 year
$\frac{P_T^t}{t_c} = 132.4$ mm/h	$\frac{P_T^t}{t_c} = 214.4$ mm/h

STEP 6: CALCULATE WEIGHTED RUNOFF COEFFICIENT FROM DWA COEFFICIENTS

One single runoff type, done in outflow calculation

Runoff Coefficients	
TYPE	**FACTOR**
Lawn Sandy < 2%	0.08
Lawn Sandy > 7%	0.18
Lawn Sandy < 2%	0.15
Lawn Sandy > 7%	0.30
Residential Single	0.50
Flats/Dense Townships	0.60
Industry, Light	0.65
Industry, Heavy	0.70
Business Local	0.60
Business CBD	0.85
Streets/Roofs	0.95

STEP 7: CONVERT PRECIPITATION INTENSITY FROM mm/min to m/s

$$\boldsymbol{i} = I_l \times 1/60000$$

10 year	50 year
$\frac{P_T^t}{t_c} = 132.4$ mm/h $i = 3.67e - 5$ m/s (divide by 3600000)	$\frac{P_T^t}{t_c} = 214.4$ mm/h $i = 5.95e - 5$ m/s (divide by 3600000)

STEP 8: CALCULATE OUTFLOW

The rational formula is a globally used formula, due to its simplicity. Due to the assumption of a stationary storm in this equation it works to a great accuracy on smaller catchment areas.

$Q = C \times i \times A$

$Q =$ Flood discharge (m^3/s)

$\boldsymbol{i} =$ Precipitation intensity (m/s) =Respective return periods intensities

$A =$ Drainage Area (m^2) =200 000 square meters

$C =$ Run-off coefficient =0.7 Industry High density

10 year	50 year
$Q = 5.18$ m3/s	$Q = 8.33$ m^3/s

10. INCREASE IN VOLUME CALCUALTION DUE TO ADDITIONS

10.1. Increase in discharge rate between pre and post development for isolated additions area:

10 year	50 year
$Q_{change} = Q_{post} - Q_{pre}$ $Q_{change} = 5.18 - 2.207 = 2.973$ m^3/s	$Q_{change} = Q_{post} - Q_{pre}$ $Q_{change} = 8.33 - 3.573 = 4.757$ m^3/s

For this calculation we only consider the first section of a hydrograph where the assumption of a linear increase in flow is made. Therefore, the excess volume of water will be determined by a triangular area up to the time of concentration. Hence;

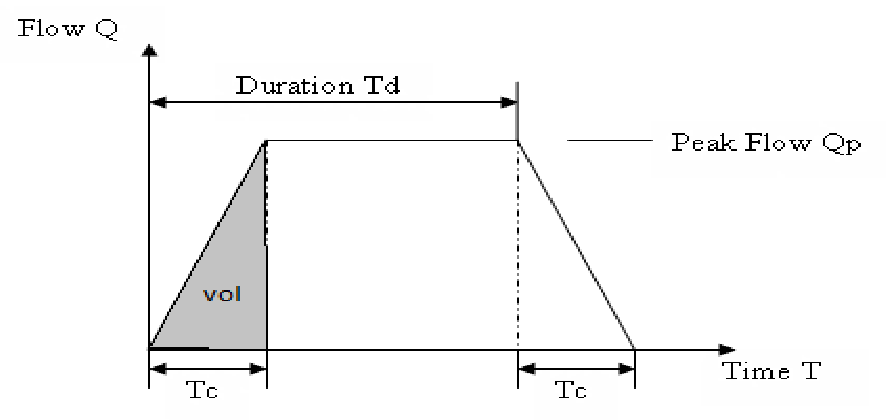


FIGURE 11.3.1 Typical linear outflow vs storm duration graph.

Increase in volume of water during design storm duration:

10 year	50 year
$V = \frac{1}{2} Q_{change} \times t_d \times 60$ $V = \frac{1}{2} 2.973 \times 15 \times 60 = 1337 \text{ m}^3$	$V = \frac{1}{2} Q_{change} \times t_d \times 60$ $V = \frac{1}{2} 4.757 \times 15 \times 60 = 2140 \text{ m}^3$

This suggests that 2140 additional cubic meters of outflow will be produced during a 1:50 year storm, this volume of water needs to be attenuated on this site and either retained in a ponding area where it can naturally infiltrate into the subgrade, or it should be ponded and slowly discharged at a rate not exceeding the pre development outflow.

11. WASTE COLLECTION AREA STORMWATER ACCUMULATION VOLUME

The wastewater collection and operations area will be considered as a closed catchment. As previously mentioned, this area includes all operations and works on waste products generated by the piggery. This isolated catchment should encompass the wastewater collection pond, waste treatment area, effluent collection, sedimentation drying pans etc.

The purpose of this segment is to determine a storage volume required to retain the rainwater falling within this area of contamination, where the rainwater collected should then be treated along with the effluent and waste products as it would be contaminated due to this area not being a roofed zone.

DEMARK THE AREA OF THE CATCHMENT IN QUESTION

The proposed contamination area covers approximately 79000 square meters. Figure 15.1 shows the proposed area and the isolation thereof by beams of a 1.5m high earth berm with access into this area over the berm and not through, as to ensure all waste and contaminated effluent and stormwater are retained in this area. Figure 15.1 shows the wastewater collection sedimentation pond, that should be fitted or inspected by a relevant specialist to evaluate the existing and future operational functionality of this pond, such that no untreated effluent is released onto natural water routes.

The required storage volume of the indicated stormwater collection area depicted in figure 15.1, is calculated in this segment:

FIGURE 15.1: PROPOSED ISOLATION OF CONTAMINATION ZONE

PRECIPITATION INTENSITY USED:

10 year	50 year
$\frac{P_T^t}{t_c} = 132.4$ mm/h $i = 3.67e - 5$ m/s (divide by 3600000)	$\frac{P_T^t}{t_c} = 214.4$ mm/h $i = 5.95e - 5$ m/s (divide by 3600000)

STEP 8: CALCULATE OUTFLOW

The rational formula is a globally used formula, due to its simplicity. Due to the assumption of a stationary storm in this equation it works to a great accuracy on smaller catchment areas.

$Q = C \times i \times A$

$Q =$ Flood discharge (m³/s)

$\boldsymbol{i} =$ Precipitation intensity (m/s) =Respective return periods intensities

$A =$ Drainage Area (m²) =79 000 square meters

$C =$ Run-off coefficient =0.4 Bare smooth packed soil, pans and dams

10 year	50 year
$Q = 1.16$ m3/s	$Q = 1.882$ m^3/s

Design storage for Stormwater within the "contaminated area":

10 year	50 year
$V = \frac{1}{2} Q_{total} \times t_d \times 60$ $V = \frac{1}{2} 1.16 \times 15 \times 60 = 522$ m^3	$V = \frac{1}{2} Q_{total} \times t_d \times 60$ $V = \frac{1}{2} 1.882 \times 15 \times 60 = 850$ m^3

Since this area has a high sensitivity, the storage pond would be sized for that of a 1:50 year flood. Therefore, a volume of 850 m³ should be stored. This area is therefore suitable to retain a high intensity flash storm, considering continuous treatment of the runoff and releasing it back into the natural surrounding areas.

Pond Average depth should therefore be about 1.5m to allow for sedimentation buildup and debris with gradual side slopes and waterproof pond liner as per specialist, this volume should then hold five times the discharge volume of a single high intensity 1:50 year storm.

Therefore, the pond size should be dimensioned for 4250 cubic meters.

12. CONCLUSION

This report yields a number of important implementations that need to be made on the site in order to keep pollutants from entering the surrounding natural flood routes. Pre and post development runoff calculations for the additions along the south-east part of the operations yielded the required temporary storage for the increase in runoff due to new facilities on previously undeveloped land.

Section 15 of this report focuses on the isolation of pollutants within a controlled catchment area, where the area is enclosed by means of a 3m wide and 1.7m earth berm, keeping the pollutants safely isolated from possible flash floods coming down the directly adjacent flood routes that pass through the site.

Firstly, to revert back to solving the increase in runoff due to the additions mentioned above, it would be safe to assume that by surrounding the waste treatment area with earth berms and retaining all stormwater entering this area by means of precipitation, will amply catch and retain the at least half the volume caused by the increase in runoff calculated in section 14. In order to attenuate an additional volume of water to decrease the site runoff due to development, another earth berm is placed on the south-western boundary, and planted with grass swales to retard the overland flow and assist in water infiltration.

Furthermore, new ponds should be built with adequate waterproof linings as per specialist, in order to restrict ingress of pollutants into natural underground water sources. Figure 15.1 shows the proposed area to be enclosed with an earth berm, this berm should disallow overland flow into the waste treatment area, and also bar any stormwater and untreated effluent from exiting this area.

FIGURE 15.1: PROPOSED ISOLATION OF CONTAMINATION ZONE

All proposed measures in this report strictly depend on the design requirements that all waste collection tanks and waste transportation conduits be closed such that no waste could ever contaminate overland flow passing through the operational areas.

Infrequent maintenance of these conduits could result in over spilling of contaminants. It is therefore crucial that the systems that transport waste products be maintained by means of an official maintenance schedule at appropriate intervals. The maintenance schedule should include a weekly system check in order to ensure that design operation of the waste management is strictly adhered to.