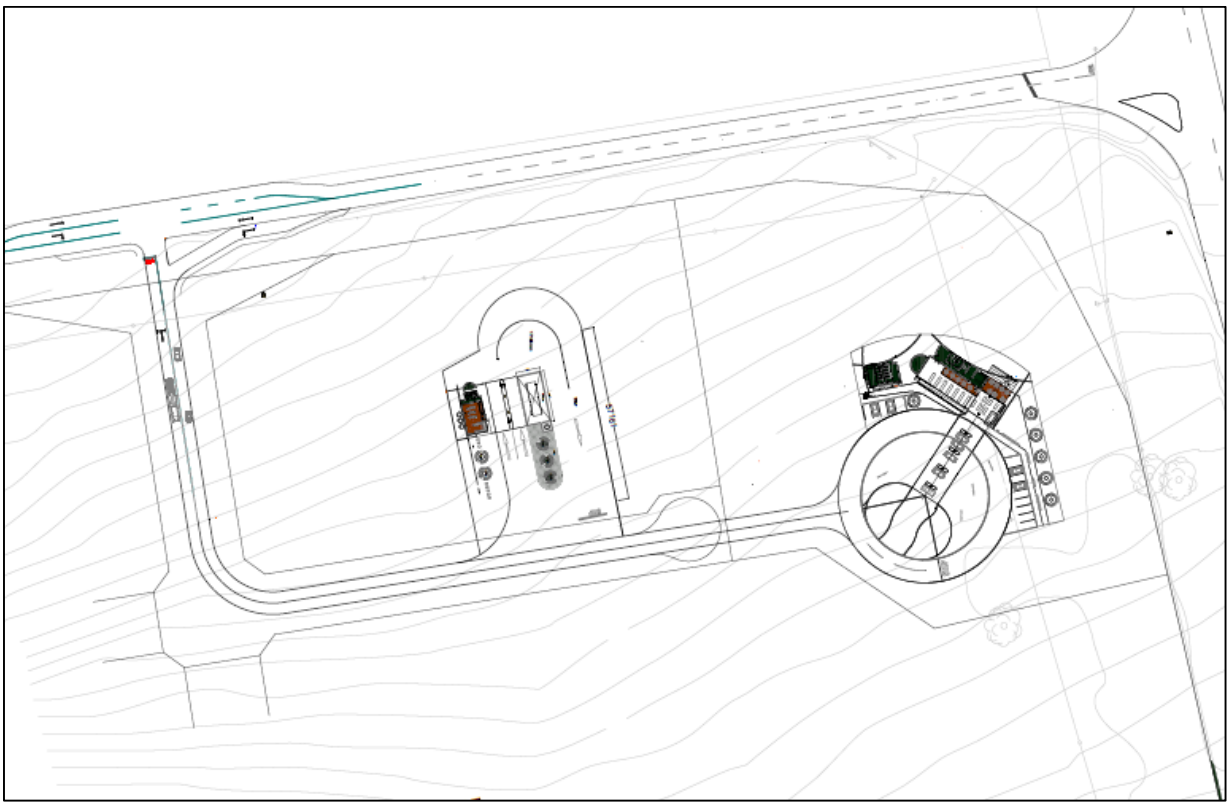
Member of the Surbana Jurong Group

SUPPLEMENTARY CIVIL ENGINEERING SERVICE REPORT FOR VLAKFONTEIN FILLING STATION WITH REGARDS TO REZONING APPLICATION No. 26512

VLAKFONTEIN FILLING STATION

Date: 06 March 2018 Ref. PB1026



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Project Name:	Vlakfontein Filling Station - Bronkhorstspruit
Project Number:	PB1026
Report for:	JCJ Developments (Pty) Ltd

REVISIONS

Revision #	Date	Change Overview	Prepared by	Reviewed by
0	5 March 2018	Services Report	Rossouw Boshoff	Leslie Lottering
1	6 March 2018	Services Report	Rossouw Boshoff	Leslie Lottering

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ABBREVIATIONS AND ACRONYMS

Abbreviation/ Acronym	Description
Gautrans	Gauteng Department of Roads and Transport
CoT	City of Tshwane Metropolitan Municipality
Ø	Diameter
ha	Hectare
k ℓ	Kilo Litre
ℓ	Litre
m	Metre
m/s	Metre per second
m^3	Cubic metre
m^3/s	Cubic metre per second
mm	Millimetre
SANS	South African National Standards

1. INTRODUCTION

SMEC South Africa (Pty) Ltd has been appointed by JCJ Developments (Pty) Ltd to assist with and address queries raised by the City of Tshwane Metropolitan Municipality, for the Township application for the proposed Vlakfontein Filling Station in Bronkhorstspruit. Our client JCJ Developments has advised us that there are certain outstanding or insufficient information required for the successful approval and acceptance of this application by the City of Tshwane Metropolitan Municipality.

An existing engineering services report for the proposed filling station was previously done by MSBR Consulting (PTY) Ltd in September 2017. The purpose of this report is not to replace the existing engineering services report, but to supplement it where certain technical matters where not sufficiently addressed as pointed out by the City of Tshwane and to review the respective sections where applicable. This report takes precedence over the respective sections of the previous report as indicated in the sections to follow. Please refer to **Annexure A** for the original Engineering services report by MSBR Consulting.

1.1 Professional Team

Professional Discipline	Name of Company	Contact Person(s)
Developer	JCJ developments	Mr. F. Eicker
Town Planner	SFP Townplanning	Mr. F Schoeman
Environmental Specialist	I-CAT Environmental Solutions	Ms M. Reyneke Ms. D. Breedt
Traffic Engineer	SMEC South Africa (Pty) Ltd	Mr. C. Botha
Civil Engineer	SMEC South Africa (Pty) Ltd	Mr. R. Boshoff

2. GENERAL INFORMATION

2.1 Locality

The site is located South of Bronkhorstspruit town, on the R25, near the Bronkhorstspruit Dam. The proposed development is situated on the proposed portion 4 on the remainder of Portion 25 of the Farm Vlakfontein 523 JR. Please refer to **Appendix A** for the proposed township layout plan.

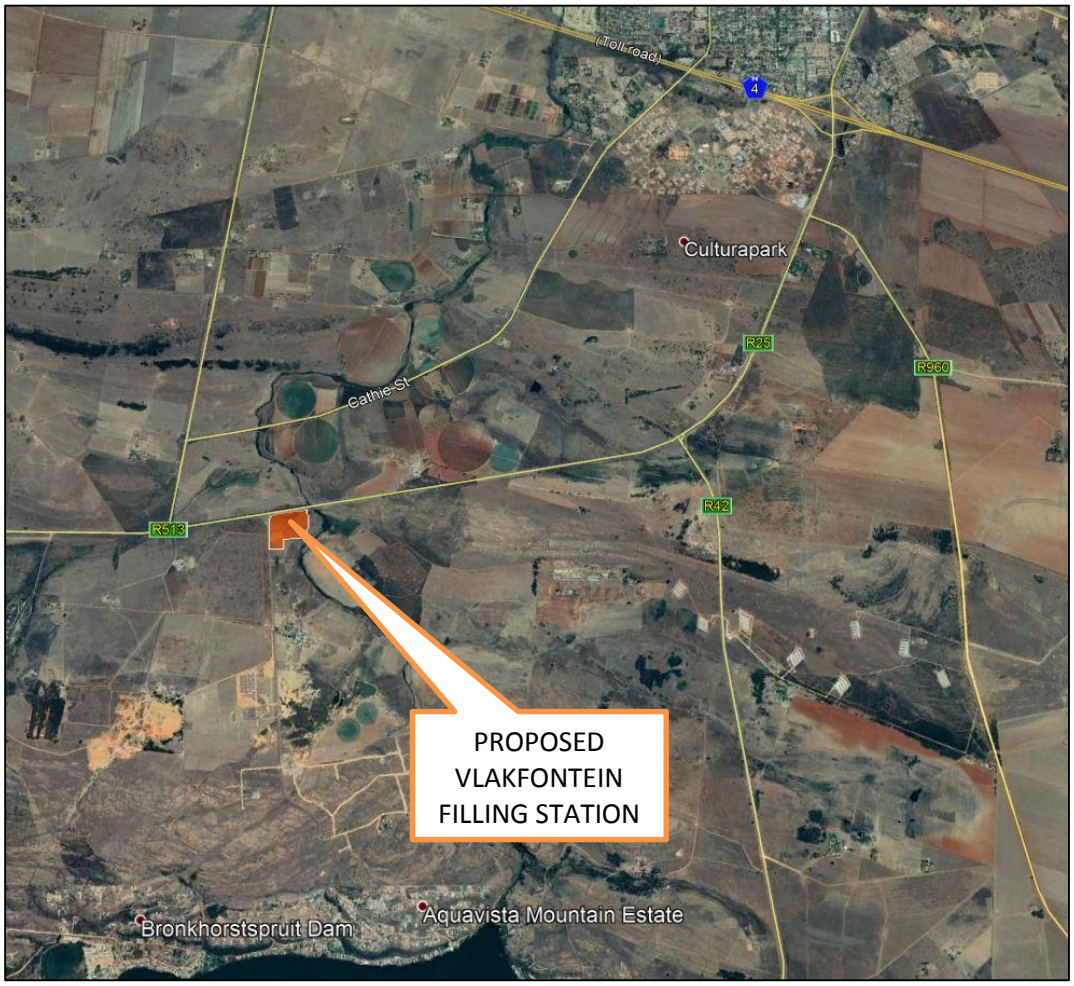

Figure 2-1: Locality Plan

2.2 Proposed Development and Land Uses

Two separate town planning applications have previously been submitted to council. The first application was submitted to council and included the entire portion (7.5719 ha). On request of the developer, a second application was submitted to divide the original portion into a portion for the Transport deport and the Fuel depot respectively. The latest revision, however, supersedes the previous individual applications and serves as a revised application.

The proposed land uses for the land portions are indicated in Table 2-1 below.

Table 2-1: Land Uses

Land Use	Area (ha)	% of Township	F.S.R	Coverage (%)
Filling Station (Convenience shop)	1.7603	23.2%	0.026	2.65%
Filling Station (Filling Bays)			0.016	1.61%
Truck depot	2.1427	28.3%	0.005	0.58%

2.3 Topography

The terrain investigated has an average gradient of approximately 3% towards the east. The majority of the site is covered with dense short grass with the exception of the existing Diesel depot which is cleared and hardened.

2.4 Flood Lines

A 1:50 and 1: 100 year flood line was conducted for the Bronkhorstspruit River and certified by Civil Concepts. Please refer to the site development plan in **Appendix A**.

2.5 Traffic Impact Study

A Traffic Impact Assessment (TIA) was completed by SMEC South Africa PTY (Ltd) in November 2016 and a revised version in February 2018. The Traffic Impact assessment is to be evaluated and approved by the council. See **Annexure B** for the revised TIA.

2.6 Civil Engineering Services

As indicated in the introduction of this report, this report is a supplement to an existing report done by MSBR Consulting Engineers in **Annexure A**.

2.6.1 Revisions and Amendments

This Report shall take precedence over the MSBR report where in conflict to each other. The sections in the existing services report will either supplement or supersede the previous report as listed below:

- ***MSBR report Section 1.15 -Roads Design:*** This section will be supplemented by Section 3 of this Report "Roads and Streets" and shall take precedence over Section 1.15 of the MSBR Report where there are any conflicts.
- ***MSBR report Section 1.16 -Stormwater Design:*** This section will be superceded by Section 4 of this report "Stormwater System" which addresses specific stormwater requirements from the City of Tshwane regarding the proposed Town

Planning application. This section shall take precedence over Section 1.16 of the MSBR Report where there are any conflicts.

- ***MSBR report Section 1.17 – Water Design:*** This section will be supplemented by Section 6 of this Report "Water" and shall take precedence over Section 1.17 of the MSBR Report where there are any conflicts.
- ***MSBR report Section 1.18 – Sewer Design:*** This section will be supplemented by Section 5 of this Report "Sewerage" and shall take precedence over Section 1.18 of the MSBR Report where there are any conflicts.
- ***MSBR report Section 1.19– Electrical Design: "****Section 1.19.1.1 Petrol Station". The Petrol Station (Vlakfontein Filling station) shall not have a Car Wash facility as stated in the report.*
- ***MSBR report Section 1.20– Estimated Costs:*** This section will be supplemented by Appendix C of this Report "Cost estimates" and shall take precedence over Section 1.15 of the MSBR Report where there are any conflicts.

2.6.2 Design Standards

All services will be designed and constructed in accordance with *Standard Specifications for Municipal Civil Engineering Works, Third Edition (2005)* compiled by the City of Tshwane Metropolitan Municipality engineering department.

The design of the water reticulation will be done in accordance with the latest edition of the *Design Guidelines for Water Reticulation and Supply* issued by the City of Tshwane.

The design of the sewer network will be done in accordance with the latest edition (November 2016) of the *Design Guidelines for Sewer Mains and Sewer Drainage Systems* issued by the Water and Sanitation Division of the City of Tshwane.

All roads and storm water will be designed according to the *City of Tshwane Manual for the Design of Streets and Storm water.*

All specifications will be used in conjunction with the *Guidelines for Human Settlement Planning and Design (Red Book)*, compiled under the patronage of the Department of Housing by the CSIR, 2000 and any other relevant guidelines accepted and approved by the City of Tshwane.

2.6.3 Ownership of Services

External Services

The construction of bulk civil services is the responsibility of the City of Tshwane Metropolitan Municipality unless otherwise agreed upon. A bulk service contribution will be payable for bulk civil engineering services except for those services otherwise agreed.

Maintenance of these services, will be the responsibility of the City of Tshwane Metropolitan Municipality. Contributions will be determined and agreed as per the City of Tshwane Metropolitan Municipality, Policy on Levying Contributions for the Provision of Engineering Services.

Internal Services

Construction of internal civil services will be the responsibility of the developer. The internal services will be taken over by the City of Tshwane and the City of Tshwane will be responsible for the maintenance of internal services. Contributions will be determined and agreed as per the City of Tshwane Metropolitan Municipality, Policy on Levying Contributions for the Provision of Engineering Services.

3. ROADS AND STREETS

3.1 External/Bulk Roads

Based on the expected trip generation, no geometric upgrades will be required for the intersection between the R25 provincial road and the Bronkhorstspruit Dam Road. The trips generated by the proposed development do not affect the intersection in a negative way.

The performance of intersections in urban road networks is defined by the Level of Service (LOS) for all the approaches to the intersection. All approaches to the intersection will operate at acceptable Level of Service (LOS) during the peak hour. The overall intersection performance is an acceptable LOS A.

3.2 Access and Internal Roads

Access from the R25 on the Northern boundary of the proposed development is prohibited due to current Gautrans restrictions. The proposed access will be from the existing Road 02254 (Bronkhorstspruit Dam Road) west of the proposed development, 320 metres south of the R25/Dam Road intersection. See Figure 3-1 below.

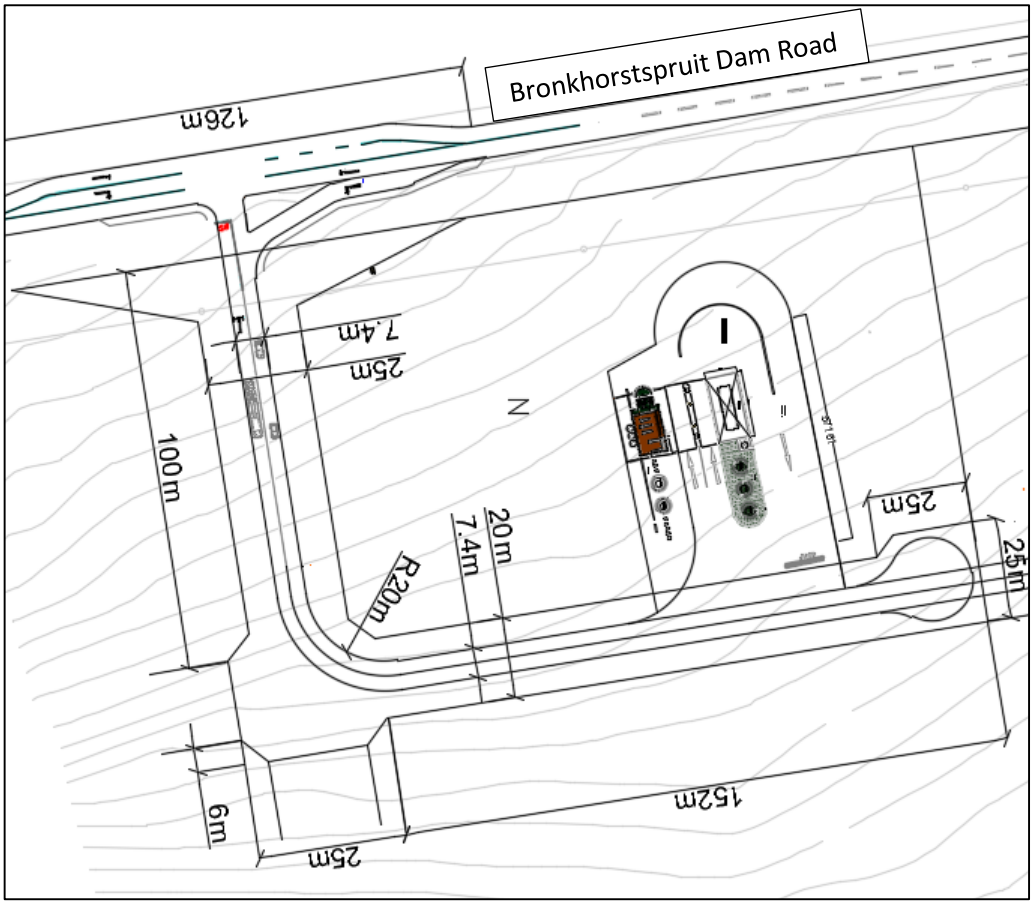

Figure 3-1: Road Layout

The Level of Service for the access of the proposed development is classified as a LOS A. It is proposed that the access intersection be designed as per the Gauteng Department of Transport, Roads and Works guidelines and standards with exclusive right turn lane as indicated in Figure 3-1 above.

It is a requirement from the City of Tshwane that the access road to the proposed development should provide access to both properties (Truck Depot and Filling Station) and consist of a turnaround facility at the end of the access road as indicated on Figure 3-1 above

A new intersection and internal roads as indicated above are proposed as part of the development and will be constructed once the township is approved. The access road will consist of a 7.4 m wide single carriage road. The road will be a Class 4a and it will require a minimum road reserve width of 25m as per City of Tshwane guidelines and standards. The portion of the access road after the left turn approaching the Truck Depot and Filling station will be a Class 4b road requiring a 20m road reserve. The road width however remains at 7.4m.

Refer to **Annexure B** for the TIA and additional info pertaining this section.

3.3 Road Classification and Geometric Design Standards

The access road will consist of Class 4a and 4b roads respectively. The details of the proposed classifications of the roads, with their respective geometric design standards, are shown in the table below.

Table 3-1: Road Classification & Geometric Design Standards

Function and Class	**Res. Access Collector** Class 4a and 4b
Road Reserve width (m)	20m and 25m
Roadway width (m)	7.4
Min gradient	0.67
Preferred max gradient	10
Max grade / grade length	12% / 70m

These roads will form the main access to the proposed development. Mountable kerbing will be provided along all the roads as per CoT's requirements except on the Gautrans no access line. At the access intersection and the Gautrans line of no access areas, semi-mountable kerbs will be provided.

A road camber of 3% will be designed and constructed, and the minimum allowable is 2%.

Roads will be constructed to conform to SANS 1200 and road materials are to meet the requirements as set out in TRH 14.

3.4 Public Transport and Parking Requirements

A minimum of 58 parking bays should be provided at the filling station based on SANRAL: standards. These include the following:

- 47 normal parking bays;
- 2 disabled parking bays;
- 2 bays for busses and coaches and
- 6 bays for trucks.

3.5 Wayleaves

Wayleave applications will be logged with the Gauteng Department of Roads and Transport, Gautrans for the acceptance and approval of the proposed new road intersection. These intersections will require construction works within the Gautrans road reserve will be designed and constructed according to the standards and requirements of Gautrans.

All other wayleave applications, where required, will be obtained from the specific service providers.

3.6 Costing

Please refer to **Appendix C** for the cost estimate of the Roads

4. STORMWATER SYSTEM

There is currently no formal storm water infrastructure in the vicinity of the proposed development site. The general drainage pattern of the proposed development is from the west towards the east with the Bronkhorstspruit River on the eastern boundary of the proposed development.

4.1 External/Bulk Stormwater

The adjacent property to the west (Remainder of portion 3 of Vlakfontein) drains towards the proposed development, but the runoff is diverted in a northern direction by the Bronkhorstspruit Dam road towards the R25. The proposed development will thus not receive runoff from this property at this stage, however, the City of Tshwane do require a 5m stormwater servitude on the Northern boundary of property alongside the R25 towards the Bronkhorstspruit river (See Figure 4-1). This is to allow for future stormwater runoff from the property when it is developed. The proposed stormwater servitude will be registered, by the developer.

4.2 Internal Stormwater

New bulk stormwater pipelines will be designed and constructed to convey storm water runoff from the hardened areas of the proposed development as well as internal and the external access roads.

Storm water runoff from inlets will be conveyed in a piped drainage system and will discharge in the Bronkhorstspruit River. Energy dissipaters will be used at outlet structures to prevent erosion.

The stormwater will not include runoff from the filling area which will contain petroleum contaminants. This contaminated runoff will drain to a separate sump from where it will be collected by a registered hazardous waste water contractor and disposed of accordingly (Also see section 8 of this report).

This stormwater pipes will be constructed in stormwater servitudes along the southern and northern property boundary. The proposed stormwater servitudes will be registered, by the developer. Please see Figure 4-1 below for the stormwater layout.

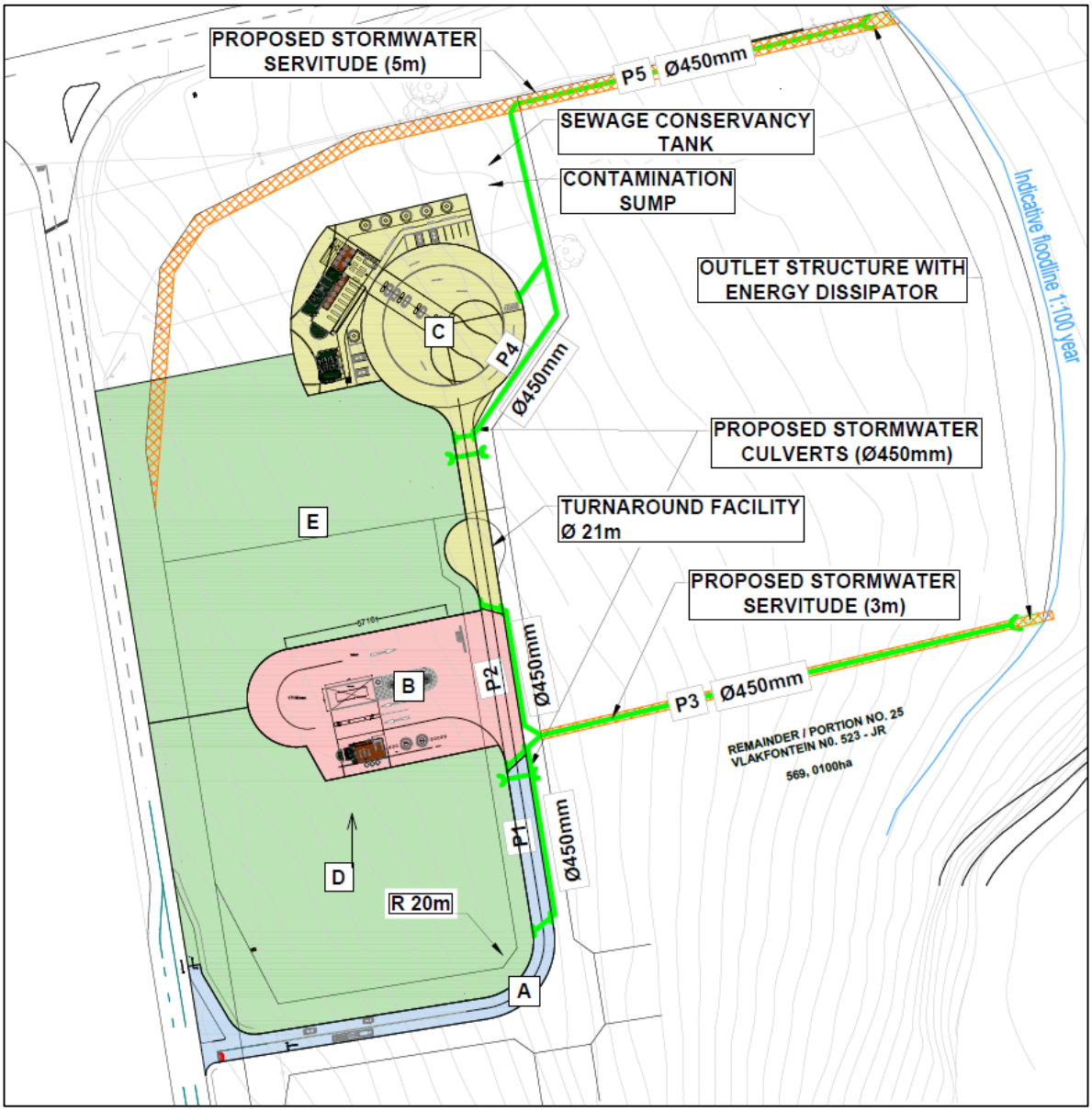

Figure 4-1: Stormwater Layout

Storm water run-off from the undeveloped areas or catchments upstream of the proposed development, will cross the proposed road through two stormwater culverts placed at the low points of these catchments (Catchments D and E as indicated above).

The roads of the proposed development will be surfaced and will be designed to act as storm water collectors and conveyors. The vertical alignment of the roads will be designed so that storm water can be conveyed to the natural low points of the roads and surrounding topography to channel or discharge the storm water into to proposed drainage systems within the development.

An underground storm water drainage system will be supplied to accommodate the minor floods (1:2 year storm occurrence) to ensure that road traffic flow is not disrupted by the minor floods. Major floods that cannot be accommodated in the minor storm water drainage system will be conveyed on the road surface.

4.3 Wayleaves

External stakeholders and land owners will not be affected by the proposed storm water infrastructure and therefor no wayleaves will be required in this regard.

4.4 Hydrology

The hydrological data used to design the storm water drainage network for the development shown in table below.

Table 4-1: Hydrological Data

Hydrological Data	
Recurrence Intervals	1:2 for storm water pipes
	1:50 years for combined pipe and road network
Average annual rainfall (mm)	700
Minimum time of concentration and run-off coefficient per the *Guidelines for the Provision of Engineering Services and Amenities in Township Development* in conjunction with the *SANRAL Drainage Manual, 5th Edition*.	
Design Method	Rational method

The peak flow for the site was determined by means of the Rational Method:

$$Q = \frac{CIA}{3.6}$$

Q = Peak flow (m^3/s)

C = Run-off coefficient (dimensionless)

I = Average rainfall intensity over catchment (mm/h)

A = Area (m^2)

3.6 = Conversion factor

4.4.1 Catchment Area

The site was subdivided into sub-areas, (A to E), as indicated in figure above. Areas A to C are categorized as paved areas. Areas D and E can be described as undeveloped areas and will therefore not contribute to change in pre and post developed peak flows.

4.4.2 Run-off Coefficient (C)

The run-off coefficient was calculated for an "Urban" area for areas A, B and C since the Truck deport and Filling station will be a paved area. The run-off coefficient for all three areas cumulated to 0.7.

The run-off coefficient for the "Undeveloped" area for areas D and E will not be influenced by development and therefore will be an unpaved area. The run-off coefficients for these areas are indicated in Table 4-2 below.

Table 4-2: Run-off Coefficient parameters

Surface Slope	%	Factor	C_S
Vlei's and pans	40	0.03	0.01
Flat areas	40	0.08	0.03
Steep areas	20	0.26	0.05
Total	100	-	0.10
Permeability	%	Factor	CP
Very Permeable		0.04	0.00
Permeable	10	0.08	0.01
Semi-Permeable	80	0.16	0.13
Impermeable	10	0.26	0.03
Total	100	-	0.16
Vegetation	**%**	**Factor**	**C_V**
Thick bush and plantation		0.04	0.00
Light bush and farm-lands	10	0.11	0.01
Grasslands	90	0.21	0.19
No vegetation		0.28	0.00
Total	100	-	0.20
Run-off Coefficient (C_S+C_P+C_V)			**0.46**

4.4.3 Rainfall intensity

The followings elements has been considered to calculate the rainfall intensity:

- Storm Duration; and
- Mean Annual Rainfall.

The Storm duration is calculated with the following formula:

$$Tc = 0.604(\frac{rL}{\sqrt{S}})^{0.467}$$

In the rational formula, the storm duration is assumed to be equal to the time of concentration. The time of concentration was calculated for each sub-area, as indicated in Table 4-3 below.

Table 4-3: Storm Durations

Variable	Area A	Area B	Area C	Area D	Area E
r	0.02	0.02	0.02	0.3	0.3
L	0.2	0.16	0.11	0.13	0.16
S	0.04	0.05	0.04	0.05	0.04
T_c	**0.10**	**0.08**	**0.07**	**0.27**	**0.32**

The following values was used for the calculation of rainfall intensities:

- A mean annual rainfall of 700mm/ year was used for the development
- Point rainfall values were obtained from the "Depth-Duration-Frequency" diagram in the drainage manual; and the
- Storm duration that was calculated previously.

The rainfall intensities for the respective catchment areas were calculated for the 1:2 year and 1:50 year recurrence intervals. See Table 4-4 below.

Table 4-4: Rainfall Intensities

Recurrence interval	Catchment	Area (m2)	Point rainfall (mm)	**Point intensity (mm/h)**	**Area reduction factor**	**Average intensity (mm/h)**
1:2 years	A	3560	9.5	97.6	0.95	92.7
	B	4064	9.5	114.1	0.95	108.4
	C	5542	9.5	129.1	0.95	122.6
	D	9920	14	52.3	0.95	49.7
	E	9899	20	64.4	0.95	61.8
1:50 years	A	3560	25	256.9	0.95	244.0
	B	4064	25	300.4	0.95	285.3
	C	5542	25	339.6	0.95	322.6

Recurrence interval	Catchment	Area (m2)	Point rainfall (mm)	Point intensity (mm/h)	Area reduction factor	Average intensity (mm/h)
1:50 years	D	9920	43	160.7	0.95	152.7
	E	9899	50	161.0	0.95	152.9

4.4.4 Peak flows

The following peak flows were determined for the respective catchment areas using the rational method:

Table 4-5: Peak Flows

Return Period	1:2	1:50
Peak flow Catchment A (m^3/s)	0.068	0.178
Peak flow Catchment B (m^3/s)	0.090	0.237
Peak flow Catchment C (m^3/s)	0.139	0.366
Peak flow Catchment D (m^3/s)	0.066	0.204
Peak flow Catchment E (m^3/s)	0.081	0.204

4.5 Standard of Services & Design Criteria

The storm water drainage system will be designed in accordance with the requirements of the City of Tshwane. See design standards in table below:

Table 4-6: Stormwater Standards and Design Criteria

Design Element	Specification
Minimum pipe size	450mm diameter
Pipe type	Concrete interlocking joint pipes, soffit to soffit Class 50D at all positions, Class 75D at internal road crossings and 100D all road major crossings.
Minimum pipe gradient	1:150 (0.67%)
Junction boxes, manholes, catch pits and outlet structures	As per City of Tshwane Specification
Minimum 80% full flow velocity	0.9 m/s
Maximum velocity	3.5 m/s
Cover	Minimum of 1.0 m and 1.0 m at road intersections

4.6 Pipe Sizing

Stormwater pipes were sized to drain stormwater from catchments A, B and C. The pipes indicated in the table below and figure above were sized according to above design criteria.

Table 4-7: Stormwater Pipe Sizes

Pipe	Calculated Flow (l/s)	Diameter (m)	manning n	Maximum d/D	Slope 1:__	velocity (m/s)	Flow capacity (l/s)
P1	64	0.45	0.013	0.8	40	3.23	440
P2	86	0.45	0.013	0.8	150	1.67	228
P3	150	0.45	0.013	0.8	35	3.45	471
P4	132	0.45	0.013	0.8	60	2.64	360
P5	132	0.45	0.013	0.8	35	3.45	471

Table 4-7 above indicates that the minimum prescribed stormwater pipe of 450mm diameter would be adequate to convey the stormwater generated by the 1:2 year storm with additional spare capacity.

4.7 Culvert Sizing

Stormwater culverts were designed for catchments D and E to convey stormwater underneath the proposed access road. The discharge capacity of a rounded culvert is calculated for two scenarios:

- In the first scenario the water flows 0.8 times lower than the height of the culvert inlet (downstream control); and
- In the second scenario the water accumulates in front of the culvert at 1.2 times the culvert height leading to full pipe flow (Upstream control).

Table 4-8: Stormwater Culvert Sizing

Variable	Downstream Control $0 < H_1/D < 0.8$	Upstream Control $0.8 < H_1/D < 1.2$
D	0.45 m	0.45 m
g	9.81 m^2/s	9.81 m^2/s
S_o	0.04 m/m	0.04 m/m

Variable	Downstream Control 0 < H1/D < 0.8	Upstream Control 0.8 < H1/D < 1.2
H_1	0.36 m	0.54 m
Q	**0.243 m^3/s**	**0.424 m^3/s**

Table 4-8 above indicates that a 450 mm diameter stormwater pipe has a flow capacity greater than the calculated peak flows for both catchments D and E for the 1:2 year storm. The 450 mm culverts would be adequate to convey the stormwater underneath the proposed access road.

4.8 Materials and Construction

The materials, construction and testing of the storm water drainage system will comply with the SABS 1200 specification. Concrete storm water pipes with interlocking (ogee) joints will be used for the storm water system. Kerb inlets manufactured to the Municipality's specification will be used. Brick junction boxes with concrete floor and cover slabs will be constructed according to the CoT requirements.

4.9 Costing

Please refer to Appendix C for the cost estimate for the stormwater

5. SEWERAGE

5.1 Bulk Sewer

There is currently no bulk sewage infrastructure near the proposed development to which the proposed new development will be able to connect to.

5.2 Internal Sewerage Reticulation

There is currently no sewage reticulation in the vicinity of the proposed development to which the proposed internal sewer network will be able to connect.

The proposed development will be serviced internally with a gravity sewer pipes and a conservancy tank. As indicated in Figure 5-1 below.

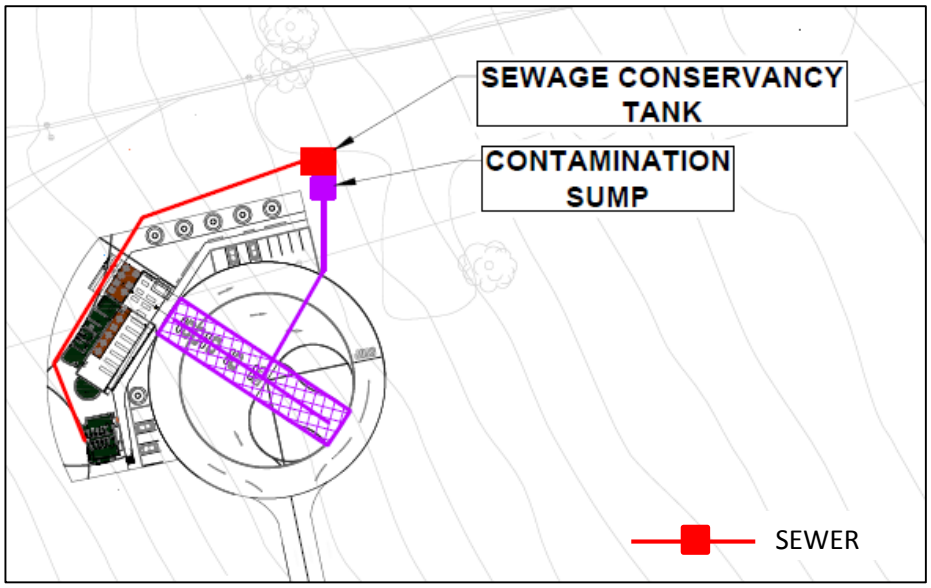

Figure 5-1: Sewer Layout

5.3 Sewerage Flow and storage

The estimated total sewerage flow from the proposed development will be approximately 7.5 kℓ/day. The sewerage flows are based the *Design Guidelines for Sewer Mains and Sewer Drainage Systems* issued by the Water and Sanitation Division of the City of Tshwane. Table 5-1 below indicates the sewage flow volume per day and required storage volume.

As indicated previously, there are no existing bulk sewer services available in the area. The sewage will drain to a conservancy tank from where the sewage will be collected on a daily basis. See Figure 5-2 below for a typical conservancy tank section.

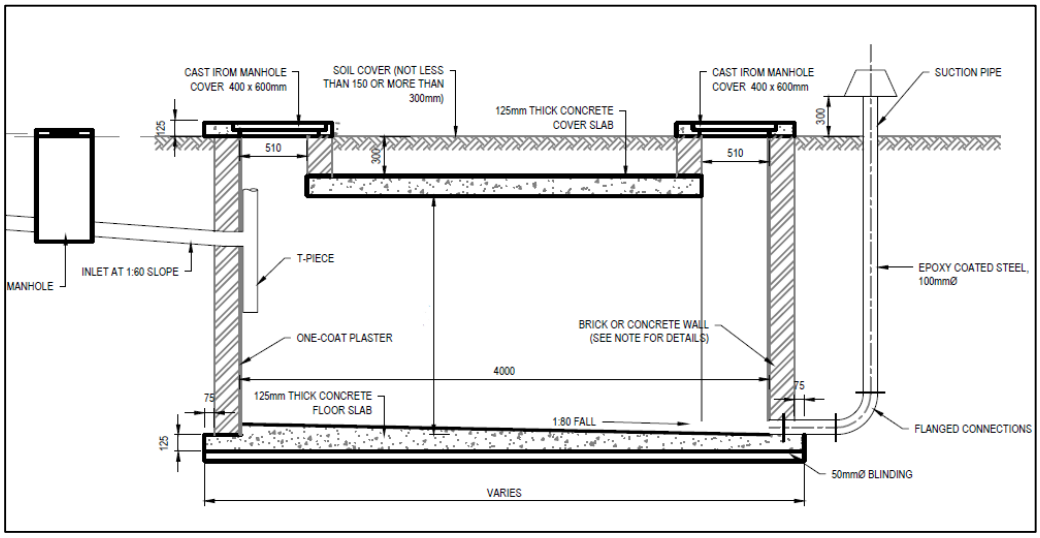

Figure 5-2: Typical Conservancy tank

The conservancy tank will be sized to keep at least two days sewage flow volume. The proposed size and dimensions on the conservancy tank are indicated in the table below:

Table 5-1: Sewer Flows

Land Use	Area (m^2)	Unit Flow	Total Flow	Min required volume of conservancy tank (2 day storage)	Proposed size of Conservancy tank (l x b x h)
Filling Station	750	1 kℓ/100m^2	7500 ℓ/day	15 m^3 15 000 ℓ	4 x 4 x 2 (24 m^3) (0.5 m freeboard depth)

5.4 Standard of Services & Design Criteria

The sewer system will be designed in accordance with the requirements of the City of Tshwane. The table and information below indicates the design criteria that will be used for the design.

Table 5-2: Sewer Standards and Design Criteria

Design Element	Specification
Peak factor for conventional small sized erf PF	2.5
Peak Wet Weather Factor (PWWF)	1.15
Minimum reticulation pipe Φ (nominal)	150mm
Depth to invert level of municipal sewer	1.5m (road reserves)
Depth to invert level of erf connection	0,4m

Design Element	Specification
Flow velocity (min)	0,77m/s
Cover over municipal sewers in servitude	1,0m
Angle between intersecting sewers	not greater than 90°
Gradients greater than 1:6	anchor blocks at each collar
Conservancy Tank	Minimum 2 days storage capacity

*Full flow design at peak design flow (self-cleaning)

5.5 Materials and Construction

The proposed materials, construction and testing of the sewage reticulation will comply with the SANS 1200 specification. Sewer pipes and fittings are uPVC (SABS 559).

6. WATER

6.1 Water Source

Currently there is no bulk water system in the vicinity of the proposed development, for the development to connect to. The development will make use of a borehole for water supply.

A groundwater abstraction assessment was done by Geo Pollution Technologies – Gauteng (Pty) Ltd. The study found a suitable borehole with a yield of 0.75 ℓ/s. It has a recommended 8 hour pumping cycle with a 16 hour recovery period. This equates to a daily yield of 21 600 ℓ

6.2 Water Demand and Storage

The estimated total water demand for the proposed development will be approximately 9 kℓ/day. This will require a storage volume of 18 kℓ/day as indicated in Table 6-1 below. The sewerage flows were calculated using the *Design Guidelines for Sewer Mains and Sewer Drainage Systems* issued by the Water and Sanitation Division of the City of Tshwane.
Water demand figures are based on the *City of Tshwane Guidelines for the Design and Construction of Water and Sanitation Systems*.

Table 6-1: Water Demand

Land Use	Area (m^2)	Unit Flow	Hourly Peak factor	Estimated Water Demand	Required Storage area (48 hours)	Recommended water storage
Filling Station	750	1.2 kℓ/100m2	3.3	9 000 ℓ/day	18 m3 18 000 ℓ	2 x 10 000 ℓ Water tanks

6.2.1 Water balance

The water balance is a breakdown of the total potable water use. The breakdowns consist of the total water abstracted from the water source, in this case a borehole, and the different water uses. Please refer to **Appendix B** for a diagram of the water balance.

6.3 Standard of Services & Design Criteria

6.3.1 Pipe Diameter, Velocities and Cover

The water reticulation system will be designed in accordance with the requirements of the City of Tshwane. The table and information below indicates the design criteria that will be used for the design.

Table 6-2: Water Standards and Design Criteria

Design Element	Specification
Minimum reticulation pipe Ø (nominal)	110mm
Flow velocity (max)	1,8m/s
Maximum water flow velocity (domestic instantaneous peak flow plus fire demand)	1.8 m/s
Hydrant flow	25 ℓ/s
Fire risk category	Moderate Risk (Category B)
Peak hourly factor	3.3

6.3.1 Fire Water

According to the *City of Tshwane Guidelines for the Design and Construction of Water and Sanitation Systems* and the *Guidelines for Human Settlement Planning and Design* guidelines for fire flow, the hydrant requirements for industrial and business is 25ℓ/s at 10m minimum working pressure The development can be categorised according to the *City of Tshwane Guidelines for the Design and Construction of Water and Sanitation Systems* and the *Guidelines for Human Settlement Planning and Design* guidelines as a Category B area.

6.4 Materials and construction

It is proposed that the materials, construction and testing of the water reticulation comply with the SANS 1200 series of specifications.

The more important materials may be summarized as follows:

- Pipes supplying domestic water to be uPVC Class 9, minimum;
- Pipe bends to be uPVC;
- All fittings to be cast-iron; AND
- All valves to be flanged

7. SOLID WASTE

The proposed development will consist of a service area with fuel pumps as well as a convenience shop and restaurant. These facilities will produce solid waste on a daily basis which will consist of food containers and wastes, paper towels, empty oil cans etc. These solid wastes will be will be temporarily stored on the facility before it is disposed. Solid waste generated during the construction phase of the proposed development will primarily consist of building rubble, spoil material and general litter.

The appropriate waste skips or bins will be provided during the construction and operational phases and will be disposed at the nearest approved and registered landfill site. Table 7-1 below indicates the estimated solid waste generation on a daily and monthly basis.

Table 7-1: Solid Waste Generation

Waste Generation Phase	Estimated daily Solid Waste generation	Estimated Monthly Solid Waste Generation
Construction	1.5 m^3/day	45 m^3
Operational	0.6 m^3/day	18 m^3

8. CONTAMINATION MANAGEMENT

Certain areas of the filling station may be contaminated with grease, oil, petrol and other contaminants from time to time. These contamination areas include the service area in the vicinity of the fuel pumps as well as the bulk filling areas of the undergrounds tanks. The floor surface of the contamination areas will be sloped towards grid covered traps which will drain the contaminated water to a holding sump.

The perimeter of the contamination areas will be slightly elevated to prevent storm water from entering the contamination areas. The contaminated water will be removed and taken off site to an approved treatment facility at determined intervals. The holding sump will be designed to retain oil and grease until it is removed. Se figure below for contamination drainage and storage layout.

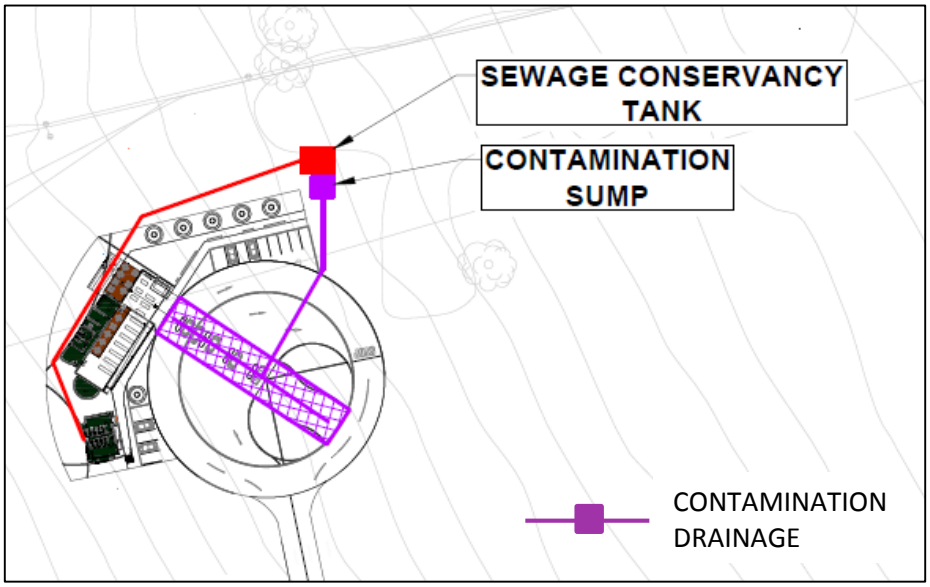

Figure 8-1: Contamination Management Layout

The capacity of the contamination sump is dependent on the emptying frequency but should at least have one day's storage volume. The estimated generation of contaminated water and suggested sump size is indicated in the table below:

Table 8-1: Contamination Generation

Contaminated Location	Area	Estimated contamination generation	Minimum Sump volume (2 days storage)	Suggested Sump size (l x b x d)
Fuel pumps and service area	500 m^2	1.0 ℓ /m^2/day	1.0 m^3	1.5m x 1.5 x 1m 2.25 m^3

9. BULK SERVICES CONTRIBUITIONS

The amount of Bulk Services Contributions for civil engineering services payable to the City of Tshwane Metropolitan Municipality will be determined with compilation of the service agreement.

10. CONCLUSION

SMEC trusts that this report meets the requirements of the City of Tshwane Metropolitan Municipality.

Should information be outstanding or unclear we would like to urge you to contact us. Any additional information will be provided as required for the acceptance of the report.

11. DOCUMENT APPROVAL FORM

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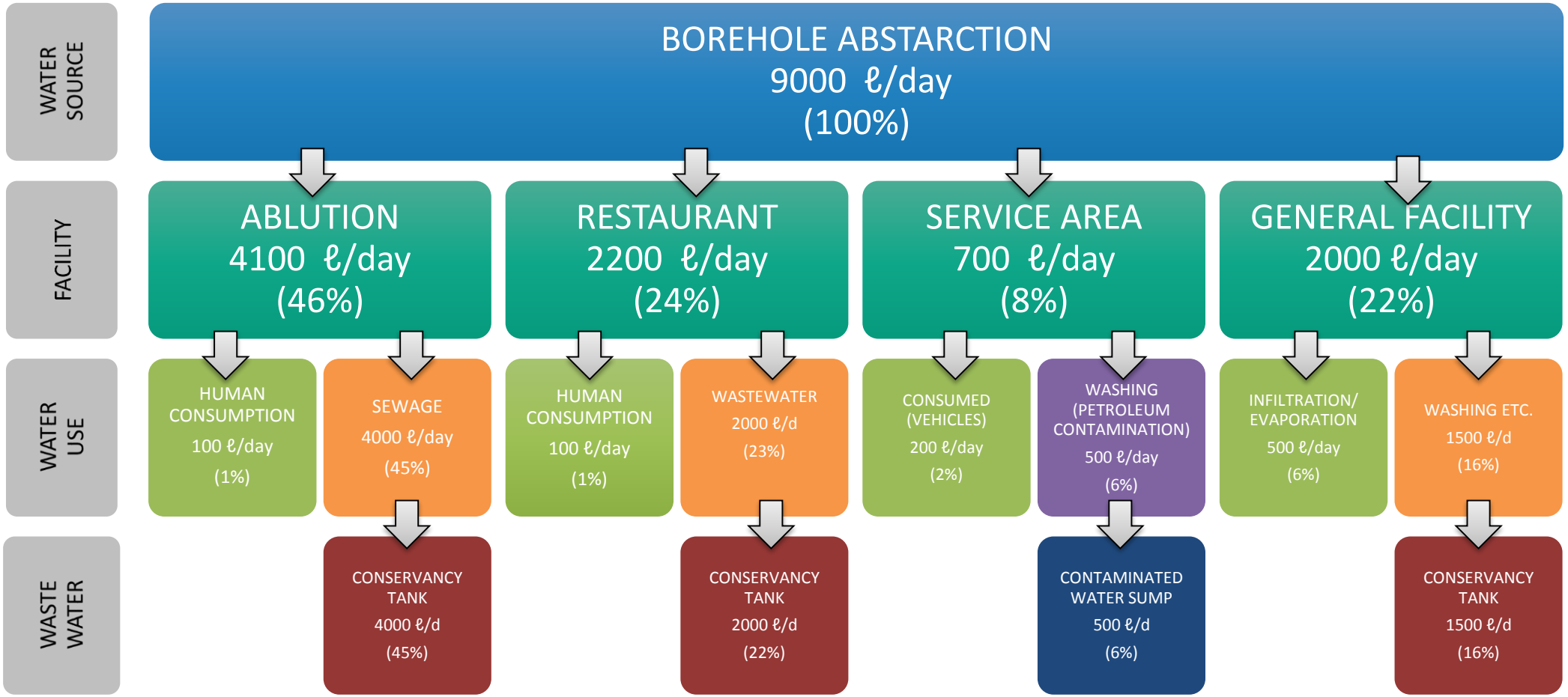
Report Name	Supplementary Civil Engineering services Report		
Project Name	Vlakfontein Filling Station	**Project Number**	PB1026
Client	JCJ Developments		

Approved by Client	JCJ Developments (Pty) Ltd.
Client	The client hereby understands and accepts the contents of this report, its Appendices and Annexures.

Approval	Signature	
	Name	Mr F. Eicker
	Role	COO
	Date	

APPENDIX A: TOWNSHIP LAYOUT PLAN

APPENDIX B: WATER BALANCE

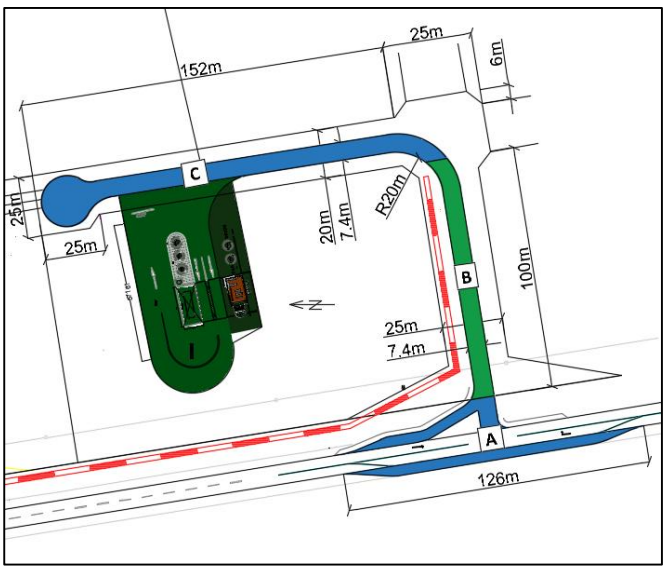


APPENDIX C: COST ESTIMATE AND ALLOCATION

Construction cost estimations for the roads and stormwater services were prepared for the financial contributions to services which will become the property of the council. The council is responsible to proportionally contribute to any additional or larger storm water infrastructure required for its services, which is over and above the requirements for the development. In this case the storm water management for both the services and development requires the minimum 450mm diameter piped system which exempt the council from a stormwater infrastructure contribution.

Water and sewer contribution by the City of Tshwane is not applicable at this stage since there is no available bulk services in the area.

Item Description	Quantity	Unit Rate	Total	Cost allocation
Intersection & Roads				
A) Intersection (A)	750 m^2	R 1200/m^2	R 900 000	JCJ Developments.
B) Access Road (B) (100m x 7.4m)	740 m^2	R 1200/m^2	R 888 000	City of Tshwane
C) Access road and Turnaround	1450 m^2	R 1200/m^2	R 1 740 000	JCJ Developments
Total			**R 3 528 000**	
Stormwater				
450 mm concrete pipe (100D)	600 m	R 2020/m	R 1 212 000	JCJ Developments
Catchpits	10	R 5000/unit	R 50 000	JCJ Developments
Outlet structure (Wingwall)	6	R 5000/unit	R 30 000	JCJ Developments
Energy dissipater	2	R 3500/unit	R 7000	JCJ Developments
Total			**R 1 299 000**	



ANNEXURE A: ENGINEERING CIVIL SERVICES REPORT (MSBR CONSULTING)

ANNEXURE B: TRAFFIC IMPACT ASSESSMENT