Appendix G3

Geotechnical Report

REPORT
ON
THE ENGINEERING GEOLOGICAL INVESTIGATION
ON
THE REMAINDER OF PORTION 105
POTION 109
PORTION 111
AND
ON
THE REMAINDER OF PORTION 331
OF
THE FARM
KNOPJESLAAGTE 385 JR.

LOUIS KRUGER GEOTECHNICS CC
PO BOX 90093
Garsfontein
0042
Tel 082 651 4819
Fax 086 671 1684

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Client

Keymacx

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON THE REMAINDER OF PORTION 105, POTION 109, PORTION 111 AND ON THE REMAINDER OF PORTION 331 OF THE FARM KNOPJESLAAGTE 385 JR.

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REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION ON THE REMAINDER OF PORTION 105, POTION 109, PORTION 111 AND ON THE REMAINDER OF PORTION 331 OF THE FARM KNOPJESLAAGTE 385 JR.

1. INTRODUCTION

Louis Kruger Geotechnics CC was appointed to do an engineering investigation on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR. The investigation was undertaken according to the normal requirements to assess the suitability of the site (SANS 634: Geotechnical Investigations For Township Development, SANS 633: Profiling, and Percussion and Core Borehole Logging In Southern Africa for Engineering Purposes, Home Building Manual Part 1 & 2", National Home Builders Registration Council, 1999) and Guidelines for Urban Engineering Geological Investigations 1997). The following aspects are addressed in this report:

- Geology and Soil profile
- Geohydrology
- Foundation conditions
- Construction material

2. TERMS OF REFERENCE

The appointment was to do an engineering investigation on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR. The following aspects were to be addressed:

- The geotechnical characteristics of the site
- Geotechnical constraints
- Founding conditions
- NHBRC Zoning

The locality of the site is shown on Figure 1.

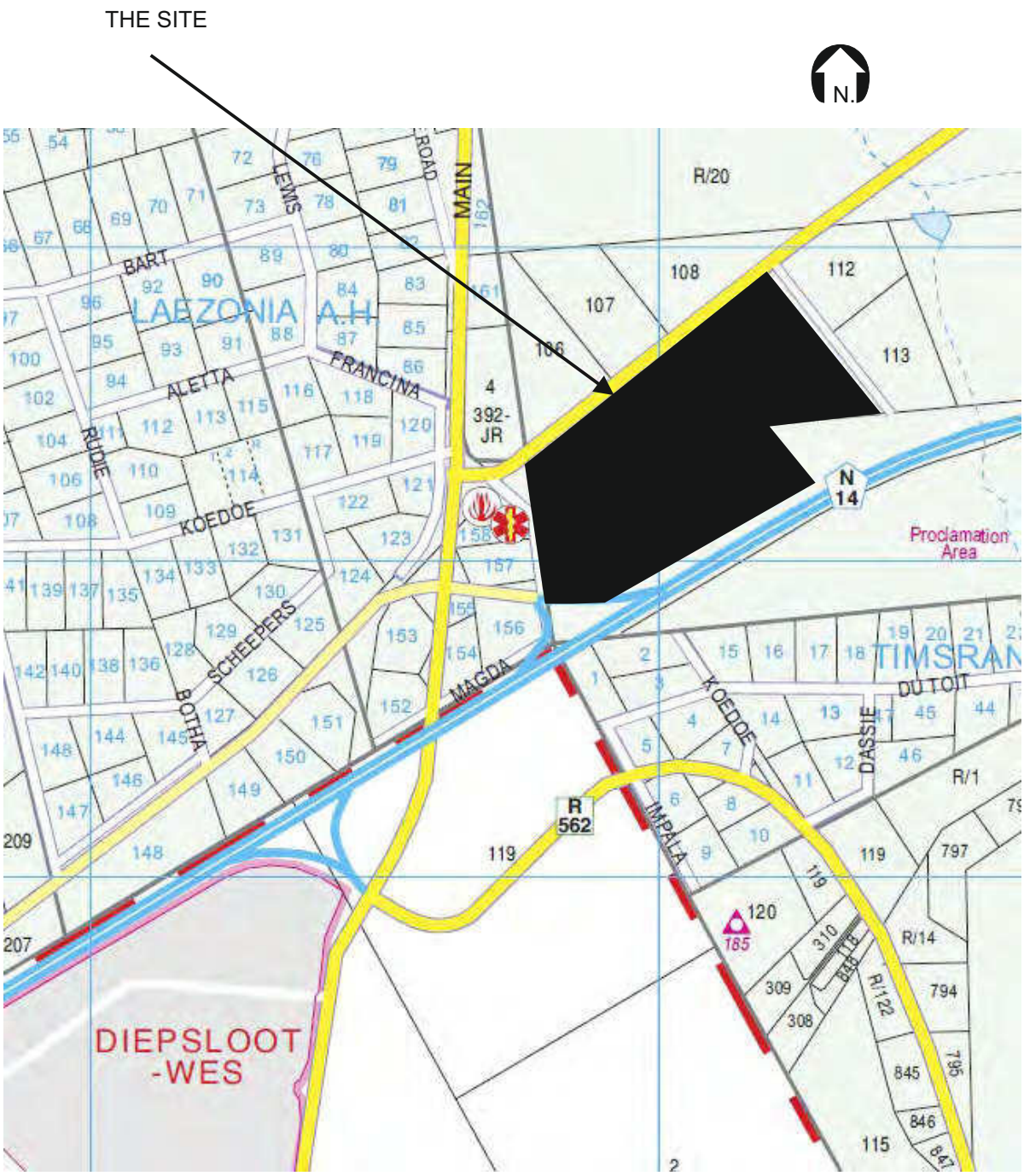
3. AVAILABLE INFORMATION

The following information was available:

- 1 : 50 000 Geological Map 2528CC Lyttelton
- Cadastral map
- Colour aerial photographs, Tshwane Metropolitan Council
- Tshwane Internet Geographical information System

4. LOCALITY

The site is situated on the Remainder of Portion 105, Potion 109, Portion 111 and on the Remainder of Portion 331 of the farm Knopjeslaagte 385 JR and is bounded by the N14 Krugerdorp Highway in the south, by Fig Street in the west, by the R114 Pretoria Road in the north and by Imbovane Street in the east. The locality of the site is shown on Figure 1.



LOCALITY	FIGURE 1 NTS

5. TOPOGRAPHY AND DRAINAGE

No topographical information was available. The Tshwane Internet Geographical information System shows that the site slopes at an average of 4% towards the north-east. No drainage features are present on the site and according to the available information it is not affected by flood lines. The topography of the site is shown on Figure 2.

6. METHOD OF INVESTIGATION

Twenty-five test pits were dug on the site and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soils laboratory for foundation indicator tests. Due to the high gravel content and the consistency of the materials encountered on the site, no undisturbed samples were taken

7. GEOLOGY AND SOIL PROFILE

According to the 1: 50 000 scale geological map the site is underlain by migmatite gneiss (granite) of the Halfway House Suite. The geology of the site was confirmed during this investigation, granite bedrock was encountered in the test pits. The test pit positions are shown on Figure 2 and the soil profiles are attached as Appendix A. The following materials were encountered on the site:

7.1 Soil profile

The test pit positions are shown on Figure 3 and the soil profiles are attached as Appendix A. The following materials were encountered on the site:

7.1.1 Colluvium

Two types of colluvium were encountered on the site:

Type A: Slightly moist, dark brown, soft, shattered, silty sand with plant roots covers the eastern part of the site. This material was encountered in fourteen test pits from surface up to an average depth of 0,3 meters.

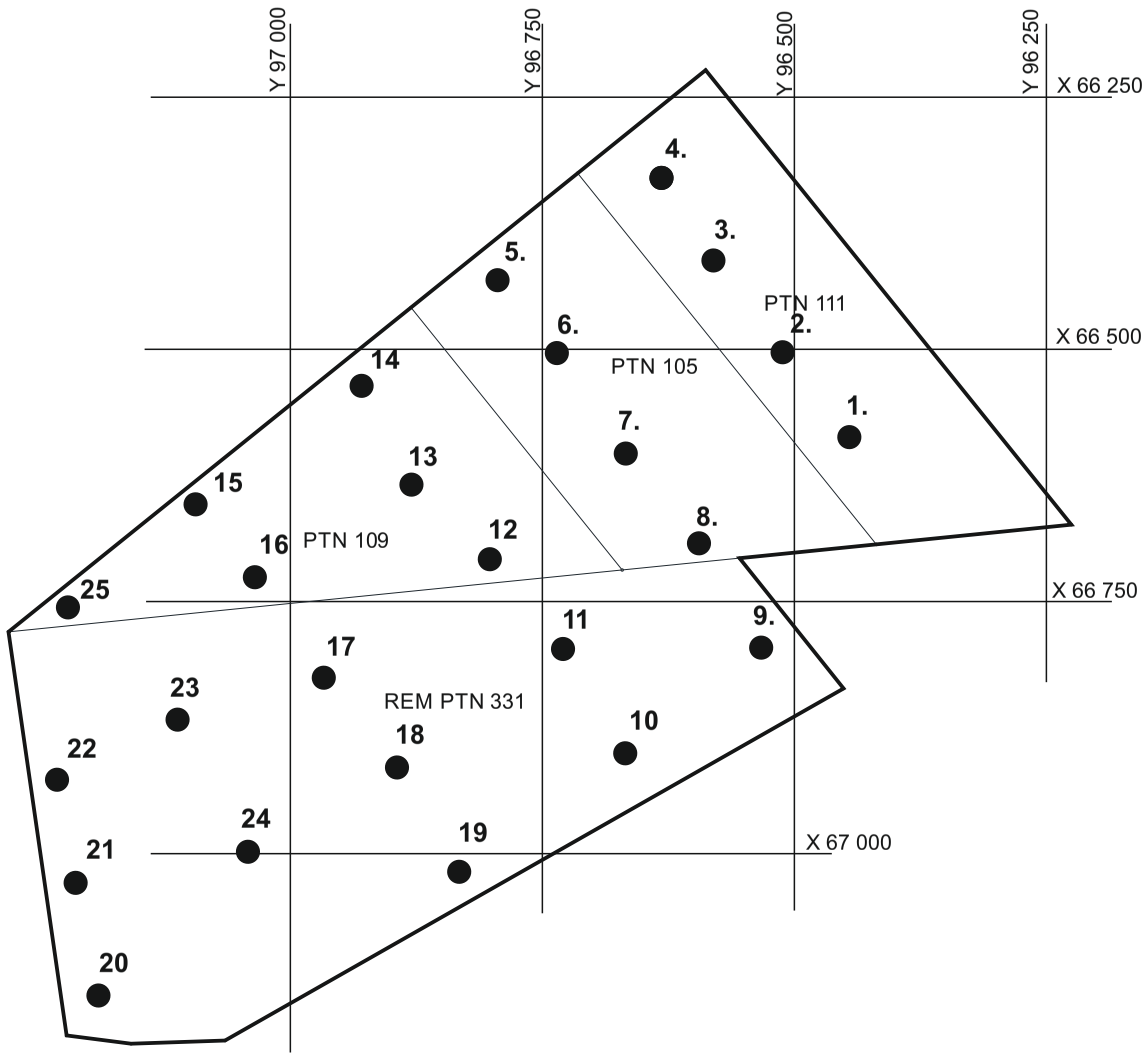
Type B: Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots was encountered on the western part of the site. This material was encountered in eight test pits from surface up to an average depth of 0,6 meters.

7.1.2 Ferricrete

Slightly moist, dark brown becoming yellow mottled orange and black, loose, silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles was encountered in twenty-three test pits from an average depth of 0,4 meters up to an average depth of 1,0 meters. In nine test pits the back actor refused hardpan ferricrete at an average depth of 0,7 meters.

7.1.3 Granite

Residual granite consisting of slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite was encountered in three test pits from an average depth 0,7 meters up to an average depth of 1,3 meters and slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments was encountered in two test pits from an average depth 1,0 meters up to an average depth of 1,6 meters. Very soft rock granite was encountered in sixteen test pits from an average depth of 1,3 meters up to an average depth of 1,7 meters. The back actor refused on soft- to medium hard rock granite in sixteen test pits at an average depth of 1,4 meters.



TEST PIT POSITIONS	SCALE 1 : 7 500	FIGURE 2

8. GEOHYDROLOGY

No ground water was encountered during the investigation. The presence of pedogenic material however indicates that a perched water table could be present during and after periods of high rainfall.

9. LABORATORY TEST RESULTS

9.1 Indicator test results

The laboratory test results are attached as Appendix B and are summarized in the following table:

MATERIAL	TP	DEPTH (m)	PI	% Clay	% Silt	% Sand	% Gravel
Colluvium Type A	1	0.2	SP	3	11	85	1
Colluvium Type A	8	0.3	NP	1	11	86	2
Colluvium Type B	17	0.3	7	6	18	56	20
Colluvium Type B	20	0.3	NP	3	21	55	21
Colluvium Type B	24	0.4	7	7	14	46	33
Nodular ferricrete	1	0.8	SP	2	10	49	39
Nodular ferricrete	15	1.0	SP	4	8	45	43
Nodular ferricrete	22	1.0	SP	1	2	47	51
Residual granite Type 1	2	0.8	NP	1	13	47	39
Residual granite Type 2	21	1.3	SP	3	10	59	28

The difference between the Type A colluvium and the Type B colluvium is reflected by the higher sand- and lower gravel content of the Type A hillwash. The difference between the nodular ferricrete and the colluvium is shown by the higher gravel content and the difference between the nodular ferricrete and the residual granite is shown by the higher silt- and lower gravel content of the residual granite. The difference between the two types of residual granite is reflected by the higher gravel- and lower sand content of the Type 1 residual granite. The variation in the composition of the materials is clearly reflected by the results.

9.2 Potential expansiveness

The potential expansiveness of the materials encountered on the site was calculated according to the method proposed by Van der Merwe (1964). The following material characteristics are considered when applying this method:

- Plasticity index
- Clay fraction (< 0,002 mm)
- Thickness of expansive material
- Thickness of non - expansive material

Assuming the laboratory test results typify the material encountered on the site, the application of the method of Van der Merwe shows that all the materials classify as “Low” and is therefore considered to be non-expansive.

9.3 Collapse potential

Due to the consistency and the gravel content of the materials, no undisturbed samples were taken.

10. ENGINEERING GEOLOGICAL ZONING

The site was divided into the following Engineering Geological Zones:

Zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock

Zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

The engineering geological zones are shown on Figure 3. *The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended*

11. GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations, which could influence the proposed development, were identified:

11.1 Founding of structures

11.1.1 Engineering geological zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock

- The composition and consistency of the colluvium varies considerably and the overall consistency is soft, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

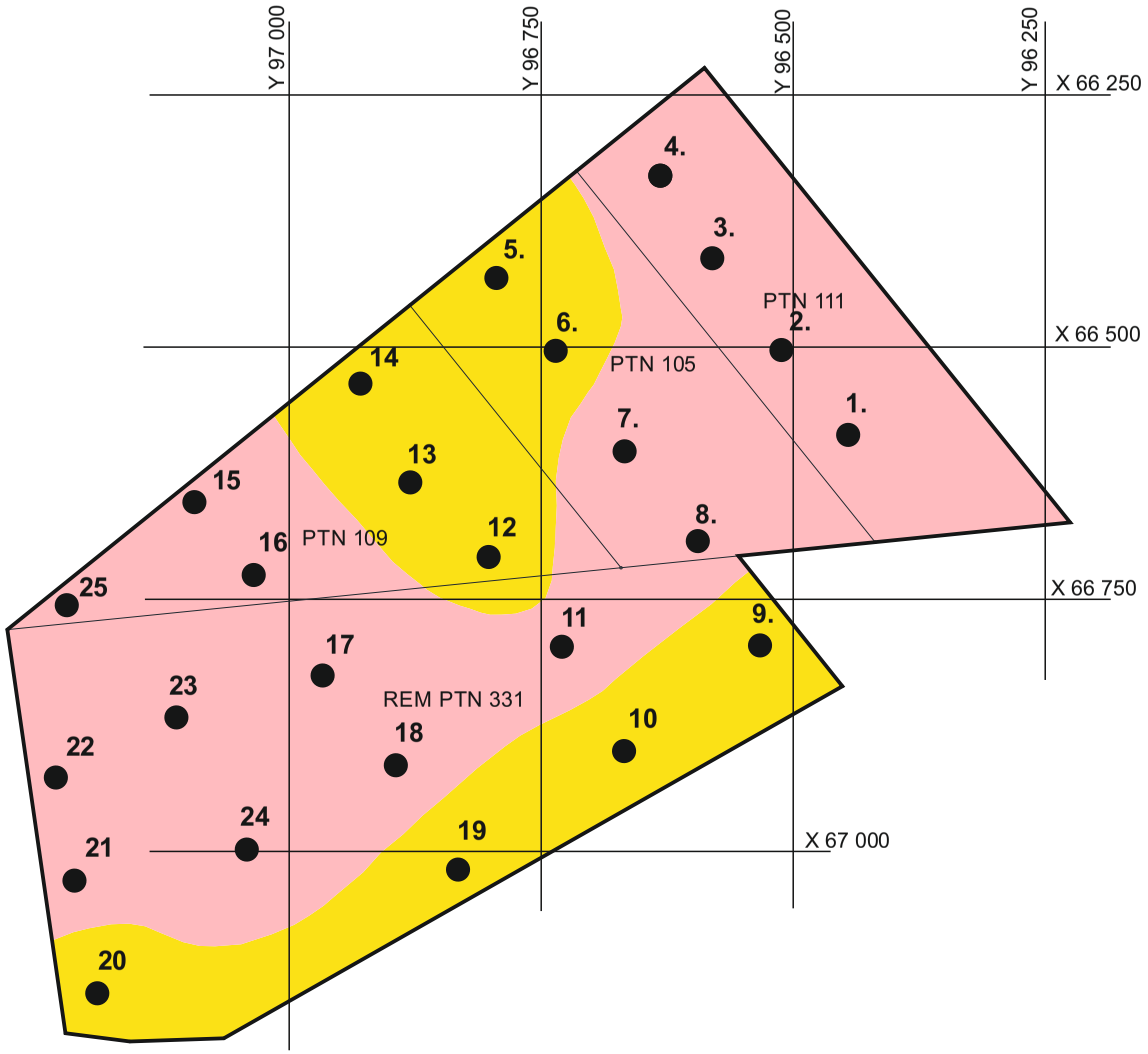
- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The soft- to medium hard rock granite bedrock is considered suitable for the founding of structures.

11.1.2 Engineering geological zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

- The composition and consistency of the colluvium varies considerably and the overall consistency is soft, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.



Zone 1: Colluvium, nodular ferricrete and residual granite underlain by granite bedrock.

Zone 2: Colluvium and nodular ferricrete underlain by hardpan ferricrete

The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended

ENGINEERING GEOLOGICAL ZONING	SCALE 1 : 7 500	FIGURE 3

- The consistency of the nodular ferricrete with patches of honeycomb ferricrete is loose and the gravel content varies considerably, therefore, it is not considered suitable founding material for unadapted structures. If unadapted structures are founded on this material, and the moisture content should increase, unacceptable differential, vertical movements could occur, with resultant cracking of structures.

- Depending on the lateral and vertical continuity, the hardpan ferricrete is considered suitable for the founding of structures.

11.2 Excavatability

In engineering geological zone 1 the back actor refused at an average depth of 1,4 meters and in engineering geological zone 2 the back actor refused at an average depth of 0,7 meters.

11.3 Construction material

Both types of colluvium classify as A-2-4, the nodular ferricrete and residual granite classifies as A-1-b. The Plasticity Index and Grading Modulus were used to assess the suitability as construction material (TRH 14)

11.4 Groundwater

A perched water table, which could cause the flooding of excavations, could be present during or after periods of high rainfall. This is confirmed by the presence of pedogenic material.

11.5 Stability of excavations

Limited instability occurred in the sidewalls of the test pits.

12. GEOTECHNICAL CLASSIFICATION

The site was classified according to the Geotechnical Classification for Urban Development (after Partridge, Wood and Brink 1993). The criteria for the classification are shown in the following table:

GEOTECHNICAL CLASSIFICATION FOR URBAN DEVELOPMENT (after Partridge, Wood and Brink 1993)

CONSTRAINT		MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness	Any collapsible horizon or consecutive horizons totalling a depth of more than 750 mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5 meters below surface	Permanent or perched water table less than 1,5 meters below surface	Swamps or marshes
C	Active soil	Low soil heave predicted	Moderate soil heave predicted	High soil heave predicted
D	Highly compressible soil	Low soil compressibility expected	Moderate soil compressibility expected	High soil compressibility expected
E	Erodibility of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10% of the total volume	Rock or hardpan pedocretes between 10 and 40% of the total volume	Rock or hardpan pedocretes more than 40% of total volume
G	Undermined ground	Undermining at a depth greater than 100 m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 100 m below surface where stope closure has ceased	Mining within less than 100 m of surface or where total extraction mining has taken place
H	Instability in areas of soluble rock	Possibly unstable	Probably unstable	Known sinkholes and dolines
I	Steep slopes	Between 2 and 6 degrees (all regions)	Slopes between 6 and 18 degrees and less 2 degrees (Natal and Western Cape) Slopes between 6 and 12 degrees and less 2 degrees (all other regions)	More than 18 degrees (Natal and western Cape) More than 12 degrees (all other regions)

	CONSTRAINT	MOST FAVOURABLE (1)	INTERMEDIATE (2)	LEAST FAVOURABLE (3)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10% probability of an event less than 100 cm/s^2 within 50 years	Mining induced seismic activity more than 100 cm/s^2	Natural seismic activity more than 100 cm/s^2
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1%	Areas within a known drainage channel or floodplain

Based on the above, the site is classified as follows:

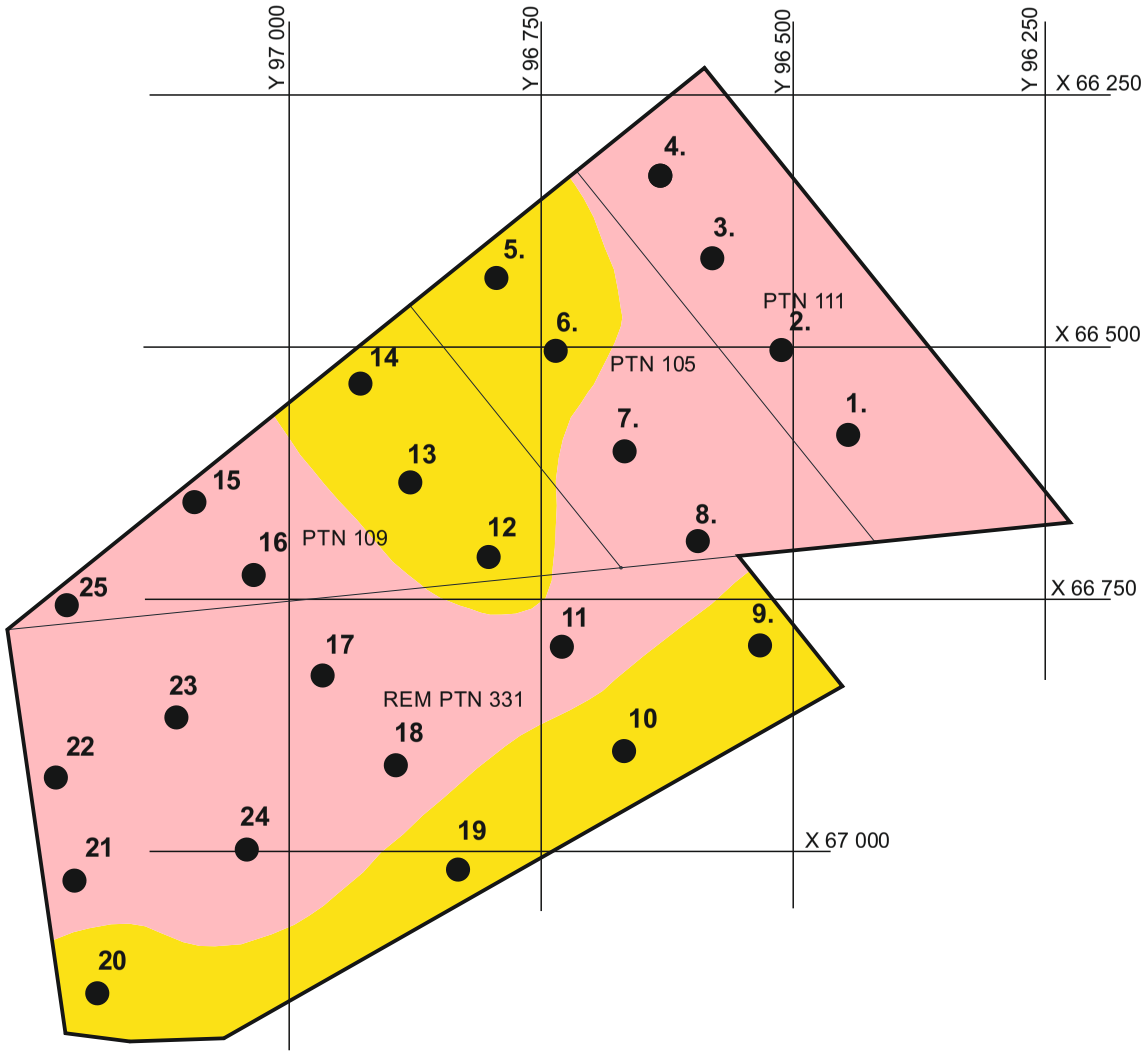
Engineering geological zone 1: 2A 1/2B 1C 2D 2E 2F 1I

Engineering geological zone 2: 1/2A 2B 1C 2D 2E 2/3F 1I

13. NHBRC CLASSIFICATION (SANS 10400-H: THE APPLICATION OF THE NATIONAL BUILDING REGULATIONS - PART H)

ZONE	NHBRC ZONE	MOTIVATION
Engineering geological zone 1 Geotechnical classification: 2A 1/2B 1C 2D 2E 2F 1I (see table)	P(Perched water table)-C1/C2-S1/S2	Due to the variation in composition, and the overall consistency, collapse is expected in the colluvium, nodular ferricrete and in the residual granite if unadapted structures are founded on it. The average thickness of the collapsible material is 1,4 meters and the thickness varies between 1,0 and 1,8 meters, therefore this part of the site is zoned as C1/C2-S1/S2. The presence of the shallow perched water table is accommodated by adding a zoning of P(Perched water table.
Engineering geological zone 2 Geotechnical classification: 1/2A 2B 1C 2D 2E 2/3F 1I (see table)	P(Perched water table)-R-C/C1-S/S1	Due to the variation in composition, and the overall consistency, collapse is expected in the colluvium and nodular ferricrete if structures are founded on it. The average thickness of the collapsible material is 0,7 meters and the thickness varies between 0,5 and 1,0 meters, therefore this part of the site is zoned as C/C1-S/S1. The presence of the shallow perched water table is accommodated by adding a zoning of P(Shallow water table),), and the presence of shallow hardpan ferricrete is accommodated by adding a zoning of R.

It is important to note that the zoning is based on the profiling of test pits and the interpolation of information between test pits; therefore it is possible that variations from the expected conditions can occur. The zoning is shown on Figure 4.



NHBRC Zone P(Perched water table)-C1/C2-S1/S2

NHBRC Zone P(Perched water table)-R-C/C1-S/S1

The boundaries between the different zones are based on field observations, aerial photographic interpretation and the interpolation of information between test pits. Therefore a conservative approach to the use of the engineering geological boundaries is recommended

NHBRC ZONING	SCALE 1 : 7 500	FIGURE 4

14. CONCLUSIONS AND RECOMMENDATIONS

It is important to note that the recommendations are based on the profiling of test pits and the interpolation of information. It is therefore possible that variations from the expected conditions can occur.

14.1 Foundations for light structures

14.1.1 NHBRC Zone P(Perched water table)-C1/C2-S1/S2

The colluvium, nodular ferricrete and the residual granite are expected to be potentially collapsible / compressible. Therefore this material is considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

If granite bedrock is present at shallow depth:

- *Deep strip footings:*
  Found structures below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

If the depth to granite bedrock becomes too deep to found economically:

- *Modified normal:*
  Found structures on reinforced strip footings, the foundation pressure should not exceed 50 kPa and structures should be provided with light reinforcement in the masonry and articulation joints at internal and external doors.

- *Stiffened strip footings, stiffened or cellular raft:*
  Found structures on stiffened strip footings or a stiffened or cellular raft with lightly reinforced masonry. The bearing pressure should not exceed 50 kPa and floor slabs should be reinforced.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Piled or pier foundations:*
  Found structures on piled or pier foundations with reinforced ground beams or solid slabs on piled or pier foundations

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled***

and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.

14.1.2 NHBRC Zone P(Perched water table)-R-C/C1-S/S1

The colluvium and nodular ferricrete are considered to be potentially collapsible. Therefore these materials are considered unsuitable in its natural state to act as a founding medium. This even applies for light structures with a foundation pressure of less than 100kPa. From the discussion foundation improvement and imparting flexibility in the brickwork are clearly required. The following alternatives are recommended:

If hardpan ferricrete is present at shallow depth and the lateral and vertical continuity is confirmed:

- *Deep strip footings:*
  Found structures below the potentially collapsible material. Structures should be provided with vertical movement joints, light reinforcement in the masonry and floor slabs should be provided with fabric reinforcement.

If the depth to hardpan ferricrete becomes too deep to found economically:

- *Modified normal:*
  Found structures on reinforced strip footings, the foundation pressure should not exceed 50 kPa and structures should be provided with light reinforcement in the masonry and articulation joints at internal and external doors.

- *Compaction of insitu soil below footings:*
  Remove unsuitable material up to a depth and width of 1,5 times the foundation width, below normal founding depth. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

- *Soil raft:*
  Remove the collapsible material to 1,0 meters beyond the perimeter of the structure to at least a depth of 1,5 times the width of the widest foundation. The loose material in the bottom of excavations should be compacted, and the excavations backfilled with suitable material, compacted in 150 mm layers to at least 93% of Mod AASHTO density at -1% to +2% of optimum moisture content. Structures can be founded on normal reinforced strip footings on the backfill and should be provided with vertical movement joints and light reinforcement in the masonry.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.1.3 Recommendations that apply to the entire site

Due to the slope of the site, it is envisaged that a level platform for the structure will be created by way of a balanced cut to fill operation. This means that on the cut end of the platform, excavations may have proceeded to the level of the hardpan ferricrete or granite bedrock, depending on the depth of cut and the thickness of the transported material at the cut end. When building platforms are constructed, the soil profile should be investigated to establish the approximate thickness of the various horizons within the platform area. The following guidelines should be followed:

- In cut sections, the alternatives listed in the previous section apply. Should the cut extend up to competent founding material, only loose material at founding level has to be removed or must be compacted

- On the fill end, the founding alternatives listed in the previous section apply. If the entire fill section is constructed by compacting a competent material, founding at shallow depth is possible.

It is important though that in spite of the guidelines given above, inspection of foundation excavations and the involvement of a competent engineer familiar with structural founding are necessary. ***It is furthermore recommended that the trenches for services be profiled and that a construction report be compiled for the development. The purpose of the construction report is to confirm or adapt the zoning of the site, and to provide more accurate information regarding the founding conditions.***

14.2 Foundations for large structures

Detailed foundation investigations should be done on the footprints of large structures.

14.3 Excavatability

The excavatability of the materials encountered on the site was evaluated according to the South African Bureau of Standards Standardized Specification for Civil Engineering Construction DB: Earthworks (Pipe Trenches. In NHBRC Zone P(Perched water table)-C1/C2-S1/S2 the excavatability is considered to classify as "soft to intermediate" up to an **average** depth of one meter. In NHBRC Zone P(Perched water table)-R-C/C1-S/S1 the excavatability is considered to classify as "soft to intermediate" up to an **average** depth of 0,5. *It is important to note that the evaluation is based primarily on the profiling of test pits and the interpolation of information between test pits. It is therefore possible that variations from the expected conditions can occur.*

14.4 Geohydrology

All excavations should be provided with adequate drainage. Structures should be provided with damp proofing and provision should be made to prevent the ingress of water into– and below foundations.

14.5 Construction material

Both types of hillwash could be suitable as fill and selected sub-grade, the nodular ferricrete and the residual granite could be suitable as fill, selected sub-grade and sub-base. *It is recommended that the suitability of material that is to be used, be confirmed by detailed laboratory testing*.

14.5 Services

Due to the expected corrosivity, it is recommended that all services be protected.

14.7 Stability of excavations

It is recommended that all excavations be cut back or shored.

14.8 General recommendations

- Water has a significant influence on the behaviour of the in-situ material. To reduce differential movements of structures it is necessary to maintain moisture equilibrium under the structures. Therefore it is recommended that the following measures regarding drainage around structures be implemented:

- No accumulation of surface water must be allowed around the perimeter of the structures and the entire development must be properly drained.

- Down pipes should discharge into a lined or precast furrow. This furrow should discharge the water 1,5 meters away from the foundation onto a paved or grassed surface sloping away from the building.

- Preferably, if no gutters or paving is to be provided around structures, a 1,5 meter wide sealed concrete apron should be cast along the perimeter of the structures the water must be channeled away from the foundation.

- Leaks in water bearing services should be attended to without undue delay.

- No large shrubs or trees should be planted closer to structures than the distances provided in the following Table:

DESCRIPTION	**MATURE HEIGHT OF TREE**		
	Up to 8m	**8m tot 15m**	**Over 15m**
Buildings other than single storey buildings of lightweight construction	-	0.5	1,2
Single storey buildings of lightweight construction (e.g. timber framed)	-	0.7	1,5
Free standing masonry walls	-	1,0[1] 0,5[2]	2,0[1] 1,0[2]
Drains and underground services • less than 1 meter deep • more than 1 meter deep	 0,5 -	 1,5 1,0	 3,0 2,0

Note:
1) These distances will generally avoid all direct damage
2) These distances assume that some movement and minor damage, which may be tolerated, might occur.
This table provides guidance on the acceptable proximity of young trees or new planting to allow for future growth. This table should not be taken to imply that construction work can occur at the specified distances from existing trees; as such work might damage the tree, or render it dangerous, but refers to the potential for future growth, either of a young tree or of planting, occurring subsequent to construction

L.J Kruger Pr. Sci. Nat.

15. REFERENCES

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APPENDIX A

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 1. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 2. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3
			Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
			1,3 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

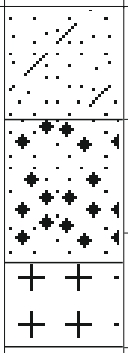
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 3. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,2 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,5 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

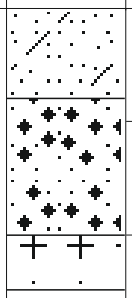
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 4. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium 0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles 1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite 1,3 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 5. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 6. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 7 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
			1,2 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 8. DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
		0,5	Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,0	Slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite - Reworked residual granite
		1,5	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 9 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 10 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,8 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 11 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,4 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments - Residual granite
			1,4 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 12 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
			0,2 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

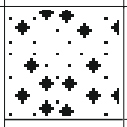
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 13 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

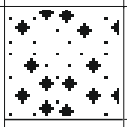
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 14 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,5 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 15 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
		0,3	
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,5	Slightly moist, orange speckled white with black stained joints, very soft rock granite
		1,8	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 16 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, dark brown, soft, shattered, silty sand with plant roots - Colluvium
		0,3	
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,5	Slightly moist, orange speckled white with black stained joints, very soft rock granite
		1,8	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 17 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,2 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,8 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 18 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite
			1,5 Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 19 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,0 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 20 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,5 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			0,9 Refusal on hardpan ferricrete
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

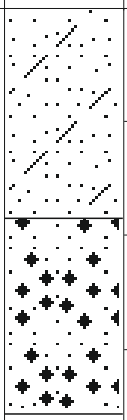
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 21 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,9
			Slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments - Residual granite
			1,8
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 22 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
		0,5	Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
		1,6	Slightly moist, orange speckled white with black stained joints, very soft rock granite
		2,0	Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 23 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Slightly moist, orange speckled white with black stained joints, very soft rock granite
			2,3
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 24 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots - Colluvium
			0,6
			Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles
			1,5
			Refusal on soft rock granite
			No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

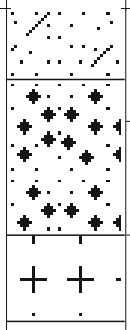
SOIL PROFILE

PROJECT: Ptn 105 Ptn 109 Rem Ptn 133 SITE: KNOPJESLAAGTE 385 JR

CLIENT: Keymacx

MACHINE: TLB LOGGED BY: LJK

TEST PIT: 25 DATE: 18/11/2015

SAMPLE / TEST	GROUND WATER	LEGEND	DESCRIPTION
			Fill, consisting of dark brown, soft, clayey sand with plant roots 0,3 Slightly moist, dark brown becoming yellow mottled orange and black, loose, \silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles 1,0 Slightly moist, orange speckled white with black stained joints, very soft rock granite 1,4 Refusal on soft rock granite No ground water

LOUIS KRUGER GEOTECHNICS PO BOX 90093 GARSFONTEIN TEL 082 651 4819

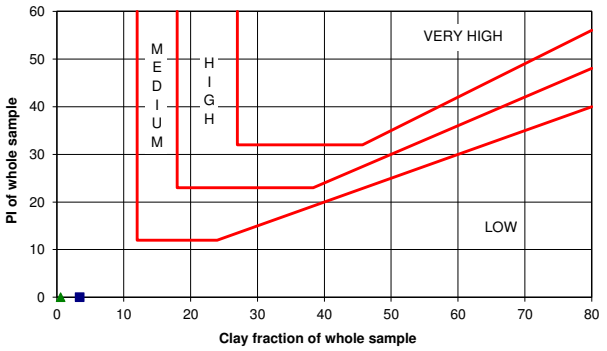
APPENDIX B

PARTICLE SIZE ANALYSIS

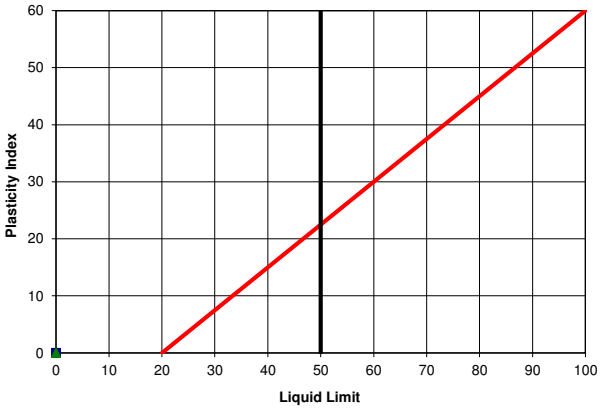
Sample No.	1	2
Soillab Sample No.	2015-S-1607-01	2015-S-1607-02
Depth (m)		
Position	SAMPLE 1	SAMPLE 2
Material Description	DARK GREY SILTY SAND	DARK GREY FERRICRETE W/ GRANITE SANDY GRAVEL
Organic Material	YES	YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	100	100
4.75 mm	100	78
2.00 mm	99	49
0.425 mm	57	7
0.075 mm	16	3
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	11	2
0.027 mm	10	2
0.013 mm	7	1
0.005 mm	6	1
0.002 mm	3	1
% Clay	3	1
% Silt	11	2
% Sand	85	47
% Gravel	1	51
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	SP	SP
Linear Shrinkage (%)	0.5	1.0
Grading Modulus	1.27	2.41
Uniformity coefficient	19	6
Coefficient of curvature	1.5	0.7
Classification	A-2-4 (0)	A-1-a (0)
Unified Classification	SM	SP
Chart Reference		

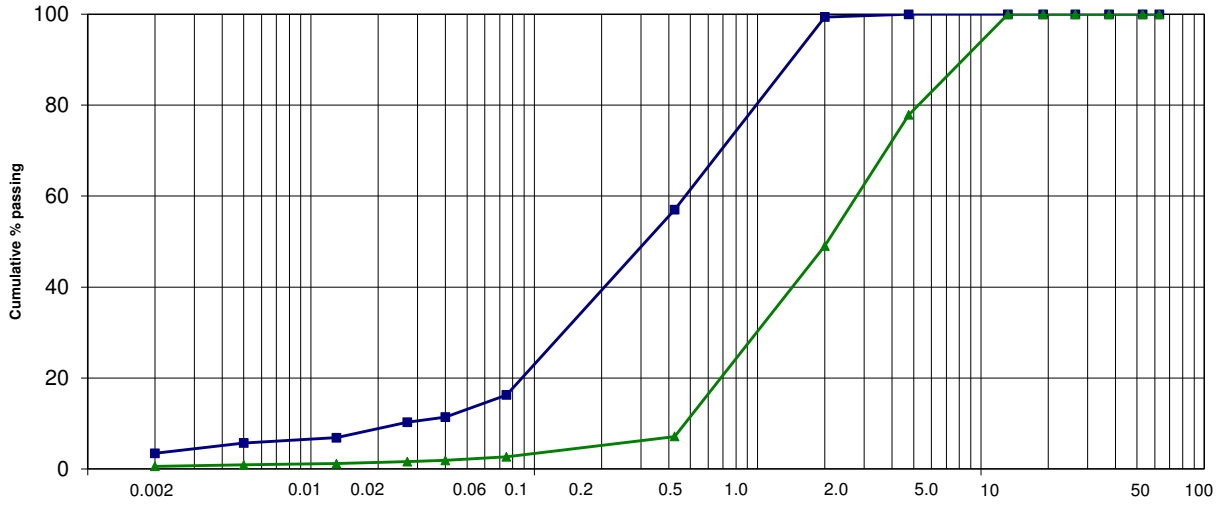
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





CLAY	SILT	SAND	GRAVEL

HIDROMETER/1607-01.xls

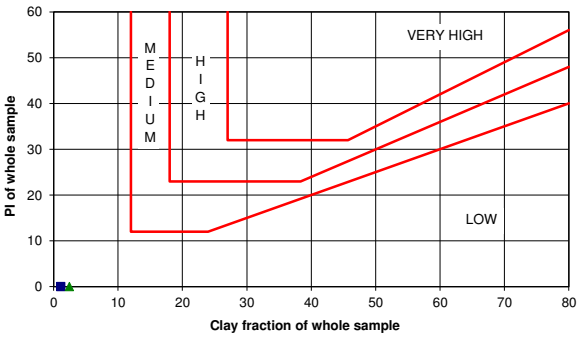
SOILLAB Part of the SMEC Group
Soillab is a SANAS accredited Testing Laboratory.
Engineering Materials Laboratory
T +27 12 813 4900 E info@soillab.co.za
Soillab Pretoria
www.soillab.co.za

PARTICLE SIZE ANALYSIS

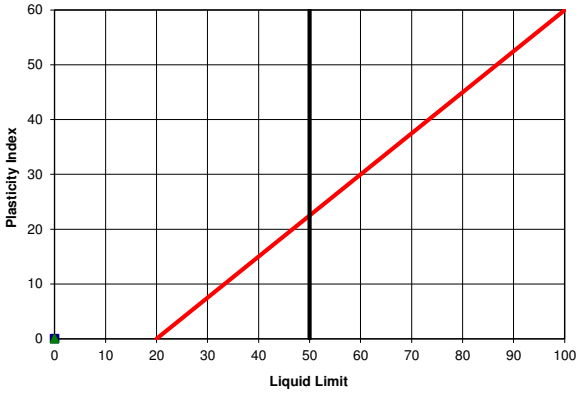
Sample No.	3	4
Soillab Sample No.	2015-S-1607-03	2015-S-1607-04
Depth (m)		
Position	SAMPLE 3	SAMPLE 4
Material Description	LIGHT GREY SILTY SAND	DARK GREY FERRICRETE QUARTZ GRAVELLY SAND
Organic Material	YES	YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	92
26.5 mm	100	92
19.0 mm	100	91
13.2 mm	100	89
4.75 mm	100	75
2.00 mm	98	61
0.425 mm	56	41
0.075 mm	14	14
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	9	10
0.027 mm	7	8
0.013 mm	4	6
0.005 mm	3	5
0.002 mm	1	2
% Clay	1	2
% Silt	11	10
% Sand	86	49
% Gravel	2	39
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	0.5
Grading Modulus	1.32	1.84
Uniformity coefficient	11	45
Coefficient of curvature	0.9	0.6
Classification	A-2-4 (0)	A-1-b (0)
Unified Classification	SM	SM
Chart Reference		

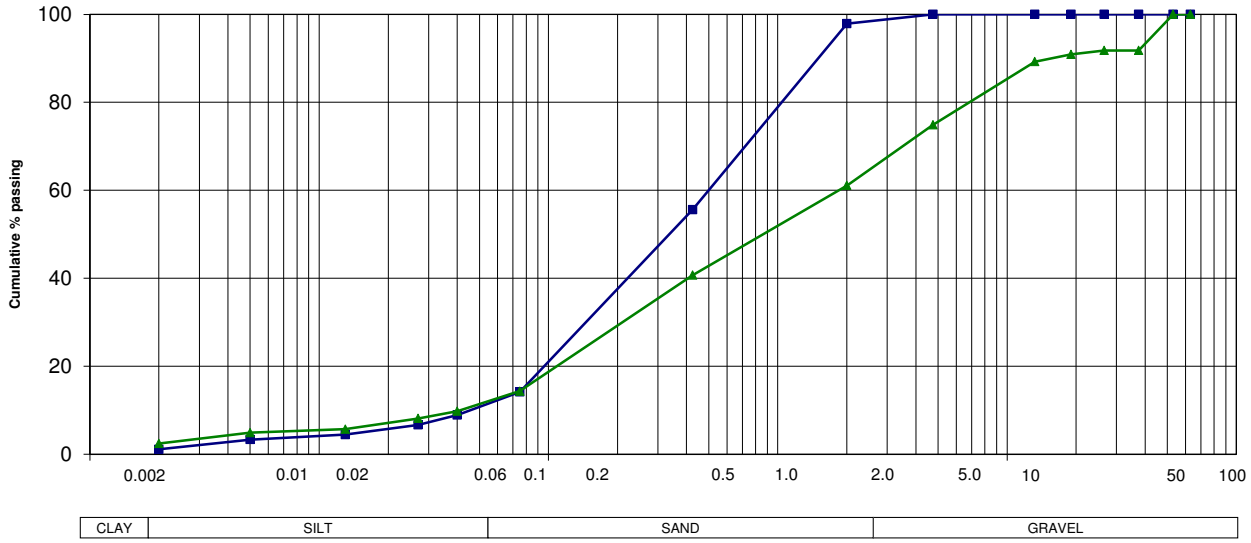
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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Soillab Pretoria
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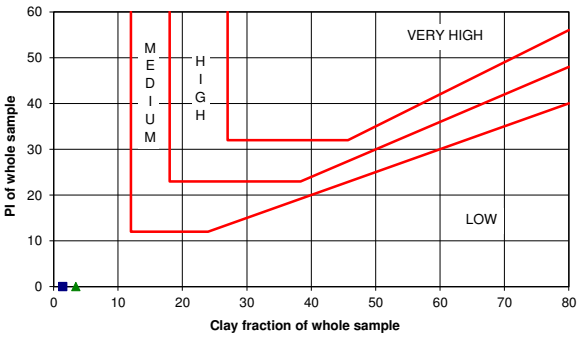
PARTICLE SIZE ANALYSIS

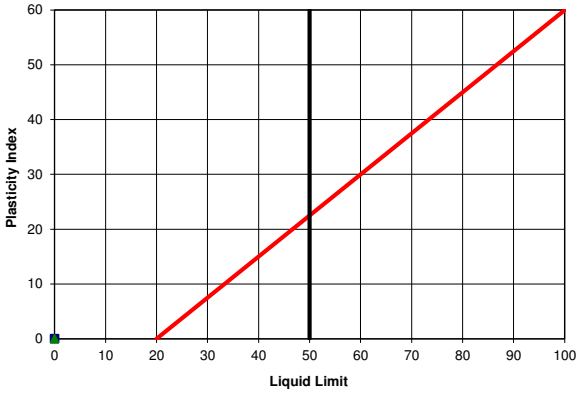
Sample No.	5	6
Soillab Sample No.	2015-S-1607-05	2015-S-1607-06
Depth (m)		
Position	SAMPLE 5	SAMPLE 6
Material Description	DARK REDDISH BROWN FERRICRETE QUARTZ GRAVELLY SAND	DARK GREY FERRICRETE QUARTZ GRAVELLY SAND
Organic Material		YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	98	96
4.75 mm	74	82
2.00 mm	61	72
0.425 mm	35	43
0.075 mm	17	15
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	11	10
0.027 mm	8	9
0.013 mm	4	6
0.005 mm	3	5
0.002 mm	1	3
% Clay	1	3
% Silt	13	10
% Sand	47	59
% Gravel	39	28
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	1.0
Grading Modulus	1.87	1.69
Uniformity coefficient	50	28
Coefficient of curvature	1.0	0.9
Classification	A-1-b (0)	A-1-b (0)
Unified Classification	SM	SM
Chart Reference		

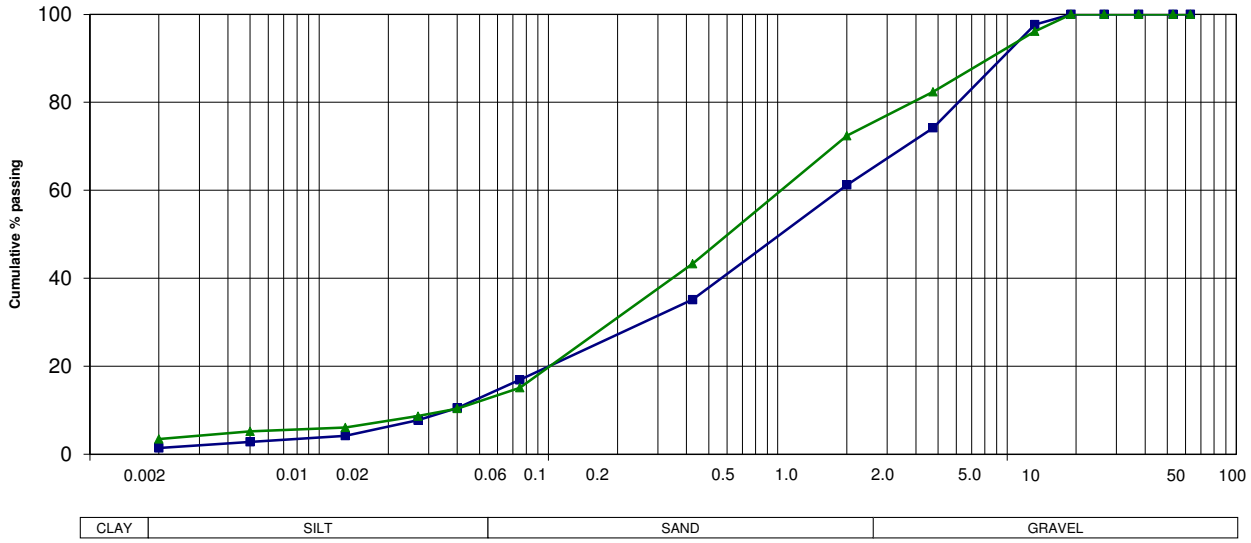
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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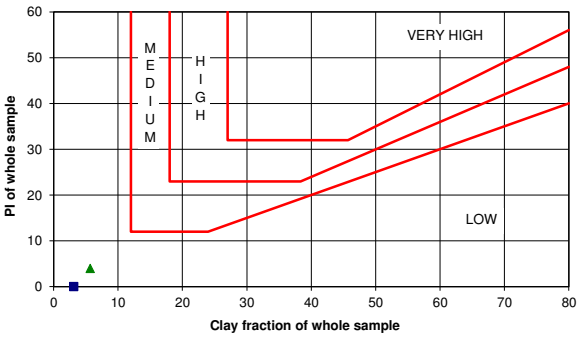
PARTICLE SIZE ANALYSIS

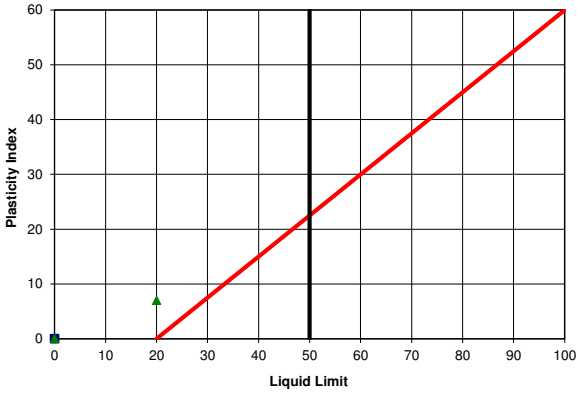
Sample No.	7	8
Soillab Sample No.	2015-S-1607-07	2015-S-1607-08
Depth (m)		
Position	SAMPLE 7	SAMPLE 8
Material Description	LIGHT BROWN FERRICRETE W/ GRANITE GRAVELLY SAND	DARK GREY FERRICRETE W/ GRANITE GRAVELLY SAND
Organic Material		YES
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	95	98
4.75 mm	87	89
2.00 mm	79	80
0.425 mm	52	57
0.075 mm	28	28
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	18	19
0.027 mm	13	16
0.013 mm	7	11
0.005 mm	5	9
0.002 mm	3	6
% Clay	3	6
% Silt	21	18
% Sand	55	56
% Gravel	21	20
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		20
Plasticity Index	NP	7
Linear Shrinkage (%)	0.0	3.0
Grading Modulus	1.40	1.36
Uniformity coefficient	35	72
Coefficient of curvature	0.6	1.9
Classification	A-2-4 (0)	A-2-4 (0)
Unified Classification	SM	SM & SC
Chart Reference		

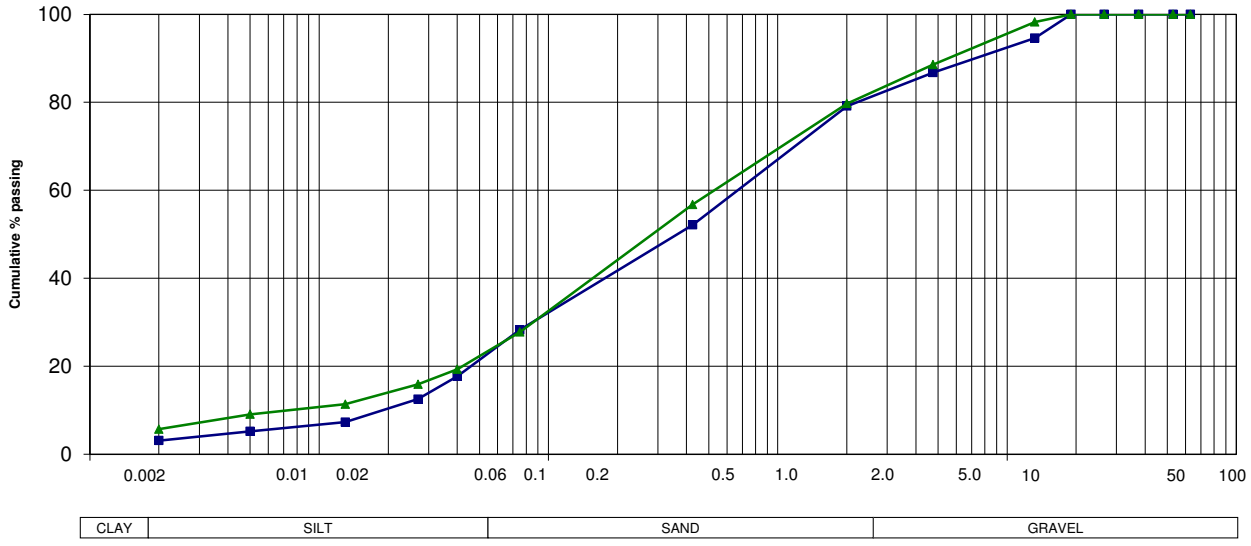
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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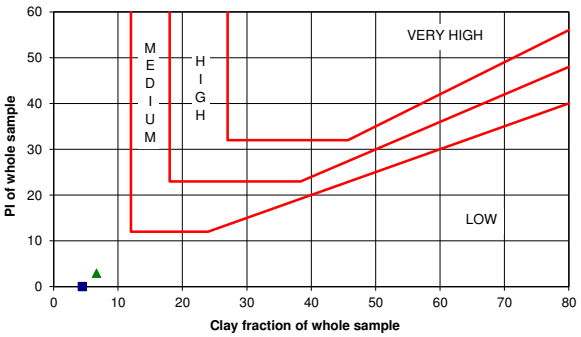
PARTICLE SIZE ANALYSIS

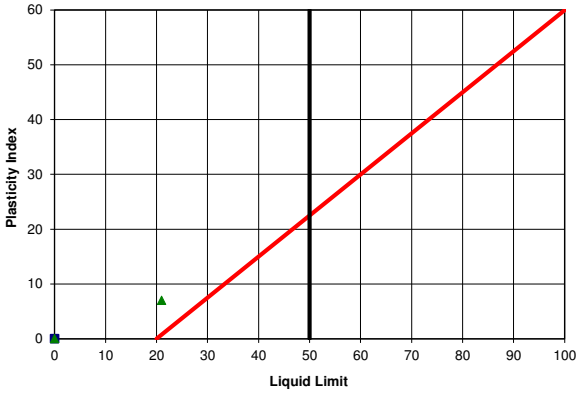
Sample No.	9	10
Soillab Sample No.	2015-S-1607-09	2015-S-1607-10
Depth (m)		
Position	SAMPLE 9	SAMPLE 10
Material Description	DARK BROWN QUARTZ FERRICRETE GRAVELLY SAND	LIGHT BROWN FERRICRETE W/ GRANITE GRAVELLY SAND
Organic Material		
Moisture (%) / Dispersion (%)		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	94	98
4.75 mm	75	90
2.00 mm	57	67
0.425 mm	37	42
0.075 mm	15	25
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	9	16
0.027 mm	8	13
0.013 mm	7	10
0.005 mm	5	7
0.002 mm	4	7
% Clay	4	7
% Silt	8	14
% Sand	45	46
% Gravel	43	33
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		21
Plasticity Index	SP	7
Linear Shrinkage (%)	1.0	3.0
Grading Modulus	1.91	1.67
Uniformity coefficient	52	99
Coefficient of curvature	0.6	1.0
Classification	A-1-b (0)	A-2-4 (0)
Unified Classification	SM	SM & SC
Chart Reference		

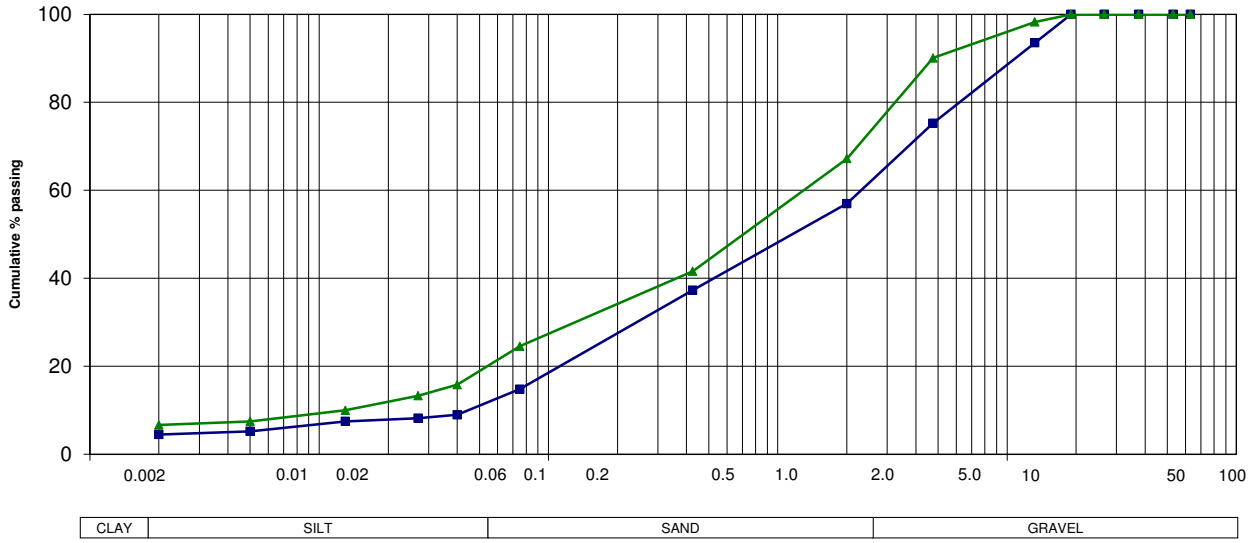
PROJECT : KNOPJESFONTEIN X2
JOB No. : 2015-S-1607
DATE : 18-11-2015

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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Appendix G4

Electrical Report

ELEKTROPLAN
CONSULTING ENGINEERS cc

CENTURION

Professional Electrical Engineering and Client Services
REG. NO. CK 90/29109/23
VAT REG. NO. 4160128684

1 LENCHENPARK
LENCHEN AVENUE SOUTH
CENTURION
SOUTH AFRICA

P.O. BOX 13165
CLUBVIEW
0014
SOUTH AFRICA

TEL : +27 (0) 12 663 5420/1
FAX : +27 (0) 12 663 7106
e-mail : scarrack@elektroplan.co.za

YOUR REF:	OUR REF:	DATE:
	PTI/05/16	2016-07-01

Mr. E. M. Keyser
NAPAJ Property Investment & Development (Pty) Ltd.
P.O. Box 34093
ERASMIA
0023

Dear Sir,

PROPOSED PEACH TREE INDUSTRIAL TOWNSHIP : ELECTRICAL RETICULATION : REVISED PROVISIONAL BASIC SERVICES REPORT

1. BULK ELECTRICAL SERVICES

This area falls within the Eskom, and more specific, the Eskom Laezonia Substation supply area and/but also within the boundaries of the City of Tshwane Metropolitan Municipality.

Following the possible upgrade of the Laezonia substation by Eskom, the supply of bulk power (maximum demand) to this proposed development, should under normal circumstances not pose a problem. However, for the proposed development of Peach Tree Extensions 15 & 16, Eskom indicated/written to those Developers (see attached correspondence in Annexure A), that they are presently not able to supply bulk power to those developments, in the near future. Therefore, with this development, situated in the close vicinity of those developments, it is recommended that negotiations are entered into with the City of Tshwane, for the supply of bulk power to this development.

It is known to us that, the CoT : Energy & Electricity department, is in the process of establishing a new 11kV satellite substation in the close vicinity of the existing Copper Leaf Golf Estate. This substation should be completed within the next nine months.

Therefore, due to the above-mentioned and the location of this satellite substation, negotiations will be entered into with the CoT, for the supply of bulk power to this proposed development.

.....2/

Due to excessive distances, loads and particularly with regards to voltage drop constraints on the medium voltage distribution system, it is hereby recommended that this proposed township/development be divided into two or more township extensions, to enable power to the initial extension (due to estimated load requirements) from the new satellite substation situated at the Copper Leaf Golf Estate. Important, services are not taken over by the CoT in phases, only in completed Extensions.

For further extensions on this property, external feeder cables must be installed in future from the new planned Monavoni primary substation to this development to accommodate the estimated loads. It is estimated that the Monavoni primary substation will be completed in approximately 24 working months, assuming the Contract start officially in July 2016, the start of the new CoT financial year. According to information received from the CoT, tenders for the Monavoni substation are already in place and the appointment of successful contractors, is imminent.

In terms of the distance that this site will eventually be from the future Monavoni substation, there will obviously be an offset in terms of payable bulk supply contribution to the CoT, for external cables installed to/for this proposed development.

2. ESTIMATED LOAD REQUIREMENTS

This proposed development, planned in four extensions/phases, consists mainly of twenty five stands in total, planned for commercial and light industrial, one stand for Municipal & one stand for infrastructure works, purposes. This proposed development is situated on Portions 105, 109 & 331 of the farm Knopjeslaagte 385-JR, totaling approximately 41.66ha. With this taken into account, the estimated load requirements for this development, are as follows :-

TABLE 1

Estimated Load Requirements For Proposed Extension 1

Item	Description	Estimated Load
1.	Commercial & light industrial : 2 stands : 7.57ha @ 50% FSR X 4kVA/100m²	1 513.60kVA
2.	Infrastructure Works : 1 stand : 0.10ha @ 50% FSR X 4kVA/100m²	20.00kVA
3.	Total Estimated Load : Extension 1	1 533.60kVA

The total estimated load for proposed Extension 1 is approximately **1.53MVA**

...../3

TABLE 2

Estimated Load Requirements For Proposed Extension 2

Item	Description	Estimated Load
1.	Commercial & light industrial : 4 stands : 7.79ha @ 50% FSR X 4kVA/100m²	1 558.10kVA
2.	Municipal : 1 stand : 0.60ha @ 50% FSR X 4kVA/100m²	120.00kVA
3.	Total Estimated Load : Extension 2	1 678.10kVA

The total estimated load for proposed Extension 2 is approximately **1.68MVA**

TABLE 3

Estimated Load Requirements For Proposed Extension 3

Item	Description	Estimated Load
1.	Commercial & light industrial : 7 stands : 10.88ha @ 50% FSR X 4kVA/100m²	2 176.30kVA
2.	Total Estimated Load : Extension 3	2 176.30kVA

The total estimated load for proposed Extension 3 is approximately **2.18MVA**

TABLE 4

Estimated Load Requirements For Proposed Extension 4

Item	Description	Estimated Load
1.	Commercial & light industrial : 6 stands : 9.41ha @ 50% FSR X 4kVA/100m²	1 882.80kVA
2.	Total Estimated Load : Extension 4	1 882.80kVA

The total estimated load for proposed Extension 4 is approximately **1.88MVA**

Therefore, the total estimated load for the complete proposed development is approximately **7.27MVA**.

…../4


PORTION 111
KNOP ESTLANGTE 365-JR
PORTION 114
KNOP ESTLANGTE 365-JR
EXTENSION 1
PROPOSED 25m STREET
PORTION 105
KNOP ESTLANGTE 365-JR
EXTENSION 2
PROPOSED 25m STREET
EXTENSION 3
PROPOSED 20m STREET
PROPOSED 20m STREET
PORTION 109
KNOP ESTLANGTE 365-JR
R/PORTION 231
KNOP ESTLANGTE 365-JR
EXTENSION 4
N14-HIGHWAY (P156/2)
ROAD PROCLAMATION NO 1459/73
N
158
ZONIA A.H.
387

...../5

3. REQUIRED ELECTRICAL MATERIALS AND EQUIPMENT

3.1 11 kV (Medium Voltage) Ring Feeder Cables

The minimum requirement for this type of development is 150mm² Cu 3-core PVC SWA PVC 11/11kV, underground cables. It may be a CoT requirement to supply & install 240mm² Cu 3-core PVC SWA PVC 11/11kV cables complete with outdoor SF6 switching units for the external bulk supply to this proposed development, due to distances.

3.2 Miniature-substations

SF6 type, concrete base, pavement mounted miniature= substations must be installed to supply low voltage power to the individual stands, as per the load requirements and designs.

3.3 Main Low Voltage Feeder Cables

600/1 000 V Cu 4-core SWA main low voltage underground feeder cables, sized as per the load requirements for each individual stand, must be installed from the miniature-substations to at least 1m into each stand.

3.4 Metering/Distribution Cubicles

12 Way, 3CR12, stubby type, side walk mounted cubicles, must be installed to supply power to individual stands and allow individual metering of electrical consumption. For larger bulk type service connections, SF6 type metering units in combination with T3 ring main units, will be required.

3.5 Street-ligting

Street-light luminaires mounted on galvanized steel poles with galvanized steel luminaire outreach must be installed in accordance with CIE 140 specifications/standards for Group A or B type roads.

For Eskom, it is a requirement of Eskom that the Developer utilize energy efficient technologies and equipment in accordance with good practice in the Residential sector and the Developer must comply with the provisions of the Distribution code.

All required electrical materials and equipment for this development must be in accordance with the Eskom specifications.

…../6

4. FINANCIAL CONTRIBUTIONS/CHARGES :

CITY OF TSHWANE : BULK SUPPLY CONTRIBUTIONS

With the City of Tshwane assumed as the supply Authority for this planned/proposed development, electrical bulk supply contributions as determined and calculated by the City of Tshwane Electrical Services Department, based on the estimated load and current Municipal tariffs (adjusted on the first day of July every new Council financial year), will be payable for these proposed developments by the Developer to the City of Tshwane. The amounts payable will be indicated in the Services Agreement between the City of Tshwane and the Developer.

The estimated bulk contribution amounts (at this stage worst case scenario), based on the City of Tshwane current financial year tariffs, are as follows :-

1. Peach Tree Industrial Extension 1 : 1 533.60kVA x R 2 445.00/kVA = **R 3 749 652.00** (Ex V.A.T.)
2. Peach Tree Industrial Extension 2 : 1 678.10kVA x R 2 445.00/kVA = **R 4 102 954.50** (Ex V.A.T.)
3. Peach Tree Industrial Extension 3 : 2 176.20kVA x R 2 445.00/kVA = **R 5 320 809.00** (Ex V.A.T.)
4. Peach Tree Industrial Extension 4 : 1 882.80kVA x R 2 445.00/kVA = **R 4 603 446.00** (Ex V.A.T.)

ESKOM CONNECTION CHARGES (IF APPLICABLE)

In addition to the Eskom standard tariff charges, connection charges are payable to Eskom to recoup the cost of providing the bulk connection.

The following short explanations for Connection Fee, Standard Connection Charge, Up-front Connection Charge and Distribution Connection Charges, are as follows :-

a. Connection Fee : It is the minimum up-front contribution towards the connection charge that is payable on the acceptance of the budget quotation.

   If acceptance of the budget quote is cancelled before actual survey or any physical construction work has been done, the Connection Fee plus quotation fee less any actual cost incurred, will be refundable. If the survey or construction has started, the full fee will be forfeited.

b. Standard Connection Charge : Is payable for cost associated with a standard connection. This Charge comprises of the Standard Connection Fee and the Standard Up-front Connection Charge.

…../7

c. Up-front Connection Charge : This charge, together with the Connection Fee, make up the Total Connection Charge.

d. Distribution Connection Charges : These Charges are raised on connection cost associated with the Distribution network.

We trust that the above meets with your requirements. Please do not hesitate to contact us for any further information.

Yours Faithfully

S CARRACK

ANNEXURE A :

COPIES OF ESKOM CORRESPONDANCE WITH PEACH TREE X 15 & 16 DEVELOPER

Stephen Carrack

From: Hylda Steenkamp <gaylin1@gmail.com>
Sent: 11 November 2014 12:20 PM
To: scarrack@elektroplan.co.za
Subject: Fwd: FW: Capacity Check

FYI
---------- Forwarded message ----------
From: **Theresa Smith**
<SmithT@eskom.co.za>
Date: Wed, Oct 15, 2014 at
8:12 AM
Subject: RE: FW: Capacity Check
To: Hylda Steenkamp <gaylin1@gmail.com>

Hi

The 1.3 mil is only for the upgrade costs project cost is additional.

The period of 2years is the **minimum** time span for mayor projects we have mayor projects that has been running for 6 years, there is no time guarantee on mayor projects.

This is an Eskom supply area but you can enquire at Tshwane if they will give you supply as I cannot say

Thank you

From: Hylda Steenkamp [mailto:gaylin1@gmail.com]
Sent: 10 October 2014 05:21 PM
To: Theresa Smith
Subject: Re: FW: Capacity Check

Hello Theresa,

Thank you for your mail.

The pole number on the property is LG60/3. I do not know if this will make a difference.

The estimate of R1.3mil, will that be the total cost of the power supply? Please clarrify.

Should we wish to continue, is there any possibilty that the period for the upgrade can be reduced as the power requirement is needed July next year.

Lastly, is it possible for us to obtain power from Tshwane if Eskom cannot meet the

required timeline?

King regards,

Tinus Steenkamp

On Fri, Oct 10, 2014 at 2:08 PM, Theresa Smith <SmithT@eskom.co.za> wrote:

Dear Customer

Please see the response from our Engineering department regarding your application for 2000kVa supply. Please note that should you wish to continue with the application the costs for the upgrade of the backbone will be for your account. The strengthening of the back bone will take a minimum of 2 years to complete as it will be registered as a mayor project.

Please notify me if we should go ahead with the application.

Thank you

From: Buhle Bujela
Sent: 10 October 2014 01:39 PM
To: Theresa Smith
Subject: RE: Capacity Check

Hi Theresa,

The 2MVA load can be added, however it collapses the voltage profile as shown below (Fig. 1) Eskom acceptable limits, to fix it we would have to upgrade the backbone conductor from Mink to Hare (about 3.5km of line) which will cost about R1.3mil.

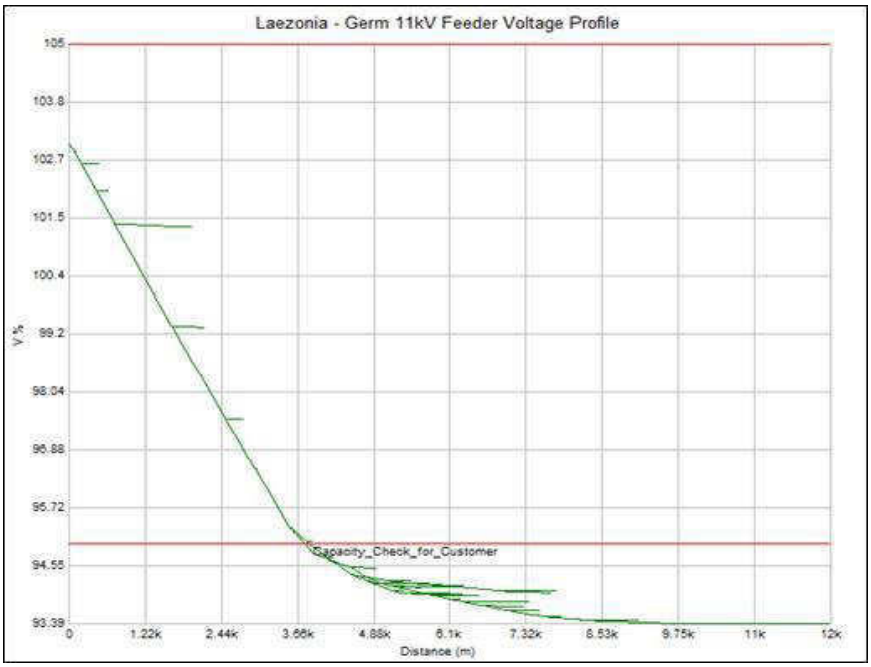


Figure 1:After adding customer on the existing line.

Kind Regards,

Buhle Bujela

From: Theresa Smith
Sent: 10 October 2014 07:53 AM
To: Buhle Bujela
Subject: Capacity Check

Hi Buhle

Can you please check if the LG54 feeder has capacity to accommodate additional 2MVA.

Thank you

I'm part of the 49Million initiative.
http://www.49Million.co.za

NB: This Email and its contents are subject to the Eskom Holdings SOC Limited EMAIL LEGAL NOTICE which can be viewed at
http://www.eskom.co.za/Pages/Email_Legal_Spam_Disclaimer.aspx

Appendix G5

Services Report

PEACH TREE EXT 21; 22; 23 & 24:

CIVIL ENGINEERING SERVICES REPORT

OCTOBER 2016

REVISION 0

Prepared for: **CITY OF TSHWANE METROPOLITAN MUNICIPALITY**

SOUTH AFRICA

On behalf of: **DexalInx(Pty)Ltd**
PO Box 8446
Centurion
0048
Contact: Mr. Heinz Mulder

By: **TELAWIZE PTY LTD**

333 Fmus Erasmus Street

Pretoria

Contact: Mr. Gawie Combrinck Pr Eng

Tel: 012 347 6299

SERVICES REPORT (INTERNAL & EXTERNAL):

PEACH TREE EXTENSIONS 21; 22; 23 & 24 - PROVISION OF CIVIL ENGINEERING SERVICES

1. CLIENT

Company	Dexalinx (Pty)Ltd
Contact Person	Mr. Heinz Mulder
Postal Address	P.O. Box 8446 Centurion 0046
Telephone No.	(012) 161 0000
Cell No	082 895 7869

2. COMPILED BY:

Company	Telawize Pty Ltd
Contact Person	G Combrinck Pr Eng 970122
Address	P.O. Box 11141 Erasmuskloof 0048
Telephone No.	(012) 347 6299
Fax No.	(012) 347 9767
E-mail	gawie@gfc-holdings.co.za

2. FOR SUBMISSION TO:

CITY OF TSHWANE METROPOLITAN MUNICIPALITY

Corporation	City of Tshwane
Contact Person	Chris Etsebeth - Roads and Storm water
Telephone No.	(012) 358 4993
e-mail	ChrisEt@tshwane.gov.za
Contact Person	Cynthia Ntuli - Water and Sanitation
e-mail	CinthiaN@tshwane.gov.za
Telephone No.	(012) 358 3578
Address	P O Box 1022 Pretoria 0001

4. PROFESSIONAL TEAM

Item Nr	Description	Name	Contact Person
1	Quantity Surveyor	VSB Quantity Surveyors	D van der Schyff
2	Town Planning	Urban Innovate	W. Slabbert
3	Developer	Dexalinx(Pty)Ltd	Heinz Mulder
4	Civil Engineer	Telawize Pty Ltd	G. Combrinck
5	Electrical Engineer	Electroplan	S. Carrack
6	Traffic Engineer	Route 2	J. Botha
7	Geotechnical Engineer	Louis Kruger Geotech CC	L. Kruger
8	Surveyor	Isazi Surveys	W Coetzer

Table of Contents

ADDENDUM

SERVICES REPORT:

PEACH TREE EXT 21; 22; 23 & 24: PROVISION OF CIVIL ENGINEERING SERVICES

1. INTRODUCTION

Telawize Pty Ltd was appointed by Dexalinx (Pty) Ltd as the Civil Engineering consultant to design the bulk and internal civil engineering services for the planned Commercial and Light Industrial and Fire station development on Peach Tree Ext 21; 22; 23 & 24. The construction process is estimated to be ten (10) months.

The professional team involved in this development is as follows:

Quantity Surveyor	VSB Quantity Surveyors	D van der Schyff
Town Planning	Urban Innovate	W. Slabbert
Developer	Dexalinx(Pty)Ltd	Heinz Mulder
Civil Engineer	Telawize Pty Ltd	G. Combrinck
Electrical Engineer	Electroplan	S. Carrack
Traffic Engineer	Route 2	J. Botha
Geotechnical Engineer	Louis Kruger Geotech CC	L. Kruger
Surveyor	Isazi Surveys	W Coetzer

2. LOCATION OF PLANNED DEVELOPMENT

This Commercial and Light Industrial development is situated on Portions 105, 109 & 331 of the Farm Knopjeslaagte 385 JR. The N14 is to the south and R114 (M34) to the north of the proposed development. The site follows a gradual slope of 4% towards the north east. The site covers an approximate area of 40.6806ha.

Figure 1 - Location Map

3. LAND USE

PEACH TREE EXT 21

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Light Industrial	2-3	2	7.5600	73,18
Special		-	-	-
Infrastructure	1	1	0.1000	0.97
Roads		-	2,6700	25,85
Total		**26**	**10.3300**	**100.00**

PEACH TREE EXT 22

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Industrial	1;3-5	**4**	7.7905	84.08
Special		-	-	-
Municipal	2	**1**	0.6000	6.48
Roads		-	-	-
Access Control	6	1	0,8748	9.44
Total		**6**	**9.2653**	**100.00**

PEACH TREE EXT 23

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Industrial	1-7	7	10.8000	92.52
Special		-	-	-
Roads		-	-	-
Access Control	8;9	2	0.8800	7.48
Total		**9**	**11.7700**	**100.00**

PEACH TREE EXT 24

Zoning	Erf No's	No of Erf	Areas (ha)	% of Total
Industrial	1-6	6	9.4140	92.78
Special		-	-	-
Roads		-	-	-
Access Control	7	1	0.7327	7.22
Total		**7**	**10.1467**	**100.00**

4. GEOTECHNICAL INVESTIGATION

Summary

Twenty-five test pits were dug on the site and the soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973). Disturbed samples of the most prominent soil horizons were taken and submitted to a soils laboratory for foundation indicator tests. Due to the high gravel content and the consistency of the materials encountered on the site, no undisturbed samples were taken

According to the 1: 50 000 scale geological map the site is underlain by **migmatite gneiss (granite) of the Halfway House Suite**. The geology of the site was confirmed during this investigation, granite bedrock was encountered in the test pits.

The following materials were encountered on the site:

Type A: Slightly moist, dark brown, soft, shattered, silty sand with plant roots covers the eastern part of the site. This material was encountered in fourteen test pits from surface up to an average depth of 0,3 meters.
Type B: Slightly moist, brown, soft, shattered, silty, gravelly, sand with plant roots was encountered on the western part of the site. This material was encountered in eight test pits from surface up to an average depth of 0,6 meters.

Ferricrete
Slightly moist, dark brown becoming yellow mottled orange and black, loose, silty, sandy, fine and medium gravel consisting of hard, round, intact, nodular ferricrete and medium ferricrete concretions and with scattered medium sized quartz cobbles was encountered in twenty-three test pits from an average depth of 0,4 meters up to an average depth of 1,0 meters. In nine test pits the back actor refused hardpan ferricrete at an average depth of 0,7 meters.

Granite
Residual granite consisting of slightly moist, greyish white mottled orange and black, firm, intact, clayey sand with medium and large ferricrete concretions and with patches of very soft rock granite was encountered in three test pits from an average depth 0,7 meters up to an average depth of 1,3 meters and slightly moist, greyish white mottled orange, firm, intact, silty sand with very soft rock fragments was encountered in two test pits from an average depth 1,0 meters up to an average depth of 1,6 meters. Very soft rock granite was encountered in sixteen test pits from an average depth of 1,3 meters up to an average depth of 1,7 meters. The back actor refused on soft- to medium hard rock granite in sixteen test pits at an average depth of 1,4 meters.

The conditions encountered on site is very favourable for commercial and light industrial development. Most of the disturbed material will be re-used in the platforms that is typically associated with warehouse type structures.

Please refer to **Annexure G** for the complete Geotechnical Report.

5. CIVIL ENGINEERING SERVICES

5.1 WATER

5.1.1 Water Design Standards

The detail water reticulation analysis shall be done according to the design standards and specifications approved by the City of Tshwane Metropolitan Municipality's (CTMM) City Engineering Department. These standards and specifications are described in the "City of Tshwane Guidelines for the design and construction of water and sanitation systems". Where applicable Chapter 9 (Water Supply) of the **"Guidelines for Human Settlement Planning and Design (2000) (Red Book)"**, shall also be used as design criteria.

Design Standards for Water Supply:

Design Element	Criteria
1. Average Annual Daily Demand (AADD) for Industrial with or FSR = 0,5 (kℓ per 100m² development)	0.4kℓ
2. Gross Average Annual Daily Demand (GAADD)	Allow for 10% losses
3. Daily Peak Factor (DPF)	3.3
4. Design Peak Flow Rate (DPFR) for domestic flows	GAADD x DPF
5. Maximum static head	90 m
6. Minimum residual head under conditions of domestic peak flows	25 m
7. Maximum linear flow velocity under conditions of domestic peak flows	1,5 m/s
8. Pipe type	uPVC pressure pipes
9. Minimum pipe class	Class 12
10. Fire flow at any one hydrant under the condition of domestic peak flows (one hydrant at a time)	25ℓ/s
11. Minimum residual head (fire plus domestic peak flow)	15 m
12. Maximum linear flow velocity under conditions of fire-fighting	2,0 m/s
13. Boundary roughness (K-Value)	0,1 mm
14. Flow formulae	D'Arcy Weissbach
15. Minimum pipe diameter	110mm

5.1.2 Planned water supply

Option A

According to the CES/GLS report, there is no connection available for this development. However, closer investigation revealed a bulk water line on the western boundary of the development, Portion

R/331 Knopjeslaagte 385 JR. We presume this line is the property of Rand Water, confirmation of ownership will be provided as soon as it is available.

This bulk water line is located within a servitude registered over portion R/331 of the farm Knopjeslaagte 385.JR on the Western side of the development.

Option B

The proposed connection option as per the GLS report is not a cost effective option for this development. The proposed route as identified by GLS in their report will result in having to cross the Swart Booi Spruit, (at an estimated cost of R 13 mil) that will require a water use license application that will impact the viability of such a connection point.

Recommendation

The proposal to supply this development with a water connection from the existing water line (Option A) located over portion R/331 is the most practical and cost effective option, as an alternative to the connection per GLS report, (Option B).

The proposed development's internal network will be supplied with an 110mmØ, 200mmØ and a 250mmØ uPVC Pipe class 12. It will connect to the existing 250mmØ Water Pipe (Option A).

Each erf will be supplied with an 110mmØ uPVC pipe connection.

Please note that Option A (Randwater) can be seen as a temporary option until such time CTMM bulk pipe is available to connect to. The developer will pay the standard bulk contributions as requested.

Refer to drawing 1632/200/01, Addendum C.

5.1.3 CES Report

The CES report was done by GLS. A summary of the proposed upgrades are listed below. These proposed upgrades (option B) are not feasible when Option A is readily available on site.

- 475 m x 600 mm Ø REPLACEMENT pipe (replacing an existing 110 mm Ø pipe)
- 460 m x 450 mm Ø main pipe
- 710 m x 450 mm Ø main pipe
- 1 045 m x 355 mm Ø main pipe
- 1 580 m x 250 mm Ø main pipe (this pipe is internal to the development)

Apart from being very expensive, these upgrades imply a water usage licence application, which will exacerbate the cost further.

Estimated Water Demands

Land use rights	Floor area (m^2)	Design Criteria ($kl/100m^2$)	FAR	Total AADD* (kl/day)	Total Demand (l/s)	Peak Factor	Peak Water Demand (l/s)
Industrial	358402	0.4	0.5	716.804	8.296	3.3	27.378
Fire Station	10028	0.6	0.5	30.084	0.348	3.3	1.149
TOTAL							**28.527**
Fire (Moderate risk)							**25.000**
TOTAL DEMAND							**53.527**

5.2 Sanitation

5.2.1 Sewer Design Standards

The detail water reticulation analysis shall be done according to the design standards and specifications approved by the City of Tshwane Metropolitan Municipality's (CTMM) City Engineering Department. These standards and specifications are described in the "City of Tshwane Guidelines for the design and construction of water and sanitation systems". Where applicable Chapter 10 (Sanitation) of the **"Guidelines for Human Settlement Planning and Design (2000) (Red Book)"**, shall also be used as design criteria.

SEWER DESIGN CRITERIA

Design Element	Criteria
1. Average Annual Daily flow for Industrial with a FSR = 0,5(kℓ per 100 m² development)	0,3 kℓ
2. Peak Factor	2,5
3. Allowance for infiltration	1,7 ℓ/s per km of pipe line 1 ℓ/s per ha on non-built-up area
4. Capacity of Sewer	Pipes may run full at the Total Design Flow, which includes the peak and infiltration flows.
5. Sewer pipe type	Structured wall uPVC pipes SABS 1601 Class 34 up to 250 mm diameter.
6. Minimum velocity	0.6 m/s
7. Minimum pipe diameter	160 mm
8. Minimum depth of cover	1,5 m in road reserves 1,2 m in mid-blocks

5.2.2 Planned sanitation services

There are no formal sewer reticulation / bulk connection available in the vicinity of the proposed development.

Based on discussions one of the previous land owners has confirmed that a proposal made to council to allow a sewer treatment works (also know as a Package Plant) on portion 109 of the farm of Knopjeslaagte 385.JR was approved as a temporary solution. A copy of approval letter is attached under Annexure I.

Based on this it is also our proposal as a temporary solution to install a sewer package plant that will be designed and constructed to a specification that will be in line with council requirements and with sufficient capacity to service the proposed development until the council main sewer connection is available. This plant is constructed as a mobile unit, consisting of skid mounted containers, 2x12m containers and 1x6m container. These units will be removed once the CTMM connection is available.

All bulk contributions payable by the developer will be paid as and when required per normal with a condition that the development must connect to the council main sewer line when it becomes available in the area in the future.

The position of the proposed temporary package plant is shown on the development layout of Ext.21. Refer to Annexure D for the location of this plant as well as Annexure E for a full technical description of the proposed plant.

The internal network will be provided with a 160mmØ and 200mmØ uPVC Pipe. It will be connected to a sewer package plant that will be constructed on the north eastern side of the development. The development will connect on the municipal sewer reticulation as soon as it is available.

Refer to drawing 1632/300/01, Addendum C.

Table 4: Estimated Sewage Outflows

This table shows the total estimated outflows for extensions 21,22,23 and 24.

Land use rights	Floor area (m^2)	Design criteria ($kl/100m^2/day$)	FAR	Total PDDWF (kl/day)
Industrial	358402	0,3	0.5	537.603
Fire Station	10028	0.6	0.5	30.084
Sub Total				**567.687**
Peak Factor (PF)		**2,5**		**1419.2175**
Provision for Infiltration		**15%**		**1632.100**
DESIGN FLOW		**(In l/s):**		**18.890**

5.3 Roads

5.3.1 Standards and Specifications

All roads are designed according to the City of Tshwane Department of Transport Standard Construction Details & Design Standards for Roads and Stormwater Drainage Infrastructure. issued by the Town Engineer's office of City of Tshwane.

5.3.2 Traffic Impact Study

The initial Traffic Impact Study was performed by Route^2 Transport Strategies on May 2016. The following is an extract of the most important issues of concern and the recommendations are:

Access Requirements

- Access to the proposed development will be from a 25m wide road linking from the R114. The access road should have two lanes in and two lanes out.
- The proposed access road will be located 600m from the R511 and R114 intersection which is in line with the Gautrans spacing requirements.

Public Transport

- The implementation of bus and minibus taxi lay-bys on both sides of the R114 at the Access Road intersection.
- Construction of a 1,5m wide sidewalk along the Access Road from the R114.

5.3.3 CLASSIFICATION OF INTERNAL TOWNSHIP ROADS

The classifications of roads with roadway widths are as follows:

Description	Class No	Function	Reserve Width	Roadway Width
Road in 32 m Road Reserve	2	Primary Distributor	32	14.8
Road in 25 m Road Reserve	4b	District and local distributors	25 m	8.0 m
Road in 20 m Road Reserve	4b	District and local distributors	20 m	8.0 m

Table 2 – Classification of Internal Township Roads

5.3.4 GEOMETRIC DESIGN STANDARDS

The internal road will be class 4b external will be class 2. The internal roads will be 8m wide

Refer to drawing 1632/400/01, Addendum C.

5.3.5 Class 4 – District and local distributors

Design speed	60 km/h
Minimum centre line radii	60 m
Minimum gradient	0,67%
Favored maximum gradient	10%
Maximum grade/grade length	12,5% over 70m
Minimum K-value: Crest	6
Sag	6

5.3.6 PAVEMENT DESIGN

The proposed pavement design is based on anticipated traffic volumes and ground conditions. The design life of the proposed pavement is 20 years on provision that repairs to the surface will be made

where necessary in order to remain its skid resistance and impermeability during the design life of the road.

The following pavement design is proposed:

5.3.7 Road with Road Surface of 8.0 meters

Paving	80 mm thick interlocking block paving. 20mm river sand.
Sub base:	200 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density. Minimum UCS = 1 200 kPA at 95% of modified AASHTO density – C4
Upper selected: Sub grade	150 mm thick natural gravel compacted to 93% of modified AAHSTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (in-situ or imported)
Lower selected: Sub grade	150 mm thick natural gravel compacted to 90% of modified AAHSTO density. Minimum CBR = 7 at 90% of modified AAHSTO density – G9 (in-situ or imported).
Fill (where required):	150 mm thick layers compacted to 90% of modified AASHTO density. Minimum CBR = 3 at 90% of modified AASHTO

5.3.8 External Road Surface with 3.7m per lane

Wearing course:	40mm Asphalt
Base	150 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density- G1
Upper: Sub base:	150 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density. Minimum UCS = 1 200 kPA at 95% of modified AASHTO density – C3
Lower: Sub base:	150 mm thick stabilized natural gravel compacted to 95% of modified AASHTO density. Minimum UCS = 3000 kPA at 95% of modified AASHTO density – C4
Upper selected: Sub grade	150 mm thick natural gravel compacted to 93% of modified AAHSTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (in-situ or imported)
Lower selected: Sub grade	150 mm thick natural gravel compacted to 90% of modified AAHSTO density. Minimum CBR – 15 at 90% of modified AASHTO density – G7 (Rip and Recompact)
Fill (where required):	150 mm thick layers compacted to 90% of modified AASHTO density. Minimum CBR = 3 at 90% of modified AASHTO

5.4 Storm water Drainage

5.4.1 Standards and Specifications

The internal storm water management system is designed according to the City of Tshwane Department of Transport: Standard Construction Details & Design Standards for Roads and Stormwater Drainage Infrastructure, issued by the Town Engineer's office of City of Tshwane.

Minimum Pipe size	:	450 mm
Pipe Material	:	Concrete
Minimum Gradient	:	1:150
Catch pit junction boxes etc	:	In accordance with the City of Tshwane Metropolitan Municipality Standard Details.

5.4.2 Design Criteria

Flood Return Period:	1:5 years for pipe systems draining
	1:20 years for the combined pipe and road systems
Design Method:	Rational method
Average yearly rainfall to be used	750mm

5.4.3 Planned Storm Water Drainage

The proposed development will generate 10.355l/s of storm water. The internal storm water network consists of ogee concrete pipes with the minimum diameter of 450mm and the maximum of 1350mm. Each erf will have its own connection to the main system.

The storm water generated on the proposed development will be discharged on Swartbooi Spruit. An outfall concrete pipe with outlet structure and energy dispensers will be constructed parallel to the R114 to the stream.

Refer to drawing 1632/500/01, Addendum C.

5.5 FLOOD LINE

In accordance with the National Water act, 1998 (act 36 of 1998) Section 144, the township is not affected by the 1: 100 year and 1: 50 year flood line.

See attached drawings.

5.6 SOLID WASTE DISPOSAL

There are numerous Solid waste removal companies operating in the area. A long term agreement will be concluded with a reputable company for the waste disposal on a regular basis. The solid waste that will be generated in the development (commercial light industrial) will be non toxic and can be disposed of at the closest public (municipal) disposal site.

6. ESTMATED PROJECT COST

A detailed Engineering design has been done. From this design a comprehensive Bill of Quantities have been compiled by both the QS and the Civil Engineers.

The estimated project cost for the provision of civil engineering services is approximately R35 million, excluding 14% vat and professional fees. A detailed breakdown of the costs is available on request.

7. BULK SERVICE CONTRIBUTIONS

7.1 Sewer and water

It will be included in this report as soon as it is available. The standard contribution will apply for both the sewerage and water reticulation.

7.2 Roads and storm water

It will be included in this report as soon as it is available. The standard contribution will apply for both Roads and Storm water.

8. SUMMARY

This development land is perfectly situated and ideal to accommodate a commercial and light industrial park.
The close proximity to the N14 and R511 main roads with free flowing access from areas such as, but not limited to, Lanseria, Diepsloot and Olivenhoutbos. This will provide a substantial number of construction and permanent job opportunities to the people residing in the adjacent areas creating an environment focused on socio-economic sustainability.

With the possibility to provision a fire station for the area as part of the development will further enhance public safety for the area.

With the thoughtful and practical application of civil engineering designs, all basic services can be provided in a sustainable manner that will ensure a long term successful development for the developer, communities in the area and Tshwane Metropolitan Municipality

Mfundo Hadebe		20157018 7	14/10/2016
Name	**Signature**	**Reg No**	**Date**

ADDENDUM A

LOCALITY MAP

PROPOSED TOWNSHIP: PEACH TREE EXTENSION 21/22

LOCALITY MAP 1:20 000

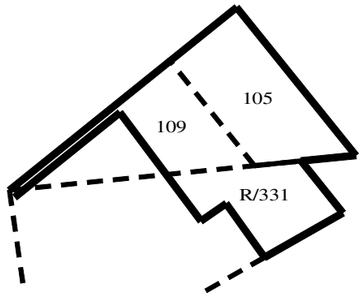
urban innovate

URBAN INNOVATE CONSULTING CC

TEL: 012 460-0670
FAX: 086 592 9974
E-MAIL: info@urbaninnovate.co.za
www.urbanonnovate.co.za

PO BOX 27011
MONUMENT PARK
0105

GEOTECHNICAL ZONES



THIS IS TO CERTIFY THAT THE TOWNSHIP LAYOUT ON THE PLAN IS IN ACCORDANCE WITH THE PROVISIONS AND RECOMMENDATIONS AS SET OUT IN THE GEOTECHNICAL INVESTIGATION FOR THE PROPOSED TOWNSHIP.

GEOTECHNICAL ZONES:

ZONE	DESCRIPTION
P-C2-S2	THE ENTIRE SITE IS ZONED - NHBRC ZONE P(FLL)-C2-S2

FLOOD LINE CERTIFICATION

1 : 50 AND 1 : 100 YEAR FLOODS

I HEREBY CERTIFY THAT IN TERMS OF SECTION 144 OF THE NATIONAL WATER ACT, ACT OF 1996, IT IS HEREBY CERTIFIED THAT THE TOWNSHIP IS NOT SUBJECT TO A FLOOD WITH AN EXPECTED FREQUENCY OF 1 : 50 YEARS AND 1 : 100 YEARS.

L.Wentzel PR. ENG. NR.950052

GENERAL NOTE:

1. CONTOURS: SUPPLIED BY ISAZI SURVEYS LAND SURVEYORS.
   1,00m INTERVALS
   DATUM: SEA LEVEL
   SYSTEM WGS
   THE CONTOURS ARE IN ACCORDANCE WITH REGULATION 18(1) OF THE TOWN-PLANNING AND TOWNSHIPS ORDINANCE,1986
2. ALL DIMENSIONS AND AREAS ARE APPROXIMATE PENDING FINAL SURVEY.
3. PROPOSED PHASES SUBJECT TO CHANGE.
4. REPRESENTS A GEOTECHNICAL ZONE LINE.
5. REPRESENTS A LINE OF NO-ACCESS.
6. REPRESENTS THE RELEVANT BUILDING LINES.

SERVITUDE NOTE:

1. EXISTING SERVITUDES TO BE INCORPORATED IN THE DESIGN OF THE TOWNSHIP.
2. PROPOSED 4m WIDE WATER ROW SERVITUDE OVER ERF 2.

PLAN No: PEACH TREE X21-22/1 **DATE:** SEPT 2016

LAND USE

USE ZONE	ERF NUMBERS	TOT. NO. OF ERVEN	MIN. ERF SIZE (m²)	AVERAGE	TOTAL AREA (Ha)	
"INDUSTRIAL 2" FOR BUSINESS BUILDINGS, COMMERCIAL USE, LIGHT INDUSTRY, CAFETERIA CAR WASH, PLACE OF REFRESHMENT, PARKING GARAGE, RETAIL INDUSTRY AND SHOPS.	2 - 6, 8	6	N/A	N/A	15,3505	78,34
"INFRUSTRUCTURE WORKS"	1	1	N/A	N/A	0,1000	0,51
"MUNICIPAL"	7	1	N/A	N/A	0,6000	3,06
"SPECIAL FOR ACCESS AND ACCESS CONTROL	9	1	N/A	N/A	0,8748	4,46
EXISTING STREETS AND WIDENING	N/A	N/A	N/A	N/A	2,6700	13,63
	TOTAL	3			19,5953	100,00

SITUATED ON PART OF PORTION 105, 109 AND REM/331 OF THE FARM KNOPJESLAAGTE 385-JR.

REPRESENTED BY THE FIGURE A-B-C-D-E-F-G-H-J-K-L-M-N-O-P-Q-R-A

CITY OF TSHWANE METROPOLITAN MUNICIPALITY, GAUTENG

PORTION 108
KNOPJESLAAGTE 385-JR

PORTION 107
KNOPJESLAAGTE 385-JR

PORTION 106
KNOPJESLAAGTE 385-JR

PORTION 109
KNOPJESLAAGTE 385-JR

PORTION 105
KNOPJESLAAGTE 385-JR

PORTION 111
KNOPJESLAAGTE 385-JR

PORTION 914
KNOPJESLAAGTE 385-

R/PORTION 331
KNOPJESLAAGTE 385-JR

PEACH TREE X 23

PEACH TREE X 24

REM/PTN 22

EXISTING ROAD (30m)

KRUGERSDORP PRETORIA ROAD

M34 KRUGER

LAEZONIA A.H.

N14-HIGHWAY (P158/2)

PROPOSED 25m STREET

PROPOSED 20m STREET

16m BUILDING LINE

5m WIDE R.O.W SERVITUDE

20m R.O.W SERVITUDE (FUTURE ROAD)

5m WIDE WATER PIPELINE SERVITUDES G No. 1048/2007

1 0,1000 Ha
2 3,8000
3 3,7600
4 3,9340
5 1,3580
6 1,3685
7 0,6000
8 1,1300
9 0,8748

A B C D E F G H J K L M N O P Q R

158

N

SCALE 1 : 3500

0 20 40 60 80 120m

ADDENDUM B

TOWNSHIP LAYOUT PLAN EXTENSION 21 – 24

ADDENDUM C

ENGINEERING DRAWINGS

NOTES AND SPECIFICATIONS

GENERAL

1. ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.
2. ALL DIMENSIONS ARE IN MILLIMETRES. (UNLESS OTHERWISE SPECIFIED).
3. DO NOT SCALE FROM THESE DRAWINGS.
4. ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
5. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, THIRD EDITION 2005 AND THE STANDARD COT DETAIL DRAWINGS.
6. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE STANDARD DRAWINGS.(IF APPLICABLE).
7. THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.
8. THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY DIRECTOR OF THE PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT, IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.
9. THE CONSULTANT REMAINS RESPONSIBLE TO ENSURE THAT ALL THE GUIDELINES, STANDARD DRAWINGS, STANDARDS AND SPECIFICATIONS OF THE PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT HAVE BEEN MET AND ARE COMPLIED WITH.
10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (123)
- CLOSED VALVE
- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED (TO BE ABANDONED)
- REDUNDANT PIPE (REDUNDANT)
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE (GAS)
- PETRONET PIPE (P_NET)
- NEW PIPE IN NEW SLEEVE (SLEEVE Ø TYPE CLASS)

SANITATION

- MANHOLE
- CE / LH
- NEW CCTV INSPECTION
- EXIST. LINE INSPECTED BY CCTV
- NEW SEWER LINE
- EXISTING SEWER LINE
- HOUSE CONNECTION

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CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	AUG 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

DIRECTOR: WATER AND SANITATION - PLANNING
NAME / Prof. Reg. No / SIGNATURE / DATE

REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)
NAME / Prof. Reg. No / SIGNATURE / DATE

DIRECTOR: SYSTEM DEVELOPMENT
NAME / Prof. Reg. No / SIGNATURE / DATE

DIRECTOR: BULK WATER
NAME / Prof. Reg. No / SIGNATURE / DATE

DIRECTOR: INFRASTRUCTURE PROVISION
NAME / Prof. Reg. No / SIGNATURE / DATE

DIRECTOR: WASTE WATER TREATMENT
NAME / Prof. Reg. No / SIGNATURE / DATE

CONSULTANT DETAIL

TELAVIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
gfc@gfc-holdings.co.za

I _____ Prof Reg Nr _____
HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/210/01
REVISION: A

DESIGNED

NAME: M. HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN

NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED

NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 21

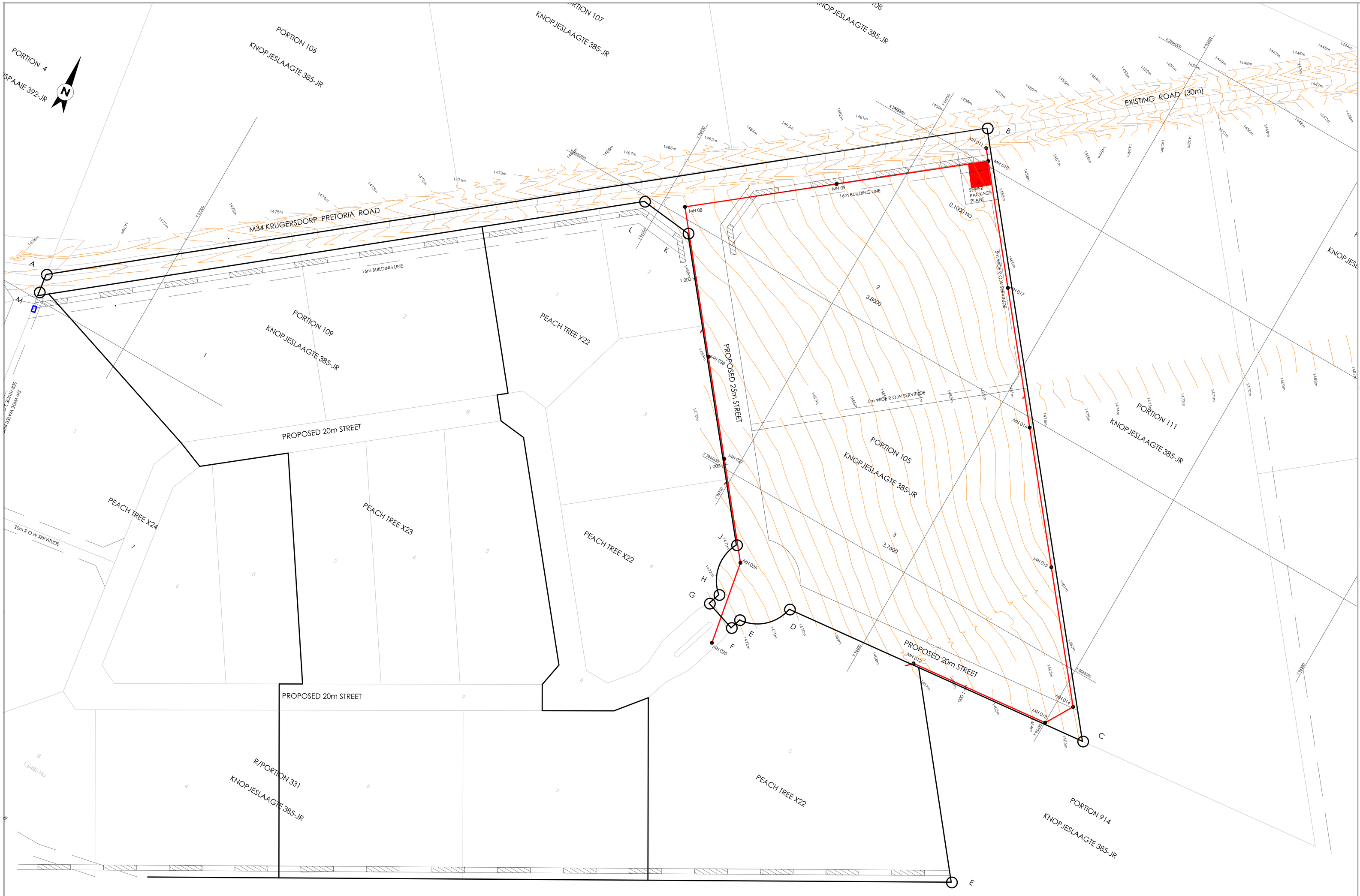
DESCRIPTION OF PROJECT:

WATER RETICULATION

GENERAL LAYOUT

WBS No. : __._____._____._____._____._____

COT DRAWING NUMBER: __._____._____._____._____._____
REVISION: 10



NOTES AND SPECIFICATIONS

GENERAL

1. ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.
2. ALL DIMENSIONS ARE IN MILLIMETRES. (UNLESS OTHERWISE SPECIFIED).
3. DO NOT SCALE FROM THESE DRAWINGS.
4. ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.
5. ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, THIRD EDITION 2005 AND THE STANDARD COT DETAIL DRAWINGS.
6. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE STANDARD DRAWINGS.(IF APPLICABLE).
7. THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.
8. THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY DIRECTOR OF THE PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT, IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.
9. THE CONSULTANT REMAINS RESPONSIBLE TO ENSURE THAT ALL THE GUIDELINES, STANDARD DRAWINGS, STANDARDS AND SPECIFICATIONS OF THE PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT HAVE BEEN MET AND ARE COMPLIED WITH.
10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (123)
- CLOSED VALVE
- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED (TO BE ABANDONED)
- REDUNDANT PIPE (REDUNDANT)
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE (GAS)
- PETRONET PIPE (P_NET)
- NEW PIPE IN NEW SLEEVE (SLEEVE Ø TYPE CLASS)

SANITATION

- MANHOLE
- CE / LH
- NEW CCTV INSPECTION
- EXIST. LINE INSPECTED BY CCTV
- NEW SEWER LINE
- EXISTING SEWER LINE
- HOUSE CONNECTION

CITY OF TSHWANE
IGNITING EXCELLENCE
PO BOX 1022
PRETORIA
0001

CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	SEPT 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

DIRECTOR: WATER AND SANITATION - PLANNING
NAME Prof. Reg. No SIGNATURE DATE

REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: SYSTEM DEVELOPMENT
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: BULK WATER
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: INFRASTRUCTURE PROVISION
NAME Prof. Reg. No SIGNATURE DATE

DIRECTOR: WASTE WATER TREATMENT
NAME Prof. Reg. No SIGNATURE DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
PROJECTS & PROJECT MANAGERS

P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
gfc@gfc-holdings.co.za

I, _____ Prof Reg Nr._____
HEREBY CERTIFY THAT THE SERVICES WILL\ HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/310/01 (A REVISION)

DESIGNED
NAME: M HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN
NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED
NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 21

DESCRIPTION OF PROJECT:

SEWER RETICULATION

GENERAL LAYOUT

WBS No. : __-_____-__-_____-__-__

COT DRAWING NUMBER: __-_____-__-_____-__-__ (10 REVISION)

NOTES AND SPECIFICATIONS

GENERAL

1 ALL MATERIAL AND WORKMANSHIP MUST COMPLY WITH THE REQUIREMENTS OF THE LATEST RELEVANT SABS REQUIREMENTS.

2 ALL DIMENSIONS ARE IN MILLIMETERS. (UNLESS OTHERWISE SPECIFIED)

3 DO NOT SCALE FROM THESE DRAWINGS.

4 ALL DIMENSIONS MUST BE CHECKED AND APPROVED ON SITE.

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6 THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE ARCHITECTS DRAWINGS. (IF APPLICABLE)

7 THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE STANDARD SPECIFICATIONS FOR MUNICIPAL CIVIL ENGINEERING WORKS, SERIES 4.

8 THE SIGNATURE OR INITIALS ON THIS DRAWING, OF ANY MANAGER OF THE TRANSPORT DEPARTMENT. IN NO WAY REMOVES ANY RESPONSIBILITY WHATSOEVER FROM THE CONSULTANT.

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10 FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

ROADS:

1 KERBING TO BE AS PER STANDARD DETAIL PLANS A AND B AND SECTION 10 OF VOLUME 1 OF CONTRACT DOCUMENT.

2 TRAFFIC CONTROL MUST COMPLY WITH THE REQUIREMENTS OF THE SOUTH AFRICAN ROAD TRAFFIC SIGNS MANUAL (THIRD EDITION),

3 VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:

EXISTING PAVING

NO KERBING

MOUNTABLE KERBING

SEMI VERTICAL KERBING

STORMWATER

1 MINIMUM PIPE DIAMETER TO BE 450mm.

2 MINIMUM FALL TO BE 1:150.

3 PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.

4 ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.

5 CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:

PROPOSED: EXISTING:

STORMWATER LINE

MANHOLE

JUNCTION BOX

KERB INLET

CATCHPIT LENGTH

2/3/2

TRANSITION LENGHT

CATCHPIT LENGTH

TRANSITION LENGTH

SCALE 1:100

SCALE 1:250

SCALE 1:500

SCALE 1:1000

SCALE 1:2500

SCALE 1:2000

SCALE 1:1500

SCALE 1:1000

1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED	DRAWN
M HADEBE	M HADEBE
DESIGN CHECKED BY: 1:1000	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS

PROJECT STATUS

CONCEPT DRAWING | TENDER DRAWING | APPROVED FOR CONSTRUCTION DRAWING | AS-BUILT DRAWING

PROJECT ENGINEER (CONSULTANT):

INITIALS AND SURNAME | SIGNATURE AND PR. No. | DATE

INSPECTOR OF WORKS (CITY OF TSHWANE):

INITIALS AND SURNAME | SIGNATURE AND PR. No. | DATE

CONSULTANT DETAIL

333 EWUS ERASMUS STREET
ERASMUSRAND
0181

P. O. BOX 11141
ERASMUSKLOOF
0048

TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0482
e-mail : gfc@gfc-holdings.co.za

TEL-AWIZE (PTY) LTD
CIVIL ENGINEERING & PROJECT MANAGEMENT

CITY OF TSHWANE

ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Lefifonkane
STRATEGIC EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

Ms. L. V. Kegakilwe-Piki
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki

SIGNATURE: ..... DATE: .....

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECEIVED
SIGNATURE/DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION
SIGNATURE DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION MANAGEMENT
SIGNATURE DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
SIGNATURE DATE

DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
SIGNATURE DATE

DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
SIGNATURE DATE

DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (NW)
SIGNATURE DATE

DIRECTOR: INTEGRATED TRANSPORT PLANNING
SIGNATURE DATE

LOCATION OF PROJECT:

PEACH TREE EXT 21

DESCRIPTION OF PROJECT

ROADS

CONTRACT No. :	PROJECT No. :
1632	1632
DATE : JUNE 2016	SCALE : 1:1000
ORIGINAL PAPER SIZE: A0	
DRAWING NO. 1632/410/01	SHEET NO: 1 OF 1
REVISION 0	

SCALE 1:1000

M. HADEBE

PORTION 4
AAIE 392-JR
PORTION 106
KNOP JESLAAGTE 385-JR
PORTION 107
KNOP JESLAAGTE 385-JR
PORTION 108
KNOP JESLAAGTE 385-JR
EXISTING ROAD (30m)
M34 KRUGERSDORP PRETORIA ROAD
16m BUILDING LINE
PORTION 109
KNOP JESLAAGTE 385-JR
PEACH TREE X22
STORM WATER CONNECTION POINT FROM PEACH TREE EXT 22
PROPOSED 25m STREET
5m WIDE R.O.W SERVITUDE
1050 mm
825 mm
750 mm
1350 mm
1200 mm
PROPOSED 20m STREET
PROPOSED 20m STREET
PEACH TREE X24
PEACH TREE X23
PEACH TREE X22
20m R.O.W SERVITUDE
R/PORTION 331
KNOP JESLAAGTE 385-JR
PEACH TREE X22
PORTION 111
KNOP JESLAAGTE 385-JR
PORTION 105
KNOP JESLAAGTE 385-JR
PORTION 914
KNOP JESLAAGTE 385-JR
N14-HIGHWAY (P158/2)
MH 01
MH 02
MH 03
MH 04
MH 05
MH 06
MH 07
MH 08
MH 09
MH 010
MH 011
MH 012
MH 013
MH 014
MH 015
MH 016
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MH 042
MH 043
MH 044
MH 045
MH 046
MH 047
MH 048
MH 049
A
B
C
D
E
F
G
H
J
K
L
M
1
2
3
0.1000 Ha
3.8000
3.7600
1.6480 Ha

NOTES AND SPECIFICATIONS

GENERAL

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3 VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:

EXISTING PAVING
NO KERBING
MOUNTABLE KERBING
SEMI VERTICAL KERBING

STORMWATER

1 MINIMUM PIPE DIAMETER TO BE 450mm.

2 MINIMUM FALL TO BE 1:150.

3 PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.

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5 CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:

PROPOSED: EXISTING:
STORMWATER LINE
MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1:100
SCALE 1:250
SCALE 1:500
SCALE 1:1000
SCALE 1:2500
SCALE 1:2000
SCALE 1:1500
SCALE 1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE
DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000
INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS

PROJECT STATUS

CONCEPT DRAWING | DEMAND DRAWING | APPROVED FOR CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)
INITIALS AND SURNAME SIGNATURE AND Pr. No. DATE
INSPECTOR OF WORKS (CITY OF TSHWANE)
INITIALS AND SURNAME SIGNATURE AND Pr. No. DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
PROJECTS IS PRIORITY MANAGING
333 EMUS ERASMUS STREET
ERASMUSRAND
0181
P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0482
e-mail : gfc@gfc-holdings.co.za

CITY OF TSHWANE

ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Lefonkane
STRATEGIC EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

Ms. L. V. Kegaikitswe-Phiri
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegaikitswe-Phiri
SIGNATURE: DATE:

LOCATION OF PROJECT:

PEACH TREE EXT 21

DESCRIPTION OF PROJECT

STORM WATER

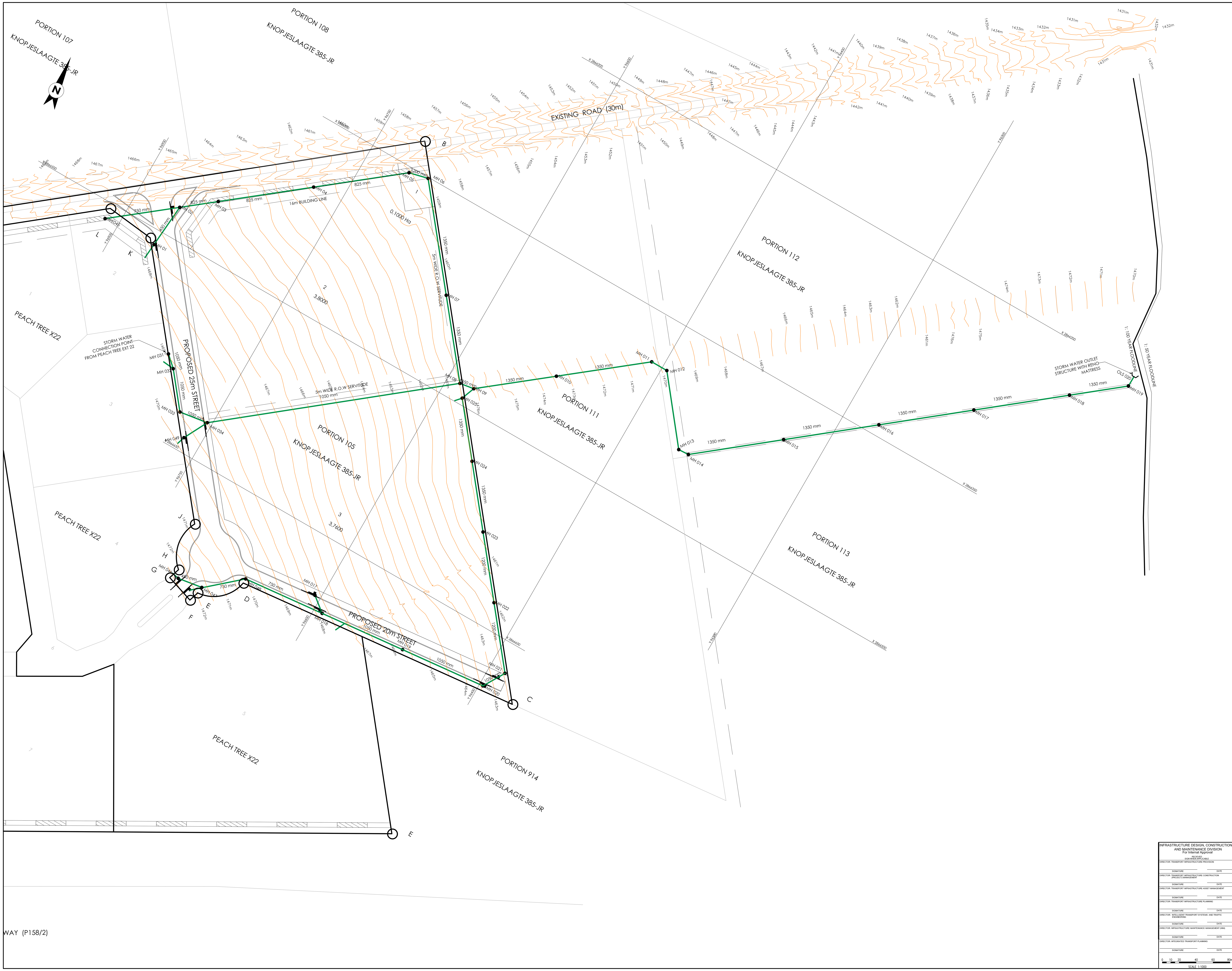
CONTRACT No. : 1632
PROJECT No. : 1632
DATE : JUNE 2016
SCALE : 1:1000
ORIGINAL PAPER SIZE: A0
DRAWING NO: 1632/510/01
SHEET NO: 1 OF 1
REVISION

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECOMMENDED
SIGNATURE WHERE APPLICABLE

DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION
SIGNATURE DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION (PROJECT) MANAGEMENT
SIGNATURE DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
SIGNATURE DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
SIGNATURE DATE
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
SIGNATURE DATE
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (IMM)
SIGNATURE DATE
DIRECTOR: INTEGRATED TRANSPORT PLANNING
SIGNATURE DATE

SCALE 1:1000

M. HADEBE



NOTES AND SPECIFICATIONS

GENERAL

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LEGEND:

EXISTING PAVING
NO KERBING
MOUNTABLE KERBING
SEMI VERTICAL KERBING

STORMWATER

1. MINIMUM PIPE DIAMETER TO BE 450mm.
2. MINIMUM FALL TO BE 1:150.
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LEGEND:

PROPOSED: | EXISTING:

STORMWATER LINE
MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1:100 (0, 1, 2, 4, 8, 10m)
SCALE 1:250 (0, 25, 50, 100, 150, 200m)
SCALE 1:500
SCALE 1:1000

1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE — SIGNATURE:.......... DATE:..........
DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000 — SIGNATURE:.......... DATE:..........
INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS — SIGNATURE:.......... DATE:..........

PROJECT STATUS

CONCEPT DRAWING | TENDER DRAWING | APPROVED FOR CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)
INITIALS AND SURNAME | SIGNATURE AND Pr. No. | DATE
INSPECTOR OF WORKS (CITY OF TSHWANE):
INITIALS AND SURNAME | SIGNATURE AND Pr. No. | DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS
333 EMUS ERASMUS STREET
ERASMUSRAND
0181
P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
e-mail : gfc@gfc-holdings.co.za

CITY OF TSHWANE

ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Letlonkane
STRATEGIC EXECUTIVE DIRECTOR
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PRETORIA
0001

Ms. L. V. Kegakilwe-Piki
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki
SIGNATURE:.......... DATE:..........

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECIEVED
SIGN WHEN APPLICABLE

DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION — SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION (PROJECT) MANAGEMENT — SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT — SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING — SIGNATURE — DATE
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING — SIGNATURE — DATE
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (IMM) — SIGNATURE — DATE
DIRECTOR: INTEGRATED TRANSPORT PLANNING — SIGNATURE — DATE

SCALE 1:1000 (0, 10, 20, 40, 60, 80m)

LOCATION OF PROJECT:
PEACH TREE EXT 21

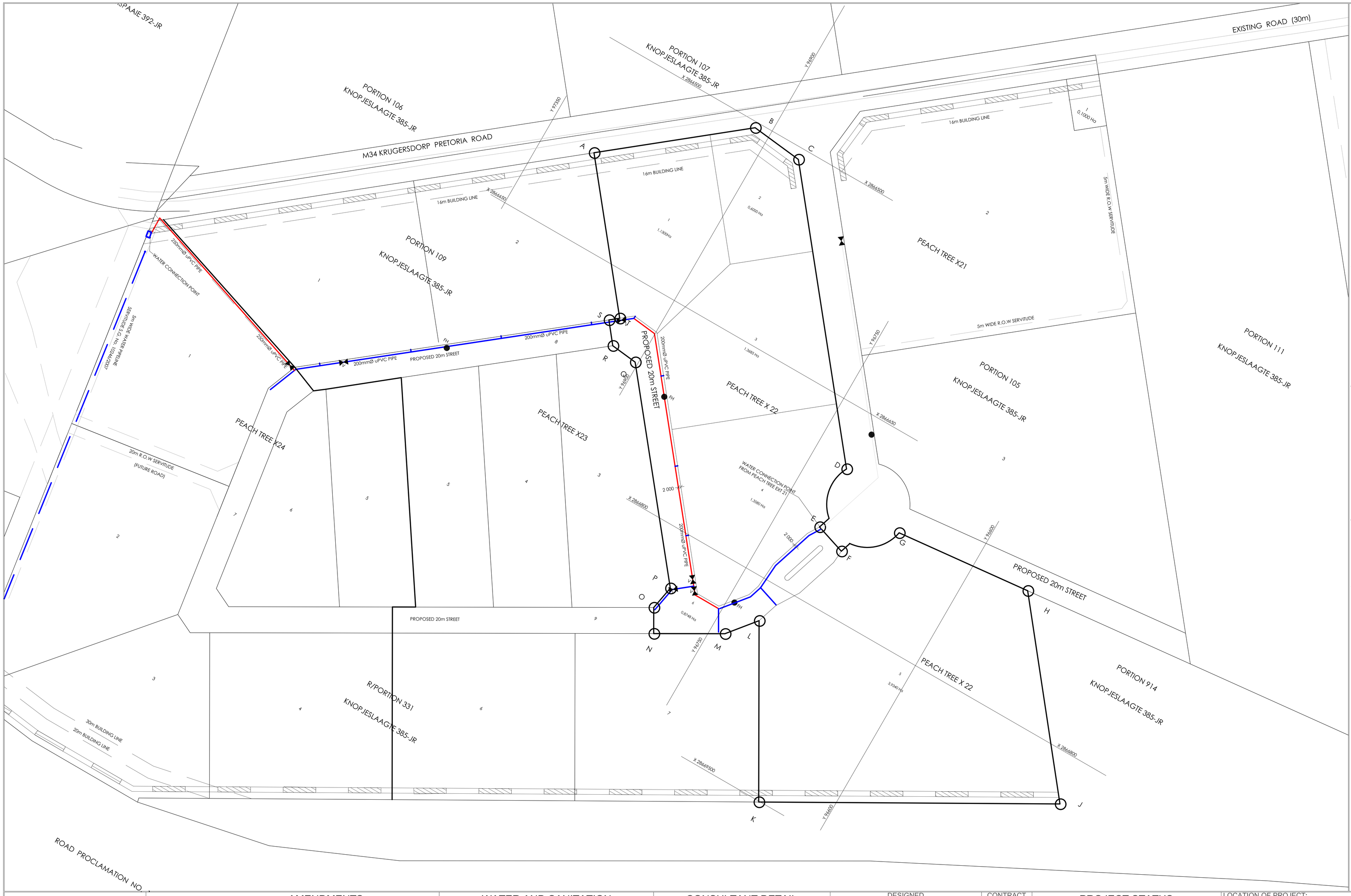
DESCRIPTION OF PROJECT
STORM WATER

CONTRACT No. :	PROJECT No. :
1632	1632

DATE :	SCALE :	ORIGINAL PAPER SIZE:
JUNE 2016	1:1000	A0

DRAWING NO.	SHEET NO:	REVISION
1632/510/02	1 OF 1	A

M. HADEBE



NOTES AND SPECIFICATIONS

GENERAL

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10. FINAL POSITION OF SERVICES TO BE DETERMINED ON SITE.

LEGEND

WATER

- NEW HYDRANT
- PROPOSED / NEW PIPE
- NEW VALVE
- NEW VALVE ON EXISTING PIPE
- NEW HYDRANT ON EXISTING PIPE
- NEW END CAP
- NEW PRV
- NEW AIR VALVE
- NEW WATER METER
- EXISTING PIPE CAPPED
- EXISTING END CAP
- EXISTING NETWORK PIPE
- EXISTING BULK PIPELINE
- EXISTING HYDRANT
- NODE NUMBER (123)
- CLOSED VALVE
- EXISTING VALVE
- EXISTNG COMMUNICATION PIPES
- EXISTING AIRVALVE
- EXISTING WATER METER
- EXISTING PRV
- EXISTING PUMP
- PIPE TO BE ABANDONED (TO BE ABANDONED)
- REDUNDANT PIPE (REDUNDANT)
- EXISTING RES DISTRIBUTION ZONE
- PROPOSED RES DISTRIBUTION ZONE
- EXISTING RAND WATER PIPE
- SUBURB BOUNDARY
- SASOL GAS LINE (GAS)
- PETRONET PIPE (P_NET)
- NEW PIPE IN NEW SLEEVE (SLEEVE Ø TYPE CLASS)

SANITATION

- MANHOLE
- CE / LH
- NEW CCTV INSPECTION
- EXIST. LINE INSPECTED BY CCTV
- NEW SEWER LINE
- EXISTING SEWER LINE
- HOUSE CONNECTION

CITY OF TSHWANE
PO BOX 1022
PRETORIA
0001

CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	AUG 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

	NAME	Prof. Reg. No	SIGNATURE	DATE
DIRECTOR: WATER AND SANITATION - PLANNING				
REGIONAL DIRECTOR: (1,2,3,4,5,6 or 7)				
DIRECTOR: SYSTEM DEVELOPMENT				
DIRECTOR: BULK WATER				
DIRECTOR: INFRASTRUCTURE PROVISION				
DIRECTOR: WASTE WATER TREATMENT				

CONSULTANT DETAIL

TELAVIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
gfc@gfc-holdings.co.za

I _____ Prof Reg Nr _____
HEREBY CERTIFY THAT THE SERVICES WILL HAVE BEEN INSTALLED ACCORDING TO NOTE 9 OF THE ABOVE NOTES AND TO THE DRAWING

SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/220/01

REVISION: A

DESIGNED

NAME: M. HADEBE Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DRAWN

NAME: M. HADEBE Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CHECKED

NAME: G. COMBRINCK Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INFORMATION OFFICE CHECKED

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

DESIGN OFFICE APPROVAL

NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT:

WATER RETICULATION

GENERAL LAYOUT

WBS No. : __-_____-__-_____-__-__

COT DRAWING NUMBER: __-_____-__-_____-__-__

REVISION: 10

NOTES AND SPECIFICATIONS

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CITY OF TSHWANE
SERVICES INFRASTRUCTURE DEPARTMENT
WATER AND SANITATION DIVISION

AMENDMENTS

NR	DATE	APPROVED	DESCRIPTION	PAR
A	SEPT 2016		FOR APPROVAL	TEL

WATER AND SANITATION

FOR INTERNAL APPROVAL - RECEIVED SIGN WHEN APPLICABLE

	NAME	Prof. Reg. No	SIGNATURE	DATE
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SIGNATURE _____ DATE _____

CONSULTANT DRAWING NUMBER: 1632/320/01

REVISION A

DESIGNED	NAME: M HADEBE	Pr Eng. Prof Reg No:	SIGNATURE: DATE:
DRAWN	NAME: M. HADEBE	Prof Reg No:	SIGNATURE: DATE:
CHECKED	NAME: G. COMBRINCK	Pr Eng. Prof Reg No:	SIGNATURE: DATE:
INFORMATION OFFICE CHECKED	NAME:	Pr Eng. Prof Reg No:	SIGNATURE: DATE:
DESIGN OFFICE APPROVAL	NAME:	Pr Eng. Prof Reg No:	SIGNATURE: DATE:

CONTRACT No: 1632
PROJECT No. 1632
SHEET No. 1 OF 1
PAPER SIZE: A0
SCALE: 1:1000
DATE: AUGUST 2016

PROJECT STATUS

RECEIVED SIGN WHEN APPLICABLE

CONCEPT DRAWING | TENDER DRAWING | APPROVED CONSTRUCTION DRAWING | AS BUILT DRAWING

PROJECT ENGINEER of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

INSPECTOR OF WORKS of COT:
NAME: _____ Pr Eng. Prof Reg No: _____
SIGNATURE: _____ DATE: _____

LOCATION OF PROJECT:

PEACH TREE EXT 22

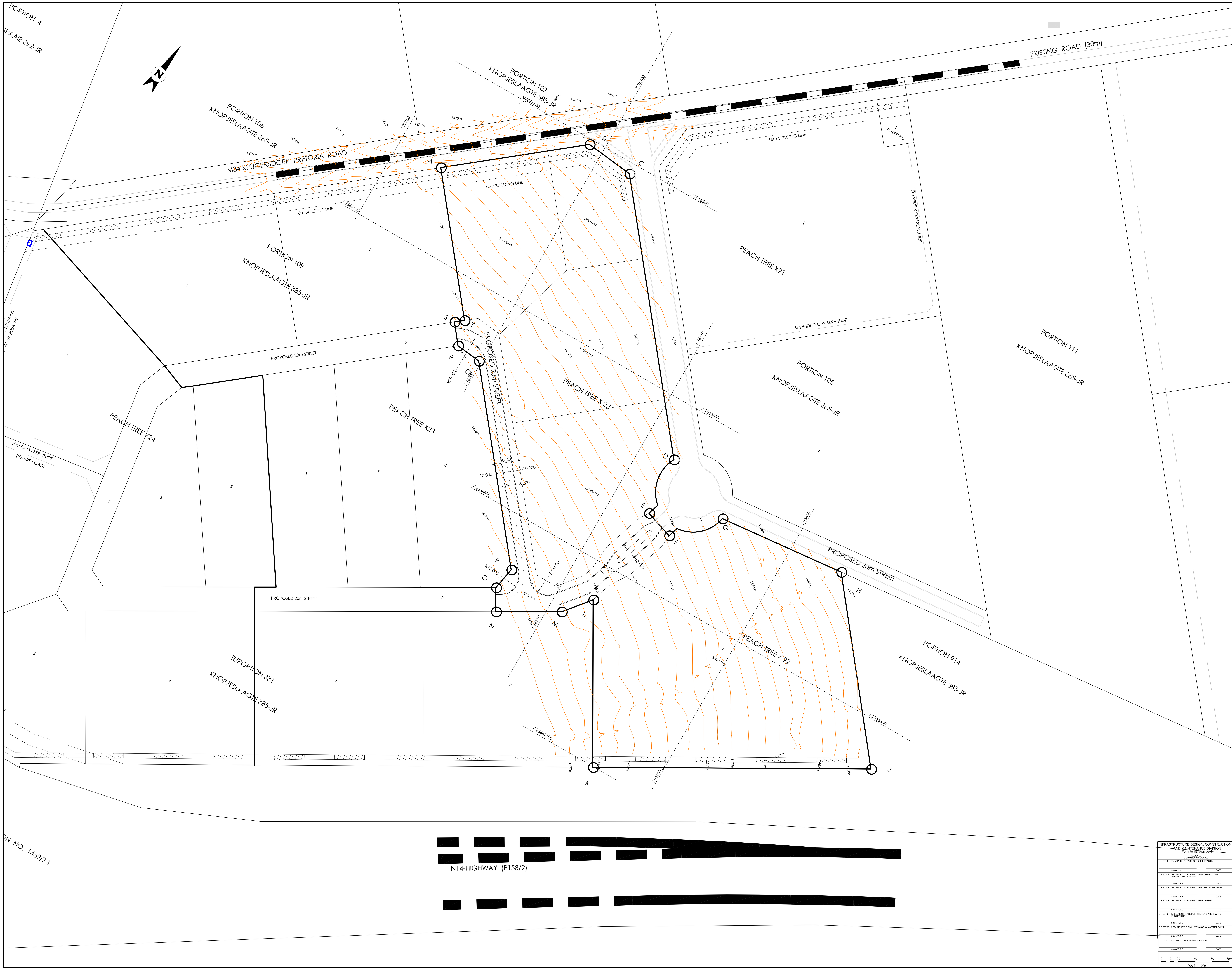
DESCRIPTION OF PROJECT:

SEWER RETICULATION

GENERAL LAYOUT

WBS No. : __-_____-__-_____-__-__

COT DRAWING NUMBER: __-_____-__-_____-__-__ REVISION 10



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3. VERTICAL AND HORIZONTAL ALIGNMENT TO FOLLOW THE EXISTING ROAD SURFACE, WITH A MINIMUM CROSS FALL OF 2 % (IF APPLICABLE)

LEGEND:

EXISTING PAVING
NO KERBING
MOUNTABLE KERBING
SEMI VERTICAL KERBING

STORMWATER

1. MINIMUM PIPE DIAMETER TO BE 450mm.
2. MINIMUM FALL TO BE 1:150.
3. PIPE BEDDING TO BE CLASS B UNLESS OTHERWISE SPECIFIED.
4. ALL EXCAVATIONS AND BEDDING MUST BE INSPECTED AND APPROVED BY THE ENGINEER BEFORE LAYING OF ANY PIPES.
5. CLEAN EXISTING STORMWATER INLETS AND REPAIR WHERE NECESSARY.(IF APPLICABLE)

LEGEND:

PROPOSED: EXISTING:
STORMWATER LINE
MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1:100
SCALE 1:250
1:1000
SCALE 1:500
SCALE 1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED: M HADEBE
SIGNATURE:........ DATE:........
DRAWN: M HADEBE
DESIGN CHECKED BY: 1:1000
SIGNATURE:........ DATE:........
INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT: D.J. CHALMERS
SIGNATURE:........ DATE:........

PROJECT STATUS

CONCEPT DRAWING / TENDER DRAWING / APPROVED FOR CONSTRUCTION DRAWING / AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)
INITIALS AND SURNAME — SIGNATURE AND Pr. No. — DATE
INSPECTOR OF WORKS (CITY OF TSHWANE):
INITIALS AND SURNAME — SIGNATURE AND Pr. No. — DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD

333 EMUS ERASMUS STREET
ERASMUSRAND
0181
P. O. BOX 11141
ERASMUSKLOOF
0048
TEL : (012) 347 6299
FAX :(012) 347 9767
CELL : 082 492 0682
e-mail : gfc@gfc-holdings.co.za

CITY OF TSHWANE

ROADS AND TRANSPORT DEPARTMENT

Mr P. I. Letlonkane
STRATEGIC EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

Ms. L. V. Kegakilwe-Piki
EXECUTIVE DIRECTOR
P.O. BOX 1409
PRETORIA
0001

DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki
SIGNATURE:........ DATE:........

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECIEVED
SIGN WHEN APPLICABLE

DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION
SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE CONSTRUCTION (PROJECT) MANAGEMENT
SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE ASSET MANAGEMENT
SIGNATURE — DATE
DIRECTOR: TRANSPORT INFRASTRUCTURE PLANNING
SIGNATURE — DATE
DIRECTOR: INTELLIGENT TRANSPORT SYSTEMS AND TRAFFIC ENGINEERING
SIGNATURE — DATE
DIRECTOR: INFRASTRUCTURE MAINTENANCE MANAGEMENT (IMM)
SIGNATURE — DATE
DIRECTOR: INTEGRATED TRANSPORT PLANNING
SIGNATURE — DATE

SCALE 1:1000

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT

ROADS

CONTRACT No. :	PROJECT No. :
1632	1632

DATE :	SCALE :	ORIGINAL PAPER SIZE:
JUNE 2016	1:1000	A0

DRAWING NO.	SHEET NO:	REVISION
1632/420/01	1 OF 1	0

M. HADEBE

NOTES AND SPECIFICATIONS

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LEGEND:

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SEMI VERTICAL KERBING

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PROPOSED: | EXISTING:

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MANHOLE
JUNCTION BOX
KERB INLET
CATCHPIT LENGTH
2/3/2
TRANSITION LENGHT
CATCHPIT LENGTH
TRANSITION LENGTH

SCALE 1:100
SCALE 1:250
SCALE 1:500
SCALE 1:1000

1:1000

AMENDMENTS

NR.	DATE	APPROVED	DESCRIPTION	PAR.

DESIGNED M HADEBE SIGNATURE:........ DATE:........	DRAWN M HADEBE
DESIGN CHECKED BY 1:1000 SIGNATURE:........ DATE:........	INFRASTRUCTURE TECHNICAL INFORMATION MANAGEMENT D.J. CHALMERS SIGNATURE:........ DATE:........

PROJECT STATUS

○ CONCEPT DRAWING ○ TENDER DRAWING ○ APPROVED FOR CONSTRUCTION DRAWING ○ AS BUILT DRAWING

PROJECT ENGINEER (CONSULTANT)

INITIALS AND SURNAME .... SIGNATURE AND Pr. No. .... DATE

INSPECTOR OF WORKS (CITY OF TSHWANE):

INITIALS AND SURNAME .... SIGNATURE AND Pr. No. .... DATE

CONSULTANT DETAIL

TELAWIZE (PTY) LTD
ENGINEERS & PROJECT MANAGERS

333 EMUS ERASMUS STREET
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CITY OF TSHWANE

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DRAWING APPROVED BY EXECUTIVE DIRECTOR
Ms. L. V. Kegakilwe-Piki

SIGNATURE:........ DATE:........

INFRASTRUCTURE DESIGN, CONSTRUCTION AND MAINTENANCE DIVISION
For Internal Approval
RECIEVED
SIGN WHEN APPLICABLE

DIRECTOR: TRANSPORT INFRASTRUCTURE PROVISION — SIGNATURE — DATE
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SCALE 1:1000

LOCATION OF PROJECT:

PEACH TREE EXT 22

DESCRIPTION OF PROJECT

STORM WATER

CONTRACT No. : 1632	PROJECT No. : 1632	
DATE : JUNE 2016	SCALE : 1:1000	ORIGINAL PAPER SIZE: A0
DRAWING NO. 1632/520/01	SHEET NO: 1 OF 1	REVISION A

M. HADEBE

ADDENDUM D

SEWERAGE TREATMENT PLANT DOCUMENTATION

Monday, July 18, 2016.

Attention: Mr. DeWet Botha.

General Introduction

This is a challenging time to find smart yet low cost engineering solutions with little down side risk. AQUA MEDIA have designed and produced a very successful range of High Speed MBBR Systems to help you provide simple low-cost solutions to meet the most stringent water and wastewater standards.

Wastewater Treatment Innovation from AQUA MEDIA CC.

AQUA MEDIA CC was founded in 1989. Since then, we have designed and supplied many wastewater treatment plants all around the world. AQUA MEDIA would like to work with you to provide 'THE RIGHT Solution" with a single system or a combination of systems to satisfy your specific need. AQUA MEDIA high quality bio systems are automated, extremely reliable, and are selected by high end clients and military around the world.

Your Package Plant Requirements

We understand from the specification we received that your requirements for a wastewater treatment system must meet BOD and Total Suspended Solids standards less than 30 mg/l. The High Speed MBBR Systems proposed are capable of average 400 m3 per day at 30 mg/l BOD effluent and provides low capital and operating cost benefits. They will require a smaller foot print than the other units you may be currently considering and have a greater range of flexibility and higher performance capability. AQUA MEDIA HS MBBR systems offer many unique features.

System Features

We have taken effort to incorporate our considerable past experience in our offer, which has made it elaborate & comprehensive. We have incorporated several world class, renowned, and well supported equipment & instrumentation, which are time tested, both at home & abroad. Care has been taken for selection of proper & robust material of construction of each component in our package plant system, as we believe that appropriate selection of materials is vital in such a sophisticated system.

- Very compact & occupies 50% less space than other sewerage treatment plants.
- Less maintenance, low capital & operating cost benefits
- Simple assembly and operated by trained, on site, labor.
- The system is prefabricated and mounted in ISO size freight containers and no larger than standard ISO freight containers.
- Easily transportable to any location unlike other conventional treatment plants

P.O. Box 685, Kyalami Estate, 1684.South Africa.
Tel: +27116744742/4725789Fax: +27116744743
Mobile:+27832635598Website: www.aquamedia.co.za
Director: Bruce Dalton

- There is no need to add micro organism.
- The system will operate without any chemical addition
- Easy start up, fully automatic operation, reliable & robust once started
- One central control panel for easy operation.
- Clog free air distribution system and by AM biofilm carrier elements.

AQUA MEDIA High-Speed MBBR – STP

A. Buffer Tank

The sewage is pumped or gravitates into the buffer tank from the community. The buffer tank equalizes the variation in flow over the day. The buffer tank is aerated with coarse bubble diffuser so that sewage does not become septic (Anaerobic). **The air supply and air diffusers are included in the AQUA MEDIA scope of supply as a separate item in the price schedule below. The buffer tank is not in the AQUA MEDIA scope of supply and will be supplied by the customer as per our drawing.**

B. Biological Treatment System to be provided

The AQUA MEDIA biological treatment system is based on the moving bed bio reactor (mbbr) process and comes with two moving bed bioreactors (MBBR) in series.

The first reactor is acting as a roughing reactor to reduce peak loads and remove approximately 80% of the influent BOD. The second reactor is a polishing reactor designed to reach the required effluent BOD.

The bioreactors are filled with "AM Biofilm Elements" a specially designed bio film carrier element which is free floating and moves around in the reactor with the flow. The AMB bio medium provides an effective bio film surface of 1000 m2 plus per m3 bulk material. Simultaneously, biomass is trapped inside the carrier elements, providing additional MLVSS in the reactors without need for conventional activated sludge return.

The bioreactors are aerated through a coarse bubble air distribution system at the bottom of the tank, with air supply from a rotary displacement air blower. The diffusers are designed and manufactured by AQUA MEDIA in stainless steel and may be removed and serviced without stopping aeration.

C. Settling Tank and Sludge Separation System

The biodegraded water flows by gravity into the clarification stage where the suspended solids settle by gravity. The water is directed through a skim well to an inclined tube settler,

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Tel: +27116744742/4725789Fax: +27116744743
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Director: Bruce Dalton

which provides the final clarification of the effluent, and where the sludge settles easily to the bottom of the tank.

The sludge is removed by a timer controlled AQUA MEDIA hydrocyclone assembly that separates volatile sludge from non volatile sludge. The excess sludge is transferred to a waste sludge holding tank which may be integrated in the AQUA MEDIA holding tank system, or arranged as freestanding thickener tank for further processing of the sludge using a filter press.

D. Tertiary Filtration system

The suspended solids in the wastewater are further polished by dedicated multimedia filters. The backwash from these units is returned to the start of the process. Clean water from the process is used to backwash the multimedia filters.

E. Chlorination system (Sterilization)

Chlorine is dosed as a calcium hypochlorite solution from a make up tank. This is proportional to flow on the downstream side of the multimedia filters. The make up tank has an electric agitator. We can offer an Ultraviolet system as an alternative sterilization method (or in addition to Chlorine dosing.)

F. Control Panel

A control panel is included which houses the motor control centre for various drives and the control of operation of the sewage treatment plant.

System Operation:

A. Flow Control.

The primary effluent from the holding tank system is pumped into the first MBBR stage by a submerged sewage pump with its own high/low level switch. The pump flow rate is manually controlled by a return control valve at the exit of the pump well, and monitored by a flow indicator with local display.

B. Effluent Control

Samples should be taken and analyzed according to local regulation for BOD and COD. A correlation is to be established between BOD and COD values, and COD measurements to be used for regular operation control. This must be done every 8 days until the system is fully settled. Bio growth accelerators can be added to speed the process initially. Laboratory equipment and chemicals can be purchased from AQUA MEDIA for this purpose if required.

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Mobile:+27832635598Website: www.aquamedia.co.za
Director: Bruce Dalton

SCOPE OF SUPPLY

1. **Design and Supply of the systems:**

A Appropriately sized air supply with distribution system.

B 2 x 310-24MAXI-3 High-Speed Bio Systems - Fully automatic systems with automatic sludge separation Main components pre-assembled and tested before shipping. Each unit consists of following components. :

- Main Bio Reactor Tank with three chambers in MS epoxy coated.
- AM Biofilament elements.
- SS Course Air Distribution systems with butterfly valves, coarse air, No clogging. AQUA MEDIA Design
- Non-Return valves (Check valves)
- Necessary Cables & Accessories
- Tube Settler
- Rotary Displacement Blower.
- Submersible Feed Pumps.
- Displacement Sludge / Recycling Pump.
- Necessary uPVC Piping & valves
- Chlorine dosing equipment
- Motor Control Panel.

C Sludge Storage

- 6 000L Sludge Storage Tank
- Piping, valves, tank connectors, etc

D Tertiary Filtration for 26 m3/hr

- Dedicated Filter Feed pumps per Filter
- Pre Strainers
- 5 x 840mm diameter Multimedia Filters
- Pre and Post Filtration sample points
- Pressure Gauges
- Manual Backwash

E Chlorination System

- 1 000L Make-up Tank
- Electric Agitator
- Milton Roy Dosing pump
- Water Make-up Lines
- Drain

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Director: Bruce Dalton

2. Technical Material to be provided with systems:

P&I Diagram and Bill of Material

System Layout and Installation Drawings.

Installation, Operation & Maintenance Manuals.

Fulll training of on site labour.

3. Start-up & Training:

AQUA MEDIA engineers can start-up and train the personnel, see options.

NOTE: More than often clients are able to start-up our bio systems by follow simple instructions in the operational manual. All systems are automatic once started up. AM High-Speed Bio Tec systems are simple to operate and extremely robust and reliable once in operation.

4. Customer To Supply:

Provide interconnecting piping to buffer tank and bioreactor, bioreactor and sludge & clean water holding tanks.

Provide field electrical wiring.

Electrical power to our control panel, 415 volts, 3 ph, 50 hz, 4 wire.

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DESIGN PARAMETERS

FLOW RATE	M3/DAY	310 x 2	CONTAINERISED		YES
TEMPERATURE	^{0}C	20	TOTAL AVE. FLOW M3/H		25.8
		INLET	OUTLET	REMOVAL %	
BOD	MG/L	300	30	90%	
SS	MG/L	300	30	90.%	
OIL & GREASE	MG/L	6	6	0%	

PLANT SPECIFICATIONS of each 310-24maxi-3

TECHNICAL SPECIFICATIONS OF		310-24maxi-3		
Description	Specification	Unit	Quantity	Specification
Maximum flow		m3/d		310
Tank container			1	
Bioreactor + Settler	Overall length	mm		12100
	Overall width	mm		2192
	Overall height	mm		2896
Bio media	Proprietary	m3	8	PU/ Levapor
Settling Media	Tube deck	m3	5 .8	PVC

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Rotary displacement blower			**1**	
	Manufacturer			**HPE blowers, Spain or Equivalent**
	Nominal capacity	**m3/h**		**400**
	Back Pressure	**mmwc**		**3700**
	Motor HP	**kw**		**5.5**
Submersible pump			**1**	
	Manufacturer			**Wilo, Germany.**
	Nominal capacity	**m3/h**		**20**
	Back pressure	**m**		**6.5**
	RPM			**2900**
	Motor HP	**kw**		**1.5**
Sludge return pump			**1**	
	Manufacturer			**Alpha, Italy**
	Nominal capacity	**m3/h**		**4**
	Back pressure	**m**		**10**
	RPM			**2900**
	Motor HP	**kw**		**0.75**
Hydrocyclone			**1**	
	Manufacturer			**AQUA MEDIA**
	Nominal capacity	**m3/h**		**3**
	Pressure drop	**m**		**4.0**

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Electricals	**Installed power**	**kw**		**10.00 kW.**
Shipping weight				
Without doors & top covers		**kg**		**12 000**
Operating weight				
Without doors & top covers		**kg**		**75 000**
Overflow pump			**1**	
	Manufacturer			**Espa, Spain**
	Nominal capacity	**m3/h**		**17**
	Back pressure	**m**		**10**
	RPM			**2900**
	Motor	**kw**		**1.1**
Shipping Weight		**kg**		**12 000**
Operating weight		**kg**		**75 000**

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PRICE SCHEDULE.

Per 620 m3/day system.

AQUA MEDIA System Offer as requested.	Qty	Unit Price ZAR	Total ZAR
A. Air blower and air diffusers in Buffer tank.	1	ZAR 98 996.00	ZAR 98 996.00
B. 2 x 310 m3/d – AM HS MBBR 310-24MAXI-3 including:- - Pre Screens, two off in set - 1 x Tertiary filtration system complete, skid mounted, complete with dedicated duty/ standby pumps for each Filter. - AFM media. - 1 x Chlorination system	1	ZAR 2 654 465.00	ZAR 5 308 930.00
C. Sludge Storage tank complete with interconnecting pipework.	1	ZAR 23 875.00	ZAR 23 875.00
C. Transport to Site	1	ZAR 73 500.00	ZAR 73 500.00
D. Clamp-On Flowmeters	2	ZAR 23 790.00	ZAR 47 580.00
E. Startup support engineering. One engineer for 5 (five) days	5	ZAR 3 950.00	ZAR 19 750.00
F. Buffer tank Civils and excavation by Client. Ancillary services by Client: Power supply to boards supplied by Aqua Media cc. Sewer outfall pipe 200 mm and isolating valve. Finished effluent pipe to final use/ disposal.			
Sub-Total Excluding VAT.			**ZAR 5 572 631.00**
Less: 1,5% Discount (subject to Terms & Conditions below)			**(ZAR 83 589.46)**
TOTAL Excluding VAT AFTER DISCOUNT			**ZAR 5 489 041.60**

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Taxes and Transport :

All prices quoted above exclude VAT. Transport cost are subject to fuel and transport costs at time of dispatch.

Recommended Options:

1. Automated raw sewage screening system: ZAR 770 250.00 + VAT.

Validity:

Prices are valid to 31 August 2016.

Payment Terms:

35% on order, 30% materials on hand, 25% on delivery, 5% on completion of installation, 5 % on completion of commissioning.

A 1,5% discount will apply provided payment is received within 15 working days of invoice.

Ownership of all goods vests in Aqua Media cc until paid for in full.

Transportation

There will be a total of two 12 m HIGH CUBE ISO containers, One container per 310m3/day plant (total 2) and one 6 m ISO standard container for shipment of Tertiary Filtration and Chlorination.

Delivery time:

We shall complete the supply of the first Sewage Waste Water Treatment Plant including Tertiary Filtration and Chlorination System as mentioned in our technical specification **within 16-18 weeks from order and payment of the advance payment invoice** (Excluding Freight Duration). Unit two will be ready for delivery in 2 – 4 weeks later.

The delivery period indicated above shall be calculated from the date of receipt of payments. We will not be held responsible for delays due to administration, financial or procurement procedures from the client or any other 3rd party.

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Force Majeure Clause:

AQUA MEDIA shall not be liable for any failure or delay to perform any of its obligations hereunder if such failure or delays has occurred by an act of God, Strike, Lockout, inability to obtain materials, fire, breakdown, war, civil commotion, destruction of plant, governmental act or regulation, or any other cause or events beyond the control of AQUA MEDIA, or its suppliers or shippers / forwarders.

WARRANTY

AQUA MEDIA , warrants the Purchaser that the system, as delivered to Purchaser, shall be free from defective material or workmanship for a period of eighteen (18) months from date of delivery or one (1) year from date of installation, whichever comes first. This warranty does not apply to damages resulting from accident, neglect, and misuse. The foregoing warranty is the only warranty extended by AQUA MEDIA, and is in lieu of other warranties, express or implied.

This Guarantee is also subject to following:

- Strictly following instructions as mentioned in system performance warranty annexure.
- Taking care of preventive maintenance as suggested by us.
- Maintaining operation & maintenance data's / records log sheets & the same is made available whenever asked by us.
- Maintaining parameters as per clauses of various annexure of our offer.

AQUA MEDIA thanks you for the opportunity to be of assistance to you on this project. If you have any questions or require additional information please do not hesitate to let us know at your earliest convenience.

Yours faithfully

Bruce Dalton.
Director.
Aqua Media cc

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Tel: +27116744742/4725789Fax: +27116744743
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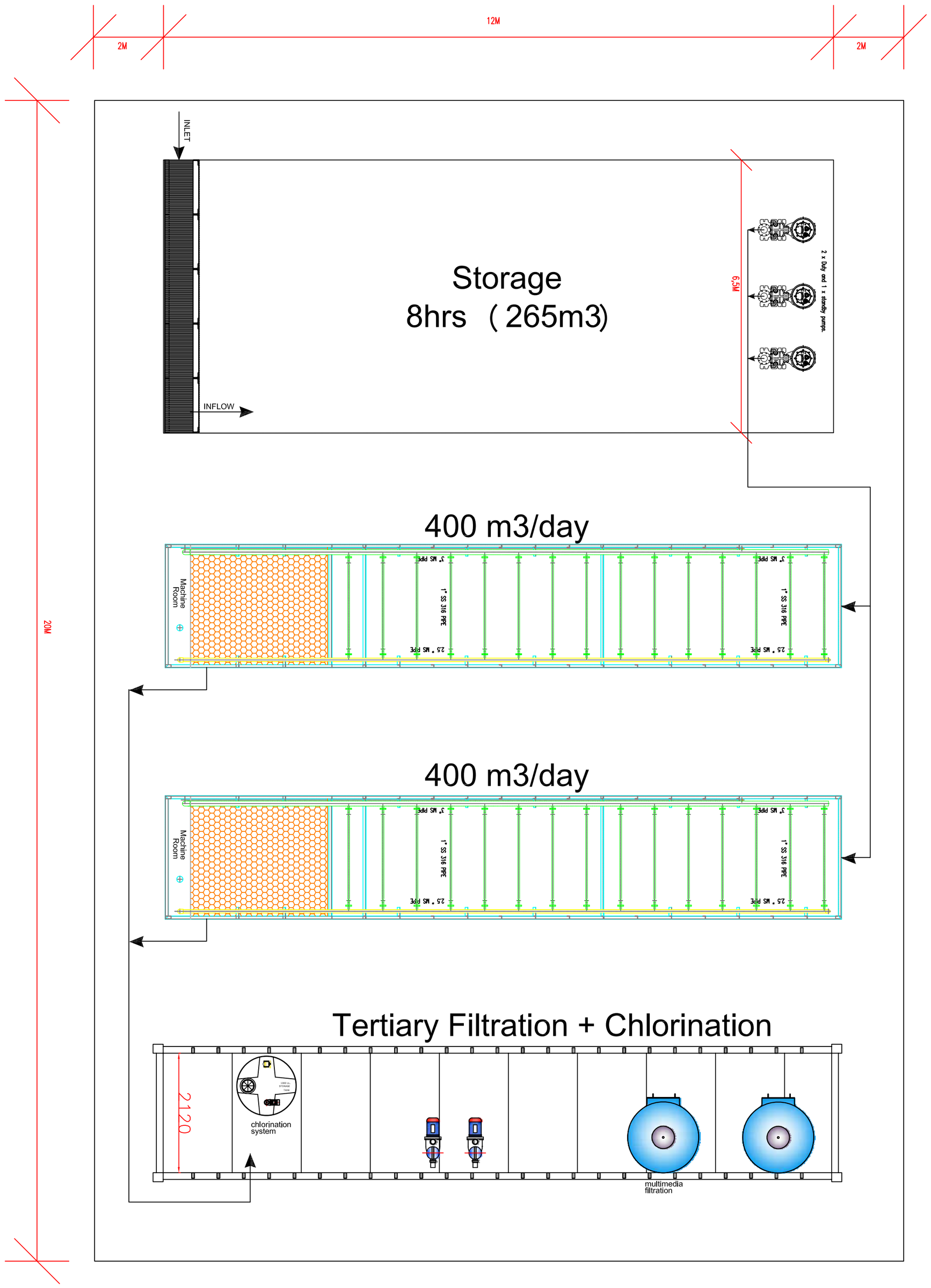


AQUA MEDIA CC

Unit 3 BARBECUE HEIGHTS, 9 DYTCHLEY RD.,
Barbecue Downs, Milnerton, 7404
P O Box 685 Woodbridge Estate, 1684, Gauteng, South Africa
Tel: +27(11) 466-0325 / 4255 /5702
Fax: +27(11) 466 0421
e-mail: dalton@aquamedia.co.za

PROJECT	NIGERIA – 2 x 400 m3/day SEWAGE TREATMENT PLANT
CLIENT	STEVE PEARSE
DRAWING TITLE	LAYOUT DIAGRAM
DRAWING No.	REV. 0
SCALE	NTS
DATE	05/11/13
DRAWN	

ADDENDUM E

GLS REPORT

25 1989 - 2014 celebrating 25 years of excellence

B17-04

15 August 2016

General Manager: Water and Sanitation
City of Tshwane Metropolitan Municipality
PO Box 6338
PRETORIA
0001

ATTENTION: Ms. Semakaleng Dlavani

Dear Ma'am,

WATER AND SEWER MASTER PLANS: DEVELOPMENT OF PROPOSED TOWNSHIP/REZONING – KNOPJESLAAGTE 385-JR PORTION 105, 109 AND 331

The attached request from Civilconsult (Gideon Ras) dated 30 March 2016 with regards to accommodating the proposed development in the Tshwane water and sewer systems has reference.

Although the City of Tshwane has water and sewer master plans, you requested this further analysis and report because :

- ☑ The development has large fire flow requirements (e.g. 20ℓ/s, 25ℓ/s or 50ℓ/s which is usually the case for higher density cluster developments, industry, general business, shopping centres or high-rise flats >= 4 storeys).
- ☑ The development has a substantially higher water demand than used in the master plan.
- ☑ The reservoir which will supply the development in future will be different to the reservoir which currently supplies the development (i.e. a change in reservoir supply zones).
- ☑ The reservoir zone in which the development falls is currently experiencing inadequate bulk water system capacity.
- ☑ The drainage area in which the development falls is currently experiencing inadequate bulk sewer system capacity.

This report is a technical report stating upgrades required in the distribution networks in the vicinity of the proposed development. The City of Tshwane engineer (yourself) will accept the report or suggest changes and will make a final decision on works to be implemented by the proposed development.

This analysis and report is based on the 2010 water and sewer master plans which are updated every quarter. The latest master plans used in this analysis were the January 2016 master plans.

All costs shown in this report are year 2015/16 Rand value estimates and **include** 40% surcharge for P&Gs, contingencies and fees but **exclude** VAT.

GLS Consulting (Pty) Ltd
Tel +27 21 880 0388 | **email:** info@gls.co.za
PO Box 814, Stellenbosch, 7599, South Africa
13 Elektron Street, Techno Park, Stellenbosch
www.eoh.co.za | **www.gls.co.za**
Reg no: 2007/003039/07

1 WATER DISTRIBUTION NETWORK

1.1 Water Resource

The City of Tshwane (CoT) straddles two primary water catchments namely: the Crocodile River basin in the west and the Olifants River basin in the east. The dividing line between these two catchments runs in a north-south direction approximately through Cullinan. Water resources in the Crocodile River basin in the west together with imports from the Vaal River basin via the Rand Water system are sufficient to supply CoT reservoirs in this basin. However, water resources in the Olifants River basin in the east are fully committed and cannot supply **additional** water to any existing or future CoT reservoirs without additional Rand Water supply through new pipelines, especially to the Cullinan WTP and Bronkhorstspruit WTP.

The CoT Water Resources Master Plan (2014) indicates that the reservoir listed in section 1.2 below is supplied from the water source shown in the table below. From this information it can be seen that this water source is adequate to cater for the proposed development.

Catchment	Water Source	%	Comment
Vaal River basin	Rand Water	100%	The master plan calculates the water volumes required at all Rand Water connections to supply applicable reservoirs. These calculations are supplied by the CoT to Rand Water and the City obtains agreements from Rand Water for these volumes.

1.2 Distribution Zone

The proposed development was taken into consideration in the above mentioned water master plan as part of the Knopjeslaagte 385-JR Ptns 105-109-331 future development area with a landuse of low density residential.

The master plan indicates that the proposed development currently falls in no reservoir supply zone but in the future will form part of the Mnandi reservoir zone as shown in **Figure 1 (Water)**.

1.3 Revised Water Demand

The combined AADD for the proposed development as originally calculated and used in the analysis of the water distribution network in the master plan was 441 kℓ/d.

The revised AADD, peak flow and fire flow calculated for the proposed development and used in the re-analysis of the water distribution network was 906 kℓ/d calculated as follows:

Erf No.	Anticipated Landuse	New Dev. Area (ha)	Density (Units/ ha)	FSR	Floor space (ha)	No. of Units	FSR Units	UWD Type	UWD (inc.UAW)		AADD (inc.UAW) (kl/d)	PDDWF incl. Infil. (kl/d)	Water / Sewer Ratio	IPDWF (l/s)	IPWWF (l/s)
	NEW DEVELOPMENT														
Erven 1 & 2	Industrial (dry)	12.391		0.60	7.434		743.43	floor	0.40	kl/100m²/d	297	211	71%	3.6	5.1
Erven 3 & 4	Industrial (dry)	16.304		0.60	9.782		978.22	floor	0.40	kl/100m²/d	391	277	71%	4.7	6.7
Erf 5	Gate house for security villages	1.147	1			1		unit	0.60	kl/unit/d	1	0	67%	0.0	0.0
Erf 6	Private open space	0.745						area	15.00	kl/ha/d	11	0	0%	0.0	0.0
Ptn 105	Industrial (dry)	8.564		0.60	5.138		513.85	floor	0.40	kl/100m²/d	206	146	71%	2.5	3.5
	Roads	1.717						none	0.00	kl/unit/d	0	0	0%	0.0	0.0
	New Master Plan Total	**40.867**				**1**	**2235**				**906**	**634**		**10.8**	**15.4**

- Peak flow using zone peak hour factor of: 3.0‡ = 31.5 ℓ/s
- Fire flow for type: Industrial/business (moderate risk) = 50 ℓ/s @ 15 m

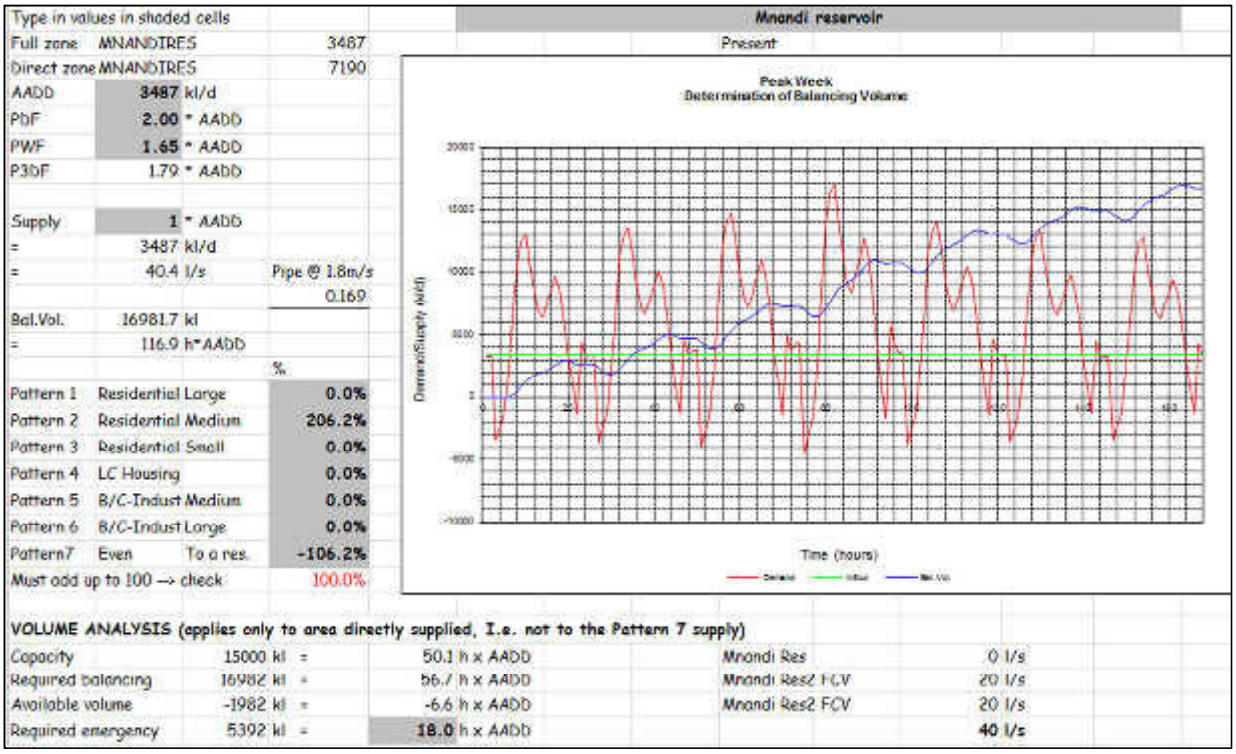
‡ Higher peak flow factors might be applicable for internal networks.

1.4 Accommodation of Proposed Development in the Existing Water System

Accommodation of the proposed development, with its revised AADD, requires implementation of the following additions and adjustments to the *existing* water system:

1.4.1 Bulk Items

The current Mnandi reservoir zone AADD plus UAW ("scenario 2" in WADISO) in the m2016-01 Tshwane water model is 3 487 kℓ l/d. The capacity of the existing Mnandi reservoir is 15 000 kℓ. The two existing FCVs can only supply 20 ℓ/s each (which is too low). Using these three input variables in a reservoir sizing spreadsheet, it shows that demand consistently exceeds supply and thus the balancing volume increases to unworkable volumes.



Type in values in shaded cells				Mnandi reservoir
Full zone	MNANDIRES		3487	Present
Direct zone	MNANDIRES		7190	
AADD	3487	kl/d		
PDF	2.00	* AADD		
PWF	1.65	* AADD		
P3DF	1.79	* AADD		
Supply	1	* AADD		
=	3487	kl/d		
=	40.4	l/s	Pipe @ 1.8m/s	
			0.169	
Bal.Vol.	16981.7	kl		
=	116.9	h*AADD		
			%	
Pattern 1	Residential Large		0.0%	
Pattern 2	Residential Medium		206.2%	
Pattern 3	Residential Small		0.0%	
Pattern 4	LC Housing		0.0%	
Pattern 5	B/C-Indust Medium		0.0%	
Pattern 6	B/C-Indust Large		0.0%	
Pattern7	Even	To a res.	-106.2%	
Must add up to 100 --> check			100.0%	

Peak Week
Determination of Balancing Volume

Time (hours)

VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)

Capacity	15000 kl	=	50.1 h x AADD	Mnandi Res	0 l/s
Required balancing	16982 kl	=	56.7 h x AADD	Mnandi Res2 FCV	20 l/s
Available volume	-1982 kl	=	-6.6 h x AADD	Mnandi Res2 FCV	20 l/s
Required emergency	5392 kl	=	18.0 h x AADD		40 l/s

The Mnandi reservoir thus needs its own new RW connection to increase the supply into the Mnandi reservoir.

1.4.2 Reticulation Items

Items required to alleviate existing problems in the water distribution system:

- None

Items required to accommodate the proposed development (excluding fire flow requirements):

• MNR.6	475	m	x	600	mm Ø REPLACEMENT pipe (replacing an existing 110 mm Ø pipe)	R	3 100 000
• MNR.7	2 460	m	x	450	mm Ø main pipe	R	9 500 000
• MNR.8	710	m	x	450	mm Ø main pipe	R	2 800 00
• MNR.9 (part of)	1 045	m	x	**355**	mm Ø main pipe	R	1 900 000

Items required to accommodate the proposed development (including fire flow requirements):

- As above, and

• ITEM 1	580	m	x	250	mm Ø main pipe (this pipe is internal to the development)	R	-

Should this development and the above pipe routes fall within a dolomitic area, the diameters stated above should be read as internal diameter sizes due to the wall thickness of HDPE pipes.

The proposed connection point to the existing water distribution system is shown in **Figure 1 (Water)** attached.

1.5 Internal Reticulation

The internal network design on the property of the proposed development is beyond the scope of this report. However, the consulting engineer for the development is required to allow for the fire flow demand as listed in 1.2 above on the internal networks.

For internal network design purposes the water distribution network provides the following energy gradelines (EGLs) at the proposed connection point (see **Figure 1 (Water)**):

- Static EGL = 1 542 m a.s.l. (76 m)
- Residual EGL = 1 523 m a.s.l. (57 m)
- Fire Flow EGL = 1 505 m a.s.l. (39 m)
- Ground Level = 1 466 m a.s.l.

1.6 Adjustments to the Master Plan

The revised AADD of the proposed development requires the following additions and adjustments to the *master plan* as indicated in **Figure 1 (Water)** attached:

Internal reticulation pipes to be re-rerouted according to the township layout and the water demand to be more than doubled from 441 kℓ/d to 906 kℓ/d.

2 SEWER NETWORK

2.1 Drainage Area

The proposed development was taken into consideration in the above mentioned sewer master plan as part of the Knopjeslaagte 385-JR Ptns 105-109-331 future development area with a landuse of low density residential.

The master plan indicates that the proposed development falls in the Swartspruit drainage area as shown in **Figure 2 (Sewer)** attached. This drainage area drains to the Sunderland WWTP.

2.2 Revised Sewer Flow

The combined peak day dry weather flow (PDDWF) for the proposed development as originally calculated and used in the analysis of the sewer system in the master plan was 193 kℓ/d.

The revised PDDWF calculated for the proposed development and used in the re-analysis of the sewer system was 634 kℓ/d with an instantaneous peak dry weather flow (IPDWF) of 10.8 ℓ/s. The design flow, or instantaneous peak wet weather flow (IPWWF), is 15.4 ℓ/s.

2.3 Accommodation of the Proposed Development in the Existing Sewer System

Accommodation of the proposed development, with its revised PDDWF, requires implementation of the following additions and adjustments to the *existing* sewer system as indicated in **Figure 2 (Sewer)** attached:

2.3.1 Sewer Bulk Items

- None.

2.3.2 Sewer Reticulation Items

MP Item No	MP Description	Total Length (m)	Design Flow	Design Flow Unit	Name	New Pipe ND (mm)	Total Cost
SB_F047.00	New Gravity	554	15.4	L/s		200	R 635 700
SB_F039.17	New Gravity	77	122.3	L/s		315	R 213 400
SB_F039.18	New Gravity	62	258.3	L/s		525	R 268 200
SB_F039.19	New Gravity	350	262.9	L/s		450	R 1 052 300
SB_F039.20	New Gravity	854	267.8	L/s		525	R 2 882 400
SB_F039.21	New Gravity	251	268.5	L/s		450	R 769 500
SB_F039.22	New Gravity	556	273.5	L/s		525	R 1 896 900
SB_F039.23	New Gravity	102	298.7	L/s		600	R 462 400
SB_F039.24	New Gravity	625	331.5	L/s		600	R 2 468 000
SB_F039.25	New Gravity	250	339.9	L/s		525	R 886 800
SB_F039.26	New Gravity	1455	356.4	L/s		600	R 5 644 600
SB_F103.01	New Flow Diversion	0	356.4	L/s		0	R 0
SB_F103.02	Alternative Gravity	396	0.2	L/s		600	R 1 588 400
SB_F004.02	New Gravity	759	36.8	L/s		250	R 1 217 200
SB_F004.03	New Gravity	310	37.9	L/s		250	R 519 700

MP Item No	MP Description	Total Length (m)	Design Flow	Design Flow Unit	Notes	New Pipe MR (mm)	Total Cost
RS_F091.03	Alternative Gravity	93	Values	l/s		225	R 146 [illegible]
RS_F091.03	New Pump Station	0	240.4	l/s	Viskplants SA PS	0	R 3 [illegible]
RS_F091.04	Alternative Rising	3431	6.2	l/s	Viskplants SA PS	560	R 21 [illegible]
RS_F091.03	Alternative Gravity	640	240.4	l/s		525	R 2 377 [illegible]
RS_F092.01	New Gravity	640	246.1	L/s		525	R 2 377 [illegible]
RS_F092.07	New Gravity	135	261.7	l/s		450	R 271 [illegible]
RS_F092.03	New Gravity	358	204.2	l/s		475	R 1 [illegible]
RS_F092.04	New Gravity	331	2[illegible]	l/s		450	R 1 [illegible]
RS_F092.02	New Gravity	423	264.1	l/s		525	R 1 561 [illegible]
RS_F092.01	New Gravity	566	273.5	l/s		525	R 2 [illegible]

The proposed connection point to the existing sewer system is shown in **Figure 2 (Sewer)** attached.

In **Figure 2 (Sewer)** attached pipes in future development areas are indicated schematically.

The above Design Flows (or PWWF) and thus pipe sizes were calculated taking cognizance of future developments upstream and downstream of the proposed development. In this regard, sewer pipes must be designed (layout and sizing) to receive design flows from all interconnecting sewer pipes as shown in **Figure 3.3 (Option 3)**.

2.4 Adjustments to the Master Plan

No adjustments to the sewer master plan are required due to the revised PDDWF of the proposed development.

Yours sincerely,

Per: Dr BF Loubser
GLS Consulting

(Report done by: Arlie Viehings)

REQUEST FROM CONSULTANT TO GLS

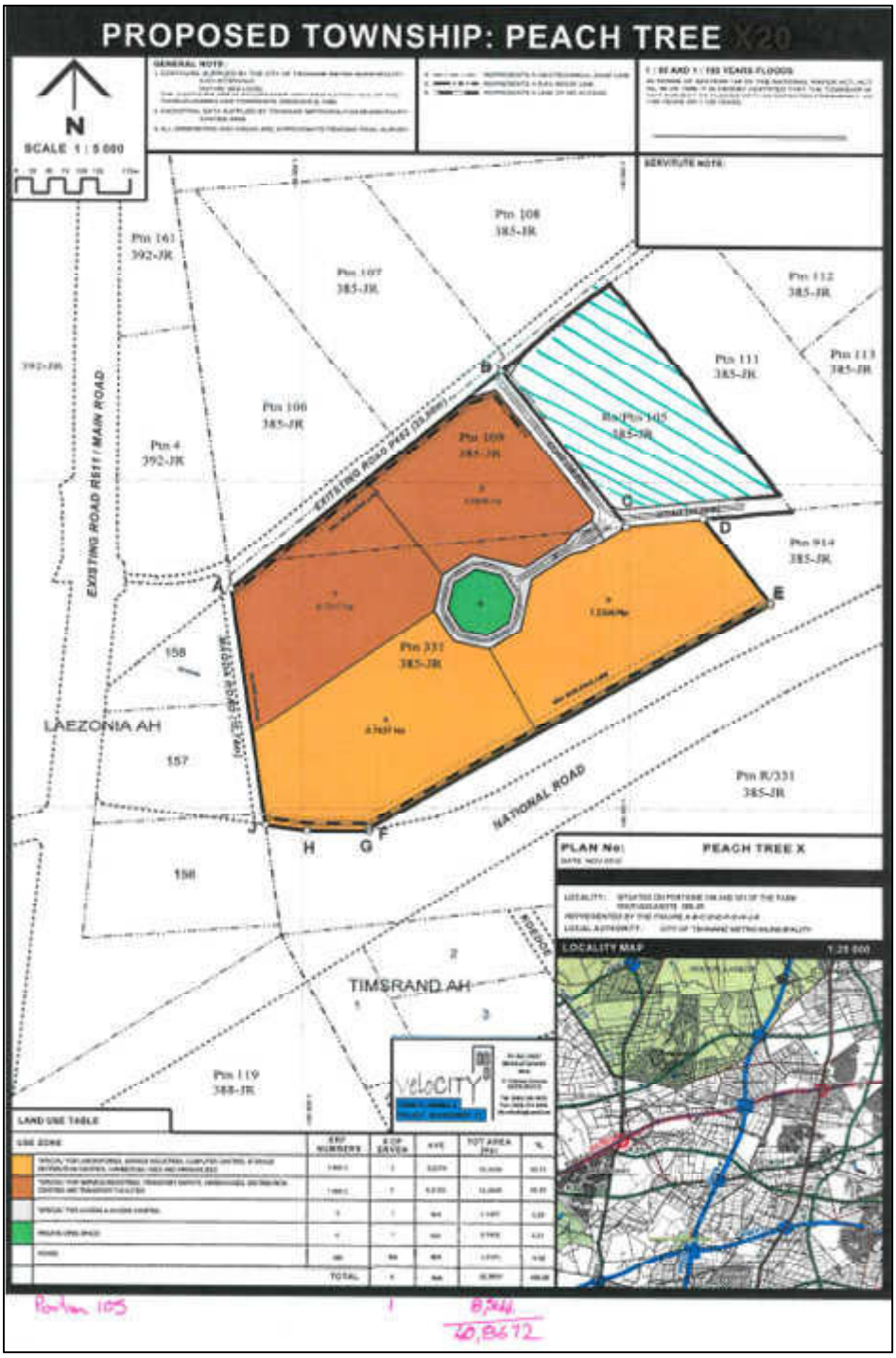
From: Gideon Ras <ras@civilconsult.co.za> Sent: Wed 30/03/2016 09:51
To: Adie Vienings
Cc: 'Leon Wentzel'; 'Civilconsult'; 'Damian Queck'; 'Danie Meintjes'
Subject: RE: Portion 109 and 331 of the Farm Knopjeslaagte 385-JR
Message SKMBT_C224e16031111260.pdf

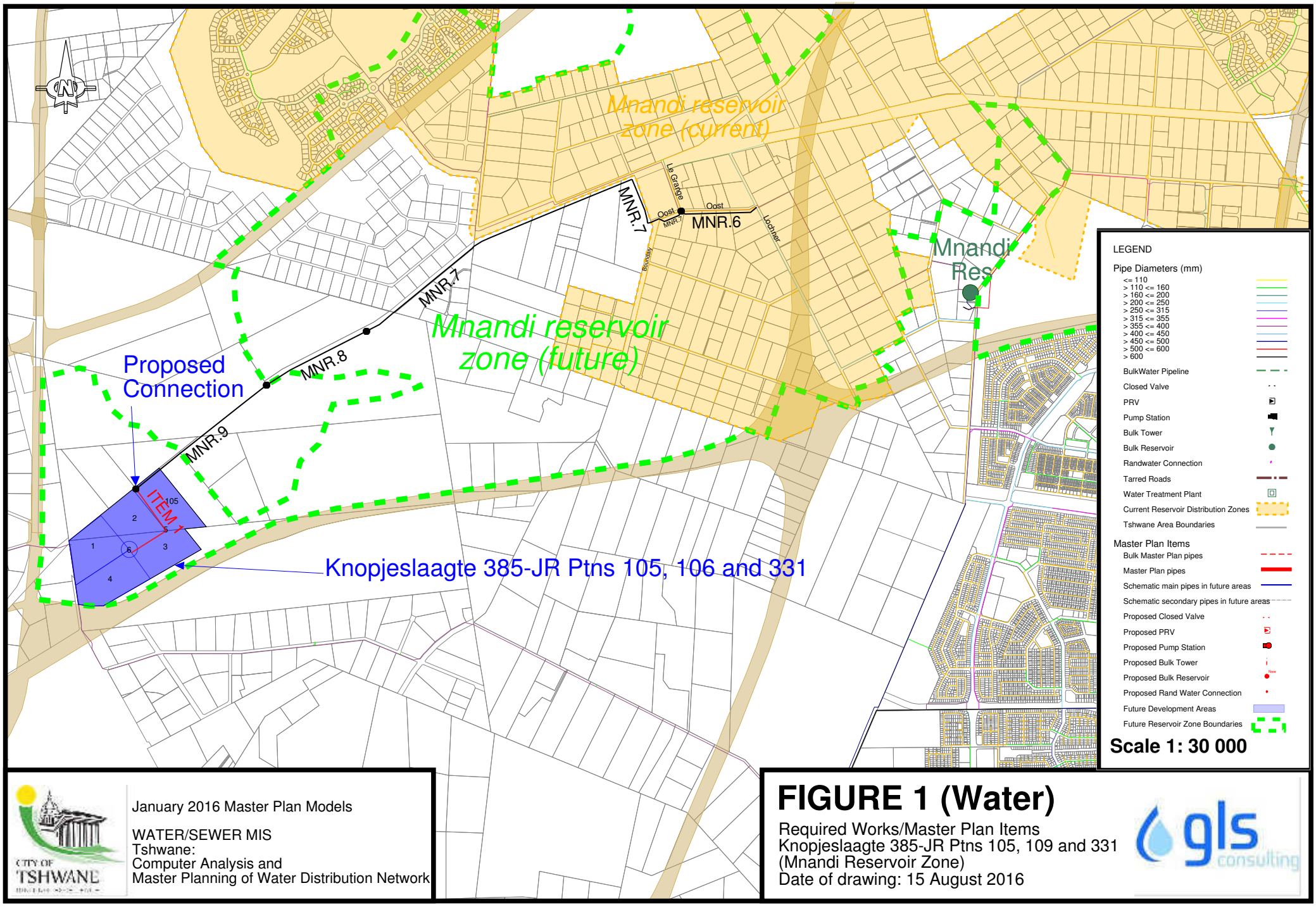
Hi Adie,

Thank you for the feedback.

Please include Remainder of Portion 105 in the analysis/report. The total area is thus approximately 40.8672ha.

Use Zone / Reservation	Erf No.	Area (ha)	FAR / Coverage	Floor Area(m^2)
"Special" for laboratories, service industries, computer centres, storage distribution centres, commercial uses and warehouse		8.5641	0.6	51384.6
"Special" for laboratories, service industries, computer centres, storage distribution centres, commercial uses and warehouse	3 & 4	16.3038	0.6	97820
"Special" for service industries, transport depots, warehouses, distribution centres and transport facilities	1 & 2	12.3905	0.6	74340
"special" for access & access control	5	1.1467	0.6	6880
Private Open Space	6	0.7452	0	-
Roads	N\A	1.7171	0	-


PROPOSED TOWNSHIP: PEACH TREE X20
N
SCALE 1 : 5 000
GENERAL NOTE:
SERVITUDE NOTE:
Ptn 108
385-JR
Ptn 107
385-JR
Ptn 112
385-JR
Ptn 111
385-JR
Ptn 113
385-JR
Rs/Ptn 105
385-JR
Ptn 106
385-JR
Ptn 109
385-JR
Ptn 4
392-JR
Ptn 141
392-JR
EXISTING ROAD R511 / MAIN ROAD
EXISTING ROAD P462 (3.36m)
Ptn 914
385-JR
Ptn 331
385-JR
158
157
156
LAEZONIA AH
TIMSRAND AH
NATIONAL ROAD
Ptn R/331
385-JR
Ptn 119
388-JR
A
B
C
D
E
F
G
H
J
PLAN No:
PEACH TREE X
LOCALITY MAP
1:25 000
LAND USE TABLE
USE ZONE
ERF NUMBERS
OF ERVEN
HA
TOT AREA (Ha)
%
TOTAL
Portion 105
8,344
20,8672



CITY OF TSHWANE

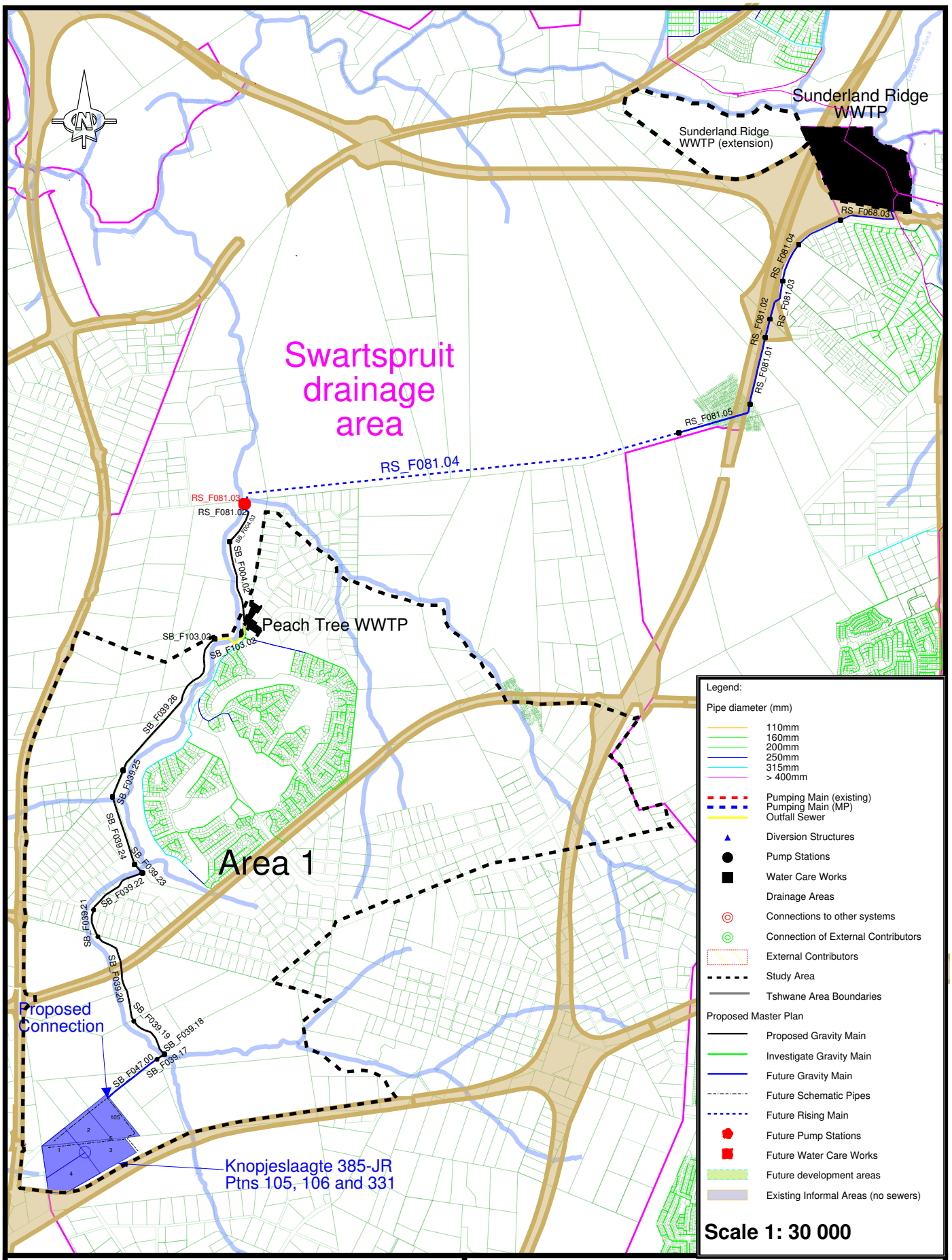
January 2016 Master Plan Models

WATER/SEWER MIS
Tshwane:
Computer Analysis and
Master Planning of Water Distribution Network

FIGURE 1 (Water)

Required Works/Master Plan Items
Knopjeslaagte 385-JR Ptns 105, 109 and 331
(Mnandi Reservoir Zone)
Date of drawing: 15 August 2016

gls consulting



January 2016 Master Plan Models

WATER/SEWER MIS
Tshwane:
Computer Analysis and
Master Planning of Water Distribution Network

FIGURE 2 (Sewer)

Required Works/Master Plan Items
Knopjeslaagte 385JR Ptns 105, 109 and 331
(Swartspruit Drainage Area)
Date of Drawing: 15 August 2016

Option 3:
Interim Vlakplaats 5A PS,
rising main and outfall sewer
to Sunderland Ridge WWTW
(eliminate Peach Tree WWTW)

To Schuveberg WWTW

Area 6

(Cost R 301m)

Erasmia PS

Sunderland Ridge WWTW

Sunderland Ridge WWTW

Area 5

Area 3

Area 4

(Cost R 36m)

Vlakplaats 5A PS

Peach Tree WWTW

Peach Tree

Area 1

(Cost R 62m)

Conn 6

Conn 5

Conn 4

Conn 3

Conn 2

Conn 1

Laezonia AH 1 PS

Area 2

FIGURE 3.3

Swartspruit Drainage Area
Option 3
m2016-04

0 500 1000 1500 2000 m

Scale 1:40000

ADDENDUM F

GEOTECHNICAL INVESTIGATION

ADDENDUM G

TRAFFIC IMPACT STUDY

ADDENDUM H

PREVIOUS APPROVALS - SEWAGE TREATMENT WITH PACKAGE PLANT

AquaPlan Business Park
120 EP Malan Rd.120 Pomona
P.O. Box 14125
Bredell 1623
Gauteng
South Africa
Tel. 011 979 2510
Fax. 011 979 2587
e-mail: enquiries@aquaplansa.co.za

PROPOSAL

600m³/day Waste Water Treatment Plant

E/4998/16-01

Client	: **GFC Consulting**
Contact Person	**:** Gawie Combrinck
Tel No.	: 012 347 6299
E-Mail	: gawiecombrinck@gfc-holdings.co.za
Date	: 14 October 2016
No of Pages	: 14

REVISION SCHEDULE

REV	DATE	DESCRIPTION	ORIGINATOR
A	2016-09-16	Issued for Approval	Taigrine Jones
00	2016-10-14	Issued to Client	Taigrine Jones
01	2016-09-19	Issued to Client	Johan Bieseman

1 INFORMATION FROM THE CLIENT

The client requested a quote for a 600m^3/day sewage treatment plant.

2 PROCESS DESCRIPTION

AquaPlan MBBR:

The AquaPlan MBBR (Moving bed, biofilm reactor) process uses two reactors in series with a final clarification stage to lower the incoming effluent BOD and COD. This is mainly an aeration process during which nitrification occurs. The MBBR process is an excellent process solution that provides excellent BOD reduction, Nitrification, and total reduction of nitrogen removal processes.

The main advantage of this process is the floating media in the reactors which aids the attached growth of micro-organisms. This in turn increases the concentration of MLVSS. Unlike many other sewage treatment systems where the micro-organisms is continually removed from the reactor, the MBBR system is used to retain these organisms, cultivate and grow them to a point where more efficient sewage treatment can be established.

The micro-organisms will be cultivated on AquaPlan special floating media, which provides an excellent substrate for media growth while still ensuring a maintenance free, self-cleansing system.

To further aid in treatment efficiency, all AquaPlan reactors will be fitted with micro bubble or fine bubble aeration to increase oxygen transfer efficiency (SOTE) which in turn saves energy on the blower units.

The process will start with the raw effluent entering into a sump, from which it will be pumped at a continuous rate of 26m^3/h into the MBBR system. Therefore the level inside the inlet sump will fluctuate, but will serve as flow equalisation unit. The raw sewage will enter into the first MBBR in which breakdown of the sewage water will start. All the liquid from this sump, including settleable solids will overflow into the second reactor for further treatment and reduction of BOD and COD. Finally, all liquid and settleable solids will overflow into a clarifier unit. The solids will then sink to the bottom of the clarifier to form a sludge blanket while the product water will overflow from the top of the clarifier.

From the clarifier the water will be pumped into a multimedia sand filter for further polishing and reduction of suspended solids at a rate of 26m^3/h. Thus the flow through the entire process will be kept constant. After filtration the water will bed dosed with sodium hypochlorite for disinfection and will flow into the client storage tank or downstream water system.

Sludge will be drawn from the bottom of the clarifier and a portion of the sludge will be recycled back to the 1st reactor to aid in biological efficiency due to the increased concentration of micro-organism. The remainder of the sludge will be pumped to a sludge collection tank or can be treated with drying beds.

3 TECHNICAL SPECIFICATION AND SCOPE OF SUPPLY:

3.1 INLET CONDITIONS OF DOMESTIC RAW SEWAGE:

bCOD / BOD (ratio)	1.6
BOD_5	240 mg/L
sBOD	80 mg/L
COD	600 mg/L
sCOD	160 mg/L
VSS	200 mg/L
TSS	240 mg/L
Temperature	> 12 ^oC

3.2 OUTLET CONDITIONS OF TREATED WATER

COD	< 75 mg/L
NH_4	< 10 mg/L
TSS	< 25
Nitrate (NO_3)	10 – 20 mg/L

Flow	
Flow rate	600 m^3/day
Treatment duration	24 hours/day
Average flow	25 m^3/h
Flow per reactor	12,5 m^3/h
Design aeration	4 hours contact time
Reactor volume	51,6 m^3
Settling velocity	1,5 m/h
Physical Dimensions:	
Total reactor & clarifier length	12 m
Total reactor & clarifier width	2,4 m
Total reactor & clarifier height	2,8 m
Reactor length	8,3 m

Clarifier length	3,7 m
Total fill volume	74 m^3
Internal	
Floating media	0,15 m^3 fill / m^3 reactor volume
Total fill	8 m^3
Clarifier lamella packs	28 packs
Fine bubble aeration	16 per reactor
Equipment	
Blower	Ecotao
Blower capacity	320 Nm^3/h
Blower pressure	400 mbar
Power usage	5,5 Kw
Submersible pump	Cyclone Industries / Grundfos
Pump capacity	26 m^3/h
Pump pressure	1 bar
Pump rpm	2,400
Pump power usage	2 Kw
Sludge recycle pump	Cyclone Industries / Grundfos
Pump capacity	5 m^3/h
Pump pressure	0,8 bar
Pump rpm	2,400
Pump power usage	0,75 Kw
Product pump	Cyclone Industries / Grundfos
Pump capacity	26 m^3/h
Pump pressure	1,5 bar
Pump rpm	2,400
Pump power usage	1,4 Kw
Electrical	
PLC	Delta

4 SCOPE OF SUPPLY

- 2 off AquaPlan MBBR Unit with air diffuser:
  - Flow rate (combined): 600 m^3/day
  - 12m x 2,4m x 2,8m
  - Includes necessary valves
  - Includes 1 x ultrasonic level detector
  - Fitted with walk way and safety railing
  - Includes 1 x SS304 Aqua Drum (drum screen)
  - Note that the detail design of the exact size of the reactors (size and volume) rests with Aquaplan
- 1 off Auxiliary Skid
  - Control Panel:
    - Delta PLC
    - Delta colour HMI
    - Push button interface for manual override
    - PLC programming
  - Chlorine Disinfection tank (carbon steel)
    - Residence time of 30 minutes
    - Fitted with under draining system for maintenance and sludge removal
    - Includes positive displacement pump to dose the disinfectant
  - Pipework as part of skid:
    - Galvanised mild steel

4.1 COMMISSIONING AND TRAINING:

All Equipment installed on site by AquaPlan will tested for functionality at our workshop. Operators can also be trained as the testing of equipment takes place.

4.2 TREATED EFFLUENT QUALITY

Considering that the raw sewage would be of a domestic nature (not industrial), the following effluent quality, in line with the General standard for Sewage effluent, can be expected:

pH:	5.5 to 9.5
Oxygen absorbed:	< 10
Chemical oxygen demand mg/l:	< 75
Free and saline ammonia (mg/l):	< 10
Suspended solids m/l:	< 25
Soap, oil, grease (with input limit of 40 mg/l)	<2.5 mg/l

Residual chlorine (after 1 hour)	0.1 mg/l
Nitrate (mg/l)	10 – 20 mg/l
E-coli count:	0 per 100ml
Temperature:	below 30°C

Treated effluent can be used for non-crop irrigation purposes or for release into a maturation pond followed by a natural water cycle such as a river.

4.3 Engineering And Standards:

The Engineering and fabrication of the items supplied under this proposal will be in accordance with all the relevant SABS Specifications and manufactured in strict accordance with the AquaPlan quality management system.

4.4 Battery Limits

4.4.1 Start Location

The start location of the battery limit is at the Inlet pipework to the rotating drum screen. The feed pressure required is 2 bar. The client will be required to supply the main incomer cable that will supply power to our centralized control panel. From this point all electrical and instrumentation cable will be supplied by AquaPlan. The piping required up to the flange connection is for the clients account.

4.4.2 End Location

The end location of the battery limit is at the discharge flange of the chlorine contact tank. The handling and disposal of the dried sludge will be for the clients account.

4.4.3 Conclusion

All equipment within this location (as described in the start and end location) will be subjected to the scope of works as described in the scope of supply section.

4.5 Exclusions:

a) Installation – AquaPlan has excluded installation from the scope of work. The AquaPlan team will however advise the client if there are any problems or enquiries during installation. Installation will strictly be done by the client.

b) Scaffolding – AquaPlan will not be responsible for the set-up or removal of any scaffolding.

c) Cranage – AquaPlan will not arrange or pay for hire or use of a crane for transport purposes our premises. If cranage is required, it will be to the cost of the client.

d) Rigging – Rigging has not been included in the quote.

e) Arranging work permits – Transportation of units and on site team is a battery limit, obtaining any work permits, access cards, or vehicle permits required to bring a truck or employees on to site will be the responsibility of the client.

f) Clearance of site – AquaPlan will not do any site work relating to clearing of site so that work can commence.

g) Any civil works – No repair work or construction activities related to the foundation or plinths will be done by AquaPlan on site. All plinths to be provided by the client.

h) Electric components – AquaPlan will not provide any electric cables to supply power to the centralized panel or control system.

i) Operation and maintenance of the plant – AquaPlan will not operate the plant or maintain any part of the plant or clarifiers. If the client required plant operators to be trained on the process and separate quote will be provided.

j) Supply of standby equipment – AquaPlan will not supply any standby pumps or units.

k) Supply and installation of any storage tanks – AquaPlan will not supply any storage tanks other than what is specified in the inclusions.

l) Chemicals – AquaPlan will not provide any chemicals needed for the process.

m) Supply of any spare parts – spare parts such as pumps and plates will not be provided.

n) Supply, installation and testing of all piping.

o) Supply of spare parts list – to be finalised on detailed design.

p) Export documentation – AquaPlan will not provide a cost for export documentation as this quote is bas ex-works.

q) Off-loading and storage from transport.

r) Any item not explicitly mentioned.

s) The inlet raw sewage screen has not been included in our supply. It is however critical that the client considers that this is included, however has not been included in this supply.

t) The inlet balancing tank /or sump has also not been included in this scope of supply.

u) Our supply is a fully functional containerised system that is put down on a concrete plinth system. We have included the complete process as needed- excluding the two points s, and t, above.

v) The excavation and raw sewerage supply into an inlet sump is to be done by the client. The raw sewerage needs to be supplied into the reactor by the client. Once the raw sewerage has been supplied into the reactor, will the Aquaplan system take care of the screened sewage to be treated. Kindly note that a raw sewerage rotating screen is required at the sump, but has not been priced at this point.

w) The client is to provide a disposal point for the treated effluent.

x) The sludge removed periodically from the reactors needs to be Taken away by the client- a sludge tank will be provided- (5000 l)

4.6 Document Deliverable List:

Documents that will be supplied to the client at project design phase:

A)	**Project Initiation Documents**	
A1	Vendor Document Register	(Client)
A2	Tender / Formal Quote and Proposal	(AquaPlan)
A3	Official Order	(Client)
A4	Formal Contract	(AquaPlan / Client)
A5	Proposed Fabrication and Project Schedule	(AquaPlan)
A7	Payment Schedule	(AquaPlan / Client)
A8	Work Breakdown Structure	(AquaPlan)
B)	**Project Progress Documents**	
B1	Monthly Progress Reports	(AquaPlan)
B2	Monthly Updated Fabricated and Project Schedule	(AquaPlan)
C)	**Process Design Documents**	
C1	Process Flow Diagram	(AquaPlan)
C2	Battery Limit Schedule	(AquaPlan)
C3	Piping and Instrumentation Diagram	(AquaPlan)
C4	Functional Design Specifications	(AquaPlan / Client)
C5	Operating and Maintenance Manual	(AquaPlan)
D)	**Mechanical Design Documents**	
D1	Drawing Register (3D & Manufacturing)	(AquaPlan)
D2	Lubrication Schedule	(AquaPlan)
D3	Spare Part / Critical Schedule	(AquaPlan)
D4	Installation and Assembly Procedure	(AquaPlan)
D5	Technical Specification(s)	(AquaPlan)
D6	Engineering Data Book	(AquaPlan)
D7	Inspection Reports	(AquaPlan)
E)	**Electrical Design Documents**	
E1	Electrical Load Schedules	(AquaPlan)

E2	Electrical Equipment Schedule	(AquaPlan)
G)	**Manufacturing Documents**	
G1	Equipment and Bill of Materials Schedule	(AquaPlan)
G2	Manufacturing Procedures	(AquaPlan)
G3	Welding Documentation	(AquaPlan)
G4	Manufacturing QC Plan	(AquaPlan)
H)	**Project Completion Documents**	
H1	Final Release and handover certificate (C1-C6)	(AquaPlan / Client)
H2	Client Hand Over Documentation	(AquaPlan / Client)

5 PROJECT COSTING

5.1 COST BREAKDOWN

Item	Description	Qty	Unit	Amount Ea	Total
1	Engineering & Design	1	Sum	R 72 000,00	R 72 000,00
2	Inlet Works and connecting pipeworkEquipment – part of the reactors	1	Sum	R 320 000,00	R 320 000,00
3	600m^3/day MBBR System (2 off reactor containerised)	1	Sum	R 3 685 000,00	R 3 685 000,00
4	Auxiliary Skid & Electrical	1	Sum	R 530 700,00	R 530 700,00
5	Transport to site	1	Ea.	R 69 450,00	R 69 450,00
6	Commissioning	1	Sum	R 21 500,00	R 21 500,00
				Sub Total A (Ex-Works and Excl. Vat)	R 4 698 650,00
7	Project Management, Quality Assurance and Control	4,00%	% of Sub Total A	R 187 946,00	R 187 946,00
8	Health and Safety Overheads	3,00%	% of Sub Total A	R 140 959,50	R 140 959,50
9	Data Books Cost	1,20%	% of Sub Total A	R 56 383,80	R 56 383,80
10	P&G's, Head Office Overheads and Engineering Cost	6,80%	% of Sub Total A	R 319 508,20	R 319 508,20
				Total (excl. VAT)	**R 5 350 447,50**

5.2 TERMS OF PAYMENT:

The following terms will be adhered to:

- 30% of total contract value upon confirmation of order.
- 20% upon verification of cast numbers/MTC's or material delivery to site.
- 30% upon mechanical completion (before shipping).
- 15% upon delivery to site.
- 5% on completion of commissioning.
- All invoices to be settled within 7 day from invoice date.

6 COMMERCIAL CONDITIONS

6.1 CONDITIONS OF PROPOSAL:

This proposal is based on AquaPlan's Standard Conditions of Contract and Sale, which are described below.

6.2 PROJECT COST AND PRICE BASIS:

The Project Cost will be fixed and firm for an order placed within the validity period, to the amount in the ZAR currency.

Prices are comprehensive and cross-subsidised; no take out prices accepted.

6.3 VALIDITY:

This proposal remains valid for a period of thirty (30) days from date hereof, after which it will become subject to confirmation or re-negotiation.

6.4 WARRANTY:

All equipment supplied by AquaPlan in terms of this offer, will be fully guaranteed against faulty design or defective workmanship.

The guarantee will be for a period of thirteen (13) months from date of delivery of such equipment, or twelve (12) months from the date of commissioning of the complete system, whichever occurs first.

AquaPlan will not be held responsible to comply with the above stated guarantee in the event where equipment has been altered, or repaired, without our knowledge, or any damage caused by others to our equipment, or system, by improper operation, misuse, abuse, negligence, accidents. This will also apply in the event where the plant is expected to perform outside of the original design specification

6.5 PROJECT PROGRAM:

The Project will be executed in accordance with the current Project Program. We will require approximately **fourteen (14) to sixteen (16) weeks (depending on material availability and workshop load)** at receipt of official order, to complete the work.

6.6 TERMINATION OF CONTRACT:

Should the Contract be terminated by the Purchaser after placement of an official order, for any reasons that are not the responsibility of AquaPlan, damages that may be suffered arising out of such termination, will be charged to the Purchaser.

6.7 RATES OF EXCHANGE VALUES:

1 US$ - R 14.00 (ZAR)

6.8 LAW OF COUNTRY:

South African Law to apply for this Contract

6.9 OUT OF SCOPE COST

Delayed or Additional Time:

The client bill for days exceeding the contract will be charged at the individual daily rate for those required to stay onsite until project completion as outlined in table below:

Discipline	Rate ZAR/hr	Discipline	Rate ZAR/hr
Design engineer	R 785,00	Senior Draughtsman	R 525,00
Project consultant	R 635,00	Drawing office administration	R 285,00
Project manager	R 785,00	Snr design draftsman - civil	R 635,00
Project Assistant / technician	R 277,00	Checker civil	R 285,00
Project Engineer	R 525,00	Commissioning manager	R 785,00
Engineering manager	R 785,00	Workshop Manager	R 635,00
Packager engineer	R 525,00	Quality Engineer	R 525,00
Lead process Engineer - design	R 785,00	Safety officer	R 285,00
Senior process engineer	R 635,00	Housekeeping superintendent	R 264,00
Process engineer	R 525,00	Planner	R 396,00
Lead Mechanical Engineer - design	R 785,00	Store manager	R 525,00
Senior Mechanical engineer	R 635,00	Store officer	R 285,00
Mechanical engineer	R 525,00	Procurement officer	R 330,00
Lead Electrical Engineer - design	R 785,00	Driver - LDV	R 158,00
Senior Electrical engineer	R 635,00	Driver - code 18	R 285,00
Electrical engineer	R 525,00	Welder	R 180,00
Lead Civil Engineer - design	R 785,00	Welder - coded	R 285,00
Senior Civil engineer	R 635,00	Boilermaker	R 285,00
Civil engineer	R 525,00	Assistant	R 95,00
Lead C&I Engineer - design	R 785,00	Semi-skilled	R 120,00
Senior C&I engineer	R 635,00	Pipe fitter	R 285,00
C&I engineer	R 525,00	Electrician (Gov. ticket)	R 397,00
Lead Piping Engineer - design	R 785,00	Electrical assistant	R 195,00
Senior Piping engineer	R 635,00	Machine operator	R 285,00
Piping engineer	R 525,00	Forklift driver	R 145,00
Departmental manager - Process	R 785,00	Painter	R 105,00
Departmental manager - Mechanical	R 785,00	Labourer	R 85,00
Departmental manager - Piping	R 785,00	Brick-layer	R 85,00
Departmental manager - Civil/structural	R 785,00	Plasterer	R 85,00

Departmental manager - C&I	R 785,00	Concrete technologist	R 285,00
Departmental manager - Electrical	R 785,00	Tiler	R 120,00
Departmental drawing office manager	R 635,00	Site Supervisor	R 525,00
All subsistence will be reimbursed per person per day spent on site			R 450.00

Appendix G6

Traffic Impact Study

TRAFFIC IMPACT STUDY

Portions 105, 109 & 331 of the Farm Knopjeslaagte 385 JR

May 2016

route 2

transport strategies

po box 67823 highveld 0169
fax: + 27 (12) 665 1011 or 086 667 6883
cell: +27 (82) 814 2230
jac.botha@route2.co.za

CESA

TABLE OF CONTENTS

Page

FIGURES

ANNEXURES

1 INTRODUCTION

Route^2 – Transport Strategies have been appointed to undertake a Traffic Impact Study for the proposed Commercial and Light Industrial development on Portions 105, 109 & 331 of the Farm Knopjeslaagte 385 JR. The site located to the north of the N14 and south of the R114 (M34).

The Site

2 SCOPE OF THE REPORT

The purpose of this report is to identify the traffic impact that would be generated by the proposed development on the surrounding road network. The study area, development trip generation, trip distribution, capacity analysis and site access requirements are assessed in the report. Recommendations are also made in terms of public transport.

2.1 Study Area

The extent of the study area is driven by an estimation of the traffic generated by the proposed development and the intersections likely to be affected by the additional traffic. The development is expected to generate +/- **840** peak hour trips, therefore a traffic impact study is required.

The study includes the intersections of:

1. R511 and R114 (M34) – priority controlled.
2. R114 and Access Road – proposed signals.

2.2 Roads Affected

R511 (P39-1)

The R511 is a Class 2 road and was recently upgraded all the way to Erasmia. This road is also the future K46 with intersection spacing of 600m.

R114 (P102-1)

The R114 (M34) is a Class 2 road. This road is a normal provincial road and should have intersection spacing of 600m.

2.3 Peak Hours Analysed

Peak morning and afternoon traffic counts were conducted on Tuesday 24 May 2016 at the intersections mentioned above.

The existing weekday AM (07:00 – 08:00) and PM (16:00 – 17:00) peak hour traffic volumes are summarised in **Figure 2**.

2.4 Assessment Scenarios

To determine the likely impact of the additional traffic on the network the following three scenarios were analysed:

- **Existing 2016** AM and PM peak hour flows;
- **Base 2017** AM and PM peak hour flows with development traffic; and
- **Future 2021** traffic.

3 PROPOSED DEVELOPMENT

This traffic impact study is in support of the Rezoning Application for Commercial and Light Industrial use. The following development controls are applied for as per **Table 1** below.

Table 1: Development Controls

Township	Land Use	Potential Size
Portions 105, 109 & 331 Farm Knopjeslaagte	Commercial & Light Industrial (36 hectares @ FAR 0.5)	140 000m^2 GLA

4 DEVELOPMENT TRAFFIC

4.1 Trip Generation

The trip generation for the development was derived using the new COTO trip Manual for Manufacturing.

The predicted peak hour traffic to and from the site is summarised in **Table 2** below.

Table 2: Peak Hour Trip Generation

Peak Hour	Land Use	Trip Rate	Split	New Trips	
				IN	OUT
Weekday AM	Manufacturing (140 000m^2)	0.6	80:20	672	168
Weekday PM	Manufacturing (140 000m^2)	0.6	80:20	168	672

4.2 Trip Distribution

The following distribution was used as summarised in **Figure 3**:

- 20% from the north along the R511.
- 40% from the south along the R511.
- 40% from the east along R114 (M34).

Figure 3 illustrates the assumed trip distribution for the development traffic while **Figure 4** illustrates the **Base 2017** traffic with the additional development traffic and an expected 5% growth in background traffic.

5 TRAFFIC IMPACT & CAPACITY ANALYSES

5.1 Assessment Criteria

The intersections have been analysed using aaSIDRA traffic analysis software. SIDRA is a computer program that provides a number of performance measures including v/c ratios, delays, level of service (LOS), etc.

When elements of a road network such as intersections are analyzed, their operating conditions are described in terms of LOS. The six letters from A to F are used to indicate different LOS. LOS A indicates very light traffic with correspondingly low delays. LOS E reflects capacity conditions, with high delays and unstable flow. LOS F reflects conditions where traffic demand exceeds capacity and traffic experiences congestion and delays. Generally LOS A to D is considered acceptable in accordance with international standards. LOS E and F on the other hand are deemed unacceptable.

A further measure of the operating conditions prevailing at any one point in a road network is the volume to capacity ratio (v/c). As the name implies it is the traffic demand volume divided by the available capacity of the roadway element. Generally ratios of up to approximately 0.9 are internationally deemed acceptable.

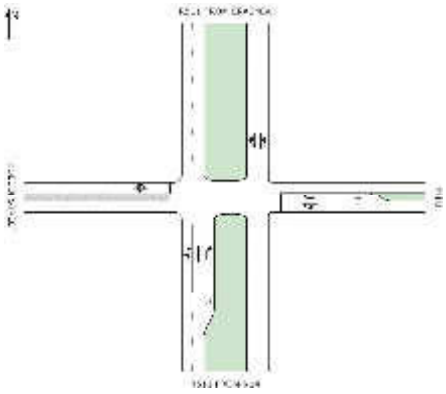
Results of the aaSIDRA capacity analyses at the intersections are discussed in the following sub sections, with details of the outputs enclosed in **Annexure A**.

5.2 Background Traffic

The analysis results of the background traffic with development traffic includes a 5% growth per annum. At this stage there is no approved latent rights in the area.

5.3 R511 and R114

Priority Controlled



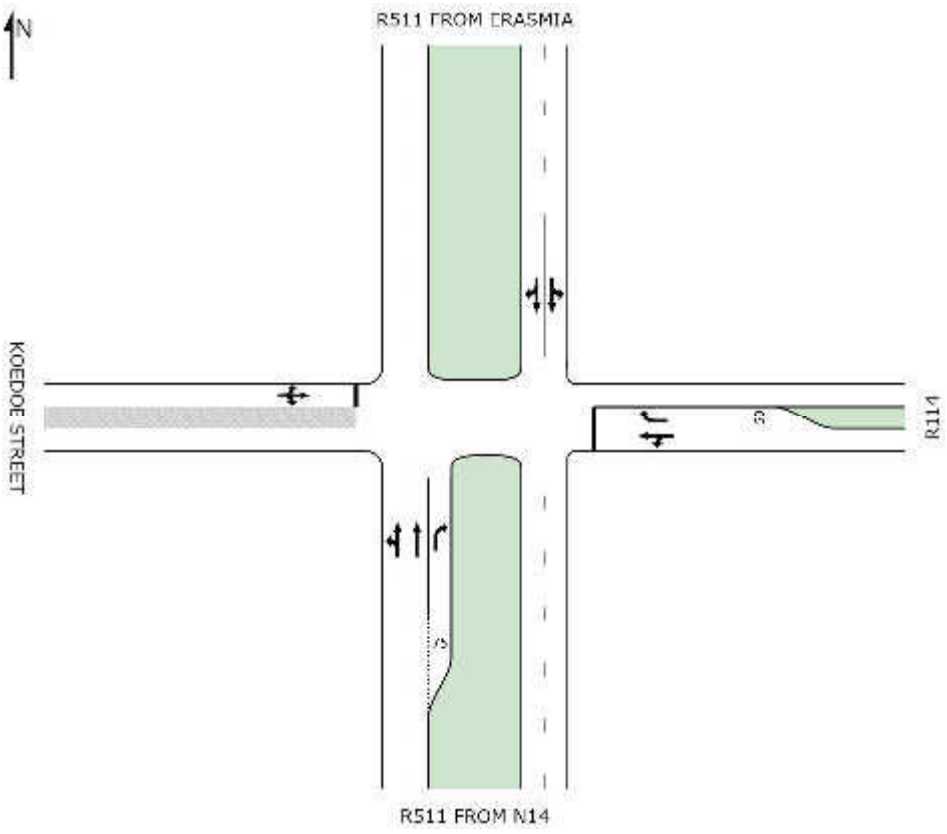
Results of Analysis:

Scenario	AM Peak Hour					PM Peak Hour				
	NB	WB	SB	EB	TOTAL	NB	WB	SB	EB	TOTAL
Existing 2015	**N/A** (34.2) {>1.0} [>120]	**F** (>120) {>1.0} [>120]	**N/A** (1.0) {0.36} [0.00]	**F** (>120) {>1.0} [66.1]	**N/A** (>120) {>1.0} [>120]	**N/A** (2.7) {0.23} [6.4]	**F** (92.1) {>1.0} [>120]	**N/A** (1.9) {0.15} [0.00]	**E** (40.8) {0.09} [1.6]	**N/A** (21.2) {>1.0} [>120]
Base 2017 + Development + Signals + Upgrades	**C** (20.4) {0.81} [108.8]	**C** (22.3) {0.85} [81.6]	**C** (26.5) {0.85} [114.3]	**C** (29.7) {0.17} [13.2]	**C** (23.1) {0.85} [114.3]	**C** (29.0) {0.69} [73.9]	**B** (12.8) {0.65} [45.8]	**B** (19.1) {0.43} [46.1]	**B** (12.0) {0.01} [1.1]	**C** (20.7) {0.69} [73.9]
Future 2021	**C** (22.3) {0.96} [>120]	**C** (25.8) {0.96} [82.2]	**D** (38.8) {0.94} [>120]	**C** (33.4) {0.20} [14.7]	**C** (29.8) {0.96} [>120]	**C** (26.6) {0.66} [86.2]	**B** (14.3) {0.69} [52.9]	**B** (18.0) {0.44} [53.2]	**B** (13.5) {0.01} [1.3]	**C** (20.2) {0.69} [86.2]

Legend	
A	Level of Service
(12.7)	Delay in Seconds
{0.95}	Volume / Capacity
[20]	Longest Average Queue in meters

For the **Existing 2016** scenario the analysis indicates that the intersection operates with major delays along the R114 approaches. To mitigate this traffic signals are proposed which has being proposed and is Warranted as per Warrant 1 of SARTSM. The signals are proposed since it is a direct result of the existing traffic volumes and not the additional development traffic.

With including the development traffic by **2017 & 2021** the intersection operation will improve considerably with the proposed traffic signals. The proposed layout is shown below with an additional northbound right turning lane.


N
R511 FROM ERASMIA
KOEDOE STREET
R114
R511 FROM N14

5.4 R114 and New Access Road

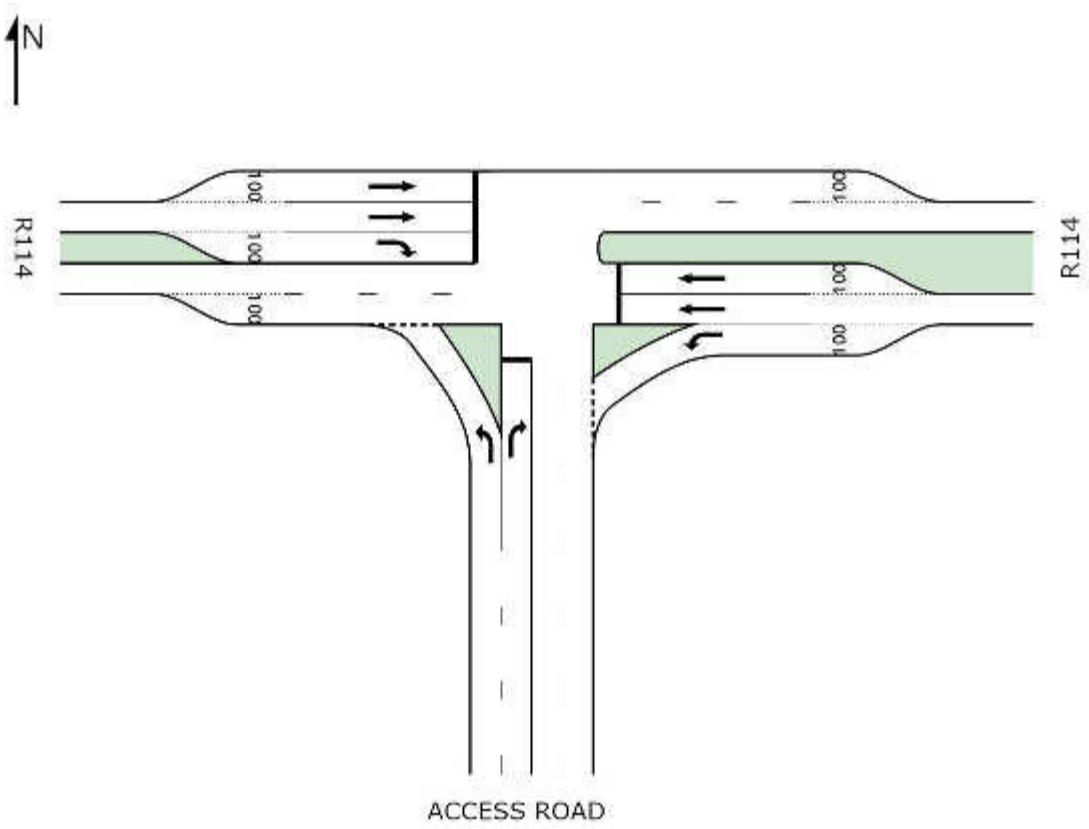
Proposed Signals

Results of Analysis:

Scenario	AM Peak Hour					PM Peak Hour				
	NB	WB	SB	EB	TOTAL	NB	WB	SB	EB	TOTAL
Base 2017 + Development + Signals	C (33.9) {0.74} [31.5]	B (12.6) {0.75} [111.7]		B (13.8) {0.75} [>120]	B (14.6) {0.75} [>120]	B (17.2) {0.46} [57.8]	B (19.4) {0.47} [55.6]		B (15.3) {0.28} [38.2]	B (17.3) {0.47} [57.8]
Future 2021	D (45.6) {0.71} [29.9]	A (4.8) {0.55} [83.1]		A (11.6) {0.72} [50.7]	A (10.3) {0.72} [83.1]	C (21.3) {0.51} [76.1]	B (17.9) {0.49} [64.4]		C (22.0) {0.43} [55.4]	C (20.4) {0.51} [76.1]

Legend	
A	Level of Service
(12.7)	Delay in Seconds
{0.95}	Volume / Capacity
[20]	Longest Average Queue in meters

For the **Base 2017 and Future 2021** scenarios the analysis indicates that the intersection operates with an acceptable LOS during the peak hours analysed if signalised. The proposed layout is illustrated below:



5.5 Concluding Remarks

Based on our site observations, the existing and base traffic volumes shown in the figures, as well as the above capacity analyses, it is concluded that the proposed development traffic will have some impact on the weekday AM and PM peak hour intersection capacities and therefore it is proposed that the R114 and Access Road to the development is signalised.

6 ACCESS REQUIREMENTS

6.1 Access Location

Access to the proposed development will be from a 25m wide road linking from the R114. The access road should have two lanes in and two lanes out.

6.2 Sight Distance & Intersection Spacing

The proposed access road will be located 600m from the R511 and R114 intersection which is in line with the Gautrans spacing requirements.

7 ACCESS TO PUBLIC TRANSPORT

7.1 Background

In terms of the "National Land Transport Act" (NLTA) (Act No.5 of 2009), it is required that an assessment of public transport be included in traffic impact studies. The following comments are relevant.

7.2 Public Transport

The following public transport facilities are recommended:

- ***The implementation of bus and minibus-taxi lay-bys on both sides of the R114 at the Access Road intersection.***

The following is proposed for pedestrians:

- ***Construction of a 1,5m wide sidewalk along the Access Road from the R114.***

8 CONCLUSION

Route 2 – Transport Strategies was appointed to prepare a Traffic Impact Study in support of the development of Portions 105, 109 & 331 Farm Knopjeslaagte Township.

The development is expected to generate 840 peak hour trips during the peak hours. The capacity analysis indicates that the intersection of the R511 and R114 needs to be signalised as a result of background traffic and the intersection of the R114 and Access Road should be signalised with the necessary turning lanes being constructed to Gautrans Standards.

The following is proposed and can be concluded:

- ***Provision of 1,5m wide sidewalk along the Access Road from the R114***.
- ***The access road should have two lanes in and two lanes out.***
- ***The implementation of bus and minibus-taxi lay-bys on both sides of the R114 and Access Road intersection.***
- ***Upgrading of the R511 and R114 intersection with signals, an additional northbound right turning lane, a southbound left turning slip lane and additional westbound turning lanes.***

Figures