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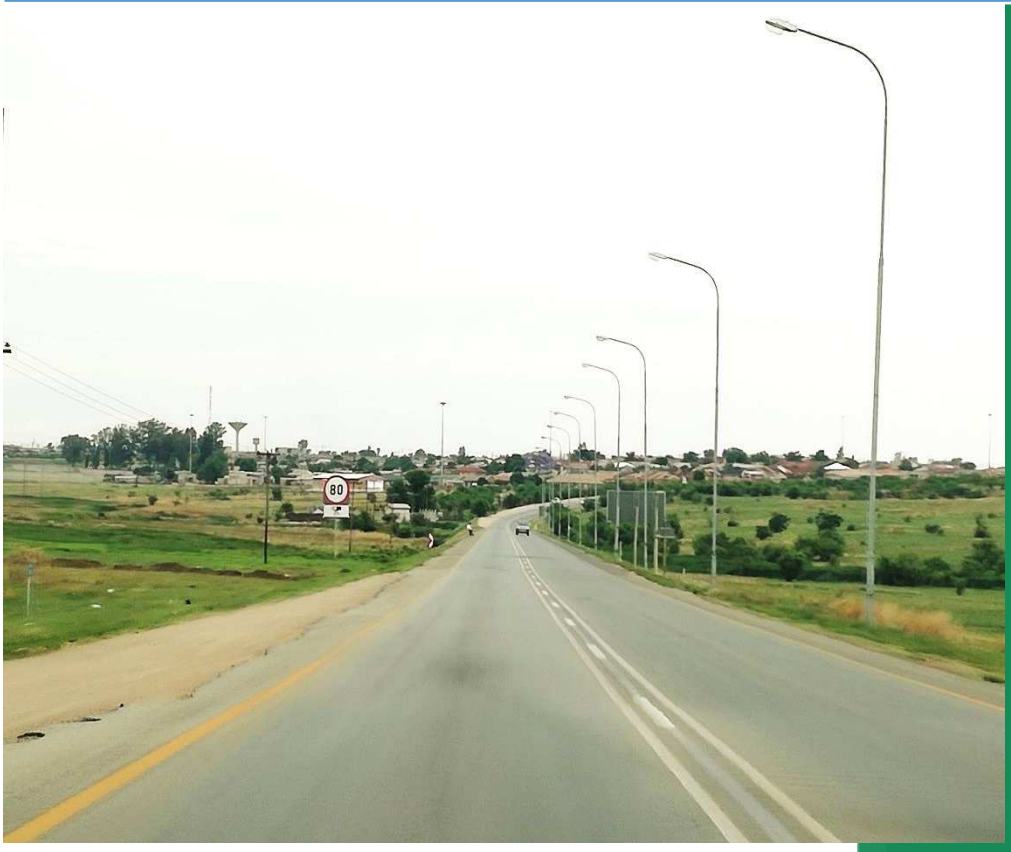
ENGINEERING SERVICES INVESTIGATIONS OVER THE FARMS ELANDSKUIL 205 IP AND 206 IP NW 405 IN VENTERSDORP, NORTH WEST PROVINCE.



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01	28/01/2018	Engineering Services Investigations Over The Farms Elandskuil 205 IP and 206 IP NW 405 In Ventersdorp, North West Province.	T. Maila	M. Mbanjwa	T. Maila

EXECUTIVE SUMMARY

Tlou Tadima Projects was appointed by Mamphele Development Planners (MDP) to conduct detailed engineering services investigations for a proposed township establishment on the remaining extent of the farms Elandskuil 205 IP and 206 IP located on the outskirts of Ventersdorp in North West Province and prepare a detailed engineering services report.

This report has thus been prepared to investigate the existing bulk engineering infrastructure capacities and effects of the proposed development on it, to identify any development constraints in terms of bulk engineering services infrastructure and give recommendations on the mitigation measures thereof.

The scope of work included the following:

- Provide a topographical and geological overview of the study area;
- Investigate the study area(s) storm water drainage;
- Conduct a study area slope analysis to determine which portion(s) of the study area are may be undevelopable;
- Investigate 1: 50 and 1:100 flooding lines of the surrounding streams and rivers that may affect the study area;
- Investigate the presence and current operational capacity of bulk engineering services infrastructure in terms of potable water supply, sanitation, electrical supply;
- Investigate road access to the study area;
- Investigate bulk engineering services demand volumes for the proposed developments;
- Investigate the impact of additional demand volumes on existing bulk engineering services infrastructure;
- Investigate road access to the site;
- Investigate the presence of solid waste disposal facilities to service the proposed development.

The availability of key bulk service infrastructure (bulk water, sanitation, electricity and waste disposal) within the vicinity of the study area render the study area feasible for development provided that developmental constraints and precautionary measures highlighted in this report are addressed accordingly.

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1. INTRODUCTION

Mamphele Development Planners CC ("MDP") was appointed to by the Housing Development Agency (HAD) in October 2017 to prepare a Township Establishment of the remaining extent of the farms Elandskuil 205 IP and 206 IP located on the outskirts of Ventersdorp in North West Province. As part of their services, MDP was also requested to do an investigation on the availability and capacity of bulk engineering services infrastructure in and around the study area and prepare a detailed engineering services report to present findings.

Tlou Tadima Projects was appointed by MDP to conduct a detailed engineering services investigations and prepare a detailed engineering services report.

This report has thus been prepared to investigate the existing infrastructure capacities and effects of the proposed development on it, to identify any development constraints in terms of bulk engineering services infrastructure and provide recommendations on the mitigation measures thereof.

2. LOCALITY

The study area is located within the JB Marks Local Municipality which is located within the Dr Kenneth Kaunda District Municipality in the North West Province. The study area consists of two portions: The farms Elandskuil 205 IP and 206 IP NW 405 within located on the outskirts of Ventersdorp town at the intersection of the N14 and the R30.

The individual land portions are discussed further below.

- **Elandskuil 205 IP**

This Portion is located on the south western outskirts of Ventersdorp and south of the National Route 14 (N14). The portion is divided by the Provincial Route 30 (R30) in which is the major north-south route linking Ventersdorp and Klerksdorp and an east-west railway line on the southern portion of the study area. The portion is currently unoccupied and can be characterized as grass land.

- **Elandskuil 206 IP**

This portion is also located on the south western outskirts of Ventersdorp, north east of the N14 and R30 intersection. The portion remains mostly unoccupied with the exception of the

north eastern edge which is occupied by informal dwellers and the north western edge which is occupied by a quarry.

The total area of both portions of land is 257.49 hectares.

Figure 1: Locality of Land Portions

3. KEY ASSUMPTIONS

This report is prepared with the understanding that the information provided by the JB Marks Local Municipality's technical division is correct.

4. SCOPE

The scope of work for the bulk engineering services investigations conducted can be summarised as follows:

- Provide a topographical and geological overview of the study area;
- Investigate the study area(s) storm water drainage;
- Conduct a study area slope analysis to determine which portion(s) of the study area are may be undevelopable;
- Investigate 1: 50 and 1:100 flooding lines of the surrounding streams and rivers that may affect the study area;
- Investigate the presence and current operational capacity of bulk engineering services infrastructure in terms of potable water supply, sanitation, electrical supply;
- Investigate road access to the study area;
- Investigate bulk engineering services demand volumes for the proposed developments;
- Investigate the impact of additional demand volumes on existing bulk engineering services infrastructure;
- Investigate road access to the site;
- Investigate the presence of solid waste disposal facilities to service the proposed development;

5. TOPOGRAPHY

5.1 Slope Analysis

The study area has an average height of 1465 meters above sea level and is dominated by gentle sloping hills and a few water courses all draining south towards the Skoonspruit River. As part of the engineering services investigations, a topographical survey was conducted to identify possible development constraints that may be posed by the sites topography. The

detailed analysis of the topographical survey revealed the following slope characteristics of the two land parcels proposed for development:

Elandskuil No. 205 IP

- Gentle to fair slopes sloping in a south westerly direction on the portion located west of the R30 and gentle to fair slopes sloping in a south easterly direction on the portion located east of the R30.
- A maximum slope of 1:23 was encountered on the southern edge of the portion located east of the R30 adjacent to the railway line.

Elandskuil No. 206 IP

- Fair slopes all sloping in a south easterly direction towards the Skoonspriut River.
- A Maximum slope of 1:10,5 was encountered on the south eastern edge of the this portion.

Maximum slopes of both portions can be deemed developable.

6. DRAINAGE

The Ventersdorp town receives an average of ± 490mm of rain annually with most of the rainfall occurring mostly during mid-summer and the least during mid-winter. Due to the topography of the study area being dominated by gentle to fair gradient hills and the majority of the study area not located in low lying areas in relation to the Skoonspruit River banks, risks associated storm water storm water runoff can be classified as being minimal. However, storm water management measures should be incorporated into the study area's development to reduce and or eliminate any potential risks to life and property that may be posed by storm water runoff.

Storm water management objectives and mitigation measures highlighted below may be used as a guideline in the planning and design stages of proposed development(s) on the study area.

6.1 Storm Water Management Objectives

Any proposed developments in the study area may have an impact on the natural storm water drainage patterns of the study area. Impacts of developments may include an increase in hardened areas, reduced infiltration areas, loss of vegetation and reduced evapo-

transpiration potential. There may also be an overall increase in the speed of runoff and peak flow rates in the receiving streams and rivers in and around the study area.

It is thus important that storm water management system(s) form part of the study area's development planning process in order to reduce and manage impacts on the water cycle during and after development. Storm water management system(s) should be planned and designed in line with municipal storm water management policies and or engineering best practices. The study area's storm water management objectives should seek to address the following objectives:

- Control the quality and quantity of storm water runoff;
- To protect local and downstream water courses;
- Encourage natural ground water recharge;
- To prevent soil erosion;
- To protect all property and life from damage caused by storm water and flooding.

6.2 Storm Water Management Control Measures

To protect all property and life from damage associated with the flooding of streams and rivers, the "National Water Act 36 of 1998" under Part 3 of Chapter 14 states that all township development layouts should have 1:100 year flood line parameters. Detailed hydraulic modelling of storm water runoff patterns of the study area and the effects of all surrounding storm water catchments were assessed to determine 1:100 year flood line parameters of the Skoonspruit River in areas that could affect certain areas of the proposed development especially in the eastern edge of portion 206 IP.

A township layout with flood line parameters is attached in Annexure B to highlight conformation of the proposed development to legislature prohibiting developments within 1:100 flood lines. In addition, the following design and construction measures should be also adopted as control and mitigation strategies to address the above-mentioned Storm Water Management Objectives:

- The storm water reticulation network should be designed to follow the contour formation of the internal road network with draining the area via kerb inlets along the road;

- Storm water reticulation design and construction of storm water infrastructure should ensure that overall development of the study area does not increase the rate of storm water runoff above that which the natural ground can safely accommodate at any point in the sub-catchments thus post development runoff should be equal or less than the pre-development runoff. It is expected that the a retention pond(s) will be required to act as a flood control measure to attenuate peak storm water runoff into natural water courses;
- Sub-surface disposal of storm water should be avoided;
- All natural and unlined channels should be inspected for adequate binding of soil to reduce erosion;
- Steeper watercourses (especially in portion 206 IP) should be protected from erosion through the use of appropriate channel linings or controlled drops to dissipate flow energy. Stone pitching should also be used to reinforce channel inverts on such slopes;
- Landscaping and or re-vegetation of areas not occupied by buildings or paving should be constructed immediately after building works have been completed, or have reached a stage where newly established ground cover to all sub-structures is not at risk from the construction works.

The above mentioned control measures will go a long way in ensuring the environmental sustainability of the development whilst also protecting life and property from storm water damage.

7. GEOLOGICAL OVERVIEW

According to 1:25 000 geological maps supplied by the Council for Geoscience, the study area is dominantly underlain by amygdaloidal andesite igneous rock types of the Ventersdorp Super Group.

A near surface geotechnical investigation was conducted on the study area by ZwaMavu Consultants to evaluate engineering characteristics of soils underlying the study area of which a detailed geotechnical investigation report will be issued to the client.

8. BULK ENGINEERING SERVICES

As a result of the proposed development within the JB Marks Local Municipality, the existing bulk services infrastructure networks in Ventersdorp will have additional volumes to accommodate and supply.

Extensive consultations with municipal technical divisions along with physical observations of the study area were conducted to build an accurate information database from which detailed assessments of existing infrastructure capacities were concluded. Assessment of existing infrastructure capacities and additional volumes required to service the proposed development are outlined below under their respective disciplines.

8.1 Water Supply

The Ventersdorp town receives its potable water supply through river extraction of the Skoonspruit River via a network of canals. The water is then purified at the Ventersdorp water treatment plant and stored in reservoirs.

Potable water supply to the Ventersdorp town, the Tshing Township which is located north west of the study area and the Moosa Park suburb is via the town's bulk water reticulation network while the surrounding farms are supplied by the towns canal network and bore holes. Even though the study area currently does not have any water supply infrastructure constructed in it, bulk service connections to service the study area can be made in the adjacent Tshing Township.

Challenges associated with water supply within the JB Marks Local Municipality are the aging infrastructure, water losses and lack of maintenance. The The Department of Water and Sanitation in partnership with the then Ventersdorp Local Municipality and now JB Marks Local Municipality have however recently completed an upgrade of the Ventersdorp bulk water supply system which included a new 5.7 Mega liter reservoir, an upgrade of the water treatment plant from 7 Mega liters a day to 14 Mega liters a day along with a 2.4 kilometer long raising main from the water treatment plant to the reservoir. The upgrade has thus increased the town's reservoir storage capacity to 10.3 Mega liters and the water treatment plant's capacity to 14 Mega liters a day. With the current water consumption of the town being estimated to be 6 Mega liters per day, the recently completed upgrades have provided a spare supply capacity of 4.3 Mega liters a day.

The following table highlights peak daily potable water supply demand volumes for the proposed development as calculated from the "Guidelines for Human Settlement and Planning" manual.

Table 1: Estimated Water Supply Demand Volumes

Zoning	No. of Erven	Area (Ha)	Sewerage Demand (Ml/d)
Residential 1	2657	114.9	0.64
Residential 2	4	14.42	0.35
Institutional	6	27.43	0.17
Business	7	10.91	1.05
Industrial	7	7.64	0.73
Municipal	8	7.69	0.74
Public Open Space	8	27.91	0
Streets		46.59	0
Total		257.49	3.68

From the above table, the total potable water supply demand required to service the proposed development is 3.68 Mega liters a day which is within the available spare capacity of 4.3 Mega liters a day. The existing infrastructure in terms of potable water supply is thus sufficient to accommodate the proposed development's demand volume.

8.2 Sanitation

Sewerage disposal in the Ventersdorp town and Tshing Township is provided through a water borne sewerage reticulation network consisting of collector sewers and raising mains with the sewerage treated at the Ventersdorp Waste Water Treatment Works (WWTW). The service levels are in the form of yard connections in each yard. Sewerage disposal in the surrounding farms, Moosa Park and informal settlements is provided through a combination of septic tanks and pit toilets. Even though the study area currently does not have any sewerage infrastructure constructed in it, bulk service connections to service the study area can be made in the adjacent Tshing Township.

Risks posed to the waterborne sewerage reticulation system in Ventersdorp are the aging infrastructure along with the lack of funding to adequately maintain and or upgrade the system.

The capacity of WWTW is 3 Mega liters a day with current sewerage volume in the system peaking at 2.7 Mega liters a day thus the system is operating at 90% of its capacity with only a space capacity of 0.3 Mega liters a day.

The following table highlights peak daily sewerage demand volumes for the proposed development inclusive of 15% infiltration from storm water and other contingencies as calculated from the "Guidelines for Human Settlement and Planning" manual.

Table 1: Estimated bulk Sewerage Demand Volumes

Zoning	No. of Erven	Area (Ha)	Floor Space Ratio (FSR)	Sewerage Demand (Ml/d)
Residential 1	2657	114.9		3.82
Residential 2	4	14.42	0.3	1.24
Institutional	6	27.43	0.3	2.37
Business	7	10.91	0.3	0.94
Industrial	7	7.64	0.3	0.66
Municipal	8	7.69	0.3	0.66
Public Open Space	8	27.91		0
Streets		46.59		0
Total		257.49		9.69

From the above table, the total sewerage demand required to service the proposed development is 9.69 Mega liters a day which far exceeds the available spare capacity of 0.3 Mega liters a day. The existing infrastructure in terms of waste water treatment is not sufficient to accommodate the proposed development.

The capacity of the waste water treatment infrastructure will thus need to be increased to accommodate additional volumes required to service the proposed development or alternative solutions to waste water treatment such as package plants and conservancy tanks septic tanks adopted to service the proposed development.

Considerations for the adoption of the above mentioned alternatives to waste water treatment are discussed below:

8.2.1 Sewerage Treatment Plants

These are pre-manufactured sewerage treatment plants assembled on site as per site requirements and conditions.

Figure 2: Non-Mobile Sewerage Treatment Package Plant

Considerations:

- Fast installation;
- Very little to no environmental impacts, clean effluent produced which can be discharged directly into watercourse;
- An effluent management system is required to manage the big volumes of effluent produced. The system should include assessing the possibility of storing the effluent and reusing for irrigation and or other uses;
- Requires regular maintenance to ensure efficiency and that the quality of effluent discharged meets environmental standards;
- Can be easily vandalised if not properly fenced off;
- Heavily reliant on a consistent electrical supply.

8.2.2 Conservancy Tanks

These are sewerage holding tanks with no outlets. When tanks are full, they are emptied and the waste disposed of at the nearest waste water treatment facility.

Figure 6: Sewerage Conservancy Tanks

Considerations:

- Fast installation;
- No environmental impacts;
- Requires no maintenance besides having to be constantly monitored and emptied at regular intervals;
- Heavily reliant on the availability and capacity of sewerage collection measures put in place. Failure to empty the tanks will render the system un-functional;
- Ideal for sites not too far from waste water treatment facilities;
- Site(s) on which tanks are installed need to be able to accommodate sewerage vacuum trucks.

8.3 Electrical Supply

Eskom is the sole bulk electricity supplier to the JB Marks Local Municipality. Residents in the Ventersdorp town receive power from the municipality while residents in the surrounding farms and villages are supplied by Eskom. Challenges facing the efficiency of the system include illegal connections, vandalism and aging infrastructure to list a few.

The current electrical supply to the municipality from Eskom is 20MVA via a network of high voltage lines. The current municipal load on the grid is 9MVA thus leaving 11MVA available to service future developments and to connect villages not currently connected.

The estimated electrical demand volumes to service the proposed development are attached in is 17.02 MVA which exceeds the 11MVA spare capacity. The existing infrastructure in terms of electrical supply is thus not sufficient to fully service the proposed development. The capacity of electrical supply infrastructure will thus need to be upgraded by at least 8 MVA to accommodate the additional demand required to service the proposed development.

A breakdown of electrical demand requirements per zone is attached in Annexure A.

8.4 Road Infrastructure

The study area is easily accessible via the N14 which is the main route linking Ventersdorp with Colingy to the west and Krugersdorp to the east; and via R30 which is the main north-south route linking Ventersdorp and Klerksdorp. Both access roads are paved and seem to be well maintained.

Typical traffic on both access roads includes small vehicles for personal use, busses and trucks transporting agricultural products between towns.

A traffic impact study is was conducted by MSN Civils to assess traffic impact the proposed development will have on the existing infrastructure and propose suitable access points from the N14 and R30 respectively. A detailed traffic impact study report is will be issued to the client once concluded.

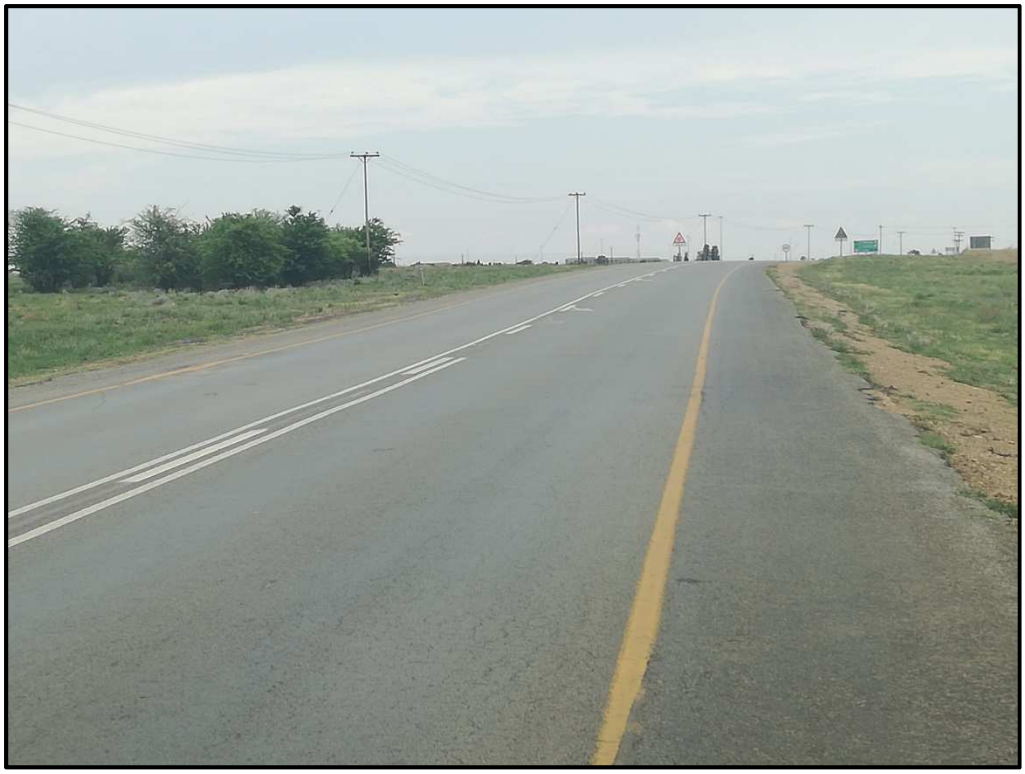

Figure 3: Road Access Along R30

8.5 Solid Waste Disposal

The JB Marks Local Municipality provides weekly waste collection services to the Ventersdorp town, Tshing Township and Moosa Suburb serviced currently by one landfill site. Waste collection services do not extend to residents the surrounding farms, villages and informal settlements. Some residents in these un-serviced areas currently dispose of their waste in unoccupied parcels of land which may pose health hazards. Challenges experienced by the municipality in terms of solid waste disposal are the increase in illegal dumping sites especially in informal settlements and villages and the lack of waste collection capacity as the current fleet is not enough and is not well serviced. In its 2017-2022 Integrated Development Plan (IDP), the JB Marks Local Municipality plans to enter into a Service Level Agreement (SLA) with the District Municipality by virtue of an additional landfill site to service the municipality's growing population.

The close proximity of the proposed development to areas currently receiving municipal waste collection services will enable the services to be easily extended to service the proposed development. The increase in solid waste that will be generated by the proposed

development may require an increase in waste collection cycles thus additional resources will be required post development to maintain the current level of service.

9. OVERALL ASSESSMENT

This report has thus been prepared to investigate the existing bulk engineering infrastructure capacities and effects of the proposed development on it, to identify any development constraints in terms of bulk engineering services infrastructure and give recommendations on the mitigation measures thereof. Below is a summary of key findings made and precautionary measures to mitigate developmental constraints identified:

Site Slope

Maximum slope gradients of the study area are deemed developable.

Storm Water

Storm water reticulation design and construction of storm water infrastructure should ensure that overall development of the study area does not increase the rate of storm water runoff above that which the natural ground can safely accommodate at any point in the sub-catchments thus post development runoff should be equal or less than the pre-development runoff. It is expected that a retention pond(s) will be required to act as a flood control measure to attenuate peak storm water runoff into natural water courses. In addition, all storm water management objectives and control measures discussed in clause 6.1 and 6.2 should be addressed accordingly.

Potable Water Supply

The total potable water supply demand required to service the proposed development is 3.68 Mega liters a day which is within the available spare capacity of 4.3 Mega liters a day. The existing infrastructure in terms of potable water supply is thus sufficient to accommodate the proposed development's demand volume.

Sanitation

The total sewerage demand required to service the proposed development is 9.69 Mega liters a day which far exceeds the available spare capacity of 0.3 Mega liters a day. The existing infrastructure in terms of waste water treatment is not sufficient to accommodate

the proposed development. An infrastructure upgrade of at least 10 Mega liters a day is required to accommodate the proposed development.

Electrical Supply

The estimated electrical demand volumes to service the proposed development are attached in is 17.02 MVA which exceeds the 11MVA spare capacity available. The existing infrastructure in terms of electrical supply is thus not sufficient to fully service the proposed development and would need to be upgraded by at least 8MVA.

Road Infrastructure

The study area is easily accessible via the N14 and or R30 which are paved roads and seem to be well maintained.

Solid Waste Disposal

The close proximity of the proposed development to areas currently receiving municipal waste collection services will enable the services to be easily extended to service the proposed development. However, additional resources will be required following development of the study area to maintain the current level of service.

The availability of key bulk service infrastructure (bulk water, sanitation, electricity and waste disposal) within the vicinity of the study area render the study area feasible for development provided that developmental constraints and precautionary measures highlighted in this report are addressed accordingly.

10. REFERENCES

The following documents were used to conduct bulk engineering services investigations along with personal meetings with the JB Marks Local Municipality's technical engineering services teams.

- Ventersdorp Local Municipality: *2015/ 2016 Final Integrated Development Plan;*
- Ventersdorp Local Municipality: *2015/ 2016 Annual Report*;
- Guidelines for Human Settlement Planning And Design;

- Reconciliation Strategy for Ventersdorp Town Area consisting of Ventersdorp, Tshing, Toevlug and Moosapark settlements in Ventersdorp Local Municipality, in the Middle Vaal Water Management Area: May 2011;
- Department of Environmental Affairs: *Guidelines for Development of Integrated Waste Management Plans 2018*

ANNEXURE A

- **Electrical Load Demand Estimate**

Classification	Entertainment	Expected occupancy (hours per day / days per week)	Estimated load requirements (VA/m^2) (Zone 1:cold interior)
A1	Entertainment / Public assembly	18 / 7	85 VA/m^2
F1	Shop / Retail	12 / 7	90 VA/m^2
G1	Offices	12 / 5	80 VA/m^2
H1 / H3	Hotel / Residential	24 / 7	90 VA/m^2
J4	Parkin Garage	12 / 5	5 VA/m^2

Table 1: Estimated load requirements per category as per SANS 204

VENTERSDORP DEVELOPMENT - LOAD CALCULATION **2018/01/25**

ERF	Land Use	Area/m2	Municipal	Business	Industrial	Institutional	Residential	Number of Dwellings units	Non Residential ADMD (Kva/m2 or kVA/res unit) (SANS 204)	Residential ADMD (Kva/m2 or kVA/res unit) (SANS 204)	Load (kVA) Before Diversity
2676	Business	1250		530					0.090		47.70
2677	Business	1710		725.04					0.090		65.25
2678	Business	150		63.6					0.090		5.72
2679	Business	2360		1000.64					0.090		90.06
2680	Business	3870		1640.88					0.090		147.68
2681	Business	1100		466.4					0.090		41.98
2682	Business	470		199.28					0.090		17.94
2662	Institutional	3080				3234			0.080		258.72
2663	Institutional	600				630			0.080		50.40
2664	Institutional	14790				15529.5			0.080		1242.36
2665	Institutional	840				882			0.080		70.56
2666	Institutional	3000				3150			0.080		252.00
2667	Institutional	5120				5376			0.080		430.08
2668	Municipal	460	483						0.080		38.64
2669	Municipal	530	556.5						0.080		44.52
2670	Municipal	1140	1197						0.080		95.76
2671	Municipal	1140	1197						0.080		95.76
2672	Municipal	2810	2950.5						0.080		236.04
2673	Municipal	600	630						0.080		50.40
2674	Municipal	720	756						0.080		60.48
2675	Municipal	290	304.5						0.080		24.36
2683 - 2689	Industrial	7640			8022				0.080		641.76
276491	Residential 1	114900					512683.8	2657		3.50	9299.50
2658 - 2661	Residential 2	14420					8075.2	2636		3.50	9226.00
	Street Lights										160.00
TOTAL kVA											**22693.67**
TOTAL MVA											**22.69**
EXPECTED DIVERSITY LOAD AT MAXIMUM MVA											**17.02**