agriculture, rural development,
land & environmental affairs
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA
Building No. 6, No. 7 Government Boulevard, Riverside Park, 1200, Mpumalanga Province GERT SIBANDE REGION
Private Bag X 11219, 1200
Tel: +27 (013) 766 6067/8, Fax: +27 (013) 766 8295, Int Tel: +27 (13) 766 6067/8, Int Fax: +27 (13) 766 8295

Litiko Letekulima, Kutfutfukiswa Kwetindzawo Tasemakhaya, Temhlaba Netesimondzawo

Departement van Landbou, Landelike Ontwikkeling, Grond en Ongewing Sake

umNyango weZelimo UkuThuthukiswa kweeNdawo zemaKhaya, iNarha neeNdaba zeBhoduluko

Application form for the rectification of unlawful commencement or continuation of a listed activity in terms of S24G of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

2017

Kindly note that:

1. This application form must be completed for all applications in terms of S24G of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.

2. An independent EAP must be appointed to complete the application form on behalf of the applicant; the declaration of independence must be completed by the independent EAP and submitted with the application.

3. In cases where an activity applied for commenced during the ECA and other activities commenced during NEMA, two applications forms must be submitted.

4. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the application form have been published or produced by the relevant competent authority.

5. The content of the application for rectification form comprises of:

   Section A: Application Information
   Section B: Activity Information
   Section C: Description of Receiving Environment
   Section D: Preliminary Impact Assessment
   Section E: Alternatives
   Section F: Appendices
   Section G: Declarations
   Annexure A: S24G Fines Regulations

6. It is compulsory to comply and complete Annexure A of this application.

7. Incomplete applications will be returned to the applicant for revision and re-submission.

8. The required information must be typed within the spaces provided. The sizes of the spaces provided are not necessarily indicative of the amount of information to be provided. The space provided extend as each space is filled with typing. A legible font type and size must be used when completing the form. The font size should not be smaller than 10pt (e.g. Arial 10).

9. The use of *"not applicable"* in the application form must be done with circumspection.

10. No faxed or e-mailed applications will be accepted. This application form must be submitted by hand or mailed to the Department.

11. Unless protected by law, all information contained in and attached to this application form may become public information on receipt by the competent authority. Upon request, any interested and affected party must be provided with the information contained in and attached to this application form.

12. This application form constitutes the initiation of the S24G application process.

13. **Activities which result in detrimental impacts to the environment are considered in a serious light by the Department and accordingly Applicants must understand that by lodging an application for the continuation of activities that commenced/ was undertaken unlawfully does not necessarily imply that the activity will be authorised. In terms of the NEMA, the MEC may either refuse to issue an EA, conditionally authorise the activity or direct you, the Applicant, to provide further information or take further steps prior to making a decision.**

DEPARTMENTAL DETAILS

DEPARTMENT DETAILS

Applications must be submitted by hand to:

S24G Unit Manager **: Ms T Tanda**
E-mail : ttanda@mpg.gov.za
Contact : **072 249 1384**
: And Ms Zandile Ngobeni
: dlaminiz@mpg.gov.za
: **079 365 9296**
Mpumalanga Department of Agriculture,Rural Development, Land and Environmental Affairs
Physical Address :2nd Floor Block 4,**Office Number 231 / 237**
Cycard Building, East Tower
Riverside Office Park (Opposite Audi Entrance Gate)
Aqua Street
Nelspruit
1200

S24G Regional Assistant Directors:

Gert Sibande **: Mr Musa Luhlanga**
Email **: mmluhlanga@mpg.gov.za**
Contact **: 082 769 4478**
Nkangala **: Mr Quinton Shakwane**
Email **: kgshakwane@mpg.gov.za**
Contact **: 082 597 9758**
Ehlanzeni **: Ms Nocawe Nkosi**
Email **: nocawe@mpg.gov.za**
Contact **: 082 683 0594**
Mpumalanga Department of Agriculture,Rural Development, Land and Environmental Affairs
Tel: Head Office 013 766 6067/8

SECTION A: APPLICATION INFORMATION

1. APPLICANT PROFILE INDEX

Cross out the appropriate box "☒".

1.1	The applicant is an individual	YES	NO
1.2	The applicant is a company	YES	NO
1.3	The applicant is a state-owned enterprise or municipality	YES x	NO
1.4	Other (specify)	YES	NO
1.5	There is more than one individual / company responsible for the unlawful commencement of listed activities	YES	NO

Name of Project applicant:	Msukaligwa Luthuli Local Municipality		
RSA Identity number:			
Contact person:			
Position in company			
Registered Name of Company/ Closed Corporation	N/A		
Trading name (if any):	Msukaligwa Local Municipality		
Registration number	N/A		
Postal address:	Corner Taute and Church street,		
	Ermelo,Mpumalanga	Postal code:	2350
Telephone:	(017) 8013851	Cell:	N/A
E-mail:		Fax:	( )

Please Note: In instances where there is more than one individual / company responsible for the unlawful commencement of listed activities, please attach a list of with all contact details to the back of this page.

Environmental Assessment Practitioner (EAP):	Mang Geoenviro Services		
Contact person:	Phakwago M.Kabelo		
Postal address:	687 Silverlakes Road, Unit 11 Kingfisher Building		
	Hazeldean Office Park	Postal code:	0081
Telephone:	(012) 770 4022	Cell:	079 054 7652
E-mail:	kabelo@manggeoenviro.co.za	Fax:	( )
EAP Qualifications	Advanced Diploma in Environmental Sciences		
EAP Registrations/Associations	Reg.EAP (2021/3538) & Cand. Sci. Nat (134805)		

Name of Landowner(s):	Msukaligwa Local Municipality		
Contact person(s):			
Postal address:	Corner Taute and Church street,		
	Ermelo, Mpumalanga	Postal code:	2350
Telephone:	(017) 801 3851	Cell:	N/A
E-mail:		Fax:	( )

Please Note: In instances where there is more than one landowner, please attach a list of landowners with their contact details to the back of this page.

Municipality in whose area of jurisdiction the activity falls:	Msukaligwa Local Municipality		
Contact person:			
Postal address:	Corner Taute and Church Street ,		
	Ermelo, Mpumalanga	Postal code:	1185
Telephone	(017) 801 3851	Cell:	N/A
E-mail:	thabetheme@albertluthuli.gov.za	Fax:	( )

Please Note: In instances where there is more than one Municipality involved, please attach a list of Municipalities with their contact details to the back of this page.

Project title:	The proposed formalization of the Davel township on portion of the farm Davelfontein 267-IS within the jurisdiction of Msukaligwa Local Municipality in Mpumalanga Province.					
Property location:	Davel township					
Farm/Erf name & number (incl. portion):	Portions of farm Davelfontein 267- IS					
SG21 Digit code:	T0IS00000000026700000					
Co-ordinates:	Latitude (S):			Longitude (E):		
	26º	27‘	46.52“	29º	39‘	18.98“

Please Note:
Where a large number of properties are involved (e.g. linear activities), attach a list of property descriptions to the back of this page.
Indicate the position of the activity using the latitude and longitude of the center point of the site for each alternative site. The co-ordinates must be in degrees, minutes and seconds. The minutes must be given to at least three decimals to ensure adequate accuracy. The EAP is required to contact the relevant competent authority with regards to the projection that must be used.

Street address:	The site can be accessed through the N17 highway
Magisterial District or Town:	Gert Sibande

Please Note: In instances where there is more than one town or district involved, please attach a list of towns or districts as well as complete physical address information for the entire area to the back of this page.

Closest City/Town:	Ermelo	Distance	13.6km

Zoning of Property:	Agricultural

Please Note:In instances where there is more than one zoning, please attach a map clearly indicating zoning of the different portions.

Was a rezoning application required?	YES	NO x
Was a consent use application required?	YES	NO x

Please Note: Where planning approvals have been granted please attach the relevant approvals.

Owners consent:	**Letters of consent from all landowners or a detailed explanation by the applic explaining why such letters of consent are not furnished must be attached to application form. .**

2. APPLICATION HISTORY

(Cross out the appropriate box "☒" and provide a description where required).

Has any national, provincial or local authority considered any development applications on the property previously?	Yes	No x

If so, please give a brief description of the type and/or nature of the application/s: (In instances where th were more than one application, please attach a list of these applications)

Not applicable, the DEA screening tool did not identify any applications on the property in question. Screening report attached.

Which authority considered the application(s):

Not Applicable

Has any one of the previous application/s on the property been approved or rejected so provide a list of the successful and unsuccessful application/s and the reasons decision/s.	Yes	No x

Not Applicable

Provide detail on the period of validity of decision(s) and expiry dates of the above applications/ permits etc.

Not Applicable

I hereby apply in terms of Section 24 G of the National Environmental Management Act (Act no 107 of 1998 as amended) for the rectification of the unlawful commencement or continuation of the listed activity(ies) in Section B of the application form:

Applicant (Full names) _____

Signature _____

Place _____ Date: _____

EAP (Full names)_____

Signature_____

Place _____ Date: _____

SECTION B: ACTIVITY INFORMATION

1. ACTIVITIES APPLIED FOR:

Separate applications are required for one development site where more than one listed activity has commenced and where these unlawfully commenced activities constitute offences in terms of different EIA regulations (refer to Table 1 & 2 of the S24G guideline).

Applicants and EAPs are strongly advised to discuss the merits of a combined application *(if deemed applicable)* with the relevant competent authority prior to the completion of this application form and submission thereof.

The Department will use its discretion in deciding to allow one application for more than 1 Section 24F contravention on one development site.

All potential listed activities associated with the development must be indicated below. (See Annexures B, C, D and E). Only those activities for which the applicant applies will be considered.

Where the EIA activity/ies applied for commenced during 2006, 2010 and 2014 listed activity regimes, the corresponding activity listed in the 2017 listings must be indicated in Table 6.

Where the Waste Management activity/ies applied for commenced during 2009 and 2013 listed activity regimes, the corresponding activity/ies listed in the 2017 listings must be indicated in Table 9.

The onus is on the applicant to ensure that all the applicable listed activities are included in the application.

Listed activities applied for. Identify the relevant listed activities applied for below:

National Environmental Management Act, 1998

Table 1:

ECA EIA Contraventions: Between 08 September 1997, end of day 09 May 2002 and still listed in terms of 2010 Regulations.	
Activities unlawfully commenced with on or after 08 September 1997 and before end 09 May 2002: EIA Regulations promulgated in terms of the ECA, Act No 73 of 1989, as amended and are still in terms of 2010 Regulations.	
Listed Activity(ies)	Details of Activity(ies)

Table 2:

ECA EIA Contraventions: Between 10 May 2002 and before end of day 03 June 2006 and still listed in terms of 2017 EIA Regulations	
Activities unlawfully commenced with on or after 10 May 2002 and before end of day 02 June 2006: EIA Regulations promulgated in terms of the ECA, Act No 73 of 1989, as amended and are still listed in terms of 2010 Regulations.	
Listed Activity(ies)	Details of Activity(ies)

Table 3:

NEMA EIA Contraventions: Between 03 June 2006 and before end of day 01 August 2010	
Activities unlawfully commenced with in terms of the NEMA, Act No 107 of 1998 (as amended) after 03 July 2006 and ended 01 August 2010	
Government Notice No. R386 Activity No(s):	Details of Activity(ies) requiring Basic Assessment
Government Notice No. R387, Activity No(s):	Details of Activity(ies) requiring a Scoping Report and EIA

Table 4:

NEMA EIA Contraventions: From 02 August 2010 and before end of day 7 December 2014	
Activities unlawfully commenced with in terms of the NEMA, Act No 107 of 1998 on/after 02August 2010 and ended 7 December 2014	
Government Notice No. R544Activity No(s):	Details of Activity(ies) requiring Basic Assessment
Government Notice No. R545, Activity No(s):	Details of Activity(ies) requiring a Scoping Report and EIA
Government Notice No. R546, Activity No(s):	Details of Activities that occurred in specific identified geographical areas only and requires a Scoping Report and EIA

Table 5:

NEMA EIA Contraventions: From 08 December 2014 and before end of day 6 April 2017	
Activities unlawfully commenced with in terms of the NEMA, Act No 107 of 1998 on/ after 08 December 2014 and ended 6 April 2017	
Government Notice No. R983 Activity No(s):	Details of Activity(ies) requiring Basic Assessment
9	The proposed development includes installation of bulk infrastructure for water or stormwater purposes.
10	The bulk reticulation to cater for the proposed development will be required.

12	A bufferzone of 30m within any watercourse will have to be kept for the proposed development.
28	The proposed formalization of Davel informal township include residential area, business area, educational facility, institutional facilities, municipal facility and public open spaces on an area currently zoned agriculture.
Government Notice No. R984, Activity No(s):	Details of Activity(ies) requiring a Scoping Report and EIA
15	The proposed development entails clearance and preparing an extent area of 35.87 hectares for formalization of Davelfontein.
Government Notice No. R985, Activity No(s):	Details of Activities that occurred in specific identified geographical areas only and requires a Scoping Report and EIA

Table 6:

NEMA EIA Contraventions: From 07April 2017	
Activities unlawfully commenced with in terms of the NEMA, Act No 107 of 1998 on/ after 07 April 2017	
Government Notice No. R983, as amended, Activity No(s):	Details of Activity(ies) requiring Basic Assessment
Government Notice No. R984, as amended, Activity No(s):	Details of Activity(ies) requiring a Scoping Report and EIA
Government Notice No. R985,as amended, Activity No(s):	Details of Activities that occurred in specific identified geographical areas only and requires a Scoping Report and EIA

<u>National Environmental Management: Waste Act, 2009.</u>

Table 7:

NEMWA Activity, 2009: From 03 July 2009 and before end of day 28 November 2013
Activities unlawfully commenced with in terms of the NEMWA, 2008 promulgated in terms of the NEMA, Act No 107 of 1998 on/after 03 July 2009 and ended 28 November 2013

Government Notice No. 718 List of Waste Management Activities No(s):	Details of Activity(ies) requiring Basic Assessment
Government Notice No. 718 List of Waste Management Activity No(s):	Details of Activity(ies) requiring a Scoping Report and EIA

Table 8:

NEMWA Activity, 2009: From 01 July 2013 and before end of day 10 October 2017	
Activities unlawfully commenced with in terms of the NEMWA, 2008 promulgated in terms of the NEMA, Act No 107 of 1998 on/after 29 November and ended 10 October 2017	
Government Notice No. 921 List of Waste Management Activities No(s) Category A:	Details of Activity(ies) requiring Basic Assessment
Government Notice No. 921 List of Waste Management Activity No(s) (Category B):	Details of Activity(ies) requiring a Scoping Report and EIA

Table 9:

NEMWA Activity, 2009: From 11 October 2017	
Activities unlawfully commenced with in terms of the NEMWA, 2008 promulgated in terms of the NEMA, Act No 107 of 1998 on/after 11 October 2017	
Government Notice No. 921, as amended, List of Waste Management Activities No(s): Category A:	Details of Activity(ies) requiring Basic Assessment
Government Notice No. 921, as amended, List of Waste Management Activity No(s), (Category B):	Details of Activity(ies) requiring a Scoping Report and EIA

2. ACTIVITY DESCRIPTION

(Cross out the appropriate box"☒" and provide a description where required).

(a) Is/was the project a new development or an upgrade of an existing development?	New x	Upgrade

(b) Clearly describe the activity and associated infrastructure commenced with, indicating what has been completed, what still has to be completed and applicable commencement dates.

The Msukaligwa Local Municipality is proposing the formalization of the Davel township on an extent area of 35.87 hectares which will also include the provision of bulk infrastructures for the Davel township. The proposed development is situated on a portion of farm Davelfontein 267-IS in Mpumalanga Province. The proposed formalization of the existing township in Davel will include the following:

- 600 x Residential 1 – residential
- 2 x Business 1 – business
- 1 x Education – crèche
- 1 x Community services – community facility
- 2 x Public Open Space – park
- Special zone – servitude
- Streets

It can also be accessed through the N17 highway in the south-west province between the larger towns of Bethal and Ermelo. The Davel area has a problem of illegal occupation of land; therefore, the municipality intends to address the issue and formalize the area as much as it can.

The proposed development site is currently occupied by illegal occupants. This resulted in the clearance of indigenous vegetation and erection of infrastructures which falls under listed activities in terms of NEMA EIA Regulations (2014).

(c) Provide details of all components of the activity and attach diagrams (e.g. architectural drawings or perspectives, engineering drawings, process flow charts etc.).

Buildings	YES	NO x
Provide brief description:		
The proposed development site is partially erected with infrastructures which are utilized by illegal occupants.		
Infrastructure (e.g. roads, power and water supply/ storage)	YES	NO x
Provide brief description:		
The existing infrastructures on the proposed development site includes residential, school, church, business and open space		

Processing activities (e.g. manufacturing, storage, distribution)	YES	NO x
Provide brief description:		
Not Applicable		
Storage facilities for raw materials and products (e.g. volume and substances to be stored)		
Provide brief description	YES	NO x
Not Applicable		
Storage and treatment facilities for solid waste and effluent generated by the project	Yes	NO x
Provide brief description		
Not Applicable		
Other activities (e.g. water abstraction activities, crop planting activities)	Yes	NO x
Provide brief description		
Not Applicable		

3. ACTIVITY NEED AND DESIRABILITY

Describe the need and desirability of the activity:
The proposed development will address the issue of resettlement of people in informal settlements. There is also a high risk of encroachment on this land should the development not be approved as planned for by Msukaligwa Local Municipality. The proposed development will prompt other developments in the area as there will be decentralization of services into the main central business areas of the Msukaligwa Local Municipality which will benefit the society in having access to services in close proximity. It will also improve and aid in more business opening in the areas. The proposed development will create job opportunities during the construction phase. This will result in the development providing a much-needed short term socio-economic return. It is strongly recommended that local subcontractors and laborers should be prioritized in the construction contract. This would increase the socio-economic return of the development.
Indicate the benefits that the activity has/had for society in general and also indicate what benefits the activity has/had for the local communities where it is located:
It will create job opportunities (permanent and temporary), ensure social upliftment of the area, create investment opportunities and create a sustainable development environment. Furthermore, the development will eventually be integrated with the environment, have proper service provision and it will be well planned.

4. PHYSICAL SIZE OF THE ACTIVITY

Indicate the physical spatial size of the activity as well as associated infrastructure (footprints):	***416000m²***
Indicate the area that has been transformed / cleared to allow for the activity as well as associated infrastructure	***416000m²***
Total area (sum of the footprint area and transformed area)	***416000m²***

5. SITE ACCESS

Was there an existing access road?	YES x	NO
If no, what was the distance over which the new access road was built?		*m*
Describe the type of access road constructed: [indicate the position of the access road on the site plan]		
The site can be accessed through unnamed road from the R541.		

6. SITE PHOTOGRAPHS

Color photographs of the site and its surroundings (taken of the site and from the site), both before (if available) and after the activity commenced, with a description of each photograph must be attached to this application. The vantage points from which the photographs were taken must be indicated on the site plan, or locality plan as applicable. If available, please also provide past and recent aerial photographs. It should be supplemented with additional photographs of relevant features on the site. Date of photographs must be included. Photographs must be attached under Appendix D to this form.

7. APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

Please list all legislation, policies and/or guidelines that were or are relevant to this activity.

Legislation	Administering Authority	Type Permit/ license/ authorization/comment	Date (if already obtained):
National Heritage Resource Act 1999, (Act 1999 No.25 of 1999)	South Africa Heritage Resource Act (SAHRA)	Record of Decision	-
National Environmental Management Act, 1998 (Act No. 107 of 1998)	DARDLEA	Environmental Authorisation	-

2014 Environmental Impact Assessment Regulations, promulgated in terms of Section 24(5) of NEMA (as amended on 07 April 2017)	DARDLEA	Environmental Authorisation	-
Constitution of the republic of South Africa 108 of 1996	South African Government	Constitution makes provision for access to safe environment, housing and education	-
POLICY/ GUIDELINES		ADMINISTERING AUTHORITY	
Msukaligwa Integrated Development Plan (IDP) 2022/2021		Municipal (District)	
Msukaligwa Spatial Development Framework 2021/2022		Municipal (District)	
Municipal Systems Act 32 of 2000		Msukaligwa Local Municipality	

SECTION C: DESCRIPTION OF RECEIVING ENVIRONMENT

Site/Area Description

For linear activities (pipelines etc) as well as activities that cover very large sites, it may be necessary to complete copies of this Section for each part of the site that has a significantly different environment. In such cases please complete copies of Section C and indicate the area which is covered by each copy No. on the Site Plan.

Section C Copy No. (e.g. 1, 2, or 3):

1. GRADIENT OF THE SITE

Indicate the general gradient of the site(s) (cross out the appropriate box).

Flat	Flatter than 1:10	1:10 – 1:5	Steeper than 1:5

2. LOCATION IN LANDSCAPE

Indicate the landform(s) that best describes the site (cross out ("☒") the appropriate box (es).

Ridgeline	Side slope of ridge	Plain	Ridge	Other
If other, provide details.				

3. GROUNDWATER, SOIL AND GEOLOGICAL STABILITY OF THE SITE

Is the site(s) located on or near any of the following [cross out ("☒") the appropriate boxes]?

Shallow water table (less than 1.5m deep)	YES	NO	UNSURE
Seasonally wet soils (often close to water bodies)	YES	NO	UNSURE
Unstable rocky slopes or steep slopes with loose soil	YES	NO	UNSURE
Dispersive soils (soils that dissolve in water)	YES	NO	UNSURE
Soils with high clay content	YES	NO	UNSURE
Any other unstable soil or geological feature	YES	NO	UNSURE
An area sensitive to erosion	YES	NO	UNSURE
If any of the answers to the above are "YES" or "UNSURE", specialist input may be requested by the Department. Information in respect of the above will often be available at the planning Sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by Geological Survey may also be used.			

4. SURFACE WATER

Indicate the surface water present on and or adjacent to the site and alternative sites (cross out ("☒") the appropriate boxes)?

Perennial River	YES	NO	UNSURE
Non-Perennial River	YES	NO	UNSURE
Permanent Wetland	YES	NO	UNSURE
Seasonal Wetland	YES	NO	UNSURE
Artificial Wetland	YES	NO	UNSURE
If any of the answers to the above are "YES" or "UNSURE", specialist input may be requested by the Department. Information in respect of the above will often be available at the planning Sections of local authorities. Where it exists, the 1:50 000 scale Regional Geotechnical Maps prepared by Geological Survey may also be used.			

5. VEGETATION AND GROUNDCOVER

5.1 VEGETATION / GROUNDCOVER (PRE-COMMENCEMENT, IF KNOWN)

Cross out ("☒") the block or describe (where required) the vegetation types / groundcover present on the site before commencement of the activity.

Indigenous Vegetation - good condition		Indigenous Vegetation with scattered aliens		Indigenous Vegetation with heavy alien infestation	X
Describe the vegetation type above:		Describe the vegetation type above:		Describe the vegetation type above: The site falls within the grassland biome vegetation (Amersfoort clay grassland) characterized by sparse shrubs. Herbaceous plants and invasive weeds are present on site with Invasive plant species being dominant.	
Provide ecosystem status for above:		Provide ecosystem status for above:		Provide Ecosystem status for above: The site falls under present ecological state class E which is a seriously modified ecosystem most of the damage have occurred which led to site having less functionality in support of the ecosystems and connection with other ecosystems.	
Indigenous Vegetation in an ecological corridor or along a soil boundary / interface		Veld dominated by alien species x		Distinctive soil conditions (e.g. Sand over shale, quartz patches, limestone, alluvial deposits, termitaria etc.) – describe	
Bare soil		Building or other structure x		Sport field	
Other (describe below)		Cultivated land		Paved surface	

5.2. VEGETATION / GROUNDCOVER (POST-COMMENCEMENT)

Cross out ("☒") the block or describe (where required) the vegetation types / groundcover present on the site after commencement of the activity.

Indigenous Vegetation - good condition		Indigenous Vegetation with scattered aliens		Indigenous Vegetation with heavy alien infestation	x
Describe the vegetation type above:		Describe the vegetation type above:		Describe the vegetation type above: Vegetation types are described in section 5.1 above. Some of disturbance to this vegetation has taken place within the development footprint which needs to be rehabilitated.	
Provide ecosystem status for above:		Provide ecosystem status for above:		Provide Ecosystem status for above:	
Indigenous Vegetation in an ecological corridor or along a soil boundary / interface		Veld dominated by alien species x		Distinctive soil conditions (e.g. Sand over shale, quartz patches, limestone, alluvial deposits, termitaria etc.) – describe	
Bare soil		Building or other structure x		Sport field	
Other (describe below)		Cultivated land		Paved surface	
Please note: The Department may request specialist input/studies depending on the nature of the vegetation type / groundcover and impact(s) of the activity/ies.					

5.3 VEGETATION / GROUNDCOVER MANAGEMENT

Describe any mitigation/management measures that were adopted and the adequacy of these:

No apparent mitigation measures were available for implementation.

6. LAND USE CHARACTER OF SURROUNDING AREA (PRE-COMMENCEMENT)

Cross out ("☒") the block that reflects the past land uses and/or prominent features that occur/red within +/- 500m radius of the site and neighbouring properties if these are located beyond 500m of the site.
Please note: The Department may request specialist input/studies depending on the nature of the land use character of the area and impact(s) of the activity/ies.

Untransformed area x	Low density residential x	Medium density residential	High density residential	Informal residential x
Retail	Commercial & warehousing	Light industrial	Medium industrial	Heavy industrial
Power station	Office/consulting room	Military or police base/station/compound x	Casino/entertainment complex	Tourism & Hospitality facility
Open cast mine	Underground mine	Spoil heap or slimes dam		Dam or reservoir

			Quarry, sand or borrow pit	
Hospital/medical center	School x	Tertiary education facility	Church	Old age home
Sewage treatment plant	Train station or shunting yard	Railway line	Major road (3 lanes or more) x	Airport
Sport facilities x	Golf course	Polo fields	Filling station	Landfill or waste treatment site
Plantation	Agriculture x	River, stream or wetland x	Nature conservation area	Mountain or ridge
Museum	Historical building	Graveyard	Archaeological site	
Other land uses (describe):				

7. REGIONAL PLANNING CONTEXT

Is/was the activity permitted in terms of the property's existing land use rights? Please explain

Yes, the activity is permitted in terms of the existing land use right.			
Is/was the activity in line with the following?			
o Provincial Spatial Development Framework (PSDF)	YES x	NO	Please explain
Specific activities in Davel fall outside this planning. The area is within the boundaries of residential communities; therefore, the proposed development will be utilized for activities associated with the nearby land uses.			
o Urban edge / Edge of Built Environment for the area	YES	NO x	Please explain
The site falls outside the urban edge.			
o Integrated Development Plan of the Local Municipality	YES x	NO	Please explain
Msukaligwa Local Municipality believes the principles call for the emergence of settlement patterns which benefits accessible to the people of Davel. For this approach to be realized all settlements in Davel should strive to achieve the following qualities: • To generate a wide range of economic opportunities. • To be convenient for inhabitants to conduct their daily activities, easily and as inexpensively as possible, • To offer a choice of living conditions to all,			

• To be equitable in the sense that all inhabitants have reasonable access to the opportunities and facilities which support living in settlements, • To promote the efficient use of resources, and • To give dignity to people through the quality of the public spatial environment. The proposed development meets all the principles mentioned above for settlements opportunities.			
o Spatial Development Framework of the Local Municipality	YES x	NO	Please explain
The Msukaligwa Local Municipality believes the principles call for the emergence of settlement patterns which create benefits accessible to the people of Davel. For this approach to be realised all settlements in Davel should strive to achieve the following qualities: • To generate a wide range of economic opportunities. • To be convenient to inhabitants to conduct their daily activities, easily and as inexpensively as possible, • To offer a choice of living conditions to all, • To be equitable in the sense that all inhabitants have reasonable access to the opportunities and facilities which support living in settlements, • To promote the efficient use of resources, and • To give dignity to people through the quality of the public spatial environment. The proposed development meets all the principles mentioned above for settlements opportunities.			
o Approved Structure Plan of the Municipality	YES x	NO	Please explain
The municipality aims to improve the following: • Housing backlogs and incomplete housing projects: illegal settlements and land invasions in areas/ lands. • Accelerating development of seven land parcels with mixed development trajectory.			
o Any other Plans	YES	NO x	Please explain
Not Applicable			

8. SOCIO-ECONOMIC CONTEXT

8.1 SOCIO-ECONOMIC CONTEXT (PRE-COMMENCEMENT)

Describe the pre-commencement social and economic characteristics of the community in order to provide baseline information.

Prior to the project commencing, the social and economic characteristics of the surrounding communities can be described as follows:

- High level of unemployment
- Low income
- Low level of education

Positive Socio-Economic Impacts:

The proposed development will result in job creation during the construction phase of the project.

Negative Socio-Economic Impacts:

- An increase in criminal activities in the local regions of the proposed activity.
- Safety impacts may occur as a result of improper safety management on site.

8.2 SOCIO-ECONOMIC CONTEXT (POST-COMMENCEMENT)

Describe the post commencement social and economic characteristics of the community in order to determine any change.

As with the pre-commencement social and economic characteristics, the post-commencement social and economic characteristics are unlikely to change.

This is because the development is not anticipated to have a significant impact on the surrounding communities during construction given the limited number of temporary jobs created and the short duration of the construction period of shacks (less than 2 months).

9. CULTURAL/HISTORICAL FEATURES

Were there any signs or evidence (unearthed during construction) of culturally or historically significant elements including archaeological or paleontological sites, on or in close proximity to the site?		YES	NO x
		UNCERTAIN	
If YES, explain:	Not Applicable		
If uncertain, the Department may request that specialist input be provided to establish whether such possibilities occurred on or close to the site.			
Briefly explain the findings of the specialist if one	Not Applicable		

was already appointed:			
Were any buildings or structures older than 60 years affected in any way?		YES	NO x
Was it necessary to apply for a permit in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999)?		YES	NO x
If yes, please submit or, make sure that the applicant or a specialist submit the necessary application to SAHRA or the relevant provincial heritage agency and attach proof thereof to this application.			

SECTION D: PRELIMINARY IMPACT ASSESSMENT

Please note, the impacts identified below refer to general impacts commonly associated with development activities. The list below is not exhaustive and may need to be supplemented. Where required, please append the information on any additional impacts to this application.

1. WASTE, EFFLUENT AND EMISSION MANAGEMENT

(a) Solid waste management

Did/does the activity produce any general waste (e.g. domestic-, commercial-, certain industrial waste, including building rubble also known as solid waste) during the construction phase and/or the operational phase?	YES x	NO
If yes, briefly describe what type of waste was produced (i.e. green waste, building rubble, etc.) in which phase.		
General waste was produced during the erection of infrastructures such as residential houses, businesses, schools, etc.		
What quantity was/is produced during the construction period?		m^3
What was/is the estimated quantity that will be produced per month during the operational phase?		m^3

Did/does the activity produce any hazardous waste (e.g. chemical, medical waste, infectious, nuclear etc.) during the construction and/or the operational phase?	YES	NO x
If yes, briefly describe what type of waste was produced (i.e. infectious waste, medical waste, etc.) in which phase.		
Not Applicable		
What quantity was/is produced during the construction period?		m^3
What was/is the estimated quantity that will be produced per month during the operational phase?		m^3

Where and how was/is waste treated / disposed of (describe each waste stream)?		
Has the municipality or relevant authority confirmed that sufficient capacity exist for treating / disposing of the solid waste to be generated by this activity(ies)? If yes, provide written confirmation from municipality or relevant authority	YES	NO x
Does/did the activity produce solid waste that was/will be treated and/or disposed of at another facility other than into a municipal waste stream?	YES	NO x

If yes, did/has this facility confirmed that sufficient capacity exist for treating / disposing of the solid waste to be generated by this activity(ies)? Provide written confirmation from the facility and provide the following particulars of the facility:	YES	NO x
Did/does the facility have an operating license? (If yes, please attach a copy of the license.)	YES	NO x

Facility name:			
Contact person:			
Postal address:			
		Postal code:	
Telephone:		Cell:	
E-mail:		Fax:	

(b) Effluent

Did/does the activity produce sewage and or any other effluent?	YES	NO x
Not Applicable		
What was/is the estimated quantity produced per month?		m^3
Was/is the effluent treated and/or disposed of in a municipal system?	YES	NO x
If Yes, did/has the Municipality or relevant authority confirmed that sufficient **unallocated** capacity exist for treating / disposing of the sewage or any other effluent generated by this activity(ies)? Provide written confirmation from the Municipality or relevant authority.		
Not Applicable		
Was/is any effluent produced be treated and/or disposed of on site?	YES	NO x
If yes, briefly describe the nature of the effluent and how it was/will be disposed of:		
Not Applicable		
Did/does the activity produce effluent that was/will be treated and/or disposed of at another facility?	YES	NO x
If yes, did/has this facility confirmed that sufficient capacity exist(ed) for treating / disposing of the liquid effluent generated by this activity(ies)? Provide written confirmation from the facility and provide the following particulars of the facility:	YES	NO
Does the facility have an operating license? (If yes, please attach a copy of the license.)	YES	NO x
Facility name:		
Contact person:		
Postal address:		
	Postal code:	
Telephone:	Cell:	
E-mail:	Fax:	

Describe the measures that was/will be taken to ensure the optimal reuse or recycling of waste water, if any:

(c) Emissions into the atmosphere

Did/does the activity produce emissions that will be disposed of into the atmosphere?	YES	NO x
If yes, did/does it require approval in terms of relevant legislation? If yes, attach a copy to this application	YES	NO x
Describe the emissions in terms of type and concentration and how it was/will be treated/mitigated:		
Not Applicable		

(d) Describe any mitigation/management measures that were adopted and the adequacy of these:

No mitigation measures were implemented.

2. WATER USE

(a) Please indicate the source(s) of water for the activity by crossing out ("☒") the appropriate box(es)

Municipal	Water Board	Groundwater	River, Stream, Dam or Lake	Other	The activity did/does not use water

If water was/is extracted from a groundwater source, river, stream, dam, lake or any other natural feature, please indicate the volume that	
was/is extracted per month:	Not measured

Please provide proof of assurance of water supply eg. letter of confirmation from Municipality/water user associations, yield of borehole etc.		
Did/does the activity require a water use permit / license from DWAF? If yes, attach a copy to this application	YES	NO x
If yes, please submit the necessary application to Department of Water Affairs and Forestry and attach proof thereof to this application.		

(b) Describe any mitigation/management measures that were adopted and the adequacy of these:

Minimal water is used on site.

3. POWER SUPPLY

(a) Please indicate the source of power supply eg. Municipality / Eskom / Renewable energy source.

Municipality

Has the Municipality or relevant service provider confirmed that sufficient electricity capacity (i.e. generation, supply and transmission) exist for activity(ies)? If yes, provide written confirmation from Municipality or relevant service provider.	YES x	NO

If power supply was/is not available, where was/is it sourced from?
Not Applicable

(b) Describe any mitigation/management measures that were adopted and the adequacy of these:

Not Applicable

4. ENERGY EFFICIENCY

(a) Describe the design measures, if any, that have been taken to ensure that the activity is energy efficient:

Energy measures such as LED lights and solar power will be considered for some of the institutional facilities of the project.

(b) Describe how alternative energy sources have been taken into account or been built into the design of the activity, if any:

Alternative energy for the development includes LED lights gas installations and solar power for the township development.

5. NOISE IMPACTS

(a) Did/does the activity result in any noise impacts?	YES	NO x
If yes, please describe and indicate the measures implemented to mitigate and manage these impacts?		
Not Applicable		

Please note: The Department may request specialist input/studies depending on the nature of the land use character of the area and potential noise impact(s) of the activity/ies.

6. VISUAL IMPACTS

(a) Did/does the activity result in any visual impacts?	YES	NO x
If yes, please describe and indicate the measures implemented to mitigate and manage these impacts?		
Not Applicable		
(b) Did/does the activity result in potential lighting impacts at night?	YES	NO x
If yes, please describe and indicate the measures implemented to mitigate and manage these impacts?		
Not Applicable		
(c) Were/are there any alternatives available to address this impact?	YES	NO x
If yes, please describe these alternatives?		
Not Applicable		

Please note: The Department may request specialist input/studies depending on the nature of the land use character of the area and potential visual impact(s) of the activity/ies.

7. SOCIO-ECONOMIC IMPLICATIONS OF THE ACTIVITY

(a) What was/is the expected capital value of the activity on completion?	Unknown	
(b) What was/is the expected yearly income or contribution to the economy that will be generated by or as a result of the activity?	Unknown	
(c) Did/does the activity contribute to service infrastructure?	YES x	NO
(d) How many permanent new employment opportunities were created?	Unknown	
(e) What was/is the expected current value of the employment opportunities to date?	Unknown	
(f) What percentage of this accrued to previously disadvantaged individuals?	Unknown	

How was (is) this (to be) ensured and monitored (please explain):
Not Applicable

8. PRELIMINARY IMPACT ASSESSMENT

Briefly describe the impacts (as appropriate), significance rating of impacts and significance rating of impacts after mitigation. This must include an assessment of the significance of all impacts. Please note: This is a preliminary impact statement. The Department may request specialist input/studies depending on the type and nature of the impact(s) of the activity/ies.

Possible Impacts	Significance rating of impacts after mitigation (Low, Medium, Medium-High, High, Very High):
Pollution to surrounding area (Waste Management)	Medium
Sanitation	Medium
Loss of vegetation	High
Air emission	Low

SECTION E: ALTERNATIVES

As part of this report, consideration must be given to alternatives that are/may have been possible had an environmental impact assessment been undertaken prior to the commencement of the activity. Please provide a detailed description of the alternatives (whether location, technology or environmental) that were/are possible in terms of this application.

Site Alternative (Preferred Alternative)

The proposed formalization is situated on portion of the farm Davelfontein 267-IS within the Msukaligwa Local Municipality. The proposed development can be accessed via an unnamed road R541. The geographical coordinates of the site are 26°27'26.52" S, 29°39'18.98".

Layout-Plan Alternative (Preferred Alternative)

No-Go Alternative

This option would come into effect if phase as well as the benefits associated with the provision of houses, schools and other much needed social facilities. A high negative socio-economic impact significance would occur if the proposed development is not constructed.

The "no-go" alternative will however result in the visual environment staying the same with the natural character of the area contributing to the "sense of place". If the development proposal is not authorized, the vegetation in the current natural parts will remain largely intact which is clearly a positive factor for the biodiversity in the area. The socio-economic benefits of this project however largely outweigh the impacts in an area The No-Go Alternative is therefore not recommended.

SECTION F: APPENDICES

The following appendices must be attached where appropriate:

Appendix	**Cross out ("☒") the box if Appendix is attached**
Appendix A: Location map	
Appendix B: Site plan(s)	
Appendix C: Owner(s) consent(s)	
Appendix D: Photographs	
Appendix E: Permit(s) / license(s) from any other organ of state including service letters from the municipality	
Appendix F: Additional Impact Assessment Information	
Appendix G: Report on alternatives	
Appendix H: Any Other (describe)	
Annexure A: Forms and Preliminary Public Participation	

SECTION G: DECLARATIONS

G1: Declarations of the EAP

1. The Independent Environmental Assessment Practitioner

I, _Phakwago M. Kabelo_____declare under oath that I –

a. act as the independent environmental assessment practitioner in this application ;
b. do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the S24G of the National Environmental Management Act, read together with the relevant Environmental Impact Assessment Regulations;
c. do not have and will not have a vested interest in the proposed activity proceeding;
d. have no, and will not engage in, conflicting interests in the undertaking of the activity;
e. undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the S24G of the National Environmental Management Act, read together with the Environmental Impact Assessment Regulations, 2014, as amended;
f. will ensure that all documents will contain all relevant facts in respect of the application & that all documentation is distributed or made available to interested and affected parties. I will ensure that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced for the rectification application.
g. will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
h. **will keep a register of all interested and affected parties that participated in a public participation process; and**
i. **will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.**

Signature of the environmental assessment practitioner:

Mang Geoenviro Services

Name of company:

25 May 2023

Date:

Signature of the Commissioner of Oaths:

Date:

Designation:

Official stamp:

G2: Declarations of the Applicant

2. The Applicant

I, _____ ,declare under oath that I -

a. **am the applicant in this application;**
b. **appointed the environmental assessment practitioner as indicated under G1 above to act as the independent environmental assessment practitioner for this application;**
c. **will provide the environmental assessment practitioner and the competent authority with access to all information at my disposal that is relevant to the application;**
d. **am responsible for complying with the directive or conditions of any environmental authorisation issued by the competent authority;**
e. **understand that I will be required to pay an administration fine in terms of S24G (4) of the Act and that a decision in this regard will only be forthcoming after payment of such a fine; and**
f. **hereby indemnify, the government of the Republic, the competent authority and all its officers, agents and employees, from any liability arising out of the content of any report, any procedure or any action for which the applicant or environmental assessment practitioner is responsible in terms of the Act.**

Signature of the applicant:

Name of company:

Date:

Signature of the Commissioner of Oaths:

Date:

Designation:

Official stamp (below):

ANNEXURE A TO THE SECTION 24G APPLICATION FORM

SECTION A: DIRECTIVE

Section 24G(1) of the National Environmental Management Act, 1998 (Act 107 of 1998) ("NEMA") provides that on application by a person who has commenced with a listed or specified activity without an environmental authorisation in contravention of section 24F(1); or a person who has commenced, undertaken or conducted a waste management activity without a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) ("NEM:WA ") the Minister, the Minister responsible for mineral resources or the MEC concerned (or the official to which this power has been delegated), as the case may be, may direct the applicant to -

i	immediately cease the activity pending a decision on the application submitted in terms of this subsection	
ii	investigate, evaluate and assess the impact of the activity on the environment	
Iii	remedy any adverse effects of the activity on the environment	
iv	cease, modify or control any act, activity, process or omission causing pollution or environmental degradation	
v	contain or prevent the movement of pollution or degradation of the environment	
vi	eliminate any source of pollution or degradation	
vii	compile a report containing -	
	aa	A description of the need and desirability of the activity
	bb	assessment of the nature, extent, duration and significance of the consequences for or impacts on the environment of the activity, including the cumulative effects and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity
	cc	description of mitigation measures undertaken or to be undertaken in respect of the consequences for or impacts on the environment of the activity
	dd	description of the public participation process followed during the course of compiling the how the issues raised have been addressed
	ee	an environmental management programme
	Provide such other information or undertake such further studies as the Minister, Minister responsible for mineral resources or MEC, as the case may be, may deem necessary.	

You are hereby provided with an opportunity to make representations on any or all of the abovementioned instruction, including where you are of the opinion that any of these instructions are not relevant for the purposes of your application, setting out the reasons for your assertion. Kindly note further that, after taking your representations into account, a final directive may be issued.

SECTION B: DEFERRAL

Section 24G(7) of the NEMA provides that if at any stage after the submission of an application it comes to the attention of the Minister, the Minister responsible for mineral resources or the MEC, that the applicant is under criminal investigation for the contravention of, or failure to comply with, section 24F(1) of the NEMA or section 20(b) of the NEM:WA, the Minister, Minister responsible for mineral resources or MEC may defer a decision to issue an environmental authorisation until such time as the investigation is concluded and-

(a) The National Prosecuting Authority has decided not to institute prosecution in respect of such contravention or failure;
(b) The applicant concerned is acquitted or found not guilty after prosecution in respect of which such contravention or failure has been instituted; or
(c) The applicant concerned has been convicted by a court of law of an offence in respect of such contravention or failure and the applicant has in respect of the conviction exhausted all the recognised legal proceedings pertaining to appeal or review.

Kindly answer the following questions:

Are you, the applicant, being investigated for a contravention of section 24F(1) of the NEMA in respect of a matter that is not subject to this application and in any province in the Republic?	YES	NO X	UNCERTAIN
If yes provide details of the offence being investigated and authority conducting the investigation, If uncertain provide details of the activity or activities in relation to which you suspect you may be under investigation.			
Are you, the applicant, being investigated for the contravention of section 20(b) of the NEMWA in respect of a matter that is not subject to this application and in any province in the Republic?	YES	NO X	UNCERTAIN
If yes provide details of the offence being investigated and authority conducting the investigation. If uncertain provide details of the activity or activities in relation to which you suspect you may be under investigation.			
Are you, the applicant, being investigated for an offence in terms of section 24F(1) of the NEMA or section 20(b) of the NEMWA in terms of which this application directly relates?	YES	NO x	UNCERTAIN
If yes provide details of the offence being investigated and authority conducting the investigation. If uncertain provide details of the activity or activities in relation to which you suspect you may be under investigation.			

If you have answered yes or uncertain to any of the above questions, you are hereby provided with an opportunity to make representations as to why the Minister, Minister responsible for mineral resources or

MEC, as the case may be, should not defer the application as he or she is entitled to do under section 24G(7).

SECTION C: QUANTUM OF THE SECTION 24G FINE

In terms of section 24G(4) of the NEMA, it is mandatory for an applicant to pay an administrative fine as determined by the competent authority before the Minister, Minister responsible for mineral resource or MEC may take a decision on whether or not to grant an ex post facto environmental authorisation or a waste management licence as the case may be. The quantum of this fine may not exceed R5 million.

Having regard to the factors listed below, you are hereby afforded with an opportunity to make representations in respect of the quantum of the fine and as to why the competent authority should not issue a maximum fine of R5 million.

Please note that Part 1 of this section must be completed by an independent environmental assessment practitioner after conducting the necessary specialist studies, copies of which must be submitted with this completed application form.

Please also include in your representations whether or not the activities applied for in this application (if more than 1) are in your view interrelated and provide reasons therefore.

PART 1: THE IMPACTS OR POTENTIAL IMPACTS OF THE ACTIVITY/ACTIVIITIES

Index: Socio Economic Impact	Place an "X" in the appropriate box
Description of variable	
The activity is not giving, has not given and will not give rise to any negative socio-economic impacts	X
The activity is giving, has given, or could give rise to negative socio- economic impacts, but highly localized	
The activity is giving, has given, or could give rise to significant negative socio-economic and regionalized impacts	
The activity is resulting, has resulted or could result in wide-scale negative socio-economic impacts.	
Motivation:	

Index: Biodiversity Impact	Place an "X" in the appropriate box
Description of variable	
The activity is not giving, has not given and will not give rise to any impacts on biodiversity	

The activity is giving, has given or could give rise to localised biodiversity impacts	X
The activity is giving, has given or could give rise to significant biodiversity impacts	
The activity is, has or is likely to permanently / irreversibly transform/ destroy a recognised biodiversity 'hot -spot' or threaten the existence of a species or sub -species.	
Motivation:	

Index Sense of Place Impact and 1 or Heritage Impact	Place an "X" in the appropriate box
Description of variable	
The activity is in keeping with the surrounding environment and I or does not negatively impact on the affected area's sense of place and /or heritage	X
The activity is not in keeping with the surrounding environment and will have a localised impact on the affected area's sense of place and/or heritage	
The activity is not in keeping with the surrounding environment and will have a significant impact on the affected area's sense of place and/ or heritage	
The activity is completely out of keeping with the surrounding environment and will have a significant impact on the affected area's sense of place and/ or heritage.	
Motivation:	

Index Pollution Impact	Place an "X" in the appropriate box
Description of variable	
The activity is not giving, has not given and will not give rise to any pollution	
The activity is giving, has given or could give rise to pollution with low impacts,	X
The activity is giving, has given or could give rise to pollution with moderate impacts.	
The activity is giving, has given or could give rise to pollution with high impacts.	
The activity is giving, has given or could give rise to pollution with major impacts.	
Motivation:	

PART 2: COMPLIANCE HISTORY AND KNOWLEDGE OF THE APPLICANT	
Index: Previous administrative action (i.e. administrative enforcement notices) issued to the applicant in respect of a contravention of section 24F(1) of the National Environmental Management	Place an "X" in the

Act and/ or section 20(b) of the National Environmental Management Waste Act	appropriate box
Description of variable	
Administrative action was previously taken against the applicant respect the abovementioned provisions.	
No previous administrative action was taken against the applicant but previous administrative action was taken against a firm(s) on whose board one or more of the applicant's directors sit or sat at the relevant time when the administrative action was taken.	
Administrative action was not previously taken against the applicant in respect of the abovementioned provisions.	X
Explanation of all previous administrative action taken in respect of the above:	
Index: Previous Convictions in terms of section 24F (1) of the National Environmental Management Act and/or section 20(b) of the National Environmental Management Waste Act	Place an "X" in the appropriate box
Description of variable	
The applicant was previously convicted in terms of either or both of the abovementioned provisions.	
No previous administrative action was taken against the applicant but previous administrative action was taken against a firm(s) on whose board one or more of the applicant's directors sit or sat at the relevant time when the administrative action was taken.	
The applicant has not previously been convicted in terms of either or both of the abovementioned provisions.	X
Explanation of all previous convictions in respect of the above:	
Index: Number of section 24G applications previously submitted by the applicant	Place an "X" in the appropriate box
Description of variable	
Number of section 24G applications previously submitted by the applicant	
No previous applications have been submitted by the applicant but a previous application(s) have been submitted by a firm(s) on whose board one or more of the applicant's directors sit or sat at the relevant time.	
No previous applications have been submitted by the applicant but the applicant sat on the board of a firm that previously submitted an application.	X
Explanation in respect of all previous applications submitted in terms of section 24G:	

PART 3: APPLICANT'S PERSONAL CIRCUMSTANCES	
Index: Applicant's legal persona	Place an "X" in the appropriate box
Description of variable	
The applicant is a natural person.	
The applicant is a firm.	X
Describe the firm: The Msukaligwa Local Municipality as the applicant is the organ of state.	

Index: Any other relevant information that the applicant would like to be considered.
Motivate and explain fully:

NOTE: An explanation as to why the applicant did not obtain an environmental authorisation and/or waste management licence must be attached to this application.

SECTION D: PRELIMINARY ADVERTISEMENT

When submitting this application form, the applicant must attach proof that the application has been advertised in at least one local newspaper in circulation in the area in which the activity was commenced, and on the applicant's website, if any.

The advertisement must state that the applicant commenced a listed or specified activity or activities or waste management activity or activities without the necessary environmental authorisation and/or waste management license and is now applying for ex post facto approval. It must include the following:

- the date;
- the location;
- the applicable legislative provision contravened; and
- The activity or activities commenced with without the required authorisation.

Interested and affected parties must be provided with the details of where they can register as an Interested and affected party and I or submit their comment. At least 20 days must be provided in which to do so.

This advertisement shall be considered as a preliminary notification and he competent authority may direct the applicant to undertake further public participation and advertising after receipt of this application form.

NOTE: Unless protected by law, all information contained in and attached to this application form may become public information on receipt by the competent authority. This application must be attached to any documentation or information submitted by am applicant further to section 24G(1).

Appendix A: Locality Map

LEGEND

SITE

DAVEL TOWNSHIP

The proposed formalization of Davel township on portion of farm Davelfontein 267-IS within the Msukaligwa Local Municipality in Mpumalanga Province.

LOCALITY MAP

DATE	21/11/2022

mang GEOENVIRO SERVICES

Head Office: Hazeldean Office Park,
King Fisher Building Unit 11,
687 Silverlakes Road, Tyger Valley
Pretoria, 0054.
Tel: +27 12 770 4022
Cell: +27 79 054 7652
Email: kabelo@manggeoenviro.co.za

Appendix B: Layout Plan

FORMALISATION OF MARIKANA INFORMAL SETTLEMENT LOCATED ON THE REMAINING EXTENT OF PORTION 6 OF THE FARM DAVELFONTEIN 267 - IS

MSUKALIGWA LOCAL MUNICIPALITY

LAND USE

ZONING	LAND USE		NO. OF STANDS	AREA Ha.	% OF AREA
RESIDENTIAL 1	RESIDENTIAL		600	24.2401	67.564738
BUSINESS 1	BUSINESS		2	0.4698	1.309478
EDUCATION	CRECHE		1	0.0934	0.260335
COMMUNITY SERVICES	COMMUNITY FACILITY		1	0.1667	0.464645
PUBLIC OPEN SPACE	PARK		2	1.05629432	2.944220
SPECIAL ZONE	SERVITUDE		*	0.7414	2.066512
STREETS	*	*	*	9.109166	25.390072
TOTAL	*		606	35,8769	100.0000

LEGEND

RULING SITE SIZES	380 m²

FENCE
POWERLINE
TAP
...DIRTY ROAD
...STRUCTURES
...ELECTRIC POWER POLE
... WATER DRAIN/ DRAIN
WV ... WATER VALVE

TOWN PLANNER
FIRM:
DATE:

ENGINEER
FIRM:
DATE:

LAND SURVEYOR
FIRM:
DATE:

FLOODLINE NOTE

IT IS HEREBY CERTIFIED IN TERMS OF ARTICLE 144 OF THE NATIONAL WATER ACT (ACT No. 36 OF 1998 THAT THE TOWNSHIP SHOWN ON THIS PLAN IS NOT AFFECTED BY FLOODLINES REPRESENTING THE MAXIMUM LEVEL LIKELY TO BE REACHED BY FLOODWATERS IN A DEFINED WATER COURSE ON AVERAGE ONCE IN EVERY 50 /100 YEARS.

GENERAL NOTES

1) CADASTRAL BOUNDARIES _____
2) GEODETIC SYSTEM WGS 84
3) ALL INTERNAL ROADS ARE 15M, 12M AND 10M WIDE UNLESS INDICATED OTHERWISE
4) ALL DIMENSIONS AND AREAS ARE APPROXIMATE & SUBJECT TO FINAL SURVEY BY PROFESSIONAL LAND SURVEYORS
5) BUILDING LINE ARE SUBJECT TO APPLICABLE SCHEME
6) ZONING ARE SUBJECT TO APPLICABLE ZONING SCHEME
7) CONTOUR NOTE: THE CONTOUR SURVEY IS IN ACCORDANCE WITH THE STANDARD LAID DOWN BY THE REGULATIONS RELATING TO TOWNSHIP ESTABLISHMENT AND LAND USE

DRAWING NOTES

DATE	2023/04/03
DRAWING NO	MSU/01
REVISION	3

DRAWN BY	N MKHWANAZI
CHECKED BY	F MATHEBULA

11 KINGFISCHER BUILDING,HAZELDEAN OFFICE PARTK, 687 SILVERLAKES ROAD, TYGER VALLEY, PRETORIA, 0054
Tel: +27 12 770 4022
Cell: 081 218 6899
Email: info@ngoti.co.za

NGOTI DEVELOPMENT CONSULTANTS

Appendix C: Impact Assessment Report

1 IMPACT ASSESSMENT

An environmental Impact Assessment must take into account the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase. Where necessary, the proposal for mitigation or optimization of an impact is noted.

1.1 Methodology to assess the Impacts

To assess the impacts on the environment, the process has been divided into two main phases namely the Construction phase and the Operational phase. The activities, products and services present in these two phases have been studied to identify and predict all possible impacts.

In any process of identifying and recognizing impacts, one must recognize that the determination of impact significance is inherently an anthropocentric concept. Duinker and Beanlands, (1986) in DEAT 2002, Thompson (1988), (1990) in DEAT 2002 stated that the significance of an impact is an expression of the cost or value of an impact to society.

However, the tendency is always towards a system of quantifying the significance of the impacts so that it is a true representation of the existing situation on site. This has been done by using wherever possible, legal and scientific standards which are applicable.

The significance of the aspects/impacts of the process have been rated by using a matrix derived from Plomp (2004) and adapted to some extent to fit this process. These matrixes use the consequence and the likelihood of the different aspects and associated impacts to determine the significance of the impacts.

Nature	**Classification of whether the impact is positive or negative , direct or indirect**
Extent	**Spatial scale of impact and classified as:** **Site**: the impacted area is the whole site or a significant portion of the site **Local**: within a radius of 2 km of the construction site. **Regional**: the impacted area extends to the immediate, surrounding and neighboring properties. **National**: the impact can be considered to be of national significance.
Duration	**Indicates the lifetime of the impact and is classified as:**

	Short term: the impact will either disappear with mitigation will be mitigated through natural processes in a span shorter than the construction phase. **Medium term:** the impact will last for the period of the construction phase, where after it will be entirely negated. **Long term:** the impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory. **Permanent:** mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity	**Describes whether an impact is destructive or benign** **Low:** impact affects the environment in such a way that natural, cultural and social functions and processes are not affected. **Moderate**: affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way. **High:** natural, cultural and social functions and processes are altered to extent that they temporarily cease. **Very high:** natural, cultural and social functions and processes are altered to extent that they permanently cease.
Probability	**Describes the likelihood of an impact to occur:** **Improbable:** likelihood of the impact materializing is very low. **Possible:** the impact may occur. **Highly probable**: most likely that the impact will occur. **Definite:** the impact will occur.
Significance	**Based on the above criteria the significance of issues was determined. The total number of points scored for each impact indicates the level of significance of the impact, and is rated as follows:** **Low**: the impacts are less important. **Medium**: the impacts are important and require attention, mitigation is required to reduce the negative impacts. **High**: the impacts are of great importance. Mitigation is therefore crucial.
Cumulative	**In relation to an activity, means the impact of an activity that in itself may not be significant but nay become significant when added to the existing and**

	potential impacts eventuating from similar or diverse activities or undertakings in the area.
Mitigation	**Where negative impacts are identified, mitigation measures (ways of reducing impacts) have been identified. An indication of the degree of success of the potential mitigation measures is given per impact.**

Criteria for the rating of impacts				
Criteria	Description			
Extent	National	Regional	Local	Site
Duration	Permanent	Long-term	Medium-term	Short-term
Intensity	Very high	High	Moderate	Low
Probability	Definite	Highly probable	Possible	Improbable
Points allocation	4	3	2	1
Significance Rating of classified impacts				
Impact	Points	Description		
Low	4-6	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.		
Medium	7-9	Mitigation is possible with additional design and construction inputs.		
High	10-12	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.		
Very high	13-16	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/ or operational phases. The effects of the impact may affect the broader environment.		
Status	Perceived effect of the impact			
Positive (+)	Beneficial impact			
Negative (-)	Adverse impact			
Negative impacts are shown with a (-) while positive ones are indicated as (+)				

2 ASPECTS, RELATED IMPACTS, SIGNIFICANCE AND PROPOSED MITIGATION MEASURES

In this section, all the possible impacts that can be predicted in both the construction and operational phases are addressed. Specific mitigation measures are proposed and the significance of these impacts given with and without mitigation measures.

Any development will have a profound impact on the environment in that most of the herbaceous and shrub layers will be destroyed.

Impacts	Significance Rating Before Mitigation Measures	Proposed Mitigation Measures	Significance Rating After Mitigation Measures
Planning/ Designing Phase			
Poor Design – Structural failures	High (Negative)	Ensure compliance with the industry standards	Low (Negative)
Disregard of legislative requirement	High (Negative)	Ensure compliance with relevant legislation and legal standards	Low (Negative)
Construction Phase			
Alteration of topography due to stockpiling of soil, building material and debris and waste material on site.	Medium (Negative)	All stockpiles must be restricted to designated areas and are not to exceed a height of 2 metres. • Stockpiles created during the construction phase are not to remain during the operational phase. • The contractor must be limited to clearly defined access routes to ensure that sensitive and undisturbed areas are not disturbed.	Low (Negative)
Consumption and use of surface water for construction purposes (i.e. water tankers for dust suppression).	Medium (Negative)	The Municipality to comment and advice on surface water availability and integrity.	Low (Negative)
Contaminated run-off:	Medium (Negative)	• Bunded areas should be used to store chemicals. • Clean-up of spills as soon as they occur.	Low (Negative)

• Spillage of fuels, lubricants and other chemicals; • Inadequate stormwater management around the site; the dumping of construction material, including fill or excavated material into, or close to surface water features that may then be washed into these features; • Construction-related activities such as cement batching; • Construction equipment, vehicles and workshop areas will be a likely source of pollution as a non-point source; and • Lack of provision of ablutions that may lead to the creation of 'informal ablutions' within or		• Keep construction activities away from the surface water resources. • Adequate provision of ablutions for construction employees. • Wastewater must not be allowed to come into direct contact with exposed soils or run across the site. Vehicles and machinery may not be washed on site. All wastewater must be collected in a sealed container and disposed of by an approved waste contractor.	

close to a surface water resource.			
Clearance of alien vegetation already present on the study area.	High (Negative)	All alien vegetation within the proposed development footprint should be removed from site and disposed of at a registered waste disposal site for the duration of construction, and continuous monitoring of seedlings need to occur until construction is complete.	Low (Negative)
Erosion, degradation and loss of topsoil due to construction activities as well surface and stormwater run-off.	High (Negative)	• Minimise the clearance of vegetation to avoid exposure of soil. • Protect areas susceptible to erosion with mulch or a suitable alternative. • Implement the appropriate topsoil and stormwater runoff control management measures as per the EMPr to prevent the loss of topsoil. • Topsoil should only be exposed for minimal periods of time and adequately stockpiled to prevent the topsoil loss and run-off.	Medium (Negative)
Removal and use of local flora for firewood.	Medium (Negative)	• No cutting down of trees for firewood. • Utilise commercially sold wood or other sources of energy. • Training of contractors on environmental awareness and the importance of flora.	Low (Negative)

Contamination of the surface and site with general waste. General waste produced on site includes: • Operational waste (clean steel, wood, glass); and • General domestic waste (food, cardboards, paper, bottles, tins).	Low (Negative)	An adequate number of general waste receptacles, including bins must be arranged around the site to collect all domestic refuse, and to minimize littering. • Bins must be provided on site for use by employees. • Bins should be clearly marked and lined for efficient control and safe disposal of waste. • Different waste bins, for different waste streams must be provided to ensure correct waste separation. A fenced area must be allocated for waste sorting and disposal on the site. • General waste produced on site is to be collected in skips for disposal at the local municipal waste site. Hazardous waste is not to be mixed or combined with general waste earmarked for disposal at the municipal landfill site. • Under no circumstances is waste to be burnt or buried on site. • Waste bins should be cleaned out on a regular basis to prevent any windblown waste and/or visual disturbance. • All general waste must be removed from the site at regular intervals and disposed of in suitable waste receptacle.	Low (Negative)

Hazardous waste produced on site includes: • Oil and other lubricants, diesel, paints, solvent; • Containers that contained chemicals, oils or greases; and • Equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen).	Medium (Negative)	The Environmental Manager must have as part of his/her records the waste manifest for each batch based disposal. • Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid). • A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal. • In the case of a spill of hydrocarbons, chemicals or bituminous, the spill should be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk.	Low (Negative)
Generation and disposal of sewage waste of temporary construction toilets.	Medium (Negative)	• On-site chemical toilets will be provided for domestic purposes during construction phase. • The contractors will be responsible for the maintenance of the chemical toilets. • Should any spills or incidents occur; the material will be cleaned up immediately and disposed of appropriately.	Low (Negative)

		• All incidents must be reported to the responsible site officer as soon as it occurs.	
Dust and emissions during construction generated by debris handling and debris piles, truck transport, bulldozing, general construction.	Low (Negative)	• Dust must be suppressed on the construction site and during the transportation of material during dry periods by the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off. • Loads could be covered to avoid loss of material in transport, especially if material is transported off site. • Dust and mud should be controlled at vehicle exit and entry points to prevent the dispersion of dust and mud beyond the site boundary. • Facilities for the washing of vehicles should be provided at the entry and exit points. • A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas. • During the transfer of materials, drop heights should be minimized to control the dispersion of mater being transferred. • The height of all stockpiles on site should be a maximum of 2m. Use of dust retardant road surfacing if made	Low (Negative)

		necessary due to the exceedance of Air Quality Guidelines.	
Generation of fumes from vehicle emissions may pollute the air.	Medium (negative)	• All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability in order to prevent smoke emissions.	Low (Negative)
During the construction phase there is likely to be an increase in noise pollution from construction vehicles and construction staff.	Medium (negative)	• All construction activities should be undertaken according to daylight working hours between the hours of 07:00 – 17:00 on weekdays and 7:30 – 13:00 on Saturdays. • No construction activities may be undertaken on Sunday. • Provide all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order. • All earth moving vehicles and equipment must be regularly maintained to ensure their integrity and reliability. • Construction staff working in area where the 8-hour ambient noise levels exceed 60 dBA must have the appropriate Personal Protective Equipment (PPE). • All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993).	Low (Negative)

Disturbance of sites of archaeological, historical and cultural significance.	Low (negative)	• There were no sites or objects of archaeological, historical and cultural significance identified, however, if during construction any possible finds are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find. • It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on: • The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.	Low (Negative)
During the construction phase there is likely to be an increase in traffic from construction vehicles.	Medium (Negative)	• Construction vehicles are to avoid main roads during peak traffic hours. • All vehicles entering the site are to be roadworthy. • Seatbelts are to be worn at all times. • When using heavy or large vehicles / equipment, “spotters” are to be present to assist the driver with his blind spots. • Any incident or damage to a vehicle must be reported immediately.	Low (Negative)

The development will result in job creation and provision of employment.	Medium (Positive)	• All labour (skilled and unskilled) and contractors should be sourced locally where possible. • A labour and recruitment policy must be developed, displayed and implemented by the contractor. • Recruitment at the construction site will not be allowed. • Where possible, labour intensive practices (as opposed to mechanised) should be practiced. • The principles of equality, BEE, gender equality and non-discrimination will be implemented.	High (Positive)
Degradation of adjacent nearby natural vegetation and wetlands.		• No construction actives may cause deterioration of the Wetland Seeps and Channeled Valley within the site. • The site and construction footprint must be fenced, and no deleterious edge effects are allowed beyond the project boundary. • Protect all areas susceptible to erosion (especially stockpiled soils and materials such as sand and tar) and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • 20m buffer distance will have to be kept for 1:10 000 year flood line	

Potential of soil erosion due to exposed soil.		• Limit vehicles, people and materials to the construction site. • Construction to preferably be undertaken in winter, when there is minimal risk of erosion. • Revegetate denude area with indigenous flora as soon as possible • Implement erosion protection measures on site to reduce erosion and sedimentation of nearby wetlands and streams. Measures could include bunding around soil stockpiles, and vegetation of areas not to be developed. • Take action before erosion develops to a large scale. • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005). • Protect all areas susceptible to erosion (especially stockpiled soils and materials such as sand and tar) and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Limit vegetation removal to only the construction area, avoid disturbance to other areas.	

Job creation during the construction phase could result in the influx of people to the area.	Medium (positive)	• If possible all labour should be sourced locally. • Contractors and their families may not stay on site. • No informal settlements will be allowed.	High (Positive)
Public safety during construction.	Medium (Negative)	• Members of the public adjacent to the construction site should be notified of construction activities in order to limit unnecessary disturbance or interference. • Construction activities will be undertaken during daylight hours and not on Sundays.	Medium (Negative)
Construction staff safety during construction.	High (Negative)	• Ensure the appointment of a Safety Officer to continuously monitor the safety conditions during construction. • All construction staff must have the appropriate PPE. • The construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents. • Report and record any environmental, health and safety incidents to the responsible person.	Medium (Negative)
Operational Phase			

Leaks of untreated water from pipelines may occur and impact on the shallow groundwater quality.	Medium (Negative)	• Any leaks should be fixed immediately and areas rehabilitated as needed.	Low (Negative)
Increased urban run-off from urban infrastructure and roads.	Medium (Negative)	• The stormwater management plan must be implemented.	Low (Negative)
Emergency evacuation plan	Low (Negative)	• Upon completion of the construction phase, an emergency evacuation plan must be drawn up to ensure the safety of the land users in the case of an emergency.	Low (Negative)
Increase in Environmental Degradation & Pollution	High (Negative)	• Prevent any influx of run-off water (from residences) or effluent into wetland habitat. • Run-off water from gardens typically contains seeds of exotic and garden-variety plants that pose a threat to wetland vegetation and ecology. Run-off water should be diverted to storm water management services and infrastructures.	Low (Negative)
Impact on sensitive areas such as the wetland and sensitive flora.	Medium(Negative)	• Limit human activity on areas that are close to sensitive sites. • A 50m buffer distance must be kept from the wetland area	Low (Negative)
Loss of the ecological function and degradation of the wetlands.	Medium (Negative)	• Engineer a method whereby accidental release of effluent can be contained and diverted to be treated.	Low (Negative)

		• Prevent disturbances to the wetland vegetation area by e.g. vehicles. • Place and maintain erosion control barriers as appropriate to prevent sedimentation.	
Impact of development on natural drainage patterns, caused by surface clearance and associated decrease of vegetation cover, leading to increased surface runoff and erosion	Medium (Negative)	• Construction activities must be restricted to the construction site to minimize the impacts of constriction phase on the wetland area.	Low (Negative)
Generation and disposal of sewage waste by the proposed development.	High (Negative)	• Pit toilets and septic tanks should be utilized due to unavailability of sewer reticulation. • Installation of 3km long sewer main outfall to connect to the Davel WWTW being constructed.	Medium (Negative)
Electrocution of vultures due to overhead power lines	Medium (Negative)	• Electrical infrastructure should be placed underground where possible. • The electrical infrastructure which normally form part of the residential development should investigate the use of insulators to be placed on conductors to prevent the bird from touching the conductor while landing or taking off and thus reducing the risk of electric shock. The length of the isolators is adapted to the size of large birds.	Low (Negative)

Generation and disposal of domestic waste by the proposed development.	Medium (Negative)	Waste will be collected by an accredited waste company and disposed of at an appropriate and licensed waste disposal facility.	Low (Negative)
The development will result in job creation and provision of employment.	Low (Positive)	• The principles of gender equality, maximizing local employment should be implemented in the provision and establishment of jobs. • Jobs for the maintenance of infrastructure and services will be created following the completion of the development. These jobs might be made available to existing labour there creating long term employment. • Service contractors could have access to other developments or projects in the area thereby creating long term employment.	Medium (Positive)
Impeded traffic flow due to ingress/egress from the residential property	Medium (Negative)	All signage and road markings for the proposed site should be in accordance with the South African Road Traffic Signs Manual".	Low (Negative)
Risk of fire explosion	Medium (Negative)	• Prevent spread of fire to surrounding buildings or vegetation. • Adequate firefighting training must be given to staff. • Ensure that relevant signage e.g. no smoking, is displayed in potentially dangerous areas and is abided by.	Low (Negative)

Dust from cleared areas	Medium (Negative)	• Exposed soil surfaces should be wet down where required to avoid dust emissions. • Vehicles transporting construction material such as building sands should remain at a speed limit of 40km/h and if required cover their loads with a tarpaulin to avoid dust emissions. • The height of stockpiles should be limited to 1.5m. • Newly cleared and exposed areas must be managed for dust and landscaped with indigenous vegetation to avoid soil erosion. Where necessary, temporary stabilization measures must be used until vegetation establishes.	Low (Negative)
Socio-economic Impact: Skills development opportunities and economic spin off activities will also occur during the operational phase. This impact is rated as positive.	Medium (Positive)	• Enhance the use of local labour and local skills as far as reasonably possible. • Where the required skills do not occur locally, and where appropriate and applicable, ensure that relevant local individuals are trained. • Ensure that goods and services are sourced from the local and regional economy as far as reasonably possible.	High (Positive)
Increase in soil erosion	Low (Negative)	• All reasonable measures should be implemented during the Operational Phase to minimise erosion. • Remedial action must be taken at the first signs of erosion.	Low (Negative)
Decommissioning Phase			

Due to the permanent nature of the development, no decommissioning is foreseen. If the project is to be decommissioned the same mitigations contained in the construction phase will apply.

3 KEY ENVIRONMENTAL IMPACTS

The following possible environmental impacts were identified

Environmental issues	Possible cause	Potential impacts
Air Pollution and Noise		
Smoke	- Vehicle emissions. - Fires.	- Health problems. - Air pollution. - Public nuisance. - Noise pollution.
Dust	- During construction. - Vehicle operation on roads. - Vegetation clearing.	
Fumes	- Fumes from vehicles. - Fumes from machinery.	
Noise	- Construction machinery and vehicles. - Presence of construction camp. - Operation noise (music and people).	
Environmental issues	**Possible cause**	**Potential impacts**
Water quality		
Pollution of water sources	- Spillage of fuel & oil from vehicles. - Spillage of building material e.g. cement etc. - Migration of contaminants off the site. - Solid waste in storm water. - Littering.	- Pollution of surface and groundwater. - Health risk. - Lower water quality. - Soil degradation. - Erosion. - Siltation.
Silt deposition in surface water	- Erosion risk due to increased run-off from built up area. - Erosion from cleared areas during construction.	

Pollution from sanitation system	- Leakages of system and incorrect management of sanitation system. - Inadequate measures to prevent sewage spillages. - Overflow of sewage to groundwater.	
Environmental issues	**Possible cause**	**Potential impacts**
Water quantity		
Impact on amount of water resources available	Over-utilisation of available water.	- Lose scarce resource - Increased pressure on ground water supply sources.
Environmental issues	**Possible cause**	**Potential impacts**
Land/Soil degradation		
Soil contamination and degradation	- Spillages of oil, chemicals from machinery & vehicles. - Removal of vegetation during clearing for construction. - Sewerage spillages. - Erosion due to increased runoff from built-up areas. - Increased erosion of drainage channels. -Site clearing during construction.	- Soil degradation - Loss of topsoil - Dust formation - Erosion
Environmental issues	**Possible cause**	**Potential impacts**
Biodiversity		
Decline in fauna and flora diversity	- Cleaning of site for construction. - Pollution of soil. - Pollution of water resources. - Physical establishment of development.	- Loss of biodiversity. - Loss of habitat. - Negative impact on biodiversity.

	- Loss of habitat due to establishment of development.	- Negative impact on rare /endangered/ endemic species and habitats.
Environmental issues	**Possible cause**	**Potential impacts**
Cultural/Heritage		
Possible loss of heritage sites	- Damage / loss during construction. - Damage / loss during operation.	- Possible loss of cultural heritage.
Environmental issues	**Possible cause**	**Potential impacts**
Visual impact		
Impact of the proposed development of sense of place.	- The physical existence of the development.	- Negative impact on landscape quality character. - Negative impact on sense of place.
Visual impact	- Construction site and buildings. - Lights at night. - Presence of new development. - Overhead power lines.	- Obstruction. - Visual intrusion. - Public nuisance.
Environmental issues	**Possible cause**	**Potential impacts**
Health and Safety		
Security	- Influx of people to area including construction workers and others after completion.	- Loss of safe and secure environment. - Threat to health. - Danger to human life.
Fires	- Accidental fires. - Burning of waste. - Cooking with fires.	

Environmental issues	Possible cause	Potential impacts
Socio-economic impacts		
Impact from change of land use from agriculture to township.	- Change of land use to residential, business, institutional, educational, public open spaces and streets.	- Impact negatively on agricultural production. - Land will no longer be used for agriculture.
Impact of the residential and other development on adjacent landowners	- Noise from construction activities, - Dust generated by construction vehicles and from site preparation. - The visual impact of lights. -The visual impact of residential and other units (business, institutional etc.)	- Nuisance and disruption. - Noise pollution. - Air pollution. - Negative visual impact.
Impacts related to the establishment of a construction camp with accommodation	- Location of construction camp. - Environmental impacts of construction activities e.g. spillage of hazardous liquids such as oil and fuel onto the soil surface. - Accommodation of construction teams on site - Littering, accidental fires, collecting of firewood and poaching. - Undesirable visitors to the area.	Adverse impact on the environment. - Resentment from neighbouring residents.
Impact ground and water pollution from littering and waste disposal during construction and operational phases	- The presence of a large work force and equipment and machinery during construction causing littering and dumping refuge and builder's rubble on site. -Construction activities from heavy vehicles and machinery.	- Soil and water pollution
	- The construction of structures such as open trenches and earth heaps might also hold safety risks for people.	- Safety risks for motorists, passengers, pedestrians and residents of the area

	- A lack of proper ablution facilities for temporary workers during construction.	- Soil and water pollution - Unhygienic conditions - Health risk.
Impact from the provision of structures and infrastructure services	- The development, construction and provision of infrastructure services.	- Pollution from sanitation systems - Pollution of water resources. - Negative visual impact of overhead power lines and electricity supply and waste removal. - Soil erosion as a result of the construction of internal roads and water reticulation networks.
Impact on archaeological /cultural / social features	- The development of structures and infrastructure services for residential and other sites. - Clearing of construction sites. - Construction of access roads. - Excavation of trenches for the installation of underground pipelines and cables.	- Negative impact on cultural or heritage resources.
Job creation Ownership	- Temporary jobs during construction phase. - Permanent jobs during operation. - New housing. - New businesses. - New schools.	- Positive impact – job Creation.

Appendix D: Report on Alternatives

1 FEASIBLE AND REASONABLE ALTERNATIVES

In terms of Environmental Impact Assessment (EIA) regulation, the Environmental Assessment Practitioner (EAP) should investigate feasible and reasonable alternatives for the proposed project. In other words, different means of meeting the requirements for the activity.

The definition of alternatives is given as: 'Alternatives' in relation to a proposed activity, means different means of meeting the general purpose and requirement of the activity, which may include alternatives to the –

a) property on which or location where the activity is proposed to be undertaken;
b) type of activity to be undertaken;
c) design or layout of the activity;
d) technology to be used in the activity; or
e) operational aspects of the activity;
f) and includes the option of not implementing the activity;

1.1 No project alternative

No alternative was considered based on a comparative assessment (No-go option versus the environmental costs of the proposed development). During the investigation, it was found that certain mitigation measures can reduce the little significant impacts on the environment if designed and implemented correctly.

Should the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) not authorize the development to proceed as planned, the development should just cease (no action) as there are no alternatives identified.

The proposed development will have positive impacts on the economic and social status of the area and address the problem of housing and service delivery. The consequences of not having an alternative for the proposed development would mean that the need for the proposed establishment of the area would not be addressed. Such a need will remain a dream.

1.2 Site Alternatives:

Site alternatives are not applicable for this project due to the fact that the proposed development entails the formalization of an existing township within boundaries of an existing residential area. The site was also selected so that mainly disturbed land will be developed.

1.3 Activity Alternatives:

The proposed project entails formalization of an existing informal settlement in Davel. Therefore, no reasonable or feasible alternative in terms of the type of activity to be undertaken could be investigated.

1.4 Design Alternative:

The unique character and appeal of Davel township were taken into consideration with the design philosophy. Various layout alternatives were considered by the applicant and town planners, also taking terrain and environmental constraints into account, the current design plan being the result.

1.5 Technology Alternative

The energy requirements of the development will be reduced by the introduction of the following energy saving methods, where possible:

- The use of energy efficient compact fluorescent lamps (CLFs).
- Water efficient measures to reduce flow fixtures in sinks and showers, dual flush systems in toilets, rain water harvesting and water recycling.
- Energy efficient streetlight technology to reduce the energy requirements of the streetlight work.

1.6 Operational Alternative:

The operational alternatives have been assessed to ensure that the best processes and services like water supply and sanitation to minimize pollution are considered to reduce any potential negative environmental impact. However, positive and negative environmental impacts will be evaluated and described in the report.

1.7 No-go option:

The no-go alternative is the option not to go ahead with the development. The no-go alternative will only be considered as an alternative if it is concluded that the preferred alternative will have significant negative impacts on the environment which cannot be reduced or managed to an acceptable level. As there it has already been indicated that there is a need and desirability for the proposed development it is anticipated that this development will relieve the demand for housing and basic services in the region. It is anticipated that the no-go alternative will constrain the development planning of the Local Municipality.

Appendix E: Public Participation

Site Notices

SITE NOTICES

NOTICE OF APPLICATION FOR ENVIRONMENTAL AUTHORISATION IN TERMS OF SECTION 24 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998)

Notice is hereby given in terms of Regulation 41 published in Government Notice No. R982 under Chapter 5 of the National Environment Management Act, 1998 (Act 107 of 1998) of the intent to submit an application for Environmental Authorisation to the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs **(DARDLEA)**.

Proponent and Location: Msukaligwa Local Municipality is proposing the formalization of the Davel township on a portion of farm Davelfontein 267-IS in the Mpumalanga Province.

NEMA Listed Activities Applied for:

- **Listing Notice 1**: GN R327 - Activity 9, 10, 12, 28
- **Listing Notice 2**: GN R325 - Activity 15

Current Zoning of the Property: Agricultural

Date of Notice: 31 May 2023

To be identified as an Interested and/or Affected Party, (I&AP), please submit your name, contact information, interest in the matter and any comments in writing within 30 days of this notice.

ISAZISO NGESICELO SOKUGUNYAZWA KWEZEMVELO NGOKWESIGABA SAMA-24 SOMTHETHO KAZWELONKE WOKUPHATHWA KWENDAWO, 1998 (UMTHETHO 107 KA-1998)

Isaziso sinikeziwe ngokoMthethonqubo wama-41 owashicilelwa eSaziso sikaHulumeni esingunombolo R982 ngaphansi kweSahluko sesi-5 soMthetho Wokuphathwa Kwemvelo Kazwelonke, 1998 (uMthetho we-107 ka-1998) ngenhloso yokuhambisa isicelo sokuGunyazwa ngezeMvelo eMnyangweni Wezolimo waseMpumalanga, Ukuthuthukiswa Kwezindawo Zasemakhaya, Umhlaba kanye Nezemvelo (DARDLEA).

Umsekeli kanye Nendawo: Umasipala Wendawo yaseMsukaligwa uhlongoza ukwenziwa ngokusemthethweni kwelokishi laseDavel engxenyeni yepulazi i-Davelfontein 267-IS esiFundazweni saseMpumalanga.

Imisebenzi esohlwini ye-NEMA ifakelwe isicelo:
• **Isaziso sokufakwa kuhlu 1:**GN R327 - Umsebenzi 9, 10, 12, 28
• **Isaziso sokufakwa kuhlu 2:**GN R325 - Umsebenzi 15

Ukuklanywa Kwamanje Kwesakhiwo: Ezolimo
Idethi Yesaziso: 31 Meyi 2023

Ukuze uhlonzwe njengomuntu onentshisekelo kanye/noma othintekayo, (I&AP), sicela ulethe igama lakho, imininingwane yokuxhumana, intshisekelo yakho odabeni kanye nanoma yikuphi ukuphawula okubhalwe phansi zingakapheli izinsuku ezingama-30 zalesi saziso.

Imibuzo mayelana nalolu daba kufanele ibhekiswe ku:

Mang Geoenviro Services
687 Silverlakes Road
Unit 11 Kingfisher Building
Hazeldean Office Park
0081

Ukubhaliswa Kokuhlanganyela Komphakathi kanye nemibuzo:

Phakwago M. Kabelo
info@manggeoenviro.co.za/ 012 770 4022

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Block 9 Unit 2 Boardwalk Office Park,
6 Eros Road, Faerie Glen, Pretoria 0004
info@manggeoenviro.co.za
www.manggeoenviro.co.za
+27 12 770 4022

Date: 31/05/2023

Proof of delivery of Background Information Documents to the IAPs for the proposed formalization of the Davel township on a portion of the farm Davelfontein 267-IS within Msukaligwa Local Municipality for the EIA Process.

Recipient Name	Contact Details	Address	Recipient Signature
Zodwa Maseko	Email: Tel: 072 869 1767	455 Kwadela	Maseko
Sipho Masombuka	Email: Tel: 073 395 8349	D714 Thembelihle	Masombuka
Ettie Malinga	Email: nomadlozi.ettie@gmail.com Tel: 076 182 5630	D204 Thembelihle	[signature]
Jabulile Vilakazi	Email: 064 724 9980 Tel:	D456 Thembelihle	[signature]
Ophelia Soko	Email: Tel: 060 6487266	D353 Thembelihle	S. Soko
Bongane	Email: Tel: 060 4212724	D354 Thembelihle	BJ
Annah Thela	Email: Tel: 072 448 4669	D489 Thembelihle	SA Thela
Ntomb Thela	Email: Tel: 060 691 2824	D489 Thembelihle	NC Thela
Nompumelelo	Email: Tel: 082 426 9145	D489 Thembelihle	[signature]
Mahlangu Jabulile	Email: Tel: —	493 "	[signature]
Mkhwanazi Nqobile	Email: Tel:	"	
Promise	Email: Tel:	D32.	[signature]
Nosipho	Email: Tel: 0635716843	D281	N. Manana.

mang GEOENVIRO SERVICES

Block 9 Unit 2 Boardwalk Office Park,
6 Eros Road, Faerie Glen, Pretoria 0004
info@manggeoenviro.co.za
www.manggeoenviro.co.za
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Recipient Name	Contact Details	Address	Recipient Signature
Lovers D Mahlangu	Email: Tel: 0843700220	D451 Kombetile	[signature]
Lungile Mgwenya	Email: Tel: 0762934202		[signature]
Sphiwe Thelo	Email: Tel: 0724484669	D289	[signature]
Busisiwe	Email: Tel: 0769172540	D113	
Themba Thomo	Email: Tel: 0603035234	D114	JP Thomo
Joyce Mkhoma	Email: Tel: 0796455755	D409	JN Mkhoma
Sonto Tshabalala	Email: Tel: 0790591241	D136	[signature]
Mandla	Email: Tel: 0604195778	D472	[signature]
Linah	Email: Tel: 0836873467	D492	[signature]
Joshua Nzuna	Email: Tel: 0783330474	Lamfela	[signature]
Nomathi Cubme	Email: Tel: 078 321 6181		Cubme
Zandile Mavimbela	Email: 0765621433 Tel:	D11	Mavimbela
Smangele Dhladhla	Email: Tel:	D454	Dhadla

mang
GEOENVIRO SERVICES

Block V Unit 2 Boardwalk Office Park,
6 Eros Road, Faerie Glen, Pretoria 0004
info@manggeoenviro.co.za
www.manggeoenviro.co.za
+27 12 770 4022

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Recipient Name	Contact Details	Address	Recipient Signature
Zodwa Manang	Email: Tel:	D469	
Nomvula Mashinini	Email: Tel:		
Nonkululeko Mgubeni	Email: Tel: 0714573126	D78	
Jeaneth Kubheka	Email: Tel:	D89	
Joanah Manang	Email: Tel: 0646218778	D191	
Mariah Nkosi	Email: Tel: 0791425743	D523	
Z. Shabangu	Email: Tel:	D188	
Linoleni Mazibuko	Email: Tel:	D481	
Albert Shongwe	Email: Tel:	D45	
Lindiwe Ngwenya	Email: Tel: 0789585733	D161	
Nompumi Nkosi	Email: Tel: 0728206124	D524	N. Nkosi
Sophy Nkosi	Email: Tel: 0725792009	D90	S. Nkosi
Patsholongu	Email: Tel:	D522	P. Shabangu
Ernest WARD Councillor	078 056 3929	248 Davel	

Appendix G: Specialist Reports

Ecological Report

PROJECT DETAILS

(EIA) PROJECT TITLE: PROPOSED DAVEL TOWNSHIP FORMALIZATION IN MSUKALIGWA LOCAL MUNICIPALITY UNDER GERT SIBANDE DISTRICT MUNICIPALITY MPUMALANGA PROVINCE

PREPARED BY AFRICA ECOLOGICAL DEVELOPMENT SERVICES

FOR MANG GEO ENVIRO SERVICES

REPORT IDENTIFICATION

Report number: AF DAVEL 31 2023

Project Title: Proposed Davel Township Formalization in Msukaligwa Local Municipality Under Gert Sibande District Municipality Mpumalanga Province

Specialist report: Biodiversity study

Date produced: 28 March 2023

Prepared by: Mr Munzhelele ED

Reviewed approved by: Mr Munzhelele ED

SACNASP Pr No 100011/11 Aquatic science

Qualifications

Master of Science in Natural Sciences, University of Venda (2013).

Bachelor of Science Honors in Natural Sciences, University of Venda (2005).

Bachelor of Science Degree in Aquatic Biology, University of Venda (2004).

This report is certified correct and represents the findings on the proposed site capability and suitability to support intended development

I declare that this report reflects a true reflection of what is existing on site and we have no conflict of interests to the project proposed.

Report signed off:  **Mr Munzhelele HE**

29/03/2023

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The project is for the proposed Davel township formalization. Therefore, Africa ecological and development services was appointed by Mang Geo Enviro services to conduct biodiversity study of the area.

An extensive survey was undertaken on 01 March 2023 to survey the site and produce report of the findings with recommendations. The area is an existing township with people staying on their own variety of houses.

Prior to site visit a desktop study was undertaken to review details of existing literature about the area. Relevant existing literatures were also reviewed to establish background data of the proposed site.

Mpumalanga Biodiversity sector plan was also reviewed to compliment relevant data.

Site is located along the N17 road to Ermelo. It lies on the grassland biome on the Highveld of South Africa. Surrounded by farms on the western side.

Due to the nature of the potential impacts that could have been caused by the existing township on the local ecology, an Ecological study was required. This was required to determine the potential presence of ecologically significant species, habitats or wetland areas within the existing land scape footprint which would be affected by the existing township. Propose mitigation and management measures in accordance with the NEMA (Act 107 of 1998) mitigation hierarchy is also recommended for further measures to address the possible environmental impacts.

NTRODUCTION

1.1 Background and Rationale

As stipulated in the master National environmental management Act and National Environmental management biodiversity Act and other environmental legislations; South African government is committed to sustainable development without a compromise on both human needs and protection of natural resources. Sustainable development principles are well observed and followed when considering authorizations for all development projects.

It is important for each proposed or existing development to undergo or to have undergone biological diversity study. Assessment for the land use and natural resources status of the site was done for the proposed site.

Locality of proposed site to determine its suitability was done intensively to verify any environmental problems that could be influenced by human activities.

This specialist report provides a baseline and impact assessment that was done on the ecosystems on the study site. This report gives details of the vegetation survey and habitat survey which were done to determine the current ecological state of the area.

All three of Mpumalanga's biomes were also reviewed as presented on the Mpumalanga biodiversity sector plan.

1.2 Aim and objectives

The aims of this study were as outlined below:

- Provide baseline data on habitat and species on and adjacent to the site
- Investigate potential impacts that might have occurred during construction and/or operational stages of the existing township when established.
- Provide advice on legislative framework relating to habitats and species on site.
- Suggest mitigation measures to be employed to address possible existing impacts.
- Identify and assess environmental impacts that could have been caused by the establishment of Davel township.
- Check and assess possibility for existence of threatened ecosystems and protected species.
- Evaluate capability of the land and determine its suitability to support the existing development.

2. STUDY AREA

2.1 Geographic Area

Davel township is located along N17 road within Msukaligwa Local Municipality under Gert Sibande district municipality in Mpumalanga Province.

Site is located at the following geographical positioning system recorded point (GPS):

Latitude: S 26°27'41,2704"

Longitude: E 29°39'9,76176

Altitude: 1731 m

Figure 2.1.1: Locality map and aerial photo

2.2 Drainage Areas and Aquatic Environment

The Davel part falls along the Upper Vaal and Olifants rivers catchment divide, and both catchments contain numerous small streams / rivers and the endorheic pans. All these systems have been classified as part of the National Freshwater Ecosystem Priority Atlas (NFEPA) project (Nel et al., 2012).

The area does have well drained soils that are able to support its infiltration capacity with more support of the grass being the main ground cover. Most of the wetlands within the study area have been shown to be natural, and form part of the important Highveld Grassland Wetland Cluster. However, some of these would be considered modified and thus have a conservation rating score of Z1 or Z2, i.e., low conservation importance. The remaining natural wetland areas associated with the local streams and pans were

mostly rated as A/B or C, i.e. Pristine to moderately modified or largely modified respectively (Nel et al., 2012).

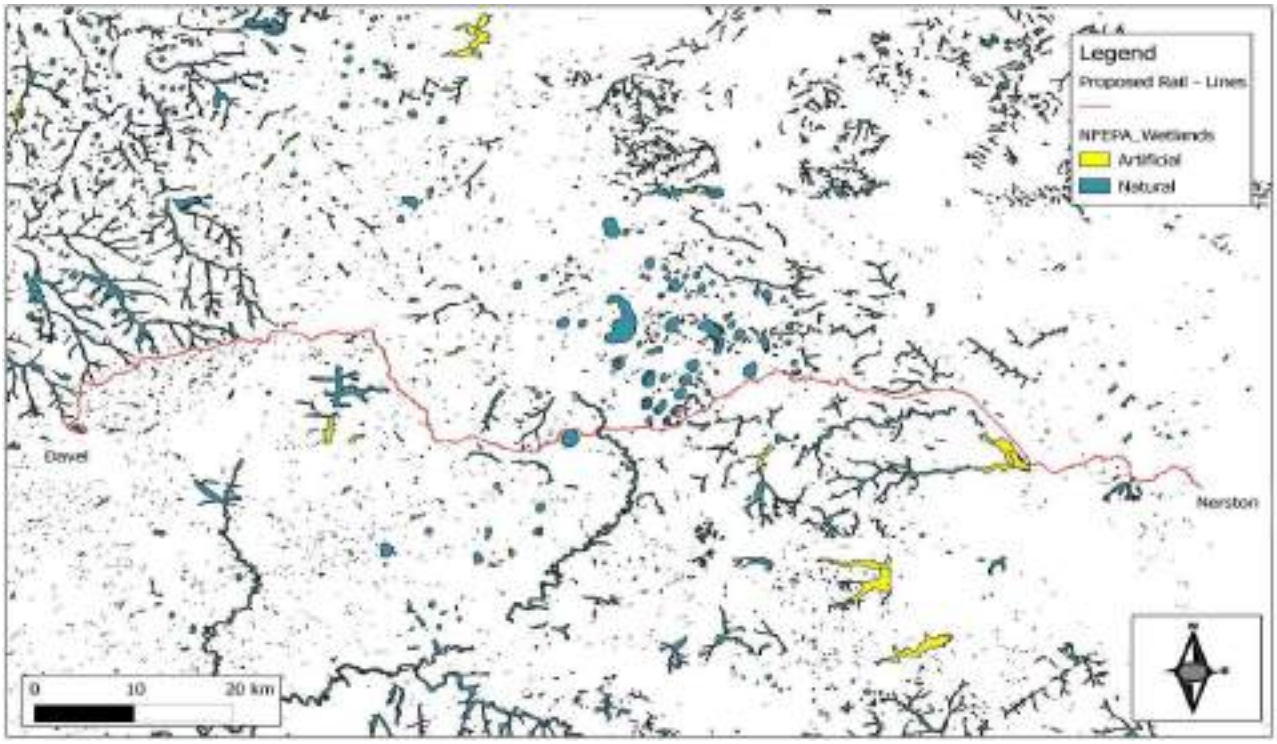


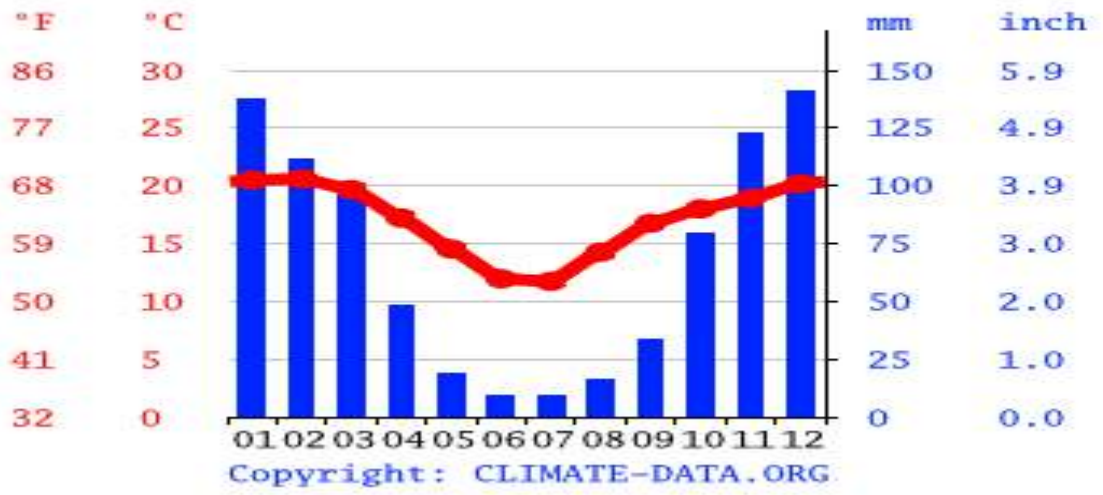
Figure 2.2.1: A map illustrating the major rivers and wetlands areas within the study region

2.3 Relief and Topography

Topography of the area is characterized of flat, gentle land scape. Locality is falling within the Highveld area of the country and province. Lies at the altitude of 1731m above sea level. Landscape of the area is flat.

2.4 Climate

Mpumalanga falls into a generally warm, summer rainfall area. In Mpumalanga, the summers are warm, muggy, and wet; the winters are short, cool, and dry; and it is mostly clear year-round. Over the course of the year, the temperature typically varies from 43°F to 79°F and is rarely below 38°F or above 86°F. The *cool season* lasts for *2.3* months, from May 29 *to* August 7, with an average daily high temperature below *70°F*. The coldest day of the year is June 30, with an average low of *43°F* and high of *68°F*.



2.4.1: Rainfall and temperature averages

3. Land use

Main Land use in the regional level varies from mines; conservation areas; industrial; game farming and agricultural land uses. Specific to the area of study main land uses are agricultural farms that include small scale farming. On the proposed area main land use is currently a grazing land and forest plantations. Agriculture is the main land use in the area with crop and livestock farming being the most practiced.

4. METHODOLOGY

The scope of the fieldwork was informed by research informed by desktop data analysis, knowledge of the study area, discussions with Darlington Borough Council, E3 Partnership Report 2005, and the timing and timescale of the study. A detailed field survey was undertaken with focus on all biological diversity aspects. Variety of surveys that were undertaken are indicated with their findings in this report.

The proposed assessment area was assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas, and relevant species present.

Species were listed and categorized as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014

This study considered collection of data considering all existing previous record to have informative data for decision making. The following surveys were done as outlined below. Data was collected for both fauna and flora by means of field surveys.

The Present Ecological State (PES) of the proposed project area was assessed and rated as per the table below.

The Present Ecological State (PES) refers to the current state or condition of an area in terms of all its characteristics and reflects the change to the area from its reference condition. The value gives an indication of the alterations that have occurred in the ecosystem. Previous aerial photos were reviewed to determine previous land cover in comparison with the latest aerial photos and done ground truthing.

Ecological Category	Score	Description
A	**> 90-100%**	Unmodified, natural, and pristine.
B	**> 80-90%**	Largely natural. A small change in natural habitats and biota may have taken place but the ecosystem functionality has remained essentially unchanged.
C	**> 60-80%**	Moderately modified. Moderate loss and transformation of natural habitat and biota have occurred, but the basic ecosystem functionality has remained predominantly unchanged.
D	**> 40-60%**	Largely modified. A significant loss of natural habitat, biota and subsequent basic ecosystem functionality has occurred.
E	**> 20-40%**	Seriously modified. The loss of natural habitat, biota and basic ecosystem functionality is extensive.
F	**0-20%**	Critically/Extremely modified. Transformation has reached a critical level and the ecosystem have been modified completely with a virtually complete loss of natural habitat and biota. The basic ecosystem functionality has virtually been destroyed and the transformation is irreversible.

Table 4.1: Criteria for present ecological state (PES) calculations

The Ecological Importance and Sensitivity (EIS) of the study area was assessed and rated as per the table below.

The Ecological Importance and Sensitivity (EIS) of an area is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales, and both abiotic and biotic components of the system are taken into

consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred.

EIS Categories	Score	Description
Low/Marginal	D	Not ecologically important and/or sensitive on any scale. Biodiversity is ubiquitous and not unique or sensitive to habitat modifications.
Moderate	C	Ecologically important and sensitive on local or possibly provincial scale. Biodiversity is still relatively ubiquitous and not usually sensitive to habitat modifications.
High	B	Ecologically important and sensitive on provincial or possibly national scale. Biodiversity is relatively unique and may be sensitive to habitat modifications.
Very High	A	Ecologically important and sensitive on national and possibly international scale. Biodiversity is unique and sensitive to habitat modifications.

Table 4.2: Criteria for ecological Importance and Sensitivity (EIS) calculations.

4.1. Provincial Habitat and Biomes overview

Assessment has been done for both terrestrial ecosystems and aquatic ecosystems as outlined below:

4.1.1 Regional background as confirmed on existing literature

As confirmed on various research papers together with Mpumalanga biodiversity sector plan several details are summarized below:

The vision of the MBSP is that healthy and sustainably managed biodiversity assets and ecological infrastructure of Mpumalanga continue to underpin widespread, shared

human benefits through the ongoing delivery of a range of ecosystem services. Its specific objectives are to:

Serve as the primary source of biodiversity information for all land-use planning and decision-making in Mpumalanga, to be used in conjunction with information from other sectors.

Ensure that Mpumalanga's ecological infrastructure is maintained, ecosystem fragmentation and loss is avoided, and the resilience of ecosystems and human communities to the impacts of climate change is strengthened.

Provide a spatial framework for environmentally sustainable development and resource-use.

Inform municipalities and other land-use planners and regulators about spatial biodiversity priorities to promote the wise management of biodiversity, and to streamline and monitor land-use decision-making.

Focus on-the-ground conservation and restoration action in biodiversity priority areas, thus supporting the MTPA in implementing its biodiversity mandate, including working with landowners to consolidate and expand the provincial protected area network.

Mainstream biodiversity conservation into the day-to-day activities of a range of development and production sectors whose primary business is not biodiversity conservation, thus promoting greater synergy between biodiversity conservation and development through implementation of the MBSP.

Terrestrial ecosystems:

Different Biomes that characterize the region include grasslands; forests and grasslands of which their nature and characteristics differ based on where they are located.

Mpumalanga incorporates elements of three different biomes grassland (occurring in the central highveld and escarpment regions, and covering the bulk of the province), savanna (occurring on the foothills and plains), and forest (on south and east-facing slopes and in river valleys).

Mpumalanga's grasslands are mainly found in the cool, open highveld landscapes of the province, above 1 000 m and with an average rainfall of over 700 mm/yr.

Mpumalanga's grasslands occur mostly on deep, fertile soils of high agricultural value. For this reason, a large proportion of this landscape has already been modified for the cultivation of crops and timber or for intensive animal production. Extensive livestock grazing can be reasonably biodiversity-friendly, provided good management and sustainable stocking rates are applied.

The many rare and endangered species characteristic of Mpumalanga's grasslands is amazing biodiversity asset. However, because of their localized distributions and short flowering durations, they are difficult to account for in environmental impact assessments, and specialist skills are required to locate and identify them reliably. Highest plant biodiversity is usually found in rocky grassland habitats and on sandy soils, and lowest on clay soils (except on soils derived from dolomite).

Savanna, found in the hotter lower-lying areas of the province, is characterized by a mixture of trees, shrubs, and grass; it is commonly referred to as 'bushveld', and, at lower altitudes, 'low-end'. Mpumalanga's savannas include tall, dense woodland in the warmer, wetter areas as well as more open woodland in the drier and cooler areas; it incorporates wooded, shrubby hill slopes, dense thickets, and grassy plains with scattered trees or bush-clumps. Such habitat diversity results from complex interactions between climate and fire, topography, geology and soils, and herbivory (by animals ranging

Mpumalanga, forests occur in small, scattered patches associated with steep, south-facing and often fire-free slopes, on sensitive soils not suited to cultivation. In many instances, forest patches occur in deeply incised river valleys in the escarpment region. They require high rainfall (over 770 mm/yr) and are supported through the dry season by groundwater from associated streams and added precipitation in the form of mist. Indigenous forests *protect* water sources rather than dry them out, as is the case with timber plantations of pine and gum trees.

Despite their scattered distribution and small patch size (with an average size of 4 ha), Mpumalanga's forests support a rich diversity of plant and animal species. Maintaining these forests in a healthy state is dependent on the connectedness of patches, achieved through riverine linkages that allow access by specialized forest fauna such as birds and monkeys.

Biome	Area(km^2)	%Mpumalanga	% Old ands	% Natural	Number of vegetation types
Grasslands	49 284	64	8.9	5,07	23
Savannah	26 649	35,5	3.2	76.8	29
Forests	400	0.5	0.1	96	14

Table 4.1.1.1 Biomes regional coverage statistics

Threatened ecosystems and endemic vegetation types

Nearly one quarter (20%) of the vegetation types in Mpumalanga are nationally gazetted as threatened. This means that these ecosystems have lost — or are at risk of losing – vital aspects of their structure, function, or composition, and have been classified as vulnerable (V), endangered (EN) or critically endangered (CR). The assessment of ecosystem threat status is based on the proportion of each ecosystem that remains intact relative to a set of thresholds. (Readers requiring a more detailed explanation of how ecosystem threat status is calculated are referred to Chapter 3 of the National Biodiversity Assessment 2011: Synthesis Report).

Most of the threatened ecosystems in Mpumalanga occur in grasslands, with most of them falling into the Vulnerable or Endangered categories. It is concerning that in the years since the publication of the MBCP, a greater proportion of Mpumalanga's ecosystems have become threatened, and have shifted from being classed as vulnerable to endangered

Freshwater Ecosystems

Mpumalanga contains over 4 000 wetlands, numerous river systems (including five major catchment areas) and a large proportion of South Africa's Strategic Water Source Areas (areas accounting for more than 50% of annual run-off). Most of the wetlands occur in grasslands of the wetter highveld and escarpment regions, with the greatest concentration of pans in the Chrissiesmeer area near Ermelo. These wetlands represent high value ecological infrastructure for securing water for human use.

Most of the wetlands in Mpumalanga fall into the category commonly referred to as 'palustrine', which includes seepage wetlands and pans

Although all of them are of high biodiversity and ecological value, there are three wetland areas that are of particular significance in Mpumalanga

The Wakkerstroom wetland complex in the south-east of the province, supports an exceptionally rich diversity of birds, including rare and threatened species such as the endemic Rudd's lark, the white-winged flufftail and the wattled crane (all of which are critically endangered), as well as rare mammals such as the endangered oribi antelope, endemic golden moles and the Cape molerat. This area has become a popular birding destination and is at the heart of a thriving ecotourism industry.

Verloren Valei, on the Steenkampsberg plateau near the town of Dullstroom, is a declared Ramsar site (a wetland of international importance). It is of high value for both bio-diversity conservation and water supply, feeding the upper catchments of the Olifants and Crocodile Rivers, two of South Africa's most important river systems which ultimately flow into Mozambique. It supports several Red List bird, frog and mammal species, and provides suitable breeding habitat for, amongst other species, the critically endangered wattled crane. It also has a high species richness of ground orchids, six endemic butterfly species, and it provides important breeding habitat for numerous fish, amphibians, and reptiles. This wetland system is currently protected within a provincial nature reserve.

The Chrissiesmeer Pan Area, near Ermelo (also called the Mpumalanga Lake District), includes more than 270 wetlands within a 20 km radius, representing the highest concentration of pans and wetlands, and the largest freshwater lake in South Africa. It qualifies as a Ramsar Site. Has been identified as an Important Bird Area (IBA) because it supports extremely high numbers of birds (especially wetland-dependent species). It is a threatened ecosystem and has been delineated as a Freshwater Ecosystem Priority Area and a Critical Biodiversity Area. The headwaters of the Vaal, Olifants and Komati Rivers are fed by the wetlands in this area. For all these reasons, the Chrissiesmeer Pan veld area has been included in a recently proclaimed Protected Environment, through the Mpumalanga biodiversity stewardship program.

Centers of endemism

Although the Province occupies only 6% of South Africa's land surface, it accounts for approximately 21% of its plant species diversity and contributes significantly to high levels of endemism in plants, mammals, and fish. This diversity is not evenly distributed throughout the province, but instead is concentrated in four of centres of endemism and species richness, which fall into a broad region of endemism within Mpumalanga, known as the Drakensberg Afromontane Region. This occurs along the high-lying mountainous areas in the east and is demarcated by groups of plants with similar geographical distributions, very often correlated with underlying geology. They contain many narrowly endemic, Red Data listed species that have highly restricted distributions, and consequently can be easily lost through habitat modification

The **Barberton Centre of Endemism** is dominated by surface outcrops of ancient volcanic (ultramafic) and sedimentary rocks which have associated with them many unusual and unique species. Outcrops of serpentine (so-called 'greenstone') occur throughout the Barberton Centre, giving rise to soils with high magnesium: calcium ratios and high concentrations of heavy metals such as nickel and chromium that are potentially toxic to many plants. This has resulted in a distinctive flora including many edaphic (soil) specialists, most of which occur in grassland areas, with a few woody serpentine-endemic plants occurring in lower-lying, savanna areas.

Species of special concern

Species of special concern are those that have ecological, economic, or cultural importance and include those that are rare, endemic, or threatened; species with unusual distributions; and medicinal and other indigenous species that are exploited commercially or for traditional use. Mpumalanga is home to approximately 334 plant species alone that are of special conservation concern; these species are rare, endemic, threatened, declining or data-deficient, and are included in the Red Data List of South African Plants. Figures for animal groups are less readily available, as the Red Lists for these groups of organisms are still in preparation.

The species of plants found in Mpumalanga account for 21% of South Africa's flora. An estimated 189 species are endemic to the province, 146 are classified as threatened (19 Critically Endangered, 31 Endangered, and 96 Vulnerable) and 334 are of high conservation concern. The majority (64 %) of these plant species are soft herbs and bulbous plants (geophytes) situated in the grassland biome, including taxa such as *Aloe* (15 species), ***Gladiolus*** (12 species), ***Disa*** (10 species), ***Ledebouria*** (9 species), ***Streptocarpus*** (11), ***Brachystelma*** (9) and 10 species of cycads. Many of the local endemics are of conservation concern and these are found in the centers of endemism described

Mpumalanga is faunally very diverse, and accounts for about 65% of the mammalian species found in South Africa. The province hosts four species that are provincially endemic (3 species of golden moles and 1 species of bat), seven that are South African endemics (4 species of golden moles, 1 species of mole-rat, 1 other rodent species and 1 species of primate), two taxa endemic to South Africa & Lesotho (1 golden mole & 1 antelope) and one taxon (antelope) endemic to South Africa, Lesotho & Swaziland. These species make a significant contribution to the high rate of mammalian endemism in the southern African sub-region, and the province plays an important role in the conservation of these taxa and their genetic variability. Most of the endemic taxa occur in grassland landscapes. Currently, 14 mammalian species in Mpumalanga are classed as threatened on the IUCN Red List (1 CR, 3 EN and 10 VU). The Mpumalanga Province offers a wide variety of habitats within the savanna, forest, and grassland biomes and this accounts for the high species richness in the province.

Mpumalanga is home to approximately 67% of South Africa's bird species. 71 of the 575 bird species in the province appear in the Red Data List, including critically endangered species such as Rudd's Lark, the White-winged Flufftail, the Eurasian Bittern, the blue swallow, and the Wattled Crane. Although Mpumalanga does not host any provincial endemics, it forms an important part of the distribution range of red-listed South African endemics such as the Yellow-breasted Pipit, Rudd's Lark, and Botha's Lark. It is also the stronghold of several threatened grassland and wetland-dependent bird species with restricted distributions. Certain species such as the Saddle-Billed Stork, White-headed Vulture and Lappet-faced Vulture are dependent on the savannas of the Mpumalanga Lowveld for survival. Twelve Important Birding Areas (IBAs

Mpumalanga has the second highest number of endemic freshwater fish species in South Africa. Fish are usually at the top of the food chain in aquatic ecosystems and form an important food source for terrestrial animals such as mammals and birds, and people. Catchments and fish sanctuaries in the eastern part of Mpumalanga are most important for conservation of threatened fish species, whose survival is placed at risk by decreased perennial flows of clean, sediment-free water. The placement of structures such as weirs and dams obstruct fish migration pathways and breeding patterns, and stocking rivers with alien, predatory fish species such as bass, reduces the chances of survival of indigenous fish species in Mpumalanga

Based on a provincial assessment, 65% of the reptile species that occur in Mpumalanga are threatened, despite their widespread distributions. Four species are known to be endemic to Mpumalanga including: Haacke's flat gecko, Mariepskop flat gecko and Rondavel flat gecko (both undescribed species of the genus *Afroedura*), and Wilhelm's flat lizard. The giant girdled lizard (the 'sungazer') although shared with other provinces is endemic to mesic grasslands and the lizards are considered threatened due to loss of suitable habitat.

None of the amphibians in Mpumalanga are known to be endemic, but many (nearly 16%) are threatened or have restricted distributions and limited breeding habitat. Many of the wetlands and pans along Mpumalanga's escarpment are important for the conservation of threatened amphibian species, although the greatest diversity occurs in the warm lowveld areas.

Eight species are considered important for setting conservation priorities because they have a restricted distribution within the province. These include: the Karoo toad, Natal cascade frog, spotted shovel-nosed frog, yellow-striped reed frog, plain stream frog, the greater leaf-folding frog, and the whistling rain frog. Although the giant bullfrog occurs elsewhere in South Africa, the Mpumalanga populations are greatly at risk due to the limited distribution in the province, a declining population and ongoing habitat modification from various land-use pressures.

This neglected group of organisms plays an essential role in maintaining ecosystem functioning, but there is little data available on the invertebrate species of Mpumalanga. It is known, however, that the central, grassland regions of the province are important for the conservation of threatened species of invertebrates, especially butterflies, dragonflies, and damselflies.

Of Mpumalanga's 383 butterfly species, nine are threatened (1 CR, 7 EN and 1 VU), one near-threatened and a further six species rare or extremely rare. The province also contains about 48% of all taxa covered in the recent red listing conservation assessment for butterflies for RSA, Lesotho, and Swaziland and around 18% of the endemic taxa in the atlas region.

Overall area is amongst one of the critical habitat sites although specific site proposed is now a degraded and fragmented habitat due to encroached residential sites. Critical and endangered ecosystems do not occur on the proposed area.

Assessment for possible feeding grounds: proposed site is a highly feeding ground supporting area kind of habitat for most of species. Underground burrowing animals also likely to exist in the area.

Nesting sites assessment: this was done to check existence of rare species such as parrots and ground horn bill. No sites were located.

Species movement patterns was also explored to test if there are any species with consideration of most dominant plant keystone species that might be influential, but none was confirmed.

4.2. Vegetation survey

A desktop review study confirmed that the area falls under grassland biome vegetation characterized by sparse shrubs. Grassland is the main biome of the area. Site is located under Amersfoort clay grassland.

During vegetation survey different plant species were identified on site and recorded focusing on specific site to be formalized. This included weeds, shrubs and grass and herbs. The identified species are presented on a table below as per their different categories. Protected tree species as per National Forest Act 84 of 1998 are also indicated on the table below. Area is still rich in species composition.

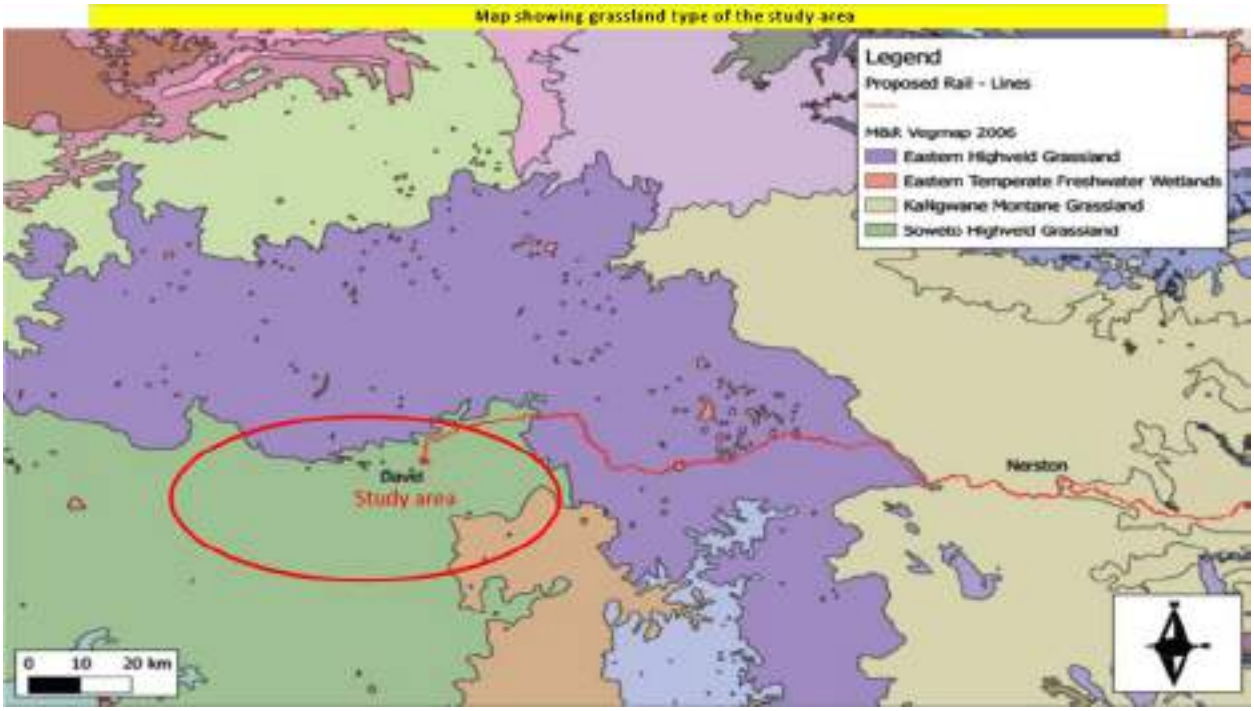
The study area is dominated by a mixture of urban and rural housing, forestry and agriculture, with the associated infrastructure such as roads, dams and the present around Davel.

According to the Mucina and Rutherford (2006) Vegmap, four regional vegetation types are present along the veld belt. These include:

- Soweto Highveld Grassland (Gm 8)
- Eastern Temperate Freshwater Wetland (Azona – Azf 3)
- Eastern Highveld Grassland (Gm 12)
- KaNgwane Montane Grassland (Gm 16)

The Biodiversity Act (No 10 of 2004) (Amendment December 2011), lists 225 threatened ecosystems based on vegetation type (Vegmap). All four vegetation types are listed by this Act as Vulnerable. Therefore, as a minimum, the Act stipulates that a minimum of a Basic Assessment must be conducted when an activity is proposed within these ecosystems.

Present maps only indicate the original extent of these ecosystems, therefore the assessment of these ecosystems, their current extent and status was done to form a major focus of the EIA field



4.2.1 Map showing vegetation types of the study area

During the site visit an intensive habitat matching was conducted and ground-truthed to determine the exact status and importance of the habitats observed at a finer scale as well as identify the presence any Species of Special Concern (Faunal & Floral).

Detailed map was verified to confirm the vegetation types of the area.

Scientific name	Common names	Population Occurrence level	Protected	Indigenous /Invasive	Life Form
Rumex acetosella	Sheep sorrel	𝍸	N/A	Weed	Herb
Phytolacla octandra	Inkberry	𝍸𝍸	N/A	Exotic	Herb
Argemone Mexicana	Yellow flowered Mexican	𝍸	N/A	Weed	Herb
Mirabilis jalapa	Four-o" clocks	𝍸𝍸𝍸	N/A	Weed	Herb
Hibiscus cannabinus	Wildstock rose	𝍸𝍸	N/A	Weed	Herb
Euphorbia heterophylla	Wild poinsettia	𝍸	N/A	Weed	Herb
Xanthium strumariam	Large cocklebur	𝍸	N/A	Weed	Herb
Zinnia peruriana	Red star zinnia	𝍸	N/A	Weed	Herb
Tagetes minuta	Tall khakhi weed	𝍸𝍸	N/A	Weed	Herb
Senecio ilicifolius	Sprinkaan senecio	𝍸	N/A	Exotic	Herb
Flaveria bidentis	Smelter's bush	𝍸	N/A	Weed	Herb
Cosmos bipinnatus	Cosmos	𝍸𝍸𝍸	N/A	Weed	Herb
Cirsium vulgare	Spear thistle	+	N/A	Weed	Herb
Campulocinium macrocephalum	Pompom weed	𝍸	N/A	Weed	Herb
Solanum sisymbriifolium	Dense-thorn bitter apple	+	N/A	Weed	Herb
Rubus cuneifolius	American brumble	𝍸	N/A	Weed	Climber
Solanum mauritianum	Bug weed	𝍸	N/A	Weed	Shrub
Richardia brasiliensis	Mexican richardia	𝍸	N/A	Weed	Herb
Modiola caroliniana	Red flowered mallow	𝍸	N/A	Weed	Herb
Malva parliflora	Small mallow	𝍸	N/A	Weed	Herb
Spergula arvensis	Corn spury	𝍸	N/A	Exotic	Herb
Verbena bonariensis	Purple top	𝍸𝍸𝍸	N/A	Weed	Herb
Verbena officionalis	Wild verbena	𝍸	N/A	Weed	Herb
Datura ferox	Large thorn apple	𝍸	N/A	Weed	Herb

Table 4.2.1 shows vegetation species composition occurrence on proposed site

Vegetation type is falling under a grassland biome. 99% of the proposed site is a grassland with grass species being the main cover. Herbaceous plants and invasive weeds are the ones appearing at stature of young seedlings and only few individuals trees to the range of 1-1,5m height. Their population sighted was less than five

individuals'. Invasive plant species are the ones that dominate the area as confirmed during surveys throughout the study area. Wattle trees plantation exist in the surrounding vicinity of the area.

Mpumalanga province is having more protected areas and areas that are demarcated as those having endemic species. But having consulted existing reports and various historical data the area of study is not falling under endemism category.

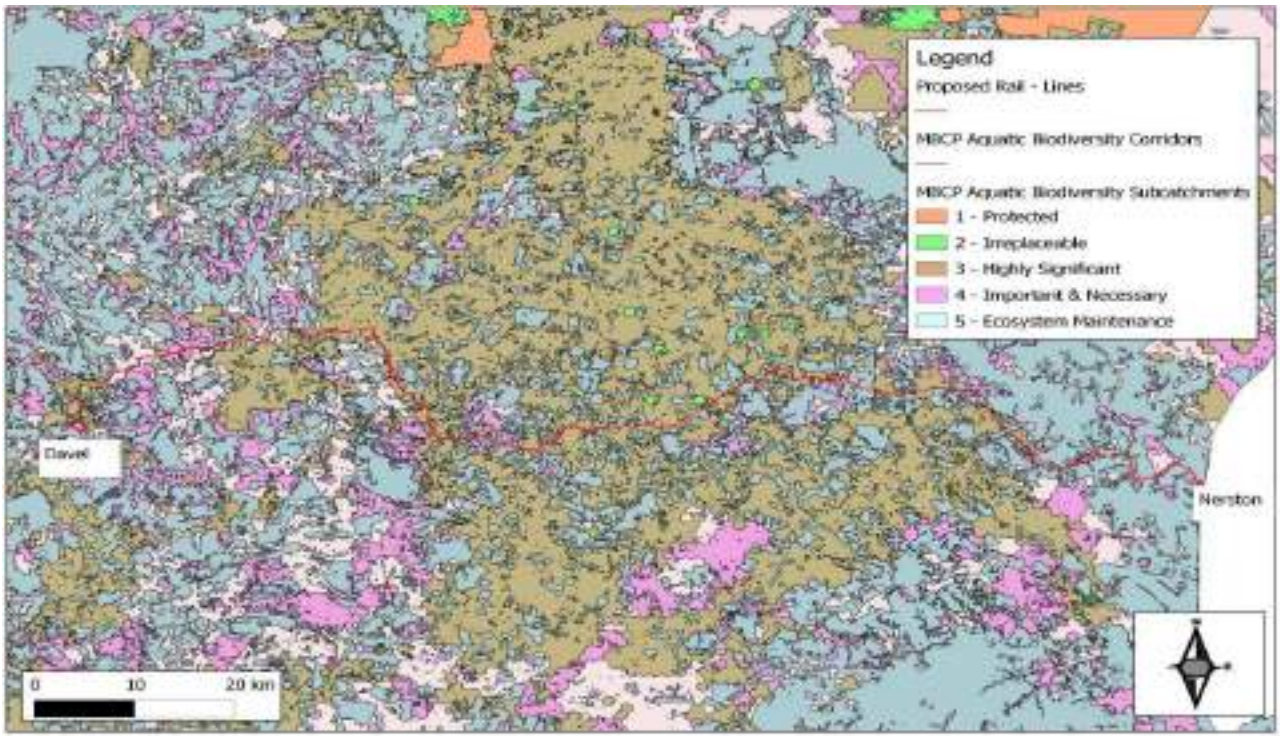


Figure 4.2.1 A map illustrating the results of the Mpumalanga Biodiversity Conservation Plan results for the Terrestrial environment (Ferrar & Lötter, 2007

Grass species were identified during field survey by means of walking through a line transect which was demarcated at an interval of 10m apart and 30m long. Grass are one of the important habitat species as they also comprise a habitat biome. Grass plays an essential role in nature as they are a major source of food. They provide shelter and nesting material. They also form important part of food chain for those species that utilize grass. They play a major habitat for rodents, birds, and insects' species. During

field survey grasses were found to be grazed condition. The area being a grassland biome is having high grass species composition which includes wetland grass and sedges. Existence of site on the grassland biome is also shown on maps below.

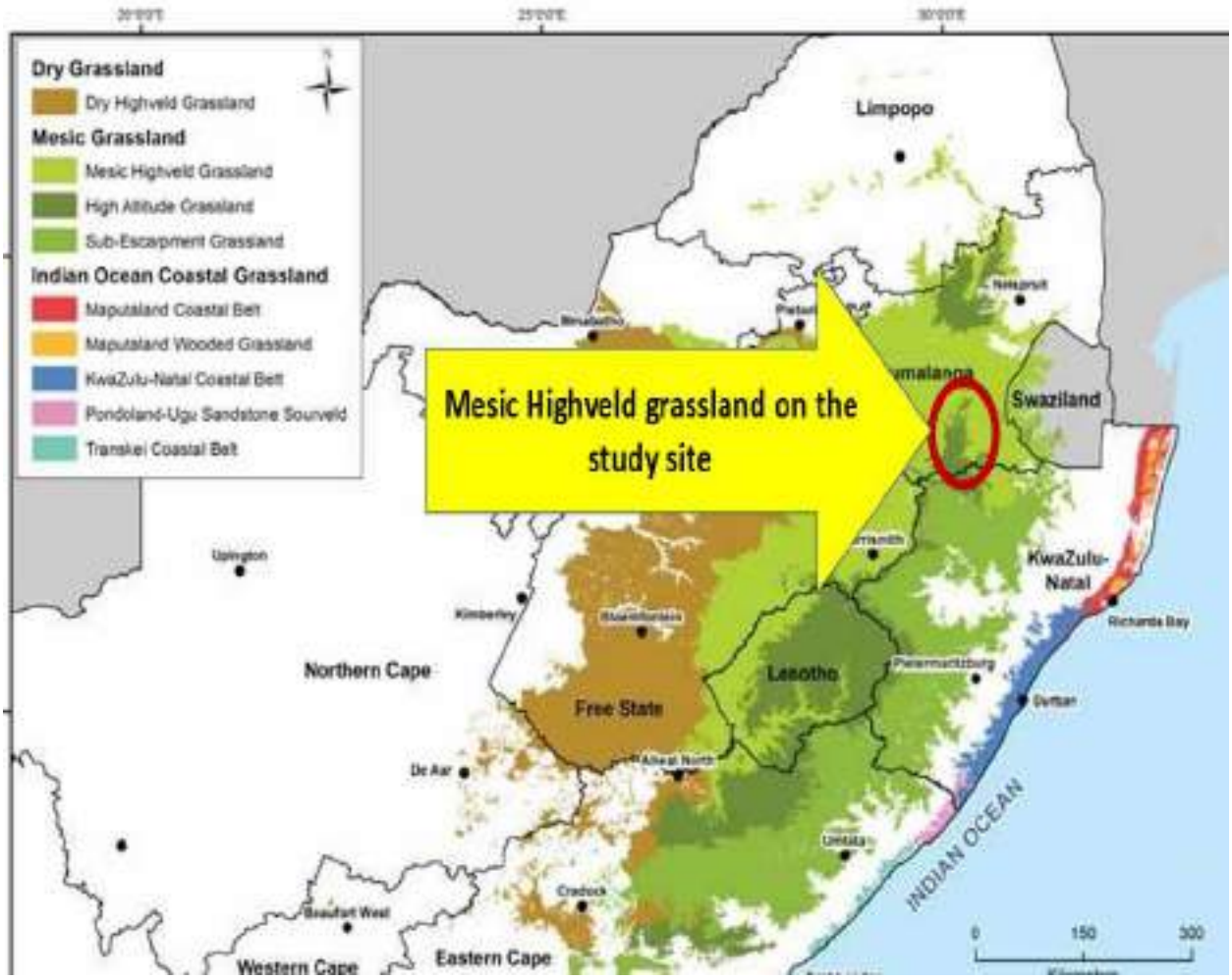


Figure 4.2.3: Map showing locality of study site being on the grassland biome.

Scientific name	Common name
Typha capensis	Common bulrush
Sporobolus africanus	Rat's tail dropseed
Cenchrus ciliaris	Foxtail buffalo grass
Panicum maximum	Guinea grass
Eragrostisrigidior	Curly leaf grass
Monocymbiumcresiiforme	Boat grass
Hyparrherniatamba	Berg gras
Setaria incrassate	Vlei bristle grass
Eragrostis racemosa	Narrow heart love grass
Merxmuelleradisticha	Mountain wire grass
Tragus berteronianus	Carrot seed grass
Andropogon Gayanus	Blue grass
Monocymbium ceresiiforme	Boat grass
Heteropogon Contortus	Spear grass
Elionurus Muticus	Wire grass
Setaria Sphacelata	Golden bristle grass

Table 4.1.2: Shows grass composition of the proposed area

4.2.1 Problem plants and herbaceous plants identified

Most of the identified plants were the indicators of disturbed area. These were identified near and surrounding homes. They are located mostly on corners where community dump their mixed waste on open spaces. Dumping of waste was determined to be the one playing major role on spreading of the problem plants.

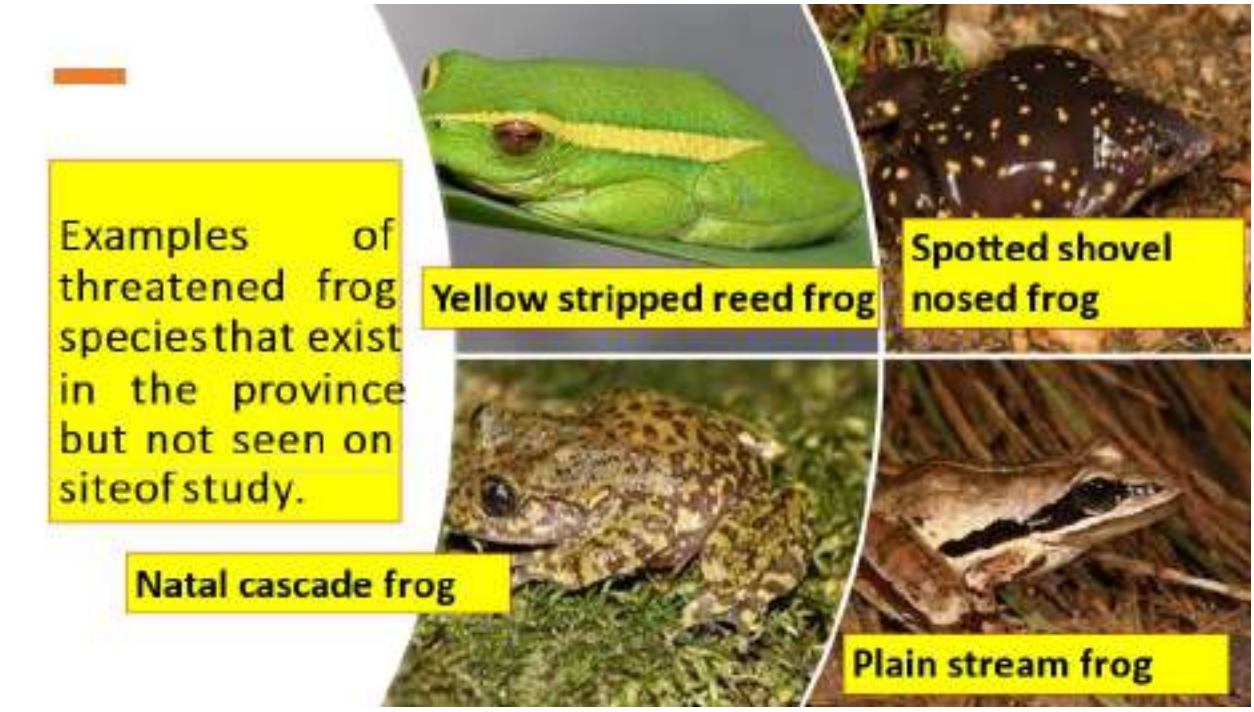
Scientific Name	Common Names	Life form	Category
Boerhavia diffusa	spiderling	Herb	Exotic
Achyranthes aspera	Burweed, Moxato	Herb	Probably exotic
Amaranthus deflexus	Perennial pig weed	Herb	Indigenous
Amaranthus hybridus	Pig weed	Herb	Exotic
Amaranthus spinosus	Thorny pig weed	Herb	Exotic
Amaranthus viridis	Slender amaranth	Herb	Exotic
Ageratina adenophora	Crofton weed	Herb	Exotic
Bidens pilosa	Common black jack	Herb	Exotic
Conyza sumatrensis	Tall fleabane	Herb	Exotic
Portulaca oleracea	porslein	Herb	Exotic
Senecio consanguineous	Starvation senecio	Herb	Exotic
Tagetes minuta	Tall khaki weed	Herb	Exotic
Xanthium strumarium	Large cocklebur	Herb	Exotic
Crotalaria sphaerocarpa	Wild lurcene	Herb	Indigenous
Mirabilis jalapa	Four-o'clocks	Herb	Exotic
Datura ferox	Large thorn apple	Herb	Exotic
Solanum elaeagnifolium	Silver leaf bitter apple	Herb	Exotic
Richardia brasiliensis	Mexican richardia	Herb	Exotic
Tribulus terrestris	Devil's thorn	Herb	Indigenous
Stylochiton natalensis	Bushveld arum	Herb	Indigenous

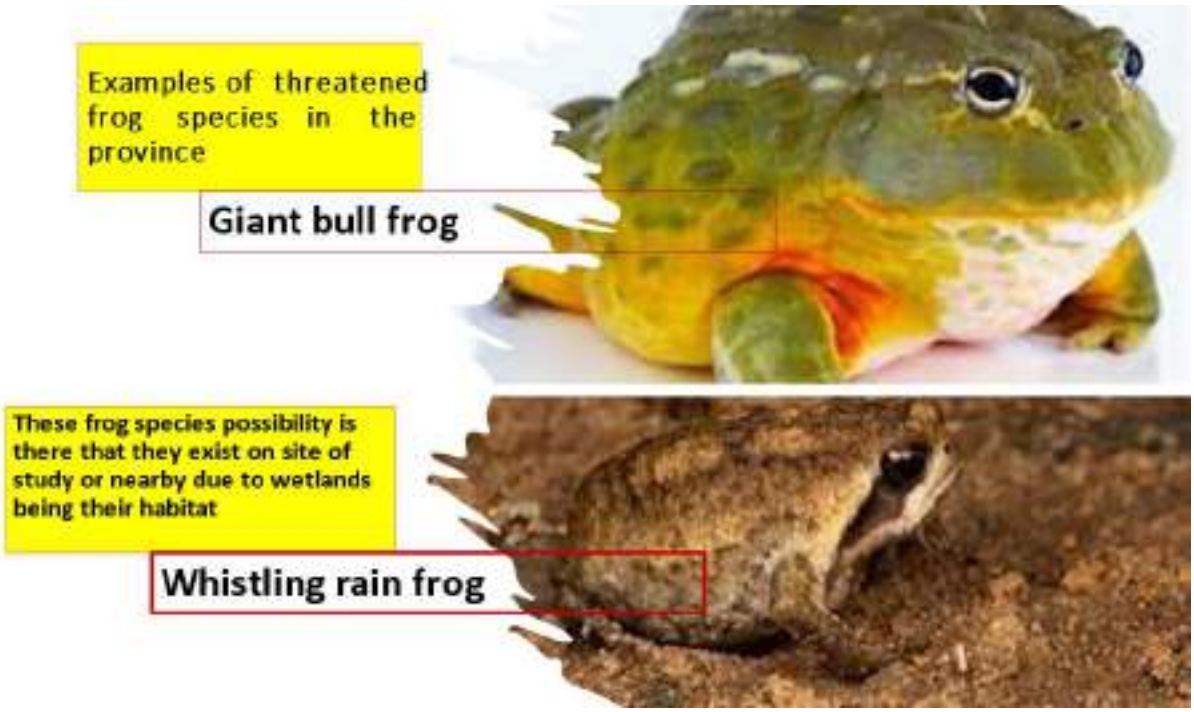
Table 4.2.1.1: Shows problem plant species composition

4.3. Reptile and amphibian survey

This was done by direct observation during a transect walk and indirect observation of callings from amphibians and reptile movement over the dry plants. No reptiles were identified during field visit although the following are likely to be found includes Chameleons, and Lizards various snakes. These are indicated on the attached appendix(s). Amphibians are highly likely to be found in the area since the area do have wetlands. Although snakes were not physically sighted, they exist in this suitable

habitat. Rare species and threatened frog species are also likely to be occurring on this site because of wetland habitats that exist.





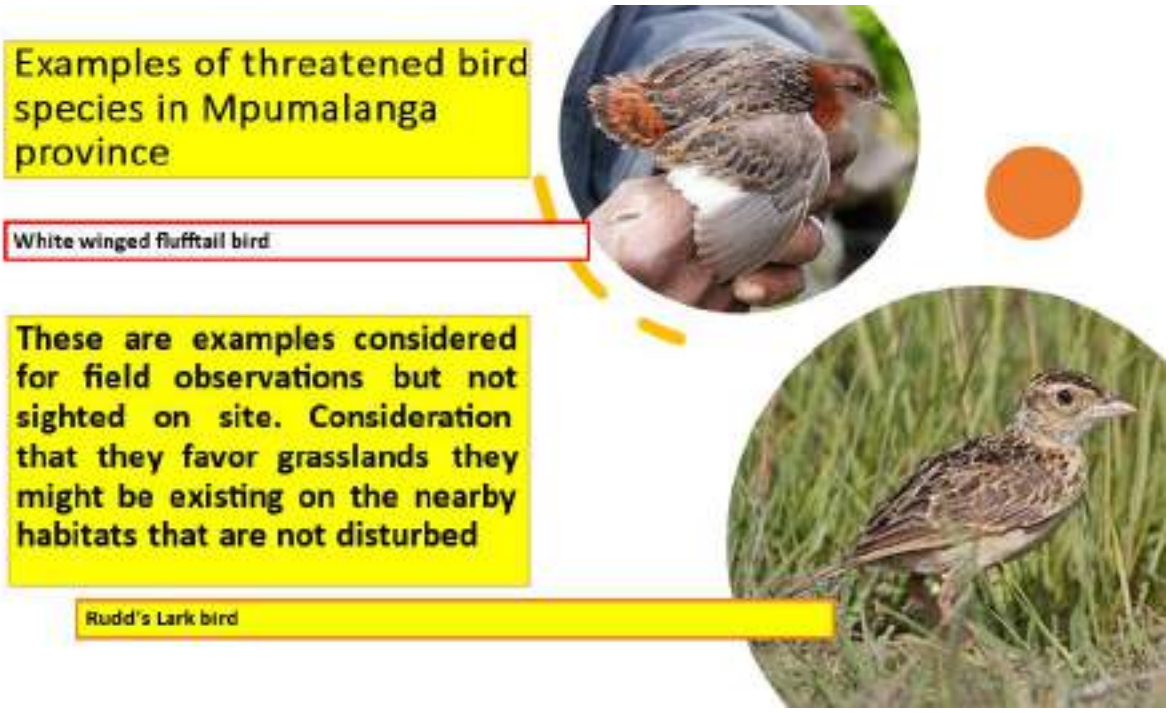
4.4. Bird survey

Birds are known to be some of the mobile species that once and again fly over to different habitats searching for food and for breeding sites. Birds were observed during site assessment. protected bird species were not identified during field visit or either on existing documents. But they are highly likely to be sighted considering data from Mpumalanga biodiversity sector plan which indicated some species that exist in the province. Since bird species are not stationed at one area; they are likely to be observed and or be occurring on the nearby habitats. In general, this area falls under the area of high ecological value which tends to support more bird species such as doves because of tree species that are loved by birds. More bird's callings were heard during field survey although couldn't easily be spotted.

Endangered wattled crane bird example but not sighted on site. Does exist in Mpumalanga

Bird species sighted on wetland

- This bird was seen on site while surveying. Its name could not be recognized due to distance of where it was.
- It resembles a crane bird which is amongst theprotected class.



Scientific name /common name	Conservation status
Dark capped bulbul (Black eye ring)	Safe
Speckled mousebird (black mask, black and white bill)	Safe
Brew rostris (*Hadida iris*)	Safe
Bronze mannikin (*Lonehura cucullata*)	Safe
Corvus albicollis (White necked raven	Safe
Streptopelia capicola (Laughing dove)	Safe
Streptopelia capicola semitorquata (Red eyed dove)	Safe

Table 4.4.1: Bird species that were seen on site

4.5 Mammal survey

Mammals are one of the species that are sensitive to disturbed and human settlement areas. Although mammals were not sighted, they are likely to be occurring in the area. It is still favorable habitat for most of small mammals.

4.6 Butterfly; Beetles; Locusts, Ants, and dragon fly survey

Butterflies and dragon fly are species that like to be found in wet areas and during flowering season. Although this is the case none of these species were identified in the area; and are also likely to be found during wet seasons when temporary ponds can be established after rains. None of protected species or rare have been identified under this category. Dragon flies are also having a potential of existing in this area. Ants were seen although not identified for rare species; locusts were sited also but no key threatened species identified.

4.7 Stream; wetland survey and existence of sensitive area(s)

The area is located on highveld area with wetlands being the dominant on the grassland biome. Wetlands are the ones that are sensitive sites and have been delineated and presented on a separate report for the same site.

Figure 4.7.1: Wetland delineation map

4.8 **CRITICAL BIODIVERSITY AREAS ASSESSMENT**

A confirmation has been done using desktop analysis on GIS and field validation to confirm status of critical biodiversity area.

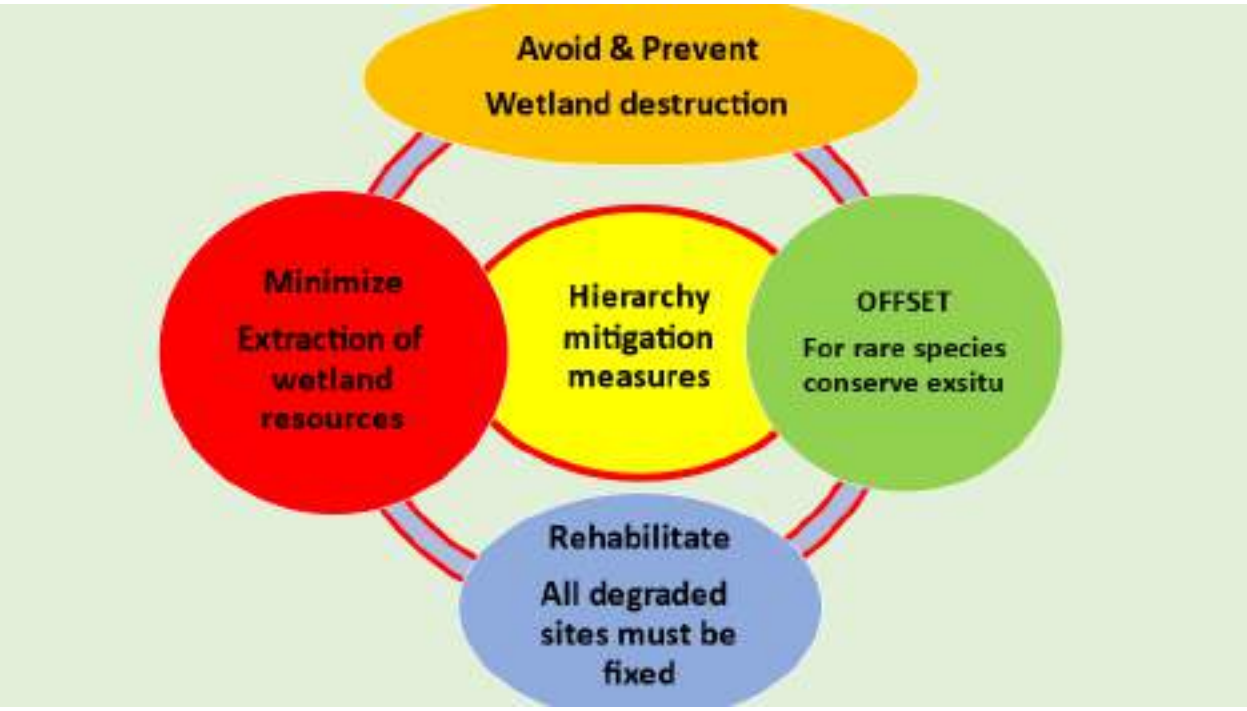
As confirmed by environmental screening report the site falls under critical biodiversity area 2.

Site due to modifications lost connections with other habitats. Fragmentation of the habitat played a major role.

Most of critical biodiversity areas that exist in the region does not cover an area where proposed site is located.

5. MITIGATION MEASURES TO BE TAKEN INTO ACCOUNT

The following mitigation measures must be taken enforced on the area during and after the establishment process to minimize damage from occurring at higher magnitude.



The Impact Mitigation Hierarchy (DEA et al., 2013)

5.1 Restrictions based on findings to minimize ecological impacts

Davel is having more existing households which indicate that population pressure on the natural resources is high which resulted to the following environmental problems:

Problem	Location	Proposed solution
Dumping of solid waste (Pollution)	open spaces, along-streets. Wetlands.	Awareness-raising. Environmental education. Provision for mobile dumping containers stations
Sand mining	On wetland edge	Stop and demarcate new sites. Environmental education and environmental monitors
Existing forest plantations	On the eastern side	Section 36 of Water Act regulations to be applied for minimum distance from wetland(100m)
Soil erosion	Existing road crossing	Proper regravelling; culverts
Over grazing	Wetland	Promote controlled grazing Livestock-reduction. Agricultural-extension-and education
Invasive alien plants	Wetland and surrounding	Clearing and control

Table 5.1.1 Environmental problems caused by humans in the area

6. RED DATA PLANT EXISTENSE ON SITE

A review on red data plant list was verified to check their existence on proposed site and none was found on site proposed.

7. EVALUATION OF PRESENT ECOLOGICAL STATE (EPS); ECOLOGICAL IMPORTANCE AND SENSITIVITY (EPIS) AND ECOLOGICAL IMPACTS

Site is falling under present ecological state class E which is a seriously modified ecosystem. Most of damage have occurred which led to site having less functionality in support of the ecosystems and connection with other ecosystems.

The Ecological Importance and Sensitivity (EIS) of the assessment area is therefore classified as Class D (low) as it not ecologically important and/or sensitive on any scale. Biodiversity is ubiquitous and not unique due to the extremely vast and homogenous and largely undeveloped surrounding natural landscape. The assessment area is not viewed as being of high conservational significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type or surface water catchment and drainage area.

The criteria for the description and assessment of environmental impacts were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April1998) in terms of the Environment Conservation Act (ECA), 1989 (Act 107 of 1989). Although the ECA EIA Regulations have been repealed, the Guideline Document still provides good guidance for significance determination (Charles J.K.1994).

The level of detail as depicted in the EIA regulations were fine-tuned by assigning specific values to each impact. To establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. The impact assessment criteria used to determine the impact of the proposed development are as follows:

- Nature of the impact.
- The Source of the impact.
- Affected stakeholders.
- Extent - The physical and spatial scale of the impact.
- Duration - The lifetime of the impact, that is measured in relation to the lifetime of the proposed development.

Below table outline impact ranking of the proposed development in and around the proposed area considering its ecological footprint. During site survey it was confirmed that community led to degradation of the wetland. Rating below is for impacts that are taking place and occurred as the area is developed.

Nature of Impact	Development stage associated with	PRESENT IMPACT RANKING, WEGHING AND SCALING							
		extent	Duration	Intensity	Probability	Weighting factor	Significance rating	Mitigation efficiency	Significance following
Removal of vegetation	**A**	**5**	**3**	**4**	**5**	**5**	**10-1**	**2.0**	**0-1**
Destabilization of soil	**A** **B**	5	2	5	5	5	20-39	3	20-39
Compaction of soil	**A** **B**	**2**	**2**	**3**	**3**	**3**	**20-39**	**1.0**	**20-39**
Spread of invasive alien plant seeds	**A**	4	4	4	6	5	20-39	0.6	20-39
Habitat fragmentation	**A**	3	3	3	3	3	0-19	1.0	0-1

Figure 7.1: Assessment of impact which has occurred and still occurring.

Cumulative impacts present on site	Impact description rate	Impact percentage of present occurrence
Removal of vegetation	Medium	15%
Destabilization of soil	High	40%
Compaction of soil	Medium	10%
Spread of invasive alien plant seeds	High	30%
Habitat fragmentation	Low	5%

Table 7.1.1: Present cumulative impact assessment

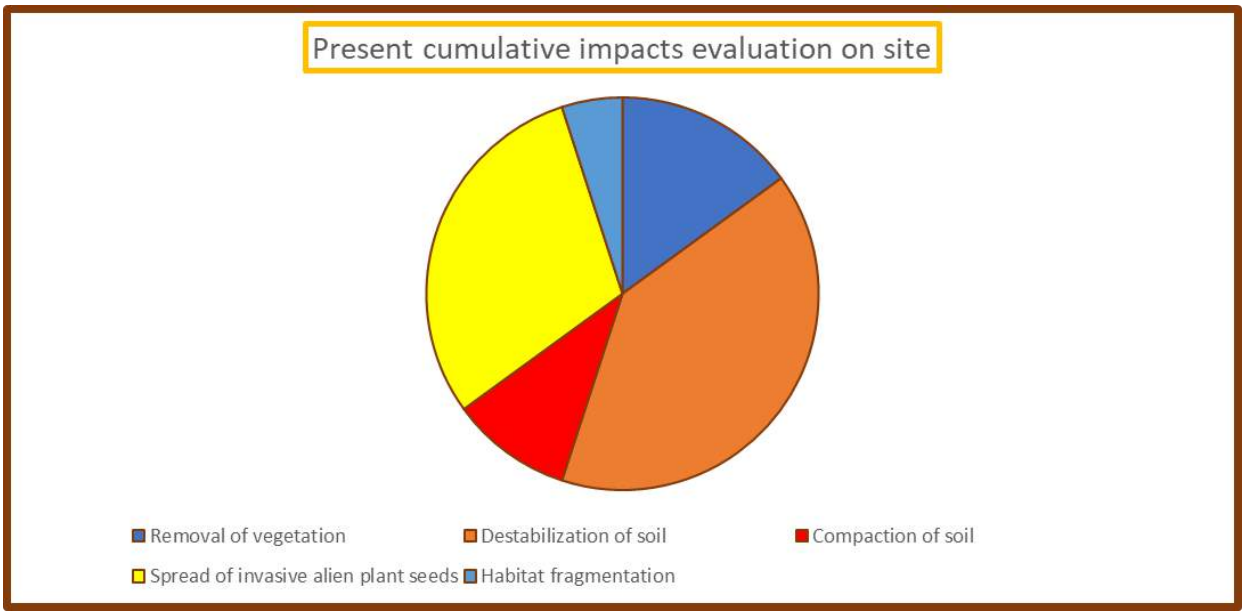


Figure 7.1.1.: Chart showing present cumulative impacts analysis

8. RECOMMENDATIONS

The proposed township establishment will require compliance to the following recommendations:

- A specialist (Environmental practitioner) must be appointed to deal with all environmental issues as indicated on the impact assessment. This will assist in implementing an environmentally friendly development.
- National Environmental management biodiversity 2004 (Act No 10 of 2004) (NEMBA) must also be considered when dealing with invasive alien plants so that all measure can be based on this legislation and its regulations.
- Environmental management plan must be developed to cater for detailed mitigations for all identified direct and indirect impacts.
- Transportation of material must be done with care to minimize the transportation of alien plants seeds from one point to another.
- People must be educated on wetland restoration and their benefits.

- Municipality must promote an eco-town ship greening in the area to safeguard existing wetland.
- A buffer zone of 50m must be complied to without any compromise to protect the wetland.
- Soil mining must not be allowed on the wetland site.
- Municipality must provide sub waste dump station in the community vicinity.
- Implement an adequate Alien Invasive Species Management and Prevention Plan during the construction phase. Such a management plan must be compiled by a suitably qualified and experienced ecologist.
- Alien invasive species individuals currently on site must be actively eradicated from the assessment area and adequately disposed of in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014.(Refer to invasive and open space management plan attached)

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APPENDIX A: LEGISLATION CONSIDERED AND RELEVANT

The criteria it was necessary to list relevant legislation for reference while working in the area and further guidance to improve compliance. Therefore, all legislations applicable are listed below:

ACRONYM	YEAR	ACT
CARA	1983	Conservation of Agricultural Resources Act (Act 43 of 1983)
ECA	1989	Environmental Conservation Act (Act 73 of 1983)
NFA	1998	National Forests Act (Act 84 of 1998)
NEMA	1998	National Environmental Management Act (Act 107 of 1998), as amended
NWA	1998	National Water Act (Act 36 of 1998)
MNCA	1998	Mpumalanga Nature Conservation Act (Act 10 of 1998)
WHCA	1999	World Heritage Convention Act (Act 49 of 1999)
MSA	2000	Municipal Systems Act (Act 32 of 2000)
MPRDA	2002	Mineral and Petroleum Resources Development Act (Act 28 of 2002)
The Protected Areas Act	2003	National Environmental Management: Protected Areas Act (Act 57 of 2003), as amended
The Biodiversity Act	2004	National Environmental Management: Biodiversity Act (Act 10 of 2004), as amended
MPRA	2004	Municipal Property Rates Act (act 6 of 2004)
MTPAA	2005	Mpumalanga Tourism and Parks Agency Act (Act 5 of 2005)
SPLUMA	2013	Spatial Planning and Land Use Management Act (Act 16 of 2013)

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended). The Biodiversity Act provides for the coordinated management, conservation and sustainable use of biodiversity across the whole country. It promotes an ecosystem-orientated approach to the management of biodiversity, taking into account the need for social transformation and development goals to be met, and recognizing that biodiversity conservation involves working beyond the boundaries of formal protected areas. The Biodiversity Act introduced a new set of biodiversity planning and management tools that have legal standing – including listed Threatened Ecosystems and Bioregional Plans.

APPENDIX B: Red data Species Checklist Considered

(National Environmental Management Biodiversity Act (Act 10 of 2004)

REPTILIA						
SCIENTIFIC NAME	**COMMON NAME**	**CRITICALLY ANDANGERED**	**ENDANGERED**	**VULNERABLE**	**PROTECTED**	**LIKELY TOEXIST ON PROPOSED AREA**
Caretta caretta	Loggerhead Sea Turtle	✓				
Dermochelys coriacea	Leatherback Sea Turtle	✓				
Eretmochelys imbricate	Hawksbill Sea Turtle	✓				
Chelonia mydas	Green Turtle		✓			
Cordylus giganteus	Giant Girdled Lizard		✓			
Lepidochelys olivacea	Olive Ridley Turtle		✓			
Psarnrnobates geornetricus	Geometric Tortoise		✓			
Bitis gabonica	Gabon Adder				✓	
Bitis schneideri	Namaqua Dwarf Adder				✓	
Bradypodion taeniabronchum	Smith's Dwarf Chameleon				✓	
Cordylus cataphractus	Armadillo Girdled Lizard				✓	
Crocodylus niloticus	Nile crocodile				✓	
Python natalensis	African Rock Python				✓	
AVES						
SCIENTIFIC NAME	**COMMON NAME**	**CRITICALLY ANDANGERED**	**ENDANGERED**	**VULNERABLE**	**PROTECTED**	**LIKELY TOEXIST ON PROPOSED AREA**
Grus carunculatus	Wattled Crane	✓				
Hirundo atrocaerulea	Blue Swallow	✓				
Neophron percnopterus	Egyptian Vulture	✓				
Poicephalus robustus	Cape Parrot			✓		
Trigonoceps occipitalis	White-headed Vulture			✓		

Aquila rapax	Tawny Eagle			✓		
A rdeotis kori	Kori Bustard			✓		
Ciconia nigra	Black Stork			✓	✓	
Circaetus fasciolatus	Southern Banded Snake Eagle			✓	✓	
Eupodotis caerulescens	Blue Korhaan			✓	✓	
Falco fasciinucha	Taita Falcon			✓		
Falco naumanni	Lesser Kestrel			✓		
Falco peregrinus	Peregrine Falcon			✓		
Geronticus calvus	Bald Ibis			✓		
Neotis ludwigii	Ludwig's Bustard			✓		
Polemaetus bellicosus	Martial Eagle			✓		
Terathopius ecaudatus	Bateleur			✓		
Tyto capensis	Grass Owl			✓		
Bucowus leadeateri	Southern Ground-Hornbill				✓	
Circus ranivorus	African Marsh Harrier				✓	
Neotis denhami	Denham's Bustard				✓	
Spheniscus demersus	Jackass Penguin				✓	

MAMMALIA						
SCIENTIFIC NAME	**COMMON NAME**	**CRITICALLY ANDANGERED**	**ENDANGERED**	**VULNERABLE**	**PROTECTED**	**LIKELY TOEXIST ON PROPOSED AREA**
Bunolagus monticularis	Riverine Rabbit	✓				
Chrysospalax villosus	Rough-haired Golden Mole	✓				
Arnblysomus robustus	Robust Golden Mole					
Damaliscus lunatus	Tsesebe			✓		
Diceros bicornis	Black Rhinoceros		✓			
Lycaon pictus	African Wild Dog		✓			
Neamblysomus gunningi	Gunning's Golden Mole		✓		✓	
Ourebia ourebi	Oribi		✓		✓	
Paraxerus palliates	Red Squirrel		✓		✓	

Acinonyx jubatus	Cheetah		✓			
Cricetomys gambianus	Giant rat		✓			
Manis temminckii	Pangolin		✓			
Neamblysomus julianae	Juliana's Golden Mole		✓			
Otomops martiensseni	Large-eared Free-tailed Bat		✓			
*Panthera **leo***	Lion		✓			
Panthera pardus	Leopard		✓			
Philantomba monticola	Blue Duiker		✓			
Atelerix frontalis	South African Hedgehog		✓			
Connochaetes gnou	Black Wildebeest		✓			
Crocuta	Spotted Hyena		✓			
Felis nigripes	Black-footed Cat		✓			
Parahyaena brunnea	Brown Hyena		✓			
Loxodonta africana	African elephant		✓			
Lutra maculicollis	Spotted-necked Otter		✓			
Mellivora capensis	Honey Badger		✓			
Redunca arundinum	Reedbuck		✓			
INVERTEBRATA						
SCIENTIFIC NAME	**COMMON NAME**	**CRITICALLY ANDANGERED**	**ENDANGERED**	**VULNERABLE**	**PROTECTED**	**LIKELY TOEXIST ON PROPOSED AREA**
Colophon spp - All species	Stag Beetles		✓			
Aloeides clarki	Coega Copper Butterfly					
Ceratogyrus spp - All species	Horned Baboon Spiders					
Echinodiscus bisperforatus	Pansy Shell			✓		
Dromica spp - All species	Tiger Beetles		✓			
Graphipterus assimilis	Velvet Ground Beetle					
Xadogenes spp -	Flat Rock Scorpions					

All species						
Halite's midae	South African Abalone				✓	
Xarpactira spp - All species	Common Baboon Spiders				✓	✓
Ichnestoma spp - All species	Fruit Chafer Beetles				✓	
Manticora spp - All species	Monster Tiger Beetles				✓	
Megacephala asperata	Tiger Beetle				✓	
Megacephala regalis	Tiger Beetle				✓	
Nigidius auriculatus	Stag Beetle				✓	✓
Oonotus adspersus	Stag Beetle				✓	
Oonotus interioris	Stag Beetle				✓	✓
Oonotus rex	Stag Beetle				✓	
Oonotus sericeus	Stag Beetle				✓	
Opisthacanthus spp - All species	Creeping Scorpions				✓	
Opistophthalmus spp - All species	Burrowing Scorpions				✓	

AMPHIBIA

SCIENTIFIC NAME	COMMON NAME	CRITICALLY ANDANGERED	ENDANGERED	VULNERABLE	PROTECTED	LIKELY TOEXIST ON PROPOSED AREA
Pyxicephalus adspersus	Giant Bullfrog				✓	
Pyxicephalus edulis	African Bullfrog				✓	

The above red data species evaluation was done and verified using existing data and consulted Mpumalanga biodiversity sector plan. For the unticked species some might occur on the surrounding habitats.

Photos: Listed photos below shows view of the site in terms of vegetation cover and condition of the land as found during field surveys.

View of ground cover dominated by grass(Grassland biome)

Weeds identified on site(Main dominants)

PROPOSED DEVELOPMENT AREA ENVIRONMENTAL SENSITIVITY

An overview of the area was undertaken through a desktop study using a recommended screening environmental tool as mandated by the national department of environmental forestry and fisheries which gazette that for every environmental impact assessment to be done for development projects screening for environmental sensitivity must be done. Site is falling under **critical biodiversity area 2** as confirmed by screening report.

Table below indicate status of environmental sensitivity as outlined on the downloaded screening report. Data indicated was verified on site.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity	Field verified Confirmation
Agriculture Theme		**X**			Correct
Animal Species Theme		X			Site modified
Aquatic Biodiversity Theme	X				Wetland Not agreeing
Archaeological and Cultural Heritage Theme				X	Correct
Civil Aviation Theme		X			N/A
Defence Theme				X	N/A
Paleontology Theme			**X**		N/A
Plant Species Theme			**X**		Low
Terrestrial Biodiversity Theme	**X**				Low

Existing development footprint has impact on the local area which extends to a buffer zone outlined. Sensitive sites are only the wetland demarcated with the delineated buffer of 50m. Terrestrial and aquatic themes are not realistic as indicated on screening report.

Development footprint determination

Magnitude of the developed area is medium to high with its limitations of the footprint remaining locally. Potential to expand out of the region is low.

The following protocols were considered to verify the site as recommended by the screening report for environmental sensitivity of the site proposed as part of required specialist assessment:

Land capability for the proposed development

Capability for the site proposed was assessed to determine its suitability to support the establishment of the township.

Geotechnical Report

OCTON GEOLOGICAL CONSULTANTS

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED FORMALIZATION OF SITE AT THE DAVEL, MSUKALIGWA LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE

Report NO: **OGT_2304325**

May 2023

Khano Mushiana

kmushiana@octongeo.co.za

Prepared By:	Prepared For:
OCTON Geological Consultants (Pty) Ltd 389 Green Shank Avenue, Groblers Park, Roodepoort, Gauteng, 1724 Email: info@octongeo.co.za www.octongeo.co.za	Block 9 Unit 2 Broadwalk Office Park, 6 Eros Road, Faerie Glen, Pretoria 0004 Email: info@manggeo.co.za www.manggeo.co.za

Document Control	OCTON Geological Consultants		Report No.	**OGT_2209002**
Report Title	GEOTECHNICAL INVESTIGATION FOR THE PROPOSED FORMALIZATION OF SITE AT THE DAVEL, MSUKALIGWA LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE			
Authors	Name	Title	Date	Signature
Compiled by	Mabasa V.R.	Geologist	April 2023	
Reviewed by	Mushiana, K.R.	Geologist	April 2023	

Approved by:

Tshivhase, K. D (BSc Hons Geology) *(Pr.Sci Nat)*

Registration No: 400111/17

EXECUTIVE SUMMARY

This geotechnical report contains the findings and development recommendations for the proposed formalization of site in Davel, within the jurisdiction of Msukaligwa Local Municipality in the Gert Sibande District, Mpumalanga Province of South Africa.

The co-ordinates that can be used to locate the site are 26°27'48.3"S, 29°39'19.9"E.

Three disturbed samples were taken from the test pit excavations for laboratory analysis of Foundation Indicators. The laboratory test results are included in Appendix B. The main geotechnical constraints to the development will be erodible soils.

The major geological formation underlaying the area is the lithologies of the Vryheid formation. This formation has been subdivided into three different lithofacies arrangements. They are dominated by fine-grained mudstone, carbonaceous shale with alternating layers of bituminous coal seams, and coarse-grained, bioturbated immature sandstones respectively.

In terms of SABS 1200D intermediate excavation is anticipated from the surface to depths of about 200 cm below natural ground level. No groundwater seepage was observed in any of the pits excavated during field investigations. The site classified as C1 and C2 in accordance with the NHBRC Residential Class Designation. The soil was found to be erodible materials.

The foundation indicator test results indicate that the gravelly silty sandy soil on site has a high amount of sand 46.4%, followed by silt averaging at 31.7%, and 17% of gravel and 4.9 % of clay; with a corresponding low Grading Modulus averaging at 0.98; which is indicative of medium to fine-grained material. The soil sampled from the test pits classifies as SC, CL & ML according to the Unified Soil Classification (USC). The Potential for Expansiveness is low according to Van Der Merwe's Activity Chart.

Based on the geotechnical investigation findings (geotechnical characteristics, geological settings, and laboratory results) the site is potentially suitable for the proposed development, but certain geotechnical constraints, such as potentially problematic soils may

affect development costs. The options for suitable foundations are modified normal, compaction of in-situ soils below individual footings, deep strip foundations, soil raft, stiffened strip footings, stiffened or cellular raft and piled or pier foundation.

It is considered that the conditions prevailing on site are such that the site is considered suitable for the proposed development, provided the recommendations outlined here are adhered to.

Please note that this executive summary does not fully relate our findings and opinions. Those findings and opinions are only presented through our full report.

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1. INTRODUCTION

Octon Geological Consultants (Pty) Ltd was appointed by Mang Geo Environmental by mid-February to conduct a phase 1 geotechnical investigation for the proposed formalization of site at the Davel, Msukaligwa local Municipality in Mpumalanga Province.

The investigation was carried out in accordance with the requirements of the National Department of Housing Generic Specification GFSH-2 (2002). This report presents the findings of the geotechnical investigation and provides recommendations for the appropriate foundation design and precautionary measures to mitigate the identified risks.

2. OBJECTIVES

The primary objective of the geotechnical investigation was to gather information on subsurface conditions at the site. The objectives can be stated as:

- Provide a description of the location geology of the proposed site;
- Define the ground conditions and classify the conditions through detailed soil profile descriptions and groundwater occurrences within the zone of influence of foundations;
- Identify potential geotechnical hazards;
- Comment upon any geotechnical constraints that may impact upon the design and construction of the proposed development (Dolomite area, etc.); and
- Provide the geotechnical basis for safe and appropriate land use planning, infrastructure, and housing unit design as well as formulation of precautionary measures and risk management procedures.

3. SITE DESCRIPTION

3.1. LOCALITY

The proposed development site (here after referred to as "the site") is in Davel, Msukaligwa local Municipality in Mpumalanga Province. The site is situated approximately 30km east of Bethal. **Figure 1** show the site locality map. The central co-ordinates that can be used to locate the site are:

- 26°27'16"**S**, 29°39'20.46"**E**

3.2. SITE DESCRIPTION

3.2.1. TOPOGRAPHY

The highest on-site topographical elevation point was recorded as 1734 mamsl (meters above mean sea level) and the lowest point at 1716 mamsl, with an elevation loss of 18 m over a lateral distance of ~768 m. The topography of the area is generally rolling terrain. The topography on the site dips south-eastwards.

3.2.2 LANDUSE, INFRASTRUCTURE AND SOIL COVER

The area is occupied by informal settlers who erected shacks in the area. The surface conditions were generally dry to slightly moist at the time of the investigation. Livestock were observed grazing at the site.

3.3.3. CLIMATE

The climate in Davel is warm and temperate. The climate here is classified as Cbw by the Köppen-Geiger system. When compared to winter, the summers have much more rainfalls. The driest month is July, with approximately 9 mm of rain. The greatest amount of precipitation occurs in December, with an average of 158 mm. The average annual temperature here is 14.9 °C. The temperatures are highest on average in February, at around 18.4 °C. The coldest month of the year is July with an average around of 9 °C.

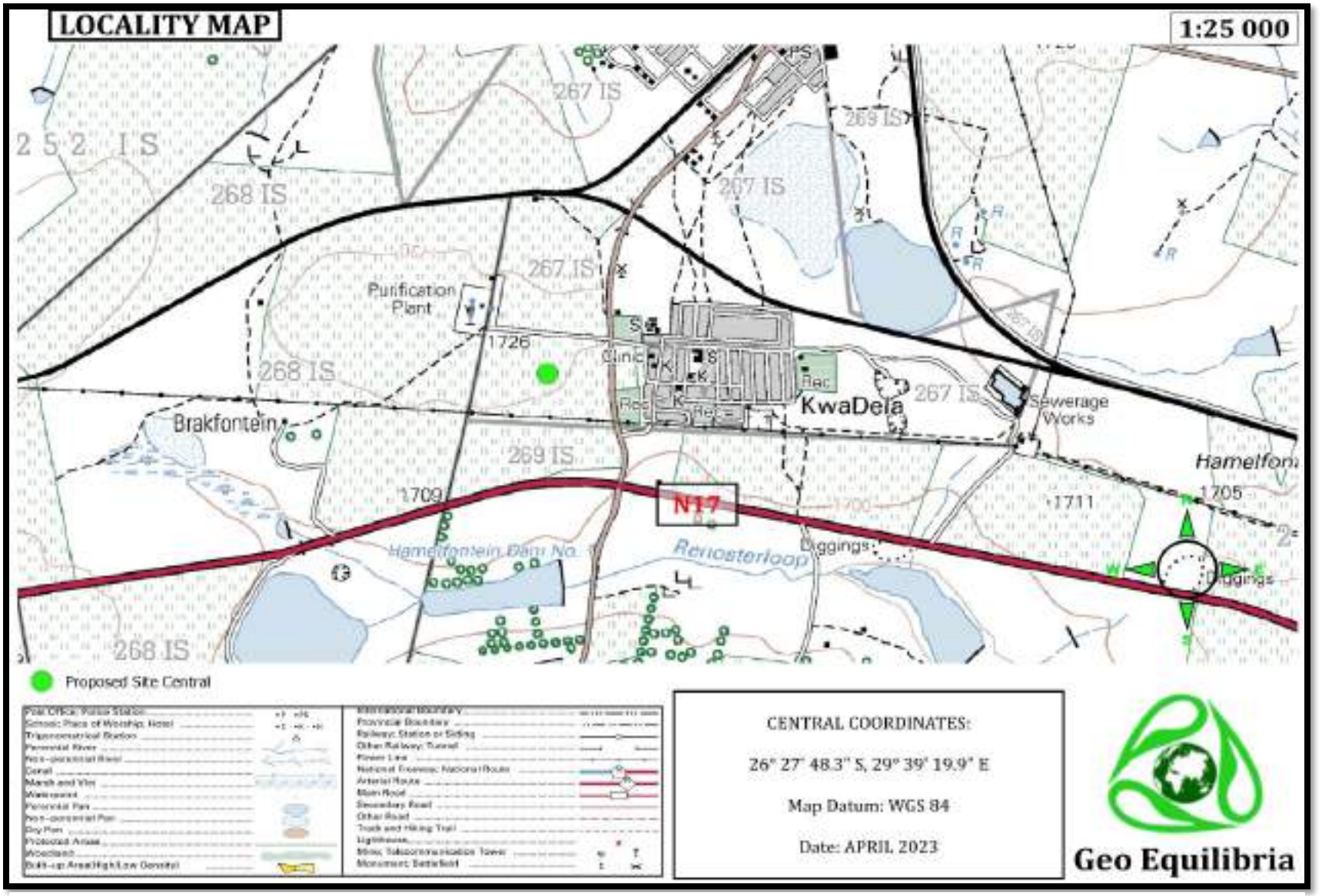

Figure 1:Locality map

4. METHOD OF INVESTIGATION

4.1. DESKTOP STUDY

Desk study included a study of published geological and topographic maps, aerial photographs, ortho-photographs, geo-hydrological maps, or any other relevant data from previous work on and around the site. The purpose of the desk study was to:

- Provide background information and technical guidance as well as to refine the scope of work for the follow-up geotechnical assessment; and
- Identify potential geotechnical significant features such as tension cracks, slope failures and bulging of faces to be confirmed during site walkover.

4.2. GEOTECHNICAL INVESTIGATION

A geotechnical investigation was conducted, during which geotechnical significant features across the site such as potential seepage zones, tension cracks and bulging of faces were recorded. This phase of investigation relied on intrusive investigation methods such as test pitting, in-situ testing to collect and provide interpretive information to make recommendations regarding foundation and structural design.

The geotechnical investigation was carried out involved the excavation of thirteen (5) test pits (TP1 to TP4) using a hand auger from the ground surface to maximum depths of around 1.5 m below ground level or machine refusal.

The test pits were positioned on various sections of the area under investigation considering the anticipated ground conditions, existing land use and the proposed development. The test pits positions were recorded in the field using a handheld Global Positioning System (GPS) with an accuracy of 3 m, and their coordinates appear on the soil profile log that is included in **Appendix A** of this report. The test pits were profiled by a geologist according to standard practice to define ground conditions and groundwater occurrences within the zone of

influence of foundation work. **Figure 2** shows the position of the test pits and geotechnical zonation of the site.

4.3. LABORATORY TESTING

Laboratory testing forms an essential part of the geotechnical investigation. Representative disturbed samples were randomly retrieved from soil horizons for examination, identification, and laboratory testing. The laboratory test results are discussed in **Section 7** of this report. All test pits were backfilled with the in-situ material immediately after profiling.

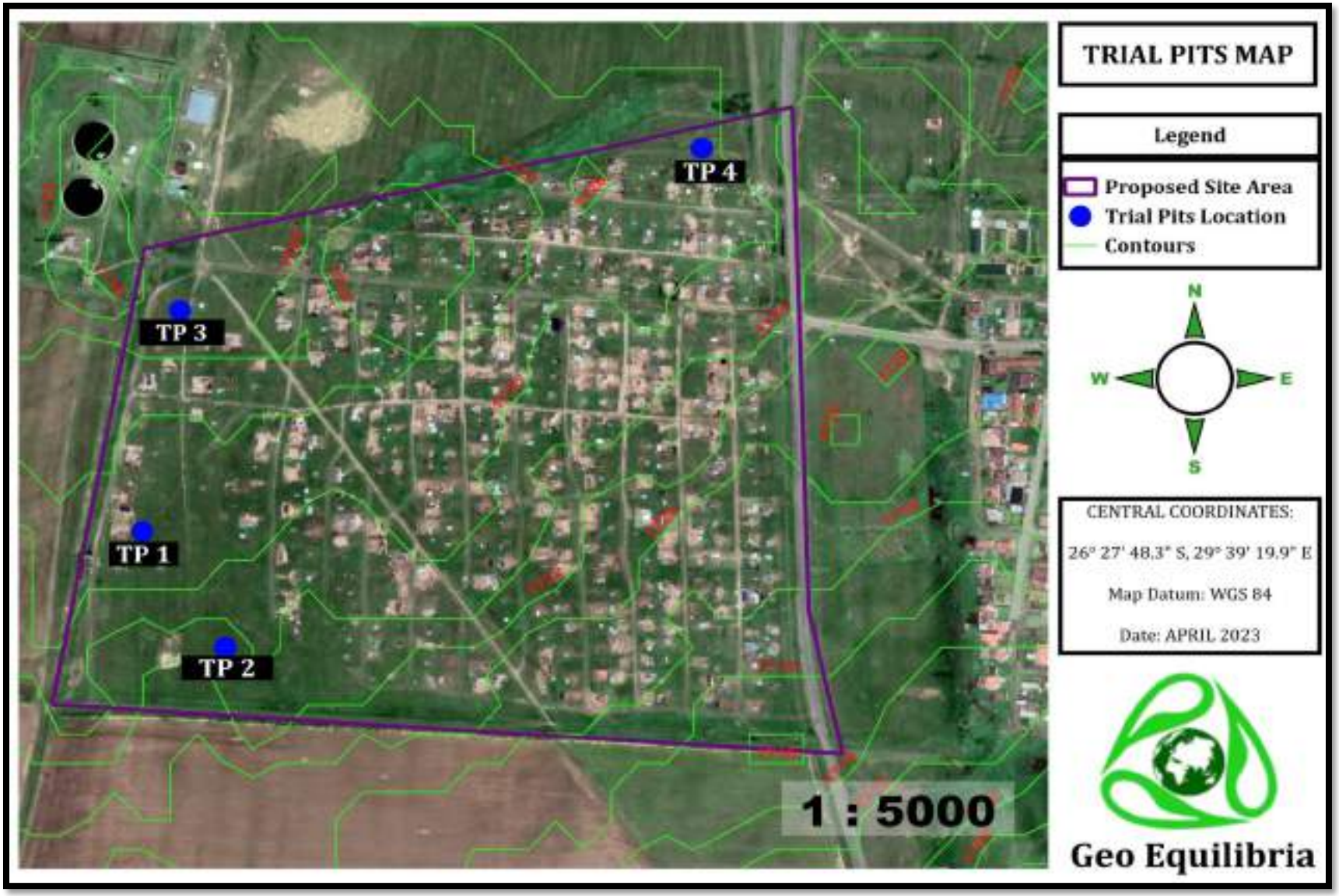

Figure 2: Trial pit positions

5. GEOLOGY

The major geological formation underlaying the area is the lithologies of the Vryheid formation. This formation has been subdivided into three different lithofacies arrangements. They are dominated by fine-grained mudstone, carbonaceous shale with alternating layers of bituminous coal seams, and coarse-grained, bioturbated immature sandstones respectively.

The alternating rock types observed in the Vryheid Formation indicate seasonal variations of storms and fairer weather in a pro-delta setting. The carbonaceous shales were formed below the water surface in anoxic conditions and the coal formed from compacted plant matter deposited at the bottom of peat swamps. These swamps formed on abandoned alluvial plains where stagnant water accumulated.

This site does not reflect any risk for the formation of the sinkholes or subsidence caused by the presence of the soluble rocks (dolomite or limestone), and no evidence of mining activity beneath the study area has been revealed.

The lithologies present in the study area are illustrated in **Figure 5** below.

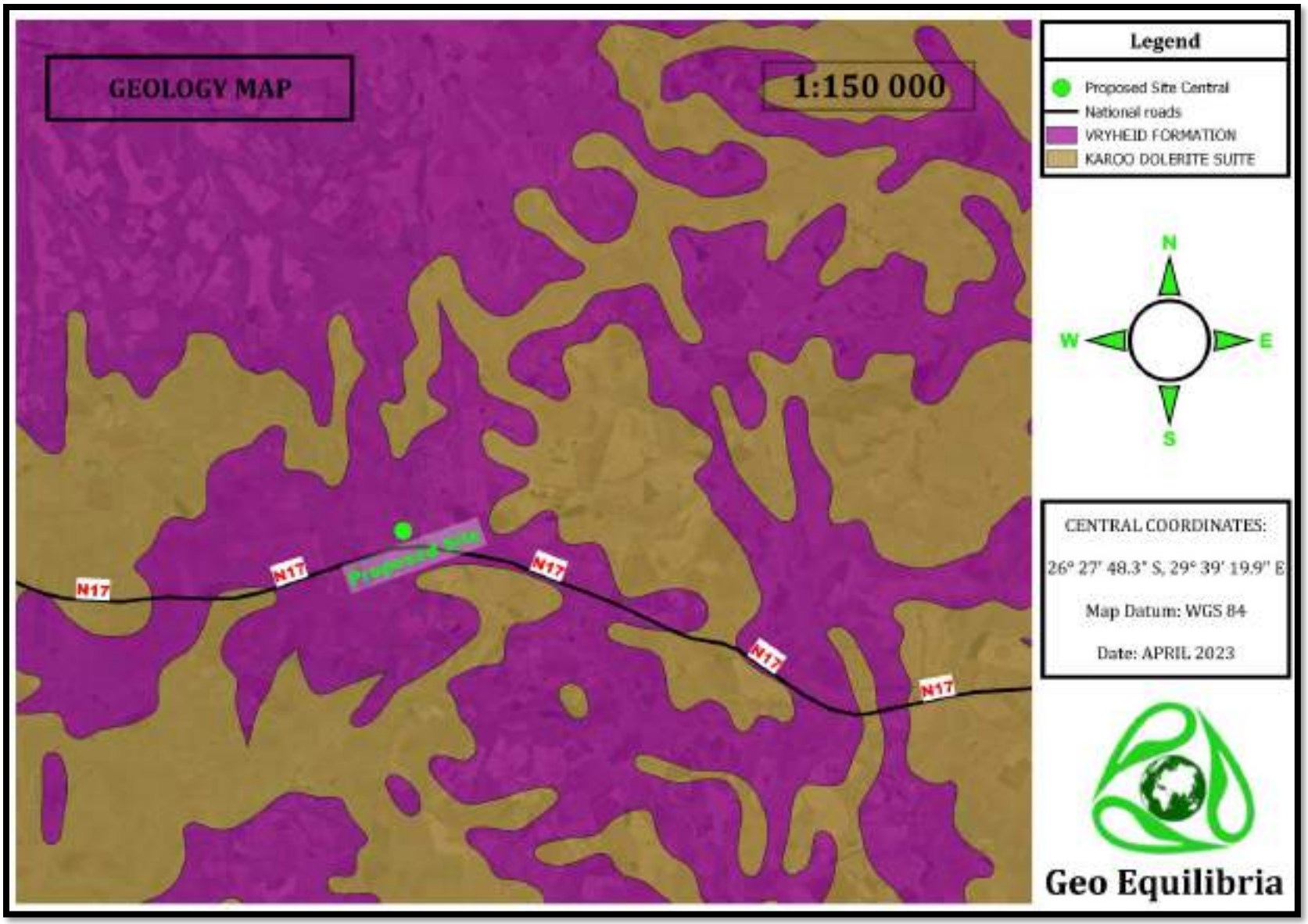

Figure 3: Regional Geological Map

6. SOIL PROFILE

A brief description of the various soil horizons encountered during these investigations is given below with a summary in **Table 1**. Detailed test pits profiles are given in **Appendix A** of this report.

6.1 TOP LAYER, SILTY SANDY MATERIAL

A relatively thin layer that described as dry, light yellow orange, loose sandy material covers the site. The soil consistency generally described as loose with some open structured as caused by ground insects and water.

This layer ranged in depths between 0.0 m to 0.4 m as encountered in all this test pits excavated.

6.2 SILTY SAND LAYER

This layer is generally described as silty sand, slightly moist, medium dense, intact, dark yellow orange.

This layer was encountered at depths ranging between 0.2 m – 0.8 m.

6.3 GRAVELY SAND LAYER

The site is underlain by a thick layer of dark yellow orange, medium dense to coarse gravel sandy soils. This horizon was encountered from depths of about 0.6 m.

The thickness of this layer could not be confirmed.

Table 1: Summary of Test Pit Profile Logs.

TEST PIT NO.	TOTAL DEPTH (M)	THICKNESS OF LAYERS (M)			GROUNDWATER SEEPAGE (M)
		FILL	TRANSPORTED SOILS	RESIDUAL SOILS /BEDROCK	
TP1	1.5	0 - 0.2	0.2 – 0.9	0.9 – 1.5	-
TP2	1.5	0 - 0.2	0.2 – 0.5	0.5 – 1.5	-
TP3	1.5	0 – 0.2	0.2 – 0.5	0.5 – 1.5	-
TP4	1.5	0 - 0.2	0.2 – 0.9	0.9 – 1.5	-

The soil profile composition and thickness were found to be highly consistent throughout the test pits. **Table 2** shows a summary of soil description.

Table 2: Summary of Soil Description.

AVERAGE DEPTH (m)	DESCRIPTION
0 – 0.7	Dry, light yellow orange sandy soil, loose with open structures caused by water and ground insects.
0.2 – 0.8	Slightly moist, yellow orange, intact, medium dense, silty sandy soil.
0.6 – 1.5	Moist, dark yellow orange, intact, dense silty sandy soil.

6.4. GROUNDWATER

No groundwater seepage was observed in any of the pits excavated during the geotechnical investigation. The test pits were excavated in a dry season. The potential for perched water table conditions to develop, particularly after heavy or prolonged periods of precipitation must also not be discounted.

7. GEOTECHNICAL EVALUATION

7.1. LABORATORY TEST RESULTS

Laboratory tests were scheduled to confirm the on-site investigation, provide a more accurate classification, and to establish engineering parameters for the soils. A total of five (3) disturbed soil samples recovered from the test pits, were subjected to laboratory testing (as per SANS 3001 test methods).

Testing was undertaken by a SANAS accredited material laboratory *RoadLab North* in Centurion, Gauteng Province. The results are attached in **Appendix B** and are summarized in **Table 3**. The following tests were scheduled:

- Sieve analysis of soil sample to 0.075mm,
- Atterberg Limits (Liquid Limit, Plastic Limit and Linear Shrinkage),
- Foundation indicators.

7.1.1. FOUNDATION INDICATORS

The foundation indicator test results indicate that the gravelly silty sandy soil on site has a high amount of sand 46.4%, followed by silt averaging at 31.7%, and 17% of gravel and 4.9 % of clay; with a corresponding low Grading Modulus averaging at 0.98; which is indicative of medium to fine-grained material,. The soil sampled from the test pits classifies as SC, CL & ML according to the Unified Soil Classification (USC). The Potential for Expansiveness is low according to Van Der Merwe's Activity Chart.

Table 3 shows a summary of the Laboratory Test Results, detailed test results of the soil samples are included as Appendix B of this report.

Detailed analysis has been carried out to facilitate appropriate design for earthworks and layer-works suitability, as well as foundation characteristics. The various tests and pertinent information from these tests are highlighted below.

6Table 3: Summary of Laboratory Results.

TEST POSITION	DEPTH (M)	MATERIAL DESCRIPTION	ATTERBERG LIMITS			GRADING				MOD		GM	CLASSIFICATION		EXPANSIVENESS	COLTO
			LL	PI	LS	CLAY	SILT	SAND	COARSE SAND	MDD	OMC		HRB	UNIFIED		
TP 1 S	0.4-0.7	SILTY SAND	22	6.0	3.0	7.8	36.6	54.7	0.9	---	---	0.5	A-4(0)	CL & ML	LOW	---
TP 2 S3	0.7-1.3	SILTY SAND	38	15	7.0	2.1	26.8	38.1	33.1	---	---	1.46	A-6(3)	SC	LOW	---

*ABBREVIATIONS			
MDD	Maximum Dry Density (kg/m3)	GM	Grading Modulus
UCS	Unconfined Compressive Strength (MPa)	PE	Potential Expansiveness
OMC	Optimum moisture Content (%)	SC	Clayey silty sand with gravel
PI	Plasticity Index	SM	Silty sand with gravel
LL	Liquid Limit	NP	Non-Plastic
LS	Linear Shrinkage	CBR	California Bearing Ratio
UCS	Unconfined Compressive Strength (MPa)	PE	Potential Expansiveness

7.1.2. ENGINEERING AND MATERIAL CHARACTERISTICS

One (01) representative disturbed soil sample, recovered from the test pit, was subjected to moisture / density relationship and CBR (strength) testing and the results are attached in **Appendix B** and summarized in **Table 4** below.

The result of the compaction tests on the residual dark brown, medium dense sandy gravel on TP3-25 yielded a maximum dry density of 1857 kg/m^3 at optimum moisture contents of 12.1%. These materials are of fair to poor quality and are not suitable for use in road or structural applications.

All material classifications were assessed in accordance with TRH14 (1985).

Table 4: Summary of Compaction Characteristics and CBR Results.

TP ID.	DEPTH (M)	DESCRIPTION	OMC (%)	MDD (KG/M3)	CBR AT MOD. AASHTO COMPACTION EFFORT						COLTO
					90%	93%	95%	97%	98%	100%	
TP 3 -25	60- 200	Dark brown, Sandy Gravel	12.1	1857	2	2	2	2	2	2	---

7.2. EXCAVABILITY AND SIDEWALL STABILITY

Excavability is defined as the ease with which the ground can be dug. This is important for developments as increased costs are associated with installing services or foundations in areas where difficulty is experienced with excavation.

Based on SANS 1200D classifications, excavability of soil on site categorized as intermediate from surface (0 m) to 1.5 m. No excavability problems are foreseen between surface and 1.5m therefore, excavation is possible with a TLB. No refusal was encountered at the site.

Test pits sidewalls were found to be unstable from surface to 0.4 m.

7.3. SLOPE STABILITY

This refers to an area comprising unstable geological materials that can move either gradually (creep) or suddenly as a slump or slide. The risk of movement is determined by factors such as the nature of the slope, gradient, role of water, type and nature of vegetation covered, seismicity and impact of human activities.

There are no signs of global slope instability on the site. The probability of landslides and mudslides occurring at this area are rare. This is primarily due to the low climatic conditions and composition of residual and transported materials in this area.

7.4. EROSION

The erosion of soils is a function of the resistance of slope materials to entrainment and transport, and the potential of slope processes that promotes erosion. The resistance of soils to erosion is also related to the mechanical strength, cohesion, and particle size of the material.

Indications for erosive soils are not evident on site.

7.5. DRAINAGE

Adequate drainage is an important factor in the promotion of a stable site. Drainage should be such that any rainfall is diverted to the nearest storm water drainage system. Both surface and subsurface drainage should be constructed such that no water ingress into the subsurface soils in and around the foundation base is possible. It is recommended that the installation of underground services and surface drainage is undertaken in accordance with SANS 1200 LF-1983.

7.6. SITE STABILITY

The site does not classify as dolomite land and no instability caused by dolomite will therefore occur. No mining activities that led to any undermining of the site are present.

7.7. SITE CLASSIFICATION AND FOUNDATION RECOMMENDATIONS

The proposed residential sites development requires the construction of sound foundations to limit settlements. From on the information obtained from this investigation, it was clear that a similarity of in-situ materials exists at the proposed site. Based on the material characteristics and the typical soil profiles, the site falls under three geotechnical zone that classifies for Residential Site Class Designations according to NHBRC GFSH-2 document as C1 and C2. The results of this classification are dealt with in the subsequent paragraphs. **Figure 6** Shows the Geotechnical Zonation map.

7.7.1. ZONE 1 (NHBRC SITE CLASS DESIGNATION R)

The following foundation options as defined by the GFHS-2 are recommended for single storey masonry house structures to be erected at Zone 1:

- Modified normal.
- Compaction of in-situ soils below individual footings
- Deep strip foundations
- Soil raft

7.7.2. ZONE 2 (NHBRC SITE CLASS DESIGNATION C2)

The following foundation options as defined by the GFHS-2 are recommended for single storey masonry house structures to be erected at Zone 2:

- Stiffened strip footings
- Stiffened or cellular raft
- Compaction of in-situ soils below individual footings
- Deep strip foundations
- Piled or pier foundations
- Soil raft

7.8. SPECIAL PRECAUTIONARY MEASURES

There are no special geotechnical engineering measures envisaged for this site.

8. CONCLUSIONS

Octon Geological Consultants (Pty) Ltd was appointed by Mang Geo Environmental in April 2023 to conduct a geotechnical investigation for the proposed formalization of site in Davel within the jurisdiction of Msukaligwa Local Municipality in the Gert Sibande District, Mpumalanga Province.

This geotechnical investigation aimed to identify potential hazards for the development, determine the ground conditions at the site to provide recommendations for safe and appropriate design.

The major geological formation underlaying the area is the lithologies of the Vryheid formation. This formation has been subdivided into three different lithofacies arrangements. They are dominated by fine-grained mudstone, carbonaceous shale with alternating layers of bituminous coal seams, and coarse-grained, bioturbated immature sandstones respectively.

In terms of SABS 1200D intermediate excavation is anticipated from the surface to depths of about 1.5 m below natural ground level. No groundwater seepage was observed in any of the pits excavated during field investigations. The site classified as C1 and C2 in accordance with the NHBRC Residential Class Designation. The soil was found to be erodible materials.

It is recommended that the structural engineer determine the best economical foundation preference for the proposed development based on the type of development based on the different available construction methods. Conditions prevailing at the site suggest that no problems are foreseen for the development of the proposed structures, provided the recommendations outlined in the report are adhered to.

It must be understood that the ground conditions described in this report refer specifically to those encountered at the inspection positions on site. It is therefore possible that conditions at variance with those discussed above may be encountered elsewhere on the property. In terms of the geotechnical information gained from the investigation, the site is suitable for the proposed development.

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1. Brink, A.B.A. (1979). Engineering Geology of Southern Africa, Volume 1. Building Publications, and Pretoria.

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LIMITATIONS

Octon Geological Consultant' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Reports are a geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore consider the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

The assessment and interpretation of the geotechnical information and the design of structures and services and the management of risk is the responsibility of the appointed Engineer.

The recommendations contained herein are not intended to dictate construction methods or sequences. They are furnished to help designers identify potential construction problems related to foundation and earth plans and specifications. Recommendations may also be useful to personnel who observe construction activity.

Potential contractors for the project must evaluate potential construction problems based on their review of the contract documents, their own knowledge of and experience in the local area, and based on similar projects in other localities, considering their own proposed methods and procedures

APPENDIX

PROJECT:	Msukaligwa	Test Pit:	TP-01	
SITE:	Davel, Msukaligwa	LOGGED BY:	Mushiana KR	
CLIENT:	Mang Geo	COORDINATES:	26° 27' 50" S, 29° 39' 8" E	
CONSULTAN	OCTON Geological Consultants Pty (Ltd)	MACHINE:	Auger	

Depth (cm)	Legend	SOIL PROFILE	Sample
10		Dry, light yellow orange, very loose to silty sandy soil with roots.	
20			
30			
40			
50			Ω TP1-1 ►
60			
70			
80			
90		Slightly moist, yellow orange, intact, medium dense silty sandy soil. Risidual.	
100			
110			
120			
130			
140		Moist, yellow orange, intact, dense silty sandy soil	
150			
160			
170			
180			
190			
200		EOH	

PROJECT	Msukaligwa	Test Pit:	TP-02	
SITE:	Davel, Msukaligwa	LOGGED BY:	Mushiana KR	OCTON
CLIENT:	Mang Geo	COORDINATES:	26° 27' 54" S, 29° 39' 11" E	
CONSULTAN	OCTON Geological Consultants Pty (Ltd)	MACHINE:	Auger	

Depth (cm)	Legend	SOIL PROFILE	Sample
10		Dry, light yellow orange, very loose to silty sandy soil with roots.	
20			
30			
40			
50		Slightly moist, yellow orange, intact, medium dense silty sandy soil. Risidual.	
60			
70			
80			
90			
100			Ω TP1-1
110			▶
120			
130			
140			
150			
160			
170			
180			
190		Moist, yellow orange, intact, dense silty sandy soil	
200		EOH	

PROJECT	Msukaligwa	Test Pit:	TP-03	
SITE:	Davel, Msukaligwa	LOGGED BY:	Mushiana KR	OCTON
CLIENT:	Mang Geo	COORDINATES:	-26.46176828, 29.65260108	
CONSULTAN	OCTON Geological Consultants Pty (Ltd)	MACHINE:	Auger	

Depth (cm)	Legend	SOIL PROFILE	Sample
10		Dry, light yellow orange, very loose to silty sandy soil with roots.	
20			
30			
40			
50		Slightly moist, yellow orange, intact, medium dense silty sandy soil. Risidual.	
60			
70			
80			
90			
100			Ω TP1-1
110			▶
120			
130			
140			
150			
160			
170			
180			
190		Moist, yellow orange, intact, dense silty sandy soil	
200		EOH	

PROJECT	Msukaligwa	Test Pit:	TP-04
SITE:	Davel, Msukaligwa	LOGGED BY:	Mushiana KR
CLIENT:	Mang Geo	COORDINATES:	-26.46021159, 29.65785904
CONSULTAN	OCTON Geological Consultants Pty (Ltd)	MACHINE:	Auger

Depth (cm)	Legend	SOIL PROFILE	Sample
10		Dry, light yellow orange, very loose to silty sandy soil with roots.	
20			
30			
40			
50			Ω TP1-1 ►
60			
70			
80			
90		Slightly moist, yellow orange, intact, medium dense silty sandy soil. Risidual.	
100			
110			
120			
130			
140			
150		Moist, yellow orange, intact, dense silty sandy soil	
160			
170			
180			
190			
200		EOH	

ROADLAB

Roadlab Centurion
121 Ellman Street Sunderland Ridge
0157
Tel: 0126667092 Fax: 0126667267
Email: centurion@roadlab.co.za
Web: www.roadlab.co.za

Job Request No.: RC 01267
Client Ref.No.: CE-OCT001-01-0001-23
Date Reported: 2023/05/16

Octon Geological Consultants (Pty) Ltd
389 Green Shank Avenue
Unit 63 Khaya Lala
Roodepoort
Attention: Mr. Khan D

Project: Mbuhaligwa

Full Classification Report SANS: GR1, GR20, GR30, GR40

SAMPLE INFORMATION AND PROPERTIES

SAMPLE NO		1001			
HOLE NO./ Km / CHAINAGE		TP9-25			
ROAD NO./ NAME Line 1 ROAD NO./ NAME Line 2		N/A			
LAYER TESTED/SAMPLED		In-Situ			
SAMPLE DEPTH		N/A			
DATE SAMPLED		[illegible]			
COLOUR OF SAMPLE		Dark Brown			
TYPE OF SAMPLE		Sandy Gravel			

SIEVE ANALYSIS - % PASSING SIEVES *(SANS 3001-GR1:2010, SANS 3001-GR2:2010)

SIEVE ANALYSIS (GR 1) % PASSING	106.0 mm					
	75.0 mm					
	63.0 mm					
	50.0 mm					
	37.5 mm					
	26.5 mm					
	19.0 mm					
	14.0 mm	100				
	5.0 mm	96				
	2.0 mm	96				
	0.425 mm	87				
	0.075 mm	64				
GM %		0.90				

SOIL MORTAR ANALYSIS (SANS 3001-PR5:2011)

COARSE SAND	2.000 - 0.425	8				
COARSE FINE SAND	0.425 - 0.250	8				
MEDIUM FINE SAND	0.250 - 0.150	8				
FINE FINE SAND	0.150 - 0.075	9				
SILT CLAY	0.075	68				

ATTERBERG LIMITS ANALYSIS - *(SANS 3001-GR10:2010)

ATTERBERG LIMITS (%) SANS GR10,GR11	LIQUID LIMIT	30				
	PLASTICITY INDEX	14				
	LINEAR SHRINKAGE	8.5				
CLASSIFICATION	H.R.B.	A-6(7)				
	COLTO	-				
	TRH 14	-				

CALIFORNIA BEARING RATIO - *(SANS 3001-GR30:2010, SANS 3001-GR40:2010)

SANS GR30 MAX. DRY DENSITY	OMC %	12.1				
	MDD (kg/m³)	1857				
	COMPAC %	11.8				
SWELL % @	MOD | NRB | PRO	5.09 | 0.65 | 0.68				
C.B.R. SANS GR40	100 %	2				
	98 %	2				
	97 %	2				
	95 %	3				
	93 %	2				
	90 %	2				

STABILISER IN LAB	Nogk
TEST TYPE	Classification
SAMPLING METHOD	TMH5
WEATHER WHEN SAMPLED	Sunny

Deviation from Test Method :
Remarks and Notes :

Opinions and interpretations are not included in our schedule of accreditation. (T0824)
The samples were subjected to analysis according to (SANS)(TMH5)(DOT)(ASTM)
The test results reported relate to the samples tested.
Further use of the above information is not the responsibility or liability of Roadlab.
Document may only be reproduced or published in their full content.
Report compiled by : Marius van Schalkwyk

sanas Testing Laboratory
Accreditation No. T0824
Prog.ver 10.7 (2018/11/07)

Willem Gockroft
Technical Signatory

1 of 1

ROADLAB

Roadlab Centurion
121 Ellman Street, Sunderland Ridge
0157
Tel: 012 666 7092 Fax: 012 666 7267
Email: centurion@roadlab.co.za
Web: www.roadlab.co.za

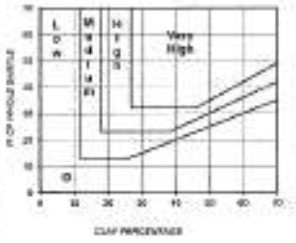
OUR REF : SC 01207
CLIENT : Orion Geological Consultants (Pty) Ltd
PROJECT : Mashishigwa

DATE RECEIVED : 02 May 22
POSITION : TP151
LAYER : In-Situ
SAMPLE No. : 1922
SAMPLE DESCRIPTION : Light Yellow Orange Silty Sand

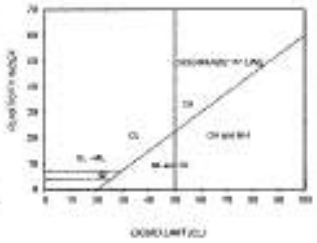
SOAKED CBR (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI	5.9
106.0	100
75.0	100
63.0	100
53.0	100
37.5	100
28.0	100
20.0	100
14.0	100
5.00	100
2.000	99
0.425	98
0.250	84
0.150	79
0.075	62
50 µm	48
5 µm	16
2 µm	7.0
2.000 - 0.425	1
0.425 - 0.250	14
0.250 - 0.150	13
0.150 - 0.075	16
< 0.075	53
Effective size	0.003
Uniformity Coefficient	37.7
Curvature Coefficient	0.5
Oversize Index	0.0
Shrinkage Product	207.0
Grading Coefficient	0.9
Grading modulus	0.58
Liquid Limit	22
Plasticity Index	6
Linear Shrinkage	3.0
PI x 0.075	-
Unified Soil Classification	CL & ML
S.A. Highway Classification	A-4 (1)

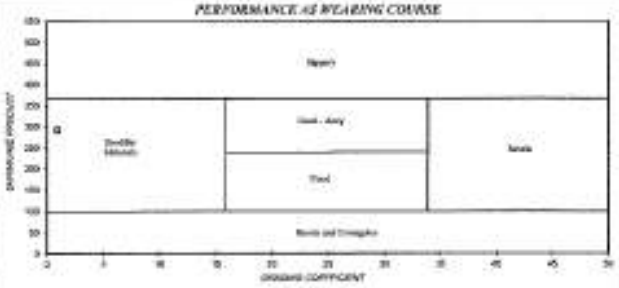
POTENTIAL EXPANSIVENESS



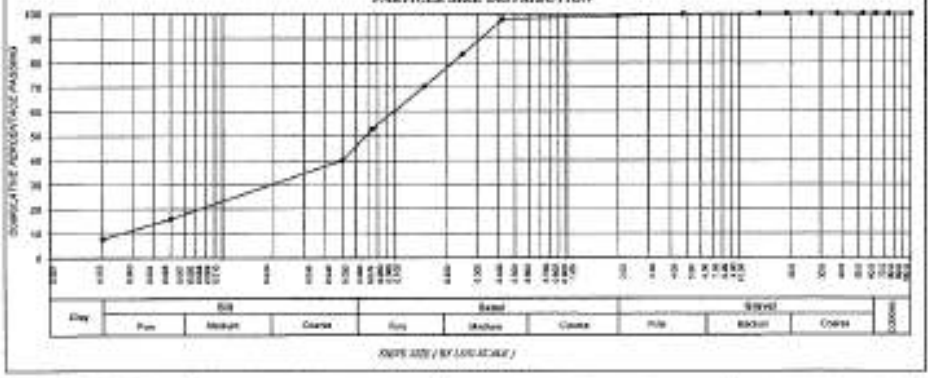
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) [0.001 - 0.002]	SILT (%) [0.002 - 0.060]	SAND (%) [0.060 - 2.00]	GRAVEL (%) [2.00 - 63.0]
7.0	36.0	56.7	0.3

ROADLAB

Roadlab Centurion
121 Ellman Street, Sunderland Ridge
0157
Tel: 012 666 7092 Fax: 012 666 7267
Email: centurion@roadlab.co.za
Web: www.roadlab.co.za

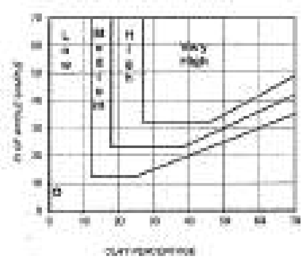
OUR REF : RC 01207
CLIENT : Octon Geological Consultants (Pty) Ltd
PROJECT : Modsaligwa

DATE RECEIVED : 03 May 23
POSITION : TP152
LAYER : In-Situ
SAMPLE No. : 1003
SAMPLE DESCRIPTION : Light Yellow Orange Silty Gravelly Sand

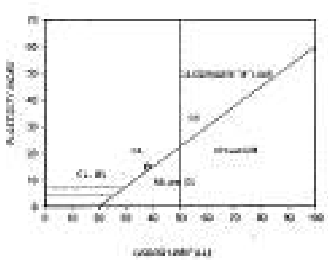
FOUNDATION INDICATOR - (SANS 3001-GR1, SANS 3001-GR10) & (ASTM Method D422)

Weighted PI		6.6
Sieve analysis Cumulative percentage passing (mm)	100.0	100
	75.0	100
	63.0	100
	50.0	100
	37.5	100
	28.0	100
	20.0	94
	14.0	88
	5.00	75
	2.000	67
	0.425	44
	0.250	44
	0.150	43
	0.075	43
	50 µm	24
	5 µm	7
	2 µm	2.1
Soil mortar analysis % < 2.00 mm	2.000 - 0.425	34
	0.425 - 0.250	1
	0.250 - 0.150	1
	0.150 - 0.075	1
	< 0.075	64
Effective size		0.012
Uniformity Coefficient		124.2
Curvature Coefficient		0.2
Overszie Index		0.0
Shrinkage Product		318.2
Grading Coefficient		24.0
Grading modulus		1.66
Atterberg Limits	Liquid Limit	38
	Plasticity Index	15
	Linear Shrinkage	7.0
	PI < 0.075	-
Unified Soil Classification		SC
U.S. Highway Classification		A-6 (2)

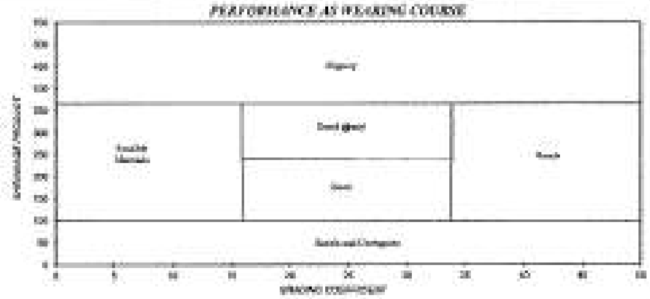
POTENTIAL EXPANSIVENESS



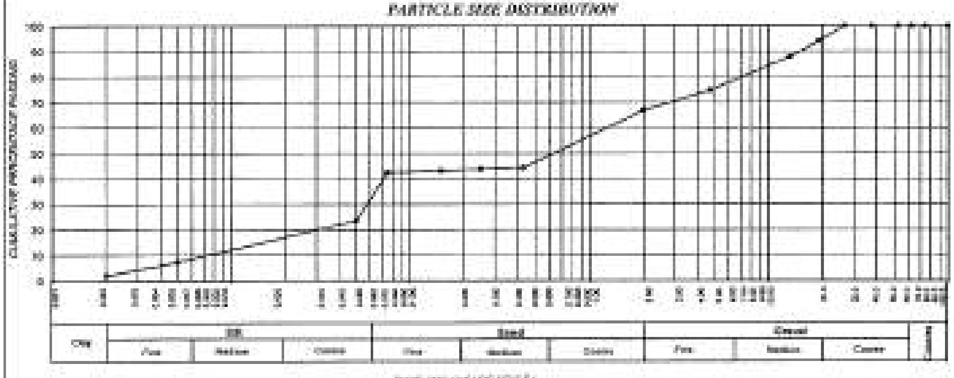
PLASTICITY CHART



PERFORMANCE AS WEARING COURSE



PARTICLE SIZE DISTRIBUTION



CLAY (%) [0.001-0.002]	SILT (%) [0.002-0.063]	SAND (%) [0.063-2.00]	GRAVEL (%) [2.00-50.0]
2.1	26.8	38.1	33.1

Heritage Report

Comprehensive and Professional Solutions for all Heritage Related Matters

CK 2006/014630/23 **VAT NO.: 4360226270**

A Phase 1 Heritage Impact Assessment & Report for the Proposed Formalization of the Msukaligwa Informal Settlement near Davel/Kwadela Msukaligwa Local Municipality, Mpumalanga

For:

Mang Geoenviro Services
6 Eros Road
Faerie Glen
0004

REPORT: **APAC023/32**

by:

A.J. Pelser
Accredited member of ASAPA
Member No. 106

April 2023

P.O.BOX 73703
LYNNWOOD RIDGE
0040
Tel: 083 459 3091
Fax: 086 695 7247
Email: apac.heritage@gmail.com

DISCLAIMER:

Although all efforts are made to identify all sites of cultural heritage (archaeological and historical) significance during an assessment of study areas, the nature of archaeological and historical sites are as such that it is always possible that hidden or subterranean sites, features or objects could be overlooked during the study. APELSER Archaeological Consulting can't be held liable for such oversights or for costs incurred as a result thereof.

Clients & Developers should not continue with any development actions until SAHRA or one of its subsidiary bodies has provided final comments on this report. Submitting the report to SAHRA is the responsibility of the Client unless required of the Heritage Specialist as part of their appointment and Terms of Reference

SUMMARY

APelser Archaeological Consulting cc (APAC cc) was appointed by Mang Geoenviro Services, on behalf of the Msukaligwa Local Municipality (comprising Davel/Kwadela), to conduct a Phase 1 Heritage Impact Assessment for proposed Formalization of the Msukaligwa Informal Settlement in the Mpumalanga Province. The study and development area are located west of Davel/Kwadela and north of the N17.

The literature review indicates that there are some cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls. Besides a recent, formal cemetery situated adjacent and to the north of the informal settlement, no significant sites, features, or material of cultural heritage (archaeological and/or historical) origin were identified and recorded in the larger study and the proposed development area during the April 2023 field assessment. This report discusses the results of both the background literature research and physical assessment and provides recommendations on the way forward.

From a Cultural Heritage point of view, it was determined that the proposed Formalization of the Msukaligwa Informal Settlement should be allowed to continue taking into consideration the recommendations provide at the end of this document.

CONTENTS

1. INTRODUCTION

APelser Archaeological Consulting cc (APAC cc) was appointed by Mang Geoenviro Services, on behalf of the Msukaligwa Local Municipality (comprising Davel/Kwadela), to conduct a Phase 1 Heritage Impact Assessment for proposed Formalization of the Msukaligwa Informal Settlement in the Mpumalanga Province. The study and development area are located west of Davel/Kwadela and north of the N17.

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The location and boundaries of the study & development area footprint were provided to the Specialist, and the assessment focused on this area.

2. TERMS OF REFERENCE

The Terms of Reference for the study was to:

1. Identify all objects, sites, occurrences and structures of an archaeological or historical nature (cultural heritage sites) located on the portion of land that will be impacted upon by the proposed development;

2. Assess the significance of the cultural resources in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value;

3. Describe the possible impact of the proposed development on these cultural remains, according to a standard set of conventions;

4. Propose suitable mitigation measures to minimize possible negative impacts on the cultural resources;

5. Review applicable legislative requirements;

3. LEGISLATIVE REQUIREMENTS

Aspects are dealt with mainly in. The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) are the two main legislations concerning the conservation of cultural resources, used as guidelines when conducting the Heritage Impact Assessment.

3.1. The National Heritage Resources Act (Act 25 of 1999)

According to the National Heritage Resources Act (Act 25 of 1999) (NHRA), the following is protected as cultural heritage resources:

a. Archaeological artifacts, structures, and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures, and sites older than 75 years
e. Historical objects, structures, and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites of scientific or technological value.

The National Estate includes the following:

a. Places, buildings, structures, and equipment of cultural significance
b. Places to which oral traditions are attached or which are associated with living heritage
c. Historical settlements and townscapes
d. Landscapes and features of cultural significance
e. Geological sites of scientific or cultural importance
f. Sites of Archaeological and paleontological importance
g. Graves and burial grounds
h. Sites of significance relating to the history of slavery
i. Movable objects (e.g. archaeological, paleontological, meteorites, geological specimens, military, ethnographic, books etc.)

The Heritage Impact Assessment (HIA) process is done to determine whether there are any heritage resources located within the area to be developed as well as to determine the possible impacts of the proposed development. An Archaeological Impact Assessment (AIA) only looks at archaeological resources, such as material remains of human life or activities which are at least 100 years of age, and which are of archaeological interest. A HIA must be done under the following circumstances:

a. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
b. The construction of a bridge or similar structure exceeding 50m in length
c. Any development or other activity that will change the character of a site and exceed 5 000m^2 or involve three or more existing erven or subdivisions thereof
d. Re-zoning of a site exceeding 10 000m^2
e. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34(1) of the Act state that no person may demolish any structure or part thereof that is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure refers to 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.

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

Archaeology, palaeontology, and Meteorites

Section 35(4) of the Act deals with archaeology, palaeontology, and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial)

a. destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;
b. destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;
c. trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or
d. bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites.
e. alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

i. destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

ii. destroy, damage, alter, exhume, or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

iii. bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the **Ordinance on Excavations** (**Ordinance no. 12 of 1980**) (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province, and local police. Furthermore, permission must also be gained from the various landowners (i.e., where the graves are located and where they are to be relocated to) before exhumation can take place.

Human remains can only be handled by a registered undertaker, or an institution declared under the **Human Tissues Act** (**Act 65 of 1983 as amended**).

3.2. The National Environmental Management Act (No. 107 of 1998)

This Act states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made.

Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

The specific requirements that specialist studies and reports must adhere to are contained in Appendix 6 of the EIA Regulations.

4. METHODOLOGY

4.1. Review of literature

A review of available literature was undertaken in order to place the development area in an archaeological and historical context. The sources utilized in this regard are indicated in the bibliography. These include Bergh (1999), Huffman (2007) & Lombard et.al (2012).

4.2. Field survey

The field assessment component of the study was conducted on the 5th of April 2023 according to generally accepted HIA practices and aimed at locating all possible objects, sites, and features of heritage significance in the area of the proposed development. The location/position of all sites, features and objects is determined by means of a Global Positioning System (GPS) where possible, while detail photographs are also taken where needed. Where possible grids were walked in the area where development is proposed.

4.3. Documentation

All sites, objects, features, and structures identified are documented according to a general set of minimum standards. Co-ordinates of individual localities are determined by means of the Global Positioning System (GPS). The information is added to the description in order to facilitate the identification of each locality.

6. DESCRIPTION OF THE AREA

The project entails the proposed formalization of the existing Msukaligwa Informal Settlement, west of Davel/Kwadela (Msukaligwa Local Municipality) in Mpumalanga. The study area has been settled (informally) to a large extent already, with only small sections not settled or transformed as a result.

The topography of the area is in general fairly flat and open, with no real rocky outcrops, ridges or hills present. Due to the extensive (mostly) informal settlement in the area, most of the original historical & natural landscape of the area has been nearly totally altered. Only a few small pockets of natural landscape remain, but these would also have been impacted in the recent past by agricultural activities such as ploughing/crop raising and livestock keeping and grazing. As a result, if any cultural heritage (archaeological and/or historical) sites, features or material of any significance did exist here, it would have been extensively disturbed and largely destroyed. The study area is surrounded by existing residential settlement and business-related developments.

Figure 1: General location of study area indicated by red polygon (Google Earth 2023).

Figure 2: Closer view of study and development area (Google Earth 2023).

7. DISCUSSION

7.1 Stone age

The Stone Age is the period in human history when lithic (stone) material was mainly used to produce tools. In South Africa the Stone Age can be divided into three periods as listed below. It is important to note that dates are relative and only provide a broad framework for interpretation. A basic sequence for the South African Stone Age (Lombard et.al 2012) is as follows:

- Earlier Stone Age (ESA) up to 2 million – more than 200 000 years ago
- Middle Stone Age (MSA) less than 300 000 – 20 000 years ago
- Later Stone Age (LSA) 40 000 years ago – 2000 years ago

It should also be noted that these dates are not a neat fit because of variability and overlapping ages between sites (Lombard et.al 2012: 125).

The closest known Stone Age occurrences are Late Stone Age sites at Carolina and Badplaas, and rock painting sites close to Machadodorp, Badplaas and Carolina. Rock art is also found close to the Olifants River and at the Rietspruit near Witbank (Emalahleni) [Bergh 1999: 4-5].

Many of the cultural resources management (CRM) surveys carried out in the larger area have been related to coal mining. Van Schalkwyk (2003) noted that Stone Age artifacts are commonly encountered in the area, but he is of the opinion that they are all in secondary contexts and of little heritage value. Van Vollenhoven (2016), on the other hand, suggests that Stone Age occupation is not known from the area, but that local research has been minimal (Orton 2017: 10).

No Stone Age sites or material were identified in the study area during the April 2023 field assessment. If any were to be present they would most likely be individual stone tools or low density scatters in open-air surface scatters around the area.

7.2 Iron age

The Iron Age is the name given to the period of human history when metal was mainly used to produce metal artifacts. In South Africa it can be divided in two separate phases (Bergh1999: 96-98), namely:

- Early Iron Age (EIA) 200 – 1000 A.D
- Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii) however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

- Early Iron Age (EIA) 250 – 900 A.D.
- Middle Iron Age (MIA) 900 – 1300 A.D.

- Late Iron Age (LIA) 1300 – 1840 A.D.

During a 1992 survey of the Kriel Area, Van Schalkwyk found a number of Iron Age occurrences (pottery etc.) near the Steenkoolspruit (Van Schalkwyk et.al. 1992: 2). No Early or Middle Iron Age sites have thus far been located on the Highveld. However, Late Iron Age stone walled sites do occur in the area. Several large Late Iron Age settlement complexes occur in this region, especially to the south of Kriel and on the farm Wildebeestkuil, close to Kinross, 24km south west of Kriel. This site was probably occupied at a very late stage in the Iron Age, after the Hlubi attack on the Tlokoa which marked the start of the Difaqane in 1821. Ceramics from these Late Iron Age sites are part of the Uitkomst Facies of the Blackburn Branch, while the site layout type is referred to as Klipriviersberg/Group III. They were most likely occupied between AD 1650 and AD 1820 (Orton 2017: 9-10).

Van Schalkwyk noted in 2003 that Iron Age occupation only commenced circa AD1500 in the vicinity of Kriel and that settlement tended to be near to water sources and rock outcrops. He mapped a number of Iron Age sites about 10 km south of Kriel. Van Vollenhoven (in 2016) reported two Late Iron Age sites to the southeast of Kriel. Huffman and Calabrese (in 1996) located just three Iron Age (Moloko) potsherds during their survey some 5km northeast of the present study area but no sites (Orton 2017:10). The author of this report worked on Late Iron Age sites near Kriel (See Pelser et.al 2007), while he recently recorded similar sites near Secunda (2019).

No Iron Age sites, features or material were identified in the area during the April 2023 field assessment.

7.3 Historic age

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write. The first Europeans to move through and into the area were the groups of Schoon and McLuckie and the missionaries Archbell and Moffat in 1829 (Bergh 1999: 12). They were followed by others such as Andrew Smith (1835), Cornwallis Harris (1836) and David Livingstone in 1847 (Bergh 1999: 13). These groups were closely followed by the Voortrekkers after 1844 and Pretoria was established in 1855 (Bergh 1999: 14-17). European settlers started to occupy huge tracts of land, claiming it as farms after the late 1840s.

Besides a large, formal cemetery located north of the informal settlement, no recent historical sites and features were identified and recorded in the study & application area in April 2023.

Results of the April 2023 Field Assessment

No sites, features or material of archaeological and/or historical origin or significance were identified in the study and Msukaligwa Informal Settlement Formalization area. The area has been nearly completely altered from its original natural and historical landscape through the recent informal settlement, while earlier agricultural activities such as ploughing, crop

growing and livestock keeping and grazing also had an impact. As a result, if any sites and features were located here in the past it would more than likely have been extensively disturbed or destroyed by these activities.

Aerial images (Google Earth) of the study and development area – dating to between 2003 and 2023 - clearly shows how the continuous expanding informal settlement and related developments have encroached into the area. Very little open areas (natural landscape) still exist. No archaeological (Iron Age stone-walling for example) and/or recent historical sites or remains (farmsteads, homestead ruins) are visible on these earlier images as well.

The only recent historical site identified is an existing, large, formal cemetery in the area. The cemetery is not located within the boundaries of the study area, and will not be affected by the proposed formalization of the Msukaligwa Informal Settlement. The ages of the graves here were not determined, but it is envisaged that most (if not all) of the graves here are less than 60 years of age. However, graves and grave sites/cemeteries always carry a High Cultural Heritage Significance Rating and care should be taken to never negatively impact on these as a result of proposed or future development. If the cemetery is to be included as part of the formalization of the Msukaligwa Informal Settlement process, it is recommended that the site be properly fenced-in, kept clean and a detailed register of graves drawn-up for use by the Local Municipality. Although there is a fence around the area demarcating the site, this is not in a good condition and the cemetery is overgrown with vegetation. Some recent burials are situated outside of the formal boundary fence as well.

GPS Location of Cemetery: S26 27 21.65 E29 39 28.41.

Figure 3: A view of some of the informal dwellings that cover the study area.

Figure 4: Another section.

Figure 5: The topography of the general area is flat and open, although there is some grass cover hampering visibility in those sections not settled on yet.

Figure 6: Closer view of the informal dwellings in the settlement.

Figure 7: A partial view of the Formal Cemetery located outside and to the north of the Informal Settlement.

Figure 8: In 2003 the study area had not yet been impacted by Informal Settlement. Evidence of earlier agricultural activities (ploughing) is visible (Google Earth 2023).

Figure 9: By 2017 Informal Settlement had already commenced (Google Earth 2023).

Figure 10: By 2020 the extent and impact of informal settlement in the area is very clear (Google Earth 2023).

Figure 11: The location of the cemetery in relation to the Msukaligwa Informal Settlement (Google Earth 2023).

Impact Assessment and Mitigation Measures

The significance of impacts is determined using the following criteria:

Probability: describes the likelihood of the impact actually occurring

- **Improbable:** the possibility of the impact occurring is very low, due to the circumstances, design or experience.
- **Probable:** there is a probability that the impact will occur to the extent that provision must be made therefore.
- **Highly probable:** it is most likely that the impact will occur at some stage of the development.
- **Definite:** the impact will take place regardless of any prevention plans and there can only be relied on mitigation measures or contingency plans to contain the effect.

Duration: the lifetime of the impact

- **Short Term**: the impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- **Medium Term:** the impact will last up to the end of the phases, where after it will be negated.
- **Long Term:** the impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- **Permanent:** the impact is non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Scale: the physical and spatial size of the impact

- **Local:** the impacted area extends only as far as the activity, e.g. footprint
- **Site:** the impact could affect the whole or measurable portion of the abovementioned property.
- **Regional:** the impact could affect the area including the neighboring residential areas.

Magnitude/Severity: Does the impact destroy the environment, or alter its function

- **Low:** the impact alters the affected environment in such a way that natural processes are not affected.
- **Medium:** the affected environment is altered, but functions and processes continue in a modified way.
- **High:** function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

Significance: This is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

- **Negligible:** the impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- **Low:** the impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.
- **Moderate:** the impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
- **High:** The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

The significance is calculated by combining the criteria in the following formula:

Sum (Duration, Scale, Magnitude) x Probability
S = Significance weighting; Sc = Scale; D = Duration; M = Magnitude; P = Probability

With no sites, features and material of cultural heritage origin and significance found in the area during the assessment, the current site layout/footprint will not impact negatively on any known sites. The impact of the proposed development on recorded and known heritage sites is therefore deemed as Neglible.

Aspect	Description	Weight
Probability	**Improbable**	**1**
	Probable	2
	Highly Probable	4
	Definite	5
Duration	**Short Term**	**1**
	Medium Term	3
	Long Term	4
	Permanent	5
Scale	Local	1
	Site	**2**
	Regional	3
Magnitude/Severity	**Low**	**2**
	Medium	6

	High	8
Significance	**Sum (Duration, Scale, Magnitude)**	**x Probability**
	Neglible	**≤20**
	Low	>20≤40
	Moderate	>40≤60
	High	>60

Results: 1+2+2×1 = 5 i.e., ≤20

The impact of the proposed development on recorded and known cultural heritage sites in the area is therefore deemed as Neglible based on the Impact Assessment criteria used. However, there is always a possibility of sites, features and material being missed as a result of various factors such as vegetation cover hampering visibility on the ground, as well as the often-subterranean nature of cultural heritage resources (including low stone-packed or unmarked graves). These factors need to be taken into consideration and it is therefore recommended that a Chance Finds Protocol be drafted and implemented for the proposed Msukaligwa Informal Settlement Formalization project.

Based on the desktop research and April 2023 field assessment it is clear that there are some cultural heritage sites and features present in the larger geographical area within which the study & proposed township formalization project is located

Besides the recent formal cemetery located to the north of and adjacent to the Informal Settlement, no other sites, features or material of cultural heritage origin or significance were identified in the area during the recent assessment.

It should also be noted that although all efforts are made to locate, identify and record all possible cultural heritage sites and features (including archaeological remains) in an area that there is always a possibility that some might have been missed as a result of vegetation cover, access issued and other factors.

7. CONCLUSIONS AND RECOMMENDATIONS

APelser Archaeological Consulting cc (APAC cc) was appointed by Mang Geoenviro Services, on behalf of the Msukaligwa Local Municipality (comprising Davel/Kwadela), to conduct a Phase 1 Heritage Impact Assessment for proposed Formalization of the Msukaligwa Informal Settlement in the Mpumalanga Province. The study and development area are located west of Davel/Kwadela and north of the N17.

The literature review indicated that there are some cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls. Besides a recent, formal cemetery situated adjacent and to the north of the informal settlement, no significant sites, features, or material of cultural heritage origin and significance were identified and recorded in the larger study and the Msukaligwa Informal Settlement area during the April 2023 field assessment.

The impact of the proposed development on recorded and known cultural heritage sites in the area is deemed as Neglible based on the Impact Assessment criteria used.

From a Cultural Heritage point of view, it is recommended that the proposed Formalization of the Msukaligwa Informal Settlement should be allowed to continue taking into consideration the recommendations provided below.

The often subterranean nature of cultural heritage resources (including low stone-packed or unmarked graves) should also be taken into consideration. Should any previously unknown or buried sites, features or material be uncovered during any development actions then an Archaeological expert should be contacted to investigate and provide recommendations on the way forward. It is therefore recommended that a Chance Finds Protocol be drafted and implemented for the proposed Msukaligwa Informal Settlement Formalization project.

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APPENDIX A: DEFINITION OF TERMS:

Site: A large place with extensive structures and related cultural objects. It can also be a large assemblage of cultural artifacts, found on a single location.

Structure: A permanent building found in isolation or which forms a site in conjunction with other structures.

Feature: A coincidental find of movable cultural objects.

Object: Artifact (cultural object).

(Also see Knudson 1978: 20).

APPENDIX B: DEFINITION/ STATEMENT OF HERITAGE SIGNIFICANCE

Historic value: Important in the community or pattern of history or has an association with the life or work of a person, group or organization of importance in history.

Aesthetic value: Important in exhibiting particular aesthetic characteristics valued by a community or cultural group.

Scientific value: Potential to yield information that will contribute to an understanding of natural or cultural history or is important in demonstrating a high degree of creative or technical achievement of a particular period

Social value: Have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.

Rarity: Does it possess uncommon, rare or endangered aspects of natural or cultural heritage.

Representivity: Important in demonstrating the principal characteristics of a particular class of natural or cultural places or object or a range of landscapes or environments characteristic of its class or of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province region or locality.

APPENDIX C: SIGNIFICANCE AND FIELD RATING:

Cultural significance:

- Low: A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.

- Medium: Any site, structure or feature being regarded less important due to a number of factors, such as date and frequency. Also any important object found out of context.

- High: Any site, structure or feature regarded as important because of its age or uniqueness. Graves are always categorized as of a high importance. Also any important object found within a specific context.

Heritage significance:

- Grade I: Heritage resources with exceptional qualities to the extent that they are of national significance

- Grade II: Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate

- Grade III: Other heritage resources of local importance and therefore worthy of conservation

Field ratings:

i. National Grade I significance: should be managed as part of the national estate

ii. Provincial Grade II significance: should be managed as part of the provincial estate

iii. Local Grade IIIA: should be included in the heritage register and not be mitigated (high significance)

iv. Local Grade IIIB: should be included in the heritage register and may be mitigated (high/ medium significance)

v. General protection A (IV A): site should be mitigated before destruction (high/medium significance)

vi. General protection B (IV B): site should be recorded before destruction (medium significance)

vii. General protection C (IV C): phase 1 is seen as sufficient recording and it may be demolished (low significance)

APPENDIX D: PROTECTION OF HERITAGE RESOURCES:

Formal protection:

National heritage sites and Provincial heritage sites – Grade I and II
Protected areas - An area surrounding a heritage site
Provisional protection – For a maximum period of two years
Heritage registers – Listing Grades II and III
Heritage areas – Areas with more than one heritage site included
Heritage objects – e.g. Archaeological, paleontological, meteorites, geological specimens, visual art, military, numismatic, books, etc.

General protection:

Objects protected by the laws of foreign states
Structures – Older than 60 years
Archaeology, paleontology and meteorites
Burial grounds and graves
Public monuments and memorials

APPENDIX E: HERITAGE IMPACT ASSESSMENT PHASES

1. Pre-assessment or Scoping Phase – Establishment of the scope of the project and terms of reference.

2. Baseline Assessment – Establishment of a broad framework of the potential heritage of an area.

3. Phase I Impact Assessment – Identifying sites, assess their significance, make comments on the impact of the development and makes recommendations for mitigation or conservation.

4. Letter of recommendation for exemption – If there is no likelihood that any sites will be impacted.

5. Phase II Mitigation or Rescue – Planning for the protection of significant sites or sampling through excavation or collection (after receiving a permit) of sites that may be lost.

6. Phase III Management Plan – For rare cases where sites are so important that development cannot be allowed.

Wetland Report

WETLAND STUDY AND DELINEATION FOR DAVEL TOWNSHIP FORMALIZATION IN MSUKALIGWA LOCAL MUNICIPALITY MPUMALANG PROVINCE

- Prepared For

mang
GEOENVIRO SERVICES

Prepared By

- Africaresources18@gmail.com

- Preventing a silent spring through promotion of sustainable development while preserving the natural resources for future generations

Africa Ecological and Development Services (Pty) Ltd

Project Name:

WETLAND DELINEATION AND IMPACT ASSESSMENT REPORT FOR THE PROPOSED DAVEL TOWNSHIP FORMALIZATION IN MSUKALIGWA LOCAL MUNICIPALITY MPUMALANGA PROVINCE.

Compiled by:

Africa Ecological and Development Services (Pty) Ltd
P.O. Box 1163,
Fauna Park, 0787, South Africa.

Client:

Global Geo Enviro specialists

Date:

March 2023

Location:

Fauna Park

Approved by:

Humbulani Munzhelele

_____

Signature:

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DECLARATION OF INDEPENDENCE

I, Humbulani Munzhelele, in my capacity as a specialist consultant, hereby declare that**:**

- I act as the independent specialist in this application.
- I will perform the work relating to this 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 comprise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, regulations, and all other applicable legislations.
- 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 24(f) of the Act.

Humbulani Munzhelele
Wetland Ecologist
Africa Ecological and Development Services (Pty) Ltd.
28 March 2023

1. Introduction

Mang-Geo-Enviro services has appointed Africa Ecological and Development Services to undertake wetland delineation and assessment and produce a specialist report for the proposed Davel township formalization within the Msukaligwa Local Municipality in Mpumalanga Province.

The focus for the study was to do delineation and assessment of wetland areas that may be directly impacted or would have been by the township proposed township formalization with a general wetland identification and delineation for systems within the 50m buffer zone of the project. Furthermore, the study was conducted to provide a description of the current ecological integrity and impacts pertaining to existing township activities and wetland systems that may be impacted. as well as providing appropriate management recommendations to mitigate the impacts on the water resources systems. The study was conducted to meet the requirements of a wetland ecological specialist assessment.

Site visit was conducted on the 01st March 2023, and this constitute a summer season survey. This report, after taking into consideration the findings and recommendation provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making with regards to the wetland functionality assessment.

1.1. Aims of the study (Project Terms of Reference)

The aims of the study are to:

- Verify the occurrence and typology of wetlands on the study site as delineated through desktop methods, and to correct the delineation based on field-based assessment, thus enabling all wetlands on the study site to be mapped.
- Assess all wetland areas on the study site in the field
- Based on the field assessment gain an understanding of the characteristics of the wetland, including hydrology, vegetation, soils, and geomorphology.
- Assess the impacts of the proposed development on the wetland, and suggest suitable mitigation measures, if relevant, to ameliorate or remove these predicted impacts.

- Conduct Wet-Health for the determination of Present Ecological State (PES) of the wetland
- Conduct Wet-Eco Services for determination of ecosystem services.

1.2. Assumptions and Limitations

Only wetlands within the boundaries of the study site were assessed as part of this study. The wetland survey was undertaken in the summer season (early March). This entails that the wetland was assessed during the summer season. Wetland delineation was also based on primarily the analysis of soil-based indicators, terrain unit indicators, hydromorphic unit indicators and water table and zonation. The predominantly grassy vegetation still displayed sufficient inflorescences to broadly identify the vegetative composition within the wetland.

The primary aim of this wetland assessment study was the delineation of the wetland, and stipulation of the buffer surrounding the wetland, in line with the stipulations of the Department of Water Affairs (DWAF) (DWAF, 2005), as well as the identification of potential impacts on the wetland associated with the proposed township establishment, as part of the EIA studies being undertaken for the proposed project. Although no water use license process is being undertaken for the proposed development, a wider assessment of the functionality and present ecological state of the wetland have been undertaken to augment the scope of this study.

1.3. Definitions and the Legislative Framework.

The proposed township formalization should take cognizance of the legislative requirements, policies, guidelines, and principles of the relevant regulatory documents such as the National Spatial Development Framework, the Msukaligwa Local Municipality Integrated Development Plan (IDP) and Biodiversity Plan; Mpumalanga biodiversity sector plan and the National Environmental Management Act (NEMA).

The National Environmental Management Act (NEMA) outlines several principles that give guidance to developers, private landowners, members of the public and authorities, of which principle number three of the act stipulates that a development must be socially, environmentally, and economically sustainable. Section number 4(a) of the Act states that consideration should be given to all relevant factors which include ecosystems disturbance and loss of biological diversity must be avoided and prevented, and or where they cannot be completely avoided must be minimised and mitigation measures applied; and that pollution

and environmental degradation be avoided, and or where such cannot be completely avoided remedial action to the environment be instituted.

2. PROJECT DESCRIPTION

2.1. Site Location and Description (Study area)

Site is located along the N17 road to Ermelo town western side to the east. The study was done on an existing township with impact already occurred. The approximates coordinates in which the site is situated are Latitude: S 26°27'41,2704" Longitude: E 29°39'9,76176"
Altitude: 1731 m.

Livestock such as goats and cows were found grazing on site. Permanent zones and seasonal zones wetlands are the most dominant than temporary zones.

Some other findings from the wetland study conducted from Davel wetland site.

A field verification which was conducted on the 1st of March 2022, revealed that the functional wetland areas which for the purpose of this study are specified as wetland zones, denoted the following:

- Road infrastructure caused desiccation of most parts of the wetland.
- Houses that have build showed being wet due to water levels of the wetland rising in summer.
- Due to disturbance on and around the wetland vicinity, there is evidence of increased sedimentation on the wetlands site with more effects caused by human activities such as dumping of waste and erosion.
- The wetland area is currently used for livestock grazing on the unoccupied site.
- The hydrology of the wetland system was observed and is still currently being transformed due to continuous overgrazing and trampling by livestock, human and vehicle, including infrastructure developed.
- The system, however, still represent typical characteristics of a both permanent and seasonal zones of wetland such as wetland soils and vegetation.

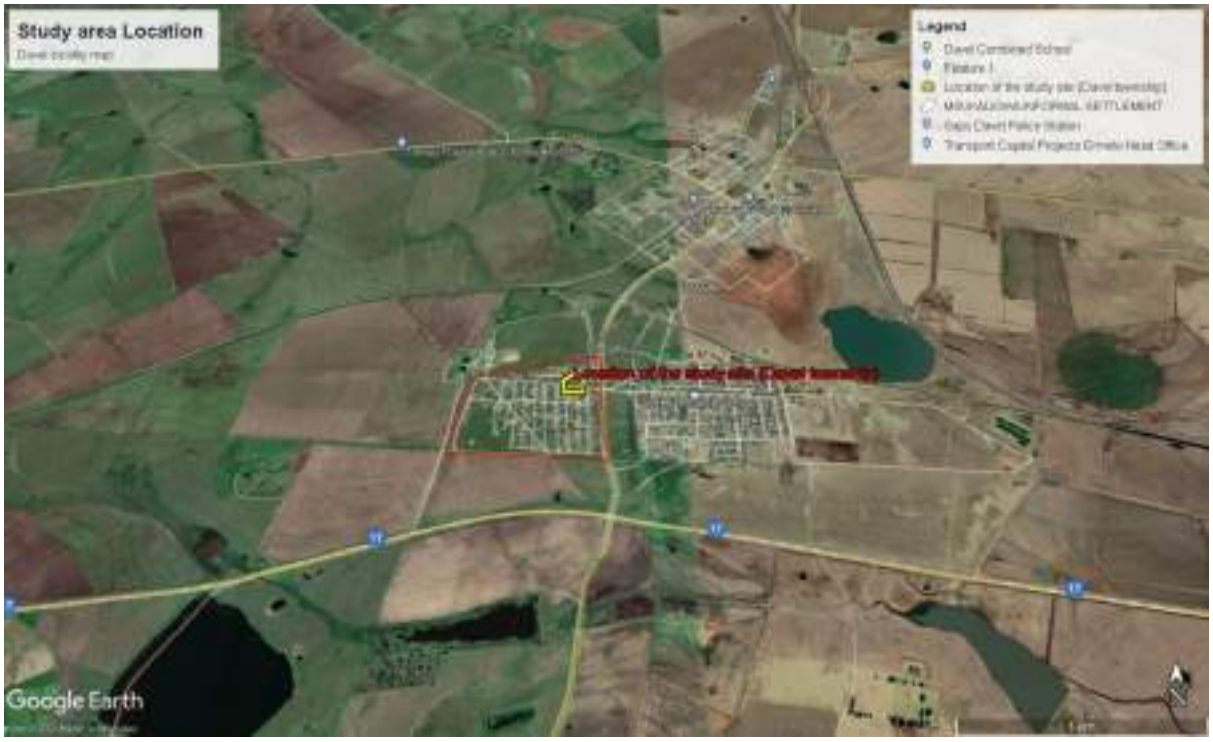


Figure 1: Site Location map showing location

2.2. Aquatic Vegetation type and Indicator Species.

Wetland vegetation survey results revealed large areas of dominant plant species with very little diversity. The wetland was dominated by a typical wetland sedges and other grass types (Table 1). Is located on a grassland biome.

Table 1: Presence of dominant plant species found within the quadrats examined at the wetland.

Family	**Taxon**	**Common name**
Poaceae	*Sporobolus africanus*	Rat's tail grass
Cyperaceae	*Scirpus ancistrochaetus*	North-eastern bulrush
Cyperaceae	*Cyperus esculentus*	Yellow nut sedge
Juncaceae	*Juncus effusus*	Soft rush
Poaceae	*Cynodon dactylon*	Bermuda grass
Poaceae	*Urochloa mosambicensis*	Bushveld signal grass
Typhaceae	*Typha capensis*	Bulrush
Poaceae	*Themeda triandra*	Red grass
Poaceae	*Eragrostis curvula*	Weeping lovegrass
Poaceae	*Cymbopogon pospischilii*	Lemongrass

It is important to note that the Davel wetlands were dominated by the grasses from the families **Poaceae**, **Juncaceae** and **Typhaceae**. These vegetation species are well suited and adapted to the conditions of wetlands conditions. These vegetation species have evolved and developed mechanisms for maturing and growing fast to withstand the unfavourable and unpredictable conditions.

2.3. Fauna Biodiversity recorded at Wetland site during the field survey on the 1st of March 2023.

2.3.1. Aquatic Macroinvertebrates.

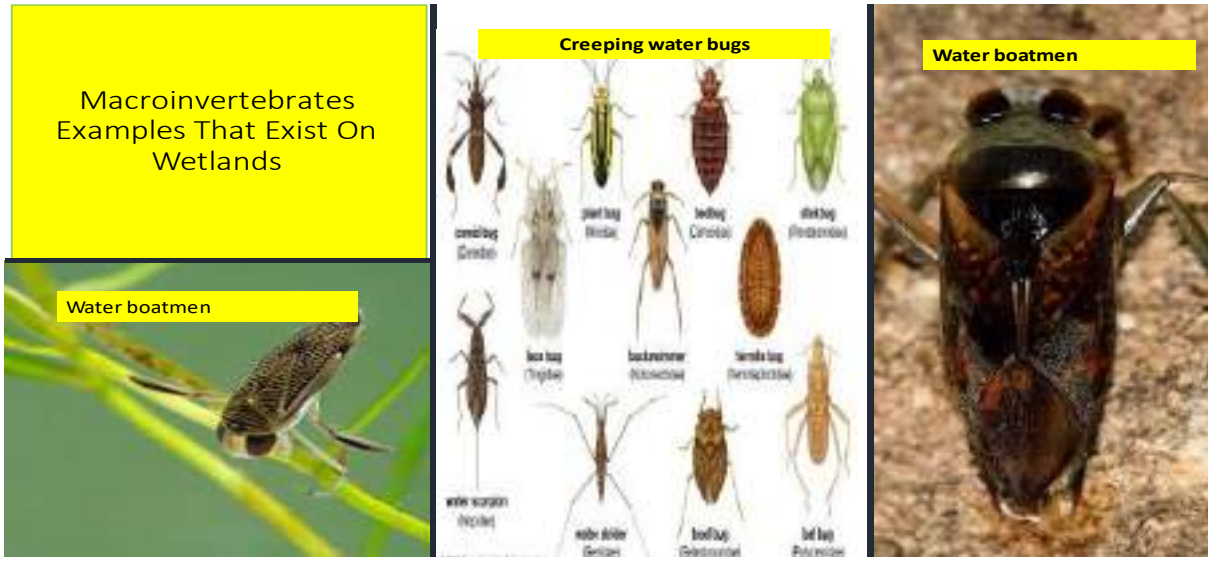
Invertebrate's samples were dominated by the hemipterans Notonectidae (*Anisops spp*) and Corixidae (*Sigara spp*). There was a very low biodiversity of invertebrates but high numbers or abundance of those taxa present. The taxa identified are all very tolerant of a wide range of water quality and adapted to low levels of oxygen. Some have the capability to burrow themselves beneath the mud to complete their growing phases in case the wetlands ponds become dry out or desiccated. Some of the observed invertebrates recorded are shown in Table 2 below.

Table 2: Presence of aquatic macroinvertebrates species examined in the Wetland site.

Order	**Family**	**Taxon**	**Common name**
Hemiptera	Corixidae	*Hesperocorixa castenea*	Water boatmen
Hemiptera	Naucoridae	*Ilyocoris cimicoides*	Creeping water bugs
Hemiptera	Notonectidae	*Notonecta maculata*	Backswimmers
Hemiptera	Nepidae	*Nepa cinerea*	Water scorpion
Diptera	Chironomidae	*Chironomous spp*	Midges
Mollusca	Lymnaedae	*Lymnaea columella*	Reticulate pond snail
Diptera	Tabanidae	*Tabanus sulcifrons*	Horse flies

It is important to note that the aquatic invertebrate families recorded at the wetlands (Table 2 above) are dominated by species from the order Hemiptera and Diptera. It is important to note that most of the species from these orders or families are airbreathers and adapted to life in low water level wetlands or vernal ponds conditions. When condition in the aquatic environment

become unsuitable or desiccated and not supporting the livelihoods, these species do take another form so that they can survive terrestrial.



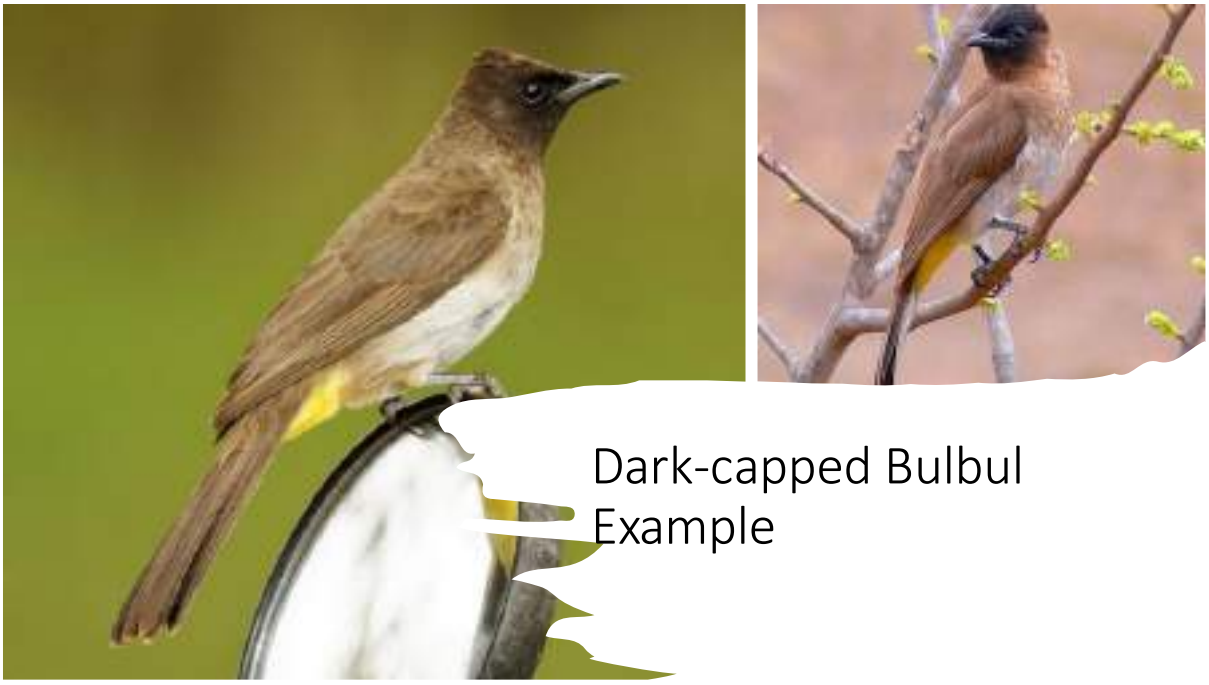
2.3.2. Bird biodiversity surveyed in ephemeral wetland site.

Due to disturbance of the wetland site, the bird life was seen to be low. Most of the birds are perceived to be around the wetlands sites for ecological benefits such as breeding, feeding and protection. Birds that were readily recognisable were recorded (Table 3).

Table 3: List of birds recorded on site during field survey and delineation of the wetland site and their abundance on the days of survey.

Common name	Species name	Abundance
Cattle egrets	*Bubulcus ibis*	++++
Brown-hooded kingfisher	*Halcyon albiventris*	++
Dark-capped Bulbul	*Pycnonotus tricolor*	++++
Hammerhead bird	*Scopus umbretta*	++
Fork-tailed Drongo bird	*Dicrurus adsimilis*	++
Grey heron	*Ardea cinerea*	+
Green-winged Pytilia	*Pytilia melba*	++++
African Masked Weaver	*Ploceus velatus*	++++
Red-billed quelea	*Quelea quelea*	++++
Laughing dove	*Streptopelia senegalensis*	++++
Red-faced mousebird	*Urocolius indicus*	++++

+ (one individual), ++ (two individuals), +++ (three individuals) and ++++ (four or more individuals), denote the abundance level.



This is one of the common birds on site. Mostly sighted targeting flies and locusts in the wetland.

2.3.3. The Anurans or amphibians identified from the wetland sites.

No record was confirmed or identified on site due to degraded nature of the wetland hence the small permanent zone identified none of these were identified.

It is important to note that these frogs are plentiful in ponds where water is dammed. They are aquatic and highly adaptable and will lay their eggs whenever conditions allow it. During wet rainy seasons they will travel to other ponds or vernal pools of water to search for food. During drought times these frogs burrow themselves in the mud, becoming dormant for up to a year. This is indeed one of the mechanisms these frogs use to survive the unpredictable and harsh environment of the ephemeral wetlands.

3. METHODOLOGY FOR ASSESSMENT

3.1. Wetland Field Assessment

The wetland area was delineated by desktop methodology prior to the site visit, focusing on the boundaries of the wetland area. GPS was used to identify important points (e.g. wetland boundaries). These GPS points were converted into a GIS shapefile to allow these points to be mapped and to facilitate the correction of wetland boundaries and the identification of very sensitive wetlands portions within the study area. Coordinated photos were also taken during delineation. Soil auger was used together with a measuring tape to accomplish a complete un-compromised wetland delineation.

3.2. Wetland Delineation

In determining the zone of the wetlands require the delineator to consider specific indicators. The indicators must always be present in the wetlands, and under normal circumstances vegetation indicator is deemed to be primary indicator. Soil indicator tends to be the most important indicator, and the other two indicators (The Terrain Unit and Soil Form Indicators) are used for confirmatory purposes (DWAF, 2005).

The National Water Act (Act 36 of 1998) defined wetland as a “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 the land in which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil”.

Wetland based delineation and sampling of wetland was based upon the DWAF guidelines "A practical field procedure for the identification and delineation of wetlands and riparian areas" (DWAF, 2005), which stipulates that consideration be given to four specific wetland indicators to determine the boundary of the wetland. These indicators are: terrain unit indicator, soil form indicator, soil wetness indicator and vegetation indicator.

This according to the DWAF (2005) guidelines for the delineation and identification of wetlands, soil wetness indicators are the most indicator of wetland occurrence, due to the fact that soil wetness indicators remain in wetland soils, even if the wetland site is degraded or drying out. Soil auger; tape measure and spade were used to profile the soil wetness.

3.3. Wetland Functional Assessment

Wetland functionality is defined by Macfarlane *et al*. (2007), as a measure of the deviation of wetland structure and function from its natural reference condition. The natural reference condition is also based on a theoretical undisturbed state which is derived from an understanding of undisturbed regional vegetation and hydrological conditions knowledge (Macfarlane *et al*., 2007). Kotze *et al*. (2007) emphasized that the wetland systems are critical for groundwater recharges, although flows through them are supplemented by surface water contributions from rain. Kotze *et al*. (2007) further reported that wetlands serve as unit for ecological services and a functional wetland system could contribute to the following: surface flow attenuation, contribution of water to the stream during dry seasons, provide water quality enhancement benefits, and as such the systems have a high potential to remove nitrogen and nitrates as well as carbon sequestration.

3.4. Determination of the Present Ecological Status (PES) of wetlands

WET-Health is a tool designed to assess the health or integrity of a wetland. Wetland health on the other hand is defined as a measure of the deviation of wetland structure and function from the wetland`s natural reference condition. This technique is used to assess hydrological, geomorphological and vegetation health in the form of ecological status categories and descriptions as shown in Table below.

Table 3.4.1: The Present Ecological Status (PES) categories and descriptions for WET-Health (Adapted from Macfarlane *et al.*, 2007).

Category	Description	Range
A	Unmodified, natural	0-0.9
B	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
C	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
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.5-5.9
E	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
F	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10

3.5. Determination of the Ecological Importance and Sensitivity (EIS) of Wetlands.

The ecological importance is an expression of a wetland`s importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system`s ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (MacFarlane *et al.*, 2007). Water resources can be classified for an appropriate management class based on EIS. The EIS allows classification of ecological importance in ecosystems and biodiversity for the estimation of species diversity and abundance. The EIS use the rating scale for the estimation of scores **(Table 3.5.1).** Furthermore, these wetlands provide specialized habitat and dispersal corridors and basic human needs such as subsistence farming and water use.

Table 5: Ecological Importance and Sensitivity rating scale used for the estimation of scores.

Ecological Importance and Sensitivity Categories	**Rating**
Very High These are wetlands that are considered ecologically important and sensitive on a natural or even international level. Biodiversity of these wetlands is usually very sensitive to flow and habitat alterations. They moderate the water quality and quantity of major rivers.	>3 and <=4
High These wetlands are considered to be ecologically important and sensitive. Biodiversity of these wetlands may be sensitive to flow and habitat alterations. Plays a role in moderating the quantity and quality of water of major rivers.	>2 and <=3
Moderate These wetlands are considered ecologically important and sensitive at a local or provincial scale. Biodiversity in these wetlands is not usually sensitive to flow and habitat alterations. However, they play a small role in moderating the quantity and quality of water in major rivers.	>1 and <=2
Low/Marginal Wetlands that are not ecologically important and sensitive at any site. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat alterations. However, they play a role in moderating the quantity and quality of water in major rivers.	>0 and <=1

3.6. Determination of Buffer Requirements

The pre-mitigation buffer requirements for the construction and operational phases are 50 m for wetlands sites respectively. These buffer requirements are relevant to all the delineated wetlands sites and should be ideal after the successful application of recommended mitigation measures.

4. Results and Discussions

4.1. Functions and values of the Wetlands

Due to the several permanent wetlands zones, such an environment is unique in nature and is good in provision of habitat for numerous rare plants and animals that are able to survive and thrive in these harsh and ever-changing conditions. In addition, birds such as egrets, ducks, hawks, kingfishers use wetlands as a seasonal source of food and water.

Due to the seasonal and permanent zones, both animals and plants living there have some adaptation to help them survive in these challenging environments. There are three basic types of strategies that mostly animals and sometimes plants use to survive and adapt, namely: getting off to a fast start; mature early or rapidly and live a prolonged period of time without water.
The facultative species include most of the other remaining frogs, few reptiles, fingernail clams, snails, insect larvae (dragonfly, damselfly, caddisfly larvae, water scorpion, gyrinidae, veliidae, naucoridae, corixidae) and leeches. The major branchiopod crustaceans (generally of facultative ephemeral wetland taxa: Cladocera (Genus: *Daphnia pulex*) were present in the water.

4.2. Status of the Davel Wetland proposed establishment area

The wetlands are less valuable with an indication that they are increasingly got threatened by human activities such as settlements, field for ploughing and vehicle activity, dumping of waste**,** trampling by livestock, digging, overgrazing and removal of vegetation together with invasive alien plants. Most of the wetlands permanent zones have already been lost and great efforts should be made to protect the remaining wetland, as their disturbance and disappearance will mark the loss of rare and important habitat and some of the associated plant and animal species as well. In general, the loss of ephemeral wetlands due to land alterations and insufficient protections has vast ecological and social consequences.

Figure 4.2.1: Indicator for soil sampling during field survey

4.3. Wetland Delineation (soils, vegetation, and soil wetness indicators)

All of the "wetland indicators" including soil wetness and vegetation indicators as well as the analysis topography (land form unit) and site hydrology were considered in the identification and delineation of wetland areas in the study site. Under most circumstances the most important indicator of the presence of hydric soils is the soil wetness indicator, i.e. examination of redoximorphic features within the soil (Collins, 2005).

4.4. Wetland Soils

The findings from the determination of wetland soils indicated that the wetlands site is dominated by loamy-clay type of soil. The wetlands had shown that one main wetland soil form is dominant within the delineated wetland areas during the site visit. Signs of wetness within the soils studied on site showed the typical mottling usually found in wetland soils. The reason for this phenomenon may be due to high level of iron in the soil. It is however important to note that another property of wetland soils known as gleying can be seen within the wetlands sites.

Figure 4.4.1: indicator for soil sampled on the permanent zones

4.5. Description of Wetland Type

Wetland type of the area is a flood plain and depression type of wetland. Mainly the characteristics of the wetland dominant are for the flood plain wetland.

4.6. Present Ecological Status

The Present Ecological Status (PES) for the assessed wetland system is presented in Table below.

The wetland is in a Category D: Largely modified. The hydrological processes and vegetation of the wetland have undergone the most significant alterations, primarily due to impacts associated with the extensive forestry activities that took place years back**.** With forestry plantation being a streamflow reduction activity, it caused drying of the wetland. Additionally, impacts such as informal road traversing the wetland area, and pipeline crossings that have resulted in soil disturbances, showing developing cracks and soil instability. In so doing, the assessed area of the wetland is deemed to be in a largely modified condition.

Seeps have been degraded with water quality been polluted in a way that green algae also got established which indicated that waste are being deposited. Green algae also indicate the disturbance on flow of water which resulted in accumulation of pollutants on dammed water and ponds.

4.7. The Ecological Health Assessment

The hydrology of wetlands sites has been "Critically Modified (F)" due to the disturbance in the various surface water runoff drainage system disturbed.

The Geomorphology component of the wetlands area has been scored "Largely Modified (D)" due to certain impacts identified as being a threat for the wetland system. The identified impacts in this regard include the changes in run-off characteristics due to high concentrations of soil degradation, sedge grass disappearance and the formation of eroded rills.

The vegetation aspect of the wetland sites has been scored a "Largely Modified (D)" score. The main aspect contributing to this rating is attributed to the development of the Township developed area. Since the construction and operation of the infrastructure involved clearing indigenous vegetation and covering soil surfaces which inhibits smooth water infiltration and substantially increases run-off.

4.8. The EIS Assessment of the Remaining Wetland Areas

The EIS Category of the wetlands was determined according to Kotze et al. (2007). The findings of the EIS assessment indicates that the wetland is deemed to be of moderate ecological importance and is therefore designated a Sensitivity Category C score (Table 5). This is largely attributable to the hydrological-functional importance of the system, primarily due to its perceived ability to regulate streamflow, runoff, and control erosion. This is because these wetlands are considered ecologically important and sensitive at a local scale. Although the biodiversity in these wetlands is not usually sensitive to flow and habitat alterations. However, they play a small role in moderating the quantity and quality of water in major rivers.

4.9. Buffer Requirements

The recommended buffer zones were delineated to various ranges based on the impact that took place and status is 50 m. The buffer zones for the wetlands should be implemented for the activities not to cause further damage on the wetland. Buffers delineation and mapping focused on wetland portions that are still valuable and have high chances of recovering if restored and protected from further human impacts.

4.10. IMPACT ASSESSMENT

4.10.1. IMPACT AND MITIGATION MEASURES

Drainage channels that are cement and concrete base must be designed by an engineer to assist in channeling water during summer when water table increases.

4.10.2. RECOMMENDATIONS

Recommendation 1: Wetland monitoring and assessment programmes.

Consistent, thorough and timely wetland monitoring and assessment programmes are a critical tool for municipality and community to better manage and protect their wetland resources. These programmes if considered can enhance the following attributes, namely:

- Establishment of a baseline in wetland extent, condition and function
- Characterize trends within and around the wetlands over time

Wetlands monitoring and assessment data can be used to help make decisions in:

The National Water Act, 36 of 1998 regulatory programmes

Wetland restoration and watershed planning

The development of meaningful water quality standards for wetlands

Recommendation 2: No construction or sand mining may take place within the wetlands or 50 m zone of regulation and such an area has been demarcated as a no-go area.

Recommendation 3: No dumping of waste may take place on wetland and water course.

Recommendation 4: Environmental education to raise awareness on value and protection of wetlands must be done for local community and schools.

Recommendation 5: Risk plan to guide on long term wetland impacts must be developped.

Recommendation 6: Houses that are existing on the site must be monitored for possible impact of water table rising in summer to assist with preparation for risk plan.

Recommendation 7: Invasive alien plants must be control using chemical and mechanical methods. Near permanent wetland only manual removal must be used. (Detailed invasive and open space management plan is attached on this report)

Recommendation 8: Drainage channeling must be done using cement based concrete to channel water when water table rises into main wetlands .

Recommendation 9: It is recommended that should there be no consideration of alternative site further wetland engineering for construction of houses on wet area be developed with engineers and certification be issued.

5. NATURE OF THE POTENTIAL IMPACTS ON WETLANDS ASSOCIATED WITH THE PROPOSED TOWNSHIP FORMALIZATION

5.1. Impact Assessment

The impact assessment considers both direct and indirect impacts, if any, to the wetland systems. The existing township is within the 50m boundary with some houses already over the 50m buffer. Degradation and desiccation of the wetland flow flood line has occurred. If the wetland area could lose its integrity, the implications could be that it cannot control and manage stormwater, sediment trapping and trapping of pollutants and ultimately sediments. There could be a further biodiversity value reduction in case the wetland loses its functionality and ecological health status.

Table 7: Impacts assessed for the proposed Township Formalization

Impact	Aspect
Construction phase	Removal of vegetation
Impeding on flow paths entering Siltation Sedimentation Eutrophication Water quality impairment	Excavations for foundations and servitudes Clearing of area for infrastructure Hardening of surface areas Vehicle activity Domestic and industrial waste
Operational phase	Increase in hardened surfaces Wetland drainage patterns change Traffic and vehicle activity The road kills of fauna species particularly frogs, snails, birds, and reptiles that could try to negotiate or transverse the main road to the other side of the road habitat.

The above impacts already occurred since area is surrounded by the developed site.
Measures to address the impacts are to be implemented without compromise.

5.2. Associated Mitigation Measures

The mitigation measures that should be considered for the township formalization are as follows:

- Concrete based drainage channels must be designed by an engineer to channel water to main wetland. Foundations of new houses must be guided by a professional engineer to avoid further damage during possible water table rising.

5.3. Impact Rating Matrix before and after mitigation measures for the wetland's sites.

The impact assessment rating matrix assessment of wetland loss before mitigation is shown in Table 8, and the one after application of mitigation measures is in Table 9 below.

Table 8: The Impact Assessment Matrix of Wetland loss before mitigation measures.

Criteria	Description	Score
Extent	The loss of wetlands is likely to have a local impact, as the catchments found within the proposed township establishment could feed directly to the wetland system	2
Duration	The loss of wetland is likely to be permanent, as the portions in the wetland could be destroyed permanently	4
Intensity	Given the largely modified or degraded nature of the wetlands on site, it is likely that the intensity will be moderate	2
Probability of occurrence	The proposed layout could destroy wetland habitat	4

Significance of the impact: The impact of the township establishment on site is likely to have a very low negative impact if mitigation measures are not taken into consideration.

Table 9: The Impact Assessment Matrix of Wetland loss after mitigation measures.

Criteria	Description	Score
Extent	The loss of wetlands is likely to have a site impact, as the catchments will be rehabilitated	1
Duration	The loss of wetland integrity is likely to be short-term, as the wetlands will have an offset of negative impacts by rehabilitation	1
Intensity	Given the degraded or alterations nature of the wetlands areas, it is likely that the intensity will be moderate.	2
Probability of occurrence	The proposed development offset will possibly reduce the loss of wetlands site	2

Significance of the Davel wetlands impact: The impact of the township establishment is likely to have a low negative impact should the wetland be conserved.

6. CONCLUSIONS

A township is located on an area which has wetland indicators for a temporary wetland. The wetland temporary zones spread mostly along the southern side and edges of the site boundaries. Wetlands have already been affected by existing township activities. The wetland area and associated buffer must be kept free from all or further development, including linear developments (i.e. roads) and underground services (pipelines etc.).

It is important that stormwater from the surrounding proposed establishment be of "soft" engineering in the stormwater design is strongly recommended, as these will likely prevent most of the impacts associated with the stormwater discharge. To ensure that existing housing structures does not get affected by possible water table increases concrete based drainages must be constructed to channel water into the main wetland located on the southern side.

Based on the findings of the wetland ecological assessment, it is the opinion of the wetland ecologist that the proposed township formalization poses a moderate risk to the integrity of the wetlands. It is therefore of utmost importance that the adherence to recommendations and ecologically sensitive site development plans, and the mitigation measures provided in this report should be ideal for general good construction practice and ongoing management, maintenance, and monitoring of perceived impacts to limit further degradation of the freshwater environment. Furthermore, it is also the opinion of the wetland ecologist and freshwater specialist that the proposed township formalization from a freshwater resource management perspective is acceptable provided no development takes place within the wetlands or the associated 50 m zone or so of regulation, dumping of wastes (diapers and glass bottles) are eliminated, and that strict adherence to mitigation measures is enforced to ensure that the ecological integrity of the freshwater environment is not further compromised.

The mitigation measures and recommendations listed herein should be adhered to as to ensure wetland areas associated with the township establishment as well as surrounding environment are protected.

7. REFERENCES

Colins NB. 2005. Wetlands: The basics and some more. Free State Department of Tourism, Environmental and Economic Affairs.

Department of Water Affairs and Forestry. 2005. A Practical field procedure for identification and delineation of Wetlands and riparian areas.

Du Preez L and Carruthers V. 2017. *Frogs of Southern Africa A complete Guide*. 2nd Edition. Leo Paper Products Ltd. China.

Kotze DC, Marneweck GC, Batchelor AL, Lindley D and Collins NB. 2007. WET-Eco-services: A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report TT 339/09. Water Research Commission, Pretoria.

MacFarlane DM, Kotze DC, Ellery WN, Walters D, Koopman V, Goodman P and Goge C. 2007. WET-Health: A technique for rapidly assessing wetland health. WRCReport TT 340/08. Water Research Commission, Pretoria.

Louis du Preez (2017), frogs of Southern Africa a complete guide, struik nature, Cape town South Africa.

Appendix A: Photos and referral maps

View of ground cover dominated by grass(Grassland biome)

Weeds identified on site(Main dominants)

Site is already having existing stands within wetland zones

These houses are within seasonal wetland zones.

Site was visited on 01 March 2023 which was a summer season and water level was high.

Residents were asked how site react during rainy season and they confirmed it becomes water saturated and houses gets wet.



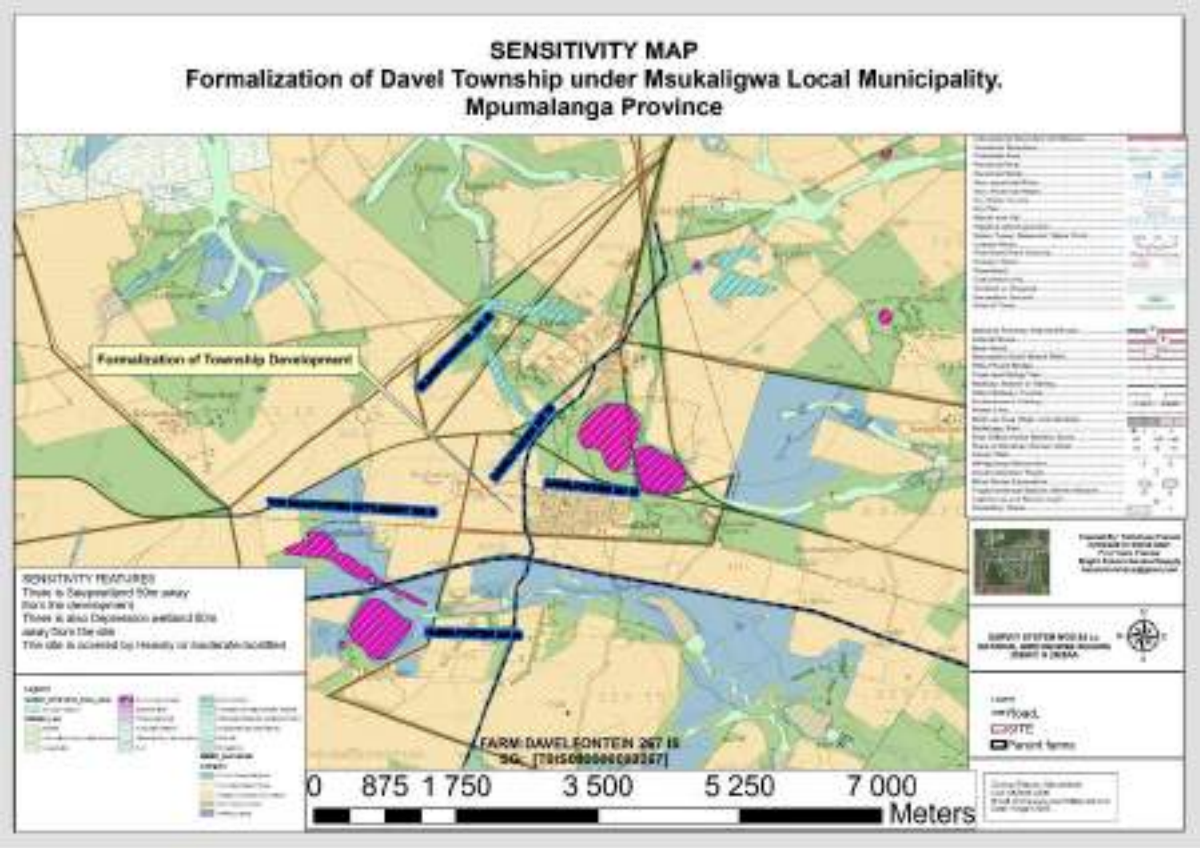
Permanent wet zones mapped on the northeastern side

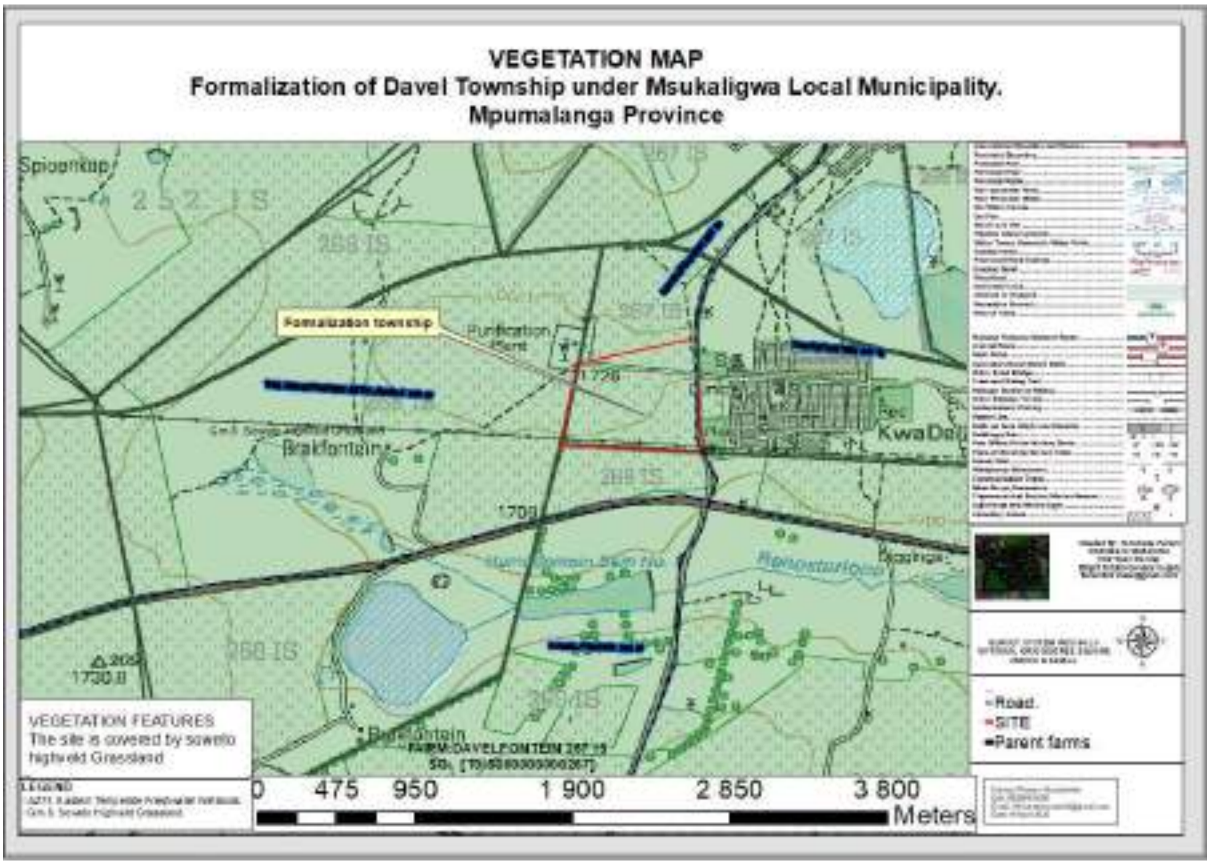
Different mapped seasonal wet zones

Comparison of site historical aerial photos

Comparison of site historical aerial photos

The above presented historical aerial photos shows that from 2011 site was vacant while from 2017 development started to be visible. 2019 to 2022 and current site fully developed.


SENSITIVITY MAP
Formalization of Davel Township under Msukaligwa Local Municipality.
Mpumalanga Province
Formalization of Township Development
SENSITIVITY FEATURES
FARM: DAVELFONTEIN 267 IS
0 875 1 750 3 500 5 250 7 000
Meters
Road
SITE
Parent farms


VEGETATION MAP
Formalization of Davel Township under Msukaligwa Local Municipality.
Mpumalanga Province
Spioenkop
Formalization township
Purification Plant
Brakfontein
KwaDela
VEGETATION FEATURES
The site is covered by soweto highveld Grassland
FARM: DAVELFONTEIN 267 IS
0 475 950 1 900 2 850 3 800
Meters
Road
SITE
Parent farms

ALIEN PLANT AND OPEN SPACE MANAGEMENT PLAN

1. PURPOSE

Invasive alien plant species pose the second largest threat to biodiversity after direct habitat destruction. The purpose of this Alien Plant and Open Space Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation of Allepad PV Two and associated infrastructure. The broad objectives of the plan include the following:

- Ensure alien plants do not become dominant in parts of the site, or the whole site, through the control and management of alien and invasive species presence, dispersal and encroachment.
- Develop and implement a monitoring and eradication programme for alien and invasive plant species.
- Promote the natural re-establishment and planting of indigenous species in order to retard erosion and alien plant invasion.

This plan should be updated throughout the life-cycle of the PV facility, as required in order to ensure that appropriate measures are in place to manage and control the establishment of alien and invasive plant species and to ensure compliance with relevant legislation.

2. RELEVANT ASPECTS OF THE SITE

The current veld condition of the site can be considered to be fair and while there are some areas that have clearly suffered some degradation in the past, the vegetation cover and composition can be considered typical for the area. There are some localised areas of *Prosopis* invasion at the project site, usually around watering points, but in general there are few alien species present across most of the site and it can be considered to be largely intact and in moderate condition.

3. LEGISLATIVE CONTEXT

Conservation of Agricultural Resources Act (Act No. 43 of 1983)

In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared alien plant species must be effectively controlled. Landowners are legally responsible for the control of invasive alien plants on their properties. In terms of this Act alien invasive plant species are ascribed to one of the following categories:

- Category 1: Prohibited and must be controlled.
- Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.
- Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)

The National Environmental Management: Biodiversity Act (NEM:BA) regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Regulations have been published in Government Notices R.506, R.507, R.508 and R.509 of 2013 under NEM:BA. According to this Act and the regulations, any species designated under Section 70 cannot be propagated, grown, bought or sold without a permit. Below is an explanation of the three categories:

- **Category 1a:** Invasive species requiring compulsory control. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- **Category 1b:** Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- **Category 2:** Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- **Category 3:** Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The following guide is a useful starting point for the identification of alien plant species: Bromilow, C. 2010. Problem Plants and Alien Weeds of South Africa. Briza, Pretoria.

It is important to note that alien plant species that are regulated in terms of the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) as weeds and invader plants are exempted from NEM:BA. This implies that the provisions of the CARA in respect of listed weed and invader plants supersede those of NEM: BA.

4. ALIEN PLANT MANAGEMENT PRINCIPLES

4.1. Prevention and early eradication

A prevention strategy should be considered and established, including regular surveys and monitoring for invasive alien plants, effective rehabilitation of disturbed areas and prevention of unnecessary disturbance of natural areas.

Monitoring plans should be developed which are designed to identify Invasive Alien Plant Species already on site, as well as those that are introduced to the site by the construction activities. Keeping up to date on which weeds are an immediate threat to the site is important, but efforts should be planned to update this information on a regular basis. When additional Invasive Alien Plant Species are recorded on site, an immediate response of locating the site for future monitoring and either hand-pulling the weeds or an application of a suitable herbicide (where permissible only) should be planned. It is, however, better to monitor regularly and act swiftly than to allow invasive alien plants to become established on site.

4.2. Containment and control

If any alien invasive plants are found to become established on site, action plans for their control should be developed, depending on the size of the infestations, budgets, manpower considerations and time. Separate plans of control actions should be developed for each location and/or each species. Appropriate registered chemicals and other possible control agents should be considered in the action plans for each site/species. The uses of chemicals are not recommended for any wetland areas. Herbicides should be applied directly to the plant and not to the soil. The key is to ensure that no invasions get out of control. Effective containment and control will ensure that the least energy and resources are required to maintain this status over the long-term. This will also be an indicator that natural systems are impacted to the smallest degree possible.

4.3. General Clearing and Guiding Principles

Alien species control programmes are long-term management projects and should consist of a clearing plan which includes follow up actions for rehabilitation of the cleared area. The lighter infested areas should be cleared first to prevent the build-up of seed banks. Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently. Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of alien species are easily dispersed across boundaries by wind or watercourses. All clearing actions should be monitored and documented to keep records of which areas are due for follow-up clearing.

i. Clearing Methods

Different species require different clearing methods such as manual, chemical or biological methods or a combination of both. Care should however be taken that the clearing methods used do not encourage further invasion and that they are appropriate to the specific species of concern. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.

Fire should not be used for alien species control or vegetation management at the site. The best-practice clearing method for each species identified should be used.

» **Mechanical control**
This entails damaging or removing the plant by physical action. Different techniques could be used, e.g. uprooting, felling, slashing, mowing, ringbarking or bark stripping. This control option is only really feasible in sparse infestations or on a small scale, and for controlling species that do not coppice after cutting. Species that tend to coppice, need to have the cut stumps or coppice growth treated with herbicides following the mechanical treatment. Mechanical control is labour intensive and therefore expensive, and could cause severe soil disturbance and erosion.

» **Chemical Control**
Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien plant invasion and may also be ineffective for many woody species which re-sprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of at a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.
- The use of chemicals is not recommended for wetland areas.

For all herbicide applications, the following Regulations and guidelines should be followed:

- Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.
- Pesticide Management Policy for South Africa published in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) – GNR 1120 of 2010.
- South African Bureau of Standards, Standard SANS 10206 (2010).

According to Government Notice No. 13424 dated 26 July 1992, it is an offence to "*acquire, dispose, sell or use an agricultural or stock remedy for a purpose or in a manner other than that specified on the label on a container thereof or on such a container*".

Contractors using herbicides need to have a valid Pest Control Operators License (limited weeds controller) according to the Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act (Act No. 36 of 1947). This is regulated by the Department of Agriculture, Forestry and Fisheries.

» **Biological control**

Biological weed control consists of the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro-organisms such as fungi or bacteria. They usually attack specific parts of the plant, either the reproductive organs directly (flower buds, flowers or fruit) or the seeds after they have dropped. The stress caused by the biological control agent may kill a plant outright or it might impact on the plant's reproductive capacity. In certain instances, the reproductive capacity is reduced to zero and the population is effectively sterilised. All of these outcomes will help to reduce the spread of the species.

To obtain biocontrol agents, provincial representatives of the Working for Water Programme or the Directorate: Land Use and Soil Management (LUSM), Department of Agriculture, Forestry and Fisheries (DAFF) can be contacted.

4.4. General management practices

The following general management practices should be encouraged or strived for:

» Establish an on-going monitoring programme for construction phase to detect and quantify any alien species that may become established.

- Alien vegetation regrowth on areas disturbed by construction must be immediately controlled.
- Care must be taken to avoid the introduction of alien invasive plant species to the site. Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment. Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.
- Cleared areas that have become invaded by alien species can be sprayed with appropriate herbicides provided that these herbicides break down on contact with the soil. Residual herbicides should not be used.
- The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow, and follow-up control is likely to be required. It is tempting to leave control until late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control, and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.
- Alien plant management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
- Some alien species are best individually pulled by hand. Regular vegetation control to reduce plant biomass within the site should be conducted. This should be timed so as to coincide with the critical growth phases of the most important alien species on site. This will significantly reduce the cost of alien plant management as this should contribute towards the control of the dominant alien species and additional targeted control will be required only for a limited number of species.
- No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used.
- During operation, surveys for alien species should be conducted regularly. It is recommended that this be undertaken every 6 months for the first two years after construction and annually thereafter. All alien plants identified should be cleared using appropriate means.

4.5. Monitoring

In order to assess the impact of clearing activities, follow-ups and rehabilitation efforts, monitoring must be undertaken. This section provides a description of a possible monitoring programme that will provide an assessment of the magnitude of alien plant invasion on site, as well as an assessment of the efficacy of the management programme.

In general, the following principles apply for monitoring:

- Photographic records must be kept of areas to be cleared prior to work starting and at regular intervals during initial clearing activities. Similarly, photographic records should be kept of the area from immediately before and after follow-up clearing activities. Rehabilitation processes must also be recorded.
- Simple records must be kept of daily operations, e.g. area/location cleared, labour units and, if ever used, the amount of herbicide used.
- It is important that, if monitoring results in detection of invasive alien plants, that this leads to immediate action.

The following monitoring should be implemented to ensure management of alien invasive plant species.

Construction Phase

Monitoring Action	Indicator	Timeframe
Document alien species present at the site	List of alien plant species	Preconstruction Monthly during Summer and Autumn (Middle November to end March) 3 Monthly during Winter and Spring
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien plant control measures implemented	Record of clearing activities	3 Monthly

Operation Phase

Monitoring Action	Indicator	Timeframe
Document alien plant species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

Civil Engineering Report

FORMALISATION OF MARIKANA INFORMAL SETTLEMENT LOCATED ON THE REMAINING EXTENT OF PORTION 6 OF THE FARM DAVELFONTEIN 267 - IS, MPUMALANGA PROVINCE

BULK ENGINEERING SERVICES REPORT

April 2023, Rev0

PREPARED BY:

Dalimede Projects (PTY) LTD
No. 11 Pierre street, IT Park RentCo Building, Office 6,
Bendor, South Africa, 0699

Tel: 015 291 0775
E-mail: admin@dalimede.com

PREPARED FOR:

Mang GeoEnviro Services
Block 9, Unit 2 Boardwalk Office Park,
6 Enos Road, Faerie Glen,
Pretoria, 0004

Tel: 012 770 4022
Cell: +27 72 573 2390
Email: fnmathebula@gmail.com / info@manggeoenviro.co.za

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Abbreviations

AADD	-	Average Annual Daily Demand
ADWF	-	Average Dry Weather Flow
DWS	-	Department of Water and Sanitation
FAR	-	Floor Area Ratio
IDP	-	Infrastructure Development Plan
kℓ	-	Kilo Litres
kℓ/day	-	Kilo Litres per day
ℓ/s	-	Litres per second
m^3	-	Cubic metre
MAP	-	Mean Annual Precipitation
Mℓ /day	-	Mega litres per day
PSC	-	Project Steering Committee
RWS	-	Regional Water Scheme
SANRAL	-	South African National Roads Authority Limited
StatsSA	-	Statistics South Africa
VIP toilet	-	Ventilated Improved Pit toilet
WC	-	Water Committee

1 INTRODUCTION

Mang GeoEnviro Services appointed Dalimede Projects to prepare the bulk engineering services report for the proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province.

This report outlines the engineering services needed for the township, i.e., roads, water, sewer and electricity.

2 LOCALITY

The proposed township is situated 37km west of Ermelo along the N17 highway, site is also 250km south-west of Mbombela City along the N17 and R38 roads, in Mpumalanga Province, South Africa. The area is administered by Msukaligwa Local Municipality under the Gert Sibande District Municipality. GPS coordinates of site are 26°27'47.35"S 29°39'20.83"E. The locality map is shown on the figures below.

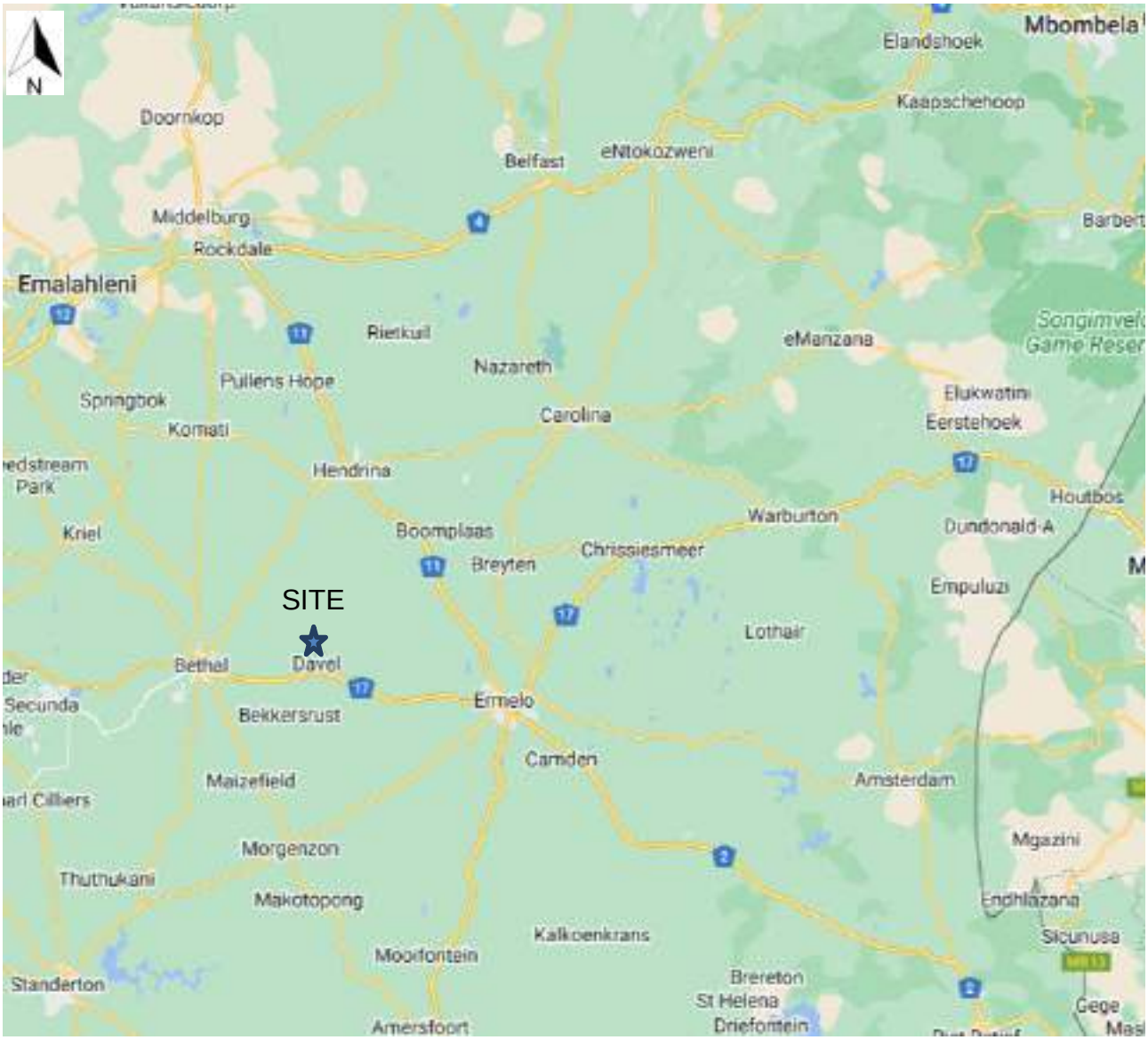

Figure 1 Locality map

Figure 2 Locality

Figure 3 Locality plan

3 TOWN PLANNING

The site is currently an informal settlement.

The site proposed land use will be mostly for residential purposes.

Table 1 Land use

ZONING	LAND USE		NO. OF STANDS	AREA Ha.	% OF AREA
RESIDENTIAL 1	RESIDENTIAL		602	25.086100	68.7
BUSINESS 1	BUSINESS		3	0.179600	0.5
EDUCATIONAL	CRECHE		1	0.1328	0.4
INSTITUTIONAL	CHURCH		1	0.1175	0.3
PUBLIC OPEN SPACE	PARK		3	0.1502	0.4
MUNICIPAL	SERVITUDE		11	0.7656	2.1
STREETS	*	*	*	10.0862	27.6
TOTAL	*		621	36.5180	100

The land use layout is shown in the figures below.

Figure 4 Site Development Plan

4 TOPOGRAPHY AND ACCESS

The site topography is generally flat.

Figure 5 Site view

Figure 6 Site view

The proposed development site can be accessed from the town roads, described below.

- Provincial road called New street. The road is bituminous top surfaced.

See the figures below.

Figure 7 Site access

Figure 8 Site access from New street

5 Floodlines

A river with a dam was observed across the N17 highway, 0.8km south of site. A flood line study is to be considered for the observed river.

Figure 9 River across the N17 highway

6 WATER SERVICE

The project site does not have existing formal municipal infrastructure for water. Msukaligwa Local Municipality is a Water Service Authority (WSA) and is also a Water Service Provider (WSP).

6.1 Water source

The Davel town is within the Usuthu River System. This system consisting of three major dams, viz;

- Westoe Dam, GPS coordinates 26°30'16.43"S 30°37'32.89"E.
- Jericho Dam, GPS coordinates 26°39'14.21"S 30°29'5.51"E, and
- Morgenstond Dam, GPS coordinates 26°42'39.48"S 30°32'38.67"E.

The main water source for Davel Town is from the Jericho Dam. Raw water is delivered from the DWS reservoirs.

Davel town receives raw water from the DWS reservoirs, GPS coordinates 26°27'37.36"S 29°39'6.39"E. The raw water is then conveyed to and purified at the following treatment works;

- Davel water treatment works (WTW). GPS coordinates 26°27'35.54"S 29°39'9.98"E. This WTW is operated by the municipality. The design capacity of the Davel WTW is 2.5Mℓ /day. However, the WTW currently produces 1Mℓ /day.

The purified water is then fed to the Davel Town.

Table 2 WTW details

Description	**Locality:**
	Davel WTW
Water Treatment Works Capacity	2.5Mℓ/day

Figure 10 Davel WTW


Figure 11 Davel WTW

Bulk meter water supply records for three months are shown in the Table below.

Table 3 Bulk meter water supply records

	Date	DWS Raw Water meter	Davel meter	Kwa Dela meter	Davel meter Demand (kℓ/d)	Kwa Dela meter Demand (kℓ/d)	Total Demand (kℓ/d)	DWS Raw Water supply (kℓ/d)
January 2023	1							
	2							
	3	6018777	85173	138108				
	4	6018860	85370	138911	197	803	1000	83
	5							
	6							
	7	6020845	86258	140188	296	426	722	662
	8	6021908	86548	140631	290	443	733	1063
	9	6022876	86835	141154	287	523	810	968
	10	6023607	87052	141577	217	423	640	731
	11	6024501	87325	141998	273	421	694	894
	12	6052730	87666	142419	341	421	762	
	13							
	14							
	15	6028529	88618	143610	317	397	714	
	16	6029481	88777	144231	159	621	780	952
	17	6030559	89088	145026	311	795	1106	1078
	18	6031543	90101	146321	1013	1295	2308	984
	19	6032480	90642	146648	541	327	868	937
	20							
	21							
	22	6035345	90668	147593	9	315	324	955
	23	6036332	91004	148139	336	546	882	987
	24	6037304	91513	148760	509	621	1130	972
	25	6038454	91715	149501	202	741	943	1150
	26	6039426	92078	150166	363	665	1028	972
	27	6040232	92268	150421	190	255	445	806
	28	6040975	92555	150961	287	540	827	743
	29	6041934	92914	151552	359	591	950	959
	30							
	31	6043639	93448	152413	267	430.5	697.5	
February 2023	1	6044930	93193	152881				
	2	6045545	94306	153614	1 113	733	1 846	615
	3							
	4	6047371	94866	154570	280	478	758	913
	5	6048151	95061	154974	195	404	599	780

	Date	DWS Raw Water meter	Davel meter	Kwa Dela meter	Davel meter Demand (kℓ/d)	Kwa Dela meter Demand (kℓ/d)	Total Demand (kℓ/d)	DWS Raw Water supply (kℓ/d)
	6	6049642	96371	155034	1 310	60	1 370	1491
	7							
	8	6050967	97180	156242	405	604	1 009	662.5
	9	6051901	98320	157043	1 140	801	1 941	934
	10							
	11	6053977	98012	158335				1038
	12	6054600	98110	159574				623
	13	6055106	98240	159884				506
	14	6056977	98392	158335				1871
	15							
	16	6058541	98493	158582				782
	17	6059471	98798	158773	305	191	496	930
	18	6060508						1037
	19	6061208	99372	162822	287	2 025	2 312	700
	20	6062496	99621	163293	249	471	720	1288
	21	6064200	99807	163452	186	159	345	1704
	22	6064582		164428		976	976	382
	23	6064928	100552	164715	373	287	660	346
	24	6065667	100870	165113	318	398	716	739
	25	6066672	101105	165785	235	672	907	1005
	26	6068606	101373	166621	268	836	1 104	1934
	27	6068786	101704	167457	331	836	1 167	180
	28	6069452	101935	168001	231	544	775	666
	29	6070284	101639	169344				832
	30							
	31							
March 2023	1							
	2	6071244	102538	168278				
	3	6071800	102735	168691	197	413	610	556
	4	6072801	103035	169213	300	522	822	1001
	5	6073742	103344	169732	309	519	828	941
	6	6074565	106559	170252		520		823
	7	6075497	106971	170899	412	647	1059	932
	8	6076103	107756	171345	785	446	1231	606
	9	6076843	1081003	171743		398		740
	10	6078358	104618	172444		701		1515
	11	6079243	107248	173861		1417		885
	12	6080179	105201	173484				936
	13	6080963	105491	174142	290	658	948	784
	14	6081090	105766	174814	275	672	947	127
	15	6082524	101750	175276		462		1434

	Date	DWS Raw Water meter	Davel meter	Kwa Dela meter	Davel meter Demand (kℓ/d)	Kwa Dela meter Demand (kℓ/d)	Total Demand (kℓ/d)	DWS Raw Water supply (kℓ/d)
	16	6083449	106233	176783		1507		925
	17	6084257	108541	178295		1512		808
	18	6085194	106816	178838		543		937
	19	6085973	107058	172329	242			779
	20	6085973	107400	178077	342			
	21	6087758	107617	178516	217	439	656	1785
	22	6088611	107914	179095	297	579	876	853
	23	6089441	108201	179546	287	451	738	830
	24	6090443	108541	180091	340	545	885	1002
	25	6091309	108758	180610	217	519	736	866
	26	6092241	109134	181389	376	779	1155	932
	27	6093118	109361	181847	227	458	685	877
	28	6093928	109551	182285	190	438	628	810
	29	6094831	109814	182841	263	556	819	903
	30	6095692	110137	183582	323	741	1064	861
	31	6096579	110403	184932	266	1350	1616	887
	Total record (kℓ/month)						**17455**	**21063**
	Minimum (kℓ/d)						**324**	**83**
	Average (kℓ/d)						**935**	**903**
	Median (kℓ/d)						**828**	**899**
	Max (kℓ/d)						**2312**	**1934**

The current mean water demand was estimated to be 935kℓ/d.

6.2 Bulk Water Pipeline

Raw water is conveyed from the Jericho Dam through a bulk pipeline connected to the Camden-Kriel pipeline. Raw water is conveyed to the twin DWS raw water reservoirs. The DWS reservoirs then convey to the Davel WTW.

Figure 12 Water bulk pipeline

The delivery pipeline from the reservoirs to the Davel Town has a 110mm diameter.

Figure 13 Davel Town delivery pipeline

6.3 Storage Reservoirs / Tanks

The Davel town has command storages at the Davel WTW.

Table 4 Existing water storage

Description	**Locality:**
	Davel Town
Davel town raw water ground tank	3.63 Mℓ
Davel town potable concrete water reservoirs	0.5 Mℓ + 0.5 Mℓ = 1 Mℓ
Davel town potable water ground tank	1.18 Mℓ
Davel town potable water elevated tank	0.26 Mℓ

Total potable water storage = 2.44 Mℓ

Figure 14 Water storage

Figure 15 Potable water storages

6.4 Water Reticulation

There is no existing formal water reticulation in the proposed development site. There are 4 informal water stand taps for the whole settlement.

6.5 Water design criteria

The water design criterion to be used is listed in the table below. The design guidelines were adopted from the CSIR document titled:

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

Table 5 The water design criteria

Item	Design element	Criteria
i.	Average Annual Daily Demand (AADD), for Residential 1 (Low income)	0.6kℓ/c/day
ii.	Average Annual Daily Demand (AADD), for Residential 1 (Medium Income)	0.9kℓ/c/day
iii.	Average Annual Daily Demand (AADD), for Residential 1 (High Income)	1.3kℓ/c/day
iv.	Group / cluster housing, Medium density	0.5kℓ/unit/day
v.	Business / commercial, FAR = 0.4	0.65kℓ/100m^2
vi.	Park	12kℓ/hectare
vii.	Municipal, FAR = 0.4	0.6kℓ/100m^2
viii.	Institutional, FAR = 0.4	0.6kℓ/100m^2
ix.	Educational, FAR = 0.4	0.6kℓ/100m^2
x.	Industrial, FAR = 0.4	0.4kℓ/100m^2
xi.	Taxi Rank	0.3kℓ/100m^2
xii.	School, crèche, educational buildings	60 ℓ/student
xiii.	Hospital, building according to Floor Area Ratio (FAR)	1.2 kℓ/100m^2
xiv.	Church buildings	0.3 kℓ/100m^2
xv.	Church grounds	1.2 kℓ/Ha
xvi.	School, crèche, educational buildings	60 ℓ/student
xvii.	School, crèche, educational grounds	12 kℓ/Ha
xviii.	Institutional, FAR = 0.4	0.6 kℓ/100m^2
xix.	Sport grounds / Recreational	40 kℓ/Ha
xx.	Residential stands; High density, small sized, with 20 to 12 units/Ha	11 kℓ/Ha/day
xxi.	Flats, High density	0.35 kℓ/unit/day
xxii.	Stadium: Buildings only	1.5 kℓ/1000seats
xxiii.	Stadium: Grounds only	12 kℓ/Ha/day
xxiv.	Hotels, guest houses, lodges, boarding houses, retirement centres & villages. Buildings according to FAR	0.9 kℓ/100m^2
xxv.	Hotels	0.2 kℓ/person
xxvi.	Golf estate - excluding golf course water requirements. Stand size less than 2670m^2.	3kℓ/stand/day
xxvii.	Garage or filling station	0.8kℓ/100m^2
xviii.	Frail care centres and hospitals, Building according to FAR	1.2kℓ/100m^2
xxix.	Gross Average Annual Daily Demand (GAADD)	Allow 10% losses

Item	Design element	Criteria
xxx.	Daily Instantaneous Peak Factor (DIPF)	1.5
xxxi.	Design Peak Flow Rate (DPFR) for domestic flows.	25ℓ/s
xxxii.	Maximum static head	90m
xxiii.	Minimum residual head under conditions of domestic peak flow	10m
xxiv.	Maximum linear flow velocity under conditions of domestic peak flow	3m/s
xxv.	Pipe type	uPVC
xxvi.	Minimum pipe class	9
xxvii.	Fire flow at any one hydrant under the conditions of domestic peak flows (one hydrant at a time)	15 ℓ/s
xviii.	Minimum residual head (fire plus domestic peak flow)	25m
xxix.	Maximum linear flow velocity under conditions of fire-fighting	3m/s
xl.	DWS storage reservoirs sizing criteria: 48 Hrs x AADD Pumped from One Source 36 Hrs x AADD Pumped from Multiple Sources 24 Hrs x AADD Gravity Source	

The following adoptions were also made:

- Residential 2 land use type has 44 Dwelling Units / Hectare
- Residential 3 land use type has 65 Dwelling Units / Hectare
- Medium sized school of 500 pupils.
- Crèche of 100 pupils.

6.6 Water demands

The estimated water demand for the proposed development is shown in table below. As per the table below, the water demand calculations indicate that the proposed township will require 376.5kℓ/d AADD and 414.1kℓ/d Gross Average Annual Daily Demand.

Table 6 Water demand (Proposed development)

Land Use	**No. of Erven**	**Area (Ha)**	**No. of Units**	**Floor Area Ratio, FAR**	**Unit flow**	**Unit of measure**	**Water Demand**	
Residential 1 (Residential)	602	25.086100	602		0.6	kℓ/erf/day	361.2	kℓ/d
Business 1 (Business)	3	0.179600		0.4	0.65	kℓ/100m^2	4.7	kℓ/d
Educational (Creche)	1	0.1328	100		0.060	kℓ/student	6.0	kℓ/d
Institutional (Church)	1	0.1175		0.4	0.600	kℓ/100m^2	2.8	kℓ/d
Public Open Space (Park)	3	0.1502			12.0	kℓ/Ha	1.8	kℓ/d
Municipal (Servitude)	11	0.7656						
Streets		10.0862						
Totals	621	36.52						
Sub-total Average Annual Daily Demand (AADD)							376.5	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							414.1	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							4.8	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	621.2	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	7.2	ℓ/s

Table 7 Water demand (Combined existing settlement + Proposed development)

Land Use	No. of Erven	Area (Ha)	No. of Units	Floor Area Ratio, FAR	Unit flow	Unit of measure	Water Demand	
Proposed development								
Residential 1 (Residential)	602	25.086100	602		0.6	kℓ/erf/day	361.2	kℓ/d
Business 1 (Business)	3	0.179600		0.4	0.65	kℓ/100m^2	4.7	kℓ/d
Educational (Creche)	1	0.1328	100		0.060	kℓ/student	6.0	kℓ/d
Institutional (Church)	1	0.1175		0.4	0.600	kℓ/100m^2	2.8	kℓ/d
Public Open Space (Park)	3	0.1502			12.0	kℓ/Ha	1.8	kℓ/d
Municipal (Servitude)	11	0.7656						
Streets		10.0862						
Davel Town existing settlement								
Water demand from existing settlement							935.0	kℓ/d
Totals		36.52						
Sub-total Average Annual Daily Demand (AADD)							1311.5	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							1442.6	kℓ/d
Gross Average Annual Daily Demand (GAADD) (added 10%)							16.7	ℓ/s
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	2164.0	kℓ/d
Multiply by a peak factor (Summer Peak Factor)					1.5	peak factor	25.0	ℓ/s

The Fire flows are shown in the table below.

Table 8 Fire flow demands

Fire category: **Moderate risk 1: Industrial, business, high rise flats ≥ four storeys**	**Quantity**	**Unit**
Total fire flow	50	ℓ/s
Duration of design fire flow	4	Hours
Minimum Flow at one hydrant (ℓ/s)	25	ℓ/s
Moderate risk 2: Cluster & low-income housing, high rise flats ≤ three storeys		
Total fire flow	25	ℓ/s
Duration of design fire flow	2	Hours
Minimum Flow at one hydrant (ℓ/s)	25	ℓ/s
Fire category: **Low risk: Single residential housing**		
Total fire flow	15	ℓ/s
Duration of design fire flow	1	Hours
Minimum Flow at one hydrant (ℓ/s)	15	ℓ/s

6.7 Bulk water capacity

The combined existing settlement + Proposed development water demand AADD is 1311.5kℓ/d = 1.31Mℓ/d.

Command reservoirs receive water through pumping.

Therefore, combined development site required storage = AADD x 2 = 1.31Mℓ x 2 = 2.62Mℓ.

Let's say 2.7Mℓ

Site required storage (2.7Mℓ) is **MORE** than the Existing reservoir capacity of 2.44Mℓ

The capacity of the existing 110mm diameter water delivery pipeline is shown in the table below.

Table 9 Pipeline existing capacity

BULKLINE	INTERNAL DIAMETER	MAX CAPACITY (at V=1.2m/s)		WATER SUPPLY	
DIAMETER	(mm)	Flow Q (ℓ/s)	Flow Q (m^3/s)	Supply (m^3/d)	Supply (Mℓ/d)
110mm	96.6	8.79	0.009	759.9	0.760

The combined development peak water demand of 25ℓ/s is more than the capacity of the existing 110mm diameter pipeline.

6.8 Water infrastructure proposed

The proposed development will increase the water demand on the existing water sources by an amount indicated by the AADD in Table 6 Water demand.

The following is proposed:

- Increase the size of the erf area for WTW and reservoirs.
- Operations to be optimised to enable the full 2.5Mℓ/d capacity of the Davel WTW to be achieved.
- Electrical generator backup.
- Full support for the of the personnel operating the WTW, distribution and reservoirs. Example in continuous training courses.
- Implement a telemetry System Control and Data Acquisition (SCADA) for the Davel WTW water scheme. A SCADA system consists of a computer placed at a central location, communications equipment, programmable logic controllers, sensors, and other devices that when put together, will monitor and control equipment and processes within the water scheme. Remote sites, equipped with remote telemetry units (RTUs), can be located as close as within the same building or as far away as across the water scheme. RTUs measure a variety of conditions and parameters, including reservoir and tank levels, temperature, voltage, current, volumes, and flow rates, and report back to a central processing unit (CPU). This technology is widely accepted in the water and wastewater industries as a reliable and efficient control system.
- Construct an elevated tank water storage.
- Upgrade pumps at the WTW.
- Construct an additional, 1km long, gravity delivery pipeline from the proposed elevated tank to the proposed development site.
- Construct water reticulation onsite to yard connection standard.

Figure 16 Proposed gravity delivery water pipeline (blue)

7 WASTEWATER SERVICE

7.1 Existing wastewater treatment works

Davel town is serviced by the following wastewater treatment works (WWTW):

- Davel WWTW, GPS 26°27'53.85"S 29°40'44.87"E. The design capacity of the WWTW is 1 Mℓ/day. The received flow is unknown as the inlet flow meter is not working.

The WWTW are located as shown in the figure below.

Figure 17 Wastewater Treatment Works

Figure 18 Wastewater Treatment Works

7.2 Bulk sewer

There is an existing 160mm diameter sewer outfall that is currently servicing Davel town.

The sewer outfall flows to the existing wastewater treatment works. The wastewater is conveyed to the treatment works through gravity outfalls.

Figure 19 Sewer pipelines (yellow)

7.3 Sewer Reticulation

There is no existing sewer reticulation within the proposed site.

7.4 Sewer flows

The design guidelines were adopted from the CSIR document titled:

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

Table 10 Sewer flow of proposed development

Land Use	**No. of Erven**	**Area (Ha)**	**Water Demand**		**Sewer Return**	**Sewer Flow**	
Residential 1 (Residential)	602	25.09	361.2	kℓ/d	85%	307.0	kℓ/d
Business 1 (Business)	3	0.18	4.7	kℓ/d	85%	4.0	kℓ/d
Educational (Creche)	1	0.13	6.0	kℓ/d	85%	5.1	kℓ/d
Institutional (Church)	1	0.12	2.8	kℓ/d	85%	2.4	kℓ/d
Public Open Space (Park)	3	0.15	1.8	kℓ/d	85%	1.5	kℓ/d
Municipal (Servitude)	11	0.77	0.0	kℓ/d	85%	-	kℓ/d
Streets		10.09					
Totals	621	36.52	376.5				
Sub-total Sewer ADWF						**320.0**	**kℓ/d**
15% Extraneous flow						48.0	kℓ/d
Gross Sewer						368.0	kℓ/d
Gross Sewer Flow						4.3	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						10.6	ℓ/s

The proposed development will have an estimated sewer ADWF of 320kℓ/d and a gross sewer flow of 368kℓ/d.

Table 11 Sewer flow (Combined existing settlement + Proposed development)

Land Use	No. of Erven	Area (Ha)	Water Demand		Sewer Return	Sewer Flow	
Proposed development							
Residential 1 (Residential)	602	25.09	361.2	kℓ/d	85%	307.0	kℓ/d
Business 1 (Business)	3	0.18	4.7	kℓ/d	85%	4.0	kℓ/d
Educational (Creche)	1	0.13	6.0	kℓ/d	85%	5.1	kℓ/d
Institutional (Church)	1	0.12	2.8	kℓ/d	85%	2.4	kℓ/d
Public Open Space (Park)	3	0.15	1.8	kℓ/d	85%	1.5	kℓ/d
Municipal (Servitude)	11	0.77	0.0	kℓ/d	85%	-	kℓ/d
Streets		10.09					
Davel Town existing settlement							
Water demand from existing settlement			935.0	kℓ/d	85%	794.8	kℓ/d
Totals		36.52	1311.5				
Sub-total Sewer ADWF						**1114.8**	**kℓ/d**
15% Extraneous flow						167.2	kℓ/d
Gross Sewer						1282.0	kℓ/d
Gross Sewer Flow						14.8	ℓ/s
Peak Factor						2.5	
Peak Sewer Flow						37.1	ℓ/s

7.5 Wastewater bulk capacity

At percent of ratio to full depth (diameter) 70% and at 1.25% slope, Manning's roughness coefficient n = 0.012. At Site 1, the existing 160mm diameter sewer pipeline has a capacity of 18.3 ℓ/s.

The proposed site estimated peak sewer flow from the proposed site is 37.1ℓ/s.

Hence, the existing 160mm diameter sewer pipeline has no capacity cannot convey the combined peak sewer flow.

7.6 Wastewater infrastructure proposed

The proposed sewer infrastructure is as follows:

- Extend the capacity of Davel WWTW.
- Construct sewer reticulation for the proposed development.
- Construct a 3km long sewer outfall from the proposed development to the Davel WWTW.

Figure 20 Proposed sewer pipeline (black)

8 ELECTRICITY

There is existing electricity supply infrastructure in the vicinity of the proposed development. This could be utilised to supply the development, subject to approval from the power authority.

Figure 21 Existing electricity supply line

9 TOWNSHIP ROADS

There is an existing functioning road network that can be used to access the proposed development.

The road infrastructure to internally service the development will be the standards of the Red Book, TMH, TRH books and the local municipality.

9.1 Classification of roads

Table 12 Classification of roads

Description	Class no.	Function	Reserve width	Roadway width
Access Road	5d	Access from existing bounding road	15m	7.4m
Internal Service Road	5f	Internal Road	13	6m
Internal Service Road	5f	Internal Road	10	6m

9.2 Geometric Design Standards

Table 13 Class 5d – Access Road

Design speed	60km/h
Minimum centre line radii	50m
Minimum gradient	0.5%
Favoured maximum gradient	10%
Maximum grade/grade length	12.5% over 70m
Maximum K-value : Crest	16
: Sag	16

Table 14 Class 5f – Internal roads

Design speed	30km/h
Minimum centre line radii	30m
Minimum gradient	0.5%
Favoured maximum gradient	12%
Maximum grade/grade length	16% over 50m
Maximum K-value : Crest	6
: Sag	8

9.3 Pavement Design

The proposed pavement designs are based on anticipated traffic volumes and ground conditions, a detailed pavement design will require a geotechnical centreline investigation report.

The table below shows the proposed pavement design for the development.

Table 15 Proposed pavement design

Design	Description
Pavement	30mm Premix Asphalt / 80mm concrete block paving
Base	150mm Thick natural gravel stabilised with Cement to create C4 material compacted to 97% of Mod AASHTO
Subbase	150mm Thick natural gravel G7 material compacted to 97% of Mod AASHTO
Upper Selected Layer	150mm Thick Natural gravel G7 material compacted to 97% of Mod AASHTO Density.
Lower Selected Layer	150mm Thick Natural gravel G7 material compacted to 97% of Mod AASHTO Density.
Roadbed & Fill (where required)	150mm Thick layers compacted to 90% of Mod AASHTO Density. Minimum CBR= 3 at 90% of Mod AASHTO Density-G9

10 STORMWATER DRAINAGE

Stormwater generated onsite can be channelled to follows the natural slope of the ground, to the lowest point. It is envisioned to use Sustainable Urban Drainage Systems (SuDS) to manage stormwater runoff from the site. A stormwater management plan will need to be submitted to the municipality before construction starts. Extraneous stormwater from above the site will be accommodated over the site.

10.1 External bulk stormwater system

The area has no existing street stormwater system.

Figure 22 Earth road at proposed site

10.2 Stormwater systems

Stormwater runoff onsite will be handled through an internal stormwater system that will be provided to drain the site in a safe and efficient way. It is proposed to make use of SuDS to manage the stormwater runoff before being discharged into the natural water courses. The stormwater can be discharged into the adjacent river and streams or channels.

Stormwater discharge control will be applied in order to reduce the damaging effect of the increase in runoff due to densification.

10.3 Hydrology

The hydrological data used in the design of the stormwater drainage system is shown in the table below.

Table 16 Hydrological data

Hydrological Data	
a) Flood return period	1: 2 years for storm water pipe system. 1: 5 years for the combined stormwater pipe and road systems
b) Average yearly rainfall	800mm
c) Minimum time of concentration and run	As per Local Municipality Guidelines
d) Design Method	Rational method

10.4 Design Standards

The table below lists the standards to be used in the design of the stormwater drainage system:

Table 17 Stormwater design standard

Design Element	**Specification**
a) Minimum pipe size	600mm diameter concrete pipe
b) Minimum pipe gradient	0.67%
c) Storm water details	Local Municipal Standard Details

11 SOLID WASTE

A regional landfill situated nearest the site is to be used to dispose solid waste. The local municipality is responsible for connecting and disposing the solid waste. If the municipality is not able to provide this service, then a private company will need to be appointed by the development owners for the service.

A refuse area with bins will be done onsite and solid waste will be disposed of at the municipal dump site as per the municipal health bylaws.

The Neighbourhood Planning and Design Guide, Creating Sustainable Human Settlements, developed by, Department of Human Settlements, Published by the South African Government, Version 1.1.

The solid waste generation range from 0.6 kg per capita per day in the poor areas, to 1.29 kg per capita per day.

The rate of 0.6kg/c/d was adopted for the township. Solid waste will be generated by the development.

Population estimate = 602 residential units x 4 people per unit = 2408 people

- Solid waste = 0.6kg/per person/day or (0.6kgx365 days)
- Waste generated per day = 0.6x 2408 = 1445kg = 1.44 tonne
- Waste generated per annum = 1.44x365 = 527 tonne

12 CONCLUSION

The proposed development will contribute towards improving the service delivery of the area and general livelihood of the residents.

FORMALISATION OF MARIKANA INFORMAL SETTLEMENT LOCATED ON THE REMAINING EXTENT OF PORTION 6 OF THE FARM DAVELFONTEIN 267 - IS, MPUMALANGA PROVINCE

BULK ENGINEERING SERVICES REPORT:

CIVIL SERVICES REPORT

Reviewed by	L. MTHUNZI Pr Tech Eng	 Signature	5/04/2023 Date

ANNEXURES

ANNEXURE 1 Layout Plan

FORMALISATION OF MARIKANA INFORMAL SETTLEMENT LOCATED ON THE REMAINING EXTENT OF PORTION 6 OF THE FARM DAVELFONTEIN 267 - IS

MSUKALIGWA LOCAL MUNICIPALITY

LAND USE

ZONING	LAND USE		NO. OF STANDS	AREA Ha.	% OF AREA
RESIDENTIAL 1	RESIDENTIAL		602	25.086100	68.7
BUSINESS 1	BUSINESS		3	0.179600	0.5
EDUCATIONAL	CRECHE		1	0.1328	0.4
INSTITUTIONAL	CHURCH		1	0.1175	0.3
PUBLIC OPEN SPACE	PARK		3	0.1502	0.4
MUNICIPAL	SERVITUDE		11	0.7656	2.1
STREETS	*	*	*	10.0862	27.6
TOTAL	*		621	36,5180	100

LEGEND

RULING SITE SIZES	450 m^2

FENCE
POWERLINE
TAP
DIRTY ROAD
STRUCTURES
ELECTRIC POWER POLE
WATER DRAIN
WV ... WATER VALVE

RE/26/268
41/268
7/268
6/269
ELECTRIC POWERLINE
WATER DRAIN

TOWN PLANNER
FIRM:
DATE:

ENGINEER
FIRM:
DATE:

LAND SURVEYOR
FIRM:
DATE:

GEOLOGIST
FIRM:
DATE:

FLOODLINE NOTE

IT IS HEREBY CERTIFIED IN TERMS OF ARTICLE 144 OF THE NATIONAL WATER ACT (ACT No. 36 OF 1998 THAT THE TOWNSHIP SHOWN ON THIS PLAN IS NOT AFFECTED BY FLOODLINES REPRESENTING THE MAXIMUM LEVEL LIKELY TO BE REACHED BY FLOODWATERS IN A DEFINED WATER COURSE ON AVERAGE ONCE IN EVERY 50 /100 YEARS.

GENERAL NOTES

1) CADASTRAL BOUNDARIES
2) GEODETIC SYSTEM WGS 84
3) ALL INTERNAL ROADS ARE 12M WIDE UNLESS INDICATED OTHERWISE
4) ALL DIMENSIONS AND AREAS ARE APPROXIMATE & SUBJECT TO FINAL SURVEY BY PROFESSIONAL LAND SURVEYORS
5) BUILDING LINE ARE SUBJECT TO APPLICABLE SCHEME
6) ZONING ARE SUBJECT TO APPLICABLE ZONING SCHEME
7) CONTOUR NOTE: THE CONTOUR SURVEY IS IN ACCORDANCE WITH THE STANDARD LAID DOWN BY THE REGULATIONS RELATING TO TOWNSHIP ESTABLISHMENT AND LAND USE

DRAWING NOTES

DATE	2023/01/16
DRAWING NO	MSU/01
REVISION	1

DRAWN BY	N MKHWANAZI
CHECKED BY	F MATHEBULA

11 KINGFISCHER BUILDING,HAZELDEAN OFFICE PARTK, 687 SILVERLAKES ROAD, TYGER VALLEY, PRETORIA, 0054
Tel: +27 12 770 4022
Cell: 081 218 6899
Email: info@ngoti.co.za

NGOTI DEVELOPMENT CONSULTANTS

Electrical Report

FORMALISATION OF MARIKANA INFORMAL SETTLEMENT LOCATED ON THE REMAINING EXTENT OF PORTION 6 OF THE FARM DAVELFONTEIN 267 - IS, MPUMALANGA PROVINCE

ELECTRICAL SERVICES REPORT

MAY 2023, Rev0

PREPARED BY:

Dalimede Projects (PTY) LTD
No. 11 Pierre street, IT Park RentCo Building, Office 6,
Bendor, South Africa, 0699

Tel: 015 291 0775
E-mail: admin@dalimede.com

PREPARED FOR:

Mang GeoEnviro Services
Block 9, Unit 2 Boardwalk Office Park,
6 Enos Road, Faerie Glen,
Pretoria, 0004

Tel: 012 770 4022
Cell: +27 72 573 2390
Email: fnmathebula@gmail.com / info@manggeoenviro.co.za

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1. EXECUTIVE SUMMARY

The proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267- IS. The area is administered by Msukaligwa Local Municipality under the Gert Sibande District Municipality. The township consists of 621 stands. All the stands are not yet electrified. There are existing medium voltage feeder lines that are supplying the area. The medium voltage line is Mink Conductor. The development will be taping from the existing medium voltage line.

The proposed site development will be connecting electricity from existing medium voltage feeder on 11KV.The feeder line will be feed from Davel Substation. The substation capacity is 88/11KV. There is existing medium voltage aluminum conductor steel reinforced passing through the development and is utilized to supply the development. Medium voltage feeder is constructed within the township connecting the distribution transformer. According to Municipality network planning department the development can be connected. It is recommended that the development can be installed according to Eskom Distribution Standard.

2. INTRODUCTION

This report outlines the design philosophy of the electrical MV and LV installation for the proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267- IS, to be established as a township. The installation is to be designed to ensure that the installation is complying with the South African national safety standard while meeting the objective of the development.

Table 1 Demographic information

ITEM	DESCRIPTION	COMMENTS
1.	**DEMOGRAPHIC INFORMATION**	
Town Layout	Number of stands	621
	Stand Density	Medium -15.5 hectare
	Town layout	Relatively Structured
	Classification of layout	Medium Density
Existing Infrastructure	Type of Road	Gravel
	Existence of Water Services	No
	Water reticulation	No
	Sewage infrastructure	No
	Others: Clinic	0
	Schools	0
	Churches	0
	Businesses	0
Site Conditions	Soil type	Red turf
	Climate	Temp: -5 to 30^{o}C
	Population	Estimated 2847 people

ITEM	DESCRIPTION	COMMENTS
2	NETWORK INFORMATION	
2.1	Substation Source	Davel Substation 88/11KV
2.3	MV conductor tyre and size	Mink

3. DEVELOPMENT PROPOSAL (LOCALITY)

The proposed township is situated 37km west of Ermelo along the N17 highway; site is also 250km south-west of Mbombela City along the N17 and R38 roads, in Mpumalanga Province, South Africa. The area is administered by Msukaligwa Local Municipality under the Gert Sibande District Municipality. GPS coordinates of site are 26°27'47.35"S 29°39'20.83"E.

The locality map is shown on the figures below.

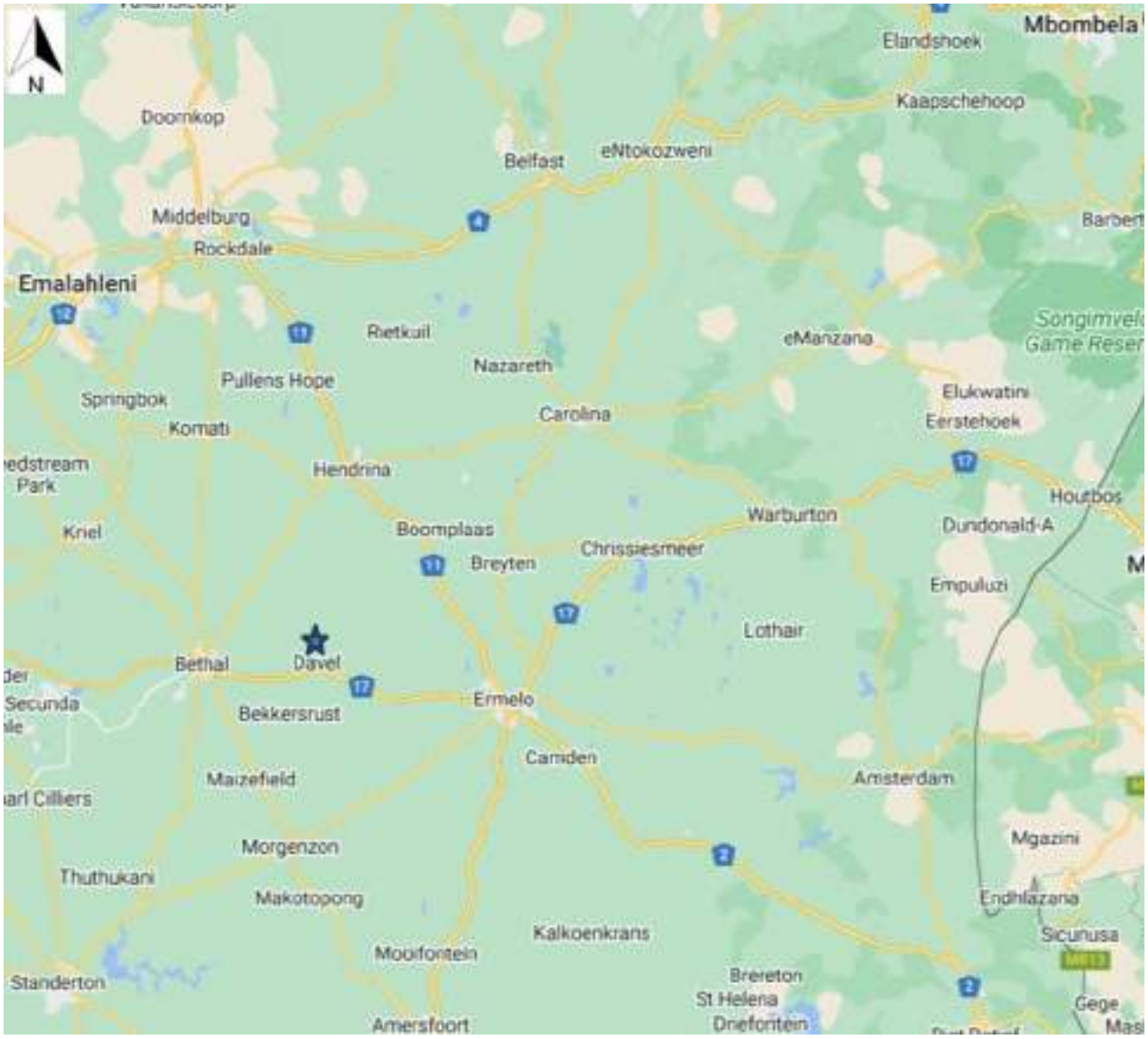


Figure 1 Locality

4. EXISTING DESIGN PHILOSOPHY

4.1 EXISTING MV RETICULATION

A site survey was conducted to determine the best and most economical means to provide power supply to site. There is an existing medium feeder line that is passing the development.

Existing Medium voltage line Davel Substation:

Figure 2 Existing Electrical Infrastructure

5. DISTRIBUTION MODEL

The objective of this task is to develop an adequate network model representing the entire development on portion 6 located on the part of the farm Davelfontein 267-IS up to the main feeder level. The main feeder is defined as the main feeder supply from Davel Substation.

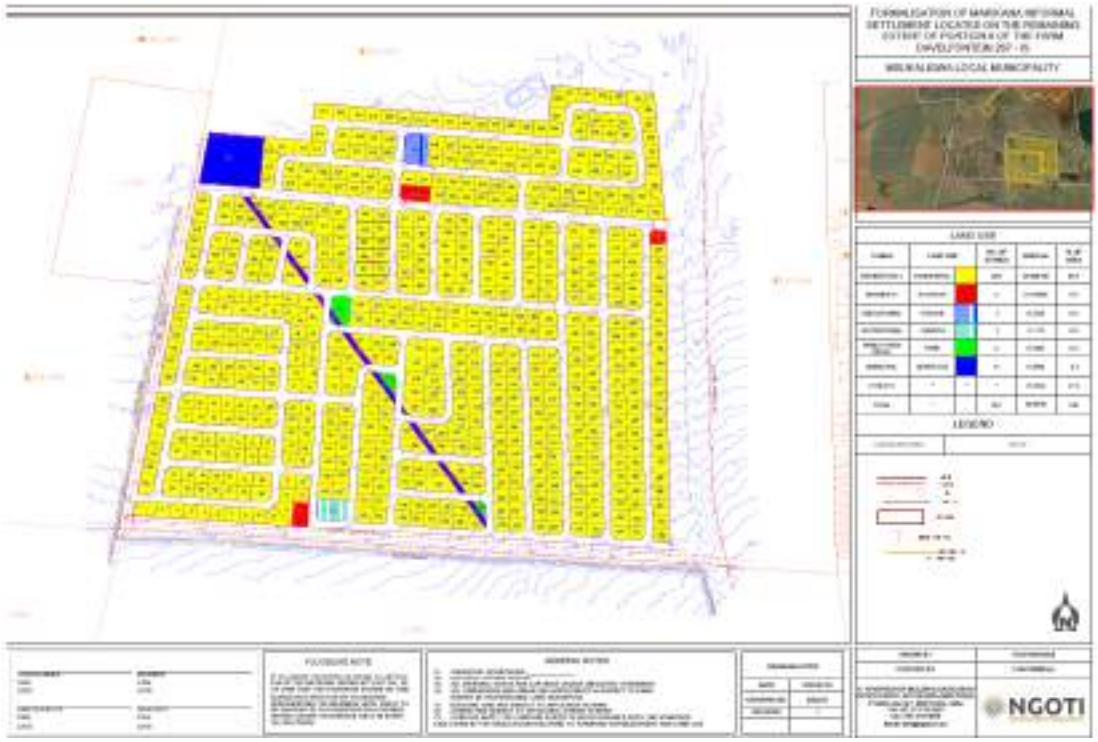


Figure 3 Proposed township development

6. SUPPLY AUTHORITY(LICENSED)

The area is situated within the electricity licensed area and supply by Municipality.

7. RETICULATION DESIGN

7.1 Method of supply

Medium voltage feeder is to be constructed within the township and connected to the distribution transformer. Medium voltage feeder (11kV) will be taping from the existing medium voltage conductor.

This is to determine the most cost-effective supply arrangement that is used and provide details of required in feed points. The following is included regarding to bulk supply:

- The planning capacity and bulk infrastructure.
- The quality of supply.
- Metering arrangement.
- Protection arrangement.
- The loss profile due to load.

7.2 Design Parameter

The Developer shall erect the MV and LV overhead line reticulation systems in accordance with Eskom's Electrification Standards (Wood Structures). The internal MV distribution systems shall comprise of "Mink "aluminum conductor steel reinforced configuration on 11m or 9m wooden poles and shall be built to 11kV specifications.

The LV distribution systems shall comprise an aerial bundled conductor (ABC) system, of the supporting core type mounted overhead on either 7- or 9-meter wooden poles. LV distributor spurs shall extend within a radius of approximately 500m from transformer positions depending on individual voltage drop requirements. LV distributor spurs shall share pole structures with the MV system where these follow parallel routes providing clearance of LV can be achieved.

Transformers shall be of the pole mounted type suitably rated to serve anticipated individual LV distributor loads and shall be of the SABS 780 type. All materials supplied by the Developer shall conform to Eskom's Buyer's Guide (Part 9 of DT Standard).

7.3 Electrical Estimate.

Table 2 Load Estimates

Item	Description	Area (Ha)	Qty	VA/stand	Total
1	Residential 1	25.086100	602	1.5	903
2	Business1	0.179600	3	1.5	4.5
3	Education (Crèche)	0.1328	1	1.5	1.5
4	Institutional (Church)	0.1175	1	1.5	1.5
5	Public open space	0.1502	3	1.5	4.5
6	Municipal(Servetude)	0.7656	11	1.5	16.5
			Total Load Demand		931.5

Total Maximum Load demand is 931.5kVA for 15years
The following design parameter is set:

- Medium voltage (Final Design)
  - ADMD 1.5kVA/stand
  - Spare capacity on feeder 0.5kVA/stand
  - Supply voltage 22kV-3 phase
  - Supply regulation(bulk) 100% (assumed)

  The projected load for the final phase (at 1.5Kva per stand) is 931.5kVA. The transformer installed capacity is suitable for and can deliver an ADMD of 1.5kVA per stand.

- Low voltage (Final Design)
  - ADMD 0.65kVA/erf
  - Supply voltage 415 / 240 volt
  - Regulation +- 10%ase
  - Service connection(max) 20 Amp

CART Parameters:

Table 3 Design parameter

ADMD	Alpha	Beta
Initial	0.49	9.15
Final	0.89	7.49

7.4 Summary of Predictions for each year.

Table 4 Prediction for each year

Year	Energy (kWh)	ADMD (kVA)	Alpha	Beta	Circuit breaker (A)
1	172,22	0,70	0,49	9,15	20.00
2	203,69	0,82	0,56	8,81	20.00
3	230,18	0,91	0,61	8,56	20.00
4	250,06	0,99	0,65	8,39	20.00
5	268,27	1,05	0,68	8,25	20.00
6	283,18	1,11	0,71	8,14	20.00
7	299,74	1,17	0,74	8,02	20.00
8	316,30	1,23	0,77	7,91	20.00
9	331,20	1,28	0,80	7,81	20.00
10	346,10	1,33	0,83	7,72	20.00
11	357,70	1,38	0,85	7.77	20.00
12	365,98	1,41	0,86	7,56	20.00
13	372,60	1,43	0,87	7 62	20.00
14	377,57	1,45	0,88	7,53	20.00
15	384,19	1,47	0,89	7,49	20.00

7.5 MV Design

The existing and proposed medium-voltage network is best described in terms of both geographic layout and electrical connection layout. The performance of the network is quantified by MV load flow studies, based on the loads described in the load forecast.

Medium Voltage supply consists of three phase Mink conductors. The conductor shall be mounted on 9m wood poles and shall run street front. A 780-pole mounted transformer shall be used to supply the stands. The transformer must not be loaded more than 108%.

All MV structures shall be constructed in accordance with Eskom Medium Voltage Distribution Standard and specifications.

The MV overhead feeder system shall comply with the requirements of Eskom's Distribution Technology, Electrification Standards and Guidelines as and where applicable for an urban concrete pole reticulation system.

a) Conductor

Type	:	Aluminum conductor steel reinforced.
Code Name	:	Mink/Fox-see Bill of Quantities/drawings
Mass	:	85kg/km / 149kg/km
Ultimate tensile strength	:	7 900 / 13 200 Newton
Max working tension	:	@ -5oC + wind 5 240 / 8760 Newton.

Mounting : See structure codes on drawings.

The maximum working tension may be exceeded only during the construction stages when the conductors are to be “over-tensioned” to 1.05 x MWT for a period of not less than 8 hours nor longer than 24 hours after which the tension is to be reduced to a figure not to exceed the stated maximum working tension of the conductor concerned.

b) Poles

Pole type	-	Wood
Pole lengths	-	7m for LV distributor 9m for LV road crossing, 11m for MV Line
Planting depth	-	1.5, 1.8 and 2m respectively
Pole marker	-	painted - black on yellow background.

c) Stays

Type	-	Fiber glass for MV and Porcelain of LV
Rods	-	M20 - 2000 long
Base plate	-	380 x 380 x 6 galvanized
Stay wire	-	7/4mm, 1100 MPA - galvanized
Planting depth	-	2m

d) Flying Stays

Flying stays shall be installed in the positions indicated on the drawings by the structure codes. Anchor poles shall be as specified for the line structures and of sufficient length to ensure the required ground clearance. Overhead stay wire shall be 7/4.00mm as specified for stays.

e) Struts

Struts shall be installed in the positions indicated on the drawings by the structure codes. Strut poles shall be as specified for the line structures. Line structure poles shall be fitted with suitable ground anchors at all strut positions. Struts shall be fitted with barbed wire anti climbing devices.

f) Insulators, Line Clamps and Other Line Components, Pole Dressing Hardware etc.

All in accordance with Eskom’s Distribution Reticulation Technology, Electrification Standards and Guidelines with particular reference to the detailed material take off sheets provided for the various line structures.

g) Sags and Tensions

The Developer shall provide suitable dynamometer sighting rods or other approved apparatus necessary for proper checking of the work. Dynamometers shall be calibrated in kg or kN.

h) Surge Arrestors

Surge arrestors shall be of the metal oxide outdoor hermetically sealed, vertical base mounted type, rated at 22kV, 10kA impulse current.

i) Sectionalizers

Dropout fuses shall be provided for each transformer zone.

7.6 Pole Mounted Transformers

Transformers shall generally comply with the following details:

Situation	:	Outdoors
Mounting	:	Suitable for single pole structure (Transformer outline)
Type	:	SABS 780
kVA rating	:	100/50 (as indicated on drawings)
No load voltage ratio	:	22000/415/231 volt
Vector group	:	Dyn 11
Parallel operation	:	Not required
MV & LV connections	:	External bushings with suitable insulated connections.

The transformers shall connect on the MV side through the use of links/or fuses as indicated on the drawings.

7.7 LV Design

The low voltage feeders shall be three phase 4 core aerial bundle conductor with bare neutral and shall be 70 and 35mm². The LV network is to be constructed in mid block layout on 7m wood poles. The feeders shall be fused at the transformer pole**.** All LV structures shall be constructed in accordance with Eskom Low Voltage Distribution Standard and specifications.

7.8 Service connection

The majority of customers are expected to purchase a 20 Amp supply. Service connections are to be made with a 4mm² concentric cables from a 4-way and 8-way distribution pole top boxes. The service connection shall be a concentric cable in accordance with SCSSCAAC7. For a 60A supply a 10mm² concentric cables shall be used. The concentric cable used on all new services shall be installed without joints from the pole-top distribution box into the standard passive unit base, which is mounted in the customer's premises.

Where the concentric cable enters the dwelling, suitable protection shall be applied around the cable to prevent damage to the insulation. The concentric cable shall form a "drip loop" before the attachment or entry point on the customer's wall as illustrated in drawings D-DT-0360 and D-DT-0361. The concentric cable entry point into the SPU shall be watertight.

The SPU consists of a standard dispenser socket (ED base) attached to a standard 110 mm x 110 mm socket outlet box as illustrated in D-DT-0347. The SPU shall be installed in every customer's home regardless of the type of supply required. For customers with a 60A supply the standard 110mm X 110mm socket outlet box shall be removed from the SPU. The SPU shall comply with SCSSCAAJ1.

The SPU integrates the incoming service cable with the metering, protection and household distribution. It provides the separation of the earth and neutral for the customer's installation. The wiring between the standard dispenser terminals and the socket outlet box is part of the customer's installation. The wiring shall be done with a separate earth and neutral wire.

The SPU shall be mounted at a position that is suitable for the customer and away from sources of heat and moisture. Refer to 7.9 in SABS 0142 for the positioning of distribution boards. On brick walls, a 6mm diameter "easy-drive" with screw (D-DT-3149) will be used to mount the SPU. In all other cases, a threaded rod with washers shall be used. A non-metallic cable gland (D-DT-3070) will be provided at the service cable entry point to the standard passive unit.
All services shall be in accordance with Eskom Distribution Services Standard and specifications.

8. MATERIAL AND EQUIPMENT SPECIFICATION.

The Developer will erect the MV and LV overhead line reticulation systems in accordance with Eskom's Electrification Standards (Wood Structures). The internal MV distribution systems shall comprise of "Mink "aluminum conductor steel reinforced configuration on 12m,11m or 9m wooden poles and shall be built to 11kV specifications.

The LV distribution systems shall comprise an aerial bundled conductor (ABC) system, of the supporting core type mounted overhead on either 7 or 9 meter wooden poles. LV distributor spurs shall extend within a radius of approximately 500m from transformer positions depending on individual voltage drop requirements. LV distributor spurs shall share pole structures with the MV system where these follow parallel routes providing clearance of LV can be achieved.

Transformers shall be of the pole mounted type suitably rated to serve anticipated individual LV distributor loads and shall be of the SABS 780 type. All materials supplied by the Developer shall conform to Eskom's Buyer's Guide (Part 9 of DT Standard).

9. EARTHING AND LIGHTNING PROTECTION SYSTEM

In accordance with Eskom Distribution Standard Part 2, with particular reference to:

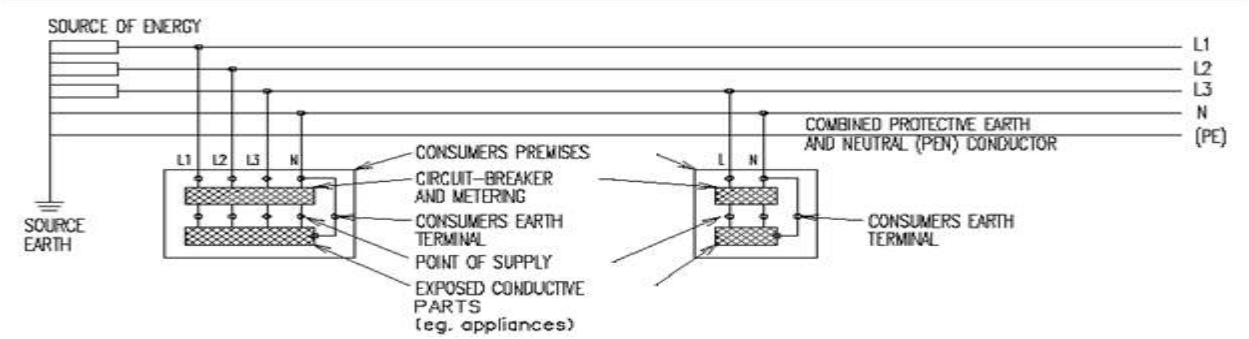


Figure 4 Consumer Schematic

Results of soil resistivity survey at 2 points.
Min Cu area : 16mm² stranded
12mm² solid

- Low Voltage
  11 kV systems : 70 Ohms
- Medium Voltage
  11kV system : 30 Ohms

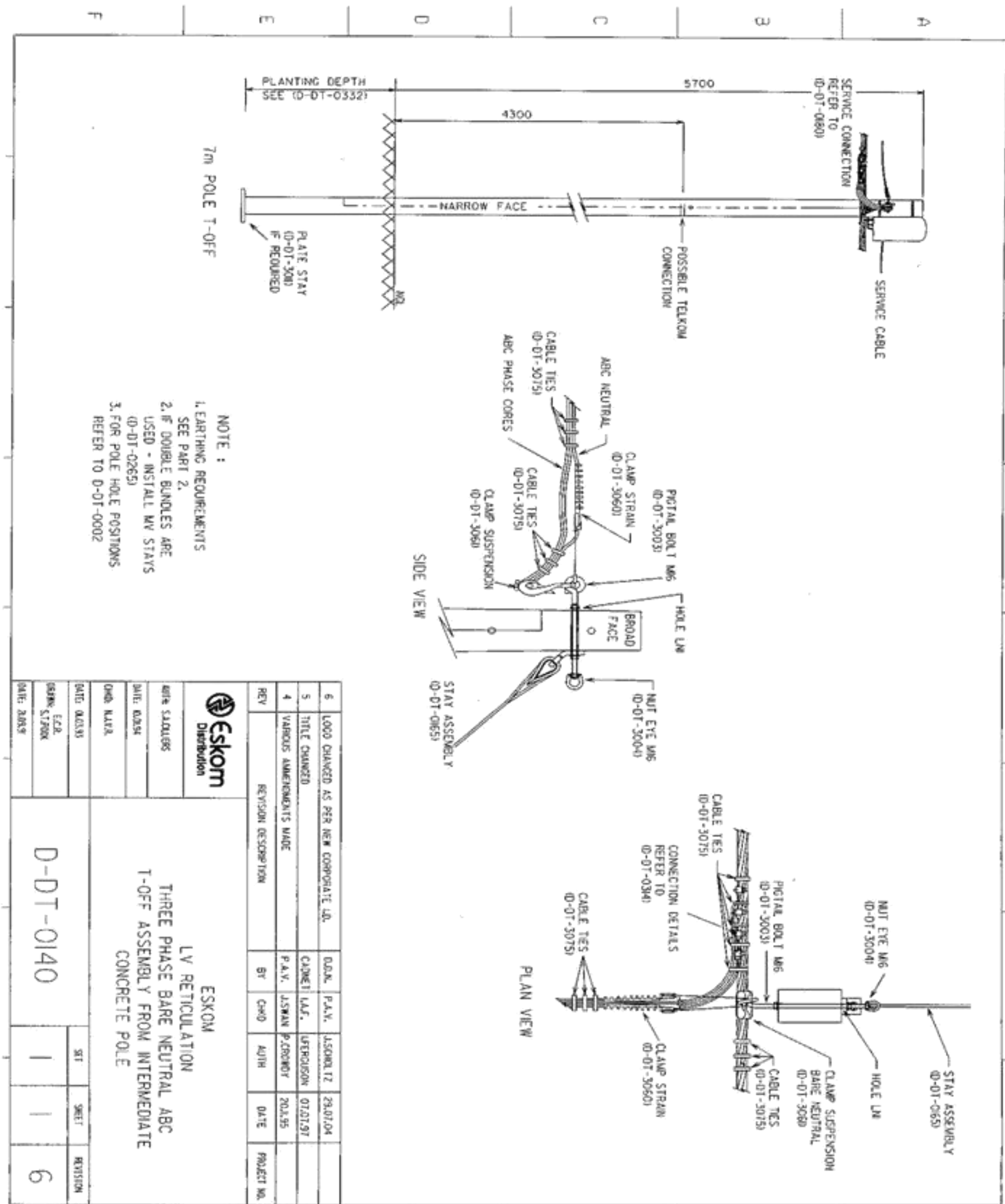
10. RECOMMENDATION

The proposed development is to be connecting electricity from the existing medium voltage feeder on 11KV. The feeder is feeding from Davel Substation. The total load after diversity maximum demand capacity is 931.5KVA. The transformer is suitable to deliver the capacity of 1.5KVA per stand. According to Municipality network planning department the development can be connected. It is recommended that the development is to be installed according to Eskom Distribution Standard.

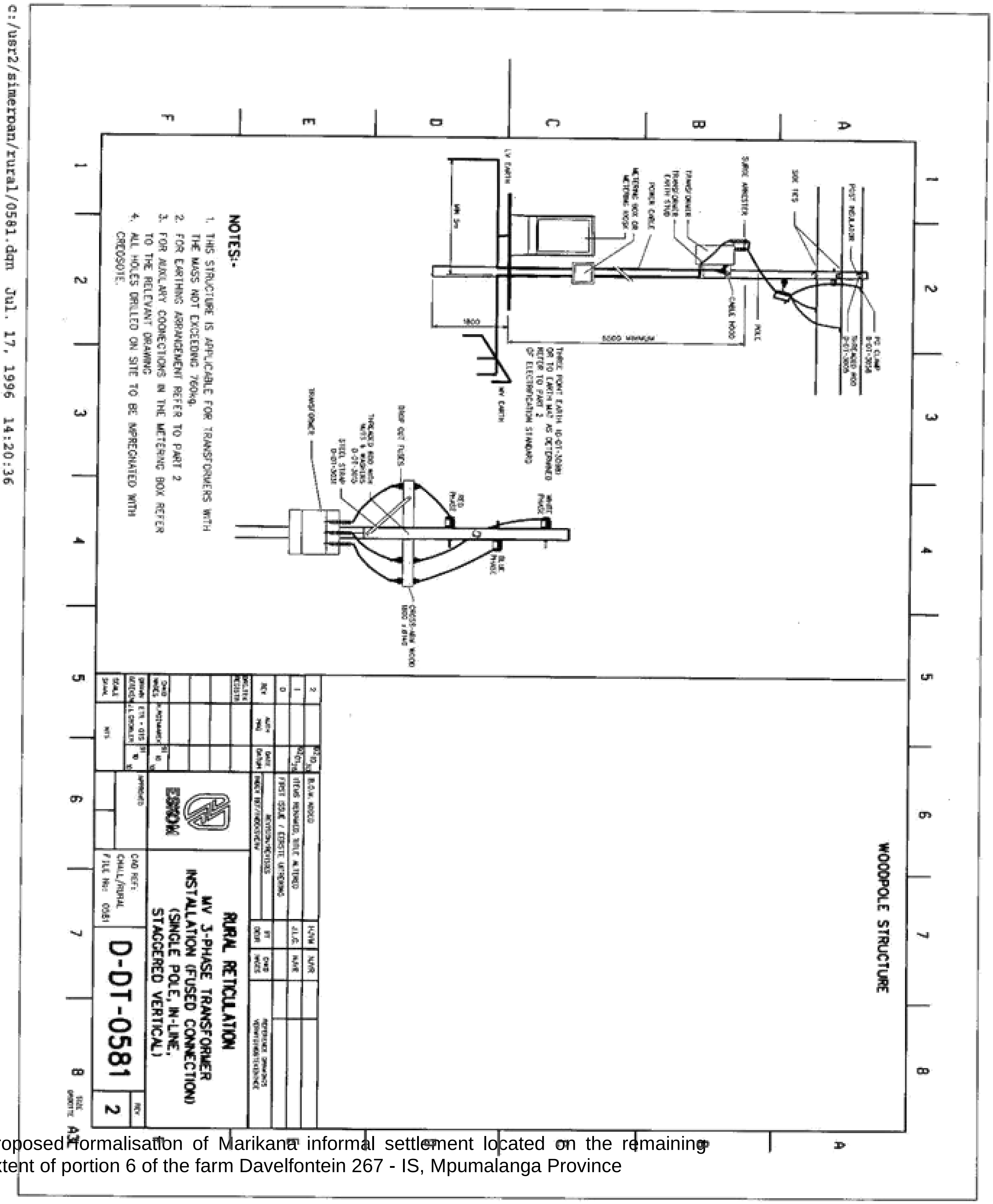
.

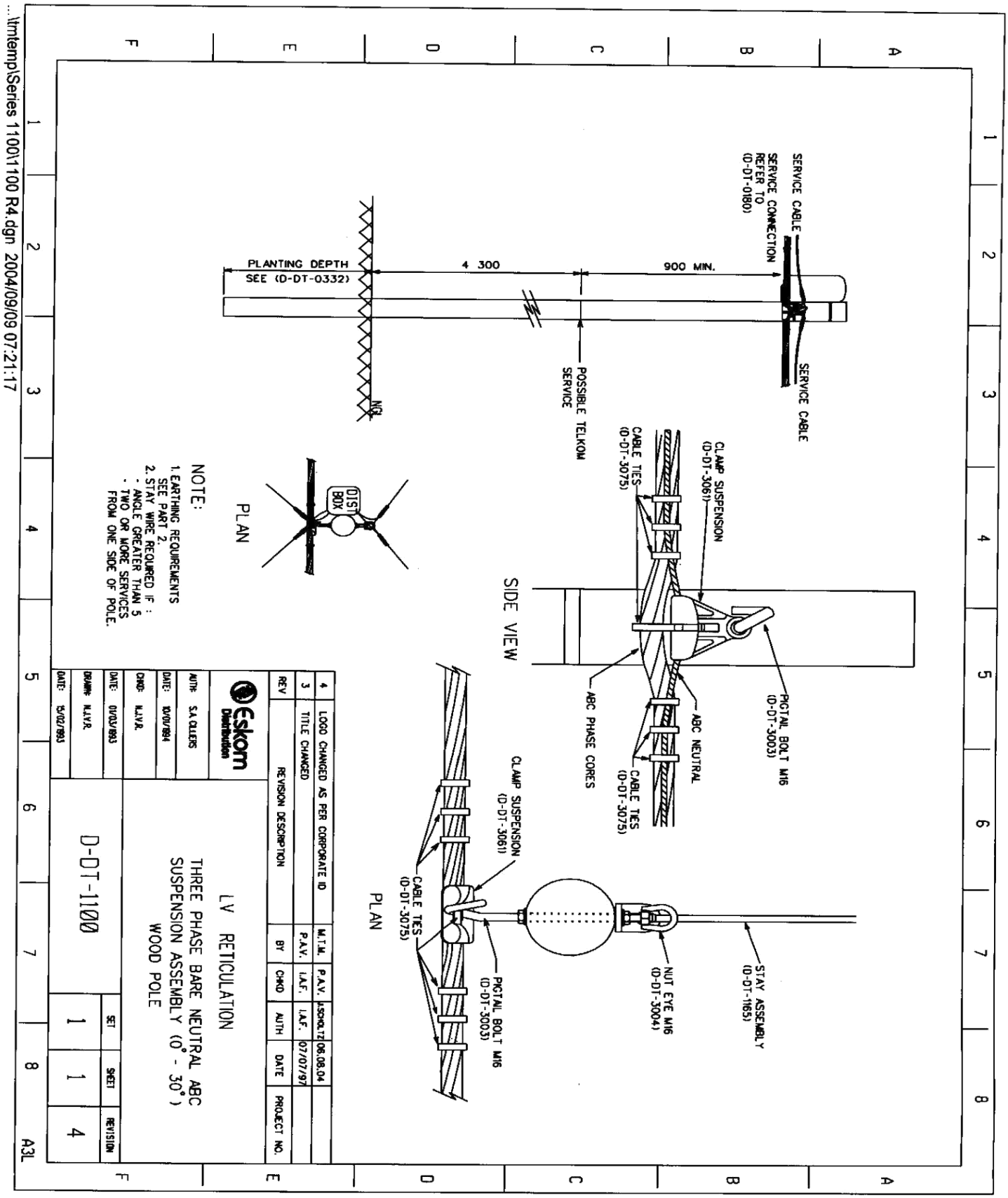
Annexure A

Eskom Drawing Standards

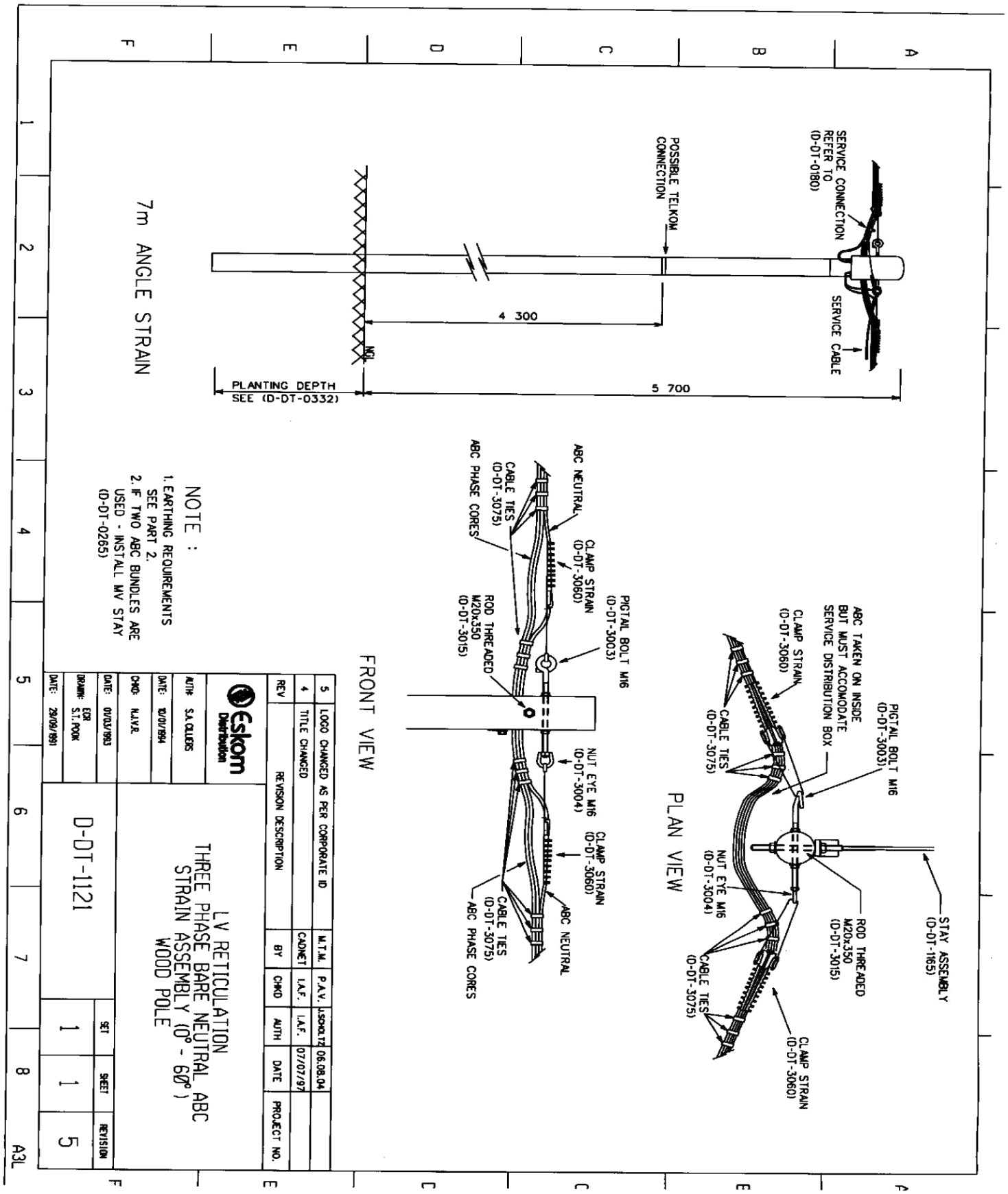


Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province

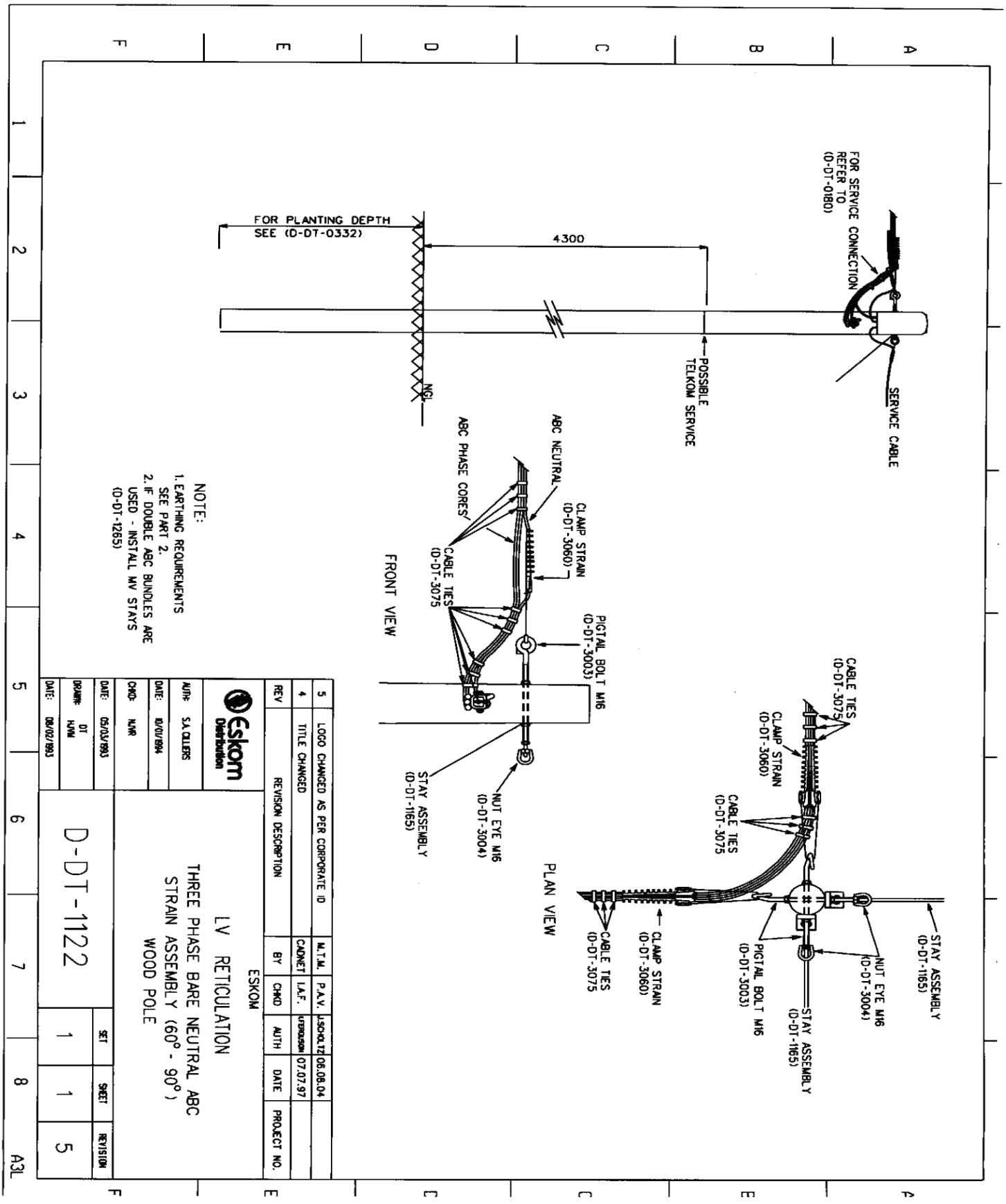

c:/usr2/simerpan/rural/0581.dgn Jul. 17, 1996 14:20:36
WOODPOLE STRUCTURE
NOTES:-
1. THIS STRUCTURE IS APPLICABLE FOR TRANSFORMERS WITH THE MASS NOT EXCEEDING 760kg.
2. FOR EARTHING ARRANGEMENT REFER TO PART 2
3. FOR AUXILARY CONNECTIONS IN THE METERING BOX REFER TO THE RELEVANT DRAWING
4. ALL HOLES DRILLED ON SITE TO BE IMPREGNATED WITH CREOSOTE.
ESKOM
RURAL RETICULATION
MV 3-PHASE TRANSFORMER INSTALLATION (FUSED CONNECTION) (SINGLE POLE, IN-LINE, STAGGERED VERTICAL)
D-DT-0581
2



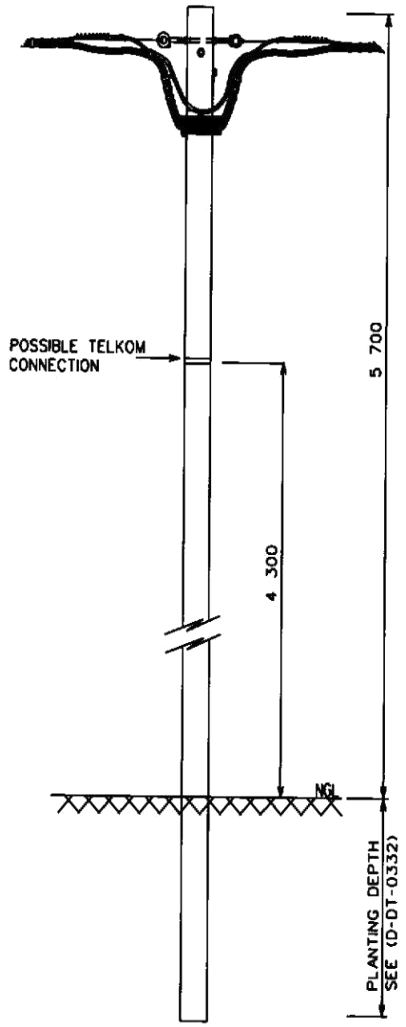
Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



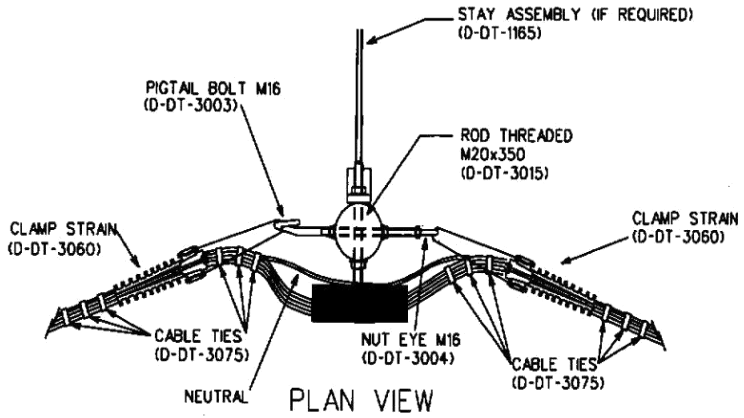
Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



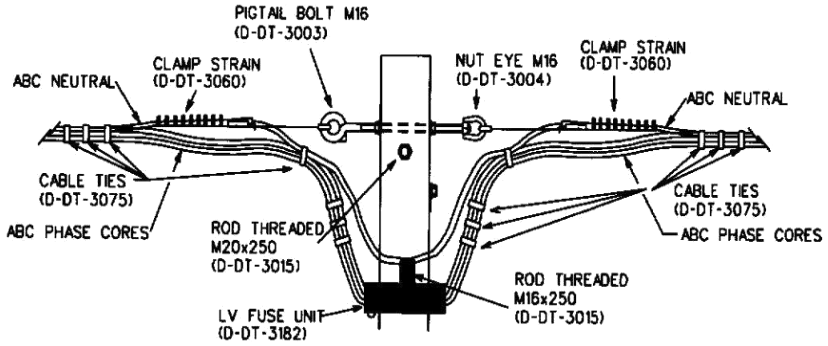
Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



7m ANGLE STRAIN



PLAN VIEW



FRONT VIEW

NOTE :

1. EARTHING REQUIREMENTS SEE PART 2.
2. IF TWO ABC BUNDLES ARE USED - INSTALL MV STAY (D-DT-0265)
3. NEUTRAL NOT TO GO THROUGH FUSE UNIT

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
1	LOGO CHANGED AS PER CORPORATE ID	M.T.M.	P.A.V.	J.SCHOLTZ	06.08.04	
0	FIRST ISSUE	CADNET	E.N.	I.A.F.	27/11/97	

Eskom Distribution

AUTH: L.FERGUSON
DATE: 27/11/1997
CHKD: E.N.
DATE: 27/11/1997
DRAWN: CADNET H.J.V.R.
DATE: 27/11/1997

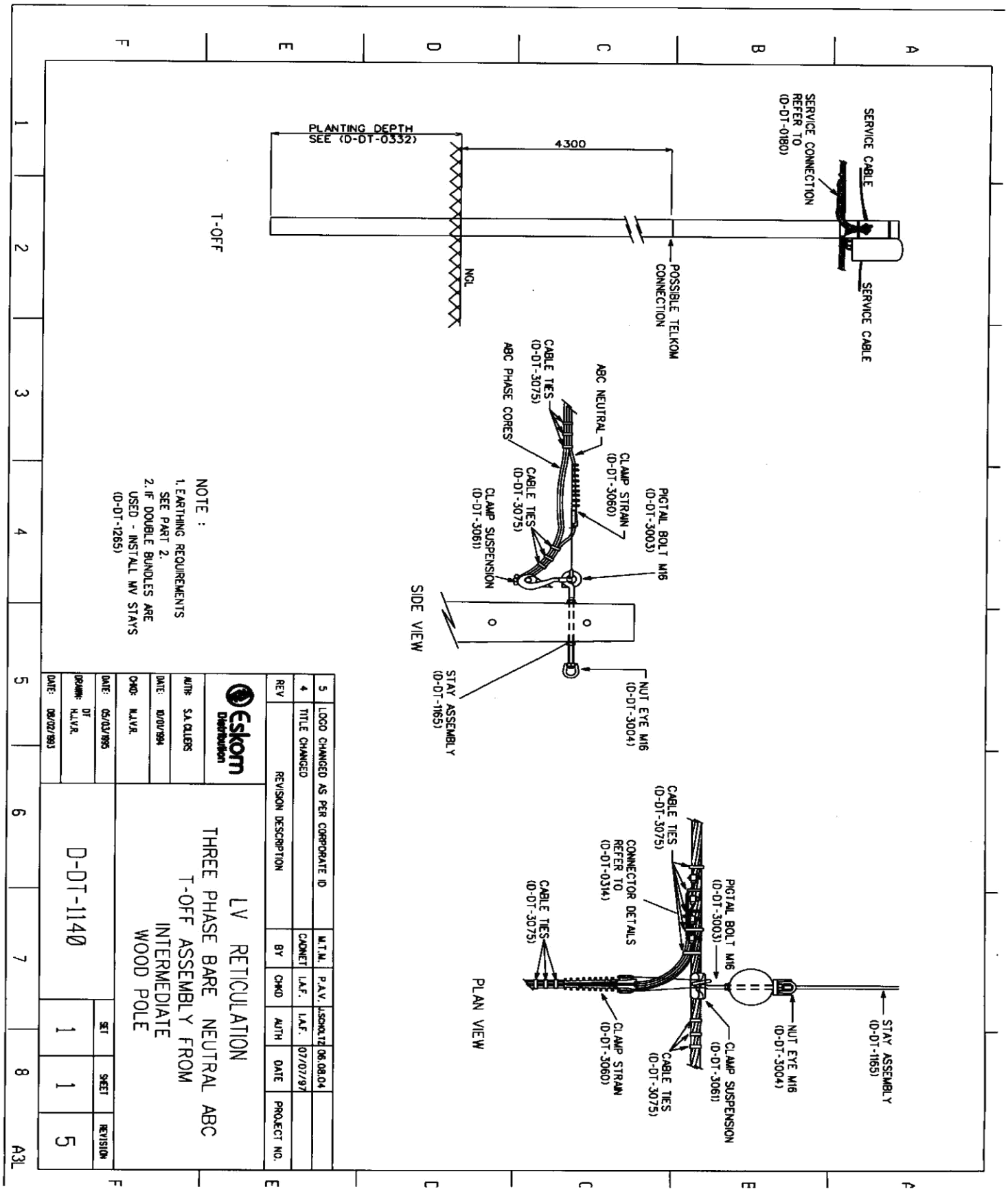
LV RETICULATION

INLINE FUSE UNIT ASSEMBLY WOOD POLE

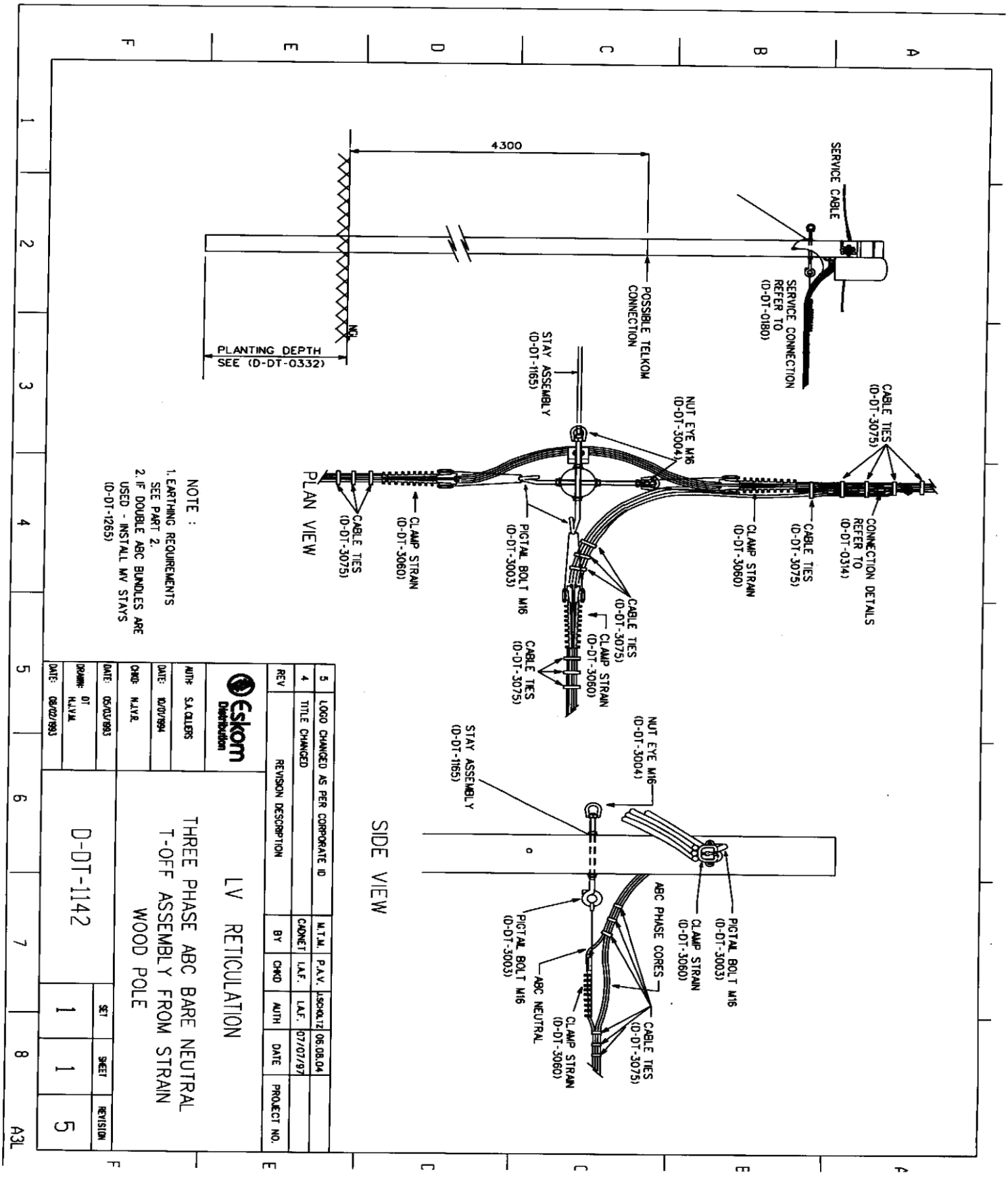
D-DT-1139

SET	SHEET	REVISION
1	1	1

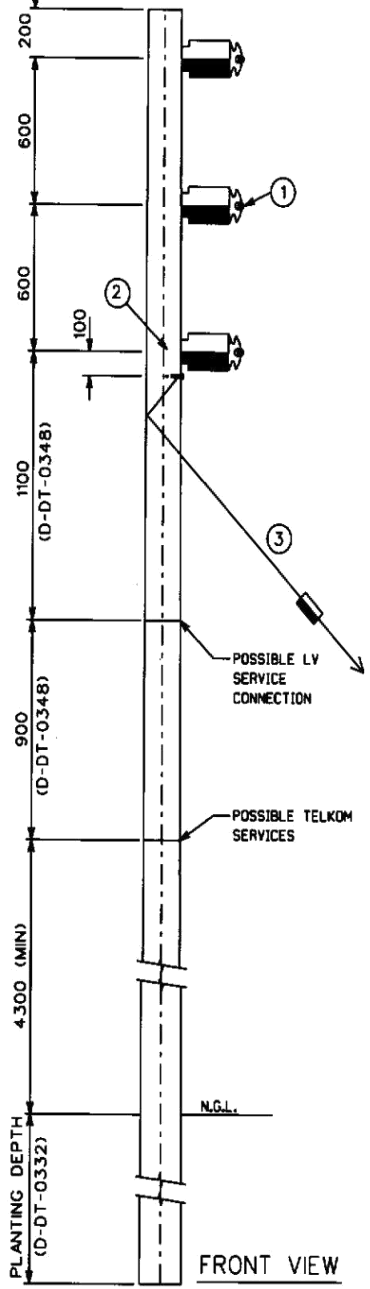
A3L



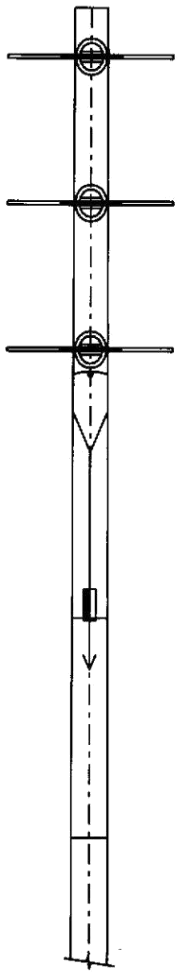
Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



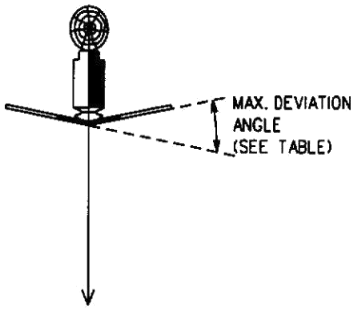
Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



FRONT VIEW



SIDE VIEW



PLAN VIEW

REFERENCE DRAWINGS		
ITEM	DESCRIPTION	DWG NO
	CONDUCTOR / INSULATOR ATTACHMENTS	
1	POSTS -TOP GROOVE TIES	D-DT-0256
	INSULATOR / STRUCTURE ATTACHMENTS	
2	POSTS -LONG SPINDLE	D-DT-0391
	BONDING AND EARTHING	
	INSULATION CO-ORDINATION	D-DT-0310
	STAYS	
3	STAY ASSEMBLY STAY ATTACHMENTS	D-DT-0341 D-DT-0312
	PHASING	
	PHASE CONFIGURATION	D-DT-0311

DEVIATION TABLE		
CONDUCTOR	MIN.	MAX.
SQUIRREL	1	12°
FOX	1	10°
MINK	1	8°
HARE	1	5°

NOTE :
NOT SUITABLE FOR ROAD CROSSINGS.

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	STAY ASSEMBLY ADDED & REF. No'S CHANGED	PBM	P.A.V.	B. HILL	18.10.05	
1	LOGO CHANGED AS PER NEW CORPORATE ID	M.T.M.	P.A. VERMAAK		10.11.04	
0	FIRST ISSUE	P.A.V.	B. BRANFIELD		11.01.99	

Eskom Distribution

AUTH: B. BRANFIELD
DATE: 11/01/1999
CHKD: B. BRANFIELD
DATE: 11/01/1999
DRAWN: IAN B. P.A. VERMAAK
DATE: 01/08/1998

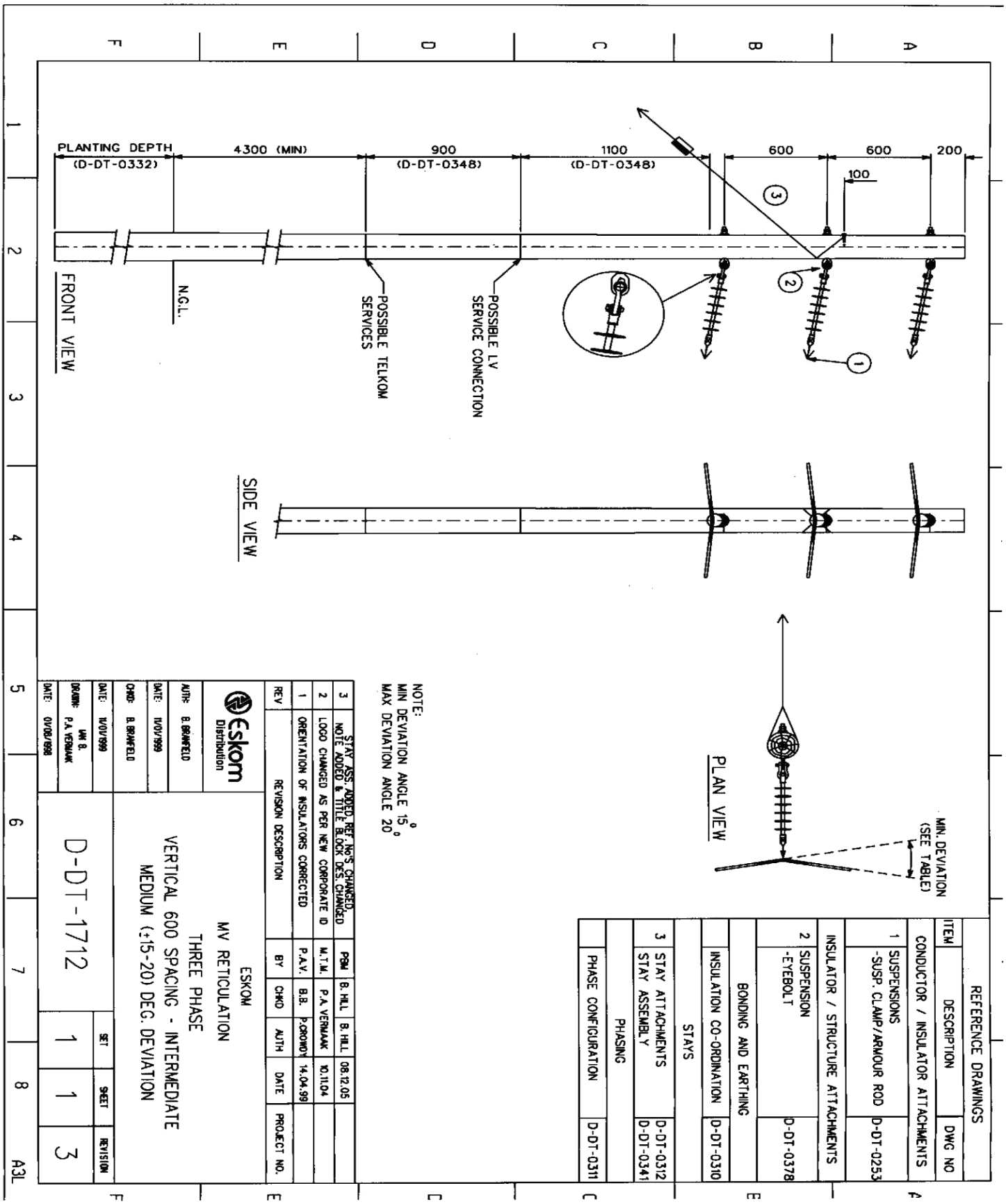
ESKOM
MV RETICULATION
THREE PHASE
VERTICAL 600 SPACING - INTERMEDIATE
SMALL (1 -10) DEG. DEVIATION

D-DT-1711

SET	SHEET	REVISION
1	1	2

A3L

Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



REFERENCE DRAWINGS		
ITEM	DESCRIPTION	DWG NO
	CONDUCTOR / INSULATOR ATTACHMENTS	
1	SUSPENSIONS -SUSP. CLAMP/ARMOUR ROD	D-DT-0253
	INSULATOR / STRUCTURE ATTACHMENTS	
2	SUSPENSION -EYEBOLT	D-DT-0378
	BONDING AND EARTHING	
	INSULATION CO-ORDINATION	D-DT-0310
	STAYS	
3	STAY ATTACHMENTS	D-DT-0312
	STAY ASSEMBLY	D-DT-0341
	PHASING	
	PHASE CONFIGURATION	D-DT-0311

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
3	STAY ASS. ADDED REF. NO'S CHANGED. NOTE ADDED & TITLE BLOCK DES. CHANGED	PSM	B. HILL	B. HILL	08.12.05	
2	LOGO CHANGED AS PER NEW CORPORATE ID	M.T.M.	P.A. VERMAAK	10.11.04		
1	ORIENTATION OF INSULATORS CORRECTED	P.A.V.	B.B.	P.CROWDY	14.04.99	

Eskom Distribution

AUTH: B. BRAMFIELD DATE: 11/01/1999

CHKD: B. BRAMFIELD DATE: 11/01/1999

DRAWN: IAN D. P.A. VERMAAK DATE: 01/08/1998

ESKOM
MV RETICULATION
THREE PHASE
VERTICAL 600 SPACING - INTERMEDIATE
MEDIUM (±15-20) DEG. DEVIATION

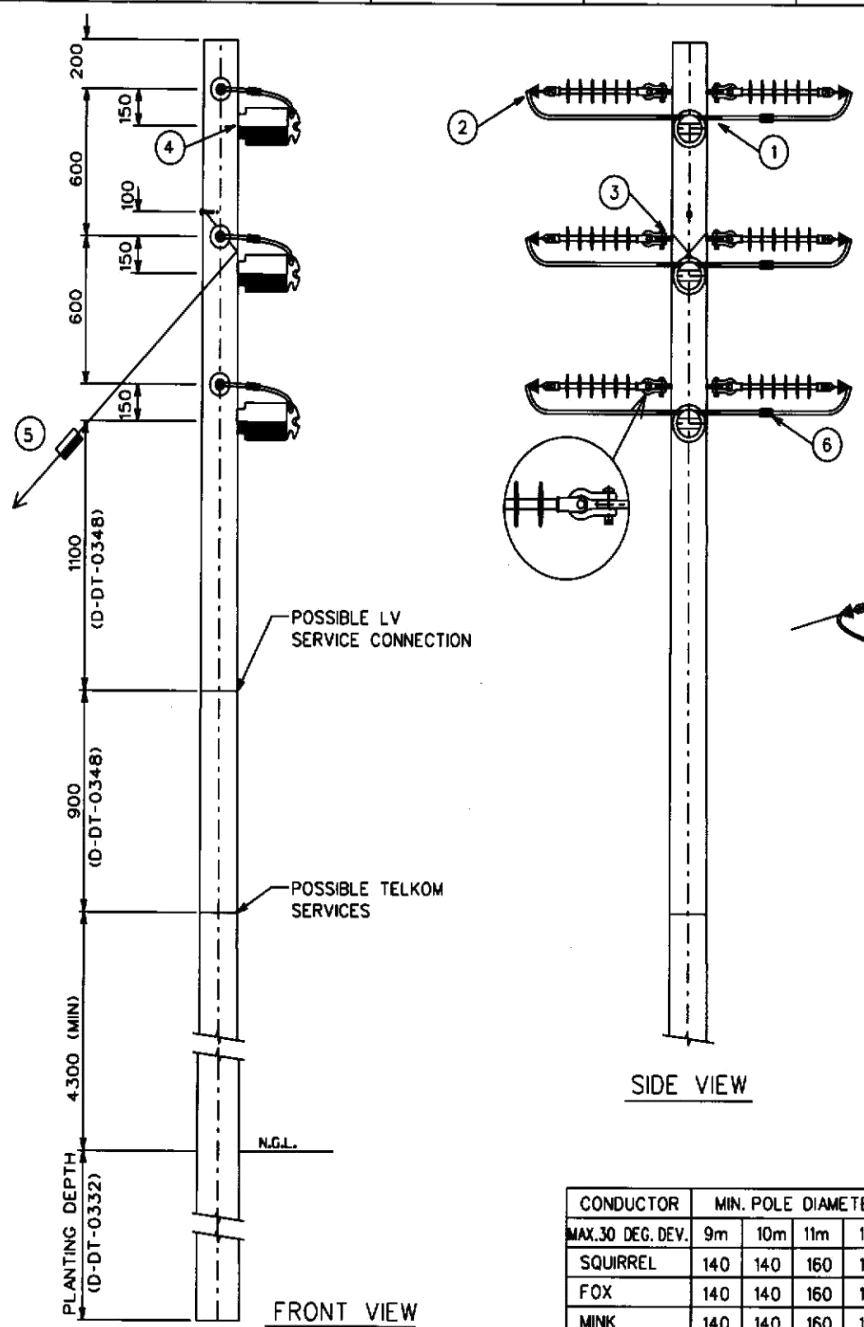
D-DT-1712

SET	SHEET	REVISION
1	1	3

A3L

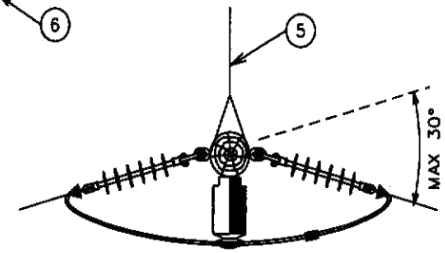
Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province

Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province



FRONT VIEW

SIDE VIEW



PLAN VIEW

REFERENCE DRAWINGS		
ITEM	DESCRIPTION	DWG NO
CONDUCTOR / INSULATOR ATTACHMENTS		
1	POSTS -SIDE GROOVE TIES	D-DT-0259
2	STRAINS -HELICAL DEAD-END -PISTOL GRIPS	D-DT-0250 D-DT-0251
INSULATOR / STRUCTURE ATTACHMENTS		
3	STRAINS -EYEBOLT	D-DT-0273
4	POSTS -LONG SPINDLE	D-DT-0391
BONDING AND EARTHING		
	INSULATION CO-ORDINATION	D-DT-0310
STAYS		
5	STAY ATTACHMENTS STAY ASSEMBLY	D-DT-0312 D-DT-0314
PHASING		
	PHASE CONFIGURATION	D-DT-0311
JOINTS		
6	NON-TENSION JOINTS	CHOICE

CONDUCTOR	MIN. POLE DIAMETER			
MAX.30 DEG. DEV.	9m	10m	11m	12m
SQUIRREL	140	140	160	160
FOX	140	140	160	160
MINK	140	140	160	160
HARE	160	160	180	180

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	REF. TO STAY ASSY. ADDED & REF. No'S AND MIN. POLE DIA'S CHANGED	PBM	B. HILL		08.12.05	
1	LOGO CHANGED AS PER NEW CORPORATE ID	M.T.M.	P.A. VERMAAK		10.11.04	

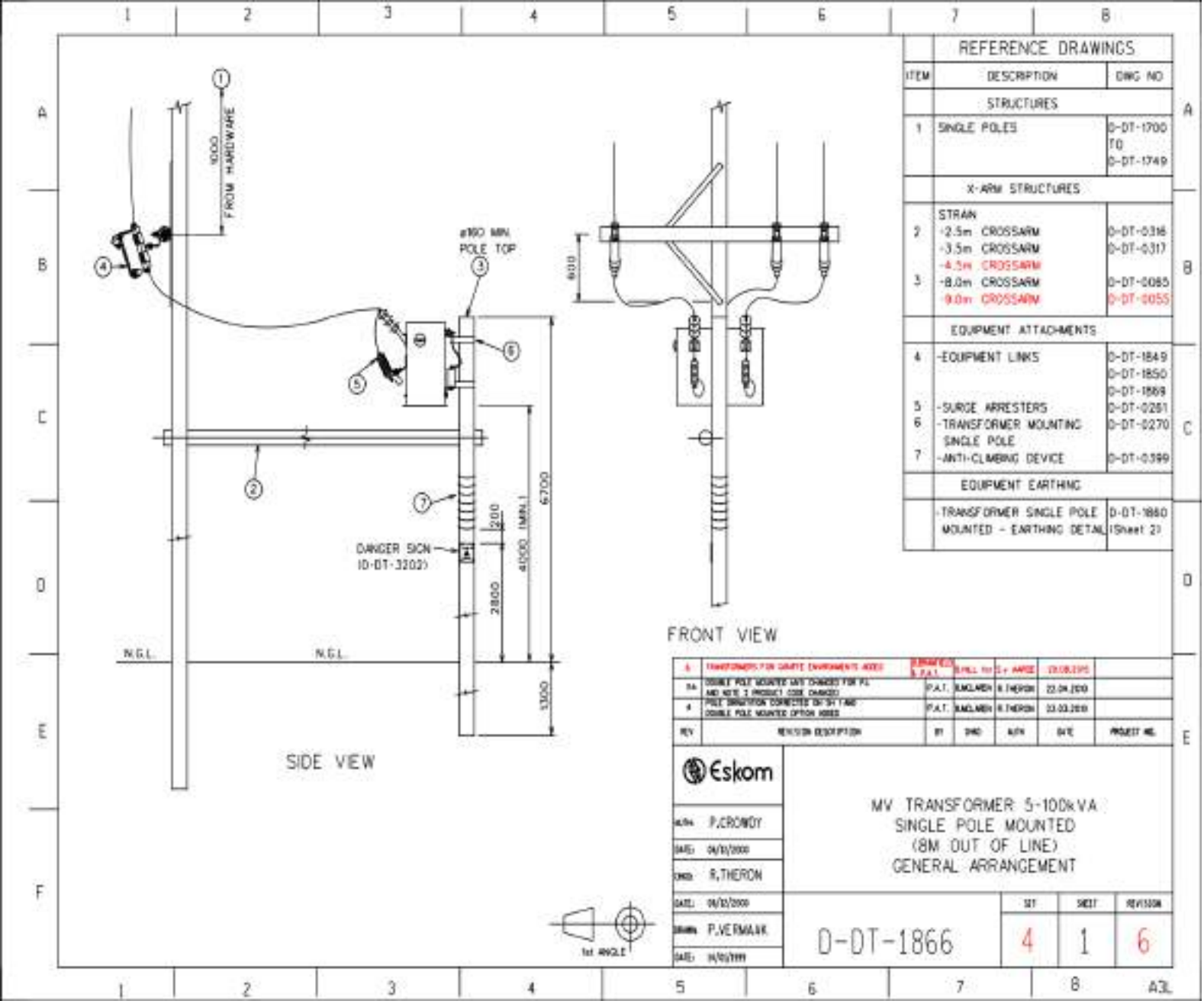
Eskom Distribution

AUTH: B. BRANFIELD 11/01/1999
CHKD: B. BRANFIELD 11/01/1999
DRAWN: IAN B. P.A. VERMAAK 01/08/1998

ESKOM
MV RETICULATION
THREE PHASE
VERTICAL 600 SPACING - STRAIN
SMALL (1 -30) DEG. DEVIATION

D-DT-1714	SET	SHEET	REVISION
	1	1	2

A3L


REFERENCE DRAWINGS
ITEM
DESCRIPTION
DWG NO
STRUCTURES
1
SINGLE POLES
D-DT-1700 TO D-DT-1749
X-ARM STRUCTURES
STRAIN
2
+2.5m CROSSARM
D-DT-0316
+3.5m CROSSARM
D-DT-0317
+4.5m CROSSARM
3
+8.0m CROSSARM
D-DT-0085
+9.0m CROSSARM
D-DT-0055
EQUIPMENT ATTACHMENTS
4
-EQUIPMENT LINKS
D-DT-1849
D-DT-1850
D-DT-1869
5
-SURGE ARRESTERS
D-DT-0251
6
-TRANSFORMER MOUNTING SINGLE POLE
D-DT-0270
7
-ANTI-CLIMBING DEVICE
D-DT-0399
EQUIPMENT EARTHING
-TRANSFORMER SINGLE POLE MOUNTED - EARTHING DETAIL
D-DT-1880 (Sheet 2)
FROM HARDWARE
1000
ø160 MIN. POLE TOP
600
DANGER SIGN ID-DT-3202)
200
4000 (MIN.)
6700
2800
1300
N.G.L.
N.G.L.
SIDE VIEW
FRONT VIEW
Eskom
P.CROWDY
R.THERON
P.VERMAAK
1st ANGLE
MV TRANSFORMER 5-100kVA
SINGLE POLE MOUNTED
(8M OUT OF LINE)
GENERAL ARRANGEMENT
D-DT-1866
SHT
SHEET
REVISION
4
1
6

Floodline Report

FORMALISATION OF MARIKANA INFORMAL SETTLEMENT LOCATED ON THE REMAINING EXTENT OF PORTION 6 OF THE FARM DAVELFONTEIN 267 - IS, MPUMALANGA PROVINCE

1:100 RETURN PERIOD FLOODLINE DETERMINATION REPORT

May 2023, Rev0

PREPARED BY:

Dalimede Projects (PTY) LTD
No. 11 Pierre street, IT Park RentCo Building, Office 6,
Bendor, South Africa, 0699

Tel: 015 291 0775
E-mail: admin@dalimede.com

PREPARED FOR:

Mang GeoEnviro Services
Block 9, Unit 2 Boardwalk Office Park,
6 Enos Road, Faerie Glen,
Pretoria, 0004

Tel: 012 770 4022
Cell: +27 72 573 2390
Email: fnmathebula@gmail.com / info@manggeoenviro.co.za

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1.0 INTRODUCTION

1.1 Study Request

The report study is to undertake floodline assessment relating to the proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province.

1.2 Locality

The proposed township is situated 37km west of Ermelo along the N17 highway, site is also 250km south-west of Mbombela City along the N17 and R38 roads, in Mpumalanga Province, South Africa. The area is administered by Msukaligwa Local Municipality under the Gert Sibande District Municipality. GPS coordinates of site are 26°27'47.35"S 29°39'20.83"E. The locality map is shown on the figures below.

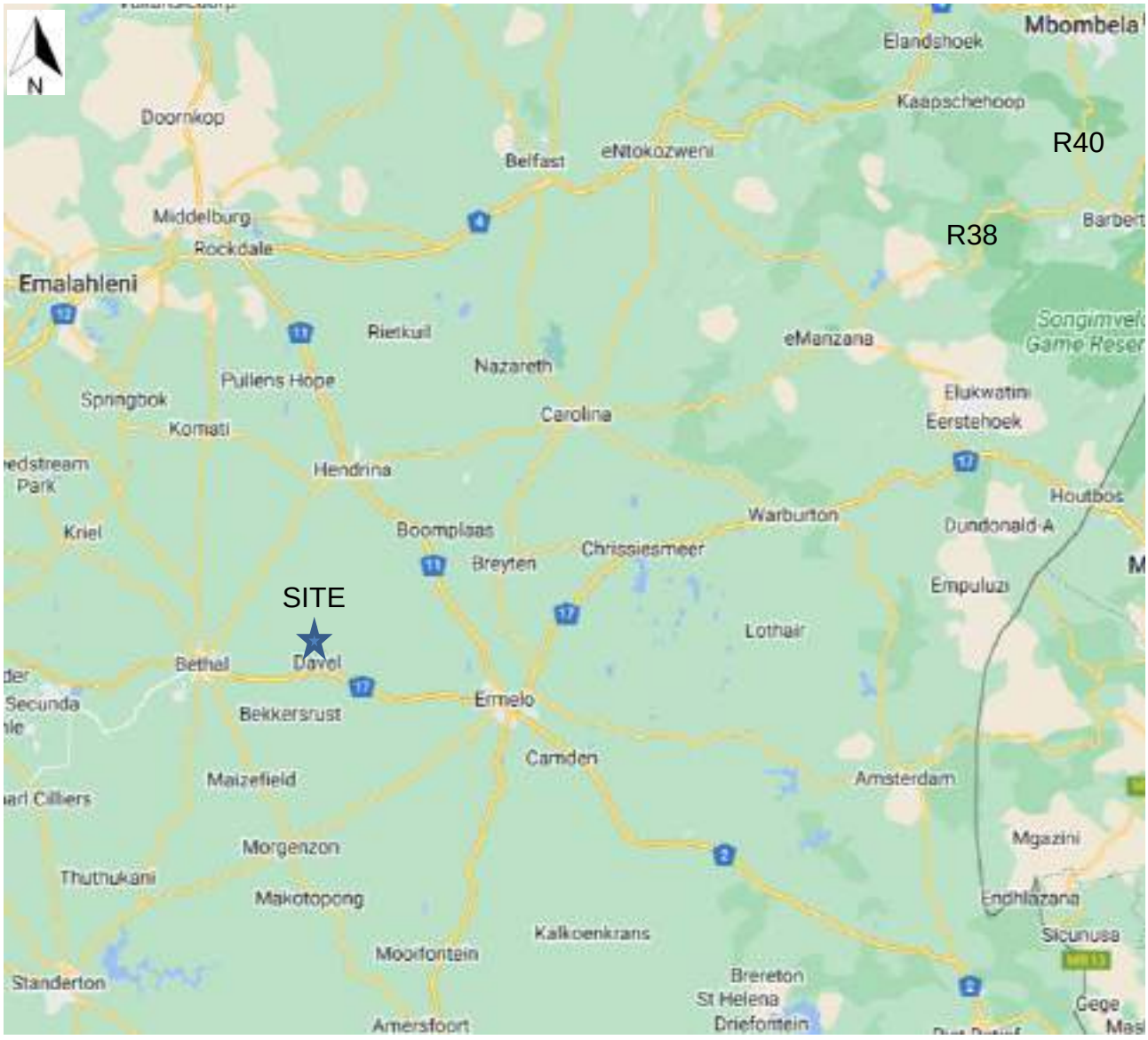

Figure 1 Location of development site

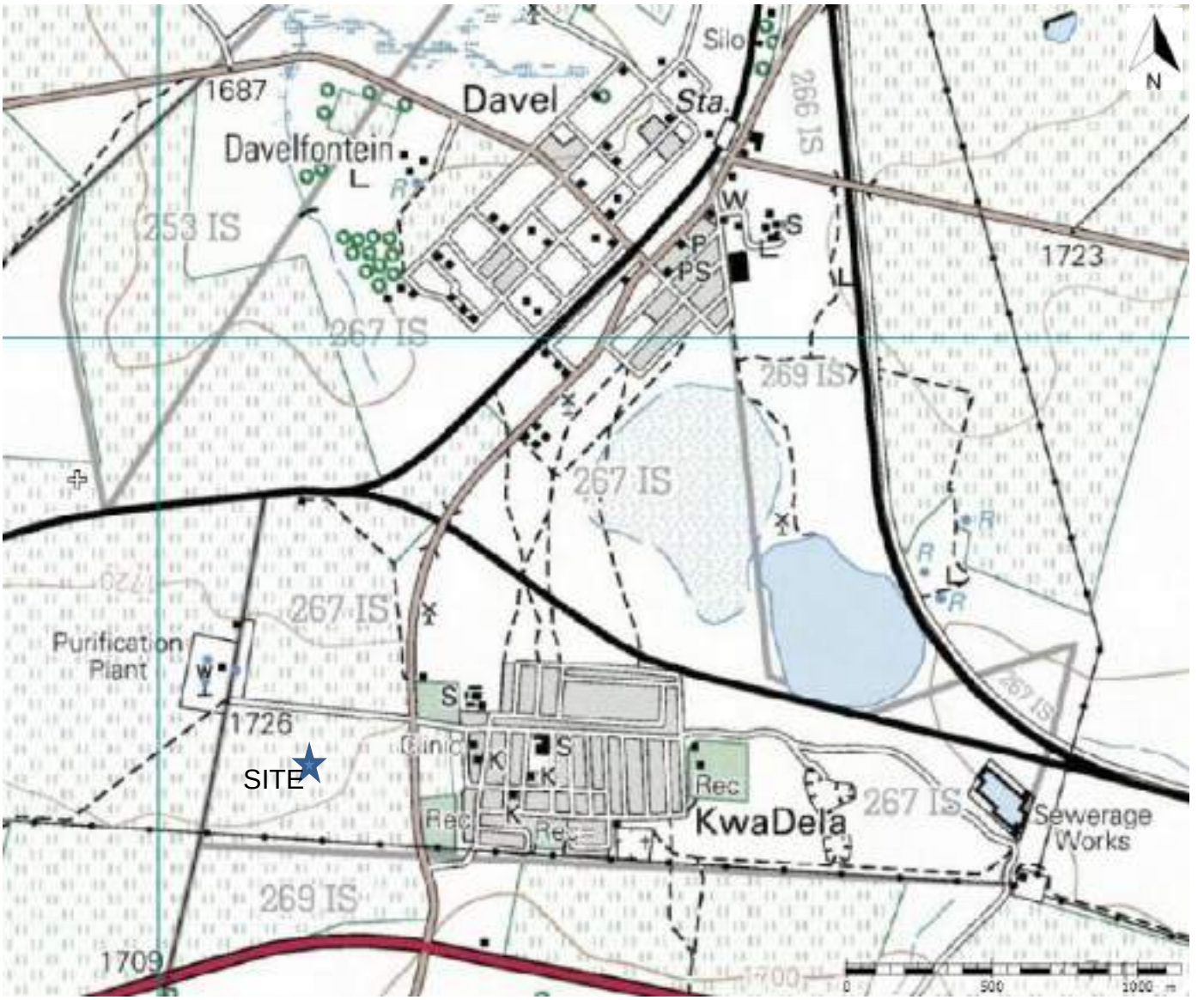

Figure 2 Project site

1.3 Background

A flood line analysis must be conducted along the stream / river traversing or in proximity of the site of proposed development.

See the figures below for the streams in catchment area in proximity to the site.

Figure 3 Streams (blue line)

Figure 4 Stream (C1)

Figure 5 Stream (C1)

1.4 Methodology

1.4.1 general

The study consists of 2 major components:

- a flood analysis to determine the flood peak flow and,
- a surface water profile analysis to determine the flood line.

The magnitude of a flood is dependent on many factors, such as catchment size, slope and rainfall intensity. There are several different methods for determining floods and in general, different methods arrive at different estimates of the peak flow rate. The accepted approach is therefore to use several methods and then make a judgment call as to which method is the most applicable to the catchment under consideration. For this study, the Rational, Alternative Rational, Standard Design Flood (SDF) methods were used to determine the peak flow rate for the 1:100 return flood.

The reason for choosing these methods was because they are applicable to the catchment and to show the variance in the flood line between the method that produced the highest flood peak and the method that produced the lowest flood peak. Hence a flood line has been produced to take cognisance of the uncertainty related to estimating floods and flood lines.

The area of the catchment in which the adjacent stream is located was determined using GIS software as were additional properties applicable to the catchment, such as the length of the watercourse and the centroid of the catchment. The flood peak flows provide the flow used in the flood line analysis using the *HEC-RAS* software.

Other input required for *HEC-RAS* is channel geometry and roughness parameters. Channel cross-sections were taken at points along the river / stream course, within the area that contour lines were provided. The stream reaches that were analysed are in a natural state.

1.4.2 Flood Modelling Methodology

Flood peaks for the catchments selected for flood modelling were estimated by the following methods using the Utility Programs for Drainage (UPD) software, 2007 with the methods detailed in SANRAL, 2013:

- Rational Method (RM).
- Alternative Rational Method (ARM).
- Standard Design Flood (SDF).
- Unit Hydrograph (UH), and
- Empirical (E).

1.4.2.1 Rational Method

This method is based on the conservation of mass and is applicable for catchment areas below 15 km^2. Aerial and time distributions of rainfall in this method are assumed to be uniform throughout the catchment. Flood peaks and empirical hydrographs can be determined by this method.

Where: The peak flow is obtained from the following relationship:

$$Q = \frac{CIA}{3.6}$$

Where: Q = peak flow (m^3/s)
C = runoff coefficient (dimensionless)
I = average rainfall intensity over the catchment (mm/hour)
A = effective runoff area of the catchment (km^2)
3.6 = conversion factor

1.4.2.2 Alternative Rational Method

This method is based on the rational method with the point precipitation being adjusted using the Design Rainfall Estimation Methodology developed by Smithers and Schulze (2003) to consider local South African conditions.
Design rainfall values for the study area were extracted from the database of six closest to site South African Weather Service stations, using the Design Rainfall Utility developed by Smithers and Schulze (2000).

1.4.2.3 Standard Design Flood (SDF) Method

This method is an empirically calibrated version of the Rational method. A major component in the development of the SDF method was the identification of regions with homogeneous flood producing characteristics. The geographic requirement was that the boundaries had to follow catchment watersheds and related to the Department of Water and Sanitation (DWS) drainage region numbering system, formally the Department of Water Affairs and Forestry (DWAF).
The regions are called ‘basins’ to avoid confusion with DWAF’s drainage regions and the South African Weather Services’ (SAWS) rainfall districts. Each basin must contain at least one flow gauging station from the DWAF published TR102 Catalogue of hydrological catchment parameters. The only information required for its application is the area of the catchment, the length and slope of the main stream / river, and the drainage basin in which it is located.

1.4.2.4 Unit Hydrograph (UH) Method

This method utilises the concept of the constant unique physical parameters of a catchment that are established in the typical form of a hydrograph. The size and duration may be further determined by considering the intensity and duration of rainfall. A unit hydrograph is a characteristic run-off response from a specific catchment. It is defined in metric terms as the hydrograph resulting from one millimetre of run-off following rainfall of unit duration with uniform spatial and time distribution over the catchment. The duration of the of the hydrograph is thus proportional to the duration of the rainfall. The volume of the hydrograph is proportional to the intensity of the rainfall.

The Hydrological Research Unit has used historical data to derive the unit hydrographs for 96 river measuring stations in South Africa. From these 96 unit hydrographs, nine synthetic hydrographs were derived for nine regions in South Africa with similar catchment characteristics, e.g. topography, soil type, vegetation and rainfall.

1.4.2.5 Empirical (E) Method

This method is mostly based on simple correlations between peak flow rates and other catchment characteristics derived in order to establish general regional parameters.

2.0 PROPOSED DEVELOPMENT

2.1 Flood Analysis

To make the analysis possible, properties of the catchments that influence the runoff relating to the 1:100 return flood event need to be determined. These properties are described in the following sections.

2.1.1 Catchment Properties

The catchment topography is composed of mainly flat areas. The landscape soils are ranging from moderate to slow to very slow infiltration rates with slightly restricted to restricted to severely restricted permeability (Schulze, 2010). The soils are classified to be semi-permeable to and with high runoff potential.

The Mean Annual Precipitation (MAP) of the catchment was determined from weather stations gridded from in the vicinity of the site. The MAP for the catchment is estimated to be 729mm.

Table 1 Rainfall data

Station Name	SAWS	Distance	Record	Latitude		Longitude		MAP
	Number	(km)	(Years)	(°)	(')	(°)	(')	(mm)
Brakfontein	0479238_W	0	79	26	28	29	38	723
Hamelfontein	0479298_W	1.8	76	26	28	29	39	723
Brakfontein	0479300_W	2.5	47	26	29	29	39	705
Uitzicht	0479326_W	6.5	39	26	26	29	41	756
Bekkersrust	0442123_W	10.2	53	26	32	29	34	681
Uitzicht	0479385_W	10.5	34	26	25	29	43	749

Table 2 MAP Data (mm)

	Return Period						
Duration	**1:2**	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**	**1:200**
1 day	56	75	89	104	126	145	165
2 day	70	95	113	132	160	184	209
3 day	80	109	130	152	185	211	240
7 day	106	144	172	201	242	275	311

The intensity of rainfall is related to the mean annual precipitation and to the rainfall region. The modified recalibrated Hershfield relationship was used to determine point rainfall. The point rainfall is then converted to intensity by dividing the point rainfall by the time of concentration for the storm durations of up to 6 hours.

$$P_{t,T} = 1,13(0,41 + 0,64\ln T)(-0,11 + 0,27\ln t)(0,79M^{0,69}R^{0,20})$$

Where:

$P_{t,T}$	=	Precipitation depth for a duration of *t* minutes and a return period of T years
t	=	Duration in minutes
T	=	Return period
M	=	2-year return period daily rainfall from TR102
R	=	Average number of days per year on which thunder was heard

The Department of Water and Sanitation (DWS) has no river gauge station in the catchment.

The climate is characterised by hot and rainy summers for a long period as well as cold and dry winters over a short period.

2.1.2 Catchment Delineation

There was one catchment that was delineated.
The catchment area is within the Upper Vaal Water Management Area.

The catchment in the table below was delineated to cover the streams nearest to the project boundary and was utilised to determine the flood peaks for 1:100 return extreme events. The catchment information is listed in the table below.

Table 3 Catchment area

Catchment Site	Catchment area (km^2)	Remark	Quaternary catchment
C1		Rural	C11F

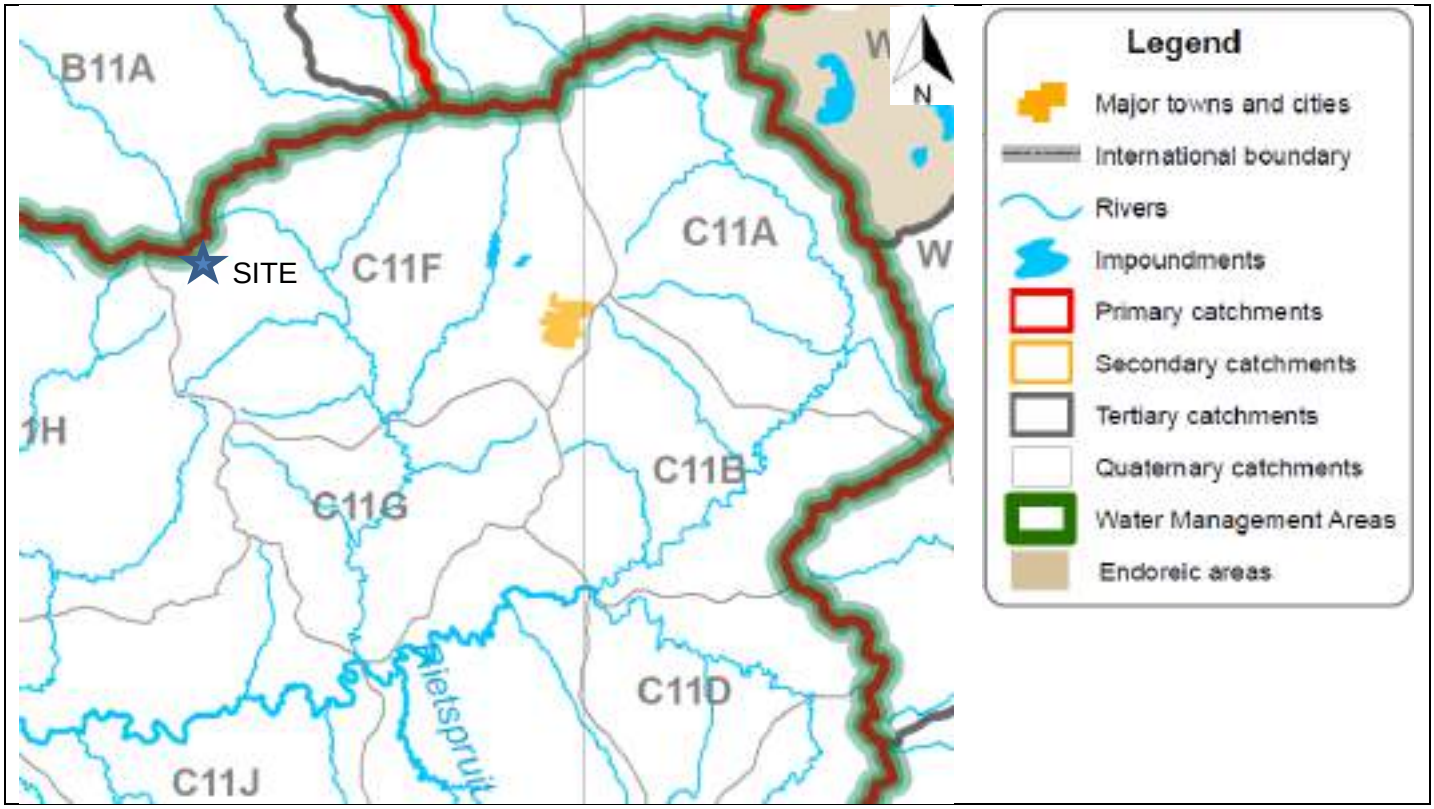

Figure 6 Quaternary catchments

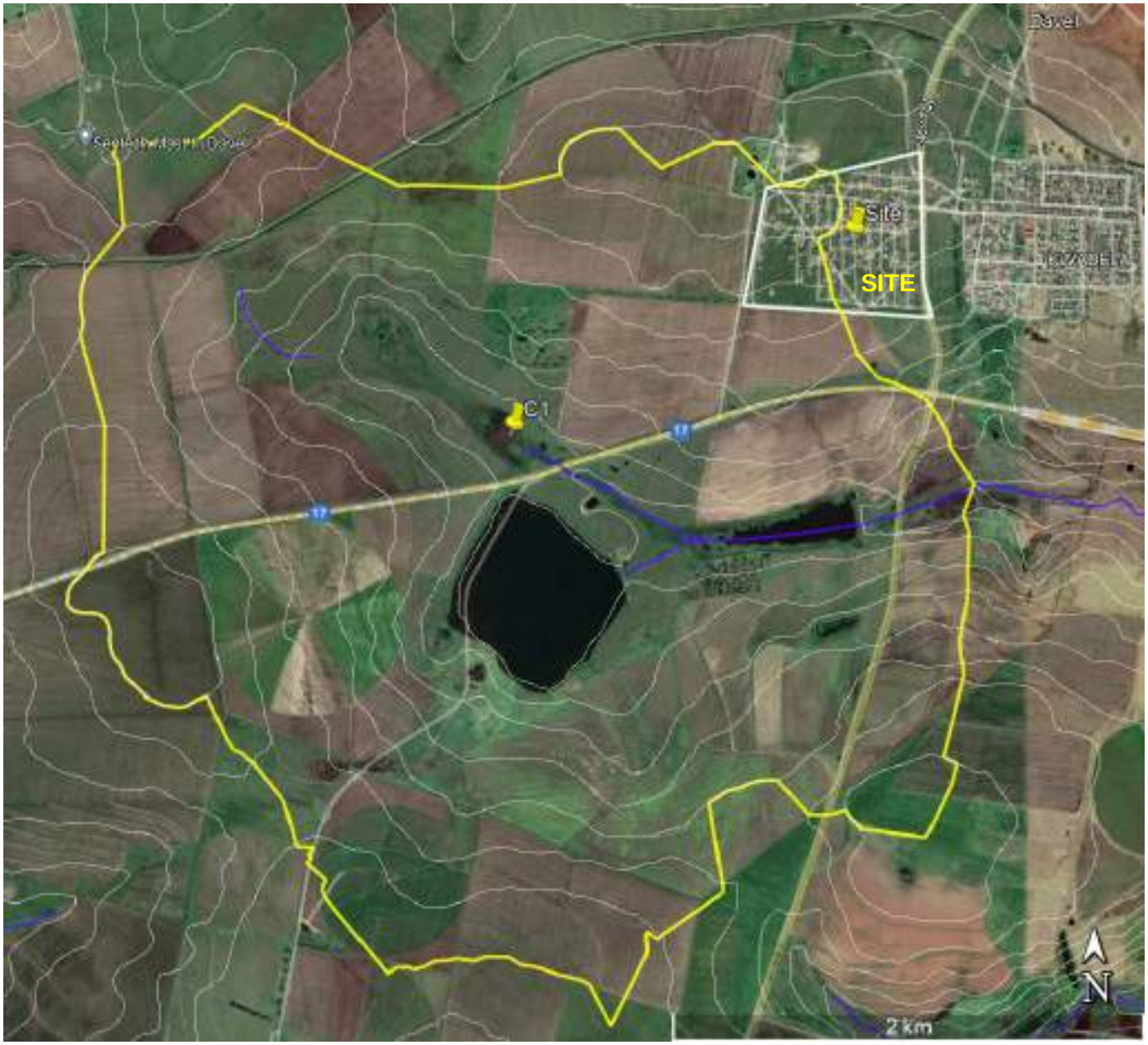

Figure 7 Catchment delineation (yellow line boundary)

Table 4 Catchment Characteristic

Characteristic	Rural	Urban	Lakes	Total
	Distribution	Distribution	Distribution	
Catchment	%	%	%	(%)
C1	94%	0%	6%	100.0%

Table 5 Rural area - Surface slope

Rural area - Surface slope	Lakes and pans (<3%)	Flat area (3 to 10%)	Hilly (10 to 30%)	Steep areas (>30%)	Total
	Distribution	Distribution	Distribution	Distribution	
Catchment	(%)	(%)	(%)	(%)	(%)
C1	67%	31%	2%	0%	100.0%

Table 6 Rural area – Permeability

Rural area - Permeability	Very permeable	Permeable	Semi-permeable	Impermeable	Total
	Distribution	Distribution	Distribution	Distribution	
Catchment	(%)	(%)	(%)	(%)	(%)
C1	0%	30%	50%	20%	100.0%

Table 7 Rural area - Vegetation

Rural area - Vegetation	Thick bush & forests	Light bush & cultivated land	Grasslands	Bare	Total
	Distribution	Distribution	Distribution	Distribution	
Catchment					(%)
C1	0%	75%	20%	5%	100.0%

Table 8 Run-off factors

Catchment	Run-off factor			
	Rural (C_R)	Urban (C_U)	Lakes (C_L)	Combined (C)
C1	0.343	0	0	**0.322**

Table 9 Hydrological input data

Catchment	Catchment Area (km^2)	Longest water course (km)	Height difference 1085 method (m)	Days thunder was heard (No.)	Area Dolomite (%)	Mean Annual Precipitation (mm)	SDF Basin no. (No.)
C1	10.092	4.774	18.4	45	0	729	6

Table 10 Catchment characteristics

Catchment Site	Catchment area (km^2)	Longest water course, L (km)	Height difference along 10-85 slope (m)	Average slope S_{av} (m/m)	Time of concentration, Tc (hours)	% Slope	MAP (mm)	Run-off factor C
C1	10.092	4.774	18.4	0.0051	1.6819	0.51%	729	0.322

Flood magnitudes

The flood magnitudes from the 1:2 return up to 1:100 return floods are presented in the Tables below.

Table 11 Point rainfall

	Return period (years)	Time of concentration (hours)	Point rainfall (mm)	ARF (%)	Average intensity (mm/h)	Factor Ft	Runoff coefficient (%)	Peak flow (m^3/s)
	1:2	1.68	39.1	99.4	23.1	0.75	24.2	15.66
	1:5	1.68	53.3	99.1	31.4	0.8	25.8	22.69
C1	1:10	1.68	67.5	98.9	39.7	0.85	27.4	30.44
	1:20	1.68	83.3	98.6	48.8	0.9	29	39.69
	1:50	1.68	108.3	98.2	63.2	0.95	30.6	54.23
	1:100	1.68	133.3	97.8	77.5	1	32.2	69.97

ARF = Area Reduction Factor

Ft = Adjustment factor for initial saturation for return period T

Table 12 Estimated stormwater flow (m^3/s)

	Rational method						Alternative rational method					
Return	**1:2**	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**	**1:2**	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**
Catchment												
C1	15.66	22.69	30.44	39.69	54.23	69.97	12.00	21.59	30.00	39.25	51.87	62.91

Table 13 Estimated stormwater flow (m^3/s)

	Standard design flood method					
Return	1:2	1:5	1:10	1:20	1:50	1:100
Catchment						
C1	7.25	25.46	42.36	61.50	90.06	114.06

The applications and limitation of flood calculation methods are shown in the table below.

Table 14 Applications and limitation of flood calculation methods

Method	Recommended maximum area (km^2)	Return period of floods that could be determined
Statistical method	No limitation (larger areas)	1:2 to 1:200
Rational method	Usually less than $15km^2$	1:2 to 1:200
Unit Hydrograph method	$15km^2$ to $5,000km^2$	1:2 to 1:100
Standard Design Flood method	No limitation	1:2 to 1:200
SCS-SA method	Less than $30km^2$	1:2 to 1:100
Empirical methods	No limitation (larger areas)	1:10 to 1:100

Flood magnitudes for the 1:100-year floods

The selected maximum peak flow is shown in the table below.

Table 15 Catchment generated estimated 1:100 peak flow

	1:2	1:5	1:10	1:20	1:50	1:100
	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s
C1	15.66	25.46	42.36	61.50	90.06	114.06

The estimated 1:100 stream flow is listed in the table below.

Table 16 Stream 1:100 return peak flow estimates

	Flow (m^3/s)					
Stream - Reach	**1:2**	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**
Stream (C1)	15.66	25.46	42.36	61.50	90.06	114.06

2.2 Flood line Modelling

The HEC-RAS model was used to determine the flood line during the event of a flood for any return period, and in this case the 1:100-year floods were modelled.

2.2.1 Cross section profile

Cross sectional data was generated using GIS and CAD software, as well as the contour lines that were obtained from the 5m contour lines that were obtained from the National Geo-Spatial Information (NGI). Sections shown in Annexure 5 were used to approximate the geometry for the river.

2.2.2 Flood profiles

Annexure 4 shows the longitudinal profile for the 1:100 return peak flow.

3.0 CONCLUSION

The determination of the 1:100 return period floodlines was undertaken for the site of the proposed development. The results of this determination provide an indication as to the extent of the areas that will be inundated by the 1:100 return design flood.

It is recommended that a buffer zone of 20m should be provided between the 1:100 flood line and any proposed development.

The lateral extent of the 1:100 return flood line is shown in Annexure 2. These flood lines have also been provided as Gauss Conform WGS84 LO29 coordinated CAD dwg softcopy files.

4.0 REFERENCES

- Smithers J.C. and Schulze R.E. (2002): Drainage rainfall and flood estimation in South Africa, WRC project KS/1060.

- The South African National Roads Agency Limited (2013): Drainage manual, 6th Edition.

ANNEXURE 1: FLOODLINE CERTIFICATE

Reg. No: 2014 / 233383 / 07

Branch Offices
Polokwane, Limpopo

DALIMEDE PROJECTS (PTY) LTD
No. 11 Pierre street,
IT Park RentCo Building, Office 6,
Bendor, Polokwane, South Africa, 0699
Tel: 015 291 0775, Cell: 079 368 8414,
E-mail: admin@dalimede.com

FLOOD LINE CERTIFICATE

Dalimede Projects (PTY) LTD was appointed by Mang GeoEnviro Services to undertake floodline assessment relating to the proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province.

This will entail to delineate the 1:100 return flood line.

Site: *Marikana informal settlement*

Township Name: *Portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province*

Co-ordinates: *26°27'47.35"S 29°39'20.83"E*

Municipality: *Msukaligwa Local Municipality under the Gert Sibande District Municipality*

In terms of section 114 of the National Water Act, Act 36 of 1998 the above-mentioned property is NOT affected by flood water within the 1:100 period from the stream / river as indicated in the floodline report. Development must be done outside of the floodline.

It is recommended that a buffer zone of 20m should be provided between the 1:100 flood line and any proposed development.

Thus, done and signed in Polokwane on this day 9 May 2023

Signature: 

Engineer: Litmos Mthunzi

Pr Tech Eng

Pr no.: ECSA 201770075

ANNEXURE 2: FLOODLINE DELINEATION

KEY

It is recommended that a buffer zone of 20m should be provided between the 1:100 flood line and any proposed development.

FLOODLINE

100 CROSS SECTION

STREAM / RIVER

REVISIONS

REV	DATE	SIGN	DESCRIPTION
0	.../.../...	....	.....

CLIENT

mang GEOENVIRO SERVICES

Mang GeoEnviro Services
Block 9, Unit 2 Boardwalk Office Park,
6 Enos Road, Faerie Glen,
Pretoria, 0004
Tel: 012 770 4022
Cell: +27 72 573 2390
Email: fnmathebula@gmail.com / info@manggeoenviro.co.za

CONSULTANT

DALIMEDE PROJECTS (PTY) LTD

Dalimede Projects (PTY) LTD
No. 11 Pierre street, IT Park RentCo Building, Office 6,
Bendor, Polokwane, South Africa, 0699

Tel: 015 291 0775, Cell: 079 368 8414,
E-mail: admin@dalimede.com
GPS; Lat: -23.894692 Long: 29.479758

DRAWING STATUS

FOR INFORMATION

PROJECT TITLE

Proposed formalisation of Marikana informal settlement located on the remaining extent of portion 6 of the farm Davelfontein 267 - IS, Mpumalanga Province.

PROJECT LOCATION

The proposed township is situated 37km west of Ermelo along the N17 highway, site is also 250km south-west of Mbombela City along the N17 and R38 roads, in Mpumalanga Province. GPS coordinates of site are 26°27'47.35"S 29°39'20.83"E.

DRAWING DESCRIPTION

FLOODLINE DELINEATION 1:100 RETURN PERIOD

SCALE	DATE	DESIGNED	DRAWN	CHECKED
As Shown	May 2023	LM	KN	CM

A1

DRAWING No.

DAVEL/FL/01

REVISION A

ANNEXURE 3: HEC-RAS PROGRAMME MODELLING RESULTS

HEC-RAS Plan: Current model River: Stream C1 Reach: 1 Profile: 1:100yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
1	143	1:100yr	114.06	1694.99	1695.76		1695.77	0.000634	0.53	255.26	353.54	0.19
1	142	1:100yr	114.06	1694.99	1695.75		1695.76	0.000721	0.56	240.07	337.70	0.20
1	141	1:100yr	114.06	1694.99	1695.73		1695.74	0.000842	0.59	224.17	323.70	0.22
1	140	1:100yr	114.06	1694.98	1695.71		1695.73	0.000956	0.62	211.77	312.10	0.23
1	139	1:100yr	114.06	1694.98	1695.69		1695.71	0.001088	0.65	200.32	302.23	0.25
1	138	1:100yr	114.06	1694.98	1695.66		1695.68	0.001210	0.67	193.01	298.37	0.26
1	137	1:100yr	114.06	1694.98	1695.64		1695.66	0.001381	0.70	185.71	299.18	0.28
1	136	1:100yr	114.06	1694.97	1695.60		1695.63	0.001595	0.73	177.40	297.29	0.29
1	135	1:100yr	114.06	1694.97	1695.56		1695.59	0.001991	0.78	165.03	293.94	0.33
1	134	1:100yr	114.06	1694.97	1695.51		1695.54	0.002889	0.88	145.00	283.31	0.39
1	133	1:100yr	114.06	1694.97	1695.39		1695.45	0.007084	1.17	108.55	271.17	0.58
1	132	1:100yr	114.06	1694.72	1695.22		1695.29	0.008827	1.19	100.19	266.33	0.63
1	131	1:100yr	114.06	1694.52	1695.03		1695.10	0.009244	1.24	96.06	252.82	0.65
1	130	1:100yr	114.06	1694.33	1694.84		1694.92	0.009223	1.27	94.50	242.38	0.65
1	129	1:100yr	114.06	1694.13	1694.66		1694.74	0.009047	1.28	93.34	232.47	0.65
1	128	1:100yr	114.06	1693.93	1694.47		1694.55	0.009130	1.31	91.22	222.58	0.66
1	127	1:100yr	114.06	1693.73	1694.29		1694.37	0.009254	1.34	88.95	212.78	0.66
1	126	1:100yr	114.06	1693.53	1694.11		1694.19	0.008652	1.34	88.66	203.05	0.65
1	125	1:100yr	114.06	1693.34	1693.92		1694.02	0.009027	1.37	85.41	193.23	0.66
1	124	1:100yr	114.06	1693.14	1693.74		1693.83	0.008991	1.41	83.30	183.17	0.66
1	123	1:100yr	114.06	1692.94	1693.56		1693.66	0.008485	1.42	82.40	173.90	0.65
1	122	1:100yr	114.06	1692.75	1693.38		1693.49	0.008704	1.46	79.40	164.67	0.66
1	121	1:100yr	114.06	1692.56	1693.21		1693.32	0.008075	1.44	79.38	156.59	0.64
1	120	1:100yr	114.06	1692.38	1693.05		1693.16	0.008119	1.46	78.01	149.15	0.65
1	119	1:100yr	114.06	1692.19	1692.89		1693.00	0.007874	1.47	77.36	142.73	0.64
1	118	1:100yr	114.06	1692.00	1692.73		1692.84	0.007695	1.49	76.78	137.65	0.64
1	117	1:100yr	114.06	1691.81	1692.58		1692.69	0.007139	1.48	77.02	131.18	0.62
1	116	1:100yr	114.06	1691.62	1692.45		1692.56	0.006195	1.46	78.28	122.79	0.58
1	115	1:100yr	114.06	1691.42	1692.32		1692.43	0.006424	1.51	75.61	115.69	0.60
1	114	1:100yr	114.06	1691.23	1692.19		1692.31	0.005790	1.50	75.90	108.04	0.57
1	113	1:100yr	114.06	1691.05	1692.08		1692.20	0.005329	1.51	75.67	100.77	0.56
1	112	1:100yr	114.06	1690.87	1691.97		1692.09	0.005513	1.55	73.75	96.92	0.57
1	111	1:100yr	114.06	1690.68	1691.84		1691.97	0.006570	1.61	70.75	99.66	0.61
1	110	1:100yr	114.06	1690.50	1691.64		1691.81	0.009772	1.80	63.37	101.91	0.73
1	109	1:100yr	114.06	1690.36	1691.37	1691.37	1691.58	0.021441	2.06	55.37	131.15	1.01
1	108	1:100yr	114.06	1690.08	1690.91		1691.00	0.006085	1.33	85.46	150.93	0.57
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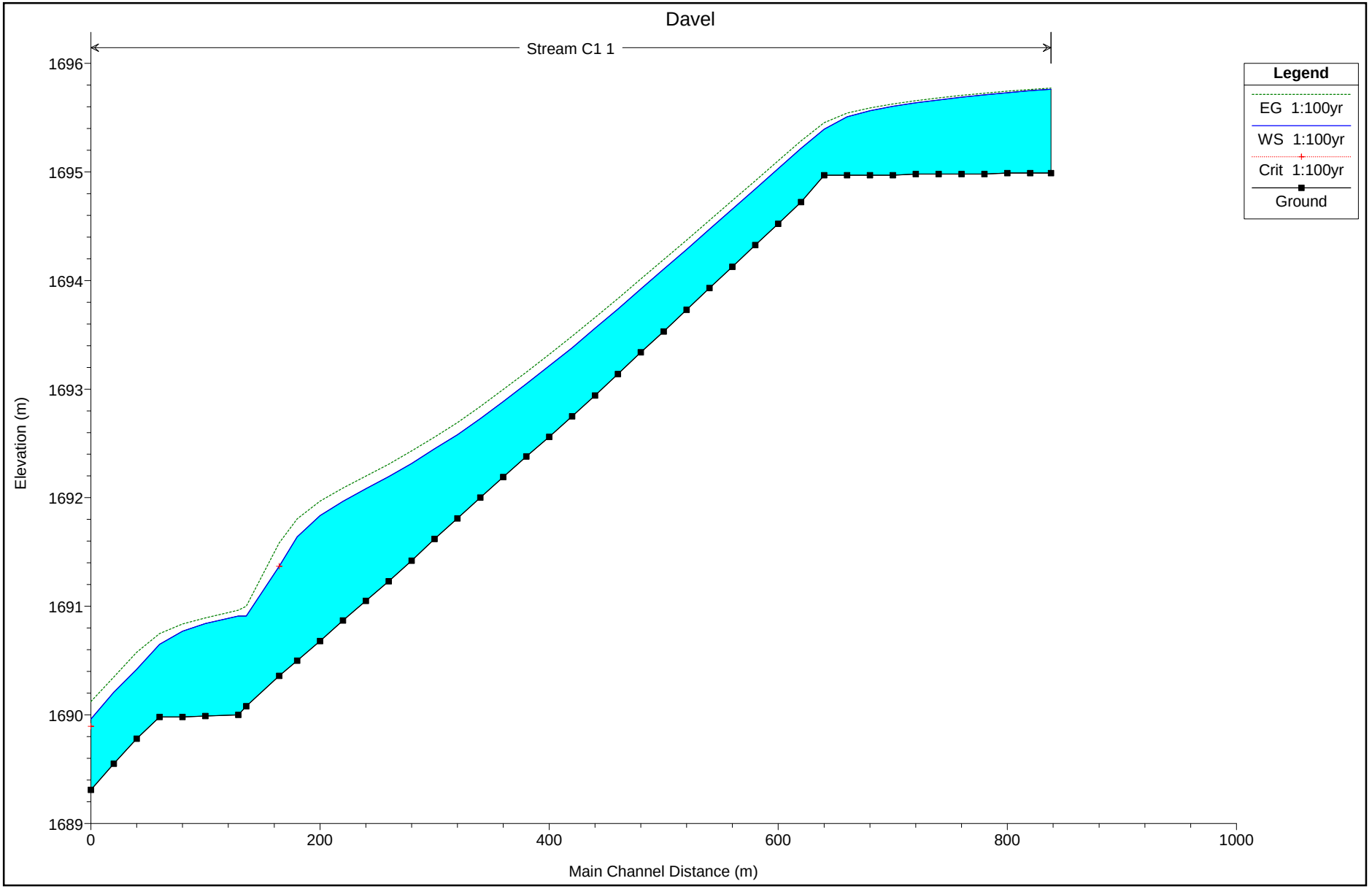
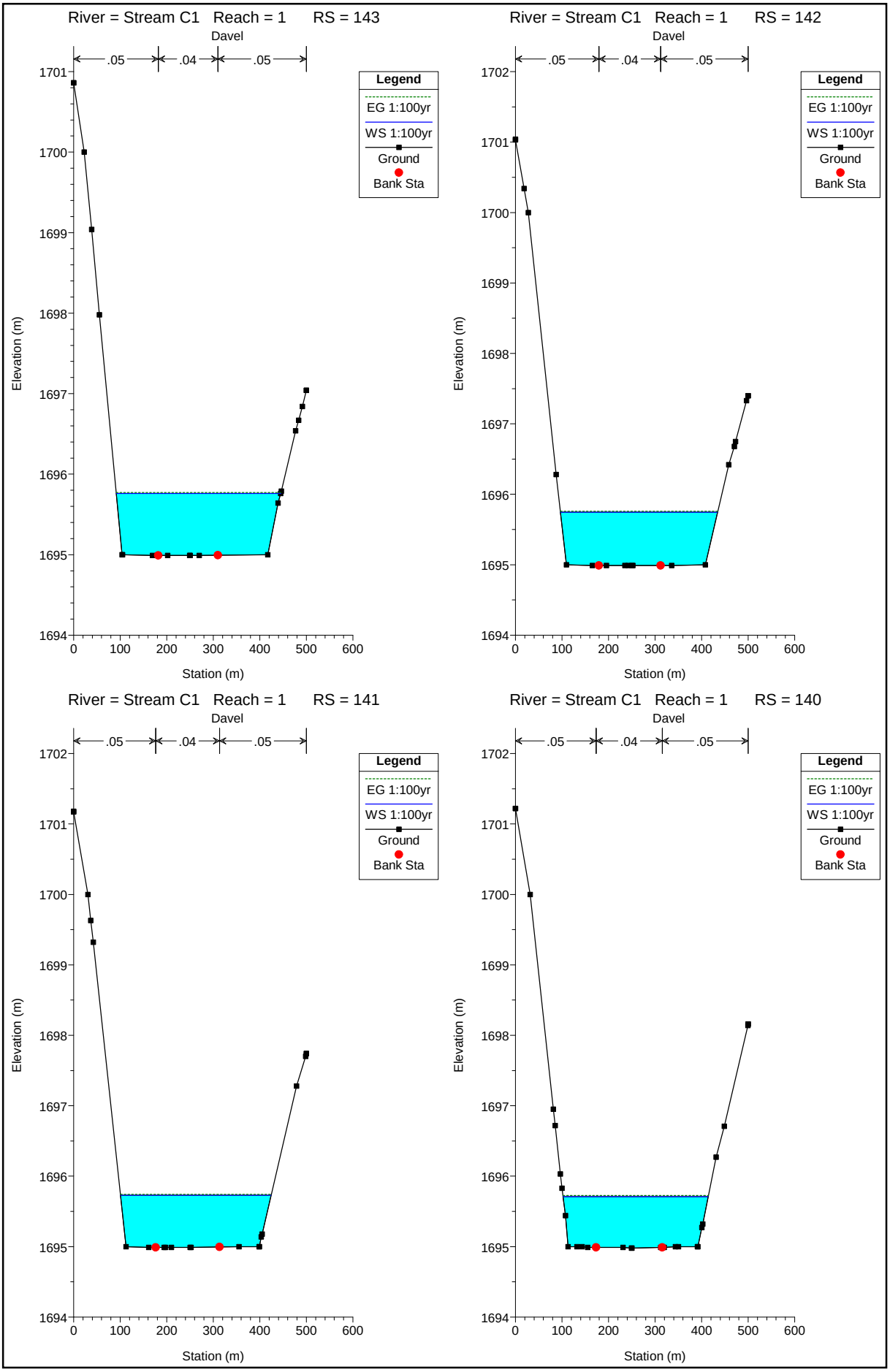
1	105	1:100yr	114.06	1689.98	1690.77		1690.84	0.003114	1.15	101.61	142.97	0.42
1	104	1:100yr	114.06	1689.98	1690.65		1690.75	0.005945	1.42	83.68	137.90	0.57
1	103	1:100yr	114.06	1689.78	1690.42		1690.58	0.012141	1.79	66.27	133.66	0.79
1	102	1:100yr	114.06	1689.55	1690.21		1690.35	0.010338	1.72	71.15	143.02	0.74
1	101	1:100yr	114.06	1689.31	1689.96	1689.90	1690.12	0.012005	1.86	67.69	140.77	0.79

ANNEXURE 4: LONGITUDINAL FLOW PROFILE FOR THE FLOOD PEAK


Davel
Stream C1 1
Legend
EG 1:100yr
WS 1:100yr
Crit 1:100yr
Ground
Elevation (m)
1696
1695
1694
1693
1692
1691
1690
1689
0
200
400
600
800
1000
Main Channel Distance (m)

ANNEXURE 5: FLOW CROSS SECTIONS FOR THE FLOOD PEAK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.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
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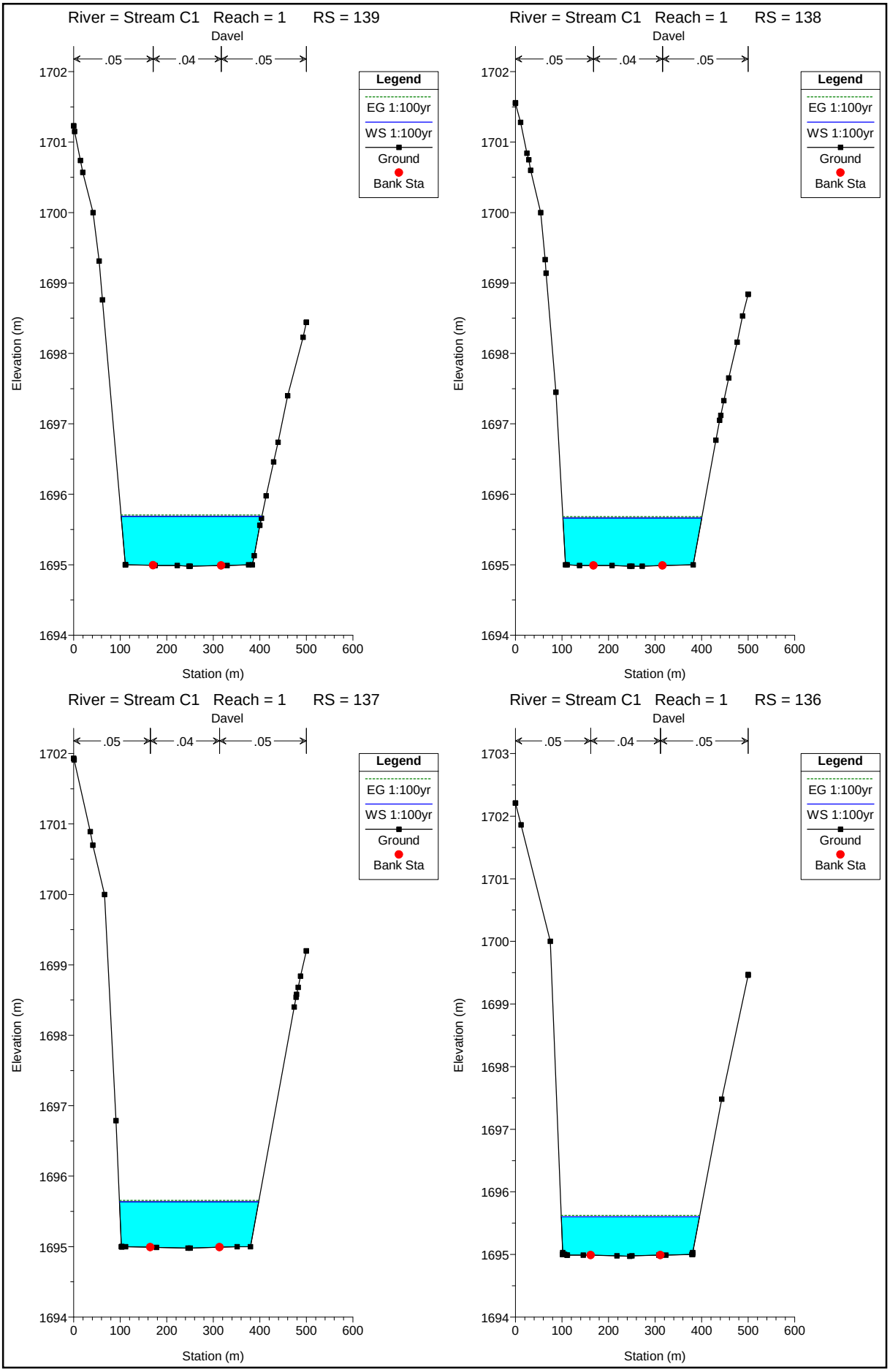
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WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Stream C1 Reach = 1 RS = 138
Davel
.05
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Stream C1 Reach = 1 RS = 137
Davel
.05
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Stream C1 Reach = 1 RS = 136
Davel
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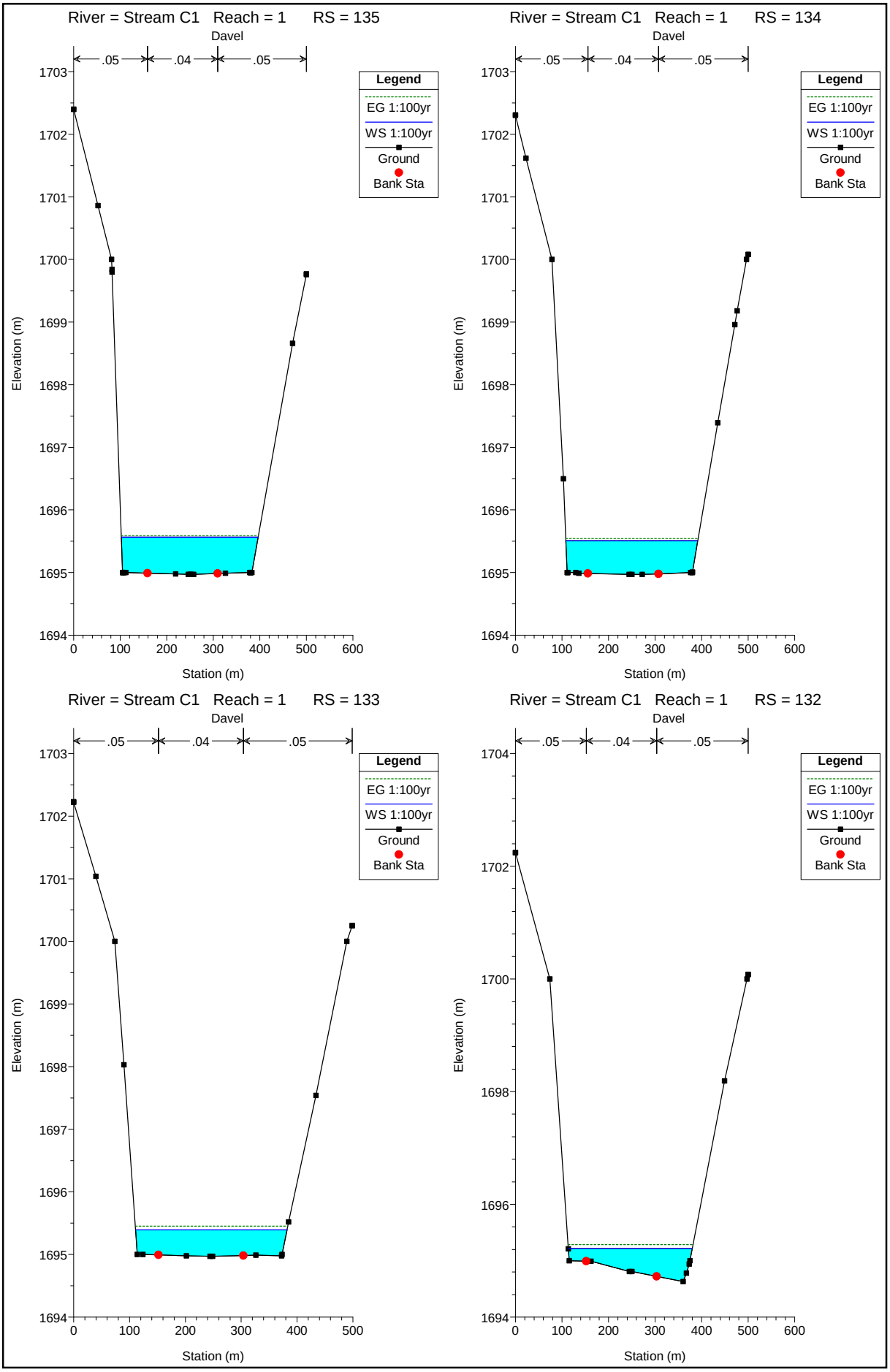
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)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.05
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
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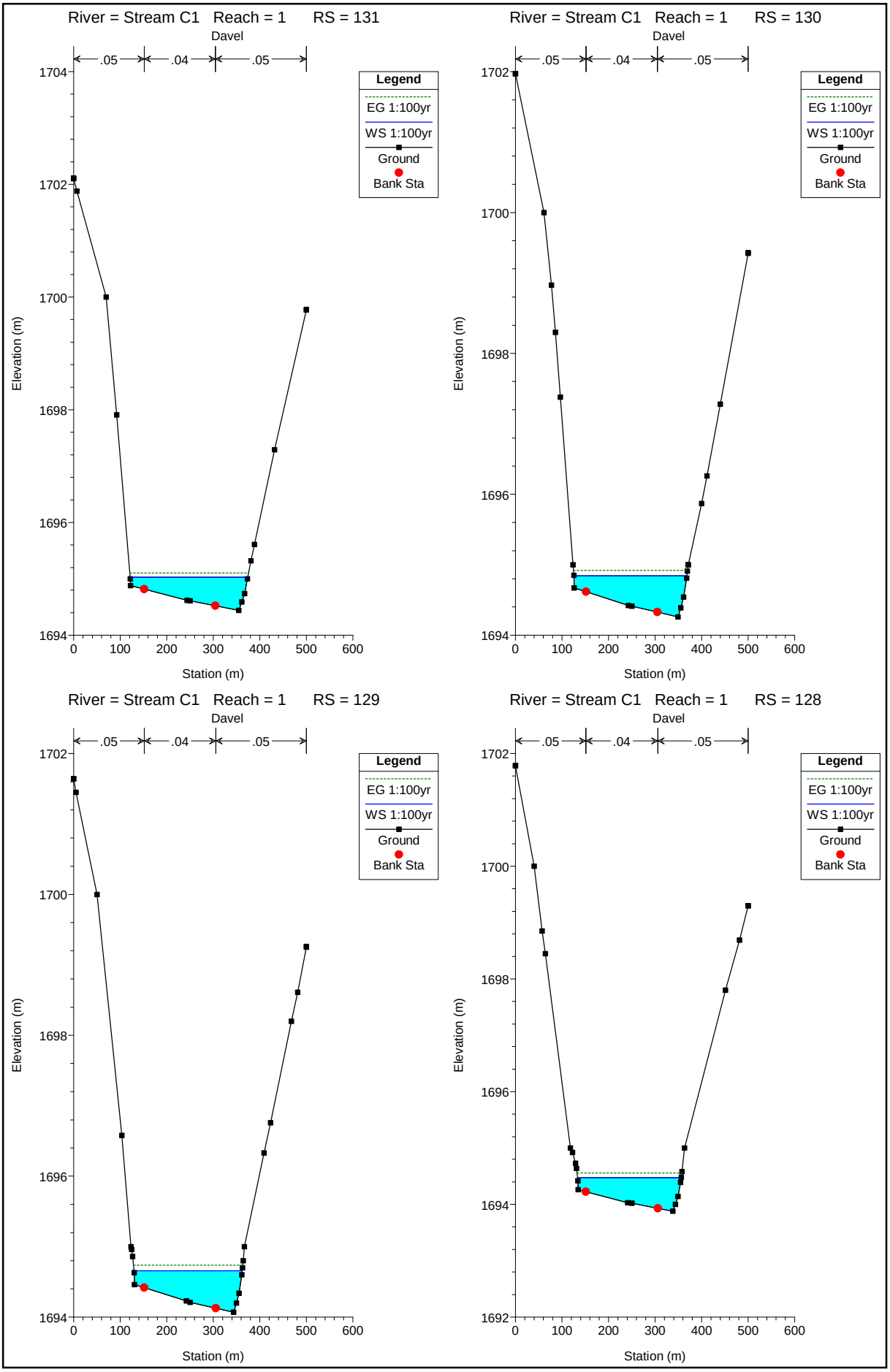
River = Stream C1 Reach = 1 RS = 131
Davel
.05
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
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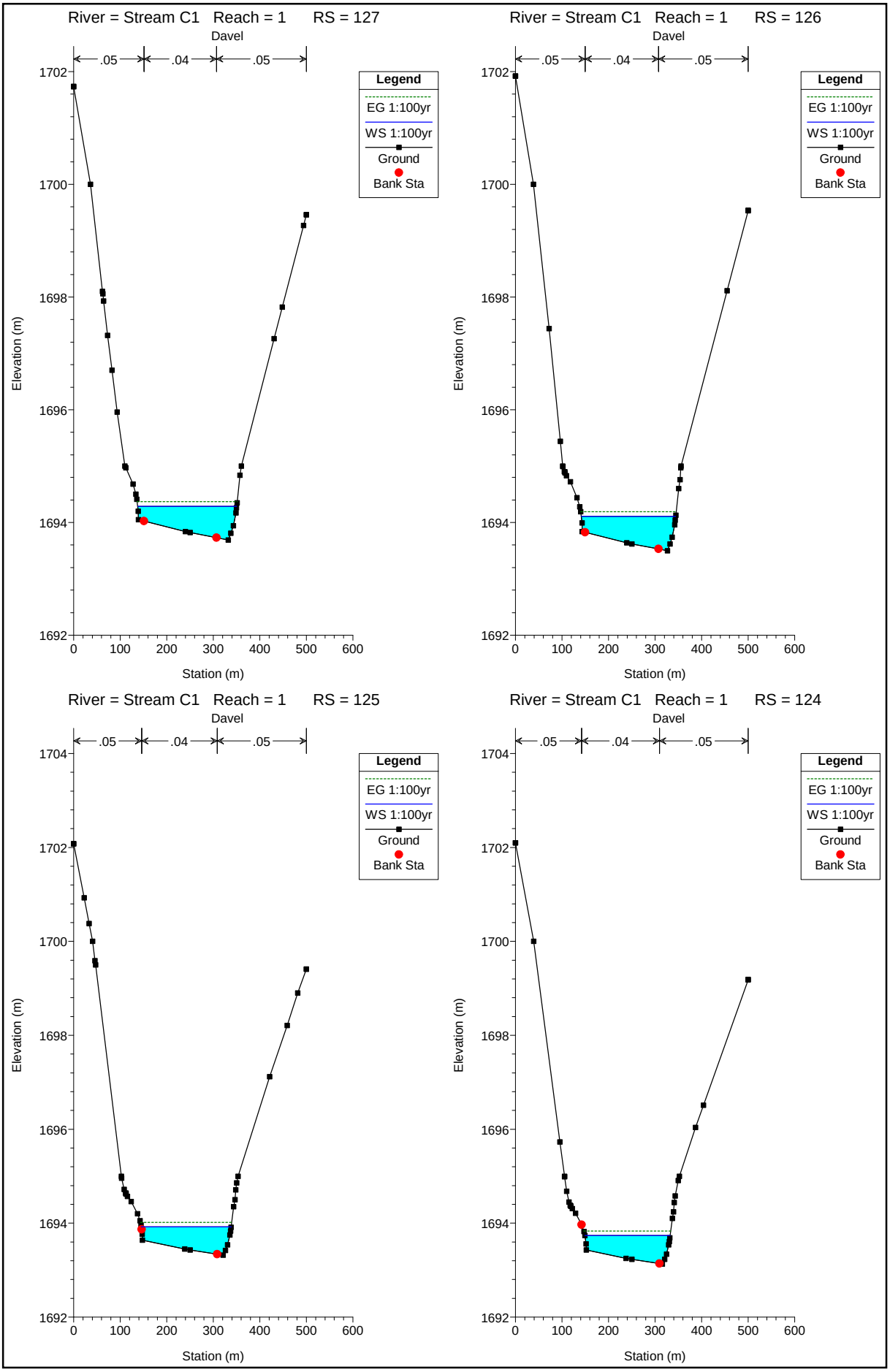
River = Stream C1 Reach = 1 RS = 129
River = Stream C1 Reach = 1 RS = 128


River = Stream C1 Reach = 1 RS = 127
Davel
.05
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
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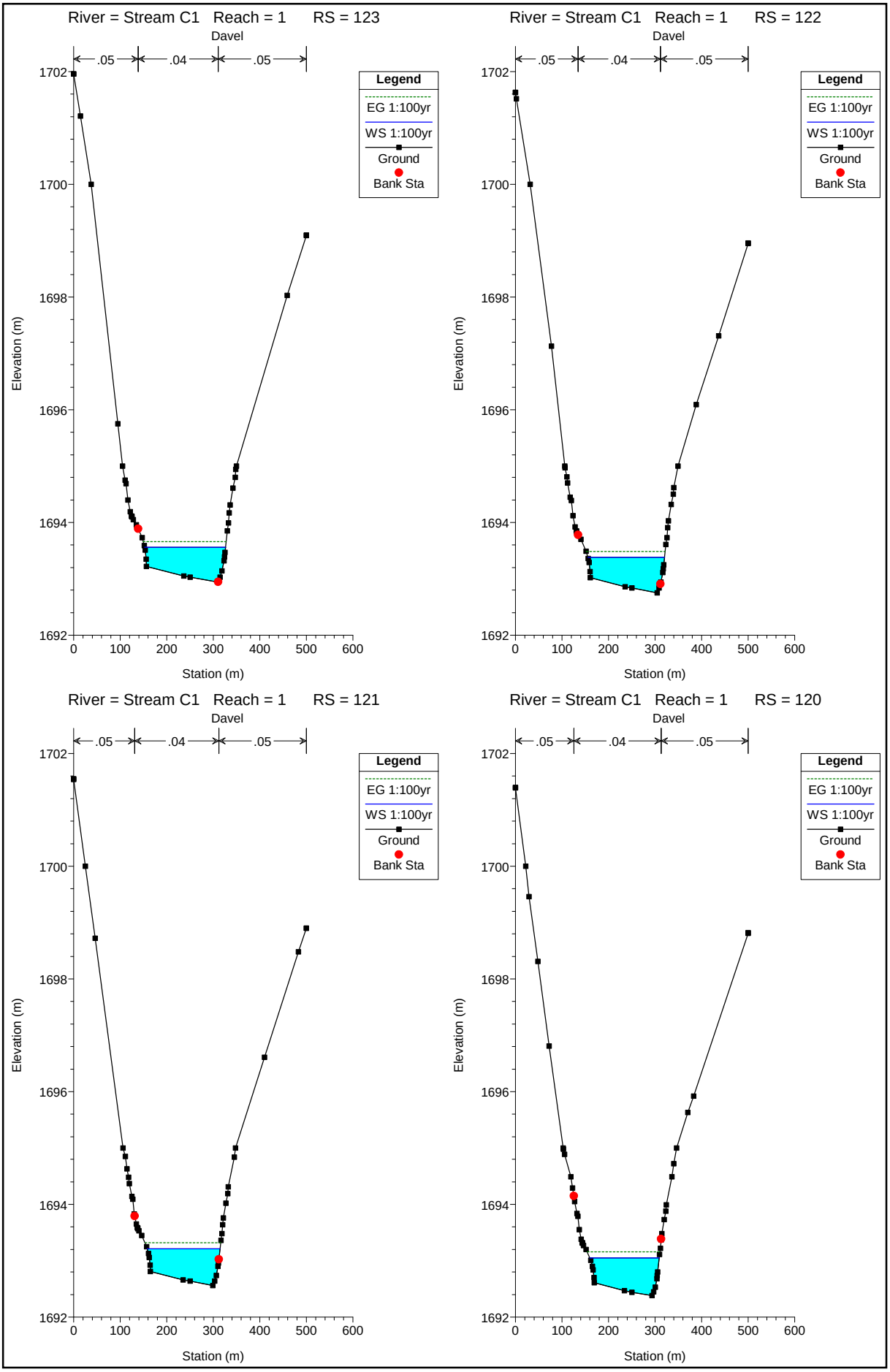
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Davel
.05
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Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
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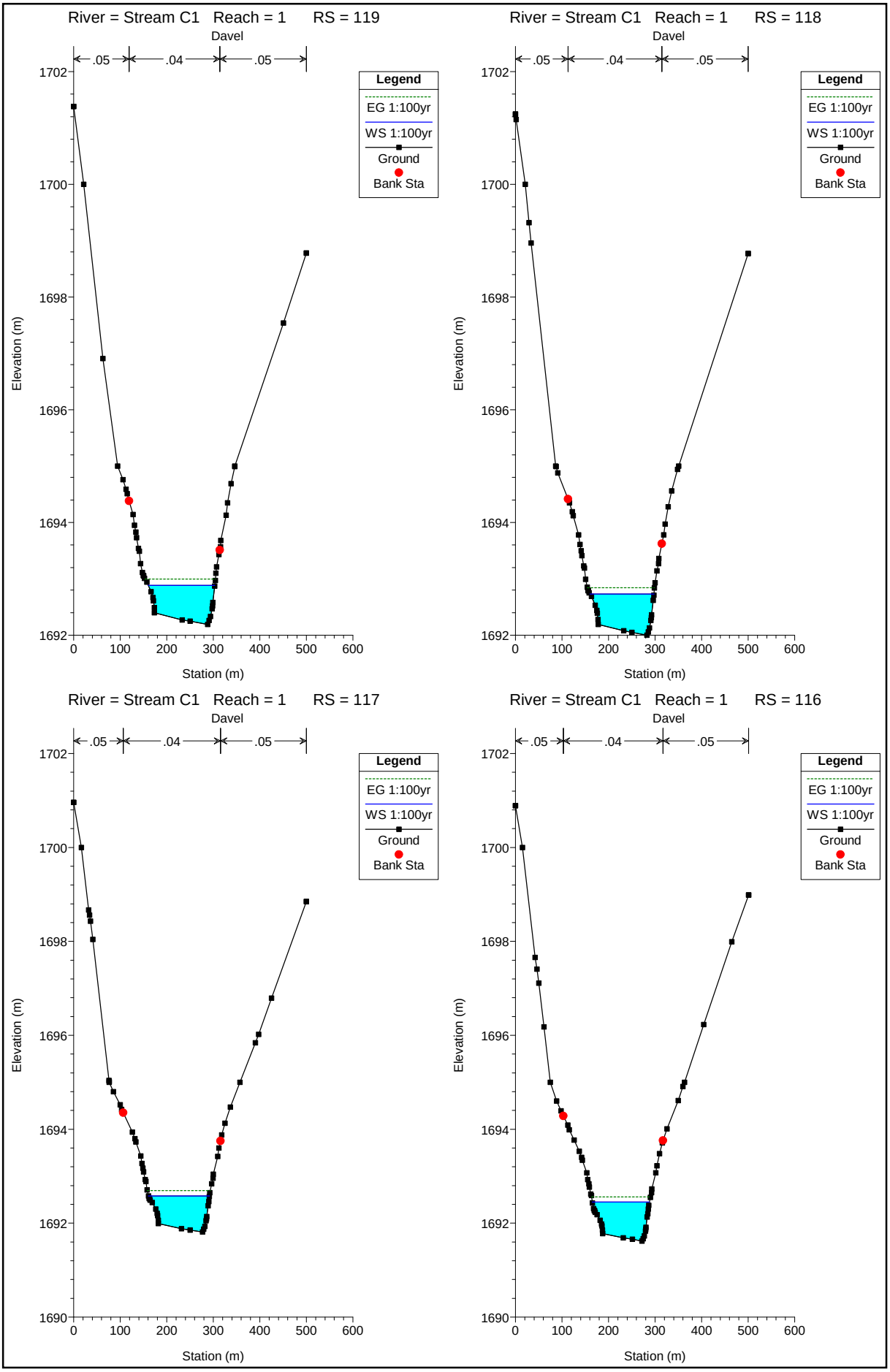
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Davel
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.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
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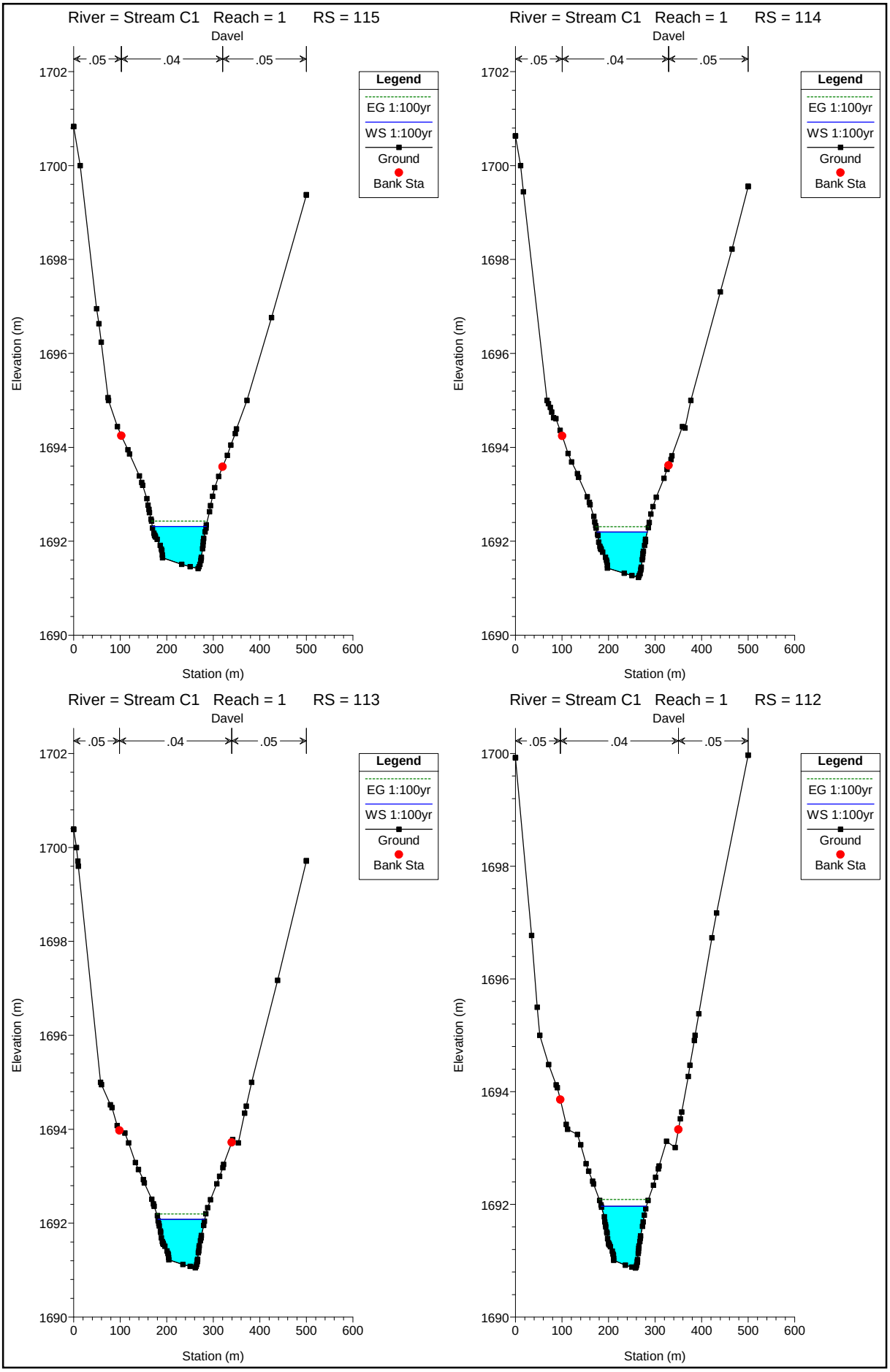
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Davel
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.04
.05
Legend
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WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Stream C1 Reach = 1 RS = 114
Davel
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.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Stream C1 Reach = 1 RS = 113
Davel
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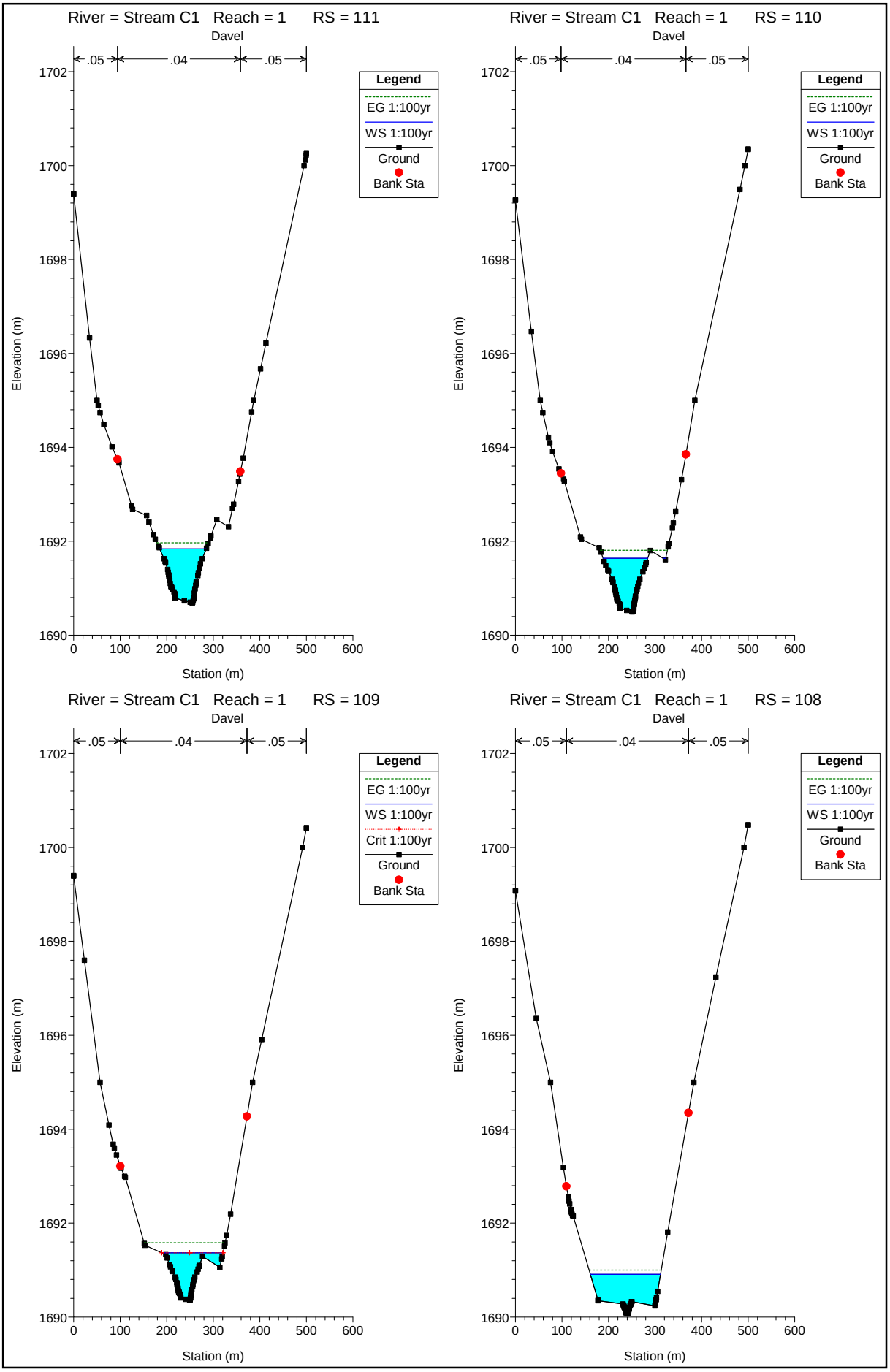
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)
River = Stream C1 Reach = 1 RS = 112
Davel
.05
.04
.05
Legend
EG 1:100yr
WS 1:100yr
Ground
Bank Sta
Elevation (m)
Station (m)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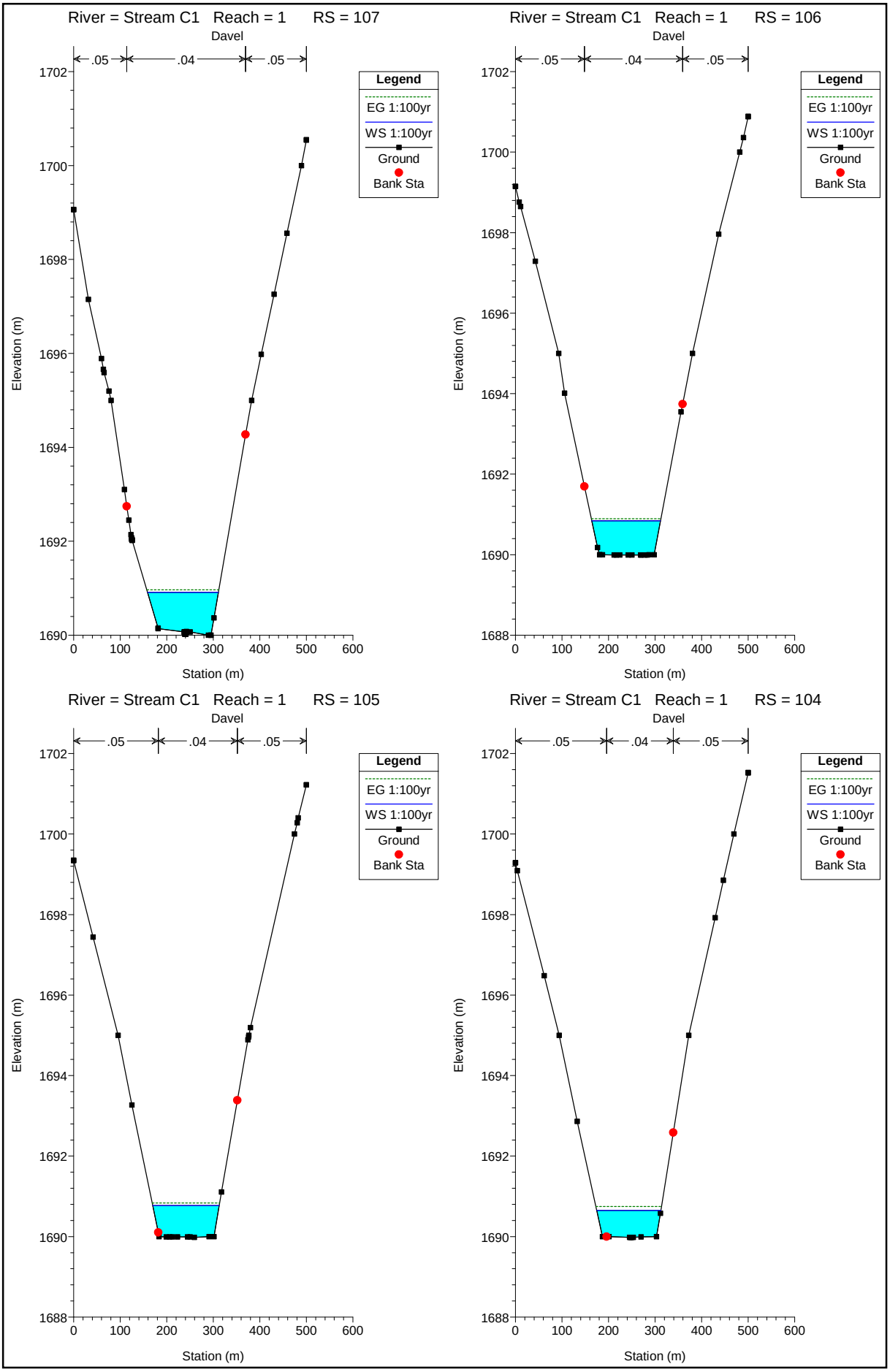
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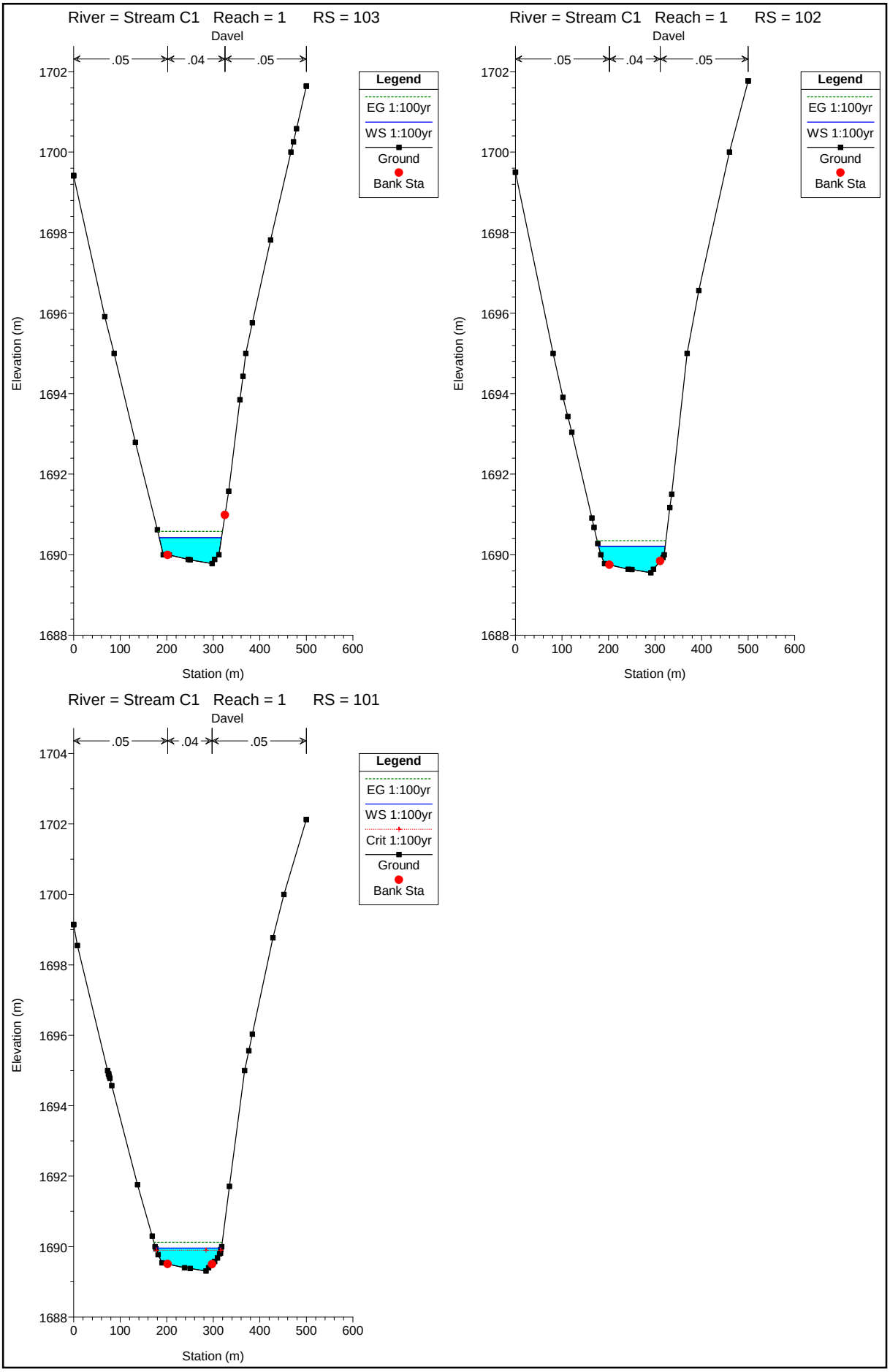
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Paleontological Report

Palaeontological Impact Assessment for the proposed formalisation of the Msukaligwa Informal Settlement, Davel, Mpumalanga Province

Desktop Study (Phase 1)

For

Mang Geoenviro Services

20 February 2022

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf
Experience: 34 years research and lecturing in Palaeontology
26 years PIA studies and over 350 projects completed

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Mang Geoenviro Services, Pretoria, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A Palaeontological Impact Assessment was requested for the proposed formalisation of the Msukaligwa Informal Settlement, just south of the town of Davel, Mpumalanga.

To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the potentially fossiliferous Vryheid Formation but it already very disturbed. In addition, boreholes cores indicated that the shales, the rock that would preserve fossils, is more than 10m below the ground surface. Any excavations for amenities are unlikely to reach the shales. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, environmental officer or other designated responsible person once excavations, drilling or mining activities have commenced. Since the impact will be low, as far as the palaeontology is concerned, the project should be authorised.

Table of Contents

1. Background

The Msukaligwa Informal Settlement is located immediately southwest of the town of Davel and north of the N17 highway. The farm is Davelfontein 267 (Figures 1-2). Davel is between Bethal and Ermelo and just north of the N17. The local municipality is proposing to formalise this settlement. Such an activity is likely to include excavations for the construction of roads, provision of electricity and pipes for freshwater and sewerage.

A Palaeontological Impact Assessment was requested for the Msukaligwa Informal Settlement project. To comply with the regulations of the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6).

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report,	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Section 8, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Sections 6, 8
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

Figure 1: Google Earth map of the general area to show the relative land marks. The Msukaligwa project area is shown by the red polygon.

Figure 2: Google Earth Map of the proposed formalisation of the Msukaligwa Informal settlement shown by the red outline. Note the area already has dwellings in place.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

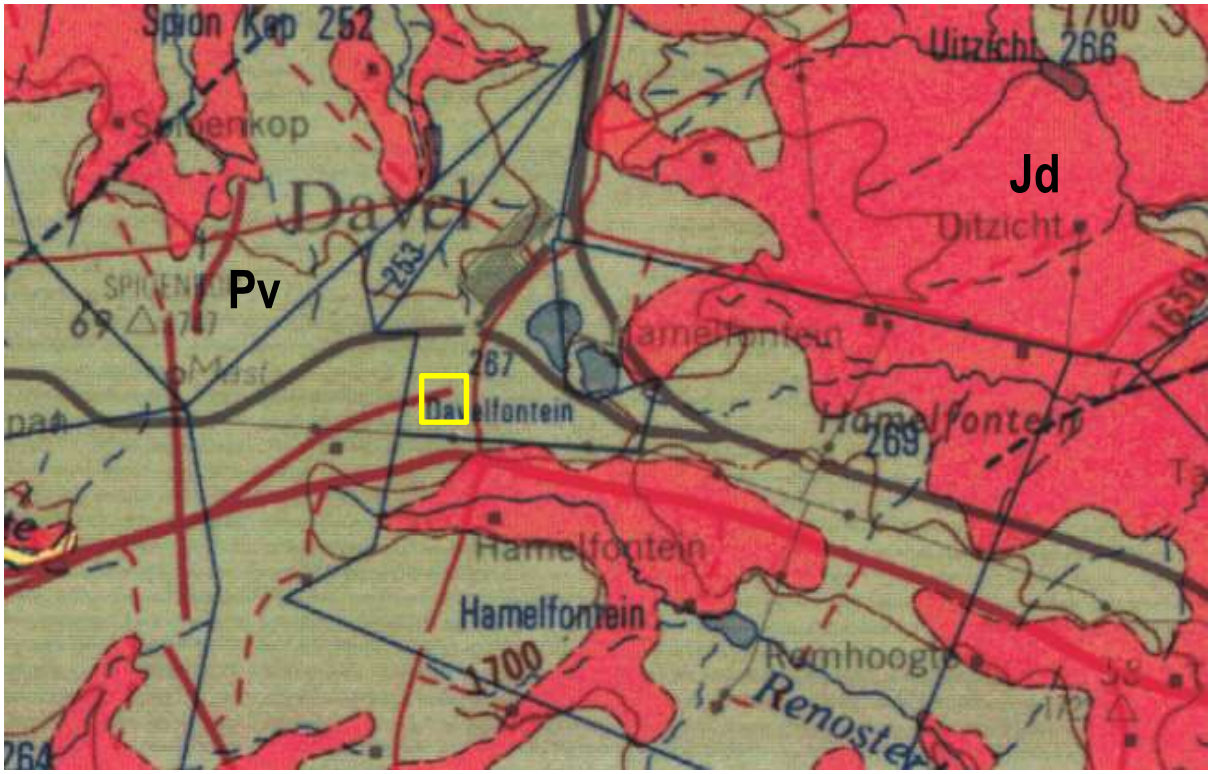

Figure 3: Geological map of the area around the Msukaligwa Informal Settlement just south of the town of Davel. The project area is indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006. Johnson et al., 2006; Partridge et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Quaternary Ca 1.0 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 183 Ma
Pv	Vryheid Fm, Ecca Group, Karoo SG	Shale, mudstone, coal, sandstone	Middle Permian ca 266 – 260 Ma

The project lies in the north eastern part of the main Karoo Basin where only the lower Karoo Supergroup sediments are exposed, in this case the Vryheid Formation (Figure 3).

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

During the Carboniferous Period South Africa was part of the huge continental landmass known as Gondwanaland and it was positioned over the South Pole. As a result, there were several ice sheets that formed and melted, and covered most of South Africa (Visser, 1986, 1989; Isbell et al., 2012). Gradual melting of the ice as the continental mass moved northwards and the earth warmed, formed fine-grained sediments in the large inland sea. These are the oldest rocks in the system and are exposed around the outer part of the ancient Karoo Basin, and are known as the Dwyka Group (Johnson et al., 2006).

Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the central and eastern part are the following formations, from base upwards: Pietermaritzburg, **Vryheid** and Volksrust Formations. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

Large exposures of Jurassic dolerite dykes occur throughout the area. These intruded through the Karoo sediments around 183 million years ago at about the same time as the Drakensberg basaltic eruption.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for development is in the Vryheid Formation.

The **Vryheid Formation** lies on the uneven topography of pre-Karoo or Dwyka Group rocks in the northern and northwestern margins, but lies directly on the Pietermaritzburg Formation in the central and eastern part. The lithofacies show a number of upward-coarsening cycles, some very thick, and they are essentially deltaic in origin. There are also delta-front deposits, evidence of delta switching, and fluvial deposits with associated meandering rivers, braided streams, back swamps or interfluves and abandoned channels (Cadle et al., 1993; Cairncross, 1990; 2001; Johnson et al., 2006). Coal seams originated where peat swamps developed on broad abandoned alluvial plains, and less commonly in the backswamps or interfluves. Most of the economically important coal seams occur in the fluvial successions (ibid). In the east (Mpumalanga and northern KwaZulu Natal), the Vryheid formation can be subdivided into a lower fluvial-dominated deltaic interval, a middle fluvial interval, and an upper fluvial-dominated deltaic interval again (Taverner-Smith et al., 1988).

Fossil plants of the *Glossopteris* flora occur in the Vryheid Formation. This flora includes *Glossopteris* leaves, seeds, fructifications, roots and wood, as well other groups such as the lycopods, sphenophytes, ferns, cordaitaleans and early gymnosperms (Plumstead, 1969; Anderson and Anderson, 1985; Bamford, 2004).

Dolerite is an igneous intrusive rock (volcanic origin) and does not preserve fossils.

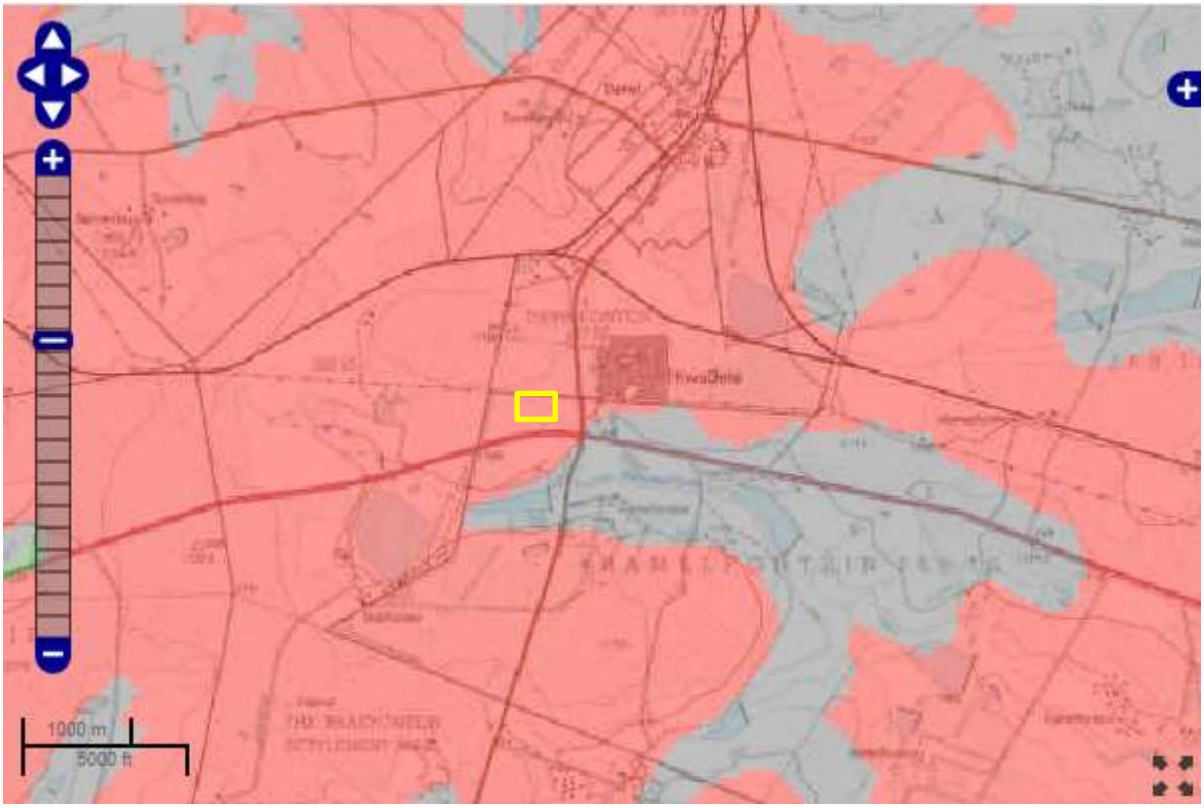

Figure 4: SAHRIS palaeosensitivity map for the site for the Msukaligwa Informal Settlement shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as very highly sensitive (red) so in most cases a site visit would be required. The site is relatively small and is already highly disturbed by the dwellings that are in place. Formalisation would require the addition of amenities such as roads, electricity and pipes for fresh water and sewerage. The excavations for these facilities are usually only a few metres deep. According to the borehole cores described for the Ermelo Coalfield (Snyman, 1998, Fig 17), the top of the core has soils and sandstones overlying the uppermost coal seam, between 10-20m below the surface. The shales (the material that might preserve fossil plants) are below the uppermost coal seam. It is very unlikely that any fossils occur on the ground surface or in the upper 10m of rock.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

Table 3a: Criteria for assessing impacts

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

Table 3b: Impact Assessment

PART B: Assessment		
SEVERITY/NATURE	**H**	-
	M	-
	L	Soils do not preserve fossils; so far there are no records from the Vryheid Fm of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be negligible
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be fossil plants in the shales and these are more than 10m below the ground surface, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is extremely unlikely that any fossils would be found in the loose soils and sands that cover the area or in the upper 10m of soil and rock that will be excavated for amenities. Nonetheless, a Fossil Chance Find Protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the right age to contain fossils but any shales are more than 10m below the ground surface. Furthermore, the material to be excavated is soil and this does not preserve fossils. Since there is an extremely small chance that fossils from the Vryheid Formation below the surface may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and the shales might contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a very small chance that fossils may occur in shales of the early Permian Vryheid Formation that occur more than 10m below the ground surface, according to boreholes cores, so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations for amenities have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low so as far as the palaeontology is concerned, the project should be authorised.

7. References

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Bamford, M.K. 2004. Diversity of woody vegetation of Gondwanan southern Africa. Gondwana Research 7, 153-164.

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Cairncross, B., 1990. Tectono-sedimentary settings and controls of the Karoo Basin Permian coals, South Africa. International Journal of Coal Geology 16, 175-178.

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Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

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Snyman, C.P., 1998. Coal. In: Wilson, M.G.C., and Anhaeusser, C.P., (Eds). The Mineral Resources of South Africa: Handbook, Council for Geosciences 16, 136-205.

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8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone or coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 5). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

9. Appendix A – Examples of fossils from the Vryheid Formation

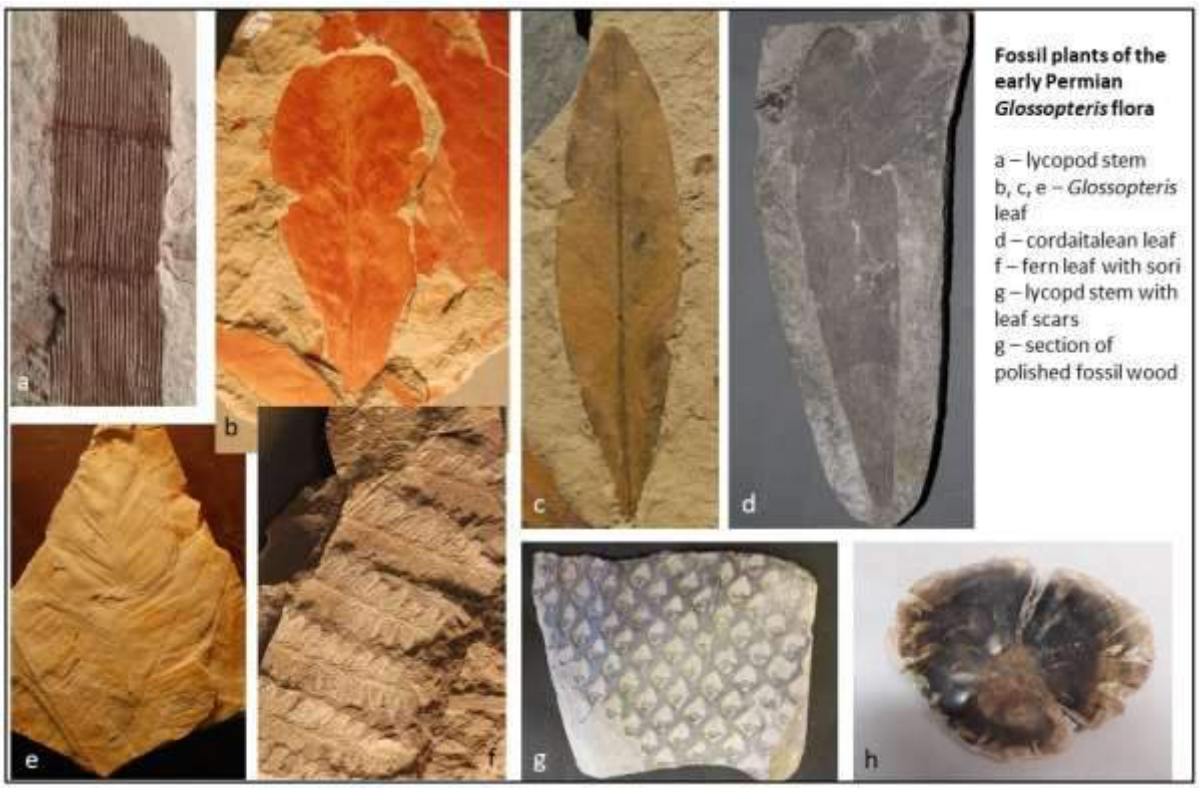

Figure 5: Photographs of fossil plants of the *Glossopteris* flora that might occur in the Vryheid Formation.

10. Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
January 2023

Present employment: Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DSI Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa

Telephone : +27 11 717 6690

Cell : 082 555 6937

E-mail : marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) **Academic qualifications**

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) **Professional qualifications**
Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) **Membership of professional bodies/associations**
Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

v) **Supervision of Higher Degrees**

All at Wits University

Degree	Graduated/completed	Current
Honours	13	0
Masters	13	3
PhD	13	7
Postdoctoral fellows	14	4

vi) **Undergraduate teaching**
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 12 - 20 students per year.

vii) **Editing and reviewing**
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Associate Editor: Cretaceous Research: 2018-2020
Associate Editor: Royal Society Open: 2021 -
Review of manuscripts for ISI-listed journals: 30 local and international journals

viii) **Palaeontological Impact Assessments**
25 years' experience in PIA site and desktop projects

- Selected from recent projects only – list not complete:
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for Enviropro
- Frankfort-Windfield Eskom Powerline 2020 for 1World
- Beaufort West PV Facility 2021 for ACO Associates
- Copper Sunset MR 2021 for Digby Wells
- Sannaspos PV facility 2021 for CTS Heritage
- Smithfield-Rouxville-Zastron PL 2021 for TheroServe
- Glosam Mine 2022 for AHSA
- Wolf-Skilpad-Grassridge OHPL 2022 for Zutari
- Iziduli and Msenge WEFs 2022 for CTS Heritage
- Hendrina North and South WEFs & SEFs 2022 for Cabanga
- Dealesville-Springhaas SEFs 2022 for GIBB Environmental
- Vhuvhili and Mukondelei SEFs 2022 for CSIR
- Chemwes & Stilfontein SEFs 2022 for CTS Heritage
- Equestria Exts housing 2022 for Beyond Heritage
- Zeerust Salene boreholes 2022 for Prescali
- Tsakane Sewer upgrade 2022 for Tsimba
- Transnet MPP inland and coastal 2022 for ENVASS
- Ruighoek PRA 2022 for SLR Consulting (Africa)
- Namli MRA Steinkopf 2022 for Beyond Heritage

ix) **Research Output**
Publications by M K Bamford up to January 2022 peer-reviewed journals or scholarly books: over 170 articles published; 5 submitted/in press; 14 book chapters.
Scopus h-index = 30; Google Scholar h-index = 39; -i10-index = 116 based on 6568 citations.
Conferences: numerous presentations at local and international conferences.

Appendix G: Environmental Management Programme

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED FORMALIZATION OF THE DAVEL TOWNSHIP ON PORTION OF THE FARM DAVELFONTEIN 267-IS WITHIN THE JURISDICTION OF MSUKALIGWA LOCAL MUNICIPALITY IN MPUMALANGA PROVINCE

REF NO:

JUNE 2023

PREPARED FOR:

Msukaligwa Local Municipality
Cnr Taute and Church Street
Ermelo, 2350

PREPARED BY:

687 Silverlakes Road,

Unit 11 King Fisher Building

Hazeldean Office Park

0081

Phone: +27 72 573 2390 / +27 12 770 4022

Email: info@manggeoenviro.co.za

Web: www.manggeoenviro.co.za

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DECLARATION OF INTEREST

I, **Phakwago Kabelo**, as authorised representative of Mang Geoenviro Services hereby confirm my independence as an Environmental Assessment Practitioner and declare that neither I nor Mang Geoenviro Services have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Mang Geoenviro Services was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Environmental Authorisation process for the formalization of Davel township.

Signature: …….. **Date:** ……..

ABBREVIATIONS

Contractor	(C)
Designated Environmental Officer	(DEO)
Department of Agriculture, Rural development, Land & Environmental affairs	(DARDLEA)
Department of Energy	(DE)
Environmental Management Programme/ Plan	(EMPR)
Independent Environmental Auditor	(IEA)
Environmental Control Officer	(ECO)
Environmental Consultant	(EC)
Environmental Assessment Practitioner	(EAP)
Employer's Representative/ Implementing Agent	(ER)
Operations Manager	(OM)

APPENDICES

Appendix A – Environmental Code of Conduct

Appendix B – Environmental Complaints Registers

Appendix C – Environmental Incidents Registers

Appendix D – Environmental Training Register

Annexure E – EA / ROD

Appendix F – EAP CV/ Expertise

DEFINITIONS

Construction:

Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.

Disturbance:

Any event or series of events that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment.

Earth Works:

This involves construction machinery, dampening and general preparation of the site for construction purposes.

Environmental Incident:

- *Any action undertaken (or omitted) by the proponent or his duly appointed representatives (e.g. contractors) that results in overly/unnecessary disturbance or damage to the environment.*
- *Any action undertaken (or omitted) by the proponent or his duly appointed representatives (e.g. contractors) that could lead to (has potential for) overly/unnecessary disturbance or damage to the environment.*
- *Non-adherence to environmental legal requirements/laws (including the stipulations of authorisations issued in respect of a proposed activity e.g. those contained in a Record of Decision).*

Environmental Management Plan:

A guideline document/directive outlining the Plan (EMP) for mitigation, monitoring and institutional measures to be taken during project implementation and operation to avoid or control adverse environmental impacts, as well as the actions needed to implement these measures (World Bank, 1999:1).

Environmental Officer:

Person/party appointed to monitor compliance with the Environmental Management Plan.

Formalisation:

To make formal, especially for the sake of official or authorized acceptance.

Interested & Affected party:

A person, group of people, an organisation (public or private), a business, or other party that has an interest or is affected in terms of their health, property rights, or economy by a proposed activity.

Impact:

A description of the potential effect or consequence of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Mitigation Measures:

Mitigation measures encompass all actions taken to eliminate, offset or reduce potentially adverse environmental impacts to acceptable levels (World Bank, 1999:1).

1 INTRODUCTION

1.1 Objectives of an EMPr

The EMPr has been compiled to provide recommendations and guidelines according to which compliance monitoring can be done during the establishment and operation of the proposed development in Davel under the jurisdiction of Msukaligwa Local Municipality in Mpumalanga Province. The objective of the EMPr is also to ensure that all relevant factors are considered to ensure an environmentally responsible development. The purpose of the EMPr is to provide specifications for "good environmental practice" for application during these phases.

This EMPr informs all relevant parties (the Project Coordinator, the Contractor, the Environmental Control Officer (ECO)) and all other staff employed by the contractor at the site as to their duties in the fulfilment of the legal requirements for the establishment and operation of the proposed development in Davel township, with particular reference to the prevention and mitigation of anticipated potential environmental impacts.

All parties should note that obligations imposed by the EMPr are legally binding in terms of the environmental authorisation granted by the relevant environmental permitting authority.

The objectives of an EMPr are to:

- Ensure compliance with regulatory authority stipulations and guidelines which may be local, provincial, national and/or international;
- Ensure that there is sufficient allocation of resources on the project budget so that the scale of EMPr-related activities is consistent with the significance of project impacts;
- Verify environmental performance through information on impacts as they occur;
- Respond to unforeseen events;
- Provide feedback for continual improvement in environmental performance;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts to minimal or insignificant levels;
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;
- Identify measures that could optimize beneficial impacts;
- Create management structures that addresses the concerns and complaints of I&APs with regards to the development;
- Establish a method of monitoring and auditing environmental management practices during all phases of the activity;
- Ensure that safety recommendations are complied with;
- Specify time periods within which the measures contemplated in the final environmental management programme must be implemented, where appropriate;

Structure and Function of an EMPr

An EMPr is focused on sound environmental management practices, which will be undertaken to minimise adverse impacts on the environment through the lifetime of a development. In addition, an EMPr identifies what measures will be in place or will be actioned to manage any incidents and emergencies that may occur during operation of the facility.

As such the EMPr provides specifications that must be adhered to, in order to minimise adverse environmental impacts associated with the construction and operations of the Davel township. The content of the EMPr is consistent with the requirements as set out in Appendix 4 of the EIA regulations stated below, for the construction and operation phases.

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(a) Details of –

(i) The EAP who prepared the environmental management programme; and

(ii) The expertise of the EAP to prepare an environmental management programme, including curriculum vitae;

(b) A detailed description of the aspects of the activity that are covered by the draft environmental management programme as identified by the project description;

(c) A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;

(d) Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of –

(i) Planning and design;

(ii) Pre-construction;

(iii) construction activities;

(iv) Rehabilitation of the environment after construction and where applicable post closure; and

(v) where relevant, operation activities;

(e) a description and identification of impact outcomes required for the aspects contemplated in (d).

(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable include actions to –

(i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;

(ii) Comply with any prescribed environmental management standards or practices;

(iii) Comply with any applicable provisions of the Act regarding closure, where applicable;

(iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;

(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);

(h) The frequency of monitoring the implementation of the impact management actions contemplated in (f);

(i) An indication of the persons who will be responsible for the implementation of the impact management actions;

(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;

(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);

(l) A program for reporting on compliance, taking into account the requirement as prescribed by the regulations;

(m) An environmental awareness plan describing the manner in which –

(i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and

(ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and

(n) Any specific information that may be required by the competent authority.

1.2 Legal Requirements

The proposed formalization of Davel township must be established according to the best industry practices, as identified in the project documents. This EMPr, which forms an integral part of the contract documents, informs the Contractor as to his/her duties in the fulfilment of the project objectives, with particular reference to the prevention and mitigation of environmental impacts caused by construction activities associated with the project. The

Contractor should note that obligations imposed by the approved EMPr are legally binding in terms of environmental statutory legislation and in terms of the additional conditions to the general conditions of contract that pertain to this project. In the event that any rights and obligations contained in this document contradict those specified in the standard or project specifications then the latter shall prevail.

The Contractor shall identify and comply with all South African national and provincial environmental legislation, including associated regulations and all local by-laws relevant to the project. Key legislation currently applicable to the construction and implementation phases of the project must be complied with.

The list of applicable legislation provided below is intended to serve as a guideline only and is not exhaustive: -

- Constitution Act (No. 108 of 1996)
- Environmental Conservation Act (No. 73 of 1989)
- EIA Regulations (2010)
- National Environment Management Act (No. 107 of 1998)
- National Environmental Management: Biodiversity Act (No. 10 of 2004)
- National Water Act (No. 36 of 1998)
- National Environmental Management: Waste Management Act (No. 59 or 2008)
- National Heritage Resource Act (No. 25 of 1999)
- Informal Land Rights Act (No. 109 of 1996)
- National Forests Act (No. 84 of 1983)
- National Heritage Resource Act (No. 25 of 1999)
- Occupational Health and Safety Act (No. 85 of 1993)

1.3 Environmental Authorization

In accordance with the requirements of the National Environmental Management Act (Act No 107 of 1998) (NEMA), and relevant EIA regulations made in terms of this Act and promulgated in August, 2010 and amended in 2014 (Government Notice 982), and listed activities under (Government Notice R 983, 984, 985), the proposed project activities were subjected to a Section 24G process.

In terms of the EIA process, all reports generated from the environmental studies form part of a series of documents for the project. The Section 24G process identified current and potentially significant environmental impacts and was the main report in the series. Additional Specialist Assessments served to supplement the assessment contained in the Section 24G report.

This Environmental Management Programme (EMPr) interprets the findings of the Section 24G report, and prescribes project-specific specifications to be achieved. In addition to the requirements of Appendix 4 of GNR 982, this EMPr is based on the principles of Integrated Environmental Management (IEM).

2 DETAILS OF THE EAP

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(a) Details of –

(i) The EAP who prepared the environmental management programme; and

(ii) The expertise of the EAP to prepare an environmental management programme, including curriculum vitae;

Environmental Consulting Company:

Mang Geoenviro Services (Pty) Ltd

687 Silverlakes Road

Unit 11 Kingfisher Building

Hazeldean Office Park

0182

Tel: 012 770 4022

Email: kabelo@manggeoenviro.co.za

Project Team:

Phakwago M. Kabelo

3 PROPOSED ACTIVITY

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(b) A detailed description of the aspects of the activity that are covered by the draft environmental management programme as identified by the project description;

(c) A map at an appropriate sale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;

3.1 Description of proposed activity

The proposed development entails formalization of the Davel township on a portion of farm Davelfontein 267-IS on an extent area of approximately 38.57 hectares within the Msukaligwa Local Municipality in Mpumalanga

Province. The proposed development site is currently occupied by illegal occupants; therefore, the municipality has the intentions of addressing the issue and formalize the area.

Latitude: 26°27'46.52 S

Longitude: 29°39'18.98 E.

Figure 1: Locality map of the proposed development site.

4 THE RECEIVING ENVIRONMENT

4.1 Vegetation

The site falls under grassland biome vegetation characterized by sparse shrubs. Grassland is the main biome of the area. The site is located under Amersfoort clay grassland.

4.2 Climate

According to the Köppen-Geiger climate classification system, the proposed sites fall within the Cwb zone (Climate-Data.Org, 2019). The area experiences more rainfalls in summer than in winter with July as the driest month with approximately 9 mm of rain. The greatest amount of precipitation occurs in December, with an average of 158 mm. The average annual temperature here is 14.9 °C. The temperatures are highest on average in February, at around 18.4 °C. The coldest month of the year is July with an average around of 9 °C.

4.3 Geology

The proposed development site is situated on a lithologies of the Vryheid formation. This formation has been subdivided into three different lithofacies arrangements. They are dominated by fine-grained mudstone, carbonaceous shale with alternating layers of bituminous coal seams, and coarse-grained, bioturbated immature sandstones respectively.

4.4 Topography

Topography of the area is characterized of flat, gentle land scape. Locality is falling within the Highveld area of the country and province. Lies at the altitude of 1731m above sea level. Landscape of the area is flat.

5 SCOPE OF THE EMPR

In order to ensure a holistic approach to the management of environmental impacts during the establishment and operation of the proposed development, this EMPr sets out the methods by which proper environmental controls are to be implemented by the Contractor and all other parties involved.

The EMPr is a dynamic document subject to influences and changes as are wrought by variations to the provisions of the project specification.

5.1 Layout of the EMPr

The EMPr is divided into three phases of development. Each phase has specific issues unique to that period of the construction and operation of the proposed development. The impacts are identified and given a brief description. The three phases of the development are then identified as below:

5.1.1 Planning and Design Phase

This section of the EMPr provides management principles for the planning and design phase of the project. Environmental actions, procedures and responsibilities as required from the developer during the planning and design phase are specified. These specifications will form part of the contract documentation and therefore the Contractor will be required to comply with these specifications to the satisfactory of the Project Coordinator and ECO.

5.1.2 Pre-Construction Phase

This section of the EMPr provides management principles for the preconstruction phase of the project. Environmental actions, procedures and responsibilities as required during the preconstruction phase are specified. These specifications will form part of the contract documentation and therefore the Contractor will be required to comply with these specifications to the satisfactory of the Project Coordinator and ECO.

5.1.3 Construction Phase

This section of the EMPr provides management principles for the construction phase of the project. Environmental actions, procedures and responsibilities as required during the construction phase are specified. These specifications will form part of the contract documentation and therefore the Contractor will be required to comply with these specifications to the satisfactory of the Project Coordinator and ECO.

5.1.4 Operational and Maintenance Phase

This section of the EMPr provides management principles for the operation and maintenance phase of the project. Environmental actions, procedures and responsibilities as required from the developer during the operation and maintenance phase are specified.

6 MITIGATION AND MANAGEMENT MEASURES

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(d) Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of –

(i) Planning and design;

(ii) Pre-construction;

(iii) Construction activities;

(iv) Rehabilitation of the environment after construction and where applicable post closure; and

(v) where relevant, operation activities;

(e) a description and identification of impact outcomes required for the aspects contemplated in (d).

(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable include actions to –

(i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;

(ii) Comply with any prescribed environmental management standards or practices;

(iii) Comply with any applicable provisions of the Act regarding closure, where applicable;

(iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;

Table 5.1 impacts and mitigation measures associated with the proposed formalization of the Davel township.

PLANNING/ DESIGNING PHASE	RESPONSIBILITY	MONITORING	TIMEFRAME
Signing of service agreement between the applicant and the relevant service providers	Applicant	Applicant	Once off
Appointment of the contractor	Applicant	Applicant	Once off
CONSTRUCTION PHASE	**RESPONSIBILITY**	**MONITORING**	**TIMEFRAME**
Layout			
The Contractor is to adhere to the following with regards to the Materials Storage Area and Contractors Camp: ✓ All servitudes and existing services must be verified prior to construction; ✓ The camp site must be fenced before construction commences; and ✓ Site establishment shall not take place on steep slopes, within 50m of wetland areas and watercourses (including drainage lines), or sites declared as no-go areas.	C	ER & DEO	Before construction
Adequate parking must be provided for site staff and visitors. This must be demarcated so not as to encroach into the surrounding environment.	C	ER & DEO	Duration of Construction Phase
Temporary Fencing			
Areas where construction activities (including temporary access tracks) are prohibited are referred to as no-go areas. Entry into these areas by any person, vehicle or equipment without the ER's written permission will result in a penalty.	C	ER & DEO	Duration of Construction Phase

The Contractor shall erect temporary fencing along the perimeter of the contractor's site camp and designated no-go areas.	C	ER & DEO	Duration of Construction Phase
The Contractor shall maintain in good order all demarcation fencing and barriers for the duration of construction activities, or as otherwise instructed.	C	ER & DEO	Duration of Construction Phase
Topsoil removal and Stock pilling			
The Contractor shall remove topsoil from all areas where topsoil will be impacted on by construction activities, including temporary activities such as storage and stockpiling areas.	C	ER & DEO	Ongoing
Stripped topsoil shall be stockpiled in areas agreed with by the ER for later use in rehabilitation and shall be adequately protected. Topsoil is considered to be the natural soil covering, including all the vegetation and organic matter. The depth of the soil may vary and due to this reason the top 300mm of soil must be removed and preserved as topsoil.	C	ER & DEO	Ongoing
Topsoil stockpiles shall be convex in shape and no more than 2m high. Stockpiles shall be shaped so that no surface water ponding can take place.	C	ER & DEO	Ongoing
Topsoil stockpiles shall be protected from erosion by wind and rain by providing suitable storm water and cut-off drains (approved by the ER) and / or the establishment of temporary indigenous vegetation.	C	ER & DEO	Ongoing

Any topsoil contaminated by hazardous substances shall not be used but shall be disposed of at a registered landfill site. Proof of appropriate disposal must be filed in the Environmental File in the Contractor's Camp.	C	ER & DEO	Ongoing
The Contractor shall be held responsible for the replacement, at his expense, of any unnecessary loss of topsoil due to his failure to work according to the requirements of this EMPr.	C	ER & DEO	Ongoing
Workshop, Equipment Maintenance and storage			
All vehicles and equipment shall be kept in good working order to maximize efficiency and minimize pollution.	C	ER & DEO	Ongoing
Stockpiling			
The Contractor shall plan his activities so that materials can be transported directly to and placed at the point where it is to be used.	C	ER & DEO	Ongoing
Should temporary stockpiling become necessary, the areas for the stockpiling of excavated / imported material shall be indicated and demarcated on the site plan submitted in writing to the ER for his approval, together with the Contractor's proposed measures for prevention, containment and rehabilitation against environmental damage?	C	ER & DEO	Ongoing
Should temporary stockpiling become necessary, the areas for the stockpiling of excavated / imported material shall be indicated and demarcated on the site plan submitted in writing to the ER	C	ER & DEO	Ongoing

for his approval, together with the Contractor's proposed measures for prevention, containment and rehabilitation against environmental damage?			
Stockpiles shall be positioned and sloped to create the least visual impact.	C	ER	Ongoing
Stormwater Control			
Temporary stormwater control measures must be installed as and when necessary, to prevent and minimise the erosion of exposed soils.	C	ER & DEO	Ongoing
If deemed necessary to prevent erosion and environmental degradation, cut-off drains must be installed to facilitate the control of surface water runoff velocities.	C	ER & DEO	Ongoing
Stormwater control barriers must be used to divert surface water runoff into vegetative buffers and not directly into the exposed workings or onto adjacent roads.	C	ER & DEO	Ongoing
Hazardous Substances			
Should any hazardous material/substances (e.g. petrochemicals, paints, etc.) need to be stored on the site, this shall be under controlled conditions. All hazardous materials/substances shall be stored in a secured, appointed area that is fenced and has restricted entry. All storage shall take place using suitable, sealable containers to the approval of the ER. These containers must be placed within a bunded area which has the capacity to contain 110% of the total volume it stores. The floor and wall of the bund area shall be impervious to prevent infiltration of any spilled / leaked material into the soil.	C	ER & DEO	Ongoing

Material Safety Data Sheets (MSDS's) must be readily available for all chemicals / hazardous substances to be used on site. Where possible and available, MSDS's should include additional information on ecological impacts and measures to minimise and mitigate against any negative environmental impacts in the result of an accidental spill.	C/ER	ER & DEO	Before commencement of construction
Noise Control			
It must be ensured that noise levels are kept to a minimum during the Construction Phase. All machinery and equipment to be utilized on the site should be fitted with mufflers and must be maintained in good working order to minimise noise levels. It is recommended further that the Contractor encourage construction workers to minimise shouting and hooting on the site. Construction work should be completed in as short a time frame as possible in order to limit the longevity of these impacts.	C	ER & DEO	Ongoing
The Contractor shall restrict all operations that result in undue noise disturbance to local communities and / or dwellings to daylight hours on workdays (Monday to Friday) or as otherwise agreed with the ER.	C	ER & DEO	Ongoing
The Contractor shall warn any local communities and / or residents that could be disturbed by noise generating activities well in advance and shall keep such activities to a minimum.	C	ER & DEO	Ongoing
The Contractor shall be responsible for compliance with the relevant legislation with the respect to noise.	C	ER & DEO	Ongoing

The entire Contractors' equipment shall be fitted with effective exhaust silencers and shall comply with the SANS recommended code of practice Code 0103:1983, for construction plant noise generation.	C	ER & DEO	Ongoing
Waste Management			
General construction waste: Must be removed from bins at enough intervals to prevent overflow. This waste must be stored in skips within a designated waste storage area in the Contractor's Camp. General waste must be transported to the local municipal General Waste Landfill Site by the Municipality, the Contractor or a private waste disposal Contractor. Service agreements in this regard must be obtained by the Applicant / Contractor prior to the commencement of construction activities. It is recommended that general wastes be separated on site and delivered to appropriate depots for recycling. This would be facilitated by the provision of separate and labelled bins / skips.	C	ER	Ongoing
The Contractor shall ensure that all site personnel are instructed in the proper disposal of all waste.	C	ER	Ongoing
Demarcated and fenced areas where waste can be safely contained and stored on a temporary basis within the Contractors Camp must be established. General waste storage areas must be separate from hazardous waste storage areas. When adequate volumes (not more than 1 month) have accumulated, waste is to be removed from site and disposed of at a licensed facility.	C	ER	Ongoing
Waste is not to be buried or burned on site.	C	ER	Ongoing
Dust Control			

Construction vehicles shall comply with speed limits and haul distances shall be minimised. Material loads shall be suitably covered and secured during transportation.	C	ER & DEO	Ongoing
Exposed soils and material stockpiles shall be protected against wind erosion. The location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors.	C	ER & DEO	Ongoing
The Contractor shall implement dust suppression measures (e.g. Water spray vehicles, covering material stockpiles, etc.) if and when required.	C	ER & DEO	Ongoing
Environmentally friendly soil stabilisers may be used as additional measures to control dust on gravel roads and construction areas if complaints are received regarding dust generation. This is especially pertinent as excessive dust could disturb moving vehicles on adjacent roads, creating a potential traffic hazard.	C	ER & DEO	Ongoing
The Contractor shall ensure that the generation of dust is minimised and shall implement a dust control programme, as necessary, to maintain a safe working environment and minimise nuisance for surrounding residential areas/dwellings.	C	ER & DEO	Ongoing
Protection of Fauna and Flora			
The Contractor shall ensure his employees do not undertake any hunting, trapping, shooting, poisoning or other disturbance of any fauna on-site or in the areas surrounding the site.	C	ER & DEO	Ongoing

The feeding of any wild animals is prohibited.	C	ER & DEO	Ongoing
The use of pesticides is prohibited unless approved by the ER.	C	ER & DEO	Ongoing
Fire Control			
The Contractor shall ensure that basic fire-fighting equipment is available at all construction activities on site.	C	ER & DEO	Ongoing
The Contractor shall appoint a Fire Officer who shall be responsible for ensuring immediate and appropriate action in the event of a fire.	C	ER & DEO	Ongoing
The Contractor shall ensure that all site personnel are aware of the procedure to be followed in the event of a fire.	C	ER & DEO	Ongoing
Protection of Heritage and cultural features			
If any archaeological or paleontological artefacts or remains / graves are uncovered during earthmoving activities, work in the vicinity of the find shall cease immediately. The Contractor shall immediately notify the ER, who shall contact the relevant Competent Authority (SAHRA) who will take appropriate steps.	C	ER & DEO	Ongoing
The Contractor will be required to abide by the specifications as set out by the Competent Authority or the Heritage Specialist appointed to investigate the find.	C	ER & DEO	Ongoing

The Contractor may not, without a permit issued by the relevant heritage resources authority, destroy damage, excavate, alter, deface or otherwise disturb archaeological material.	C	ER & DEO	Ongoing
Environmental Education & Awareness			
It is the Contractors' responsibility to provide the site foreman with no less than 1 hour's environmental training and to ensure that the foreman has enough understanding to pass this information onto the construction staff.	C	ER & DEO	Prior to moving on site
The Contractor / ECO must be on hand to explain any technical issues and to answer questions.	C/ECO	ER & DEO	Ongoing
OPERATIONAL PHASE	**RESPONSIBILITY**	**OCCURRENCE**	**METHOD**
Water Quality Management			
The Msukaligwa Local Municipality must be contacted with regard to any discharge to sewer	OM	Ongoing	Site inspection
Management of Contaminated Land			
Post-remediation monitoring plan to be implemented to determine effectiveness of remedial actions and serve as an early-warning system for potential re-occurrence.	OM to outsource as appropriate	Ongoing	Ongoing monitoring
Drainage Systems			
Stormwater culverts and drains must be covered with metal grids to prevent blockages.	OM	Ongoing	Site inspection
Traffic Flow			
All signage and road markings must adhered to South African Road Traffic Signs Manual	OM	Ongoing	-

Control of Littering			
Adequate waste disposal bins are to be provided around the township. These are to be regularly emptied and the contents thereof collected by an approved Waste Service Provider.	OM	Ongoing	Site inspection
The recycling of waste is encouraged. As such, the provision of separate recycling bins for the disposal of paper, tins and plastic should be erected and displayed in a suitable and visual location on site. A reputable Recycling Waste Company must be appointed to collect recyclable waste (**if applicable).**	OM	Ongoing	Site inspection
Waste Storage and Removal			
Burning of waste is not permitted, under any conditions.	OM	Ongoing	Site inspection
Ablution facilities serviced by septic tanks (if applicable) are to be sign posted informing the public not to deposit foreign substances or objects into the system.	OM	Ongoing	Site inspection
Health and Safety			
Ensure that all staff is trained in what to do in the case of an emergency such as an on-site fire.	OM	Ongoing	Site inspection
Staff personnel are to be trained in first aid.	OM	Ongoing	Site inspection
Fire Control			
Emergency numbers must be displayed with the correct details of the nearest firefighting station at all times.	OM	Ongoing	Site inspection

Ensure that relevant signage e.g. no smoking, is displayed in potentially dangerous areas and is abided by.	OM	Ongoing	Site inspection
Socio-Economic			
Local labour must be prioritized where applicable to enhance local employment	OM	Ongoing	-
General			
M**ismanagement:** • A maintenance team as well as a landscaping team is needed to ensure that the development is well maintained. • Planting of indigenous vegetation			

7 ENVIRONMENTAL MONITORING

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);

(h) The frequency of monitoring the implementation of the impact management actions contemplated in (f);

A monitoring programme must be implemented for the duration of the construction phase of the proposed development. This programme will include:

- Establishing a baseline of pre-construction site conditions validated with photographic evidence.
- Monthly audits to be conducted by an independent ECO for the duration of the construction phase to ensure compliance to the EMPr conditions, and where necessary make recommendations for corrective action. These audits can be conducted randomly and do not require prior arrangement with the Project Coordinator.
- Compilation of an audit report with a rating of compliance with the EMPr. The ECO shall keep a photographic record of the demarcated sites and construction area. The Contractor shall be held liable for all unnecessary damage to the environment. A register shall be kept of all complaints from the community. All complaints / claims shall be handled immediately to ensure timeous rectification / payment by the responsible party.
- Compilation of a final audit report after all site construction and rehabilitation are completed.

8 ROLES AND RESPONSIBILITIES

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(i) An indication of the persons who will be responsible for the implementation of the impact management actions;

8.1 The Applicant

The Project Coordinator is responsible for overall management of project and EMPr implementation. The following tasks will fall within his / her responsibilities:

- Be familiar with the recommendations and mitigation measures of this EMPr, and implement these measures.
- Monitor site activities on a daily basis for compliance.
- Conduct internal audits of the construction site against the EMPr.
- Confine the construction site to the demarcated area.

- Rectify transgressions through the implementation of corrective action.

8.2 Contractor

The contractor is responsible for the overall execution of the activities envisioned in the construction phase including the implementation and compliance with recommendations and conditions of the EMPr. The Contractor must therefore ensure compliance with the EMPr at all times during construction activities and maintain an environmental register which keeps a record of all environmental incidents which occur on the site during formalization of the Davel township. These incidents may include:

- Public involvement / complaints
- Health and safety incidents
- Incidents involving Hazardous materials stored on site
- Non-compliance incidents

The Contractor is also responsible for the implementation of corrective actions issued by the ECO and Project Coordinator within a reasonable or agreed period of time.

8.3 Environmental Control Officer (ECO)

For the purposes of implementing the conditions contained herein Msukaligwa Local Municipality must appoint an ECO for the contract. The ECO shall be the responsible person for ensuring that the provisions of the EMPr and its Environmental Code of Conduct as well as the environmental authorisation are complied with during the construction period. The ECO's duties in this regard will include, inter alia, the following:

- Conduct regular site visits to be able to report on and respond to any environmental issues;
- Report compliance and non-compliance issues to the municipal representative and authorities as applicable;
- Advise the Contractor on environmental issues within the defined work areas;
- Review access and incident records that may pertain to the environment and reconcile the entries with the observations made during site inspection, monitoring and auditing;
- Recommend corrective action when required for aspects of non-compliance with the EMPr;
- Take immediate action on site where clearly defined and agreed "no-go" areas are violated or in danger of being violated and to inform Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) representative of the occurrence immediately and to take action;
- Be contactable by the public regarding matters of environmental concern as they relate to the operation of the works; and
- Take immediate action on site when prescriptive conditions are violated, or in danger of being violated and to inform the DARDLEA representative of the occurrence and action taken.

9 COMPLIANCE WITH THE EMPR

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;

(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);

A copy of the EMPr must be kept on site at all times during the construction period. The EMPr will be binding on all contractors operating on the site and must be included within the Contractual Clauses.

It should be noted that in terms of Section 28 of the National Environmental Management Act (No. 107 of 1998) those responsible for environmental damage must pay the repair costs both to the environment and human health and the preventative measures to reduce or prevent further pollution and/or environmental damage (The 'polluter pays' principle).

9.1 Non-compliance

The contractors shall act immediately when notice of non-compliance is received and take corrective action. Complaints received regarding activities on the construction site pertaining to the environment shall be recorded in a dedicated register and the response noted with the date and action taken. The ECO should be made aware of any complaints.

Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define the manner by which the environment is managed. Failure to redress the cause shall be reported to the relevant authority for them to deal with the transgression, as it deems fit.

The Contractor is deemed not to have complied with the EMPr if, *inter alia*:

- There is evidence of contravention of the EMPr specifications within the boundaries of the construction site, site extensions and roads;
- There is contravention of the EMPr specifications which relate to activities outside the boundaries of the construction site.
- Environmental damage ensues due to negligence;
- Construction activities take place outside the defined boundaries of the site; and/or
- The Contractor fails to comply with corrective or other instructions issued by the Engineer within a specific time period.

It is recommended that the engineers/contractors institute penalties for the following less serious violations and any others determined during the course of work, as detailed below:

- Littering on site.
- Lighting of illegal fires on site.
- Persistent or unrepaired fuel and oil leaks.
- Any persons, vehicles or equipment related to the Contractor's operations found within the designated "no-go" areas.
- Excess dust or excess noise emanating from site.
- Possession or use of intoxicating substances on site.
- Any vehicles being driven in excess of designated speed limits.
- Removal and/or damage to fauna, flora or cultural or heritage objects on site.
- Urination and defecation anywhere except at designated facilities.

9.2 Emergency preparedness

The Contractor shall compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts, throughout the construction period. Such activities may include, *inter alia*:

- Accidental waste water discharges to water and land.
- Accidental exposure of employees to hazardous substances.
- Accidental fires.
- Accidental spillage of hazardous substances.
- Specific environmental and ecosystem effects from accidental releases or incidents.
- These plans shall include:
- Emergency organisation (manpower) and responsibilities, accountability and liability.
- A list of key personnel and contact details.
- Details of emergency services available (e.g. the fire department, spill clean-up services, etc.).
- Internal and external communication plans, including prescribed reporting procedures where required by legislation.
- Actions to be taken in the event of different types of emergencies.
- Incident recording, progress reporting and remediation measures required to be implemented.
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.
- Training plans, testing exercises and schedules for effectiveness.

The Contractor shall comply with the emergency preparedness and incident and accident-reporting requirements, as required by the Occupational Health and Safety Act (No. 85 of 1993), the NEMA (No. 107 of 1998), the National Water Act (No. 36 of 1998) and the National Waste Act (No. 59 of 2008) as amended and/or any other relevant legislation.

9.3 Incident reporting and remedy

If a leakage or spillage of hazardous substances occurs on site, the local emergency services must be immediately notified of the incident. The following information must be provided:

- the location;
- the nature of the load;
- the extent of the impact; and
- the status at the site of the accident itself (i.e. whether further leakage is still taking place, whether the vehicle or the load is on fire).

Written records must be kept on the corrective and remedial measures decided upon and the progress achieved therewith over time. Such progress reporting is important for monitoring and auditing purposes. The written reports may be used for training purposes in an effort to prevent similar future occurrences.

9.4 Penalties

Where environmental damage is caused or a pollution incident, and/or failure to comply with any of the environmental specifications contained in the EMPr, Msukaligwa Local Municipality and/or contractor shall be liable.

The following violations, and any others determined during the course of work, should be penalised:

- Hazardous chemical/oil spill and/or dumping in non-approved sites.
- Damage to sensitive environments.
- Damage to cultural and historical sites.
- Unauthorised removal/damage to indigenous trees and other vegetation, particularly in identified sensitive areas.
- Uncontrolled/unmanaged erosion.
- Unauthorised blasting activities (if applicable).
- Pollution of water sources.
- Unnecessary removal or damage to indigenous trees.

The following steps will be followed by the ECO on behalf of Msukaligwa Local Municipality, when observing a transgression:

1. **Transgression observed**: Give a warning to the Contractor, with time to remedy the situation. Report transgression and agreed remedial action to the developer.
2. **Transgression not remedied**: Report the Contractor directly to DARDLEA and Project coordinator and issue a financial penalty to the Contractor (see list of fines below) with an agreed time period to remedy the situation with the assistance of DARDLEA (if necessary).
3. **Failure to remediate**: Depending on the severity and impact significance of the transgression, which must be assessed and discussed with the developer prior to reporting to competent authority, the ECO may undertake to report directly to DARDLEA (Compliance) recommending that for:
    - HIGH impact: DARDLEA to issue a notice to cease construction.
    - MEDIUM impact: DARDLEA to issue a notice instructing Msukaligwa Local Municipality to implement recommended remedial action.
    - LOW impact: ECO to notify, but up to discretion of DARDLEA to apply sanction.

In all cases, however, non-compliance with a condition must be reported to DARDLEA in the monthly audit reports. However, the ECO will also report on corrective actions proposed and implemented.

The following schedule of fines for environmental damage or EMPr transgressions were adapted from the City of Cape Town: Standard Environmental Specifications.

Transgression or Resultant Environmental Damage	Min. fine	Max. fine
Failure to comply with prescriptions regarding ECO appointment and monitoring of EMPr	R1 000	R2 000
Failure to comply with prescriptions regarding environmental awareness training	R2000	R10 000
Failure to comply with prescriptions regarding method statements	R2 000	R10 000
Failure to report environmental damage or EMPr transgressions to the ECO	R1 000	R2 000
Failure to carry out instructions of the DEO/ECO regarding the environment of the EMPr	R1 000	R2 000
Failure to comply with prescriptions posting of emergency numbers	R2 000	R10 000
Failure to comply with prescriptions regarding information boards	R1 000	R2 000

Failure to comply with prescriptions regarding a complaints register	R1 000	R2 000
Failure to comply with prescriptions regarding site demarcation and enforcement of “no go” areas	R2 000	R10 000
Failure to comply with prescriptions regarding site clearing	R2 000	R10 000
Failure to comply with prescriptions for the storage of imported materials within a designated Contractors yard	R1 000	R2 000
Failure to comply with prescribed administration, storage or handling of hazardous substances	R1 000	R2 000
Failure to comply with prescriptions regarding equipment maintenance and storage	R1 000	R2 000
Failure to comply with fuel storage, refuelling, or clean-up prescriptions	R1 000	R2 000
Failure to comply with prescriptions regarding procedures for emergencies (spillages and fires)	R2 000	R10 000
Failure to comply with prescriptions regarding construction camp	R2 000	R10 000
Failure to comply with prescriptions for the use of ablution facilities	R1 000	R2 000
Failure to comply with prescriptions regarding water provision	R1 000	R2 000
Failure to comply with prescriptions for the use of designated eating areas, heating source for cooking or presence of fire extinguishers	R1 000	R2 000
Failure to comply with prescriptions regarding fire control	R2 000	R10 000
Failure to comply with prescriptions for solid waste management	R2 000	R10 000
Failure to comply with prescriptions to prevent water pollution and sedimentation	R2 000	R10 000
Failure to comply with prescriptions to the protection of natural features, flora, fauna and archaeology	R2 000	R10 000

Failure to comply with prescriptions regarding speed limits	R1 000	R2 000
Failure to comply with prescriptions regarding noise levels of construction activity	R2 000	R10 000
Failure to comply with prescriptions regarding working hours	R2 000	R10 000
Failure to comply with prescriptions regarding aesthetics	R1 000	R2 000
Failure to comply with prescriptions regarding dust control	R1 000	R2 000
Failure to comply with prescriptions regarding security and access onto private property	R1 000	R2 000
Failure to comply with prescriptions regarding cement and concrete batching	R2 000	R10 000

10 REPORT

According to appendix 4 of GN R 982, an environmental management programme must include:

(l) A program for reporting on compliance, taking into account the requirement as prescribed by the regulations;

10.1 Administration

Before the construction and decommissioning activities begin, the Contractor shall give to the ECO and the Project Coordinator a written method statement setting out the following:

- Location of the campsite and storage area.
- Details of the construction and decommissioning activities.
- Identification of impacts that might result from the activity (e.g. soil erosion).
- Identification of activities that may cause an impact.
- Methodology and/or specifications for impact prevention for each activity or aspect (e.g. soil stabilisation using…).
- Methodology and/or specifications for impact containment for each activity or aspect.
- Emergency/disaster incident and reaction procedures.
- Treatment and continued maintenance of impacted environment.

The Contractor may provide such information in advance of any activities provided that new submissions shall be given to the ECO and/or engineer whenever there is a change or variation to the original.

The ECO and/or engineer may provide comment on the methodology and procedures proposed by the Contractor but he shall not be responsible for the Contractor's chosen measures of impact mitigation and emergency/disaster management systems.

10.2 Good housekeeping

The Contractor shall undertake "good housekeeping" practices during construction and decommission. This will help avoid disputes on responsibility and allow for the smooth running of the contract as a whole.

Good housekeeping extends beyond the wise practice of construction methods to include the care for and preservation of the environment within which the construction is situated.

10.3 Record keeping

The Project coordinator and the ECO will continuously monitor the Contractor's adherence to the approved impact prevention procedures and the ECO shall issue to the Contractor a notice of non-compliance whenever transgressions are observed. The ECO should document the nature and magnitude of the non-compliance in a designated register, the action taken to discontinue the non-compliance, the action taken to mitigate its effects and the results of the actions. The non-compliance shall be documented and reported to the engineer in the monthly report. These reports shall be made available to DARDLEA when requested.

10.4 Document control

The Contractor and Project coordinator shall be responsible for establishing a procedure for electronic document control. The document control procedure should comply with the following requirements:

- Documents must be identifiable by organisation, division, function, activity and contact person.
- Every document should identify the personnel and their positions, who drafted and compiled the document, who reviewed and recommended approval, and who finally approved the document for distribution.
- All documents should be dated, provided with a revision number and reference number, filed systematically, and retained for a five-year period.

The Contractor shall ensure that documents are periodically reviewed and revised, where necessary, and that current versions are available at all locations where operations essential to the functioning of the EMPr are performed. All documents shall be made available to the ECO and other independent external auditors.

11 ENVIRONMENTAL AWARENESS

According to appendix 4 of GN R 982, an Environmental Management Programme must include:

(m) An environmental awareness plan describing the manner in which –

(i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and

(ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and

Contractors shall ensure that its employees and any third party who carries out all or part of the Contractor's obligations are adequately trained with regard to the implementation of the EMPr, as well as regarding environmental legal requirements and obligations. Training shall be conducted by the ECO where necessary.

Environment and health awareness training programmes should be targeted at three distinct levels of employment, i.e. the executive, middle management and labour. Environmental awareness training programmes shall contain the following information:

- The names, positions and responsibilities of personnel to be trained.
- The framework for appropriate training plans.
- The summarised content of each training course.
- A schedule for the presentation of the training courses.

The ECO shall ensure that records of all training interventions are kept in accordance with the record keeping and documentation control requirements as set out in this EMPr. The training records shall verify each of the targeted personnel's training experience.

The Msukaligwa Local Municipality shall ensure that adequate environmental training takes. All employees shall be given an induction presentation on environmental awareness and the content of the EMPr. The presentation needs to be conducted in the language of the employees to ensure it is understood. The environmental training shall, as a minimum, include the following:

- The importance of conformance with all environmental policies.
- The environmental impacts, actual or potential, of their work activities.
- The environmental benefits of improved personal performance.
- Their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirement of the Agency's environmental management systems, including emergency preparedness and response requirements.
- The potential consequences of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities.

- Environmental legal requirements and obligations.
- Details regarding floral/faunal species of special concern and protected species, and the procedures to be followed should these be encountered during the construction of approach roads or construction camps.
- The importance of not littering.
- The importance of using supplied toilet facilities.
- The need to use water sparingly.
- Details of and encouragement to minimise the production of waste and re-use, recover and recycle waste where possible.
- Details regarding archaeological and/or historical sites which may be unearthed during construction and the procedures to be followed should these be encountered.

Monitoring of environmental training

The Contractor must monitor the performance of construction workers to ensure that the points relayed during their introduction have been properly understood and are being followed. If necessary, the ECO and / or a translator should be called to the site to further explain aspects of environmental or social behaviour that are unclear. Toolbox talks are recommended.

12 CLOSURE PLANNING

Final site cleaning - the contractor shall clear and clean the site and ensure that all equipment and residual materials not forming part of the permanent works is removed from site before issuing the completion certificate or as otherwise agreed.

Rehabilitation - the contractor (landscape architect/horticulturist) shall be responsible for rehabilitating and re-vegetation of all areas disturbed/areas earmarked for conservation during construction to the satisfaction of the engineer and ECO.

12.1 Post-construction audit

A post-construction environmental audit must be carried out and submitted to DARDLEA at the expense of the developer so as to fulfil conditions of the Environmental Authorisation granted. Objectives should be to audit compliances with the key components of the EMPr, to identify main areas requiring attention and recommend priority actions. The audit should be undertaken annually and should cover a cross section of issues, including implementation of environmental controls, environmental management and environmental monitoring.

Results of the audits should inform changes required to the specifications of the EMPr or additional specifications to deal with any environmental issues which arise on site and have not been dealt with in the current document.

12.2 Management review and revision of the EMPr

The EMPr is to be reviewed annually for the first three years and then once every five years thereafter, by an independent environmental consultant, unless otherwise specified by the authorities. The auditor is to highlight issues to be addressed in the EMPr or changes required during the annual audit. These points are to be included as an annexure to the EMPr and to be considered during the review process. Recommended changes to the EMPr must be forwarded to DARDLEA for approval and comment, before subsequently being incorporated into the EMPr.

13 CONCLUSIONS

Although all foreseeable actions and potential mitigations or management actions are contained in this document, the EMPr should be seen as a day-to-day management document. The EMPr thus sets out the environmental and social standards, which would be required to minimise the negative impacts and maximise the positive benefits of the construction and operational activities. The EMPr could thus change daily, and if managed correctly lead to a successful construction and operational phases.

All attempts should be made to have this EMPr available, as part of any tender documentation, so that the Engineer and Contractor are made aware of the potential cost and timing implications needed to fulfil the implementation of the EMPr, thus adequately costing for these.

13.1 General review of EMPr

The EMPr will be reviewed by the ECO on an on-going basis. Based on observations during site inspections and issues raised at site meetings, the ECO will determine whether any procedures require modification to improve the efficiency and applicability of the EMPr on site.

Any such changes or updates will be registered in the ECO's record, as well as being included as an annexure to this document. Annexure of this nature must be distributed to all relevant parties.

ANNEXURE A

Environmental Code of Conduct

The applicant is committed to ensuring that the operation of the development is done according to the highest environmental standards so that the ecological footprint of the development is minimised where possible.

The applicant requires that all personnel involved in the operation process accept their responsibilities towards the EMP and the environment. This includes all permanent, contract or temporary workers as well as any other person involved with the project or visiting the site. Ignorance, negligence, recklessness or a general lack of commitment will not be tolerated.

If you do not understand the rules you must seek assistance to ensure compliance. The following people can assist you in ensuring compliance with the EMP.

Your Supervisor: ……

Environmental Control Officer:……..

Project Manager:……

ANNEXURE B

Environmental Complaints Register						
	Name of Complainant	**Contact Details**	**Nature of Complaint**	**Responsible Person**	**Date Action Taken**	**Details of Action Taken**

ANNEXURE C

Environmental Incidents Register					
Date	**Incident**	**Action Required**	**Responsible Person**	**Action Implemented**	**Date Action Implemented**

ANNEXURE D

Environmental Training Register				
Date Company	Employee	Employee Signature	Supervisor	Supervisor Signature

ANNEXURE E

ENVIRONMENTAL AUTHORISATION / ROD

ANNEXURE F

EAP CV/EXPERTISE