LOXTON WIND FACILITY 2

STORMWATER MANAGEMENT PLAN

24th April 2023
Version 1

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EXECUTIVE SUMMARY

Objective

The Applicant, Loxton Wind Facility 2 (PTY) LTD, proposes the construction of a wind energy facility (WEF), known as the Loxton WEF 2, located on a site ±17 km east of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. At this stage, the proposed Loxton WEF 2 will comprise up to sixty-two (62) wind turbines with a maximum total energy generation capacity of up to approximately 480 MW.

The main objective of the 'Stormwater Management Plan' is to determine the impact/s of the proposed development on the immediate and greater area concerning stormwater and to include these findings in the Environmental Impact Assessment (EIA) submission. The assessment will comprise a desktop assessment and include preliminary stormwater-related matters arising during the construction phase, through the Operation & Maintenance Phase, up to and including the decommissioning phase of the development.

The proposed Loxton Wind Energy Facility 2 forms part of cluster development with two additional developments adjacent to this facility as separate EIA applications: - Loxton Wind Energy Facility 1 and Loxton Wind Energy Facility 3. Although this report only focuses on the Loxton WEF 2, all three developments are considered for this study as they share common boundaries, drainage lines and catchments.

Key Findings

No significant risks concerning the proposed development are foreseen, provided the recommendations below are noted before and during the detailed design and construction stages. Furthermore, several recommendations were highlighted and therefore noted as important.

The proposed development / infrastructure will have a minimal impact on the stormwater quality and quantities post-development (operational phase). This development's construction phase typically generates the highest surface run-off during the construction phases coinciding with the wet season. However, it will be temporary, and impacts can be mitigated and considered nominal. The post-development stormwater flow from the operation phase will have a minimal impact on the immediate environment if adequate stormwater designs are implemented to maintain existing drainage patterns and flows in the catchments.

Several mitigation measures are proposed to accommodate the development and reduce the impact on the surrounding area.

Recommendation

Concerning this report, associated assessment, and the findings made within, SKERP Consulting Engineers believes that the Loxton WEF 2 and associated grid infrastructure will have a nominal impact on the existing stormwater catchments. The project is therefore deemed acceptable from a stormwater perspective, provided this report's recommendations and mitigation measures are implemented. Hence, Environmental Authorisation (EA) should be granted for the EIA application.

This document should also be read in conjunction with the EMPr. The developer, owner, and professional team shall adhere to the requirements and conditions set out in the EMPr.

DECLARATION BY SPECIALIST

I, MERCHANDT LE MAITRE, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application objectively, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have 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.

Signature of Specialist: 

Name of Company: SKERP Consulting Engineers (Pty) Ltd

Date: 24th April 2023

LOXTON WIND FACILITY 2 (PTY) LTD

LOXTON WIND FACILITY 2

STORMWATER MANAGEMENT PLAN

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1. INTRODUCTION

SKERP Consulting Engineers has been appointed by the Loxton Wind Facility 2 (Pty) Ltd. (hereafter referred to as "Loxton 2" or "Loxton WEF 2") to complete a Stormwater Management Plan (SWMP) for the proposed 480 MW Loxton Wind Energy Facility 2 and associated grid infrastructure (hereafter referred to as the "proposed facility / facilities"). The facility is situated ±17 km east of Loxton within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

The proposed facility and associated grid infrastructure between Loxton, Carnarvon and Victoria West will not be located within a Renewable Energy Development Zone (REDZ).

The proposed Loxton Wind Energy Facility 2 forms part of cluster development with two additional developments adjacent to this facility as separate EIA applications: - Loxton Wind Facility 1 and Loxton Wind Facility 3. Although this report only focuses on the Loxton WEF 2, all three developments are considered for this study as they share common boundaries, drainage lines and catchments.

The development details at each WEF are indicated below:

Loxton	Coverage (ha)	Number of turbines	MW	Permanent footprint (ha)
WEF 1	7 200	42	240	65
WEF 2	15 000	62	480	110
WEF 3	12 500	38	240	65
TOTAL	**34 700**	**142**	**960**	**240**

2. WIND ENERGY FACILITY COMPONENTS

The WEF will consist of the following:

2.1 WEF Components

At this stage, the proposed Loxton 2 WEF will comprise up to sixty-two (62) wind turbines with a maximum total energy generation capacity of up to approximately 480 MW. In summary, the proposed Loxton WEF 2 development will include the following components:

- Up to 62 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations with a permanent footprint of approximately 9.1 ha;
- Each turbine will have a crane hardstand of 70 m x 45 m. The permanent footprint for turbine hardstands will be up to approximately 20 ha.
- Each turbine will have a temporary blade hardstand of 80 m x 45 m. The temporary footprint for blade hardstands will be up to approximately 23 ha.
- Temporary laydown areas (with a combined footprint of up to approximately 38 ha) which will accommodate the boom erection, storage and assembly area;
- Battery Energy Storage System (with a footprint of up to 5ha);
- One construction period laydown areas (temporary) up to 6 ha each;

- Medium voltage (33 kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where possible.
- One on-site substation up to 4 ha in extent to facilitate the connection between the wind farm and the electricity grid;
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 15 m road corridor may be temporarily impacted upon during construction and rehabilitated to 6m wide after construction. The WEF will have a total road network of up to 100 km.
- One temporary site camp establishment and concrete batching plant (each with a combined footprint of up to 2 ha); and
- Operation and Maintenance buildings (each with a combined footprint of up to 2 ha) including a gate house, security building, control centre, offices, warehouses, parking bays, storage facility and a workshop.

2.2 Grid Connection Components

The Electrical Grid Infrastructure (EGI) associated with the Loxton WEF considers a 300m wide corridor route from the Loxton Switching Station/Collector Station to the Gamma MTS. The EGI is located within the Central Strategic Powerline Corridor and, therefore, is subject to a Basic Assessment process in accordance with GN 113 of 16 February 2018 listed under NEMA, 1998.

3. OBJECTIVE AND SCOPE OF WORK

The study's main objective is to develop a conceptual stormwater management plan for the proposed development during the operation & maintenance phase. To achieve this objective, the following will be assessed and discussed under their relevant headings in this report: -

- Climate
- Surface Hydrology
- Development Stormwater Management
- Development run-off Calculations
- Conclusions & Recommendations

The scope of work consists of the following:

a) A site investigation (A desktop investigation was completed using historical data from previous studies in the area).

b) Consultations with the relevant authorities and / or stakeholders.

c) Extract the climate of the area from sources commonly available.

d) Desktop analysis of the existing surface hydrology

e) Evaluate the impact of the proposed development on the existing catchment and propose a suitable SWMP.

f) Conclude and propose possible mitigation measures.

g) Seasonal impacts affect this assessment.

3.1 Legal Requirements & Guidelines

Key legal requirements and guidelines for the proposed facilities are as follows:

- Government Notice 509 (GN509), as published in Government Gazette 40229 of 2016 and refers to the National Water Act, 1998 (Act No. 36 of 1998)
- National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA)
- National Water Act, 1998 (Act No 36 of 1998) (NWA)

4. SPECIALIST CREDENTIALS

Merchandt Le Maitre from SKERP has compiled this Stormwater Management Plan. He has a B Tech (Baccalaureus Technologiae) in Civil Engineering with over 19 years of experience, with 13 years in renewable energy. His extensive experience in the different facets of Civil Engineering means he can advise clients in the renewable energy sector in; geotechnical engineering, topographical studies, stormwater management, water demand, transportation studies, accesses and internal layout designs and Glint and Glare Assessments. A full Curriculum Vitae is included in 'Appendix A.'

5. ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are to be noted:

- The analysis is based on the information provided at the time by Loxton Wind Facility 2 and its representatives.
- Digital Terrain Model: 25m DEM from NGI (2014) & 2m DEM from GeoSmart (2016: 3122AB, 3122BA, 3122AD, 3122AC)
- Technical Specifications for the facility are:

Table 5-1 Technical Specification for Loxton WEF 2

Technical Component	Dimensions
Number of Turbines	Maximum of 62
Capacity	≤ 480 MWac
Hub Height	≤ 160 m
Rotor Diameter	≤ 200 m
Construction Period (assumed)	± 24 months (TBC)
Expected Lifespan	20 - 25 years (TBC)
Road Width	Up to 6 m (Permanent)
Length of Internal Roads	±100 km

- Some of the figures provided are indicative as many of the components are still at the design stage and will only be confirmed closer to the construction time.

6. PROJECT DESCRIPTION

6.1 Locality

Loxton WEF 2 and associated infrastructure is located ±17 km east of Loxton in the Northern Cape Province. Road R63 between Loxton and Carnarvon bisects the facility on the western boundary. Road R63 between Loxton and Victoria West is located ±2 km south of Loxton WEF 2 (Refer **Figure 6-1** below).

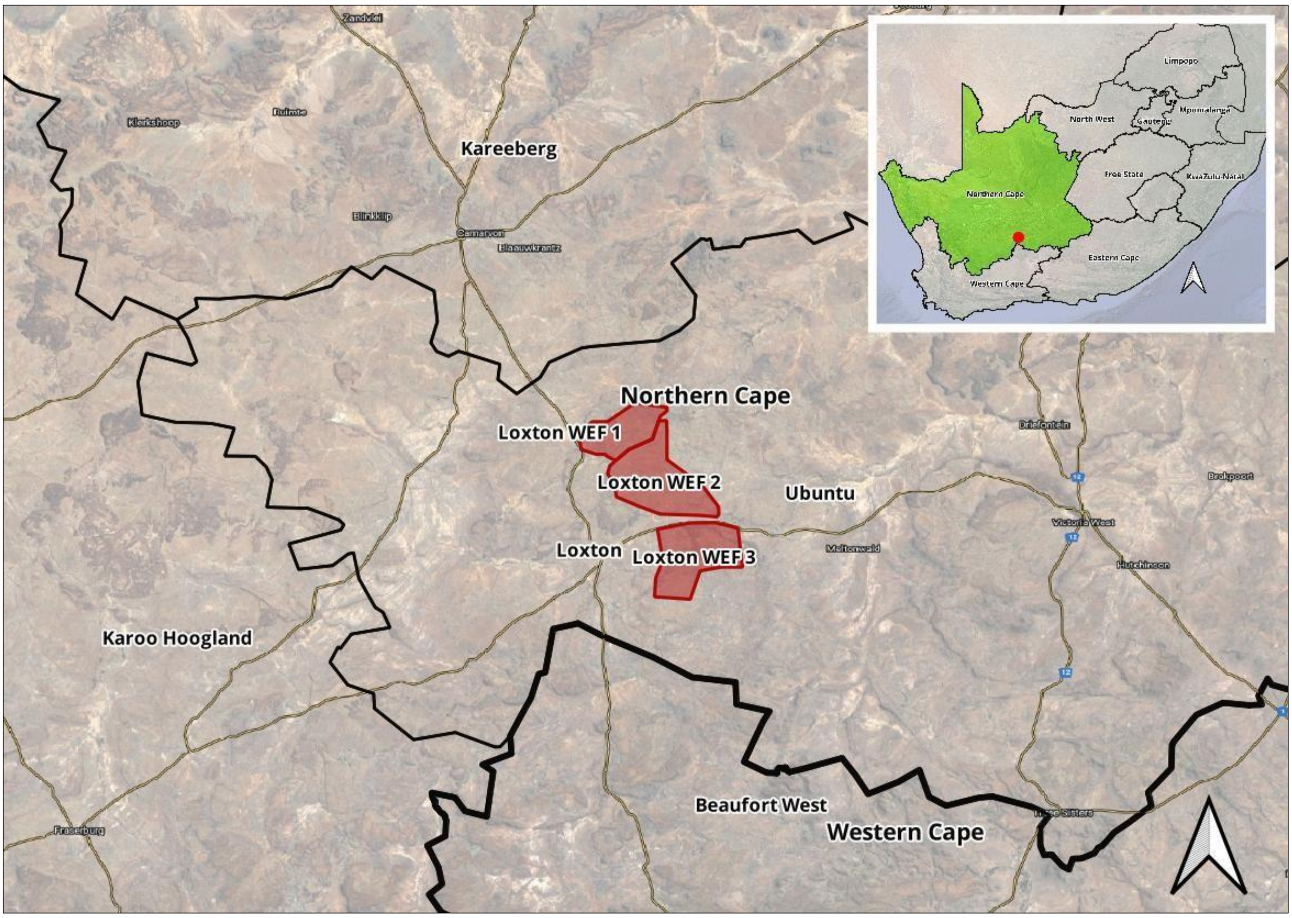


Figure 6-1 Loxton WEF - Regional Context

The Loxton WEF 2 project site covers approximately 15 000 ha and comprises the following farm portions (Refer to **Figure 6-2**):

- Portion 4 of the Farm Rietfontein No. 572;
- Portion 12 of the Farm Rietfontein No. 572;
- Portion 11 of the Farm Rietfontein No.572;
- Remaining Extent of Farm Rietfontein No.572;
- Remaining Extent of the Farm Saaidam No. 574;
- Remaining Extent of the Farm Yzervarkspoort No. 139;
- Portion 2 of the Farm Yzervarkspoort No. 139;
- Remaining Extent of the Farm Springfontein No. 573;
- Remaining Extent of Farm 582

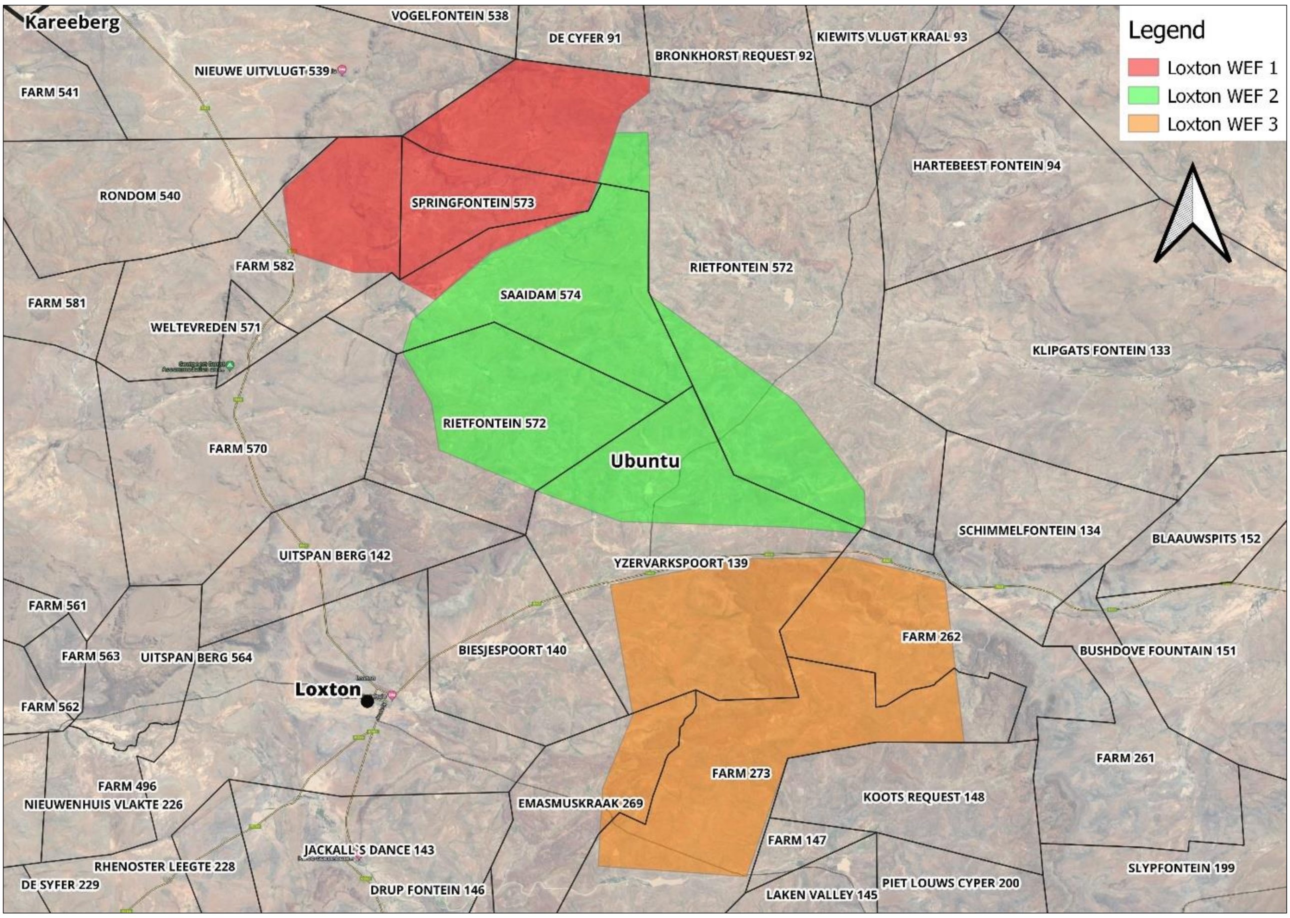


Figure 6-2 Loxton WEF - Site Locality

7. GEOTECHNICAL STUDY

7.1 Geotechnical Desktop Study Report

A desktop Geotechnical Study[1] for the proposed development was completed in February 2023 by SMEC South Africa on the proposed sites indicated in **Section 6**.

A summary extract from the Geotechnical Study confirms the site comprises the following geological context. Refer to **Figure 7-1**.

[1] SMEC South Africa, Charles Warren-Codrington (2023). Loxton Wind Energy Cluster. Geotechnical Desktop Study Report

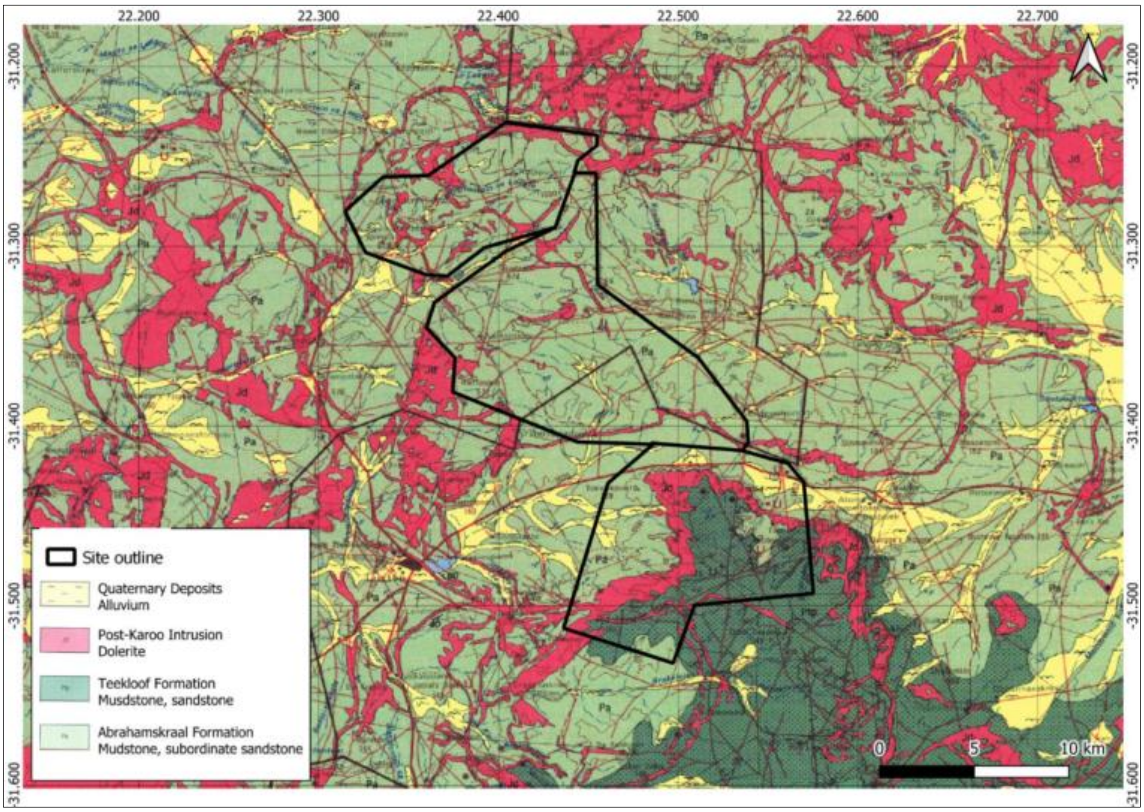


Figure 7-1 Geological Map of Proposed Development Loxton WEF 1,2 & 3

In summary, the facility will have the following typical soil profile: -

A review of 3122 Victoria West, 1:250 000 Geological Series indicates that the Loxton WEF site is underlain by the sedimentary rocks belonging to Abrahamskraal and Teekloof formations of the Adelaide Subgroup, Karoo Sequence.

The Abrahamskraal Formation, which underlies most of the site, forms the lower part of the Adelaide Subgroup and comprises up to 2 500 m thick fining upward succession (Woodford and Chevallier, 2002). It comprises grey to green mudstone interlayered with fine to medium-grained sandstone, with the mudstone sandstone ratio of 4:1 (Johnson et al. 1996).

Over 40% of the Loxton WEF 3 is underlain by the younger Teekloof Formation, comprising up to 1 000 m thick interlayered fining upward succession. This sequence is dominated by grey mudrock with thin feldspathic sandstone bodies deposited in a fluvial environment (Johnson et al. 1996).

*The sedimentary sequence is intruded by a series of dolerite sills which form ridges and is regionally covered by Quaternary alluvial sand deposits occurring along the drainage lines (***Figure 7-1***).*

We recommend that a comprehensive Geotechnical Report be carried out to form part of the detailed design stage and refinement of the SWMP.

8. CLIMATE

8.1 Climate Classification[2]

Loxton WEF 2 and associated infrastructure is located ±17 km east of Loxton in the Northern Cape Province. Referring to the Klöppen-Geiger climate classification system, the Northern Cape Province has a variety of climates and is predominantly dominated by hot desert climates (type 'BWh') and cold semi-arid climates (type 'BSk'). The Loxton area is classified as a hot desert climate (type 'BWk').

8.2 Average Temperature[3]

The Average Maximum temperatures range between 13.2° and 29.1°C. January is the year's warmest month, with an average high temperature of 29.1°C. July is the coldest month of the year, with an average low temperature of 3.9°C. Refer to **Figure 8-1** below.

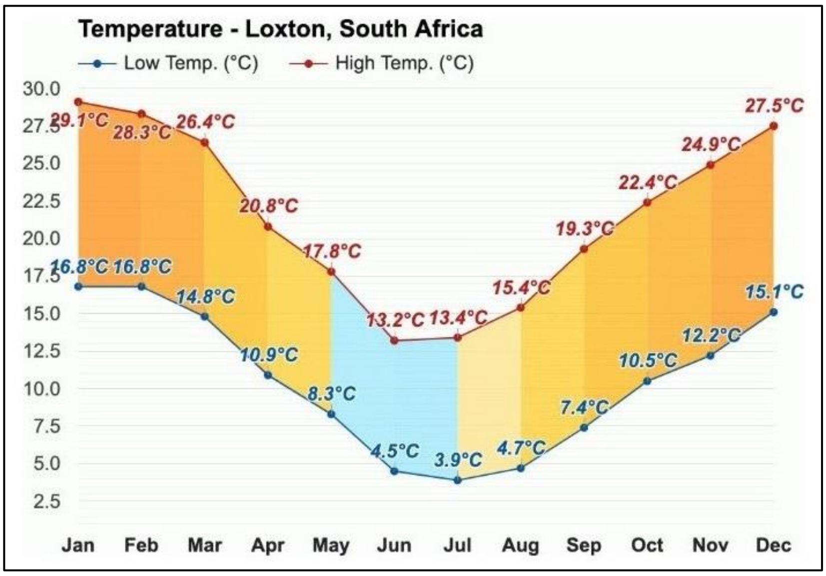


Figure 8-1 Average Temperature – Loxton, South Africa

8.3 Mean Annual Precipitation (MAP)[4]

As mentioned in **Section 8.1** above, the Loxton region is a hot desert climate with an annual average rainfall of ±70 mm, mainly between December and April. January is, on average, the wettest month of the year, with ±21 mm accumulated for the month. The driest month with the least amount of rainfall of ±3mm accumulated for the month is the month of November. Refer to **Figure 8-2** below.

[2] en-climate-data
[3] Weather Atlas
[4] Weather Atlas

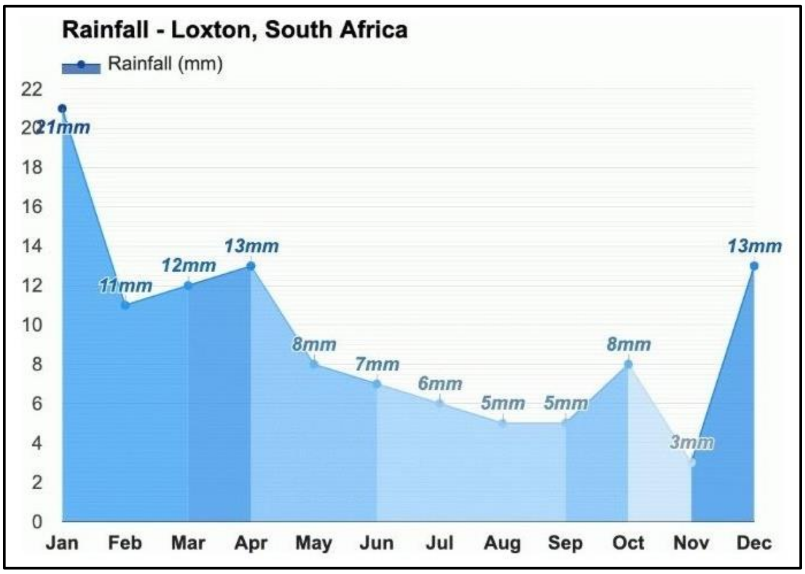


Figure 8-2 Average Rainfall – Loxton, South Africa

The average rainfall days per annum is ±29 days, with January having the highest number of rainfall days (5.9 days). The month with the least rainfall days is November (2.6 days). Refer to **Error! Reference source not found.Error! Reference source not found.** below.

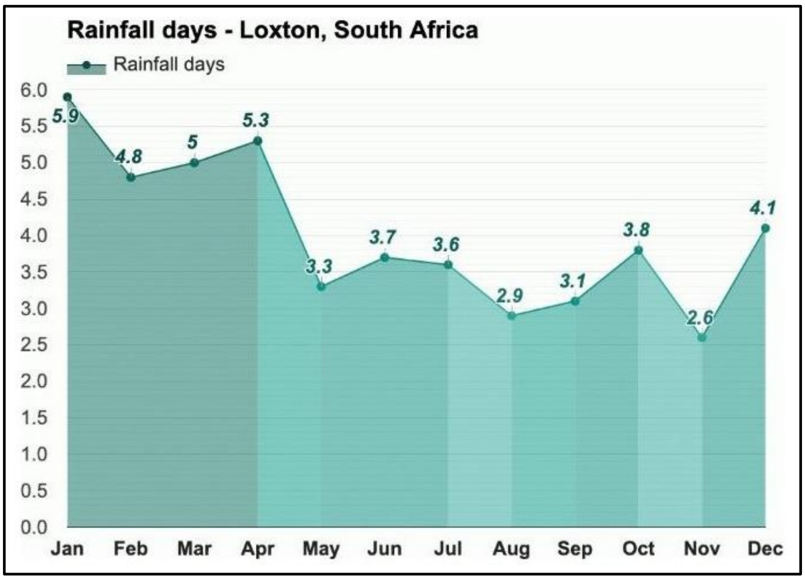


Figure 8-3 Average Rainfall Days – Loxton, South Africa

8.4 Humidity[5]

The region's relative humidity ranges from a maximum of 57% in June to a minimum of 36% in November.

[5] Weather Atlas

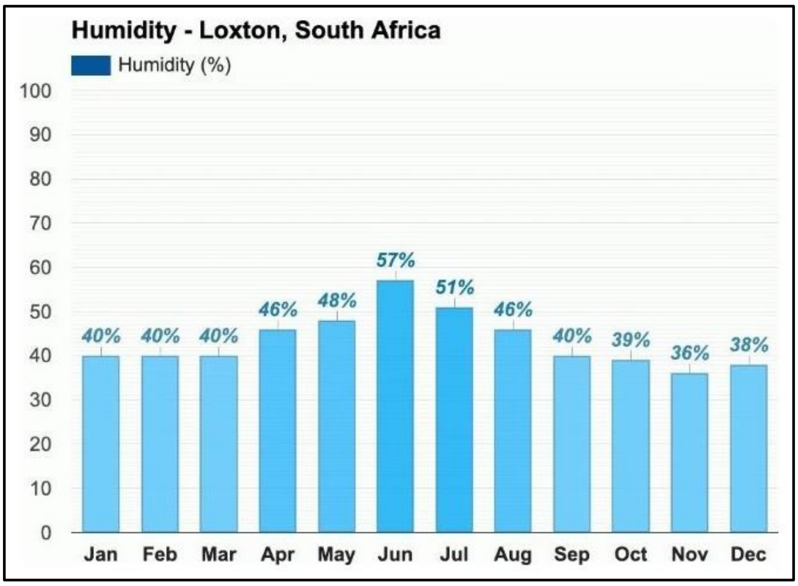


Figure 8-4 Average Relative Humidity – Loxton, South Africa

8.5 Design Rainfall

Design Rainfall Estimation[6] software was used to obtain the rainfall data (tabulated below in **Table 8-1**) required for the run-off calculations.

Table 8-1 Loxton WEF 2 Design Rainfall Data

Return Period		2yr	5yr	10yr	20yr	50yr	100yr	200yr
Duration		Rainfall Depth (mm)						
5	min	6.6	9.3	11.2	13.2	15.8	18	20.2
10	min	9.5	13.4	16.1	18.9	22.8	25.8	29
15	min	11.7	16.5	19.9	23.4	28.1	31.9	35.8
30	min	14.3	20.2	24.3	28.6	34.3	39	43.8
45	min	16.1	22.7	27.4	32.1	38.6	43.8	49.2
60	min	17.4	24.6	29.7	34.9	41.9	47.5	53.4
90	min	19.6	27.7	33.4	39.2	47.1	53.4	60
120	min	21.3	30.1	36.3	42.6	51.2	58	65.2
240	min	24.9	35.2	42.5	49.8	59.9	67.9	76.3
360	min	27.3	38.6	46.6	54.6	65.7	74.5	83.7
480	min	29.2	41.2	49.7	58.3	70.1	79.5	89.3
600	min	30.7	43.3	52.3	61.3	73.8	83.6	94
720	min	32	45.2	54.5	63.9	76.9	87.2	97.9
960	min	34.1	48.2	58.2	68.2	82.1	93.1	104.5
1200	min	35.9	50.7	61.2	71.8	86.3	97.9	110
1440	min	37.4	52.9	63.8	74.8	90	102	114.6
1	day	31.7	44.7	53.9	63.3	76.1	86.3	96.9
2	days	37.5	53	63.9	74.9	90.2	102.2	114.8
3	days	41.4	58.5	70.6	82.8	99.6	112.9	126.8

[6] *Design Rainfall Estimation in South Africa Version 3* developed by MJ Gorven, JC Smithers and RE Schulze

Return Period		2yr	5yr	10yr	20yr	50yr	100yr	200yr
Duration		Rainfall Depth (mm)						
4	days	43.6	61.6	74.3	87.2	104.9	118.9	133.6
5	days	45.5	64.2	77.4	90.8	109.2	123.9	139.1
6	days	47	66.3	80	93.9	112.9	128	143.8
7	days	48.3	68.2	82.3	96.5	116.1	131.7	147.9

9. SURFACE HYDROLOGY

9.1 Drainage of Catchment

9.1.1 Primary Catchment

The site falls within the 'Orange River' drainage catchment (Primary Catchment 'D'), covering an area of ±973 000 km² (including the Vaal River catchment). To the north, the Orange River catchment extends into Namibia; to the east, the Drakensberg mountains; to the south, the Western Cape and Eastern Cape provincial boundaries to the south, ultimately flowing westwards between South Africa and Namibia towards the Atlantic Ocean, shown in **Figure 9-1** below.

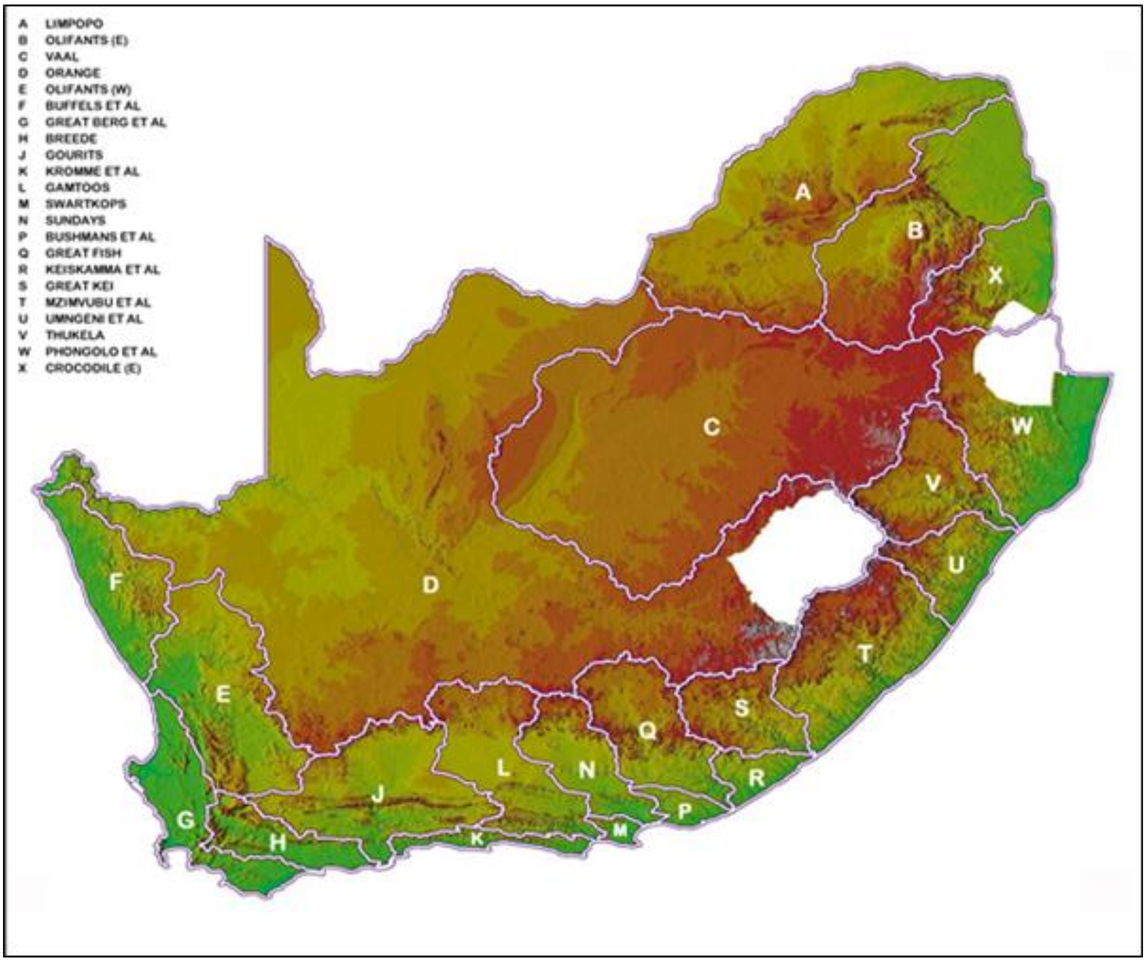


Figure 9-1 Department of Water and Sanitation (DWS) – Primary Catchments

9.1.2 Quaternary Catchment

The proposed facility is in Quaternary Catchments D55D, D55F, D55G, D55C, D61J and D61F. Catchments D55D, D55F, D55G and D55C form part of the upper reaches of the Hartbees River, and catchments D61F and D61J form part of the upper reaches of the Brak River, which then ultimately flows into the upper reaches of the Orange River, shown in **Figure 9-1** below.

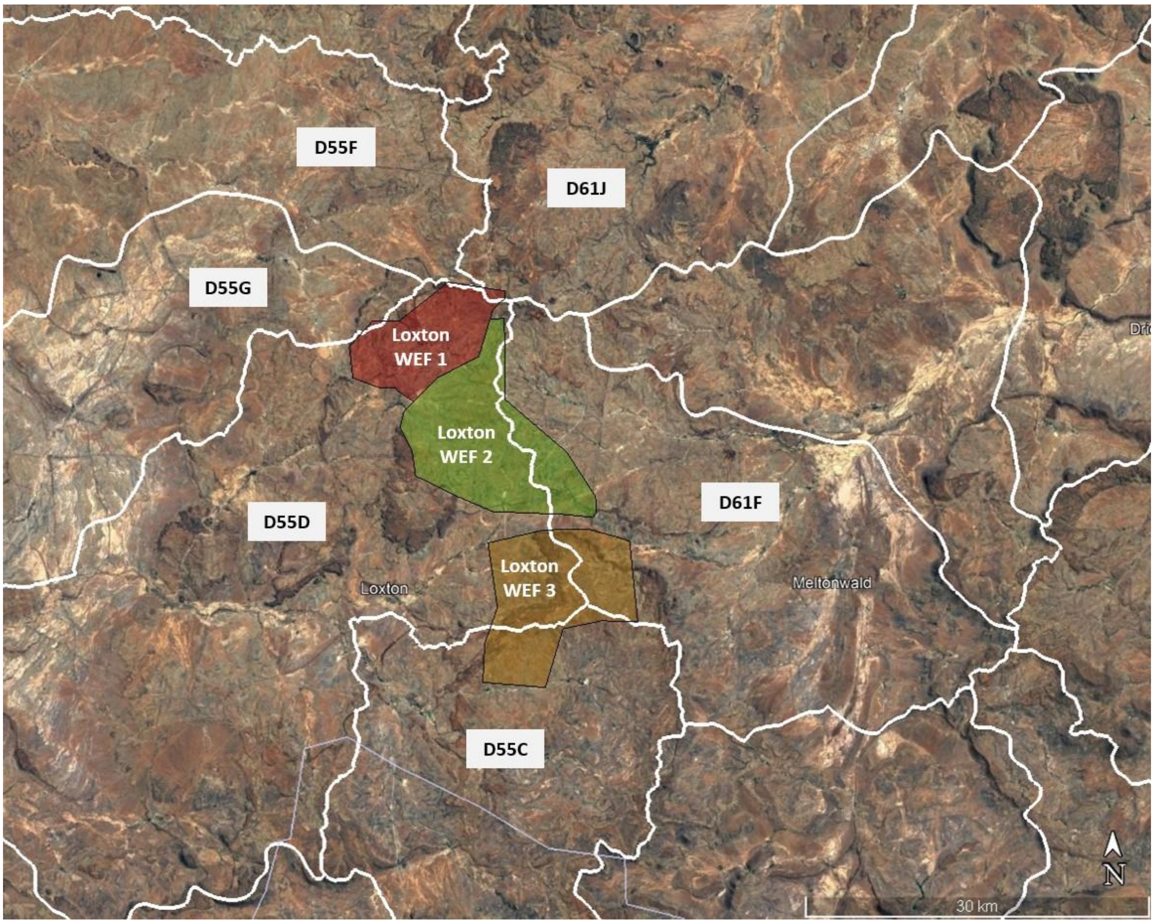


Figure 2-2 Department of Water and Sanitation (DWS) – Quartenary Catchments

10. STORMWATER MANAGEMENT

10.1 Impact of Development[7]

Development is defined as the process of modification or evolution, which historically involves the improvement / construction of buildings and civil infrastructure. A new development leads to an alteration in the hydraulic properties of the subjected area, changing surface run-off properties into pervious or impervious layers and subsequently increasing the surface run-off and altering inundation areas. Common historical stormwater infrastructure and surfaces are constructed to efficiently manage the run-off, resulting in shorter catchment response times and increased peak flows.

As a result of the proposed development, stormwater management is key to reducing the negative impacts and keeping the receiving environment in its natural state. The management is achieved with adequate mitigation measures, per the applicable stormwater drainage standards and policies, to ensure the development can be accommodated within the receiving environment.

10.2 The Purpose of Stormwater Management[8]

The purpose of stormwater management is based on several aspects: health and safety, quality of life, and water conservation. These aspects are briefly described below:

- Directing and discharging the stormwater allows the public to protect their health, welfare, and safety. It also provides for the protection of property from flood hazards.

[7] *Guidelines for Human Settlement Planning and Design compiled by CSIR Building and Construction Technology*
[8] *Guidelines for Human Settlement Planning and Design compiled by CSIR Building and Construction Technology*

- Enhance the quality of life in communities that are affected.
- To grasp the opportunity to conserve water for beneficial public uses.
- To safeguard the natural environment.
- The balance of economic development and the necessity for a sustainable environment; and
- Optimum stormwater management methodologies are adopted so that the primary beneficiaries pay as per their possible gains.

10.3 Stormwater Management Policies & Design Guidelines

Urban Stormwater Management policies require that the post-development run-off from an area for storms of similar recurrence intervals may not exceed the run-off generated under the pre-development condition. For rural developments, the emphasis should focus more on the detrimental effect on the immediate environment concerning the control of water velocity and erosion rather than minor increases between the pre and post-development flow volumes.

This study area falls within the Ubuntu Local Municipality and the Pixley Ka Seme District Municiplaity, and, to our knowledge, specific policies, design guidelines, and standards are not available. Therefore, we recommend that the stormwater drainage system refers to the "Red Book[9]" and the "Drainage Manual[10]".

10.4 Stormwater Management Philosophy

The Stormwater Management Philosophy for the proposed development urges the developer, the professional teams, and contractors to achieve the following:

- Always maintain adequate ground cover in all areas to reduce the risk of erosion by wind, water and all forms of traffic.
- Prevent the concentration of stormwater flow at any point where the ground is susceptible to erosion. Where unavoidable, adequate protection of the ground must be provided.
- Reduce concentrated stormwater flows as much as possible by providing effective attenuation measures.
- Ensure the development does not increase the stormwater flow rate above what the natural ground can safely accommodate.
- Ensure that all stormwater control structures are constructed safely and aesthetically pleasing in keeping with the overall development.
- Prevent pollution of waterways and water features.
- Contain soil erosion by constructing protective works to trap sediment at appropriate locations. This protection applies particularly during construction; and
- Avoid situations where natural or artificial slopes become saturated and unstable during and after construction.

10.5 Stormwater Management Drainage System

Stormwater drainage systems can be seen as dual systems incorporating minor and major storm return periods.

The minor stormwater drainage system caters for frequent storm events. Storms are of a minor nature, usually including stormwater run-off with frequent return periods such as 2yr, 5yr and / or 10 years.

[9] *Guidelines for Human Settlement Planning and Design compiled by CSIR Building and Construction Technology*
[10] *Drainage Manual 6th Edition, Published by The South African National Roads Agency SOC Ltd, 2013*

The major stormwater drainage system caters for severe, infrequent storm events supported by the minor drainage system. Storms of a major nature include less frequent return periods, such as 20 years and more.

11. PRE-DEVELOPMENT RUN-OFF CHARACTERISTICS

11.1 Catchment Description

The development falls within twenty-seven (27) minor catchment areas, forming part of the six (6) quaternary catchments mentioned in **Section 9.** The development's catchment areas vary in size ranging from 0.93 km^2 to 58.8 km^2 and are predominantly flat (~1.8%). The development catchment shows evidence of clearly defined watercourses with drainage lines occurring in multiple directions between the separate catchments.

The development is located in a rural area of the Northern Cape Province where sheep farming predominantly occurs. Referring to the SANBI Vegetation Map (2012), the vegetation in the area is described as 'Eastern Upper Karoo' and features;

> *Flat and gently sloping plains (interspersed with hills and rocky areas of Upper Karoo Hardeveld in the west, Besemkaree Koppies Shrubland in the northeast and Tarkastad Montane Shrubland in the southeast), dominated by dwarf microphyllous shrubs, with 'white grasses of the 'genera Aristida and Eragrostis.*

The proposed WEF development is located between existing streams, rivers or floodplains. Therefore, the flood inundation of these areas will need to be determined at crossings and where infrastructure encroaches on the inundation areas.

11.2 Site Topography

Extensive, irregular plains cover the area on a slightly sloping plateau. All three developments combined have a natural ridge line running north to south, dividing the development into two catchments, one flowing northeast and the other west. Both catchments' drainage lines ultimately join again in the Orange River. As mentioned above, defined drainage lines run through the proposed developments and form part of prominent drainage lines, namely the Soutpoort Rivier, Brak Rivier, Klein Brak and Bitterwaterspruit are located within the Quaternary catchments outside the proposed developable area. (Refer to **Figure 11-1** below).

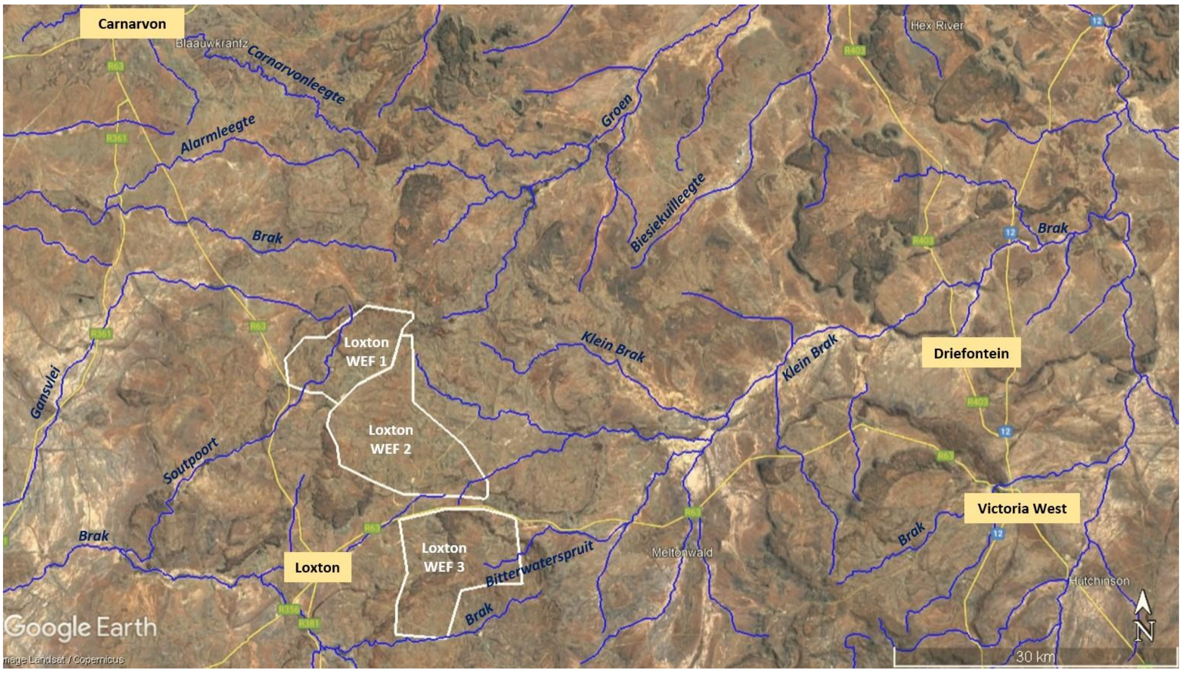


Figure 11-1 Larger Drainage Lines (Blue) outside the development

Please note that detailed contour data was not available for the broader study area. Therefore, the National Geo-Spatial Information (NGI) 's 25 m DEM was sourced to provide terrain data for this area.

Contours were generated from the Digital Elevation Model (DEM) at 2.5 m intervals using ESRI's 3D Analyst Extension for ArcGIS. Therefore, we recommend that an updated and detailed SWMP be completed once a more accurate Digital Terrain Model (DTM) of the site is available.

From **Figure 11-2** and **Figure 11-3** below, we confirm a natural slope of less than 3% for catchment areas forming part of the development with the following percentages:

- Wetlands & Pans (<3%) – 95%
- Flat Areas (3% to 10% slope) – 5%
- Hilly Areas (10% to 30% slope) – 0%
- Steep Areas (>30% slope) – 0%

11.3 Site Vegetation

The vegetation in the area is made up of sparsely vegetated plains, dominated by white grasses giving the vegetation a semi-desert 'steppe' character. In years of abundant rainfall, more vegetation and longer grass can be expected.

Figure 11-2 Current Site Vegetation (Sept 2021)

Figure 11-3 Typical Drainage Lines (Sept 2021)

Figure 11-2 and **Figure 11-3** indicate the typical ground cover on the site, with the following percentage splits applicable: -

- Thick Bush & Plantations – 0%
- Light Bush & Farmlands – 0%
- Grasslands – 50%
- No Vegetation – 50%

11.4 Geotechnical Conditions

Concerning **Section 7** – **Geotechnical Study** above, soil conditions have been assumed as follows: -

- Very Permeable – 20%
- Permeable – 70%
- Semi-permeable – 10%
- Impermeable – 0%

11.5 Hardstand Areas

The property currently has no areas of hardstand: -

- Hardstand Areas – 0%

11.6 Run-Off Coefficient

Based on *Table 3C.1* of the *Drainage Manual – 6th Edition*[11], the following run-off coefficients have been assigned for this calculation: -

Table 11-1 Pre-Development Run-Off Coefficient

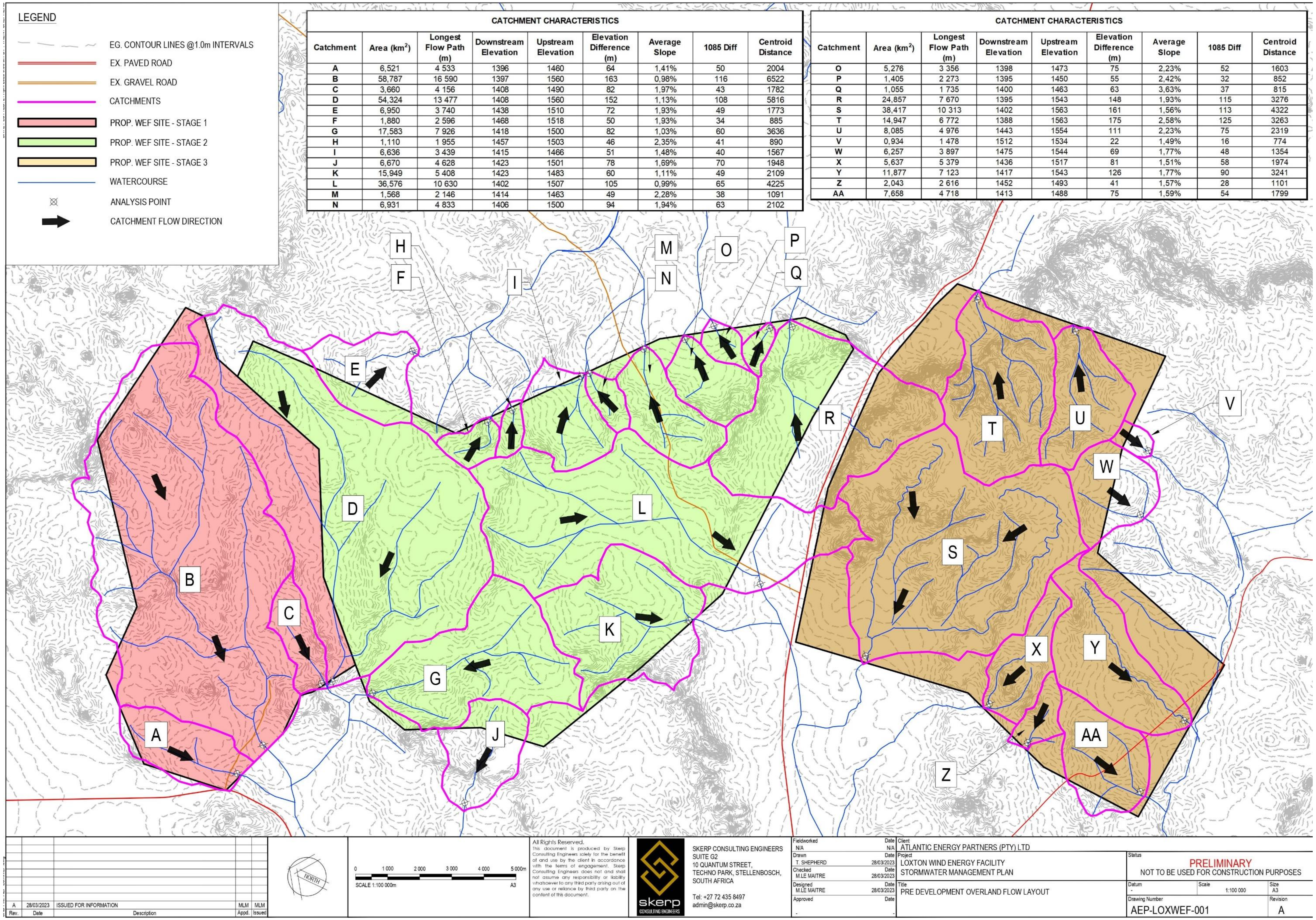
Surface Slope - Wetlands & Pans	**0,03**	**95,0%**	0,029
Surface Slope - Flat Areas (3-10%)	**0,08**	**5,0%**	0,004
Surface Slope - Hilly Areas (10-30%)	**0,16**	**0,0%**	0,000
Surface Slope - Steep Areas (>30%)	**0,26**	**0,0%**	0,000
Soil - Very Permeable	**0,04**	**20,0%**	0,008
Soil - Permeable	**0,08**	**70,0%**	0,056
Soil - Semi-Permeable	**0,16**	**10,0%**	0,016
Soil - Impermeable	**0,26**	**0,0%**	0,000
Vegetation - Thick Bush / Plantations	**0,04**	**0,0%**	0,000
Vegetation - Light Bush / Farmlands	**0,11**	**0,0%**	0,000
Vegetation - Grasslands	**0,21**	**50,0%**	0,105
Vegetation - No Vegetation	**0,28**	**50,0%**	0,140
			0,358

Based on the preceding table, we calculated a **PRE-DEVELOPMENT Run-Off Coefficient** of **0.358**.

It should also be noted that no 'Area Reduction Factor' has been applied as we believe the drainage catchment areas are too small.

[11] *Drainage Manual 6th Edition, Published by The South African National Roads Agency SOC Ltd, 2013*

Figure 11-4 Loxton WEF 2 Development Area– Pre-Development Overland Flow



CATCHMENT CHARACTERISTICS

Catchment	Area (km²)	Longest Flow Path (m)	Downstream Elevation	Upstream Elevation	Elevation Difference (m)	Average Slope	1085 Diff	Centroid Distance
A	6,521	4 533	1396	1460	64	1,41%	50	2004
B	58,787	16 590	1397	1560	163	0,98%	116	6522
C	3,660	4 156	1408	1490	82	1,97%	43	1782
D	54,324	13 477	1408	1560	152	1,13%	108	5816
E	6,950	3 740	1438	1510	72	1,93%	49	1773
F	1,880	2 596	1468	1518	50	1,93%	34	885
G	17,583	7 926	1418	1500	82	1,03%	60	3636
H	1,110	1 955	1457	1503	46	2,35%	41	890
I	6,636	3 439	1415	1466	51	1,48%	40	1567
J	6,670	4 628	1423	1501	78	1,69%	70	1948
K	15,949	5 408	1423	1483	60	1,11%	49	2109
L	36,576	10 630	1402	1507	105	0,99%	65	4225
M	1,568	2 146	1414	1463	49	2,28%	38	1091
N	6,931	4 833	1406	1500	94	1,94%	63	2102

CATCHMENT CHARACTERISTICS

Catchment	Area (km²)	Longest Flow Path (m)	Downstream Elevation	Upstream Elevation	Elevation Difference (m)	Average Slope	1085 Diff	Centroid Distance
O	5,276	3 356	1398	1473	75	2,23%	52	1603
P	1,405	2 273	1395	1450	55	2,42%	32	852
Q	1,055	1 735	1400	1463	63	3,63%	37	815
R	24,857	7 670	1395	1543	148	1,93%	115	3276
S	38,417	10 313	1402	1563	161	1,56%	113	4322
T	14,947	6 772	1388	1563	175	2,58%	125	3263
U	8,085	4 976	1443	1554	111	2,23%	75	2319
V	0,934	1 478	1512	1534	22	1,49%	16	774
W	6,257	3 897	1475	1544	69	1,77%	48	1354
X	5,637	5 379	1436	1517	81	1,51%	58	1974
Y	11,877	7 123	1417	1543	126	1,77%	90	3241
Z	2,043	2 616	1452	1493	41	1,57%	28	1101
AA	7,658	4 718	1413	1488	75	1,59%	54	1799

12. POST-DEVELOPMENT RUN-OFF CHARACTERISTICS

12.1 Site Development Plan (SDP)

Concerning the SDP, the proposed Loxton WEF 2 layout will consist of 62 turbines, an access road, internal roads, substation, battery energy storage system (BESS), turbine laydown areas, auxiliary buildings, and external buildings access roads etc. The total development area will cover a combined area of ±34 700 ha. In contrast, the permanent footprint of Loxton WEF 1 will only cover ±65 ha, Loxton WEF 2 covers ±65 ha and Loxton WEF 3 covers ±110 ha.

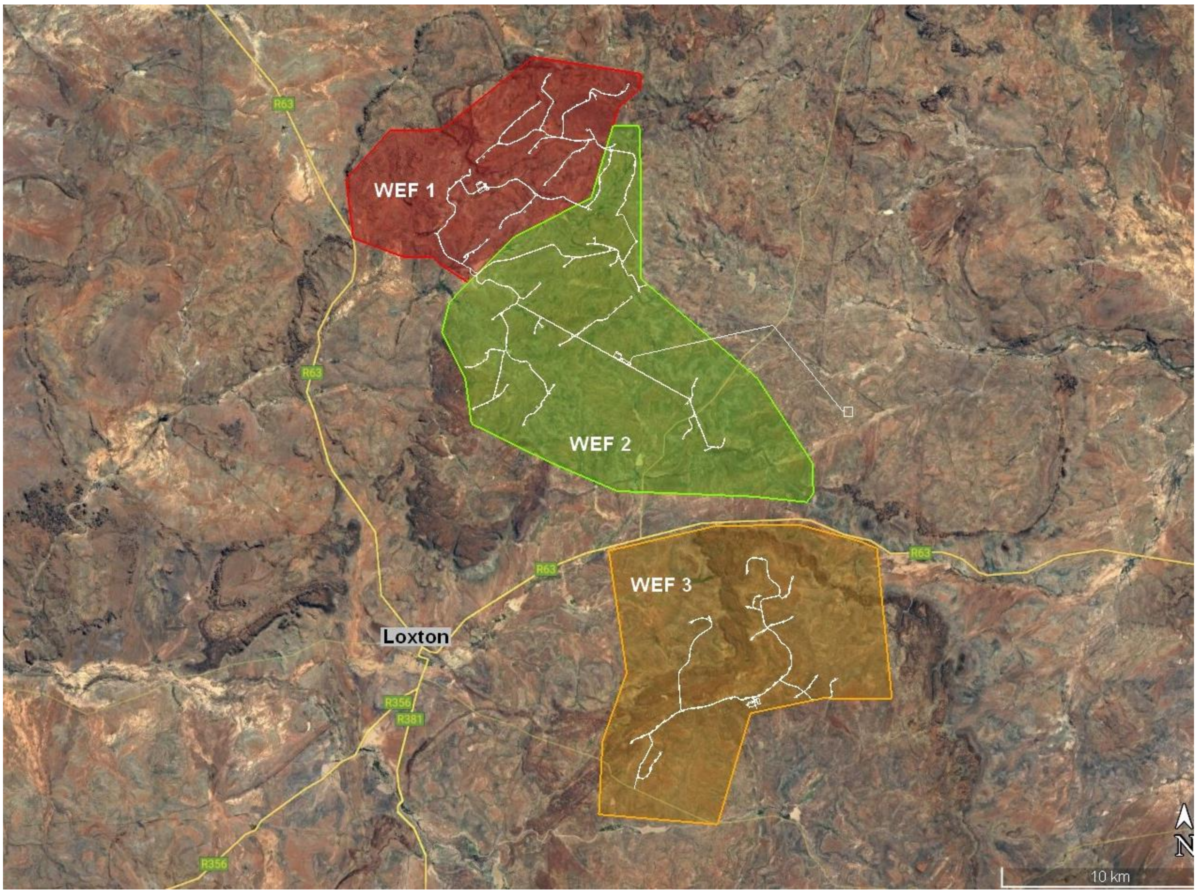


Figure 12-1 Loxton WEF 2 SDP (Indicated in green)

12.2 Site Topography

Bulk platforms, roads and buildings will be constructed at less steep slopes than the natural topography.

The following percentage splits are applicable: -

- Flatter Areas (0% to 3% slope) – 95%
- Flat Areas (3% to 10% slope) – 5%
- Hilly Areas (10% to 30% slope) – 0%
- Steep Areas (>30% slope) – 0%

12.3 Geotechnical Conditions

Concerning **Section 7 – Geotechnical Study**, it has been assumed that the percentages used in the 'pre-development' run-off coefficient will remain unchanged for the 'post-development' as there would be little or no effect from the facility on the existing ground conditions.

The following percentages will be used: -

- Very Permeable – 20%
- Permeable – 70%
- Semi-permeable – 10%
- Impermeable – 0%

12.4 Developed Components

Once developed, it has been confirmed that the property will have no significant impervious surfaces in the form of surfaced roads or buildings other than the natural ground cover. However, gravel roads and platforms will be constructed across the site to provide access to the WTG's. Gravel roads will have frequent discharge points to reduce stormwater concentrations and ultimately minimise the development impact.

A slight increase in the area of imperviousness is therefore assumed:-

- Gravel Roads & Platforms – 94%
- WEF Facility – 6%
- Grasslands – 0%
- No Vegetation – 0%

12.5 Run-Off Coefficient

Based on *Table 3C.1* of the *Drainage Manual – 6th Edition*[12], the following run-off coefficients percentages have been assigned for this calculation: -

Table 12.1 Post-Development Run-Off Coefficient

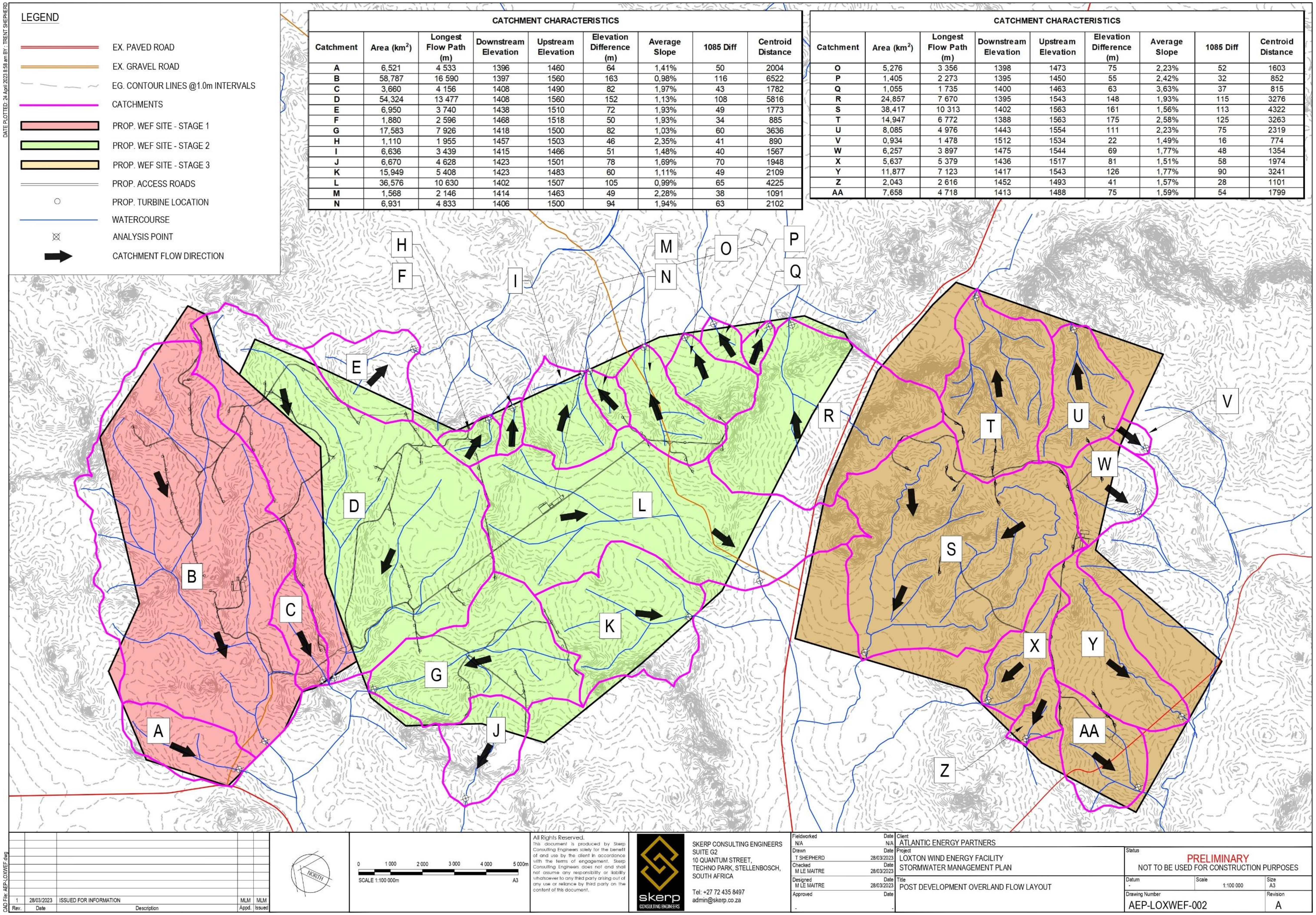
UN-DEVELOPED COMPONENT: Run-off Percentages			
Surface Slope - Wetlands & Pans	**0,03**	**95,0%**	0,029
Surface Slope - Flat Areas (3-10%)	**0,08**	**5,0%**	0,004
Surface Slope - Hilly Areas (10-30%)	**0,16**	**0,0%**	0,000
Surface Slope - Steep Areas (>30%)	**0,26**	**0,0%**	0,000
Soil - Very Permeable	**0,04**	**20,0%**	0,008
Soil - Permeable	**0,08**	**70,0%**	0,056
Soil - Semi-Permeable	**0,16**	**10,0%**	0,016
Soil - Impermeable	**0,26**	**0,0%**	0,000
Vegetation - Thick Bush / Plantations	**0,04**	**0,0%**	0,000
Vegetation - Light Bush / Farmlands	**0,11**	**0,0%**	0,000
Vegetation - Grasslands	**0,21**	**50,0%**	0,105
Vegetation - No Vegetation	**0,28**	**50,0%**	0,140
			0,358
DEVELOPED COMPONENT: Run-off Percentages			
Surface Slope - Wetlands & Pans	**0,03**	**100,0%**	0,030
Surface Slope - Flat Areas (3-10%)	**0,08**	**0,0%**	0,000
Surface Slope - Hilly Areas (10-30%)	**0,16**	**0,0%**	0,000
Surface Slope - Steep Areas (>30%)	**0,26**	**0,0%**	0,000
Soil - Very Permeable	**0,04**	**20,0%**	0,008
Soil - Permeable	**0,08**	**70,0%**	0,056
Soil - Semi-Permeable	**0,16**	**10,0%**	0,016
Soil - Impermeable	**0,26**	**0,0%**	0,000

[12] *Drainage Manual 6th Edition, Published by The South African National Roads Agency SOC Ltd, 2013*

Gravel Roads & Platforms	**0,50**	**94,0%**	0,470
WEF Facilities	**1,00**	**6,0%**	0,060
Vegetation - Grasslands	**0,21**	**0,0%**	0,000
Vegetation - No Vegetation	**0,28**	**0,0%**	0,000
			0,640
RUN-OFF COEFFICIENT: Without DOLOMITE			
Percentage **UN-DEVELOPED**		**99,0%**	**0,354**
Percentage **DEVELOPED**		**1,0%**	**0,006**
TOTAL Run-Off coefficient			**0,360**

Based on the preceding table, we calculated a factored **POST-DEVELOPMENT Run-Off Coefficient** of **0.360.**

Figure 12-2 Loxton WEF 2 – Post-Development Overland Flow



CATCHMENT CHARACTERISTICS

Catchment	Area (km^2)	Longest Flow Path (m)	Downstream Elevation	Upstream Elevation	Elevation Difference (m)	Average Slope	1085 Diff	Centroid Distance
A	6,521	4 533	1396	1460	64	1,41%	50	2004
B	58,787	16 590	1397	1560	163	0,98%	116	6522
C	3,660	4 156	1408	1490	82	1,97%	43	1782
D	54,324	13 477	1408	1560	152	1,13%	108	5816
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H	1,110	1 955	1457	1503	46	2,35%	41	890
I	6,636	3 439	1415	1466	51	1,48%	40	1567
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K	15,949	5 408	1423	1483	60	1,11%	49	2109
L	36,576	10 630	1402	1507	105	0,99%	65	4225
M	1,568	2 146	1414	1463	49	2,28%	38	1091
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CATCHMENT CHARACTERISTICS

Catchment	Area (km^2)	Longest Flow Path (m)	Downstream Elevation	Upstream Elevation	Elevation Difference (m)	Average Slope	1085 Diff	Centroid Distance
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P	1,405	2 273	1395	1450	55	2,42%	32	852
Q	1,055	1 735	1400	1463	63	3,63%	37	815
R	24,857	7 670	1395	1543	148	1,93%	115	3276
S	38,417	10 313	1402	1563	161	1,56%	113	4322
T	14,947	6 772	1388	1563	175	2,58%	125	3263
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V	0,934	1 478	1512	1534	22	1,49%	16	774
W	6,257	3 897	1475	1544	69	1,77%	48	1354
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Y	11,877	7 123	1417	1543	126	1,77%	90	3241
Z	2,043	2 616	1452	1493	41	1,57%	28	1101
AA	7,658	4 718	1413	1488	75	1,59%	54	1799

13. SURFACE MODELLING

13.1 Modelling Selection

EMPIRICAL and STATISTICAL METHODS were not considered for this project as insufficient hydrological records and observed points were available for the area. Therefore, a deterministic method has thus been selected to determine the results.

This method comprises mainly manual, graphic and computer-generated spreadsheets. Therefore, we believe our selection of the 'UNIT HYDROGRAPH METHOD '(HRU 1972) is appropriate because the site does not have a varying degree of post-development land change and does not have any existing permanent dams and sub-catchments. Computerised spreadsheets have been used to assist with iterations and to eliminate manual calculation errors.

As noted in **Section 11**, the proposed site is affected by twenty-seven (27) minor catchments. **Section 13.2** below modelled the surface run-off for each catchment for Pre and Post-Development conditions.

13.2 Surface Run-Off Modelling Results

Table 13-1 Pre-Development Modelling Results (Q = m^3/s)

Catchment	Return Period (Years)					
	2	5	10	25	50	100
A	1,789	6,861	9,790	14,336	20,949	29,083
B	5,829	28,704	40,960	59,979	87,647	123,112
C	1,175	4,332	6,182	9,052	13,227	18,363
D	6,166	29,520	42,124	61,683	90,137	125,724
E	2,223	8,126	11,595	16,979	24,812	34,445
F	0,919	2,983	4,256	6,232	9,107	12,643
G	2,943	12,918	18,433	26,992	39,444	54,758
H	0,618	1,937	2,764	4,047	5,914	8,210
I	2,191	7,917	11,297	16,543	24,174	33,559
J	1,886	7,153	10,206	14,945	21,840	30,319
K	3,727	14,848	21,187	31,024	45,336	62,937
L	5,044	23,172	33,066	48,419	70,755	98,231
M	0,780	2,522	3,599	5,270	7,700	10,690
N	1,928	7,355	10,496	15,369	22,459	31,179
O	1,883	6,646	9,484	13,887	20,294	28,173
P	0,762	2,399	3,423	5,012	7,324	10,167
Q	0,676	2,026	2,892	4,234	6,188	8,590
R	4,738	19,886	28,377	41,553	60,721	84,296
S	3,713	16,738	23,885	34,974	51,108	70,951
T	5,046	20,734	29,586	43,324	63,308	87,888
U	6,606	24,962	35,620	52,159	76,219	105,811
V	16,447	45,838	65,409	95,779	139,962	194,302
W	8,952	30,732	43,854	64,215	93,837	130,270
X	6,741	25,355	36,180	52,979	77,418	107,476
Y	4,932	20,441	29,169	42,713	62,416	86,649
Z	11,559	36,393	51,932	76,044	111,123	154,267
AA	1,789	6,861	9,790	14,336	20,949	29,083

Table 13-2 Post-Development Modelling Results

Catchment	Return Period (Years)					
	2	5	10	25	50	100
A	1,789	6,861	9,790	14,336	20,949	29,083
B	5,960	29,264	41,658	60,831	88,483	123,879
C	1,202	4,417	6,287	9,181	13,354	18,477
D	6,304	30,096	42,842	62,560	90,997	126,507
E	2,273	8,284	11,793	17,221	25,048	34,659
F	0,939	3,041	4,328	6,321	9,194	12,721
G	3,009	13,170	18,748	27,376	39,820	55,099
H	0,618	1,937	2,764	4,047	5,914	8,210
I	2,240	8,071	11,490	16,778	24,404	33,768
J	1,928	7,292	10,380	15,158	22,048	30,508
K	3,811	15,137	21,548	31,465	45,768	63,329
L	5,157	23,624	33,630	49,108	71,430	98,842
M	0,797	2,571	3,660	5,344	7,774	10,757
N	1,972	7,499	10,675	15,588	22,673	31,373
O	1,925	6,776	9,646	14,085	20,487	28,348
P	0,779	2,445	3,481	5,083	7,394	10,231
Q	0,692	2,066	2,941	4,295	6,247	8,643
R	4,844	20,274	28,861	42,144	61,301	84,821
S	3,796	17,064	24,292	35,472	51,596	71,392
T	5,160	21,138	30,090	43,939	63,913	88,435
U	6,755	25,449	36,227	52,900	76,946	106,470
V	16,816	46,732	66,524	97,141	141,298	195,512
W	9,153	31,331	44,601	65,128	94,733	131,081
X	6,893	25,849	36,797	53,732	78,157	108,145
Y	5,043	20,840	29,666	43,320	63,012	87,189
Z	11,819	37,103	52,817	77,125	112,184	155,227
AA	1,829	6,995	9,957	14,540	21,149	29,264

The results above indicate that the proposed development will have little to no effect between the Pre and Post-Development flows. Therefore, we believe implementing minor localised stormwater management guidelines can accommodate the proposed development without negatively impacting the downstream catchment.

14. STORMWATER MANAGEMENT & GUIDELINES

The buildings / structures within the development will require the control of stormwater run-off as per the stormwater management philosophy and policies of the local authority / municipality. The following guidelines are intended to assist in the design of the major and minor stormwater infrastructure and to ensure that the objectives of this SWMP are met during the planning, design, construction, and operational phases of the development.

14.1 Buildings

Any building will inevitably result in some degree of flow concentration or deflection around buildings. The developer / owner shall ensure that all stormwater flow paths are protected against erosion.

Any inlet to a piped system shall be fitted with a screen / grating to prevent debris and refuse from entering the stormwater system. This must be installed immediately upon the installation of the infrastructure. The onus is on the owner / developer to maintain the state of the screen / grating to ensure smooth flow.

No building works, earthworks, walls or fences may obstruct or encroach on a watercourse inside or outside the site without approved plans that do not compromise the objectives of the SWMP in addition to any required Authority approvals.

14.2 Roof Drainage

Building designs must ensure that rainfall run-off from roofing and other areas, not subjected to excessive pollution, can be efficiently captured for re-use for on-site irrigation and non-potable water uses.

Where storage for re-use and ground conditions permit, rainwater run-off should connect to detention areas to maximise groundwater recharge. These detention areas must be designed to attenuate run-off, specifically, the peak flows experienced in the reaches of a watercourse-.

14.3 Parking and Paved Areas

Parking or paved areas should be designed to attenuate stormwater run-off to an acceptable degree by allowing ponding or infiltration. Stormwater from such areas must be discharged and controlled as overland sheet flow or larger attenuation facilities.

14.4 Roads

Roads should be designed and graded to avoid the concentration of flow along and off the road. Regular side drains discharge points along roads for overland flow to continue as sheet flow towards drainage lines per pre-development conditions (Refer **Figure 6-1**). Where flow concentration is unavoidable, measures to incorporate the road into the major stormwater system should be taken, providing appropriately designed attenuation storage facilities at suitable points.

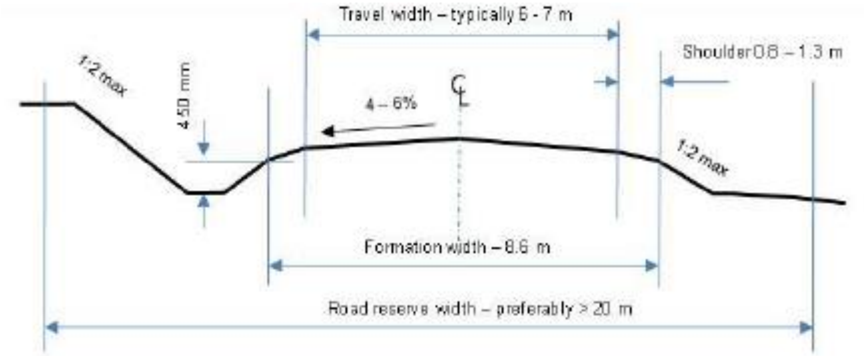

Figure 14-1 Typical Road Cross Section showing side drains

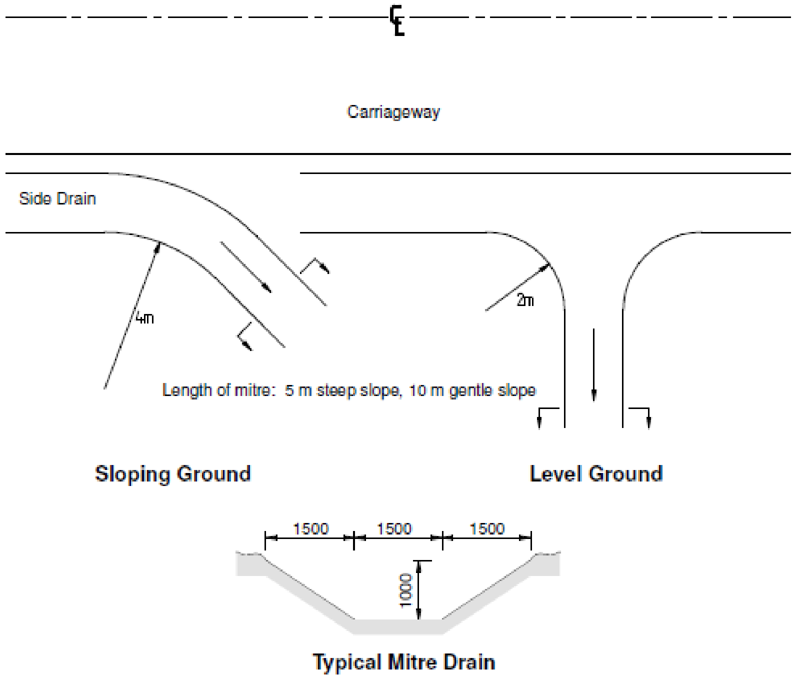

Figure 14-2 Typical Stormwater Mitre Drain / Channel

Gravel roads crossing drainage lines require a suitable-sized culvert, concrete causeways or cut-off walls to ensure vehicles can safely pass over natural drainage lines. Culverts for roads must be designed to ensure that the capacity of the culvert does not exceed the pre-development stormwater flow at that point, and attenuation storage should be provided on the upstream side of the road crossing.

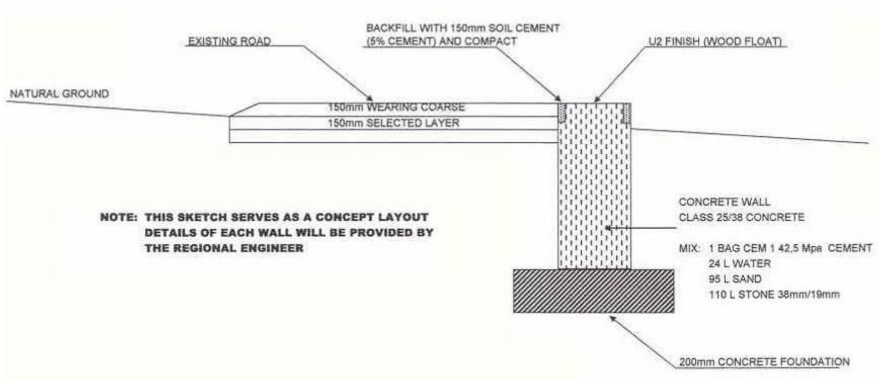

Figure 14-3 Typical Detail of a Cut-Off wall

Figure 14-4 Typical Low-Level Concrete structure

Outlet and culvert discharge points into the natural watercourse must be designed to dissipate flow energy, and any unlined downstream channel must be adequately protected against soil erosion. (Refer **Figure 14-5**)

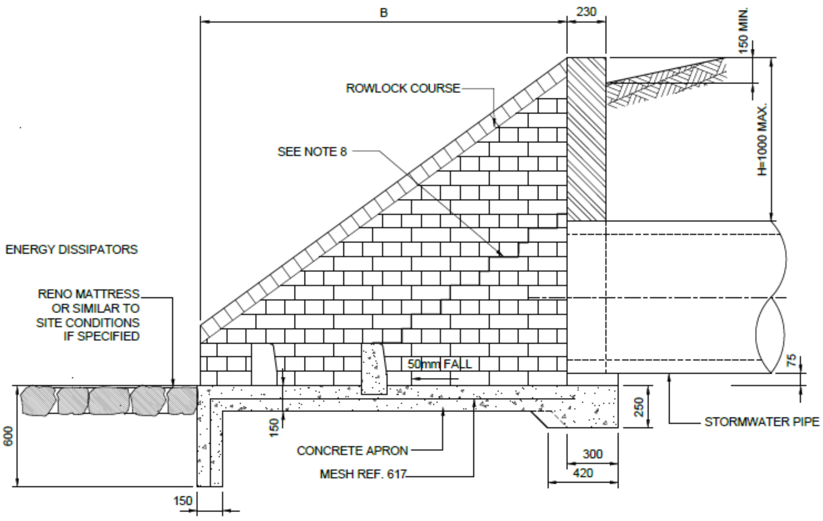

Figure 14-5 Typical Stormwater Headwall with Energy Dissipators

14.5 Subsurface Disposal of Stormwater

Any construction providing for the subsurface disposal of stormwater should be designed to ensure that such disposal does not cause slope instability or areas of concentrated saturation or inundation. Infiltration structures should be integrated into the terrain to be unobtrusive and in keeping with the natural surroundings.

14.6 Channels

Channels may be constructed to convey stormwater directly to a natural watercourse where deemed necessary and unavoidable. The channels must be suitably lined to prevent erosion and scour and provide maximum possible energy dissipation of the flow. Such linings will vary from vegetated earthen to stone pitching or reinforced concrete.

14.7 Energy Dissipation

Measures should be taken to dissipate flow energy wherever concentrated stormwater flow is discharged onto the natural ground.

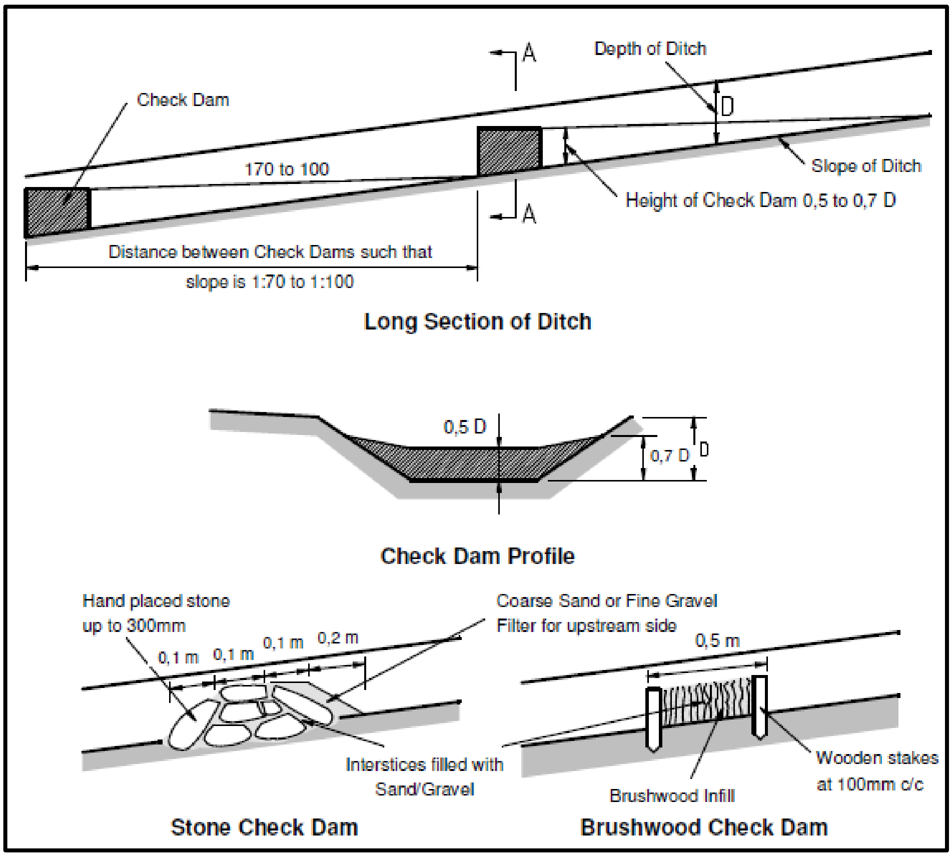

Figure 14-6 Typical Erosion Control

14.8 Open Trenches

Open trenches should not be left open and unprotected for extended periods and should be progressively backfilled as construction proceeds. Excavated material to be used as a backfill must be placed close to the trench on the upstream side to avoid loose material from washing away.

14.9 Stockpiles

Material is to be stockpiled away from drainage paths. Loose material such as stone, sand or gravel must be covered or kept damp to minimise dust. Temporary silt screens are to be positioned immediately downstream of stockpiles to intercept loose material which may be washed away.

14.10 Stormwater Pollution Control

The stormwater systems should be free from materials that could harm the water systems' fauna, flora, and aquatic life.

Sites which generate "dirty" (Grey or Black) water must have measures in place that separates the clean and "dirty" water. Depending on the nature of the "dirty" water, the water must either be discharged into the wastewater system or contained on-site for off-site treatment.

15. STORMWATER MANAGEMENT POLICY

The following rules are to be observed by the owner, developer, professional team, contractors, and sub-contractors:

- The Environmental Management Program (EMPr), as per the EIA and approved by the competent authority, will manage stormwater run-off during construction. All construction activities within the development must comply with the EMPr. This SWMP document is supplementary to the EMPr. The control measures herein are not considered all-encompassing, as the contractor will have to adapt site-specific control measures.
- Before the commencement of any construction activities, the contractor must compile and submit his construction SWMP, which needs to comply with the approved EMPr. The plan must include measures to control and prevent erosion during and after construction.
- Existing flood lines / wetlands / stormwater attenuation areas should be protected from encroachment by the development.
- Development designs must include measures for attenuating the increased concentration of stormwater run-off. The post-development peak flows can be attenuated to pre-development conditions if adequate stormwater mitigation measures are not implemented.
- On-site stormwater control systems, such as swales, berms and attenuation ponds, must be constructed before any other construction commences. These systems must be monitored and appropriately adjusted as construction progresses to ensure complete stormwater, erosion and pollution control.
- All formed embankments must be adequately stabilised.
- An approved landscaping and re-vegetation plan must be implemented immediately after building works have reached a stage where newly established ground cover is not at risk from the construction works.
- The contractor must show that this document's provisions, regulations and guidelines have been considered.
- In the event of a failure to adequately implement the approved SWMP, the contractor shall be responsible for all consequential damage at his own cost. The developer is therefore advised to ensure that all members of the professional team and contractors are competent to undertake the development work and are adequately insured.
- Appropriately designed attenuation / detention facilities will be located at appropriately selected sites based on geotechnical, environmental and topographical conditions, including wetland conservation.
- Where conditions permit, open ditches, drains and channels will be used instead of pipes. On steeper slopes, where high flow velocities are anticipated, appropriate linings for all channels must be provided to withstand erosion. Such linings will vary from vegetated earthen to stone pitching and reinforced concrete.
- Flow velocities must be reduced wherever possible to reduce the erosion potential in channels and points of flow concentration (typically at outlets).
- Silt, trash and oil traps must be strategically provided to ensure water quality is not compromised and prevent drainage system blockages.
- Areas within the proposed development that are bound on stormwater attenuation areas, near road crossings, watercourse confluences and water features might be subject to flooding. In these situations, all development should take place above the outfall levels with an appropriate freeboard allowance.
- Potential future development in these sub-catchments should be considered, and any stormwater attenuation requirements should be identified for areas flowing into the development area. Likewise, consideration must be given to the stormwater flowing out of the development, which may impact the downstream areas and watercourses. Appropriate measures must be taken to ensure any upstream development does not result in an increased flood damage risk downstream; and
- All-natural and unlined channels should be inspected for adequate soil binding by sustainable ground cover. Stone pitching should be used to reinforce channel inverts on steep slopes.

16. CONCLUSION & IMPACT STATEMENT

- In conclusion;
  - The Surface Modelling (**Section 13**) reveals that the proposed development / infrastructure will have a minimal impact on the stormwater quality and quantities of post-development stormwater flow (operational phase).
  - The highest impact will, in all likelihood, occur during the construction phase, and these impacts must be strictly managed under the advisement of the guidelines set out in this document.
  - The need for formal stormwater interventions can be minimised if the development is designed to maintain the existing drainage patterns. Overland flow via poorly-defined drainage paths will be the primary form of conveyance.
  - The Civil Engineers must prepare a detailed stormwater management plan for construction purposes describing and illustrating the proposed stormwater and erosion control measures during the detailed design phase.
  - A comprehensive geotechnical study is completed before the detailed design stage of this development.
  - The guidelines described in **Section 14 – STORMWATER MANAGEMENT & GUIDELINES** should be incorporated into the detailed design of the development.
  - The policy described in **Section 15 – STORMWATER MANAGEMENT POLICY** be implemented.
- Impact Statement;
  - Concerning this report, associated assessment, and the findings made within, SKERP Consulting Engineers believes that the Loxton WEF 2 and associated grid infrastructure will have a nominal impact on the existing stormwater catchments. The project is therefore deemed acceptable from a stormwater perspective, provided this report's recommendations and mitigation measures are implemented. Hence, Environmental Authorisation (EA) should be granted for the EIA application.
  - This document should also be read in conjunction with the EMPr. The developer, owner, and professional team shall adhere to the requirements and conditions set out in the EMPr.

REFERENCES

Climate Data for Cities Worldwide (Loxton) - ***www.en.climate-data.org***

Council for Scientific and Industrial Research (CSIR) - *Guidelines for Human Settlement Planning and Design compiled by CSIR Building and Construction Technology (2003)*

Department Water & Sanitation

Lauren M. Cook and Richard H. McCuen – *Hydrologic Response of Solar Farms (May 2013)*

MJ Gorven, JC Smithers and RE Schulze - *Design Rainfall Estimation in South Africa (Version 3)*

South African National Botanical Institute – *National Vegetation Map 2012*

South African National Roads Agency – *Drainage Manual 6th Edition (2013)*

Bramford, Prof M – *Paleontology. Loxton WEFs 1,2,3. Loxton Wind Facility 2 (Pty) Ltd (2022)*

Weather Atlas (Loxton) – *www.weather-atlas.com*

Western Cape Provincial Administration – *Gravel Roads Manual Rev 0*

APPENDIX A: SPECIALIST CURRICULUM VITAE

CURRICULUM VITAE

Name	Merchandt Le Maitre
Profession	Civil Engineer
Name of Firm	Skerp Consulting Engineers
Present Appointment	Senior Civil Engineer
Years with Firm	1 Year
Date of Birth	25 September 1982, Johannesburg, South Africa
ID Number	820925 5037 086
Nationality	South African

Education

- University of Johannesburg (2006)
- University of South Africa (2016)

Professional Qualifications

- N Dip: Civil Engineering
- B Tech: Civil Engineering (Water)
- Pr.Tech.Eng. (Reg. No. 2018300094)
- CPEng (In Process)

Membership in Professional Societies

- Engineering Council of South Africa (ECSA) – Pr Tech Eng; (Reg N° 2018300094)
- Engineering New Zealand – CPEng (In Process)
- South African Institute of Civil Engineers (SAICE)

Employment Record

Sept 2022 – Present	Skerp Consulting Engineers – Senior Civil Engineer (Cape Town)
Nov 2020 – Aug 2022	SiVEST SA (PTY) LTD – Divisional Manager (Pretoria)
May 2004 – Oct 2020	SiVEST SA (PTY) LTD – Senior Civil Engineering Technician (Pretoria)
Jan 2004 – April 2004	Con Roux Zambia - Junior Foreman (Zambia)
Dec 2002 – Dec 2003	Neda Engineering - Vacation Work (Nelspruit)

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent
Afrikaans	Fluent	Fluent	Fluent

Years of Working Experience: 18

Countries of Work Experience

- South Africa
- New Zealand
- Australia
- Swaziland
- Zambia
- Kenya
- Namibia

Fields of Expertise

- Bulk Services Studies
- Feasibility Studies
- Service Reports
- Infrastructure Design
- Contract Documentation & Procurement
- Contract Administration
- Procurement and Construction Monitoring

Overview

Merchandt joined his previous company as a student Civil Engineering Technician in 2004. He received a company bursary to complete his studies and permanently joined the company for 18 years. During his 18 years at the company, he registered as Professional Civil Engineering Technician and soon became a Divisional Manager of the firm.

He was actively involved in numerous infrastructure projects, which included Feasibility Studies, Design, Procurement, Contract Administration, Monitoring and closing out of projects. His contractual experience includes the General Conditions of Contract (GCC) and New Engineering Contract (NEC4).

Recently, he started at Skerp Consulting Engineers, a South African company serving clients abroad. His broad spectrum of skills can now be applied to local and international clients while mentoring young Engineers and Draftsmen.

A summary of his experience is indicated in each field below:

<u>Roads & Stormwater</u>
Design, Implement & Contract Administration:

- Provincial Road Intersections (Class 2 Roads)
- Municipal Roads (Class 3-5 Roads)
- Residential, Commercial & Industrial Civil Engineering Services
- Bulk Stormwater Infrastructure

<u>Hydrology</u>

- Attenuation Reports
- Flood Inundation Assessments / Floodline Reports
- Stormwater Management Reports
- Stormwater Assessments / Investigations
- Roof Gutter & Down Pipe Design / Assessments / Reports

<u>Water & Sanitation</u>
Design, Implement & Contract Administration:

- Water supply lines, including Bulk Water
- Water Pump Stations
- Sanitation networks, including Outfall Sewers
- Sewer Pump Stations
- Irrigation Networks (Farms)

Renewable Energy
- Transportation Impact Assessments
- Water Demand Assessments
- Glint & Glare Assessments
- Stormwater Management Reports
- Preliminary Engineering Reports & Designs

Projects Experience (by Sector)

CIVIL ENGINEERING SERVICES (TOWNSHIP)

- Tijger Valley Extension 10, 20, 21, 22, 23, 27, 38-44, 72, 105-113, 19, 62, 103, 104, 34, 35, 36, 123 etc. - Design, Procurement, Contract Administration and Monitoring of civil services.
- Derdepoort Extension 181- Design, Procurement, Contract Administration and Monitoring.
- Project Springbok, Sasolburg - Design, Procurement, Contract Administration and Monitoring.
- Arcadia Extension 11 - Design, Procurement, Contract Administration and Monitoring.
- Lakeside Erf 181- Design, Procurement, Contract Administration and Monitoring.
- Longmeadow Extension 10, 11 & 12 - Design, Procurement, Contract Administration and Monitoring.
- Bushwillow Estate - Design, Procurement, Contract Administration and Monitoring.
- Forum Homini – Draughting Monitoring of Dam Spillway construction & sewer reticulation.
- Longmeadow Extension 7, 8, 9, 10, 11, 12 – Civil Engineering services and design of earth retaining wall.
- Lakeside Erf 181 – Design and supervision of Civil Engineering Services, including Attenuation facilities.
- Mbabane Kingdom Hall – Bulk earthworks and road Design, Procurement, Contract Administration and Monitoring.
- Kungwini Bulk Water – Draughting and supervising a Steel Bulk Water Supply Pipe.
- Mooikloof Booster Station – Design and supervision of a water booster pump facility.
- PTN 2 of 148 Athol – Compiling and analysis Stormwater Assessment.
- Mooibosch Development – Compiling of Services reports and Floodline Determination.
- Hazeldean Extension 39 – Design and supervision of Civil Engineering Services.
- Hazeldean Retirement Village – Design of Civil Engineering Services.
- Kungwini Collector Sewer – Design of Collector Sewer.
- Maroeladal Extension 9 – Design and compilation of Services Report.
- Hazeldean Oukraal – Design of Civil Engineering Services
- Hazeldean Business Park – Design and compilation of Services Reports.
- Erf 181 Derdepoort – Design and compilation of Services Reports and preliminary design of Provincial Intersection.
- Erf 92 Edenburg – Floodline Determination and design and compilation of the Services report.
- Longmeadow Extension 12 Stormwater – Design of Stormwater Reticulation.
- Astral Foods - Design, Procurement, Contract Administration and Monitoring of civil services.
- Astral Foods Pretoria East – Condition Assessment
- Cotton Gin Mpumalanga – Design & Procure all services
- Montana X217 – Design of Civil Engineering Services
- Wendywood Showroom - Design of Civil Engineering Services
- Holding 4 Craighaven - Design of Civil Engineering Services
- Witkoppen X140 – Design, Procurement, Contract Administration and Monitoring of civil services.

- Tatu City – Design, Procurement, Contract Administration and Monitoring of civil services.
- Hyundai The Glen – Design, Procurement, Contract Administration of civi services
- Hyundai Menlyn Mall – Pavement remedial works, investigation, procurement and monitoring.
- Iona Development (New Zealand) – Design of civil services
- Arataki Residential Development (New Zealand) – Design of civil services
- Riverbend Development (New Zealand) – Design of civil services

ROADS & INTERSECTION DESIGN

- D631 Intersection – Design, Wayleave Approval, Procurement, Contract Administration and Monitoring.
- D36 Intersection & Road Widening - Design, Wayleave Approval, Procurement.
- K34 Intersection – Design, Wayleave Approval, Procurement, Contract Administration and Monitoring.
- K101 Intersection – Design, Wayleave Approval.
- Justice Mahomed, University, Walton Jameson Rd Intersection – Design, Wayleave Approval, Procurement, Contract Administration and Monitoring.
- Cedar Road West – Design, Wayleave Approval, Procurement, Contract Administration and Monitoring.
- Brikor – Design of New Intersection.
- New Zealand Embassy – Design of Intersection.
- East Point Game - Design, Wayleave Approval, Procurement, Contract Administration and Monitoring.

HYDROLOGY AND STORMWATER

- Hazeldean Floodline - Data collection, Flood determination and compilation.
- Gautrain Railway Stormwater Management – Design and compile stormwater management and attenuation facilities.
- Stormwater Modelling for Project Springbok – Attenuation of hazardous material in the stormwater system.
- Sappi Ngodwana Floodline – Data collection, Flood determination and compilation. This floodline included cognisance of the Ngodwana dam.
- Irene Mall Stormwater Management - Accommodation of the Post Development of stormwater flow through an existing township / suburb.
- Loftus Park Stormwater Management – Accommodation of the Post Development stormwater flow through an existing township / suburb.
- Pienaars River Floodline Modelling – Modelling of the river through two future Class 1 & 3 road bridge structures.
- Renewable Energy Stormwater Management – Many Management Plans for the Renewable Energy sector have been completed.
- Longmeadow Extension 10 (Pick & Pay) – Design and compilation of Stormwater Management report.
- Erf 4173 Peter Place – Floodline Determination.
- Irene Mall Township – Design of Civil Engineering Services and Stormwater Management.
- Mitsubishi McCarthy Midrand – Design and compilation of Stormwater Management report.
- Isago @ N12 – Floodline Determination.
- Innoland – Floodline Determination.
- Lot 204 Edenburg – Floodline Determination
- Erf 90 Douglasdale – Floodline Determination.
- PTN 35 Houtkoppen – Floodline Determination.
- Erf 4173 Peter Place – Floodline Determination.
- Hyde Close Floodline – Floodline Determination.
- Chartwell Floodline – Floodline Determination
- Hyundai East Rand – Roof Gutter & Down Pipe design
- Oilifants River – Floodline Determination
- Holding 4 Craighaven – Stormwater Management Assessment
- Rokeby Residential Development (Tasmania) – Stormwater Management Assessment

- Iona Development (New Zealand) – Design of stormwater reticulation and management components

WATER TRANSFER / RETICULATION AND SANITATION COLLECTORS / OUTFALLS

- Bojanala Platinum District Municipality – Water & Sanitation Bulk Master Planning.
- Hazeldean Development – Bulk Water Supply & Collector Sewer Design, Procurement, Contract Administration and Monitoring.
- Mamba Kingdom – Bulk Water Analysis.
- Lesedi Local Municipality Bulk Water - Design, Wayleave Approval, Procurement, Contract Administration and Monitoring.
- NEF Tomato Paste Project – Design of Farm Irrigation Network

RENEWABLE ENERGY

- Leeudoringstad PV – Design of Internal layout and the management of servitude registration.
- Dyansons Klip 5 – Stormwater Management Report
- De Aar Solar – Stormwater Management Report
- Droogfontein Solar – Stormwater Management Report
- Mierdam Solar – Stormwater Management Report
- Prieska– Stormwater Management Report
- Hoekplaas – Stormwater Management Report
- Noupoort WEF – Stormwater Management Report
- Copperton PV – Stormwater Management Report
- Klipgats PV – Stormwater Management Report
- Tooverberg Wind Energy Facility – Transportation Impact Assessment, Water Demand Assessment & Internal Service Designs
- Umsobomvu Solar Energy - Transportation Impact Assessment
- Prieska Solar Energy - Transportation Impact Assessment Amendment
- Droogfontein Solar Energy - Transportation Impact Assessment Amendment
- Loeriesfontein Solar Energy - Transportation Impact Assessment Amendment
- Koeris WEF - Transportation Impact Assessment Amendment
- East Gate Shopping Centre - Glint & Glare Assessment
- Oya Energy - Glint & Glare Assessment
- Yemaya – Glint & Glare Assessment
- Beaufort West WEF – Preliminary Engineering Report
- Heuweltjies WEF – Transportation Study
- Kraaltjies WEF – Transportation Study
- Koup 1 & 2 – Transportation Study
- Grootegeluk Solar Project – Transportation Study
- Swakopmund Power Plant – Glint & Glare Assessment
- Klipkraal WEF - Transportation Impact Assessment & Stormwater Management Assessment
- Lichtenburg PV Cluster – Transportation Assessment & Stormwater Management Report
- Poffader WEF – Transportation Assessment & Stormwater Management Report
- Leeudoringstad PV – Stormwater Management Report, Internal Service Designs, Servitude approvals
- Ingwe Wind Energy Farm – Transportation Assessment
- Suikerbekkie PV – Glint & Glare Assessment
- Several projects are Confidential as they are not yet in the public domain and hence have not been included in the list above.

OTHER

- Project Springbok – Design of Services and Railway Siding
- Phalaborwa Mining Company – Preliminary Design of Bulk Water feed and Railway Line
- Kansanshi Copper Mine, Zambia – Junior Site Foreman
- Final Quality Control (QC) for Sasol Secunda
- NDT testing – MMC Nelspruit, Global Forest Products Sabie
- Boiler inspections and preliminary design – MMC Nelspruit, Global Forest Products, TSB Malelane

Computer Skills

- AutoCAD Civil 3D
- AutoCAD Storm and Sanitary Analysis
- Microsoft Office
- Microsoft Project
- TechnoCAD
  - Surfmate
  - Roadmate
  - Pipemate
  - Watermate
- AutoTURN (Vehicle Turning Simulation Software)
- RiverCAD
- HecRAS
  - 1D Flood Modelling
  - 2D Flood Modelling