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TECHNICAL REPORT FOR CIVIL ENGINEERING SERVICES

FOR

MEULENZICHT LANDGOED DEVELOPMENT, GEORGE

APRIL 2025

REVISION 0

COMPILED FOR:

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Table of Contents

ANNEXURES:

REPORT DETAILS:

Lyners Reference No:	C24051/AA
Client	Atterbury (Pty) Ltd
Report prepared by:	F van Eck, G Wallace
Client representative	J Prinsloo, G van den Berg
Revision record and date	Revision 0
Keywords	Civil Services Report, Meulenzicht Landgoed

DISCLAIMER

1. INTRODUCTION

Atterbury (Pty) Ltd appointed Neil Lyners & Associates (Pty) Ltd (hereafter referred to as Lyners) to compile a civil engineering services report for the Meulenzicht Landgoed Development in George.

The report will deal with the following matters:

- The availability of civil engineering services;
- Planning of the civil engineering services.

The various developments will consist of the following land uses:

- Residential Zone II and III;
- Open Spaces;
- Agricultural.

2. AVAILABLE INFORMATION AND INVESTIGATIONS

The following information was available to us for the investigation:

- Sub-division plan (revision P) received from Nuvorm on 14 April 2025 (See **Annexure A**);
- Existing services information received from George Municipality and GLS (See **Annexure B**);
- Detail and topographic survey of the entire property completed in November 2024;
- Geotechnical conditions from preliminary geotechnical soil investigation (See **Annexure G**).

3. LOCATION OF THE WORKS

The proposed development, Meulenzicht Landgoed, are located on Erf 25537, situated north of the National Route 2 (N2) and east of Urbans Boulevard, between the Modderrug River and the Swart River.

The site is easily accessible via Urbans Boulevard, a formal surfaced road. The GPS coordinates for Meulenzicht Landgoed are 33°59'12.31"S, 22°31'21.69"E.

4. SITE TOPOGRAPHY, DRAINAGE AND VEGETATION

The development area is situated at elevations ranging from approximately 213m to 172m above mean sea level (MSL). The site is predominantly covered with grassland, with clusters of trees concentrated in the lower-lying areas. It is surrounded by a variety of land uses, including residential developments, commercial developments and agricultural activities.

Natural drainage patterns direct surface water toward existing watercourses, which ultimately meet with the Swart River along the eastern boundary of the site.

5. HYDROLOGY AND CLIMATE

The Mean Annual Precipitation used for the preliminary investigation is 850mm per annum for the George area.

6. TRAFFIC IMPACT ASSESSMENT

ITS (Pty) Ltd was separately appointed by the Developer to investigate and comment on the concept Site Development Plan (SDP) as well as the expected transport related impacts of the proposed development on the surrounding road network. A copy of their report is provided in **Annexure F**.

7. EXTERNAL SERVICES

GLS Consulting Engineers was appointed by George Municipality to assist the Municipality as Water Services Authority with the master planning for water and sewer services in the George area. The proposed development footprint forms part of the Kraaibosch master plan.

The updated GLS drawings in **Annexure B** indicate the existing and proposed external (bulk) water and sewer services reticulations as obtained from the various authorities and reports. This drawing will be updated during future planning and final design phases.

7.1 Water

The local authority appointed GLS as the master planning consulting engineers for the investigation of the bulk water supply infrastructure.

The water Annual Average Daily Demand will be as per Guidelines (Red Book) standards and as discussed in the GLS correspondence (see **Annexure B**). Table 1 below indicates the water Annual Average Daily Demand (Based on the similar developments' historic consumption in the area):

Table 1: Annual Average Daily Demand for Water

Land Use	Unit of Measure (No/100m2/ha)	No. Units (No/100m2/ha)	UWD/Unit (kL/unit/d)	AADD Inc. UAW (kL/d)	Phase
Phase 1					
Residential (George & Wilderness) - Low density, large sized Residential stands	unit	83	0.938	77.81	B1
Sub-Total:		**153**		**77.81**	
Phase 2					
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	49	0.813	39.81	B2
Sub-Total:		**139**		**39.81**	
Phase 3					
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	25	0.813	20.31	B3
Sub-Total:		**79**		**20.31**	
Phase 4					
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	70	1.125	78.75	B4
Sub-Total:		**97**		**78.75**	
Phase C					
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	50	1.125	56.25	C
Sub-Total:		**50**		**56.25**	
Total for all Phases (kL/d):				**272.94**	
Allow for additional 10% future demand from neighboring properties		**10%**		**27.29**	
Total (kL/d):				**300.23**	

The total Annual Average Daily Demand will therefore be 300.23kL/day (3.5l/s) with a peak demand of 16.1l/s.

Water Treatment Capacity

The following treatment capacity of the existing infrastructure are confirmed in the GLS report (see **Annexure B**) and the George Municipality capacity letter (see **Annexure E**):

- The George Municipal Water Treatment Works (old and new) is currently operating under constraint;

- 20Ml/day capacity upgrade of the new treatment works is in progress with an estimated completion date of February 2025;
- The treatment works will have sufficient capacity for the development in its entirety once the 20Ml/day capacity upgrade is commissioned.

Bulk Pipelines and Pump Stations

The development falls within the George Main Zone and Kraaibosch reservoir zone.

- George Main zone: The reservoirs and bulk pipelines currently have sufficient capacity to service the development;
- Kraaibosch reservoir zone: The zone has sufficient capacity with the current theoretical demand, but insufficient capacity in the theoretical fully occupied demand, and cannot support the full development, i.e. the implementation of the next reservoir (2Ml) is required to service the full development.

Connection Proposals

The technical report by GLS (see **Annexure B**) included 2 proposals for connection to the water network / system, which includes the master plan system and an interim solution.

- Interim solution proposal: To install an interim PRV connection on the existing 250mm Ø George main pipeline. The interim solution (refer to section 3.4.3 and 3.5.3 of the GLS technical report) is not accepted by George Municipality as a solution for this development and will not be considered further;
- Master Plan proposal: To service the Kraaibosch development node, the master plan includes the construction of a future 4Ml reservoir and tower. The current tower has sufficient capacity to service the development, however the future 4Ml reservoir will require construction to service the development. The municipality confirmed that the 4Ml can be replaced with two 2Ml reservoirs. For the development only one 2Ml reservoir will be built and provision will be made in terms of land area for a future 2Ml reservoir. See **Annexure E** for correspondence from George Municipality.

The current supply pipes to and from the existing reservoir and water tower will be relocated to the proposed road reserves as requested by the George Municipality. See **Annexure D**, drawing 24051-C-004-01.

7.2 Sewerage

The local authority appointed GLS as the master planning consulting engineers for the investigation of bulk sewer infrastructure.

The sewer Peak Daily Dry Weather Flow will be as per Guidelines (Red Book) standards and as discussed in the GLS correspondence (see **Annexure B**). Table 2 below indicates sewer Peak Daily Dry Weather Flow:

Table 2: Peak Daily Dry Weather Flow for Sewer

Land Use	Unit of Measure (No/100m2/ha)	No. Units (No/100m2/ha)	UWD/Unit (kL/unit/d)	Sewer Ratio (% x UWD)	PDDWF Excl. Infilt. (kL/d)	Phase
Phase 1						
Residential (George & Wilderness) - Low density, large sized Residential stands	unit	83	0.938	49%	38.13	B1
Sub-Total:		**153**			**38.13**	
Phase 2						
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	49	0.813	54%	21.50	B2
Sub-Total:		**139**			**21.50**	
Phase 3						
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	25	0.813	54%	10.97	B3
Sub-Total:		**79**			**10.97**	
Phase 4						
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	70	1.125	45%	35.44	B4
Sub-Total:		**97**			**35.44**	
Phase C						
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	50	1.125	45%	25.31	C
Sub-Total:		**50**			**25.31**	
Total for all Phases(kL/d):					**131.35**	
Allow for additional 10% future demand from neighboring properties		**10%**			**13.13**	
Total (kL/d):					**144.48**	

The total Peak Daily Dry Weather Flow will therefore be 144.48kL/day (1.7l/s) with a peak demand of 4.25l/s.

Wastewater Treatment Capacity

The following wastewater treatment capacity of the existing infrastructure are confirmed in the GLS report (see **Annexure B**) and the George Municipality capacity letter (see **Annexure E**):

- The Outeniqua Wastewater Treatment works currently has sufficient capacity to support the development.

Bulk Pipelines and Pump Stations

The development falls within the Outeniqua WWTW drainage area.

- The development falls within the future Kraaibosch 3 pump station drainage area. The infrastructure, refer to Figure 2 in the GLS technical report (see **Annexure B**), required to convey sewage of the proposed development to the south and west has not been implemented;
- Bulk conveyance infrastructure (pipelines and pump stations) will require implementation by the developer to connect to the Municipal sewer network if the developer want to proceed with the option to connect to the existing sewer network.

Connection Proposals

The technical report by GLS (see **Annexure B**) includes 3 proposals for connection to the sewer network / system, which includes the master plan system and 2 interim solutions.

- Interim solution proposal 1: The proposal includes the building of Kraaibosch 3 PS. The sewage generated from the development will gravitate to Kraaibosch 3 PS and from there the sewage will be pumped to Kraaibosch PS. The interim solution (refer to section 4.3.2, 4.3.4, 4.4.1 of the GLS technical report report) are not accepted by George Municipality as a solution for this development and will not be considered further;
- Interim solution proposal 2: The proposal includes the building of 3 internal small pump stations (Kraaibosch Ridge PS 2 to Kraaibosch Ridge 4 PS). The sewage generated from the development will gravitate to the 3 small pump stations and from there the sewage will be pumped to Kraaibosch PS. The interim solution (refer to section 4.3.2, 4.3.4, 4.4.1 of the GLS technical report report) are not accepted by George Municipality as a solution for this development and will not be considered further;
- Master Plan proposal: The proposal includes the implementation of the master plan solution, and that all sewage from or generated by the proposed development be conveyed via the system from Kraaibosch 3 PS to Thembalethu 6 PS via Kraaibosch 4 PS and Destiny Africa PS as indicated on Figure 2 in the GLS technical report.

George Municipality has further made 2 alternative connection proposals for the development namely (See **Annexure E**):

- Alternative proposal 1: The developer will be permitted to construct a conservancy tank, where practically possible to service parts of the development, in lieu of a connection to the Municipal network, and a discharge permit shall be issued permitting discharge of sewage at the Outeniqua WWTW. Due to the extent of the development the proposal is not practical but could be considered for very limited parts of the development, subject to the approval of the Municipality and the Developers capacity to service the conservancy tanks;
- Alternative proposal 2: Alternatively, design, implement, operate and maintain an on-site wastewater treatment package plant. The Developer should however note the requirements in terms of the National Water Act and registration as a Water Services Intermediary with the Municipality for compliance monitoring. The Developer should note that this proposal includes the added advantage of treated effluent that could potentially be used for non-potable use that will reduce the potable water demand.

  Refer to **Annexure C** for the sewer package plant technical report from Alveo Water. The treated effluent will either be discharged into the existing watercourse or reused for irrigation purposes on the open green spaces. A copy of the correspondence from George Municipality confirming the option of a sewer package plant is included in **Annexure E**.

Alternative proposal 2 of George Municipality will be the Developer's preferred option for dealing with the internal sewage of the development.

7.3 Stormwater Drainage

The natural drainage patterns of the site channel the surface water flow towards existing watercourses situated in two valleys running through the centre of the two areas, which ultimately meet with the Swart River along the eastern boundary of the site. The natural drainage direction of the site will be incorporated in the internal network's detail design phase.

Existing stormwater infrastructure on the proposed development footprint consist of 450mm Ø stormwater pipes adjacent and crossing Urbans Boulevard road and Stormwater portal culverts crossing Urbans Boulevard road. The proposed development will not be connecting onto the existing 450mm Ø stormwater pipe network. The capacity of the existing stormwater culverts will be verified during detail design phase and will be upgraded if needed. The existing stormwater dam on Meulenzich Landgoed may be utilised as a 'wet" stormwater retention pond.

Annexure H contains a detailed Stormwater Management Plan for the development.

7.4 Access

Permanent access to Meulenzicht Landgoed development will be from newly built roads connecting via a proposed traffic circle onto the existing road Urban Boulevard which connects to the N2 highway.

During the construction phase, construction vehicles will make use of the temporary construction access road.

The TIA attached as **Annexure F** describes the requirement of a bridge over the Modderrig river in future when future areas to the east and south of Meulenzicht Landgoed develop.

8. INTERNAL SERVICES

The design of internal services will be done in accordance with the "Human Settlements Planning and Design Guideline ('i.e., Red Book)", along with George Municipality Civil Engineering Standards and Requirements for Services.

8.1 Roads

In general all internal roads will have a 12m or 14m wide road reserve with a 5.5m or 6.4m wide road. Road surfaces will be asphalt roads or interlocking paved roads with a 1.5m wide concrete or paved sidewalk. The different road surface finishes are subject to the final design. The kerb on the high side of the road will consist of a MK10 mountable kerb while the lower side will allow for a CK5 channel and mountable kerb to accommodate stormwater from the road surfaces. The proposed typical road cross section is shown on drawing 25041-C-002-201 in **Annexure D**.

The structural design period for all pavement layers will be 20 years. Structural design of layers will be in accordance with the TRH4 and the "Red Book" requirements.

The following pavement structures are envisaged, but are subject to final design:

Asphalt Roads

- 30mm and 35mm Medium continuously graded asphalt compacted to 93% maximum void less density;
- 150mm G4 Base course compacted to 98% maximum dry density;
- 150mm G5 Subbase compacted to 95% maximum dry density (100% for sand);
- 150mm G7 Upper selected layer compacted to 93% maximum dry density (100% for sand);
- 150mm G8 Lower selected layer compacted to 93% maximum dry density (100% for sand);
- 150mm Insitu material compacted to 90% maximum dry density (100% for sand).

Paving Roads

- 60mm and 80mm Paver on 20mm sand;
- 150mm C4 Base course compacted to 98% maximum dry density;
- 150mm G7 Upper selected layer compacted to 93% maximum dry density (100% for sand);
- 150mm G8 Lower selected layer compacted to 93% maximum dry density (100% for sand);
- 150mm Insitu material compacted to 90% maximum dry density (100% for sand).

Sidewalk

- 100mm 25MPa Concrete or 60mm Paver on 20mm sand;
- 125mm G5 Subbase compacted to 95% maximum dry density (100% for sand);
- 150mm G7 Upper selected layer compacted to 93% maximum dry density (100% for sand);
- 150mm Insitu material compacted to 90% maximum dry density (100% for sand).

8.2 Sewerage

The internal underground pipe network will be installed in the roadway, on the higher side of the roadway and inside erven that slopes away from the roads and will comply to the Municipality's minimum requirements with regards to vertical gradients as well as material.

The sewer system will consist of 160mm Ø and 200mm Ø uPVC (Class 34) pipes, sewer manholes and every erf will receive a 110mm Ø erf connection and will be clearly marked inside the erf. The proposed sewer layouts is shown on drawings 24051-C-003-02 and 24051-C-003-03 in **Annexure D.**

The internal sewer system will drain to localized small sewer pumpstations (See detail in **Annexure D**) that will pump to the proposed 360kL sewer package plant for wastewater treatment of the development. The sewer package plant forms part of the external bulk services as described at the end of paragraph 7.2. Refer to **Annexure C** for the sewer package plant technical report from Alveo Water. The treated effluent will either be discharged into the existing watercourse or reused for irrigation purposes on the open green spaces. A copy of the correspondence from George Municipality confirming the option of a sewer package plant is included in **Annexure E**.

8.3 Water

The proposed internal water network will be installed on the lower side of the road reserve (higher side of road) and will consist of the required isolating valves, fire hydrants, air valves, water meters and erf connections as per George Municipality Civil Engineering Standards and Requirements for Services.

The water system will consist of 110mm Ø, 160mm Ø and 200mm Ø uPVC (Class 12) pipes and every erf will receive a 25mm erf connection and will be clearly marked inside the erf. The proposed water layouts is shown on drawings 24051-C-004-02 and 24051-C-004-03 in **Annexure D.**

A 2Ml reservoir will be constructed as part of the bulk civil services to supply the development with water. Additional land will be made available for the construction of another 2Ml reservoir for future development needs.

The existing 150mm dia. water pipe that supplies the existing reservoir with municipal water, from the 250mm Ø pipe located in the N2 road reserve, will be relocated and replaced with a new 160mm Ø uPVC pipe. The existing 300mm Ø water pipe from the existing reservoir and which supplies the lower areas towards Victoria Bay will also be replaced and repositioned with a new 315mm Ø uPVC pipe.

8.4 Stormwater Drainage

The stormwater drainage will be designed in accordance with the philosophy of providing for a minor and major system. Careful attention will be given to the layout of the road reserves to drain, capture and convey stormwater away from the proposed development. This water can then be utilised to supplement the irrigation water supply.

The major system will consist of roads and open channels to ensure overland escape routes for the larger storm run-offs. The minor system will consist of kerb inlet catch pits and underground stormwater pipes with manholes. The proposed stormwater layouts is shown on drawings 24051-C-005-02 and 24051-C-005-03 in **Annexure D**.

The minor system will be designed to accommodate the 1 in 2 year return period run-offs and the major systems for the 1 in 50 year run-offs. The minimum pipe diameters will be 375 mm Class 100D for longitudinal runs and catch-pit connections.

The stormwater run-off from most of the area will drain towards existing water courses situated in two valleys running through the centre of the development. From there the stormwater run-off ultimately meets with the Swart River along the eastern boundary of the site.

At major outlet points, stormwater outlet structures will make provision for energy dissipation in stilling basins and erosion protection where required. During construction, special attention will be paid to the use of silt traps at stormwater inlets and at natural low points to prevent silt and rubbish to be deposited in the river.

A comprehensive stormwater management plan is attached in **Annexure H**.

8.5 Communication

As part of the installation of the civil engineering services, an underground sleeve layout, with junction boxes, will be installed to accommodate fibre services to be installed by a suitable services provider. The fibre system will consist of 110mm Ø pipes with a 50mm Ø erf connection and will be clearly marked inside the erf. The proposed fibre layouts is shown on drawings 24051-C-006-02 and 24051-C-006-03 in **Annexure D**.

9. WASTE MANAGEMENT

The development will be incorporated in the existing municipal waste infrastructure and the municipality will collect the waste at an approved collection point near or at the gatehouse of each development.

10. RECOMMENDATIONS

The following are recommendations to facilitate the successful development of this site:

- Construct a 2Ml reservoir for the bulk water supply to the development and allocate additional land for the construction of a 2Ml reservoir for future development needs in the area;
- Reroute existing bulk water pipes across the development;
- Construct a 360kL sewer package plant for the treatment and management of the wastewater generated from the development;
- Install internal civil engineering services as per this report;
- Update cost estimate after preliminary and detail design drawings;
- Appoint a geotechnical engineer to do a Phase 1 geotechnical investigation and report.
- Provide this report as input to the Environmental Application Process.

We trust you find above in order. Please feel free to contact us should you require additional information or have any queries.

Yours faithfully

Francois van Eck Pr Eng
for LYNERS

ANNEXURE A

Subdivision/Master Plan from Nuvorm

MEULENZICHT LANDGOED			
		Units	GLA
Phase B1	**13,2258 ha**		
Main entrance / Gatehouse			
Full title erven		83	-
Phase B2	**3,9348 ha**		
Full title erven		49	-
Phase B3	**4,2971 ha**		
Full title erven		25	-
Phase B4	**15,2092 ha**		
Full title erven		70	-
Phase B5	**0,7482 ha**		
Treatment plant			-
Phase C	**28,5678 ha**		
Future Expansion			-
		227 units	0 m²

nuvorm

architecture | urban design | landscape architecture | interior design

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NOTES

MEULENZICHT LANDGOED
65.9788 ha
227 units

MEULENZICHT
ATTERBURY

25537, 25538, 25541
KRAAIBOSCH

GEORGE

CONCEPT MASTER PLAN

CODE	PHASE	DISCIPLINE	NUMBER	REV
24AA	01	UD	1003	P

MEULENZICHT LANDGOED			
		Units	GLA
Phase B1	**13,2258 ha**		
Main entrance / Gatehouse			
Full title erven		83	-
Phase B2	**3,9348 ha**		
Full title erven		49	-
Phase B3	**4,2971 ha**		
Full title erven		25	-
Phase B4	**15,2092 ha**		
Full title erven		70	-
Phase B5	**0,7482 ha**		
Treatment plant			-
Phase C	**28,5678 ha**		
Future Expansion			-
		227 units	0 m²

nuvorm

architecture | urban design | landscape architecture | interior design

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NOTES

MEULENZICHT LANDGOED
65.9788 ha
227 units

MEULENZICHT
ATTERBURY

25537, 25538, 25541
KRAAIBOSCH

GEORGE

PHASING PLAN

CODE	PHASE	DISCIPLINE	NUMBER	REV
24AA	01	UD	1004	P

ANNEXURE B

GLS Service Availability Report and Correspondence (Water and Sewer)

06 September 2024

Director: Civil and Technical Services
George Municipality
PO Box 19
GEORGE
6530

ATTENTION: Ms Lindsay Mooiman

Ma'am,

WATER AND SEWER MASTER PLANS: DEVELOPMENT OF PROPOSED TOWNSHIP/REZONING – GEORGE ERVEN 25537, 25538, 25541 AND PORTION 400 OF THE FARM KRAAIBOSCH 195 (AAN DE MEULEN & KRAAIBOSCH RIDGE)

The request from Neil Lyners and Associated dated 26 April 2024 with regards to accommodating the proposed development in the George water system has reference.

This report is a technical report stating upgrades required in the water and sewer networks in the vicinity of the proposed development. The George Municipal engineering professional (yourself) will make a final decision on works to be implemented by the proposed development.

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Directors: RL Pole, AG Hingeston, AN Umichand

1 INTRODUCTION

1.1 Brief

This report is a technical report stating upgrades required in the water and/or sewer networks in the vicinity of the proposed development. The George Municipal engineering professional (yourself) will make a final decision on works to be implemented by the proposed development.

The latest master plans used in this analysis were the m2024-03 master plans.

1.2 Disclaimer

The investigation has been performed and this report has been compiled based on the information made available to GLS. All efforts, within budget constraints, have been made during the gathering of information to ensure the highest degree of data integrity. The information supplied to GLS by George Municipality and other Consultants at the outset of this assessment is assumed to be the most accurate representation of the existing system up to date hereof.

GLS hereby confirms that any contributions of the developer to the required construction of infrastructure and/or the upgrading of existing infrastructure, whether it be in the form of a capital contribution or in the form of constructing sections of new infrastructure, is a matter to be discussed and agreed upon between the developer and the George Municipality.

All costs shown in this report are year 2023/24 Rand value **estimates** and **include** 50% surcharge for P&Gs, contingencies and fees but **exclude** VAT.

1.3 Version control

Issue Date	***Type***	***Version***	***Remarks***
2024/07/08	Draft	1	Issued for comments and approval
2024/07/10	Revision	2	Added summaries for interim/alternative options
2024/08/05	Revision	3	Added phases for the development, removed internal schematic items.
2024/09/06	Revision	4	Updated summary of sewer costing

2 WATER DEMAND & SEWER FLOWS

2.1 *Impact of the proposed development*

The proposed development was taken into consideration in the master plan as part of the Sawmill development area.

The water demand and sewer return flow contribution of the proposed development is outlined in the table below:

Land Use	Unit of measure (No/100m2/ha…)	No. Units (No/100m2/ha…)	UWD/unit (kL/unit/d)	Sewer ratio (% x UWD)	AADD Inc. UAW (kL/d)	PDDWF Excl. Infilt. (kL/d)
Phase 1	**Estimated Start Date:**			**Estimated Occupation Date:**		
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	259	0.625	54%	210.44	113.64
Sub-Total		**259**			**210.4**	**113.6**
Phase 2	**Estimated Start Date:**			**Estimated Occupation Date:**		
Residential (George & Wilderness) - High density, small sized Residential stands	unit	207	0.625	63%	129.38	81.51
Flats (George & Wilderness) - Medium density Flat units up to 50 m² (Footprint=0.6 and Storeys=1)	unit	220	0.625	80%	68.75	55.00
Sub-Total		**427**			**198.1**	**136.5**
Total		**686**			**408.6**	**250.1**

2.2 *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 545.9 kL/d (theoretical demand).

The revised AADD, peak flow and fire flow calculated for the proposed development and used in this re-analysis of the water distribution network is 408.6 kL/d.

- Annual average daily demand of George Main zone = 198.1 kL/d
- Peak flow using a zone peak hour factor of 3.00‡ = 5.70 L/s
- Annual average daily demand for Kraaibosch Tower zone = 210.5 kL/d
- Peak flow using a zone peak hour factor of 4.60‡ = 11.20 L/s
- Fire flow (Low rise flats <= 3 storeys) using a peak hour factor of 2.0 = 20 L/s @ 10 m
- Fire flow (Residential) using a peak hour factor of 2.0 = 15 L/s @ 10 m

2.3 *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 422.4 kL/d (theoretical flow).

The revised PDDWF (excluding infiltration) calculated for the proposed development and used in the re-analysis of the sewer system is 250.1 kL/d. The design flow, or instantaneous peak wet weather flow (IPWWF), is 6.6 L/s.

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

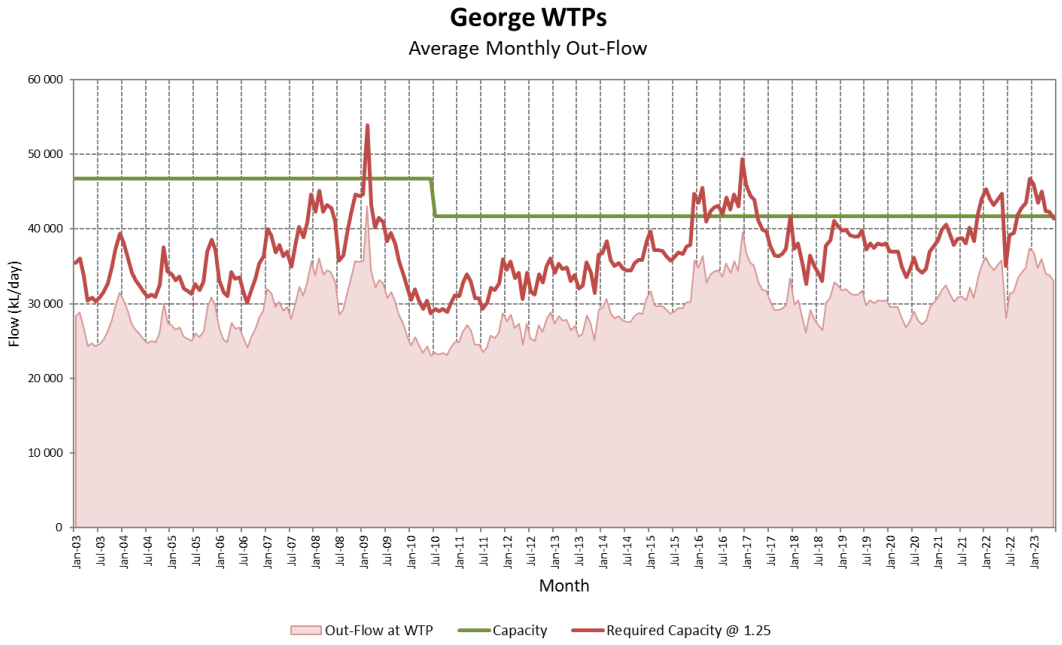
3 WATER DISTRIBUTION NETWORK

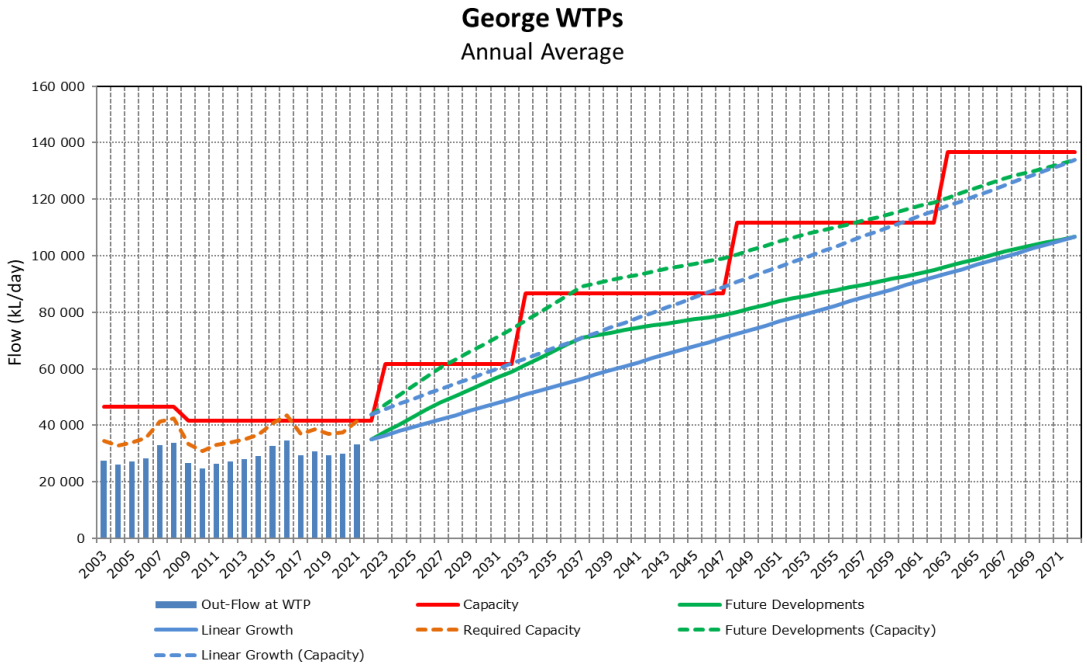
3.1 Water Resources

Water Treatment Plant capacity

The master plan indicates that the proposed development falls in the George Main zone and supplied from the Old and New George WTPs.

The two graph overleaf shows that the design capacity of the Old and New George WTPs (green line) has been exceeded by the average monthly required capacity (dark red line) a few times in the last decade. The WTPs are thus operating at risk and needs to be extended.





Based on available information the capacity, present flow and projected short-term flow are as follows:

George WTPs	Capacity	Comment
Existing Capacity	41 700 kL/d	Design capacity 46 200 kL/d
Measured Flow (incl. 1.25 factor)		
Annual Average (2003-2023)	43 537 kL/d	Maximum 2016/17
	-1 837 kL/d	No spare capacity available
Monthly Average (2003-2023)	56 022 kL/d	February 2009
	-14 322 kL/d	No spare capacity available
Monthly Average (2022/23)	48 599 kL/d	December 2022
	-6 899 kL/d	No spare capacity available
Modelled Flow (incl. 20% water loss and 1.25 factor)		
T_AADD (existing)	43 955 kL/d	m2024-03 MP
	-2 255 kL/d	No spare capacity available
3yr Projection	50 601 kL/d	
	-8 901 kL/d	No spare capacity available
5yr Projection	60 570 kL/d	
	-18 870 kL/d	No spare capacity available

Note: *T_AADD: Theoretical Annual Average Daily Demand*
The flow projections include all stands that are presently vacant but expected to be occupied over the next 5 years as well as all future areas likely to develop within the next 5 years

3.2 Distribution Zone

The master plan indicates that the proposed development falls partly in the George Main and Kraaibosch Tower zones as shown in **Figure 1 (Water)** attached.

An interim option was investigated to accommodate the Kraaibosch Ridge component of the development in the George Main zone until construction of the additional Kraaibosch reservoir.

3.3 Categorisation of required upgrades

The items are categorised as follows:

- General system specific MP Items – required to address capacity issues and backlogs in the bulk and reticulation systems serving the proposed development, but not specifically required for the development per sé.
- Development specific MP Items – new additions to (or deviations from) the existing Master Plan, required specifically for the proposed development, as a result of more accurate information relative to the original estimate of future development.

It is important to note that all proposed items are schematic in nature, final size and location is subject to a complete design by a suitably qualified engineer. The final locality in particular is subject to legislative requirements including but not limited to pipes not crossing private stands, no servitudes registered in private stands and no pipes in stands with an area less than 400m².

3.4 Bulk Water Supply

Reservoir storage capacity

One of the main considerations in bulk water supply is reservoir storage capacity and in the assessment of storage capacity, two demand scenarios are considered.

The first (Theoretical Current Demand) scenario represents the demand in the system as it is currently experienced, i.e. it only includes the demand for stands that are developed (vacant stands are ignored), and only due to land use rights currently being exercised. An allowance for 20% water losses is also included in the scenario.

The second (Theoretical Fully Occupied Demand) scenario is the planning scenario and represents the demand of all the existing stands, irrespective of whether they are developed or vacant. Most importantly, the demand is based on the zoning of each stand i.e. the maximum demand allowed for under existing land use rights (known as zoning rights). Ideally the existing system should have sufficient capacity for this scenario which represents all existing development rights. An allowance for 20% water losses is also included in this scenario.

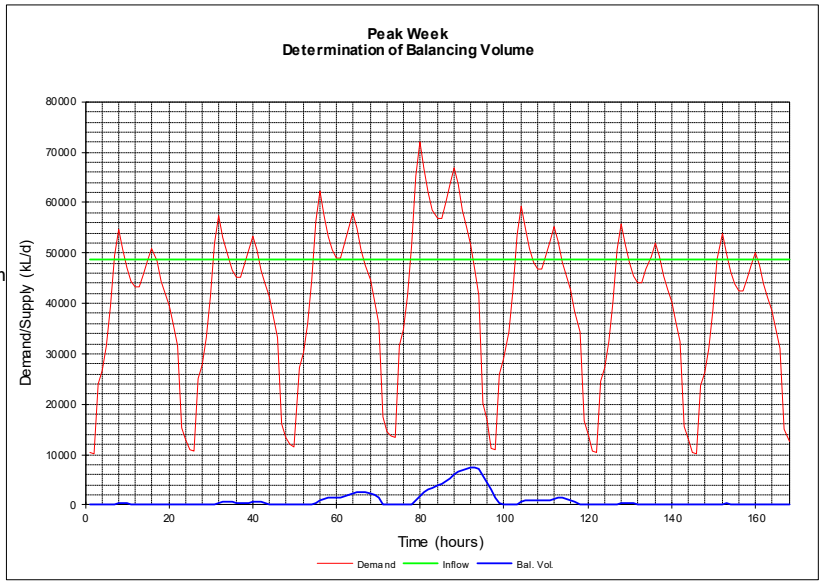
The difference between the two demand scenarios becomes relevant when there is “perceived” spare storage capacity in the Theoretical Current Demand scenario and no storage capacity in the Theoretical Fully Occupied Demand scenario. This means that the storage capacity allotted to all existing stands (in the Theoretical Fully Occupied Demand scenario) is currently not utilised in the Theoretical Current Demand scenario, it is however still committed to the water demands derived from the zoning rights.

Reservoir capacity assessment (Theoretical Current Demand)

The current George Main zone AADD plus 20% UAW (Theoretical Current Demand) in the m2024-03 water model is 28 705 kL/d. The capacity of the existing Reservoirs @ Old WTP is 36 120 kL. The FCV is set at 565 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity is 8 890 kL.

Type in values in shaded cells				
Full zone	28 705	kL/d		
Direct zone	19 811	kL/d		
AADD	**28 705**	kL/d		
PDF	**1.70**	* AADD		
PWF	**1.40**	* AADD		
P3DF	1.51	* AADD		
Supply	**1.70**	* AADD		
=	48 798	kL/d		
=	565	L/s	Pipe @ 1.8m/s	
			632	mm
Bal.Vol.	7 419	kL/d		
=	6.2	h*AADD		
			%	
Pattern 1	Large zone	Large	**69.0%**	
Pattern 2	Small zone	Medium	**0.0%**	
Pattern 3	LC Housing	Small	**0.0%**	
Pattern 4			**0.0%**	
Pattern 5			**0.0%**	
Pattern 6			**0.0%**	
Pattern 7	Even	To a res.	**31.0%**	
Must add up to 100 --> check			100.0%	

Res @ Old WTP Site



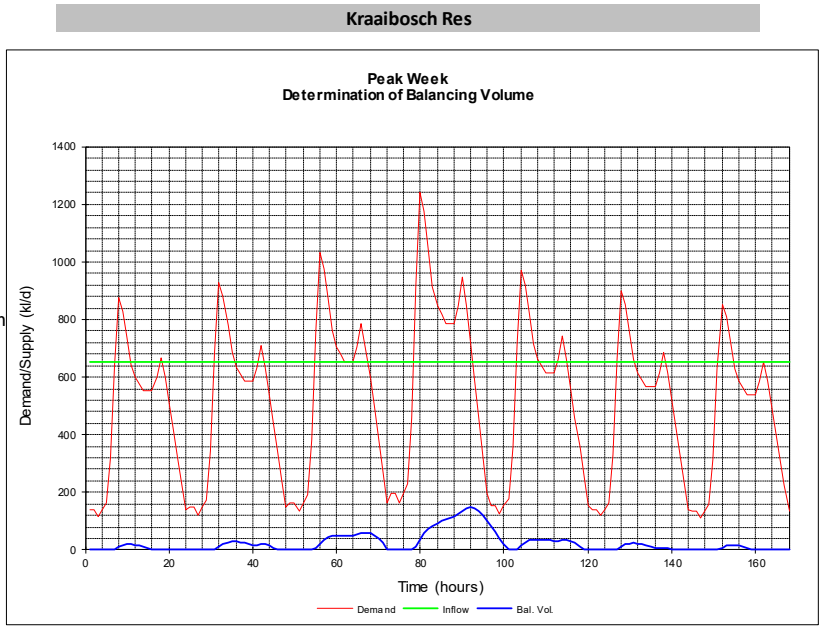
VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)

Capacity	**36 120**	kL	=	43.8 h x AADD
Required balancing	7 419	kL	=	9.0 h x AADD
Available volume	28 701	kL	=	34.8 h x AADD
Required emergency	19 811	kL	=	**24.00** h x AADD
Spare capacity	8 890	kL	=	10.8 h x AADD

Reservoir capacity assessment (Theoretical Current Demand)

The current Kraaibosch Reservoir zone AADD plus 20% UAW (Theoretical Current Demand) in the m2024-03 water model is 284 kL/d. The capacity of the existing Kraaibosch Reservoir is 1 000 kL. The FCV is set at 8 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity is 569 kL.

Type in values in shaded cells			
Full zone	284	kl/d	
Direct zone	284	kl/d	
AADD	**284**	kl/d	
PDF	**2.30**	* AADD	
PWF	**1.80**	* AADD	
P3DF	1.99	* AADD	
Supply	**2.30**	* AADD	
=	654	kl/d	
=	8	l/s	Pipe @ 1.8m/s
			73 mm
Bal.Vol.	147	kl	
=	12.4	h*AADD	
			%
Pattern 1	Large zone	Large	**0.0%**
Pattern 2	Small zone	Medium	**100.0%**
Pattern 3	LC Housing	Small	**0.0%**
Pattern 4			**0.0%**
Pattern 5			**0.0%**
Pattern 6			**0.0%**
Pattern 7	Even	To a res.	**0.0%**
Must add up to 100 --> check			100.0%



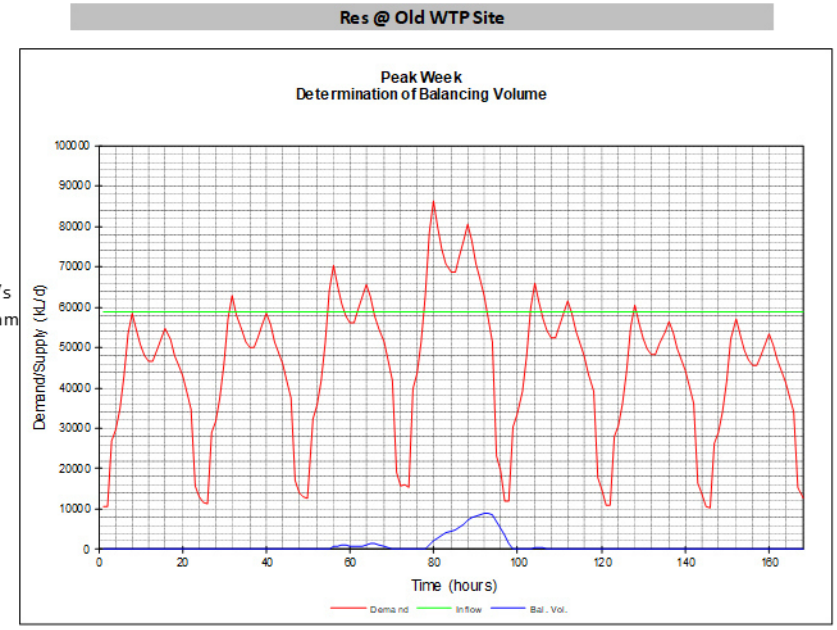
VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)

Capacity	**1 000**	kl	=	84.5 h x AADD
Required balancing	147	kl	=	12.4 h x AADD
Available volume	853	kl	=	72.0 h x AADD
Required emergency	284	kl	=	**24.00** h x AADD
Spare capacity	569	kl	=	48.0 h x AADD

Reservoir capacity assessment (Theoretical Fully Occupied Demand)

The current George Main zone AADD plus 20% UAW (Theoretical Fully Occupied Demand) in the m2024-03 water model is 34 671 kL/d. The capacity of the existing Reservoirs @ Old WPT is 36 120 kL. The FCV is set at 682 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity of 4 401 kL is sufficient to cater for the proposed development.

Type in values in shaded cells			
Full zone	34 671 kL/d		
Direct zone	22 831 kL/d		
AADD	**34 671** kL/d		
PDF	**1.70** * AADD		
PWF	**1.30** * AADD		
P3DF	1.42 * AADD		
Supply	**1.70** * AADD		
=	58 940 kL/d		
=	682 L/s	Pipe @ 1.8m/s	
		695 mm	
Bal.Vol.	8 888 kL/d		
=	6.2 h*AADD		
		%	
Pattern 1	Large zone	Large	**65.9%**
Pattern 2	Small zone	Medium	**0.0%**
Pattern 3	LC Housing	Small	**0.0%**
Pattern 4			**0.0%**
Pattern 5			**0.0%**
Pattern 6			**0.0%**
Pattern 7	Even	To a res.	**34.1%**
Must add up to 100 --> check			100.0%



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

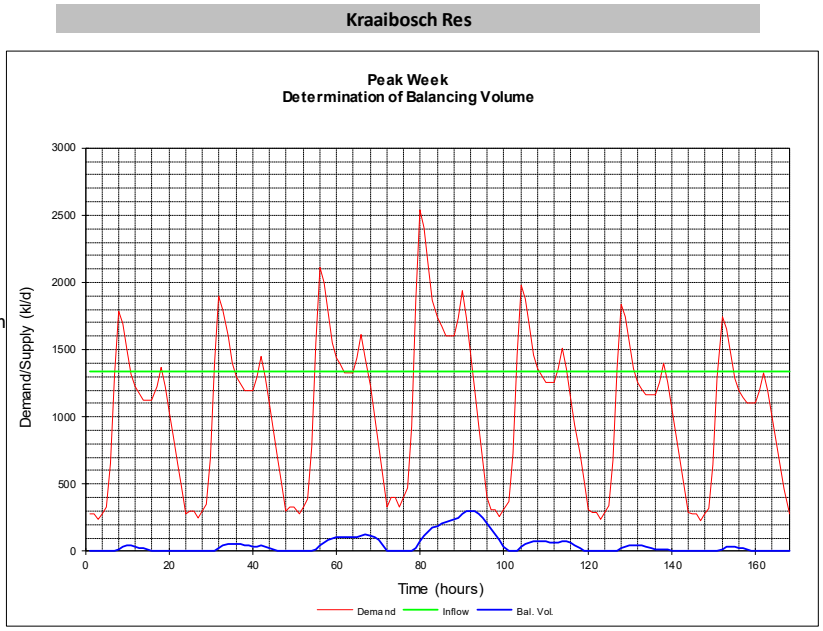
Capacity	**36 120** kL	=	38.0 h x AADD
Required balancing	8 888 kL	=	9.3 h x AADD
Available volume	27 232 kL	=	28.6 h x AADD
Required emergency	22 831 kL	=	**24.00** h x AADD
Spare capacity	4 401 kL	=	4.6 h x AADD

Reservoir capacity assessment (Theoretical Fully Occupied Demand)

The current Kraaibosch Reservoir zone AADD plus 20% UAW (Theoretical Fully Occupied Demand) in the m2024-03 water model is 34 671 kL/d. The capacity of the existing Kraaibosch Reservoir is 1 000 kL. The FCV is set at 15 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity of 119 kL is insufficient to cater for the proposed development.

DETERMINATION OF RESERVOIR BALANCING VOLUME and/or REQUIRED SUPPLY RATE

Type in values in shaded cells			
Full zone	581	kl/d	
Direct zone	581	kl/d	
AADD	**581**	kl/d	
PDF	**2.30**	* AADD	
PWF	**1.80**	* AADD	
P3DF	1.99	* AADD	
Supply	**2.30**	* AADD	
=	1 335	kl/d	
=	15	l/s	Pipe @ 1.8m/s
			105 mm
Bal.Vol.	300	kl	
=	12.4	h*AADD	
			%
Pattern 1	Large zone	Large	**0.0%**
Pattern 2	Small zone	Medium	**100.0%**
Pattern 3	LC Housing	Small	**0.0%**
Pattern 4			**0.0%**
Pattern 5			**0.0%**
Pattern 6			**0.0%**
Pattern 7	Even	To a res.	**0.0%**
Must add up to 100 --> check			100.0%



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

Capacity	**1 000**	kl	=	41.3 h x AADD
Required balancing	300	kl	=	12.4 h x AADD
Available volume	700	kl	=	28.9 h x AADD
Required emergency	581	kl	=	**24.00** h x AADD
Spare capacity	119	kl	=	4.9 h x AADD

Tower storage capacity assessment and supply rate

Water towers serve merely to sustain pressure in a network and should not be regarded as facilities for balancing peaks and for emergency supply. Because of their relatively small volumes, the supply rates to towers must be such that they can be kept full at all times.

On the other hand, volumes must be large enough to allow room for operation of pumps filling the tower (where applicable) such that the number of pump cycles per day is limited. The following guidelines were used for evaluation and planning of water towers:

- Supply rate into tower : 1,0 to 1,1 x PHF x AADD
- Tower storage : 2 h to 6 h x AADD

The Kraaibosch tower has a capacity of 100 kL and the supply pump station has one operational and one standby pump set, each with a supply duty point of 55 L/s at 35 m head.

Scenario:	Theoretical Current Demand	Theoretical Fully Occupied Demand	Theoretical Fully Occupied Demand (incl. the proposed development)
Parameter:			
Existing Capacity (kL)	100	100	100
AADD (kL/d)	284	581	791
Peak Flow (L/s)	9.8	18.9	30.1
Peak Factor (current)	3.00	2.80	3.30
Storage (hours)	±8	±4	±3
Supply rate (L/s)	10.9	20.7	33.2
Existing Pump Station (L/s)	55.0	55.0	55.0

It is evident that both the Kraaibosch tower and its supply pump station has capacity to accommodate the proposed development.

3.4.1 Existing bulk water system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the bulk water system:

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing WTPs (Old WTP and New WTP)					
GMR_B01.01	Water Treatment Facility to install: New WTP	20 500 m³/d @	254 m EGL	R 287 482 000	R 1 888 334 0.66%
	Existing: Old WTP	20 000 m³/d @	254 m EGL	n.a.	n.a.
	Existing: New WTP	20 000 m³/d @	254 m EGL	n.a.	n.a.
	Existing: Ebb-and-Flow WTP	1 700 m³/d @	254 m EGL	n.a.	n.a.
GMR_B01.06	Pipe to install	7 m x	500 mm Ø	R 543 000	R 5 478 1.01%
GMR_B01.07d	Pump Only to install: New WTP PS	220 L/s @	55 m	R 2 136 000	R 21 548 1.01%
			Total	**R 290 161 000**	**R 1 915 359**

3.4.2 Accommodation of the proposed development in the bulk water system

Development specific items required in the bulk water system:

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (George Main zone)					
Development - Phase 2 (Aan de Meulen)					
GMR_01.02	Pipe to install	186 m x	450 mm Ø	R 2 057 000	R 128 033 6.2%
GMR_01.03	Pipe to install	128 m x	315 mm Ø	R 691 000	R 114 856 16.6%
GMR_01.04	Pipe to install	179 m x	355 mm Ø	R 1 224 000	R 121 791 10.0%
GMR_01.11a	Pipe to install	187 m x	450 mm Ø	R 1 926 000	R 102 221 5.3%
			Sub-Total	**R 5 898 000**	**R 466 901**
Existing external system (Kraaibosch Reservoir and Tower zone)					
Development - Phase 1 (Kraaibosch Ridge)					
KBR_B01.02a	Pipe to install	58 m x	500 mm Ø	R 1 065 000	R 44 837 4.2%
KBR_B01.03	Reservoir to install: Kraaibosch Res	4 000 m³ @	209 m TWL	R 17 550 000	R 738 855 4.2%
KBR_B01.04a	Pipe to install	34 m x	500 mm Ø	R 863 000	R 36 332 4.2%
			Sub-Total	**R 19 478 000**	**R 820 024**
			Total	**R 25 376 000**	**R 1 286 924**

3.4.3 Accommodation of the proposed development in the bulk water system (interim period)

Development specific items required in the bulk water system prior to the construction of the additional Kraaibosch reservoir:

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (George Main zone) - interim option					
Development - Phase 1 (Kraaibosch Ridge)					
GMR_01.03 #[1]	Pipe to install	128 m x	315 mm Ø	R 691 000	R 114 856 16.6%
GMR_01.04 #[1]	Pipe to install	179 m x	355 mm Ø	R 1 224 000	R 121 791 10.0%
			Sub-Total	**R 1 915 000**	**R 236 647**
Development - Phase 2 (Aan de Meulen)					
GMR_01.02	Pipe to install	186 m x	450 mm Ø	R 2 057 000	R 128 033 6.2%
GMR_01.11a	Pipe to install	187 m x	450 mm Ø	R 1 926 000	R 102 221 5.3%
			Sub-Total	**R 3 983 000**	**R 230 254**
			Total	**R 5 898 000**	**R 466 901**

Notes: #[1] An interim PRV was proposed for Kraaibosch 195-21 development. If not implemented under Kraaibosch 195-21, it can be moved as per Figure 1 (Water). Alternatively a new interim PRV connection can be made on the existing 250mmØ George main pipeline at either of the proposed connection points presented on Figure 1 (Water).

3.5 Water Reticulation System

Accommodation of the proposed development, with its revised AADD, requires implementation of the following additions and adjustments to the *existing* water system as indicated in **Figure 1 (Water)**.

3.5.1 Existing water reticulation system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the water distribution system:

Item No	MP Type	Description	Extent	Size	Cost	Pro-rata Cost
None						
				Total	**R -**	**R -**

3.5.2 Accommodation of the proposed development in the water reticulation system

Development specific items required in the water distribution system (**including** fire flow requirements):

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (Kraaibosch Reservoir and Tower zone)					
Development - Phase 1 (Kraaibosch Ridge)					
KBT_F01.03	Pipe to install	395 m x	355 mm Ø	R 2 172 000	R 417 517 19.2%
			Total	**R 2 172 000**	**R 417 517**

3.5.3 Accommodation of the proposed development in the water reticulation system (interim period)

Development specific items required in the water distribution system (**including** fire flow requirements) prior to the construction of the additional Kraaibosch reservoir:

Item No		Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (Kraaibosch Reservoir and Tower zone)						
Development - Phase 1 (Kraaibosch Ridge)						
KBT_F01.03	#[1]	Pipe to install	395 m x	355 mm Ø	R 2 172 000	R 417 517 19.2%
KBT_F01.04	#[3]	Pipe to install	147 m x	355 mm Ø	R 986 000	R 233 583 23.7%
KBT_F01.05	#[3]	Pipe to install	185 m x	355 mm Ø	R 1 171 000	R 277 410 23.7%
KBT_F08.01a	#[3]	Pipe to install	31 m x	160 mm Ø	R 187 000	R 187 000 100.0%
KBT_F08.01b	#[3]	Pipe to install	152 m x	160 mm Ø	R 283 000	R 283 000 100.0%
KBT_F08.03	#[2]	Pressure Reducing Valve to install	233 m EGL	100 mm Ø	R 304 000	R 304 000 100.0%
				Total	**R 5 103 000**	**R 1 702 511**

Notes:
#[1] The 355mm Ø is to be isolated from Kraaibosch tower supply until the additional Kraaibosch reservoir is constructed and the interim PRV decommissioned.
#[2] Interim PRV was proposed for Kraaibosch 195-21 development. If not implemented under Kraaibosch 195-21, it can be moved as per Figure 1 (Water).
#[3] Depending on the final position of the proposed interim PRV, these items can be omitted.

The proposed connection points to the existing water distribution system are shown in **Figure 1 (Water)**.

3.6 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 2.2 above on the internal networks.

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

Connection Point	Static		Residual		Fire Flow		Ground Level
	EGL (m a.s.l.)	Head (m)	EGL (m a.s.l.)	Head (m)	EGL (m a.s.l.)	Head (m)	(m a.s.l.)
Future system - George Main							
Point A	295.0	92.5	275.2	72.7	269.9	67.4	202.5
Future system - Kraaibosch Reservoir and Tower							
Point B	233.0	29.4	227.4	23.8	226.7	23.1	203.6
Future system - George Main (interim period)							
Point C	233.0	37.8	232.0	36.8	230.2	35.0	195.2
Point D	233.0	28.9	232.0	27.9	230.2	26.1	204.1

4 SEWER CONVEYANCE NETWORK

4.1 Sewer Drainage Area

The master plan indicates that the proposed development falls in the future Kraaibosch 3 PS drainage area as shown in **Figure 2 (Sewer)** attached. This drainage areas drains to the Outeniqua WWTW.

An interim option was investigated to accommodate the proposed development in the exiting sewer system via the existing Kraaibosch PS as the master plan option requires the construction of the Kraaibosch 3 PS, Kraaibosch 4 PS and the Destiny Africa PS.

4.2 Categorisation of required upgrades

The items are categorised as follows:

- General MP Items – required to address capacity issues and backlogs in the bulk and reticulation systems serving the proposed development, but not specifically required for the development per sé.
- Development specific MP Items – new additions to (or deviations from) the existing Master Plan, required specifically for the proposed development, as a result of more accurate information relative to the original estimate of future development.

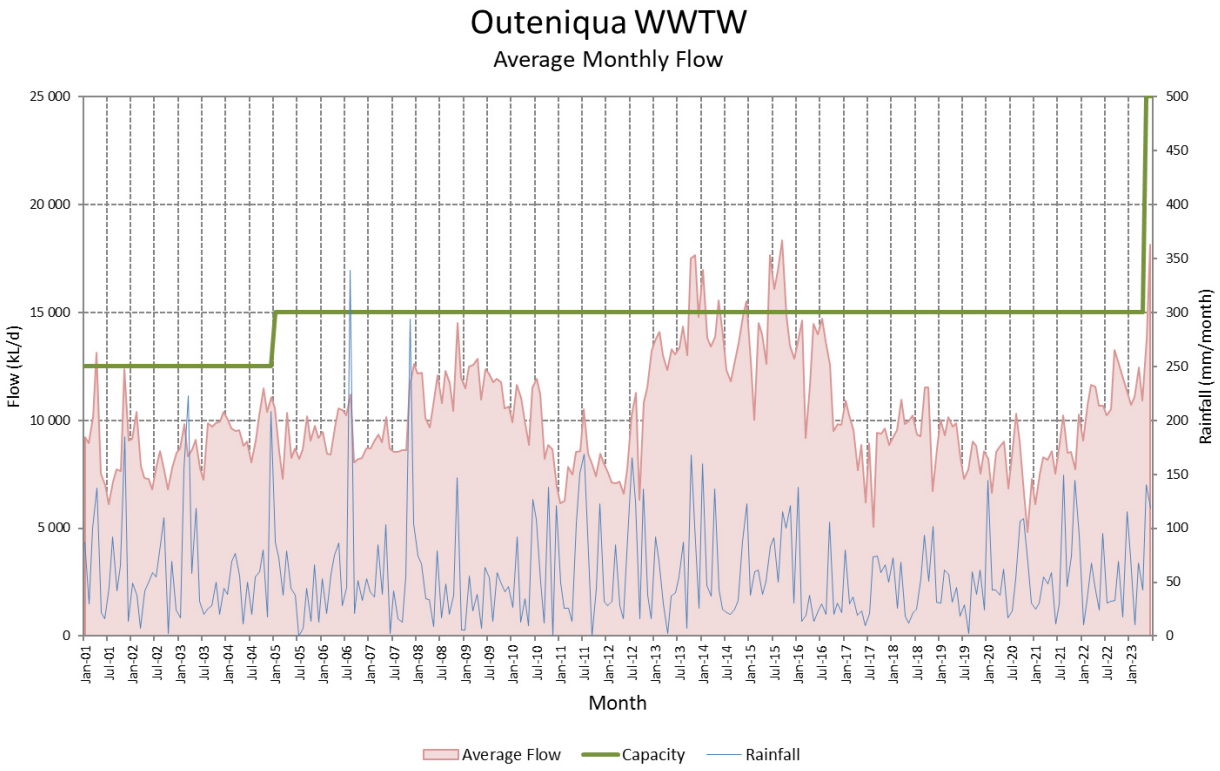
It is important to note that all proposed items are schematic in nature, final size and location is subject to a complete design by a suitably qualified engineer. The final locality in particular is subject to legislative requirements including but not limited to pipes not crossing private stands, no servitudes registered in private stands and no pipes in stands with an area less than 400m^2.

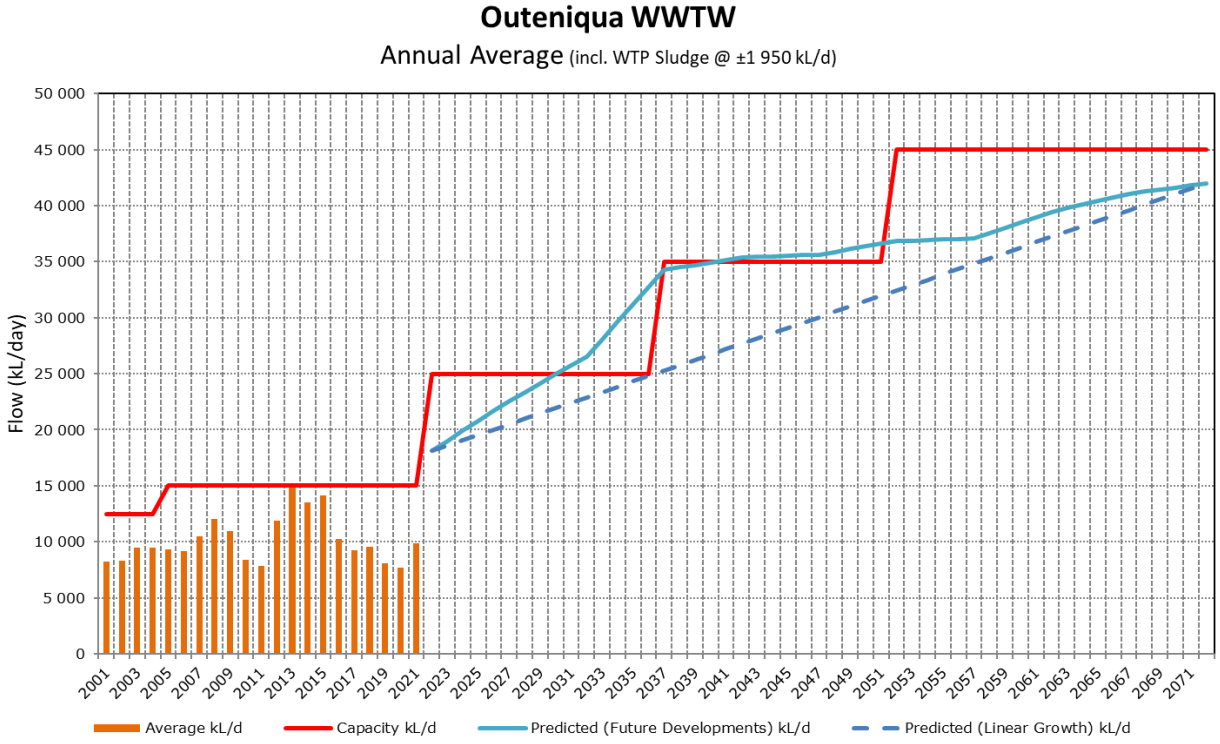
4.3 Bulk Sewer Drainage

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)**.

Wastewater Treatment Works capacity

The graph overleaf shows that the design capacity of the Outeniqua WWTW (green line) has been exceeded by the Average Monthly Flow (light red shaded area) a few times in the last decade. The WWTW has since been upgraded and is thus not operating at risk.


Outeniqua WWTW
Average Monthly Flow
Flow (kL/d)
Rainfall (mm/month)
Month
Average Flow
Capacity
Rainfall


Outeniqua WWTW
Annual Average (incl. WTP Sludge @ ±1 950 kL/d)
Flow (kL/day)
Average kL/d
Capacity kL/d
Predicted (Future Developments) kL/d
Predicted (Linear Growth) kL/d

Based on available information the capacity, present flow and projected short-term flow are as follows:

Outeniqua WWTW	Capacity	Comment
Existing Capacity	25 000 kL/d	
Measured Flow		
Annual Average (2001-2023)	14 846 kL/d	Maximum 2013/14
	10 154 kL/d	Spare capacity available
Monthly Average (2001-2023)	10 591 kL/d	September 2015
	14 409 kL/d	Spare capacity available
Monthly Average (2022/23)	13 761 kL/d	May 2023
	11 239 kL/d	Spare capacity available
Modelled Flow		
T_PDDWF (existing)	18 113 kL/d	m2024-03 MP - Incl. WTP sludge flow = 1 260 kL/d
	6 887 kL/d	Spare capacity available
3yr Projection	20 781 kL/d	Incl. WTP sludge flow = 1 260 kL/d
	4 219 kL/d	Spare capacity available
5yr Projection	22 561 kL/d	Incl. WTP sludge flow = 1 260 kL/d
	2 439 kL/d	Spare capacity available

Note: T_PDDWF: Theoretical Peak Daily Dry Weather Flow (Total Wastewater Flow, Peak day in week)
The flow projections include all stands that are presently vacant but expected to be occupied over the next 5 years as well as all future areas likely to develop within the next 5 years

4.3.1 Existing bulk sewer system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the bulk sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Existing bulk system (from Thembalethu 6 PS to Outeniqua WWTW)									
OT_20.02	MP	Upgrade existing Rising	400	800	4	873.6 L/s	R 1 278 000	R 15 715	1.23%
OT_20.03	MP	Upgrade existing Rising	500	800	12	873.7 L/s	R 1 453 000	R 17 864	1.23%
OT_37.04	MP	Upgrade existing Gravity	315	450	8	494.7 L/s	R 209 000	R 4 538	2.17%
OT_61.01 #[1]	MPi	Upgrade existing Pump Station (Investigate first): Thembalethu PS 6	-	-	-	494.7 L/s	R 20 573 000	R 446 726	2.17%
OT_61.02a #[1]	MPi	Upgrade existing Rising (Investigate first)	250	650	351	494.7 L/s	R 6 294 000	R 136 669	2.17%
OT_61.02b #[1]	MPi	Upgrade existing Rising (Investigate first)	250	650	31	494.7 L/s	R 1 368 000	R 29 705	2.17%
OT_61.02c #[1]	MPi	Upgrade existing Rising (Investigate first)	250	650	330	494.7 L/s	R 5 970 000	R 129 634	2.17%
						Sub-Total	**R 37 145 000**	**R 780 850**	
Existing WWTW (Outeniqua WWTW)									
	-	-	-	-	-	- -	R -	R -	1.00%
						Sub-Total	**R -**	**R -**	
						Total	**R 37 145 000**	**R 780 850**	

Notes: #[1] A first phase upgrade of the Thembalethu 6 PS to 240 L/s is planned in the short term .

4.3.2 Existing bulk sewer system considerations (interim period)

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the bulk sewer system for the interim connection prior to construction of the Kraaibosch 4 and Destiny Africa PSs:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Existing bulk system (from Meul PS to Outeniqua WWTW) - Interim option 1/2									
OT_03.01 #[1]	MP	Upgrade existing Pump Station: Meul PS	-	-	-	405.0 L/s	R 9 640 000	R 255 686	2.65%
OT_03.02 #[1]	MPi	Upgrade existing Rising (Investigate first)	450	650	484	405.0 L/s	R 8 341 000	R 221 232	2.65%
OT_09.01 #[2]	MPi	Upgrade existing Gravity (Investigate first)	700	1 000	18	475.4 L/s	R 718 000	R 16 224	2.26%
OT_09.02 #[2]	MPi	Upgrade existing Gravity (Investigate first)	700	1 000	26	476.0 L/s	R 889 000	R 20 062	2.26%
OT_09.03 #[2]	MPi	Upgrade existing Gravity (Investigate first)	600	900	14	498.1 L/s	R 553 000	R 11 926	2.16%
OT_09.04 #[2]	MPi	Upgrade existing Gravity (Investigate first)	700	825	260	483.5 L/s	R 4 638 000	R 103 043	2.22%
OT_10.01	MP	Upgrade existing Pump Station: Schaapkop PS	-	-	-	590.7 L/s	R 11 055 000	R 201 037	1.82%
OT_10.02	MP	Upgrade existing Rising	500	700	154	590.7 L/s	R 4 456 000	R 81 033	1.82%
OT_10.03 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	316	591.7 L/s	R -	R -	1.82%
OT_10.04 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	32	837.1 L/s	R -	R -	1.28%
OT_10.05 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	9	1 536.1 L/s	R -	R -	0.70%
OT_10.06 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	4	698.9 L/s	R -	R -	1.54%
						Sub-Total	**R 40 290 000**	**R 910 244**	
Existing bulk system (divert flow from Meul PS to Thembalethu 6 PS) - Interim option 1/2									
OT_20.02	MP	Upgrade existing Rising	400	800	4	873.6 L/s	R 1 278 000	R 15 715	1.23%
OT_20.03	MP	Upgrade existing Rising	500	800	12	873.7 L/s	R 1 453 000	R 17 864	1.23%
OT_37.04	MP	Upgrade existing Gravity	315	450	8	494.7 L/s	R 209 000	R 4 538	2.17%
OT_27.01 #[3]	MPa	Abandon existing Pump Station: Thembalethu PS 1	-	-	-	- L/s	R 287 000	R -	0.00%
OT_27.02 #[3]	MPa	Abandon existing Rising	200	250	867	- L/s	R 10 000	R -	0.00%
OT_38.01 #[3]	MPa	Abandon existing Pump Station: Thembalethu PS B	-	-	-	- L/s	R 287 000	R -	0.00%
OT_38.02 #[3]	MPa	Abandon existing Rising	79	90	99	- L/s	R 10 000	R -	0.00%
OT_39.01 #[3]	MPa	Abandon existing Pump Station: Thembalethu PS A	-	-	-	- L/s	R 287 000	R -	0.00%
OT_39.02 #[3]	MPa	Abandon existing Rising	79	90	91	- L/s	R 10 000	R -	0.00%
OT_50.01	MPa	Abandon existing Pump Station: Parkdene PS 2	-	-	-	- L/s	R 287 000	R -	0.00%
OT_50.02	MPa	Abandon existing Rising	150	200	227	- L/s	R 10 000	R -	0.00%
OT_51.01	MPa	Abandon existing Pump Station: Parkdene PS 3	-	-	-	- L/s	R 287 000	R -	0.00%
OT_51.02	MPa	Abandon existing Rising	150	200	151	- L/s	R 10 000	R -	0.00%
OT_58.02 #[2]	MPi	Upgrade existing Gravity (Investigate first)	200	450	47	22.9 L/s	R 458 000	R -	0.00%
OT_61.01	MPi	Upgrade existing Pump Station (Investigate first): Thembalethu PS 6	-	-	-	494.7 L/s	R 20 573 000	R 446 726	2.17%
OT_61.02a #[2]	MPi	Upgrade existing Rising (Investigate first)	250	650	351	494.7 L/s	R 6 294 000	R 136 669	2.17%
OT_61.02b #[2]	MPi	Upgrade existing Rising (Investigate first)	250	650	31	494.7 L/s	R 1 368 000	R 29 705	2.17%
OT_61.02c #[2]	MPi	Upgrade existing Rising (Investigate first)	250	650	330	494.7 L/s	R 5 970 000	R 129 634	2.17%
OT_62.01 #[3]	MP	Upgrade existing Pump Station: Thembalethu PS 7	-	-	-	50.0 L/s	R 5 670 000	R -	0.00%
OT_62.02 #[3]	MP	Upgrade existing Rising	200	250	1 170	50.0 L/s	R 3 169 000	R -	0.00%
OT_F91.02a	FM	New Gravity	-	160	109	2.8 L/s	R 279 000	R -	0.00%
OT_F91.02b	FM	New Gravity	-	160	80	2.8 L/s	R 546 000	R -	0.00%
OT_F91.03	FM	New Gravity	-	160	964	3.9 L/s	R 2 043 000	R -	0.00%
OT_F92.02a	FM	New Gravity	-	160	36	1.5 L/s	R 127 000	R -	0.00%
OT_F92.02b	FM	New Gravity	-	160	95	1.5 L/s	R 642 000	R -	0.00%
OT_F92.03	FM	New Gravity	-	160	157	2.5 L/s	R 377 000	R -	0.00%
OT_F93.02a	FM	New Gravity	-	160	56	1.5 L/s	R 169 000	R -	0.00%
OT_F93.02b	FM	New Gravity	-	160	89	1.5 L/s	R 605 000	R -	0.00%
OT_F94.02 #[3]	FM	New Gravity	-	200	514	35.6 L/s	R 1 265 000	R -	0.00%
OT_F94.03 #[3]	FM	New Gravity	-	250	515	35.9 L/s	R 1 512 000	R -	0.00%
OT_F94.04 #[3]	FM	New Gravity	-	250	211	36.2 L/s	R 654 000	R -	0.00%
OT_F94.05 #[3]	FM	New Gravity	-	315	1 631	52.8 L/s	R 5 801 000	R -	0.00%
OT_F95.02 #[3]	FM	New Gravity	-	160	9	0.1 L/s	R 72 000	R -	0.00%
OT_F96.02 #[3]	FM	New Gravity	-	160	24	0.1 L/s	R 102 000	R -	0.00%
OT_F97.02 #[3]	FM	New Gravity	-	160	25	16.2 L/s	R 104 000	R -	0.00%
						Sub-Total	**R 62 225 000**	**R 780 850**	
Existing WWTW (Outeniqua WWTW)									
	-	-	-	-	-	- -	R -	R -	0.22%
						Sub-Total	**R -**	**R -**	
						Total	**R 102 515 000**	**R 1 691 095**	

Notes:

#[1] Upgrading of the Meul PS is currently underway.

#[2] In the master plan an investigation of this pipe is proposed implying that not all information on slopes, inverts etc. was available. The pipe should therefore first be investigated through field inspections and surveys to verify that upgrading is in fact required.

#[3] Construction of an outfall sewer and upgrading to Thembalethu PS 7 is underway.

4.3.3 Accommodation of the proposed development in the bulk sewer system

Development specific items required in the bulk sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Future bulk system (from Thembalethu 6 PS to Outeniqua WWTW)									
OT_F04.03	FM	New Gravity	-	160	409	7.6 L/s	R 898 000	R 535 255	59.6%
OT_F04.04	FM	New Gravity	-	160	40	21.8 L/s	R 135 000	R 66 522	49.3%
OT_F05.01	FM	New Gravity	-	160	315	0.6 L/s	R 703 000	R 703 000	100.0%
OT_F05.02	FM	New Gravity	-	160	338	0.9 L/s	R 751 000	R 536 548	71.4%
OT_F06.01	FM	New Pump Station: Kraaibosch3 PS	-	-	-	26.3 L/s	R 5 452 000	R 2 226 821	40.8%
OT_F06.02a	FM	New Rising	-	160	655	26.3 L/s	R 1 077 000	R 439 891	40.8%
OT_F06.02b	FM	New Rising	-	160	39	26.3 L/s	R 206 000	R 84 139	40.8%
OT_F06.02c	FM	New Rising	-	160	309	26.3 L/s	R 518 000	R 211 572	40.8%
OT_F07.02	FM	New Gravity	-	160	235	13.5 L/s	R 538 000	R 221 776	41.2%
OT_F32.01	FM	New Gravity	-	315	218	93.2 L/s	R 992 000	R 114 335	11.5%
OT_F32.02	FM	New Gravity	-	200	612	94.6 L/s	R 1 838 000	R 208 708	11.4%
OT_F32.03	FM	New Gravity	-	315	251	157.7 L/s	R 1 133 000	R 77 176	6.8%
OT_F32.04	FM	New Gravity	-	315	72	207.8 L/s	R 367 000	R 18 972	5.2%
OT_F35.01 #[1]	FM	New Pump Station: Kraaibosch4 PS	-	-	-	207.8 L/s	R 14 168 000	R 732 400	5.2%
OT_F35.02 #[1]	FM	New Rising	-	450	1 442	207.8 L/s	R 12 631 000	R 652 946	5.2%
OT_F36.01	FM	New Gravity	-	315	214	210.5 L/s	R 977 000	R 49 857	5.1%
OT_F36.02	FM	New Gravity	-	525	213	257.8 L/s	R 4 844 000	R 201 840	4.2%
OT_F36.03	FM	New Gravity	-	315	20	336.1 L/s	R 144 000	R 4 602	3.2%
OT_F37.01 #[2]	FM	New Pump Station: Destiny Africa PS	-	-	-	336.1 L/s	R 18 685 000	R 597 186	3.2%
OT_F37.02 #[2]	FM	New Rising	-	550	1 214	336.1 L/s	R 13 102 000	R 418 749	3.2%
						Total	**R 79 159 000**	**R 8 102 295**	

Notes: *#[1] A potential first phase of Kraaibosch 4 PS could be 50 L/s and a 355mm Ø rising main.*

#[2] A potential first phase of Destiny Africa PS could be 100 L/s and a 450mmØ rising main.

4.3.4 Accommodation of the proposed development in the bulk sewer system (interim period)

Development specific items required in the bulk sewer system for the interim connection prior to construction of the Kraaibosch 4 and Destiny Africa PSs:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Future bulk system (from Meul PS to Outeniqua WWTW) - Interim option 1									
OT_F04.03	FM	New Gravity	-	160	409	7.6 L/s	R 898 000	R 535 255	59.6%
OT_F04.04	FM	New Gravity	-	160	40	21.8 L/s	R 135 000	R 66 522	49.3%
OT_F05.01	FM	New Gravity	-	160	315	0.6 L/s	R 703 000	R 703 000	100.0%
OT_F05.02	FM	New Gravity	-	160	338	0.9 L/s	R 751 000	R 536 548	71.4%
OT_F06.01	FM	New Pump Station: Kraaibosch3 PS	-	-	-	26.3 L/s	R 5 452 000	R 2 226 821	40.8%
OT_F06.02d #[3]	FA	New Rising (Alternative)	-	160	276	26.3 L/s	R 465 000	R 189 925	40.8%
OT_F06.02e #[3]	FA	New Rising (Alternative)	-	160	1 522	26.3 L/s	R 2 478 000	R 1 012 117	40.8%
OT_F07.02	FM	New Gravity	-	160	235	13.5 L/s	R 538 000	R 221 776	41.2%
						Total	**R 11 420 000**	**R 5 491 963**	

Notes: *#[3] The master plan proposes that the development area drain to the Thembalethu PS 6 with a prerequisite for this option being the construction of the Destiny Africa and Kraaibosch 4 pumping systems. As part if interim accommodation of the development, the proposed Kraaibosch 3 PS could pump to the existing Kraaibosch PS. In future a rising main to the future Kraaibosch 4 PS can be constructed.*

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Future bulk system (from Meul PS to Outeniqua WWTW) - Interim option 2									
OT_F04.05 #[4]	FA	New Rising (Alternative)	-	110	210	7.3 L/s	R 258 000	R 158 511	61.4%
OT_F04.06 #[4]	FA	New Pump Station (Alternative): Kraaibosch Ridge PS 4	-	-	-	7.3 L/s	R 3 162 000	R 1 942 681	61.4%
OT_F05.03 #[4]	FA	New Rising (Alternative)	-	90	186	3.0 L/s	R 211 000	R 211 000	100.0%
OT_F05.04 #[4]	FA	New Pump Station (Alternative): Kraaibosch Ridge PS 2	-	-	-	3.0 L/s	R 1 825 000	R 1 825 000	100.0%
OT_F06.02e #[4]	FA	New Rising (Alternative)	-	160	1 522	26.3 L/s	R 2 478 000	R 1 601 749	64.6%
OT_F07.03 #[4]	FA	New Pump Station (Alternative): Kraaibosch Ridge PS 3	-	-	-	17.0 L/s	R 3 738 000	R 3 738 000	100.0%
						Total	**R 11 672 000**	**R 9 476 941**	

Notes: *#[4] An alternative for the interim accommodation of the development without Kraaibosch 3 PS, is the construction of two pumping stations (Kraaibosch Ridge 2 and 4) to lift sewer flow over the watershed to a main Kraaibosch Ridge PS 3. This would include constucting the Kraaibosch 3 interim rising main up to Kraaibosch Ridge 3 PS. With further phased development Kraaibosch PSs 2 - 4 can be decommissioned in favour of Kraaibosch 3 PS and the rising main extended or decommisioned for a rising main to Kraaibosch 4 PS.*

4.4 *Sewer reticulation 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)**.

4.4.1 Existing sewer reticulation system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the existing sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Existing collector system (from Meul PS to Outeniqua WWTW) - Interim option 1/2									
OT_34.03	MPi	Upgrade existing Gravity (Investigate first)	315	450	42	89.9 L/s	R 425 000	R 50 783	11.9%
						Total	**R 425 000**	**R 50 783**	

4.4.2 Accommodation of the proposed development in the sewer reticulation system

Development specific items required in the existing sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Development - Phase 1 (Kraaibosch Ridge)									
OT_F04.02	FM	New Gravity	-	160	681	5.2 L/s	R 1 458 000	R 1 458 000	100.0%
OT_F07.04	FM	New Gravity	-	160	743	9.6 L/s	R 1 587 000	R 1 587 000	100.0%
Development - Phase 2 (Aan de Meulen)									
OT_F04.01	FM	New Gravity	-	160	222	4.4 L/s	R 513 000	R 513 000	100.0%
OT_F07.05	FM	New Gravity	-	160	171	0.8 L/s	R 406 000	R 406 000	100.0%
						Total	**R 3 964 000**	**R 3 964 000**	

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

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

The above Design Flows (or IPWWF) and thus pipe sizes were calculated taking cognizance of future developments upstream of the proposed development. In this regard, sewer pipes within the proposed development must be designed (layout and sizing) to receive a Design Flow from the following future connection point (see Figure 2 (Sewer)).

Connection Point	Design Flow (L/s)
Point A	0.78

As the Design Flow already accommodates stormwater ingress, the pipes can be designed to flow 100% full with the Design Flows provided above.

5 SUMMARY

Water supply:

Summary of costing:	Cost	Pro-rata Cost
General items required to alleviate existing problems in the bulk water system	R 290 161 000	R 1 915 359
Development specific items required in the bulk water system	R 25 376 000	R 1 286 924
General items required to alleviate existing problems in the water distribution system	R -	R -
Development specific items required in the water distribution system (including fire flow requirements)	R 2 172 000	R 417 517
Total	**R 317 709 000**	**R 3 619 801**

Summary of costing - Interim option (Kraaibosch Ridge PRV):	Cost	Pro-rata Cost
General items required to alleviate existing problems in the bulk water system	R 290 161 000	R 1 915 359
Development specific items required in the bulk water system	R 5 898 000	R 466 901
General items required to alleviate existing problems in the water distribution system	R -	R -
Development specific items required in the water distribution system (including fire flow requirements)	R 5 103 000	R 1 702 511
Total	**R 301 162 000**	**R 4 084 771**

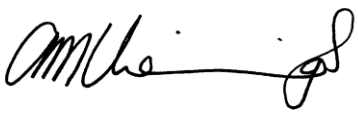
Sewer drainage:

Summary of costing (Master Plan):	Cost	Pro-rata Cost
General items required to alleviate problems in the bulk sewer system:	R 37 145 000	R 780 850
Development specific items required in the bulk sewer system:	R 79 159 000	R 8 102 295
General items required to alleviate problems in the existing sewer system:	R -	R -
Development specific items required in the existing sewer system:	R 3 964 000	R 3 964 000
Total	**R 120 268 000**	**R 12 847 146**

Summary of costing - Interim option 1 (Kraaibosch 3 PS):	Cost	Pro-rata Cost
General items required to alleviate problems in the bulk sewer system:	R 102 515 000	R 1 691 095
Development specific items required in the bulk sewer system:	R 11 420 000	R 5 491 963
General items required to alleviate problems in the existing sewer system:	R 425 000	R 50 783
Development specific items required in the existing sewer system:	R 3 964 000	R 3 964 000
Total	**R 118 324 000**	**R 11 197 840**

Summary of costing - Interim option 2 (Kraaibosch Ridge PSs):	Cost	Pro-rata Cost
General items required to alleviate problems in the bulk sewer system:	R 102 515 000	R 1 691 095
Development specific items required in the bulk sewer system:	R 11 672 000	R 9 476 941
General items required to alleviate problems in the existing sewer system:	R 425 000	R 50 783
Development specific items required in the existing sewer system:	R 3 964 000	R 3 964 000
Total	**R 118 576 000**	**R 15 182 818**

Yours sincerely,



_____

Per: A Vienings (Pr. Eng.)
GLS Consulting

(Report done by: J Rudolph)

REQUEST FROM CONSULTANT TO GLS

24051CG -Sawmill Development - George : GLS Services Availability Report

Reply | Reply All | Forward | ...

GW George Wallace <gwallace@lyner

To Johann Rudolph

Cc Francois van Eck

Fri 2024/04/26 13:04

You replied to this message on 2024/04/29 08:10.

Translate message to: English | Never translate from: Afrikaans | Translation preferences

Middag Johann,

Hoor by Flip jy hou bietjie wittebrood maar is weer Maandag terug op kantoor.

Ons benodig n beskikbaarheid van dienste verslag (water en riool) vir n nuwe otwikkeling op die ou 'Sawmill' langs die N2.
Kan ons dalk Dinsdag oggend 30April so 08h30 dalk n 'teams' meeting doen om net bietjie agtergrond te gee?

Bevestig asseblief.

Groete,

George Wallace B Tech | Civil Technologist | Tel: 044 887 0223 | Mobile: 084 569 5373

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RE: Technical assessment: Kraaibosch Ridge & Aan de Meulen

JR

Johann Rudolph <johann.rudolph@gls.co.za>
To George Wallace
Cc Francois van Eck

You replied to this message on 20/11/2024 15:32.

George Erven 25537_25538_25541 and 195 Ptn 400 - Report Letter (Rev3).pdf
1 MB

Dag sê George,

Hier is die vorige verbruike (laaste wysiging op 6 September) en nuutste verbruike:

Land Use	Unit of measure (No/100m2/ha...)	No. Units (No/100m2/ha...)	UWD/unit (kL/unit/d)	Sewer ratio (% x UWD)	AADD Inc. UAW (kL/d)	PDDWF Excl. Infilt. (kL/d)	Development
Phase 1		**Estimated Start Date:**		**Estimated Occupation Date:**			
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	70	0.813	54%	56.88	30.71	A1
Residential (George & Wilderness) - Low density, large sized Residential stands	unit	83	0.938	49%	77.81	38.13	B1
Sub-Total		**153**			**134.69**	**68.84**	
Phase 2		**Estimated Start Date:**		**Estimated Occupation Date:**			
Flats (George & Wilderness) - Medium density Flat units up to 50 m² (Footprint=0.6 and Storeys=1)	unit	90	0.313	80%	28.13	22.50	A2
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	49	0.813	54%	39.81	21.50	B2
Sub-Total		**139**			**67.94**	**44.00**	
Phase 3		**Estimated Start Date:**		**Estimated Occupation Date:**			
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	54	0.813	54%	43.88	23.69	A3
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	25	0.813	54%	20.31	10.97	B3
Sub-Total		**79**			**64.19**	**34.66**	
Phase 4		**Estimated Start Date:**		**Estimated Occupation Date:**			
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	27	0.813	54%	21.94	11.85	A4
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	70	1.125	45%	78.75	35.44	B4
Sub-Total		**97**			**100.69**	**47.28**	
Phase 5		**Estimated Start Date:**		**Estimated Occupation Date:**			
Flats (George & Wilderness) - Low density Flat unitsup to 50 m² (Footprint=0.6 and Storeys=1)	unit	205	0.375	76%	76.88	58.43	A5
Sub-Total		**205**			**76.88**	**58.43**	
Phase 6		**Estimated Start Date:**		**Estimated Occupation Date:**			
Business/Commercial - Business 1 - Business 4 - Medium < 5 000m²	100m²	25	0.875	63%	21.88	13.78	A6
Sub-Total		**25**			**21.88**	**13.78**	
Phase 7		**Estimated Start Date:**		**Estimated Occupation Date:**			
School, crèche, educational - Building and grounding	100m²	10	0.750	58%	7.50	4.35	A7
Flats (George & Wilderness) - Low density Flat unitsup to 50 m² (Footprint=0.6 and Storeys=1)	unit	40	0.375	76%	15.00	11.40	A7
Sub-Total		**50**			**22.50**	**15.75**	
Total		**748**			**488.8**	**282.7**	

Die rioolafloop sluit infiltrasie uit, die inflitrasie volume word per meter pypyn in ag geneem (m.a.w. die volume is suiwer afloop van elke erf).

Johann Rudolph *BTech Civil Eng*
Civil Engineering Technologist II

GLS Infrastructure planning

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ANNEXURE C

Sewer Package Plant Technical Report from Alveo Water

Reg. No. 2007/007336/07 VAT No. 4140239387

Conventional Activated Sludge with Membrane Bioreactor WWTP

DESIGN REPORT

for

OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT, GEORGE

November 2024

REV.	DATE	ISSUED TO	AUTHOR	REVIEWED
0	27/11/2024	George Wallace	Meyer de Villiers	

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Firgrove Industrial Estate
Macassar

DIRECTORS: M. de Villiers | A Kajee
VAT NO: 414 023 9387 | REG NO: 2007/007336/07

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Table of Contents

1 Introduction

The Oumeulen Village and Meulenzicht Landgoed development by Atterbury Properties is a new development planned for the Kraaibosch area between George and Wilderness. It is located next to the N2 opposite the turnoff to Victoria Bay. The development consists of mainly residential plots and units developed over several phases on the rolling hills between several valleys draining towards the Indian Ocean.

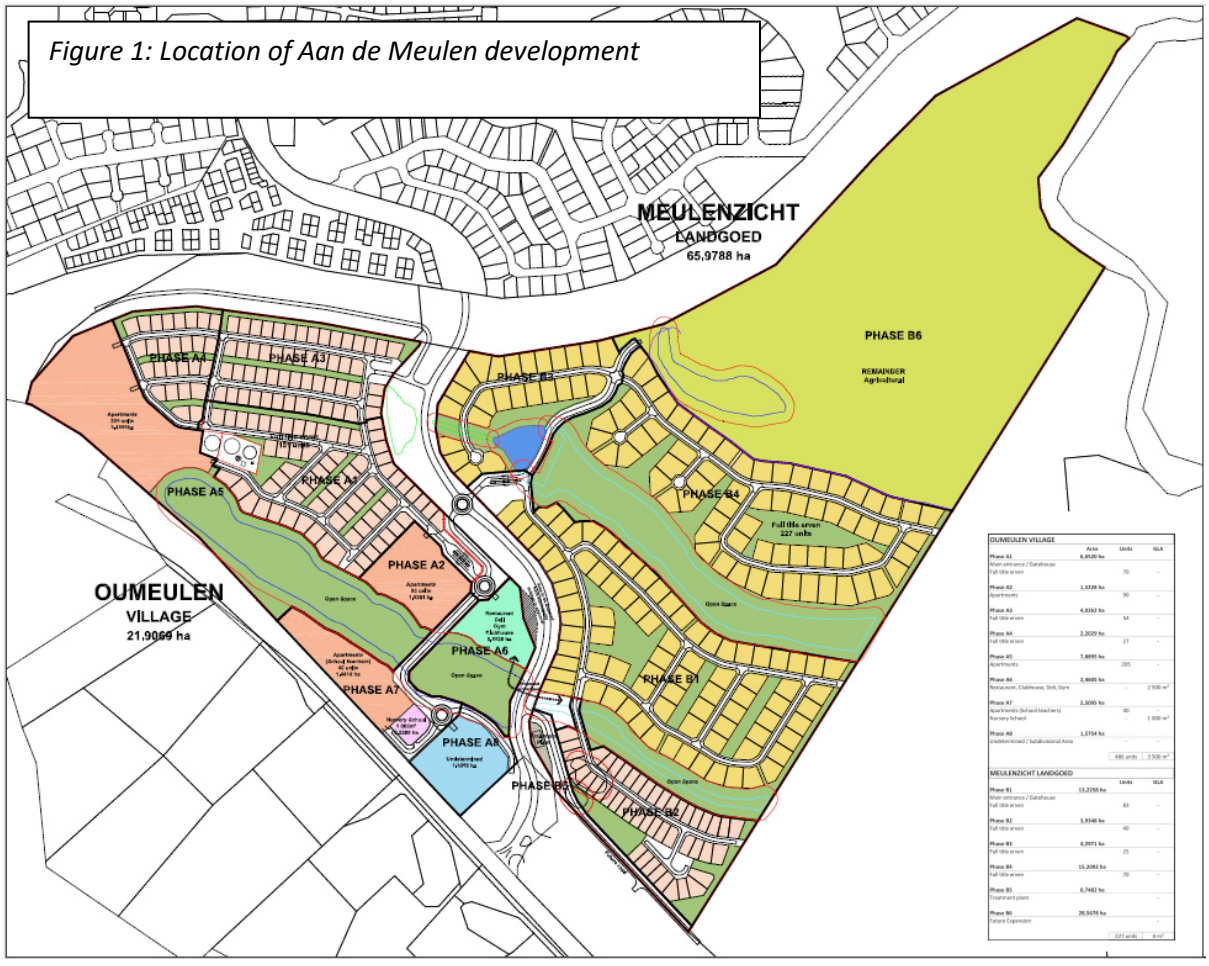


Figure 1: Location of Aan de Meulen development

The Peak Daily Dry Weather Flow (PDDWF) has been calculated by GLS Infrastructure Planning as 308.05kℓ/day (see table below). Assuming a 15% infiltration rate for wet weather conditions the Peak Daily Wet Weather Flow (PDWWF) will be taken as 354.25kℓ/day.

Table 1: Wastewater Yield Table

Land Use	Unit of Measure (No/100m2/ha)	No. Units (No/100m2/ha)	UWD/Unit (kL/unit/d)	Sewer Ratio (% x UWD)	PDDWF Excl. Infilt. (kL/d)	Phase
Phase 1						
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	70	0.813	54%	30.71	A1
Residential (George & Wilderness) - Low density, large sized Residential stands	unit	83	0.938	49%	38.13	B1
Sub-Total:		**153**			**68.84**	
Phase 2						
Flats (George & Wilderness) - Medium density Flat units up to 50 m² (Footprint=0.6 and Storeys=1)	unit	90	0.313	80%	22.50	A2
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	49	0.813	54%	21.50	B2
Sub-Total:		**139**			**44.00**	
Phase 3						
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	54	0.813	54%	23.69	A3
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	25	0.813	54%	10.97	B3
Sub-Total:		**79**			**34.66**	
Phase 4						
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	27	0.813	54%	11.85	A4
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	70	1.125	45%	35.44	B4
Sub-Total:		**97**			**47.28**	
Phase 5						
Flats (George & Wilderness) - Low density Flat units up to 50 m² (Footprint=0.6 and Storeys=1)	unit	205	0.375	76%	58.43	A5
Sub-Total:		**205**			**58.43**	

Phase 6						
Business/Commercial - Business 1 - Business 4 - Medium < 5 000m²	100m²	25	0.875	63%	13.78	A6
Sub-Total:		**25**			**13.78**	
Phase 7						
School, creche, educational - Building and grounding	100m²	10	0.750	58%	4.35	A7
Flats (George & Wilderness) - Low density Flat units up to 50 m² (Footprint=0.6 and Storeys=1)	unit	60	0.375	76%	17.10	A7
Sub-Total:		**70**			**21.45**	
Phase C						
Residential (George & Wilderness) - Very Low density, extra large sized Residential stands	unit	50	1.125	45%	25.31	C
Sub-Total:		**50**			**25.31**	
Total for all Phases(kL/d):					**313.75**	
Allow for additional 10% future demand from neighboring properties		**10%**			**31.38**	
Total (kL/d):					**345.13**	

In order to buffer the hourly peak in the morning and evening, a 12 hour concrete buffer tank will be incorporated upstream of the bioreactor.

No wastewater sample has been provided as the development has not been constructed, so the wastewater plant design was based on typical medium to high strength wastewater influent quality as listed in Table 2.

Table 2: Assumed influent water quality

Parameter	Unit	Maximum Value
Influent COD (mg COD/l)	mg/ℓ	800
Influent TKN (mg N/l)	mg/ℓ	40
Free and saline ammonia	mg/ℓ	25
Influent Total Phosphorus (mg P/l)	mg/ℓ	12
Total Suspended Solids (mg TSS/l)	mg/ℓ	450
Fats, Oils and Grease	mg/ℓ	30
Alkalinity (mg/l as CaCO3)	mg/ℓ	150

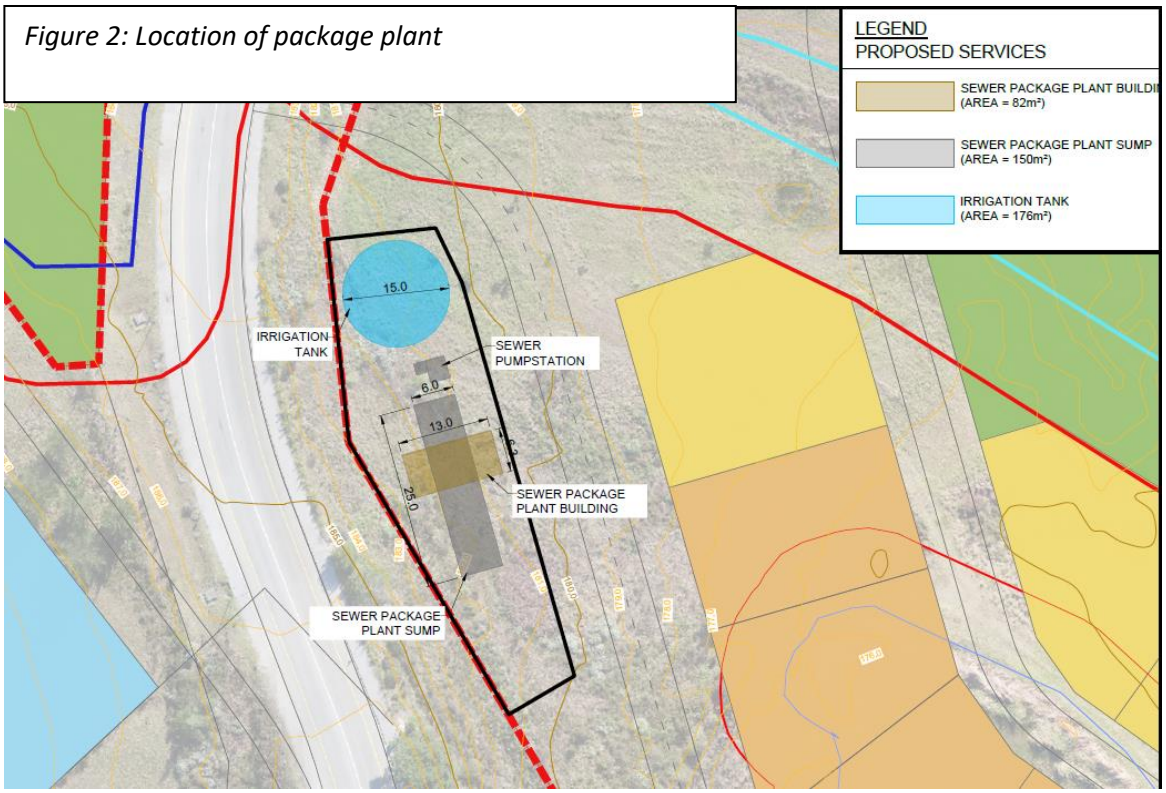
The wastewater will be treated to the Department of Water and Sanitation's General Discharge Limits, as shown in Table 3 below:

Table 3: General Limits of discharge

Parameter	General Limit
COD (mg COD/l)	75
Ammonia as Nitrogen (mg N/l)	6
Nitrate as Nitrogen (mg N/l)	15
Orthophosphates (mg P/l)	10
Total Suspended Solids (mg TSS/l)	25
Faecal Coliform (per 100ml)	1000

The package plant will be located alongside the access road of the development as per Figure 2.

Figure 2: Location of package plant



2 Technical Description

Alveo Water's state of the art Membrane Bioreactor (MBR) Wastewater Treatment Plant (WWTP) is constructed and installed inside an underground concrete structure. It is our proposed solution for a rapid, cost effective and aesthetically pleasing decentralized wastewater treatment solution.

2.1 General Process Description

Conventional Activated Sludge (CAS) plants use natural bacteria to break down organic matter as well as convert waste into stable sludge, treated effluent and gases such as carbon dioxide (CO_2), methane (CH_4) and nitrogen (N_2). The three main groups of active bacteria are aerobic, anaerobic, and anoxic. Anaerobic bacteria are prominent in the equalisation chamber, anoxic bacteria are prominent in the anoxic chamber and aerobic bacteria are prominent in the aeration chamber.

Membrane Bioreactor (MBR) technology combines simple microfiltration with bio-digestion to reap the benefits of combined physical separation and biological removal. The dependency of effluent quality on influent quality is removed with an MBR system and thus MBR systems consistently provide quality effluent water. Furthermore, the minimal transfer of suspended solids through the MBR system allows the concentration of active bacteria to increase as much as four (4) times that possible in a CAS plant. This ensures that superior bio-digestion occurs with the use of an MBR at a fraction of the area required when using CAS alone.

Figures 3 to 5 below illustrate civil wastewater treatment plants recently commissioned. These plants are without equal in South Africa and unmatched in design, technology and built quality throughout the world.

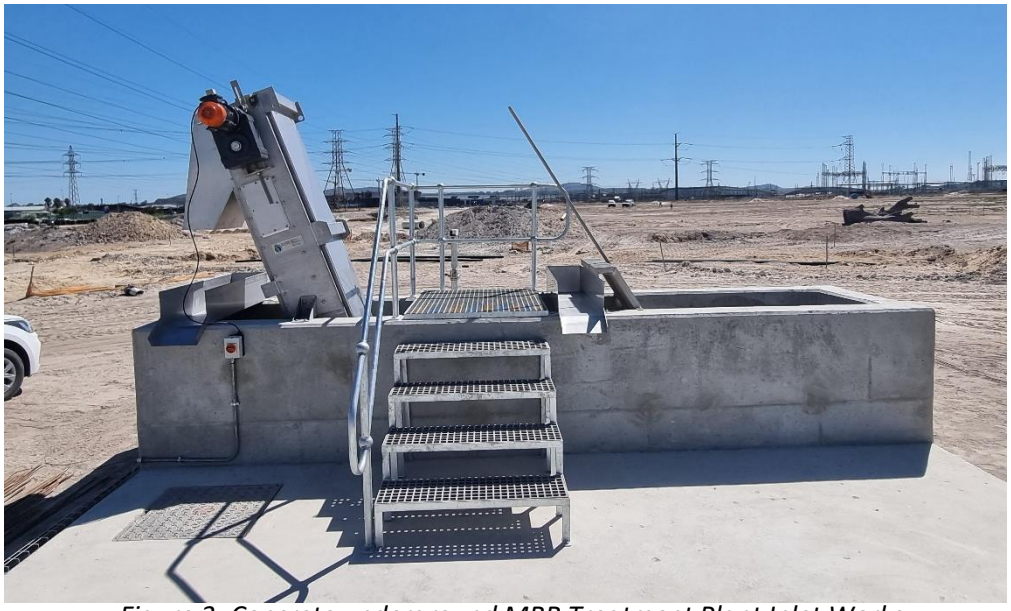


Figure 3: Concrete underground MBR Treatment Plant Inlet Works

Figure 4: Concrete underground MBR equipment room and sludge silos

Figure 5: Recently completed MBR plant showing inlet works and control room

2.2 Block Flow Diagram

The block flow diagram gives a simplified indication of the process that will be followed for the treatment of effluent water received at the Aan de Meulen WWTP.

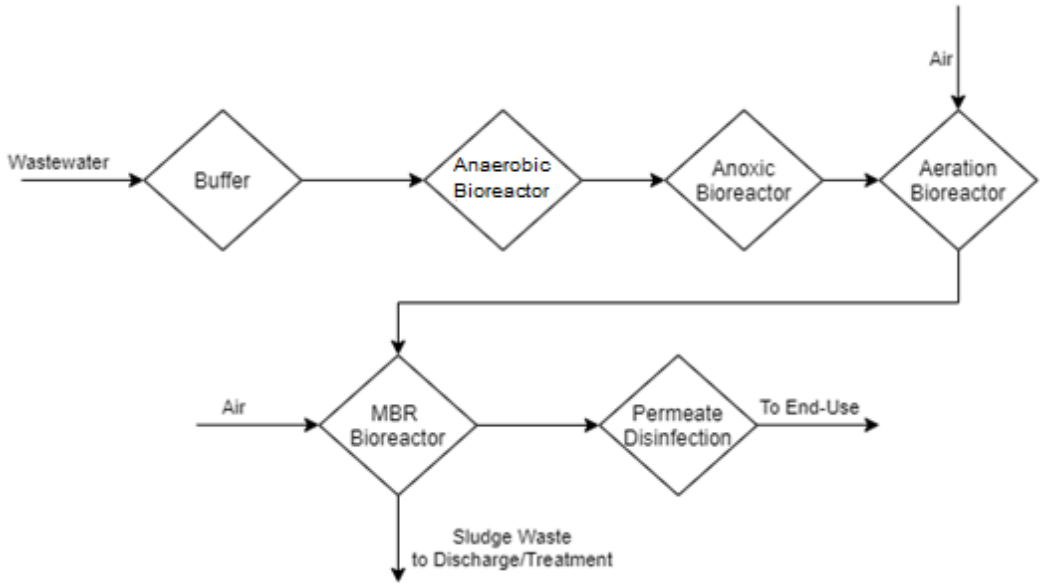


Figure 6: Typical process flow diagram for treatment works

2.3 Treatment Process Description

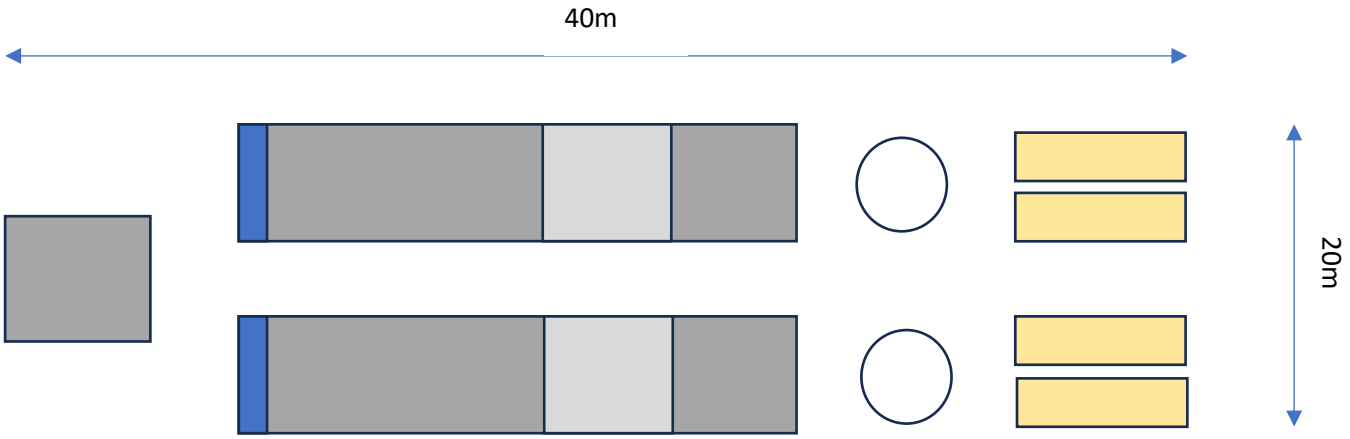
Upstream of the WWTP, Alveo Water will install the following equipment before and in the 12 hour buffer tank:

- 20 mm handrake screen (coarse)
- 10mm automatic front rake screen (medium)
- Duty/standby buffer pumps, to feed the WWTP

The WWTP will be constructed in concrete, which will house the following:

- 12 hour buffer tank
- 3mm fine parabolic screen
- Anoxic section packing or mixer
- Aerobic section diffuser disks and pipework
- MBR membranes on stainless steel stands
- Blowers for aeration and membrane scouring
- Permeate pumps to remove water from MBR chamber
- Sludge thickening silos
- Sludge drying bags
- UV and sodium hypochlorite disinfection
- CIP tank and skid to clean membranes periodically
- All electrical control, cabling and instrumentation required for a fully functional plant

2.4 Plant Layout



2.5 Electrical Requirements

An estimate of the power consumption of the plant can be summarised in Table 4 as follows:

Table 4: Estimated power consumption for 360kl/d plant

Drive	Motor kW	kWh per day
Buffer Pump	7.5	90
Anoxic Mixer	4.5	90
RAS Pump	6	138
Permeate Pump	4.5	60
Aeration Blower	22	506
Scour Blower	18	414
Chlorine Dosing Disinfection	0.1	2
UV Light	0.75	18
Other (Lights, Fan)	1	23
Total:	**64.35**	**1341**

The WWTP has to run all the time to maintain healthy biological activity. Therefore, a standby generator must be budgeted for if Eskom power is used and load shedding is assumed to continue. The estimated generator size for this plant would be 100kVA.

3 Cost Estimate

3.1 Capital Costs

Table 5 below summarises the civil, mechanical and electrical costs associated with the proposed MBR WWTP. Please note that this is an initial estimate of the plant cost and as such, is subject to change upon finalization of the development, site, location and design of the plant. At present, an underground concrete plant has been priced for budget purposes to accommodate 360 kℓ/d of influent with an assumed COD of approximately 800 mg/ℓ.

Table 5: Capital cost breakdown for the proposed concrete wastewater treatment works

Section	Description	Amount	
	CONCRETE WORK FOR STRUCTURE		
1	Civil, Concrete and Building Work	R	4 150 000.00
Sub-Total		**R**	**4 150 000.00**
	MECHANICAL AND ELECTRICAL		
2	Inlet works	R	750 000.00
3	Mechanical equipment	R	3 100 00.00
4	Electrical Equipment	R	700 000.00
5	Design & Overheads	R	375 000.00
Sub-Total		**R**	**4 925 000.00**
	Transport, Installation and Commissioning		
6	Transport, Installation, Commissioning & P&Gs	R	450 000.00
Sub-Total		**R**	**450 000.00**
TOTAL EXCLUDING VAT		**R**	**9 525 000.00**

* Cost per kilolitre R26 458/kℓ

The cost of spares and consumables are not included and is the client's responsibility and they will have to indicate which spares and the quantity of such spares to be included in the price.

3.2 Operational Costs

Approximately 40230 kWh will be consumed by the plant per month at maximum design flow. However, as this is a budget level pricing, a detailed design can be drawn up to minimize energy consumption by utilizing high efficiency motors, variable speed drives and advanced blower control systems.

Typical service and maintenance costs will be required. Below is an estimate of the running cost of the plant. Please note that this excluded diesel for the standby generator.

Table 2: Estimated chemical consumption

Description	Quantity	Expected monthly cost (R/m)
Labour	10	R 4 500.00/m
Transport	80	R 480.00/m
Sodium Hypo	200	R 3 200.00/m
TOTAL		**R 8 180.00/m**

3.3 Delivery

The expected delivery time for this plant will be **7 months** from date of order. The concrete structure is estimated to take approximately 5 months to build, while the installation of the mechanical and electrical equipment should take two months to complete.

3.4 Qualifications

- All prices are quoted in South African Rand (ZAR)
- Prices exclude Value Added Taxes (VAT)
- The estimate is valid for 6 months whereafter prices must be adjusted for inflation.

3.5 Exclusions and Battery Limits

Description	**Alveo Water Responsibility**	**Client Responsibility**
Sewer pumpstations		✓
Sewer rising mains		✓
Buffer sump	✓	
Buffer pumps and screens to WWTP	✓	
Site preparation, bulk earthworks		✓
Excavation and final earthworks	✓	
Fencing, landscaping, lighting, security, access road		✓
Loading and delivery of equipment to site	✓	
Generator or backup power		✓
Installation and commissioning of equipment	✓	
Sludge drying	✓	
Sludge disposal		✓
Treated water tanks, pumps and reticulation to end use		✓

ANNEXURE D

Preliminary Civil Engineering Layout Drawings

LEGEND
EXISTING SERVICES

- CONTOURS
- FENCELINE
- ELECTRIC FENCE
- GATE
- EDGE OF TAR
- PAVING EDGE
- SIGN BOARD
- GRAVEL ROAD
- CONCRETE ROAD
- CONCRETE FEATURES
- BUILDINGS
- ELECTRIC POLES
- STREET LAMP
- OVER HEAD POWERLINE
- FLOW DIRECTION & DIAMETER
- STORMWATER CONDUIT
- STORMWATER LABELS
- STORMWATER CATCHPITS
- STORMWATER MANHOLE
- HYDRANT/VALVE BOX
- VALVE MANHOLE
- WATER TAP VALVE
- WATER SCOUR VALVE
- WATER AIR VALVE
- EMBANKMENTS & SLOOTS
- ROAD SIGN
- RODING EYE
- BENCHMARKS
- EDGE OF CONCRETE
- CABLE COVERS
- BOUNDARY
- AREA OF DENSE VEGETATION
- TREES
- DENSE VEGETATION
- WET LANDS
- DAM EDGE
- GUARD RAIL
- SEWER CONDUIT
- SEWER MANHOLES
- SEWER LABEL
- BOTTOM KERB
- EDGE OF KERBING
- GIS CADASTRAL
- CALCULATED CADASTRAL
- JOJO TANK
- SERVITUDE ROAD
- SERVITUDE PIPELINE
- PIPELINE BRIDGE

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR: 0 — 37.5 — 75 Meters 1:1250

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REVISIONS

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

DESIGNED	GW
DRAWN	HMV
CHECKED	MF

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email: george@lyners.co.za

APPROVED
ENGINEER:
DATE: 2024-12-06

APPROVED
CLIENT:
DATE:

CLIENT: ATTERBURY — *It's a matter of association*

PROJECT: OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE: EXISTING SERVICES LAYOUT

SCALE: 1:1250 on A0
SHEET: 1 OF 1
CONTRACT No.:
PROJECT No.: 24051 CG
DRAWING No.: 24051-C-001-01
REV: A
COORDINATE SYSTEM: WGS84 / Lo 23°

iso full bleed a0 (841.00 x 1189.00 mm) Lyners_AutoCAD.ctb 2024-12-06

U:\WERKE\2400\24051 CG - SAWMILL DEVELOPMENT - GEORGE\DRAWINGS\1.2 ACTIVE\24051-C-001-01 (EXISTING SERVICES LAYOUT).DWG

24051-C-002-02: KERB LAYOUT - MEULENZICHT SECTION 1
24051-C-003-02: SEWER LAYOUT - MEULENZICHT SECTION 1
24051-C-004-02: WATER LAYOUT - MEULENZICHT SECTION 1
24051-C-005-02: STORMWATER LAYOUT - MEULENZICHT SECTION 1
24051-C-006-02: FIBRE LAYOUT - MEULENZICHT SECTION 1

24051-C-002-01: KERB LAYOUT - OUMEULEN
24051-C-003-01: SEWER LAYOUT - OUMEULEN
24051-C-004-01: WATER LAYOUT - OUMEULEN
24051-C-005-01: STORMWATER LAYOUT - OUMEULEN
24051-C-006-01: FIBRE LAYOUT - OUMEULEN

24051-C-002-03: KERB LAYOUT - MEULENZICHT SECTION 2
24051-C-003-03: SEWER LAYOUT - MEULENZICHT SECTION 2
24051-C-004-03: WATER LAYOUT - MEULENZICHT SECTION 2
24051-C-005-03: STORMWATER LAYOUT - MEULENZICHT SECTION 2
24051-C-006-03: FIBRE LAYOUT - MEULENZICHT SECTION 2

MEULENZICHT
LANDGOED

OUMEULEN
VILLAGE

OUMEULEN
VILLAGE

MEULENZICHT
LANDGOED

Proposed 2 Ml Reservoir

Future 2 Ml Reservoir

Temporary access road to market

Treatment Plant

SCALEBAR
0 37.5 75
Meters 1:1250

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW	
DRAWN	HMV	
CHECKED	MF	

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APPROVED
ENGINEER: _____
DATE: 2024-12-09

APPROVED
CLIENT: _____
DATE: _____

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
KEY PLAN LAYOUT

SCALE	on A0	SHEET
1:1250		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-001-05 REV A
COORDINATE SYSTEM: WGS84 / Lo 23°

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

Plot Scale: 0.6 (841.00 x 1189.00 mm) Lyners_AutoCAD.ctb 2024-12-09

U:\WERKE\2400\24051 CG - SAWMILL DEVELOPMENT - GEORGE\DRAWINGS\1.2 ACTIVE\24051-C-001-05 (KEY PLAN LAYOUT).DWG

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- KERB BK2+C1
- KERB CK5
- KERB MK10

N

MEULENZICHT
LANDGOED

For continuation, refer to Drawing Number: 24051-C-002-01

For continuation, refer to Drawing Number: 24051-C-002-03

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW	
DRAWN	HMV	
CHECKED	MF	

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APPROVED
ENGINEER:
DATE: 2024-12-09

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
KERB LAYOUT: MEULENZICHT SECTION 1

SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-002-02 REV A

COORDINATE SYSTEM: WGS84 / Lo 23°

Plot Scale: 1.00 x 1189.00 mm) Lyners_AutoCAD.ctb 2024-12-09

U:\WERKE\2400\24051 CG - SAWMILL DEVELOPMENT - GEORGE\DRAWINGS\1.2 ACTIVE\24051-C-002-01 (KERB LAYOUT - OUMEULEN).DWG

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- KERB BK2+C1
- KERB CK5
- KERB MK10

N

For continuation, refer to Drawing Number: 24051-C-002-02

For continuation, refer to Drawing Number: 24051-C-002-01

OUMEULEN
VILLAGE

Treatment Plant

MEULENZICHT
LANDGOED

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW	
DRAWN	HMV	
CHECKED	MF	

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APPROVED
ENGINEER:
DATE: 2024-12-09

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
KERB LAYOUT: MEULENZICHT SECTION 2

SCALE	on A0	SHEET
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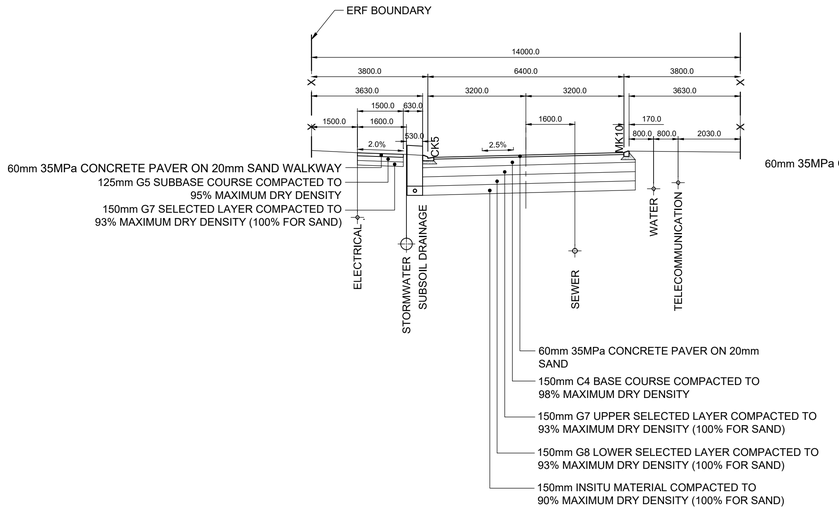
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-002-03 REV. A

COORDINATE SYSTEM: WGS84 / Lo 23°



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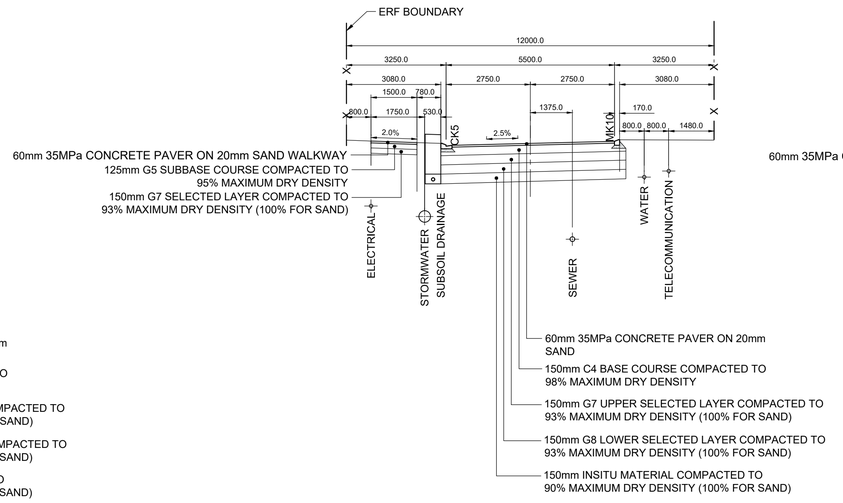
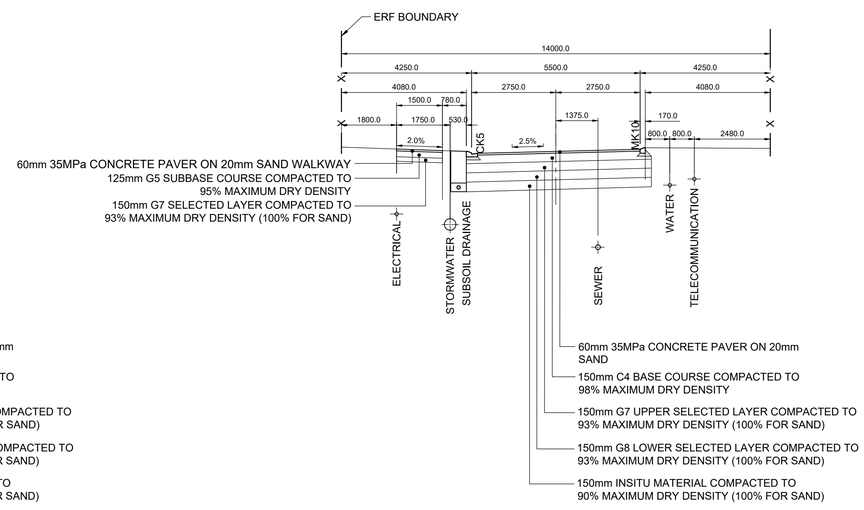
TYPICAL CROSS SECTION - FOR PAVING
SCALE 1:100



12m ROAD RESERVE: 5.5m ROAD
TYPICAL CROSS SECTION - FOR PAVING
SCALE 1:100



14m ROAD RESERVE: 5.5m ROAD
TYPICAL CROSS SECTION - FOR PAVING
SCALE 1:100

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 3 6
Meters 1:100

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	FOR INFORMATION	2024-12-06	GW	FvE

REVISIONS

DESIGNED	GW	
DRAWN	GW	
CHECKED	FvE	

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APPROVED
ENGINEERS: _____
DATE: 2024-12-06

APPROVED
CLIENT: _____
DATE: _____

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND
MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
ROADS
TYPICAL CROSS SECTION

SCALE	SHEET
on A1 AS SHOWN	1 OF 1
CONTRACT No.	PROJECT No. 24051CG

DRAWING No. 24051-C-002-201 REV A

COORDINATE SYSTEM: WGS84 / Lo7°

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- FOUL SEWER MANHOLE
- FOUL SEWER END CAP
- PVC-U CLASS 34 PIPELINE
- FOUL SEWER FLOW DIRECTION
- 110mmØ PVC-U CLASS 34 HOUSE CONNECTION
- HDPE PE 100 PN12.5 RISING MAIN
- FLOW DIRECTION
- PUMPSTATION
- RISING MAIN HORIZONTAL BENDS
- STREAM COSSING

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH1	44155.327	3762061.747
FSMH2	44142.669	3762086.564
FSMH3	44109.321	3762135.360
FSMH4	44049.836	3762179.295
FSMH5	43990.351	3762223.230
FSMH6	43973.375	3762226.257
FSMH7	43932.685	3762229.574
FSMH8	43845.736	3762249.571
FSMH9	43767.896	3762276.786
FSMH10	43773.302	3762282.237
FSMH11	43772.090	3762278.410
FSMH12	43724.577	3762286.565
FSMH13	44150.493	3762141.413
FSMH14	44132.166	3762163.882
FSMH15	44070.503	3762209.290
FSMH16	44008.839	3762254.698
FSMH17	43989.574	3762261.743
FSMH18	43929.066	3762268.762
FSMH19	43855.659	3762286.845
FSMH20	43789.985	3762316.119

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH21	43710.154	3762334.921
FSMH22	43676.167	3762280.736
FSMH23	44209.136	3762212.613
FSMH24	44199.874	3762180.240
FSMH25	44206.700	3762238.137
FSMH26	44161.697	3762217.014
FSMH27	44189.764	3762249.809
FSMH28	44113.258	3762258.150
FSMH29	44142.839	3762278.076
FSMH30	44121.231	3762300.656
FSMH31	44104.228	3762327.852
FSMH32	44068.469	3762288.803
FSMH33	44078.694	3762364.189
FSMH34	44018.864	3762318.589
FSMH35	44035.477	3762343.102
FSMH36	44035.549	3762353.831
FSMH37	44057.290	3762385.455
FSMH38	44019.802	3762412.573
FSMH39	43969.528	3762435.883
FSMH40	43903.102	3762441.997

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH41	43836.676	3762448.112
FSMH42	43777.643	3762431.515
FSMH43	44010.886	3762373.295
FSMH44	43994.341	3762380.968
FSMH45	43953.222	3762390.653
FSMH46	43896.455	3762393.399
FSMH47	43839.689	3762396.146
FSMH48	43791.406	3762382.922
FSMH49	43748.709	3762385.796
FSMH50	43770.186	3762422.462
FSMH51	44227.047	3762082.323
FSMH52	44254.659	3762081.205
FSMH53	44331.816	3762093.365
FSMH54	44408.973	3762105.526
FSMH55	44421.778	3762113.689
FSMH56	44440.899	3762146.589
FSMH57	44444.435	3762166.752
FSMH58	44439.682	3762195.213
FSMH59	44410.667	3762245.436
FSMH60	44247.058	3762125.543

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH61	44312.092	3762136.097
FSMH62	44369.680	3762146.688
FSMH63	44399.594	3762169.203
FSMH64	44384.952	3762214.278
FSMH65	44366.671	3762242.377
FSMH66	44363.571	3762283.058
FSMH67	44299.544	3762288.096
FSMH68	44268.581	3762321.515
FSMH69	44240.291	3762319.605
FSMH70	44214.698	3762335.656
FSMH71	44177.421	3762369.479
FSMH72	44140.291	3762403.170
FSMH73	44106.086	3762440.661
FSMH74	44072.517	3762477.461
FSMH75	44051.206	3762493.956
FSMH76	44025.709	3762506.652
FSMH77	43963.241	3762517.222
FSMH78	43900.845	3762527.879
FSMH79	44328.701	3762316.826
FSMH80	44291.396	3762356.423

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH81	44280.791	3762372.951
FSMH82	44254.870	3762358.384
FSMH83	44244.091	3762360.063
FSMH84	44204.965	3762395.459
FSMH85	44165.838	3762430.855
FSMH86	44205.081	3762483.920
FSMH87	44154.259	3762499.855
FSMH88	44125.731	3762473.828
FSMH89	44110.062	3762539.402
FSMH90	44091.761	3762510.225
FSMH91	44061.889	3762530.347
FSMH92	44031.655	3762543.042
FSMH93	44026.363	3762586.629
FSMH94	44002.414	3762548.447
FSMH95	43982.922	3762589.121
FSMH96	43961.765	3762559.390
FSMH97	43910.532	3762564.141
FSMH98	43859.408	3762572.873
FSMH99	43837.927	3762536.626
FSMH100	44264.180	3762404.358

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH101	44251.261	3762455.145
FSMH102	44249.639	3762486.278
FSMH103	44260.160	3762555.033
FSMH104	44267.370	3762591.379
FSMH105	44236.217	3762598.638
FSMH106	44216.296	3762606.497
FSMH107	44191.433	3762625.711
FSMH108	44152.368	3762669.013
FSMH109	44105.721	3762694.126
FSMH110	44060.597	3762721.735
FSMH111	44027.972	3762730.980
FSMH112	43992.963	3762733.024
FSMH113	44196.030	3762576.235
FSMH114	44166.069	3762598.501
FSMH115	44135.017	3762579.187
FSMH116	44154.978	3762611.011
FSMH117	44131.500	3762636.738
FSMH118	44057.894	3762636.898
FSMH119	44077.132	3762667.569
FSMH120	44012.678	3762636.561

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH121	44042.214	3762683.649
FSMH122	44039.589	3762688.943
FSMH123	44015.953	3762693.698
FSMH124	43941.677	3762627.108
FSMH125	43985.312	3762695.007
FSMH126	43896.185	3762631.505
FSMH127	43925.182	3762677.734
FSMH128	43954.179	3762723.964
FSMH129	43970.473	3762730.765
FSMH130	44212.043	3762680.189
FSMH131	44140.718	3762731.034
FSMH132	44102.526	3762754.440
FSMH133	44078.685	3762767.262
FSMH134	44046.317	3762780.220
FSMH135	44257.574	3762654.778
FSMH136	44243.997	3762699.470
FSMH137	44233.535	3762708.924
FSMH138	44178.204	3762748.491
FSMH139	44120.922	3762785.269
FSMH140	44097.651	3762797.476

MEULENZICHT MANHOLE SETTING OUT DATA

MH ID	Y	X
FSMH141	44064.259	3762812.308
FSMH142	44150.790	3762827.043
FSMH143	44108.038	3762872.634
FSMH144	44103.088	3762910.313
FSMH145	44066.327	3762903.700
FSMH146	44040.089	3762862.583
FSMH147	44013.851	3762821.466
FSMH148	44000.599	3762786.546

RISING MAIN SETTING OUT DATA

MH ID	Y	X
FSPS1	43673.275	3762276.126
FSPS2	43765.169	3762425.807
FSPS3	43833.875	3762532.166
FSPS4	43968.678	3762735.213
FSPS5	43997.837	3762778.427
RMB1	43674.626	3762281.456
RMB2	43832.946	3762534.449
RMB3	43955.929	3762730.142
RMB4	43996.947	3762782.041
RMB5	44034.337	3762857.287
RMB6	44294.716	3762665.377

Notes:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Levels and position of existing sewer network to be verified before construction any discrepancies are to be liaised with the engineer immediately.
3. All main sewer pipes to be 160mmØ PVC-U Class 34 Heavy Duty, unless otherwise specified.
4. All sewer house connections to be 110mmØ PVC-U Class 34 Heavy Duty, unless otherwise specified
5. Pipes to be laid on bedding for flexible pipes according to SABS 1200 LB:DRAWING LB-2.
6. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
7. For continuation, refer to Drawing Numbers: 24051-C-003-01 and 24051-C-003-03
8. For setting out data, refer to Drawing Number: 24051-C-003-02
9. For Sewer House Connection Detail, refer to Drawing Number: STE-R-12

Meulenzicht Stream Crossing Setting Out Data

POINT	Y	X
31	44448.364	3762160.509
32	44438.655	3762163.001
33	44439.358	3762166.797
34	44434.900	3762193.496
35	44433.549	3762195.835
36	44436.605	3762195.357
37	44437.872	3762195.110
38	44445.154	3762192.806
39	44449.512	3762166.707
40	44403.403	3762173.661
41	44391.664	3762177.431
42	44384.565	3762199.287
43	44393.805	3762203.209
44	44339.379	3762279.946
45	44303.941	3762282.758
46	44204.173	3762286.542
47	44298.008	3762289.754
48	44300.353	3762291.315
49	44303.322	3762292.818
50	44328.102	3762290.864
51	44335.064	3762285.301
53	43725.297	3762281.616
54	43666.705	3762274.560
55	43683.557	3762301.891
56	43693.573	3762299.083
57	43686.102	3762286.965
58	43723.870	3762291.516
59	43790.285	3762455.473
60	43787.845	3762458.184
61	43785.714	3762462.833
62	43785.213	3762466.050
63	43831.378	3762537.515
64	43842.394	3762536.139

For continuation, refer to Drawing Number: 24051-C-003-01

For continuation, refer to Drawing Number: 24051-C-003-03

PLAN LAYOUT : MEULENZICHT SECTION 1
SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW	
DRAWN	HMV	
CHECKED	MF	

CONSULTING ENGINEERS
LYNERS
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GEORGE
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Tel: 044 887 0223/Fax: 044 887 0741
email: george@lyners.co.za

APPROVED
ENGINEER: _____
DATE: 2025-02-20

APPROVED
CLIENT: _____
DATE: _____

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
SEWER LAYOUT: MEULENZICHT SECTION 1

SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-003-02 REV. A
COORDINATE SYSTEM: WGS84 / Lo 23°

Lyners_AutoCAD.ctb 2025-02-20
U:\WERKE\24000\24051 CG - SAWMILL DEVELOPMENT - GEORGE\DRAWINGS\1.2 ACTIVE\24051-C-003-01 (SEWER LAYOUT - OUMEULEN).DWG

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- FOUL SEWER MANHOLE
- FOUL SEWER END CAP
- PVC-U CLASS 34 PIPELINE
- FOUL SEWER FLOW DIRECTION
- 110mmØ PVC-U CLASS 34 HOUSE CONNECTION
- HDPE PE 100 PN12.5 RISING MAIN
- FLOW DIRECTION
- PUMPSTATION
- RMB3 RISING MAIN HORIZONTAL BENDS
- STREAM COSSING
- CONNECTION TO SERVICES

Notes:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Levels and position of existing sewer network to be verified before construction any discrepancies are to be liaised with the engineer immediately.
3. All main sewer pipes to be 160mmØ PVC-U Class 34 Heavy Duty, unless otherwise specified.
4. All sewer house connections to be 110mmØ PVC-U Class 34 Heavy Duty, unless otherwise specified
5. Pipes to be laid on bedding for flexible pipes according to SABS 1200 LB:DRAWING LB-2.
6. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
7. For continuation, refer to Drawing Numbers: 24051-C-003-01 and 24051-C-003-02
8. For setting out data, refer to Drawing Number: 24051-C-003-02
9. For Sewer House Connection Detail, refer to Drawing Number: STE-R-12

Meulenzicht Stream Crossing
Setting Out Data

POINT	Y	X
100	43971.537	3762730.508
101	43968.992	3762730.582
102	43964.677	3762732.593
103	43962.067	3762734.354
104	43994.893	3762783.034
105	43997.098	3762782.476
106	44009.855	3762781.370

For continuation, refer to Drawing Number: 24051-C-003-02

For continuation, refer to Drawing Number: 24051-C-003-01

OUMEULEN
VILLAGE

MEULENZICHT
LANDGOED

IRRIGATION TANK
SEWER PUMPSTATION
SEWER PACKAGE PLANT BUILDING
Treatment Plant
SEWER PACKAGE PLANT SUMP

PLAN LAYOUT : MEULENZICHT SECTION 2
SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED GW
DRAWN HMV
CHECKED MF

CONSULTING ENGINEERS
LYNERS
PO Box 757
GEORGE
6530
Tel: 044 887 0223/Fax: 044 887 0741
email: george@lyners.co.za

APPROVED
ENGINEER: _____
DATE: 2024-12-09

APPROVED
CLIENT: _____
DATE: _____

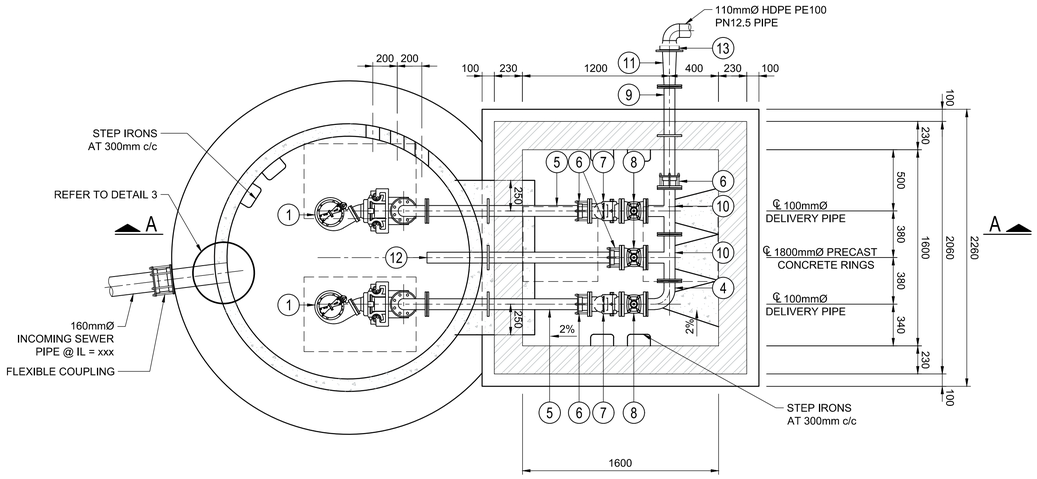
CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

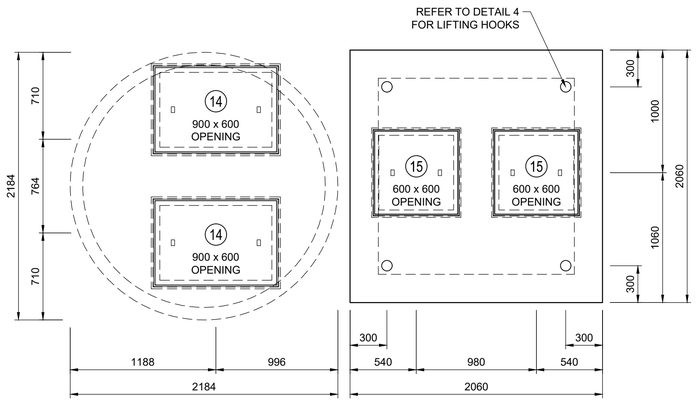
TITLE
SEWER LAYOUT: MEULENZICHT SECTION 2

SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

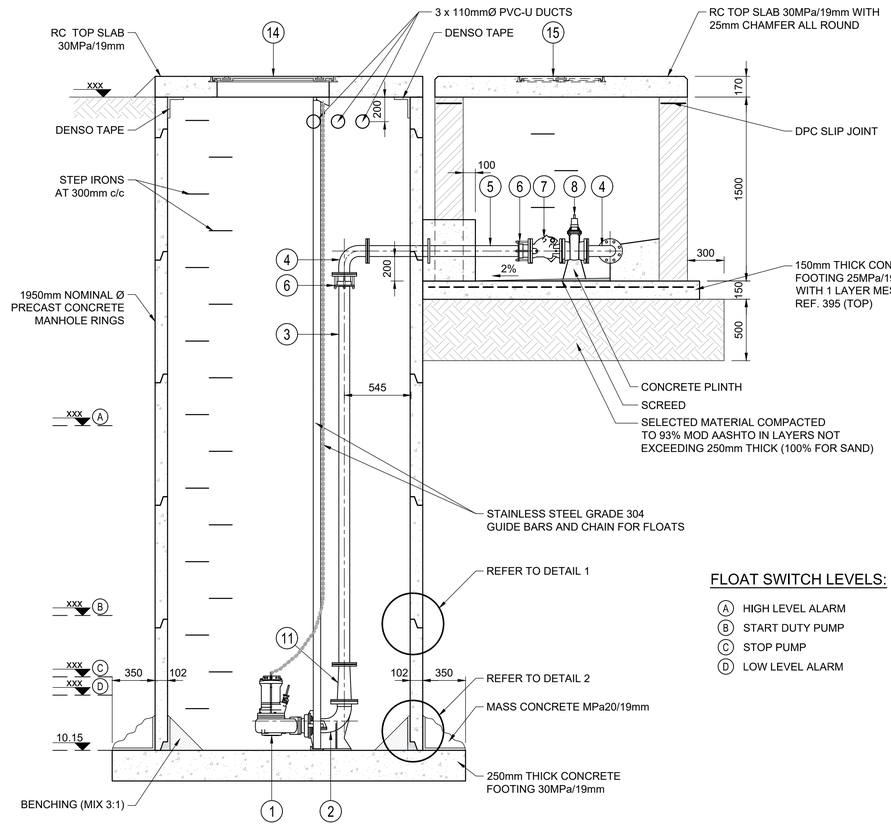
DRAWING No. 24051-C-003-03 REV A
COORDINATE SYSTEM: WGS84 / Lo 23°



PLAN
SCALE 1:25



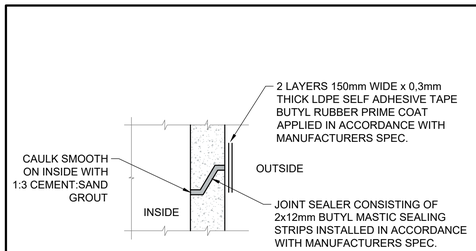
COVER SLABS
SCALE 1:25



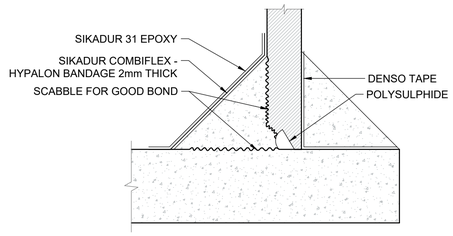
SECTION A-A
SCALE 1:25

FLOAT SWITCH LEVELS:

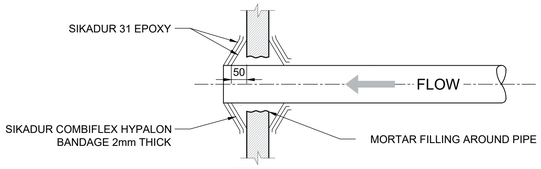
- (A) HIGH LEVEL ALARM
- (B) START DUTY PUMP
- (C) STOP PUMP
- (D) LOW LEVEL ALARM



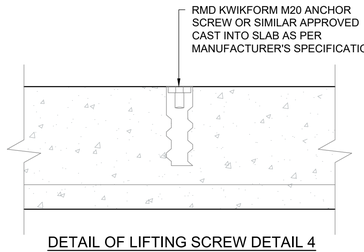
DETAIL 1
NTS



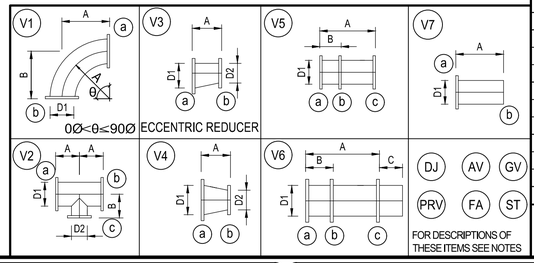
DETAIL 2
NTS



DETAIL 3
SCALE 1:10



DETAIL OF LIFTING SCREW DETAIL 4
SCALE 1:10



Notes:

1. Materials

Steel and stainless steel pipes shall comply with the following

1.1 Stainless steel pipes shall be grade 304 and shall comply with ANSI B36.19M Schedule 10S.
1.2. Mild steel pipes up to 150mmØ shall be seamless, medium class steel pipes manufactured in accordance with SANS 62.
1.3. Mild steel pipes of 200mmØ and greater shall be manufactured in accordance with SANS 719 shall be grade C pipe material and the wall thickness shall be in accordance with table 2, column 3 of SANS 719.
1.4. Flange drilling shall be in accordance with SANS 1123: table 1000/3.
1.5. All nuts, bolts, hooks or other steel items inside the pump station and valve chamber that are not protected by galvanising, must be stainless steel.
1.6. Dimensions of all pipes, fittings, valves, etc. must be submitted for approval on a shopdrawing before any material is ordered.
1.7. Step irons to be Calcamite-type or approved equivalent.

2. Corrosion protection of pipes, specials, couplings and valves

2.1 Corrosion protection internal and external to all steel pipes to be double hot-dipped galvanising after manufacture.
2.2 Mild steel pipes shall be galvanized and coated with three layers of Carbogaurd 891, 125 micron dry film thickness (DFT) per layer.
2.3 SABS approval certificates of all coatings and galvanizing to be delivered to the engineer for approval.
2.4 All mild steel pipe work buried in the ground shall be externally protected by a wrapping system. The specification for the wrapping system is as follows:
- Clean surface to required standard (minimum preparation ST2 according to SI6 055900-1967)
- Brush or spray Denso priming solution or Denso S105 paste Denso mastic to create profile for Denso tape, so as to ensure that there are no air voids forming beneath the Denso tape.
- Denso tape (petrolatum tape) wrapped spirally around prepared area.
- Double wrap polyethelene tape (minimum 300 micron thick).

2.5 All valves (including check valves) shall have a sinter epoxy powder coatings on interior and exterior metal surfaces.
2.6 Backfilled material compacted to 93% MOD AASHTO (100% for sand) unless otherwise specified
2.7 Nuts and bolts to be Grade 304 s/s with approved anti-seize compound.

3. Openings

3.1 All openings in precast pump station rings must be closed with class 20MPa/19mm concrete after the pipes have been installed.

4. General

4.1 All dimensions shown on this drawing shall be verified by the contractor in order to ensure that on-site requirements are met. Dimensions may vary depending on the type and make of items such as valves. Any discrepancies must be reported to the engineer prior to the ordering of any materials.
4.2 Final position of pumps & guiderails to be determined once puddle pipes have been fixed into place

4. Pumps

5.1 Robot Submersible Vortex pump. Model: DWP22-30DD with 130mmØ impeller to suit V100 Duckfoot bend.
5.2 Float switches on stainless steel chain at A, B, C and D as indicated on drawing.

DESCRIPTION OF COUPLINGS AND VALVES

SHAPE	DESCRIPTION
DB	V100 DUCKFOOT BEND OR SIMILAR APPROVED
FA	HDPE STUB END WITH STAINLESS STEEL TABLE 1000/3 BACKING RING, CONTINUOUSLY BUTT WELDED TO PIPE
GV	DOUBLE-FLANGED, NON-RISING SPINDLE, CLOCKWISE CLOSING, WITH HANDWHEEL RESILIENT SEAL GATE VALVE TO SABS 664 - 10 BAR AVK OR SIMILAR APPROVED
NRV	DOUBLE-FLANGED, CAST IRON SINGLE DOOR SWING CHECK VALVE TO SABS 144, 10 BAR AVK OR SIMILAR APPROVED
VJ	KAMFLEX BLACK PN10 FLANGE ADAPTOR WITH s/s GRADE 316 BUTS AND BOLTS

LEGEND

●	STAINLESS STEEL
□	EXACT LENGTH TO BE DETERMINED ON SITE
✶	FLANGED END
W	WELDED (ALL WELDING TO BE DONE BY MANUFACTURER OF PIPES AND NOT ON SITE)
#	SCOUR TEE
∞	THREAD FEMALE CONNECTION
8	THREAD MALE CONNECTION

PIPE SCHEDULE

Item No.	Shape	D1 (mm)	D2 (mm)	A (mm)	B (mm)	C (mm)	Θ (deg)	Flanges a	Flanges b	Flanges c	Quantity
1	PUMPS (Refer to notes for Particular Specification)							-	-	-	2
2	DB	100	-	-	-	-	-	*	*	-	2
3	V5	80	-	□3150	-	-	-	*	-	-	2
4	V1	80	-	190	190	-	90	*	*	-	3
5	V5	80	-	□1300	500	-	-	*	*	-	2
6	VJ	80	-	-	-	-	-	*	-	-	6
7	NRV	80	-	-	-	-	-	*	*	-	2
8	GV	80	-	-	-	-	-	*	*	*	3
9	V5	80	-	800	400	-	-	*	*	-	1
10	V2	80	-	190	190	-	-	*	*	*	2
11	V4	100	80	300	-	-	-	*	*	-	3
12	V5	80	-	□1550	500	-	-	*	*	-	1
13	FA	100	-	-	-	-	-	*	-	-	1
14	900 x 600mm SAINT GOBAIN COVER AND FRAME TYPE 9E OR SIMILAR APPROVED										2
15	600 x 600mm SAINT GOBAIN COVER AND FRAME TYPE 9A OR SIMILAR APPROVED										2

SCALEBAR
0 0.5 1 1.5 m
Scale 1:25

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'24-12-09	GW	FvE

REVISIONS

DESIGNED	GW	'24-12
DRAWN	GW	'24-12
CHECKED	FvE	'24-12

CONSULTING ENGINEERS

LYNERS
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email: george@lyners.co.za

APPROVED
ENGINEERS: _____
DATE: 2024-12-09

APPROVED
CLIENT: _____
DATE: _____

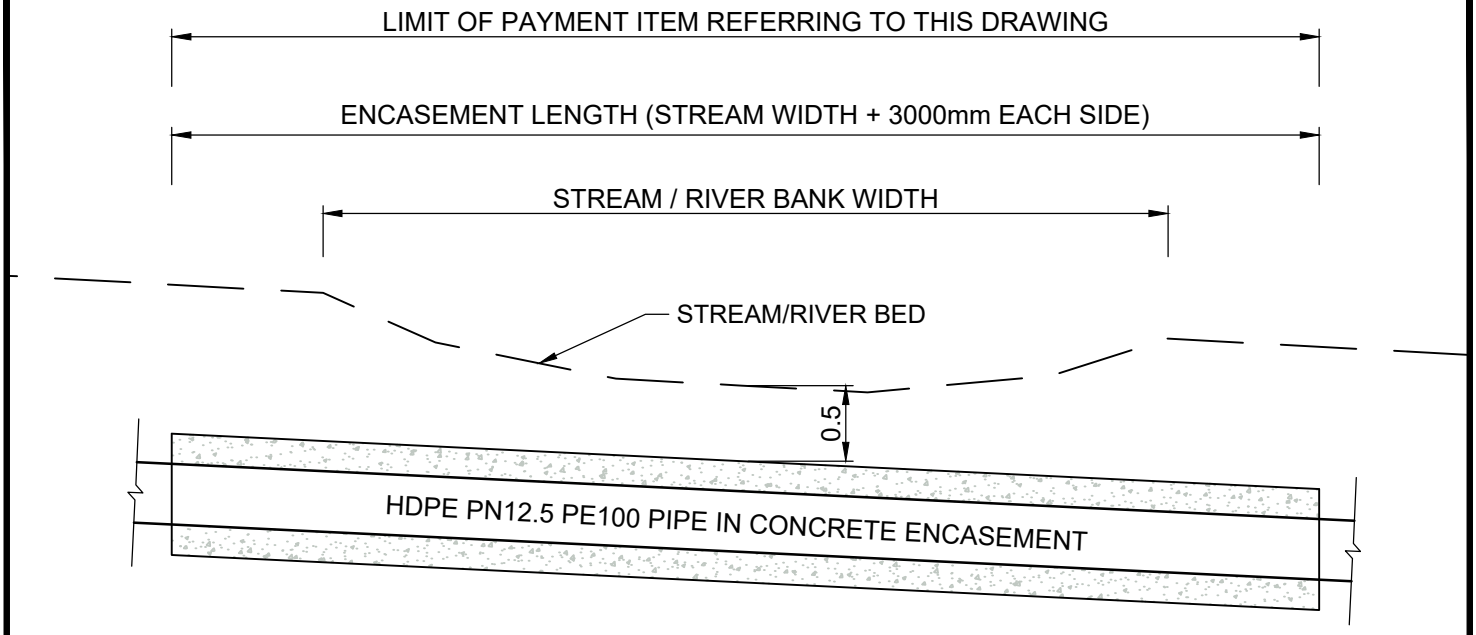
CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
TYPICAL DETAIL OF SEWAGE PUMPSTATION (FSPS)

SCALE	on A1	SHEET
AS SHOWN		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-003-101 REV A
COORDINATE SYSTEM:WGS84/Lo23°

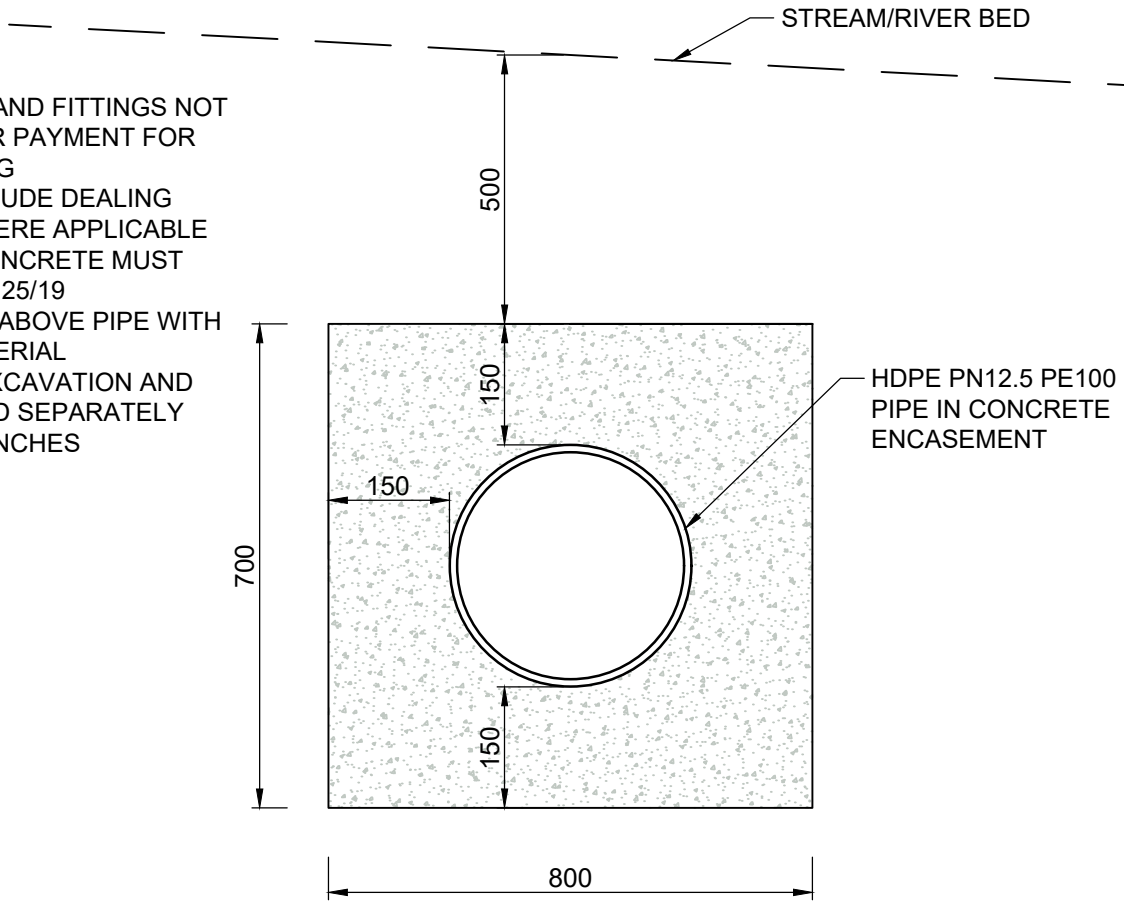


WATER CROSSING - LONGITUDINAL SECTION

N.T.S.

NOTES:

1. ANCHOR BLOCK AND FITTINGS NOT INCLUDED UNDER PAYMENT FOR WATER CROSSING
2. PRICE MUST INCLUDE DEALING WITH WATER WHERE APPLICABLE
2. ENCASEMENT CONCRETE MUST HAVE STRENGTH 25/19
3. BACKFILL 500mm ABOVE PIPE WITH EXCAVATED MATERIAL
4. PAYMENT FOR EXCAVATION AND BACKFILLING PAID SEPARATELY UNDER PIPE TRENCHES



WATER CROSSING - CROSS SECTION

N.T.S.

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

CONSULTING ENGINEERS
LYNERS
PO Box 757
GEORGE
6530
Tel: 044 887 0223/Fax: 044 887 0741
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TITLE

WATER CROSSING DETAIL

PROJECT No.	SCALE on A4	DRAWING No.	REV
C24051	ON_DRAWING	24051-C-003-01	A

APPROVED :	DRAWN	DATE	CHECKED	DATE
FVE	GW	'25-02	FVE	'25-02

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- WATER METER CHAMBER
- T-PIECE
- BENDS
- ENDCAP
- FIRE HYDRANT
- REDUCER
- 110mmØ PVC-U CLASS 16 WATER PIPELINE UNLESS OTHERWISE SHOWN
- 32mmØ HDPE PE 100 PN 16 WATER CONNECTION
- 25mmØ HDPE PE 100 PN 16 DOUBLE WATER CONNECTION
- STREAM COSSING

Notes:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Levels and position of existing water network to be verified before construction any discrepancies are to be liaised with the engineer immediately.
3. All main water pipes to be 110mmØ PVC-U Class 16 Heavy Duty, unless otherwise specified.
4. All water house connections to be 32mmØ PVC-U Class 16 Heavy Duty, unless otherwise specified
5. Pipes to be laid on bedding for flexible pipes according to SABS 1200 LB:DRAWING LB-2.
6. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
7. For continuation, refer to Drawing Numbers: 24051-C-004-02 and 24051-C-004-03
8. For Water House Connection Detail, refer to Drawing Number: STE-W-29G

MEULENZICHT FITTINGS SETTING OUT DATA

ID	DIA	PART	Y	X
B1	110mmØ	11.25° BEND	44182.280	3762042.191
B2	110mmØ	11.25° BEND	44192.301	3762052.349
B3	110mmØ	11.25° BEND	44199.060	3762064.136
B4	110mmØ	22.5° BEND	43760.072	3762333.133
B5	110mmØ	22.5° BEND	43787.970	3762376.972
B6	110mmØ	22.5° BEND	43794.648	3762381.897
B7	110mmØ	11.25° BEND	43834.554	3762392.595
B8	110mmØ	11.25° BEND	43845.076	3762394.091
B9	110mmØ	11.25° BEND	43961.152	3762387.043
B10	110mmØ	11.25° BEND	43995.573	3762377.946
B11	110mmØ	11.25° BEND	44005.802	3762373.727
B12	110mmØ	11.25° BEND	44027.358	3762358.909
B13	110mmØ	45° BEND	44032.846	3762353.254
B14	110mmØ	45° BEND	44033.607	3762344.281
B15	110mmØ	22.5° + 11.25° BEND	43980.508	3762287.780
B16	110mmØ	11.25° BEND	43781.212	3762321.271
B17	110mmØ	11.25° BEND	43797.724	3762315.749
B18	110mmØ	11.25° BEND	43851.224	3762291.086
B19	110mmØ	11.25° BEND	43863.028	3762286.812
B20	110mmØ	11.25° BEND	43936.227	3762269.738
B21	110mmØ	11.25° BEND	43990.723	3762263.889
B22	110mmØ	11.25° BEND	44005.164	3762259.085
B23	110mmØ	11.25° BEND	44016.636	3762252.802
B24	110mmØ	11.25° BEND	44126.507	3762171.864
B25	110mmØ	11.25° BEND	44135.366	3762164.056
B26	110mmØ	11.25° BEND	44142.395	3762156.458
B27	110mmØ	11.25° BEND	44172.520	3762114.043
B28	110mmØ	11.25° BEND	44179.949	3762107.060
B29	110mmØ	11.25° BEND	44187.368	3762102.365
B30	110mmØ	11.25° BEND	44443.323	3762192.668
B31	110mmØ	11.25° BEND	44446.496	3762173.782
B32	110mmØ	11.25° BEND	44446.419	3762160.857
B33	110mmØ	11.25° BEND	44443.807	3762148.437
B34	110mmØ	11.25° BEND	44438.922	3762137.028
B35	110mmØ	11.25° BEND	44424.558	3762113.389
B36	110mmØ	22.5° BEND	44418.186	3762107.320
B37	110mmØ	22.5° BEND	44410.034	3762103.392
B38	110mmØ	11.25° BEND	44243.152	3762078.244
B39	110mmØ	11.25° BEND	44228.986	3762079.569
B40	160mmØ	11.25° BEND	44217.511	3762113.204
B41	160mmØ	11.25° BEND	44222.856	3762120.814
B42	160mmØ	11.25° BEND	44229.800	3762126.929
B43	160mmØ	11.25° BEND	44236.703	3762130.734
B44	160mmØ	11.25° BEND	44286.573	3762149.581
B45	160mmØ	11.25° BEND	44297.902	3762156.757

MEULENZICHT FITTINGS SETTING OUT DATA

ID	DIA	PART	Y	X
B46	160mmØ	11.25° BEND	44306.761	3762166.244
B47	160mmØ	11.25° BEND	44314.202	3762178.844
B48	160mmØ	11.25° BEND	44322.300	3762201.112
B49	160mmØ	11.25° BEND	44331.249	3762218.803
B50	160mmØ	11.25° BEND	44342.694	3762235.905
B51	200mmØ	22.5° BEND	44405.721	3762248.628
B52	160mmØ	11.25° BEND	44350.818	3762244.445
B53	160mmØ	22.5° BEND	44347.715	3762267.553
B54	160mmØ	22.5° BEND	44344.865	3762300.199
B55	160mmØ	22.5° BEND	44339.887	3762309.616
B56	160mmØ	11.25° BEND	44291.953	3762360.402
B57	110mmØ	11.25° BEND	44031.267	3762545.565
B58	110mmØ	11.25° BEND	44047.244	3762540.088
B59	110mmØ	11.25° BEND	44072.917	3762526.855
B60	110mmØ	11.25° BEND	44099.677	3762506.169
B61	110mmØ	11.25° BEND	44169.422	3762430.591
B62	110mmØ	11.25° BEND	44244.812	3762362.359
B63	110mmØ	22.5° + 11.25° BEND	44250.585	3762360.492
B64	110mmØ	22.5° + 11.25° BEND	44256.386	3762361.078
B65	160mmØ	11.25° BEND	44272.155	3762392.939
B66	160mmØ	11.25° BEND	44265.995	3762407.588
B67	160mmØ	11.25° BEND	44255.481	3762446.071
B68	160mmØ	11.25° BEND	44252.160	3762472.139
B69	160mmØ	11.25° BEND	44252.737	3762488.990
B70	110mmØ	22.5° BEND	43910.931	3762573.644
B71	110mmØ	22.5° BEND	43981.307	3762685.421
B72	110mmØ	22.5° BEND	43987.171	3762690.254
B73	110mmØ	22.5° BEND	43994.962	3762692.747
B74	110mmØ	11.25° BEND	44018.641	3762691.762
B75	110mmØ	11.25° BEND	44034.240	3762688.053
B76	110mmØ	11.25° BEND	44046.950	3762683.058
B77	110mmØ	22.5° BEND	44002.953	3762553.688
B78	110mmØ	11.25° BEND	44123.759	3762638.928
B79	110mmØ	11.25° BEND	44132.337	3762633.184
B80	110mmØ	11.25° BEND	44094.246	3762518.568
B81	110mmØ	11.25° BEND	44148.103	3762604.430
B82	110mmØ	11.25° BEND	44169.977	3762591.905
B83	110mmØ	11.25° BEND	44185.511	3762579.479
B84	110mmØ	11.25° BEND	44203.726	3762568.741
B85	110mmØ	11.25° BEND	44224.264	3762560.793
B86	110mmØ	11.25° BEND	44272.481	3762603.343
B87	110mmØ	11.25° BEND	44272.022	3762614.576
B88	110mmØ	22.5° BEND	44247.812	3762696.903
B89	110mmØ	22.5° BEND	44242.865	3762704.623
B90	110mmØ	45° + 11.25° BEND	44094.724	3762869.568

MEULENZICHT FITTINGS SETTING OUT DATA

ID	DIA	PART	Y	X
B91	110mmØ	45° + 11.25° BEND	44111.285	3762872.962
B92	110mmØ	22.5° BEND	44120.877	3762840.937
B93	110mmØ	11.25° BEND	44064.205	3762814.786
B94	110mmØ	11.25° BEND	44050.453	3762818.296
B95	160mmØ	22.5° BEND	44351.119	3762263.288
BWM1	200mmØ	Water Meter Chamber	44400.738	3762248.248
EC1	110mmØ	END CAP	44167.035	3762033.209
EC2	110mmØ	END CAP	43732.568	3762332.313
EC3	110mmØ	END CAP	44104.663	3762267.017
EC4	110mmØ	END CAP	44203.713	3762195.578
EC5	110mmØ	END CAP	44420.878	3762228.677
EC6	110mmØ	END CAP	43881.600	3762571.463
EC7	110mmØ	END CAP	44152.736	3762828.360
EC8	110mmØ	END CAP	44093.921	3762867.645
EC9	110mmØ	END CAP	44228.825	3762821.418
FH1	110mmØ	FIRE HYDRANT	43734.695	3762331.837
FH2	110mmØ	FIRE HYDRANT	43934.172	3762388.682
FH3	110mmØ	FIRE HYDRANT	43962.592	3762266.989
FH4	110mmØ	FIRE HYDRANT	44188.148	3762163.445
FH5	110mmØ	FIRE HYDRANT	44437.475	3762205.122
FH6	110mmØ	FIRE HYDRANT	44211.824	3762084.395
FH7	160mmØ	FIRE HYDRANT	44282.943	3762374.762
FH8	110mmØ	FIRE HYDRANT	43984.157	3762571.026
FH9	110mmØ	FIRE HYDRANT	44101.646	3762504.231
FH10	160mmØ	FIRE HYDRANT	44262.057	3762550.233
FH11	110mmØ	FIRE HYDRANT	44084.205	3762660.903
FH12	110mmØ	FIRE HYDRANT	44231.856	3762713.007
FH13	110mmØ	FIRE HYDRANT	44030.583	3762821.185
V1	110mmØ	ISOLATING VALVE	43759.768	3762331.813
V2	110mmØ	ISOLATING VALVE	43982.605	3762270.824
V3	110mmØ	ISOLATING VALVE	43959.353	3762267.254
V4	110mmØ	ISOLATING VALVE	44196.244	3762098.555
V5	110mmØ	ISOLATING VALVE	44214.823	3762083.278
V6	160mmØ	ISOLATING VALVE	44348.409	3762241.939
V7	160mmØ	ISOLATING VALVE	44351.230	3762261.842
V8	110mmØ	ISOLATING VALVE	44085.306	3762518.442
V9	110mmØ	ISOLATING VALVE	44089.842	3762369.044
V10	160mmØ	ISOLATING VALVE	44280.806	3762378.310
V11	110mmØ	ISOLATING VALVE	43910.107	3762568.870
V12	110mmØ	ISOLATING VALVE	44069.956	3762660.510
V13	110mmØ	ISOLATING VALVE	44086.610	3762659.473
V14	110mmØ	ISOLATING VALVE	44094.980	3762519.737
V15	110mmØ	ISOLATING VALVE	44248.680	3762555.290
V16	110mmØ	ISOLATING VALVE	44266.702	3762573.646
V17	110mmØ	ISOLATING VALVE	44107.331	3762795.372

MEULENZICHT T-PIECE SETTING OUT DATA

ID	SIZE	PART	Y	X
R1	110mmØ 160mmØ	REDUCER	44205.617	3762082.435
R2	160mmØ 110mmØ	REDUCER	44262.752	3762553.737
T1	160mmØ 160mmØ 110mmØ	T-PIECE	44207.204	3762086.222
T2	110mmØ 110mmØ 110mmØ	T-PIECE	43758.545	3762326.509
T3	110mmØ 110mmØ 110mmØ	T-PIECE	43980.291	3762265.541
T4	110mmØ 110mmØ 110mmØ	T-PIECE	44064.338	3762216.744
T5	110mmØ 110mmØ 110mmØ	T-PIECE	44146.631	3762151.082
T6	160mmØ 160mmØ 110mmØ	T-PIECE	44209.816	3762093.355
T7	200mmØ 160mmØ 160mmØ	T-PIECE	44352.545	3762244.576
T8	110mmØ 110mmØ 110mmØ	T-PIECE	43909.713	3762566.660
T9	110mmØ 110mmØ 110mmØ	T-PIECE	44002.395	3762550.830
T10	110mmØ 110mmØ 110mmØ	T-PIECE	44090.661	3762514.221
T11	160mmØ 160mmØ 110mmØ	T-PIECE	44281.963	3762376.406
T12	110mmØ 110mmØ 110mmØ	T-PIECE	44073.896	3762667.034
T13	110mmØ 110mmØ 110mmØ	T-PIECE	44153.505	3762609.171
T14	160mmØ 160mmØ 110mmØ	T-PIECE	44262.487	3762552.400
T15	110mmØ 110mmØ 110mmØ	T-PIECE	44131.512	3762850.993
T16	110mmØ 110mmØ 110mmØ	T-PIECE	44101.122	3762798.396

Meulenzicht Stream Crossing Setting Out Data

POINT	Y	X
1	44451.413	3762159.717
2	44441.428	3762162.307
3	44441.493	3762173.360
4	44438.506	3762191.164
5	44436.531	3762195.368
6	44448.516	3762191.940
7	44451.498	3762174.185
8	44369.008	3762240.816
9	44353.115	3762239.605
10	44346.611	3762232.769
11	44335.574	3762216.274
12	44326.896	3762199.122
13	44318.743	3762176.700
14	44310.789	3762163.231
15	44302.459	3762154.312
16	44294.108	3762155.589
17	44291.799	3762156.194
18	44289.205	3762157.167
19	44294.685	3762160.638
20	44302.734	3762169.257
21	44309.661	3762180.988
22	44317.703	3762203.102
23	44326.925	3762221.331
24	44338.776	3762239.041
25	44347.272	3762247.972
26	44346.251	3762261.372
27	44342.864	3762265.615
28	44341.593	3762280.280
29	44352.422	3762271.157
30	44352.566	3762269.491
31	44355.988	3762265.203
32	44357.151	3762249.942
33	44366.511	3762250.730
34	44368.392	3762246.173

For continuation, refer to Drawing Number: 24051-C-004-01

For continuation, refer to Drawing Number: 24051-C-004-03

PLAN LAYOUT : MEULENZICHT SECTION 1
SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED GW
DRAWN HMV
CHECKED MF

CONSULTING ENGINEERS
LYNERS
PO Box 757
GEORGE
6530
Tel: 044 887 0223/Fax: 044 887 0741
email: george@lyners.co.za

APPROVED
ENGINEER:
DATE: 2024-12-09

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
WATER LAYOUT: MEULENZICHT SECTION 1

SCALE 1:750 on A0
SHEET 1 OF 1
CONTRACT No.
PROJECT No. 24051 CG
DRAWING No. 24051-C-004-02
REV A
COORDINATE SYSTEM: WGS84 / Lo 23°

Drawing Size: A0 (841.00 x 1189.00 mm) Lyners_AutoCAD.ctb 2024-12-09
U:\WERKE\2400\24051 CG - SAWMILL DEVELOPMENT - GEORGE\DRAWINGS\1.2 ACTIVE\24051-C-004-01 (WATER LAYOUT - OUMEULEN).DWG

Notes:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Levels and position of existing water network to be verified before construction any discrepancies are to be liaised with the engineer immediately.
3. All main water pipes to be 110mmØ PVC-U Class 16 Heavy Duty, unless otherwise specified.
4. All water house connections to be 32mmØ PVC-U Class 16 Heavy Duty, unless otherwise specified
5. Pipes to be laid on bedding for flexible pipes according to SABS 1200 LB:DRAWING LB-2.
6. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
7. For continuation, refer to Drawing Numbers: 24051-C-004-02 and 24051-C-004-03
8. Refer to Drawing Number: 24051-C-004-02 FOR Setting Ot Data.
9. For Water House Connection Detail, refer to Drawing Number: STE-W-29G

LEGEND

PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- WATER METER CHAMBER
- T-PIECE
- BENDS
- ENDCAP
- FIRE HYDRANT
- REDUCER
- 110mmØ PVC-U CLASS 16 WATER PIPELINE UNLESS OTHERWISE SHOWN
- 32mmØ HDPE PE 100 PN 16 WATER CONNECTION
- 25mmØ HDPE PE 100 PN 16 DOUBLE WATER CONNECTION
- STREAM COSSING

Meulenzicht Stream Crossing Setting Out Data

POINT	Y	X
35	44265.744	3762594.900
36	44267.461	3762603.723
37	44267.051	3762613.756
38	44256.566	3762649.412
39	44264.548	3762644.349
40	44269.127	3762642.143
41	44276.992	3762615.396
42	44277.501	3762602.962
43	44275.230	3762591.293
44	44272.999	3762592.014

PLAN LAYOUT : MEULENZICHT SECTION 2

SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR

0 22.5 45

Meters 1:750

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW
DRAWN	HMV
CHECKED	MF

CONSULTING ENGINEERS
LYNERS
PO Box 757
GEORGE
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email: george@lyners.co.za

APPROVED
ENGINEER:
DATE: 2024-12-09

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
WATER LAYOUT: MEULENZICHT SECTION 2

SCALE on A0: 1:750
SHEET: 1 OF 1
CONTRACT No.:
PROJECT No.: 24051 CG
DRAWING No.: 24051-C-004-03
REV: A
COORDINATE SYSTEM: WGS84 / Lo 23°

iso full bleed a0 (841.00 x 1189.00 mm) Lyners_AutoCAD.ctb 2024-12-09

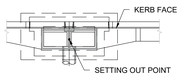
U:\WERKE\2400\24051 CG - SAWMILL DEVELOPMENT - GEORGE\DRAWINGS\1.2 ACTIVE\24051-C-004-01 (WATER LAYOUT - OUMEULEN).DWG

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- STORMWATER MANHOLE
- STORMWATER DOUBLE CATCHPIT
- STORMWATER HEADWALL
- STORMWATER FLOW DIRECTION
- CLASS 100D CONCRETE PIPE

Notes:

1. The contractor must verify the location and extent of all the existing services prior to commencement of work.
2. For typical Stormwater Manhole Detail refer to Detail Drawing Number: STE/SW-99A.
3. For typical Double Kerb Inlet-Gully and Catchpit details, refer to Detail Drawing Number: STE/SW-53.
4. Levels and position of existing Stormwater network must be verified before construction. Any discrepancies are to be confirmed with the engineer immediately.
5. Catchpits deeper than 1.0m, shall have step irons according to Detail Drawing Number: STE/SW-53.
6. For detail of sub-surface drain layerworks, refer to Detail Drawing Number: STE/SW-12
7. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
8. For continuation, refer to Drawing Numbers: 24051-C-005-02 and 24051-C-005-03
9. The setting out position of the catchpits are as follows.



All other structures setting out information refers to the centre of the structure.

MEULENZICHT STRUCTURE SETTING OUT DATA

MH ID	Y	X
SWCP1	44324.667	3762096.348
SWCP2	44407.754	3762109.586
SWCP3	44440.204	3762164.803
SWCP4	44305.647	3762178.350
SWCP5	44322.044	3762217.361
SWCP6	44200.630	3762195.196
SWCP7	44113.699	3762259.894
SWCP8	44102.123	3762181.574
SWCP9	44029.872	3762234.542
SWCP10	44037.237	3762358.935
SWCP11	43914.566	3762396.751
SWCP12	43787.444	3762385.156
SWCP13	43934.316	3762263.505
SWCP14	43860.780	3762280.737
SWCP15	43762.701	3762318.923
SWCP16	43710.729	3762330.566
SWCP17	44161.329	3762429.483
SWCP18	44103.756	3762492.432
SWCP19	43993.452	3762545.822
SWCP20	43910.669	3762559.941
SWCP21	43859.555	3762568.659
SWCP22	44261.721	3762397.892
SWCP23	44244.682	3762480.330
SWCP24	44253.904	3762547.006

MEULENZICHT STRUCTURE SETTING OUT DATA

MH ID	Y	X
SWCP25	44263.123	3762593.482
SWCP26	44122.527	3762646.661
SWCP27	43983.108	3762695.311
SWCP28	44208.738	3762721.585
SWCP29	44146.423	3762764.698
SWCP30	44087.862	3762797.815
SWCP31	44017.440	3762816.399
SWCP69	44416.314	3762213.566
SWGI1	44324.474	3762636.698
SWHW1	44431.838	3762175.438
SWHW2	44303.718	3762228.746
SWHW3	44205.909	3762239.481
SWHW4	44148.829	3762283.423
SWHW5	44005.929	3762203.930
SWHW6	44058.877	3762390.411
SWHW7	43789.002	3762456.899
SWHW8	43754.552	3762282.280
SWHW9	43674.011	3762284.978
SWHW10	44076.742	3762467.711
SWHW11	43830.115	3762532.916
SWHW12	44260.745	3762597.792
SWHW13	44139.368	3762680.002
SWHW14	43968.288	3762730.653
SWHW15	43996.301	3762784.892

MEULENZICHT STRUCTURE SETTING OUT DATA

MH ID	Y	X
SWHW16	44266.488	3762772.644
SWHW17	44301.773	3762627.691
SWHW18	44412.418	3762203.057
SWHW19	44273.170	3762615.873
SWHW20	44260.107	3762620.853
SWHW27	44352.620	3762238.750
SWHW28	44336.897	3762259.348
SWHW29	44318.033	3762172.386
SWHW30	44298.036	3762174.270
SWHW31	44446.668	3762177.465
SWHW32	44436.799	3762179.866
SWHW33	44328.842	3762213.130
SWMH1	44418.475	3762116.998
SWMH2	44435.436	3762146.091
SWMH3	43840.335	3762400.788
SWMH4	43767.078	3762422.960
SWMH5	43789.957	3762311.177
SWMH6	43703.175	3762332.259
SWMH7	43653.291	3762569.829
SWMH8	44247.645	3762444.588
SWMH9	44059.061	3762809.047
SWMH10	44008.632	3762817.794
SWMH11	44299.912	3762734.755

PLAN LAYOUT : MEULENZICHT SECTION 1
SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

REV	DESCRIPTION	DATE	BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW	
DRAWN	HMV	
CHECKED	MF	

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email: george@lyners.co.za

APPROVED
ENGINEER:
DATE: 2025-02-20

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

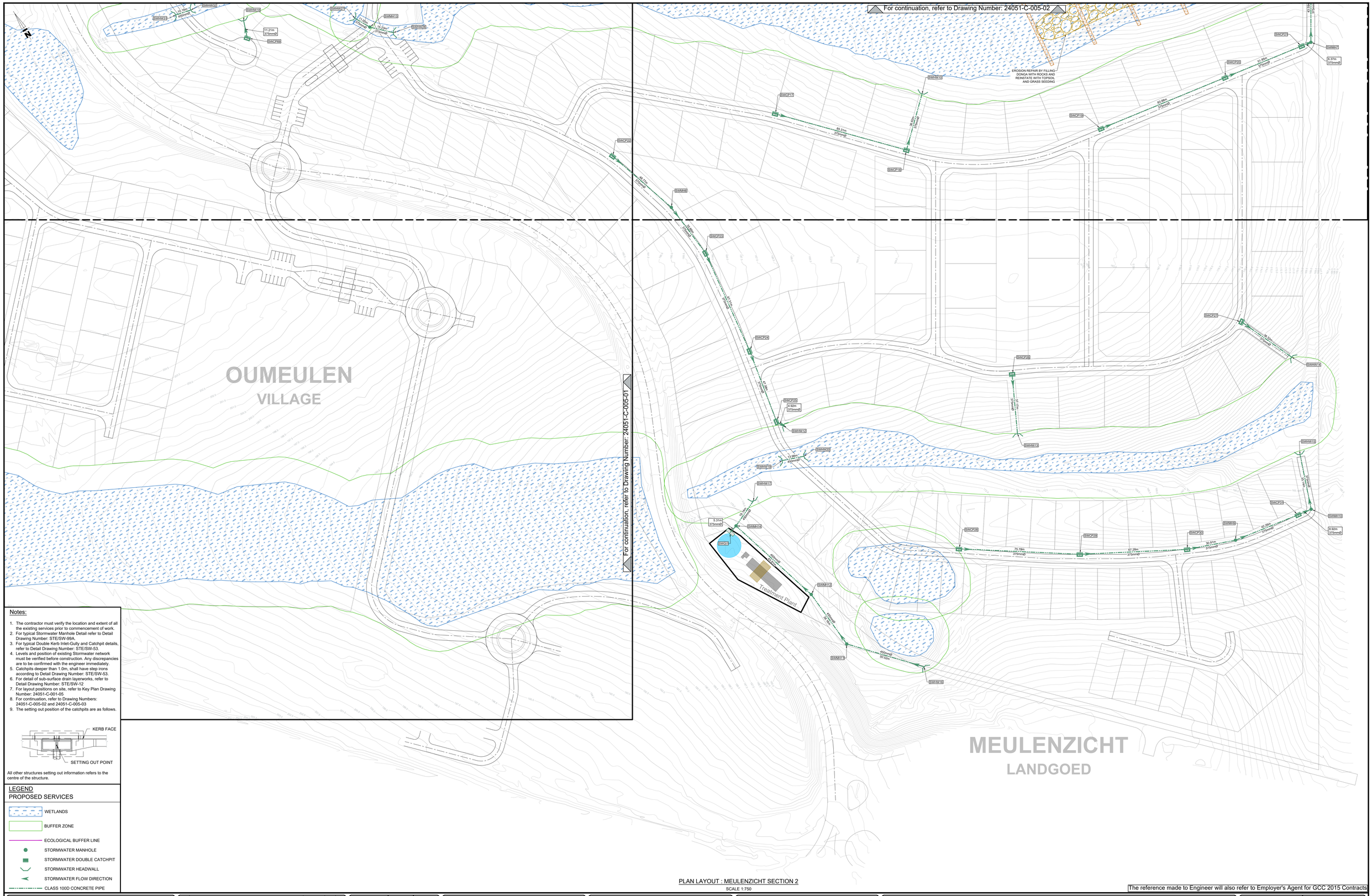
PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
STORMWATER LAYOUT: MEULENZICHT SECTION 1

SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-005-02 REV A

COORDINATE SYSTEM: WGS84 / Lo 23°



Notes:

1. The contractor must verify the location and extent of all the existing services prior to commencement of work.
2. For typical Stormwater Manhole Detail refer to Detail Drawing Number: STE/SW-99A.
3. For typical Double Kerb Inlet-Gully and Catchpit details, refer to Detail Drawing Number: STE/SW-53.
4. Levels and position of existing Stormwater network must be verified before construction. Any discrepancies are to be confirmed with the engineer immediately.
5. Catchpits deeper than 1.0m, shall have step irons according to Detail Drawing Number: STE/SW-53.
6. For detail of sub-surface drain layerworks, refer to Detail Drawing Number: STE/SW-12
7. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
8. For continuation, refer to Drawing Numbers: 24051-C-005-02 and 24051-C-005-03
9. The setting out position of the catchpits are as follows.

All other structures setting out information refers to the centre of the structure.

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- STORMWATER MANHOLE
- STORMWATER DOUBLE CATCHPIT
- STORMWATER HEADWALL
- STORMWATER FLOW DIRECTION
- CLASS 100D CONCRETE PIPE

PLAN LAYOUT : MEULENZICHT SECTION 2

SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR

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Meters 1:750

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

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DRAWN	HMV	
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APPROVED
ENGINEER:
DATE: 2025-02-20

APPROVED
CLIENT:
DATE:

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PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
STORMWATER LAYOUT: MEULENZICHT SECTION 2

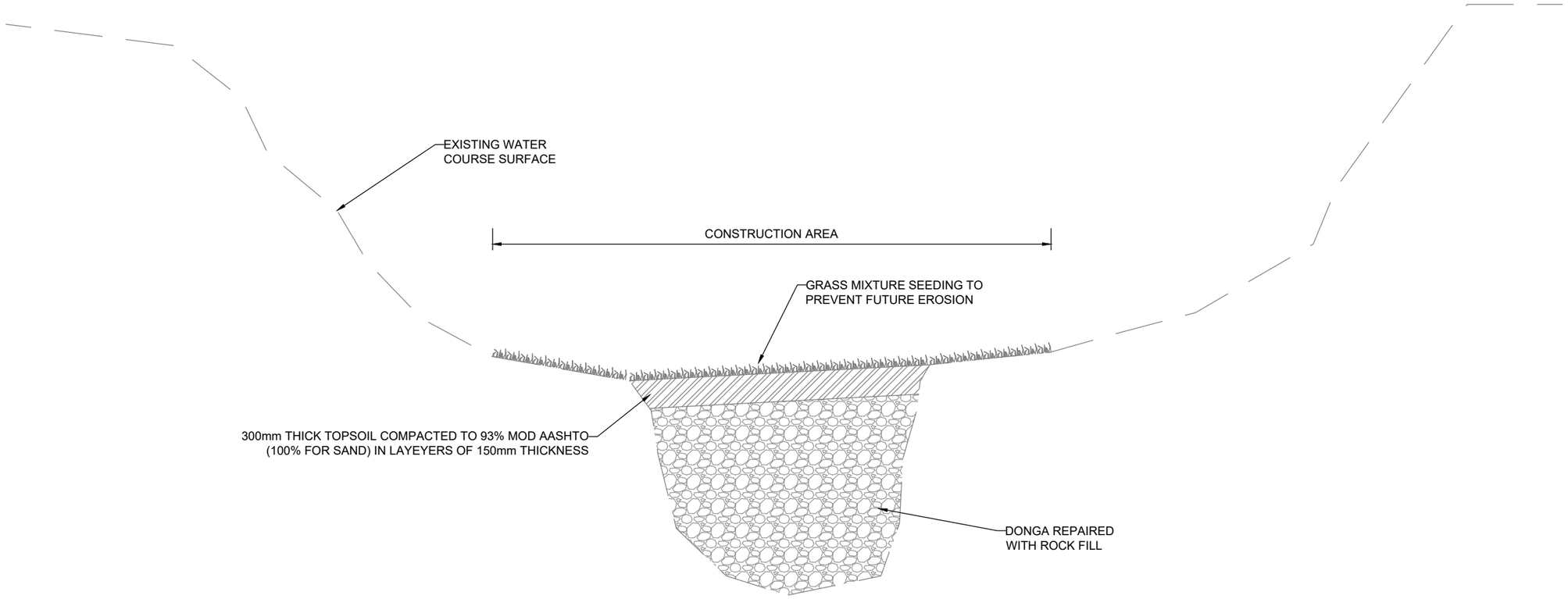
SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-005-03 REV A

COORDINATE SYSTEM: WGS84 / Lo 23°

NOTES:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Contractor to stay within the construction area.
3. Levels and position of existing donga erosion to be verified before construction, any discrepancies are to be liaised with the engineer immediately.



TYPICAL CROSS SECTION FOR DONGA REPAIR

SCALE 1:50

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'25-02-19	GW	FvE

REVISIONS

DESIGNED	GW	25-02
DRAWN	GW	25-02
CHECKED	FvE	25-02

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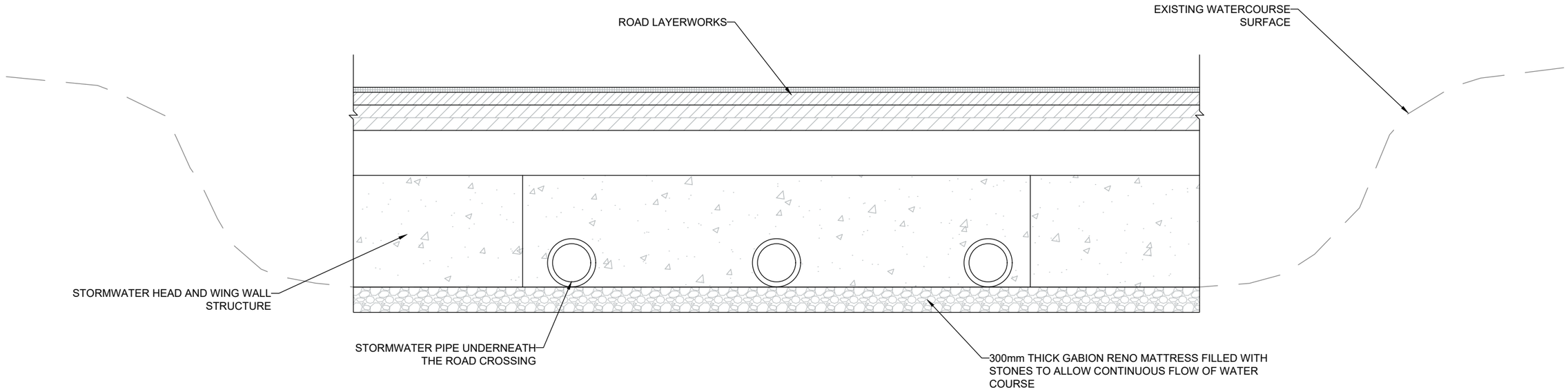
PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
TYPICAL DETAIL OF DONGA EROSION REPAIR

SCALE on A3 1:50	SHEET 1 OF 1
CONTRACT No.	PROJECT No. 24051CG

DRAWING No. 24051-C-005-102 REV A

COORDINATE SYSTEM: WGS84 / Lo 23°



TYPICAL CROSS SECTION FOR ROAD CROSSING OVER STREAM

SCALE 1:50

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	'25-02-19	GW	FvE

REVISIONS

DESIGNED	GW	25-02
DRAWN	GW	25-02
CHECKED	FvE	25-02

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PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
TYPICAL DETAIL OF ROAD STREAM CROSSING

SCALE on A3 1:50	SHEET 1 OF 1
CONTRACT No.	PROJECT No. 24051CG

DRAWING No. 24051-C-005-103 REV A

COORDINATE SYSTEM: WGS84 / Lo 23°

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- 110mmØ FIBRE SLEEVES
- FIBRE MANHOLES
- 400mmØ ACCESSIBLE JUNCTION BOX
- HOUSE CONNECTION

Notes:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Rise up / Long Radius Bend and penetration into building by others.
3. Sleeve layout to be read in conjunction to Electrical Engineers and Landscape Architect Layout. Any discrepancies to be brought under the Engineers attention.
4. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
5. For continuation, refer to Drawing Numbers: 24051-C-006-02 and 24051-C-006-03
6. Refer to Drawing Number: 24051-C-006-02 for Setting Out Data.

N

MEULENZICHT
LANDGOED

For continuation, refer to Drawing Number: 24051-C-006-01

MAIN SUPPLY POINT BY SERVICE PROVIDER

For continuation, refer to Drawing Number: 24051-C-006-03

PLAN LAYOUT : MEULENZICHT SECTION 1
SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

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REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

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APPROVED
ENGINEER:
DATE: 2024-12-09

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

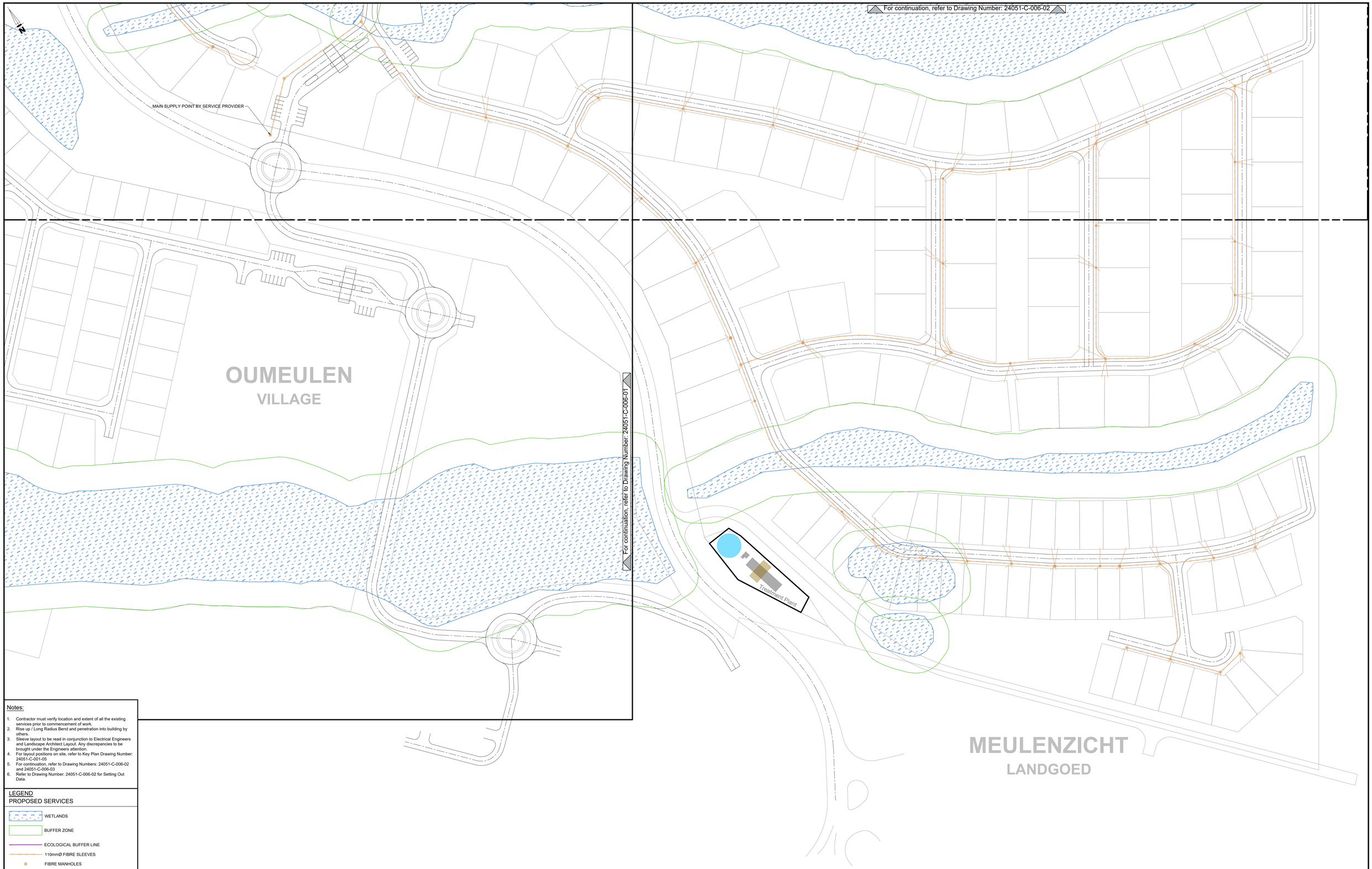
PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
FIBRE LAYOUT: MEULENZICHT SECTION 1

SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No.
		24051 CG

DRAWING No. 24051-C-006-02 REV A

COORDINATE SYSTEM: WGS84 / Lo 23°



Notes:

1. Contractor must verify location and extent of all the existing services prior to commencement of work.
2. Rise up / Long Radius Bend and penetration into building by others.
3. Sleeve layout to be read in conjunction to Electrical Engineers and Landscape Architect Layout. Any discrepancies to be brought under the Engineers attention.
4. For layout positions on site, refer to Key Plan Drawing Number: 24051-C-001-05
5. For continuation, refer to Drawing Numbers: 24051-C-006-02 and 24051-C-006-03
6. Refer to Drawing Number: 24051-C-006-02 for Setting Out Data.

LEGEND
PROPOSED SERVICES

- WETLANDS
- BUFFER ZONE
- ECOLOGICAL BUFFER LINE
- 110mmØ FIBRE SLEEVES
- FIBRE MANHOLES
- 400mmØ ACCESSIBLE JUNCTION BOX
- HOUSE CONNECTION

PLAN LAYOUT : MEULENZICHT SECTION 2
SCALE 1:750

The reference made to Engineer will also refer to Employer's Agent for GCC 2015 Contracts

SCALEBAR
0 22.5 45
Meters 1:750

All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV BY	CHKD
A	ISSUED FOR INFORMATION	2024-12-09	HMV	MF

REVISIONS

DESIGNED	GW	
DRAWN	HMV	
CHECKED	MF	

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APPROVED
ENGINEER:
DATE: 2024-12-09

APPROVED
CLIENT:
DATE:

CLIENT
ATTERBURY
It's a matter of association

PROJECT
OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)

TITLE
FIBRE LAYOUT: MEULENZICHT SECTION 2

SCALE	on A0	SHEET
1:750		1 OF 1
CONTRACT No.		PROJECT No. 24051 CG

DRAWING No. 24051-C-006-03 REV. A

COORDINATE SYSTEM: WGS84 / Lo 23°

ANNEXURE E

George Municipality Capacity Letter and Correspondence (Water and Sewer)

J Koegelenberg
Director: Civil Engineering Services
Directorate: Civil Engineering Services
E-mail: jkoegelenberg@george.gov.za
Tel: +27 (0)44 801 9278

Reference number: Kraaibosch Ridge and Aan de Meulen (Erf 25537, 25538, 25541 aqnd Erf 195/400)
Date: 06 September 2024

Enquiries: M Geyer
Tel: 044 801 9268 (internal extension 1607)

Neil Lyners and Associates (Pty) Ltd
Fairview Office Park Building 8
1st Street
Bergsig
George
6530

Attention: Mr G Wallace / F van Eck

ERF 25537, 25538, 25541 AND ERF 195/400 (KRAAIBOSCH RIDGE AND AAN DE MEULEN): WATER AND SANITATION CAPACITY FOR PROPOSED DEVELOPMENT

The accommodation of the proposed development in the George Municipal water and sanitation system refers.

The Civil Engineering Services (CES) Directorate confirms that the proposed development was taken into account as part of the:
- Sawmill development area, and
- future water and sanitation master plans forming part of the George Municipal development area.

The water demand and sewer flow were recalculated based on the information provided.

Upon conclusion of the above, the appointed master planning consultant, GLS, provided the required technical detail on a concept level to confirm the water and sanitation system upgrades required and associated estimated costs to support the proposed development.

It should be noted that the technical detail provided by GLS does not absolve the developer from appointing a civil engineering consulting firm to prepare the designs required for the various services required to support the development.

1. PROPOSED DEVELOPMENT FOOTPRINT

The proposed implementation plan of the development is included as part of the technical report/assessment, and forms part of the Kraaibosch master plan.

The erven are located along the N2 in the Kraaibosch development node. Refer to figure 1 below.

Figure 1: Proposed implementation plan (Aan de Meulen and Kraaibosch Ridge

2. WATER AND SANITATION BULK INFRASTRUCTURE CAPACITY: EXISTING INFRASTRUCTURE

2.1. TREATMENT CAPACITY

a) Water Treatment

- The Water Treatment Works (old and new) is currently operating under constraint.
- A 20Ml/day capacity upgrade of the new treatment works is in progress with an estimated completion date of February 2025.
- The treatment works will have sufficient capacity for the development in its entirety once the 20Ml/day capacity upgrade is commissioned.

b) Wastewater Treatment

- The Outeniqua Wastewater Treatment works currently has sufficient capacity to support the development.

2.2. BULK PIPELINES AND PUMP STATIONS

a) Water

The development falls within the George Main Zone and Kraaibosch reservoir zone.

- George Main zone: The reservoirs and bulk pipelines currently have sufficient capacity to service the development.
- Kraaibosch reservoir zone: The zone has sufficient capacity with the current theoretical demand, but insufficient capacity in the theoretical fully occupied demand, and cannot support the full development, i.e. the implementation of the next reservoir (4ML) is required to service the full development.

b) Sanitation

The development falls within the Outeniqua WWTW drainage area.

- The development falls within the future Kraaibosch 3 pump station drainage area. The infrastructure, refer to figure 2 below, required to convey sewage of the proposed development has not been implemented.
- Bulk conveyance infrastructure (pipelines and pump stations) will require implementation by the developer to connect to the Municipal sewer network.

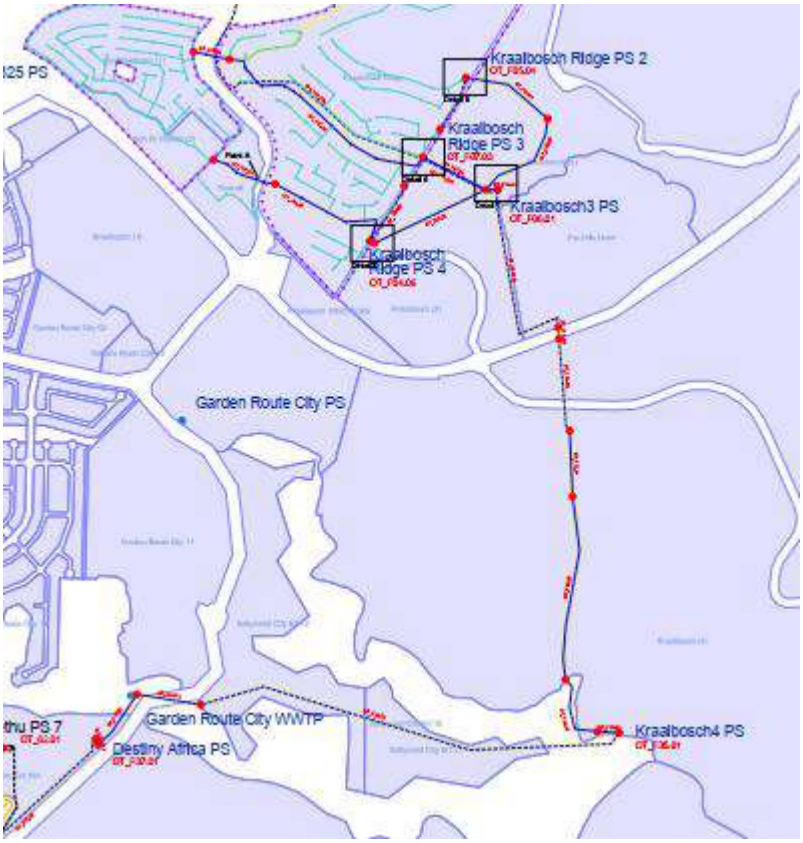

Figure 2: Kraaibosch 3 PS via Destiny Africa PS drainage area proposed infrastructure upgrades

3. PROPOSALS FOR CONNECTION

3.1. WATER INFRASTRUCTURE

General

All infrastructure beyond the extent of the current infrastructure (bulk and link services) as well as the reticulation internal to the development is considered development specific and is for the full cost of the developer (design and implementation and associated environmental cost etc.).

All such required link and internal water infrastructure will require the necessary maintenance and operation by the developer or subsequent HOA/POA and utility company, except where agreed/stated otherwise.

Bulk services over and above the requirements of the development:
The alignment of these services will have to be coordinated and agreed to between the various surrounding developers (Sasol Garage etc.) and the George Municipality.

The services agreement should include these costs and services for payment by other Developers once they make use of the service provided by this proposed development and, for the offsetting of development charges as applicable.

Alternatively, the Developer will have to wait until the construction of the reservoir can be implemented by the George Municipality which is subject to funding approval and prioritization by Council.

Existing infrastructure

The Municipal water network / system extend to the existing Kraaibosch reservoir and tower, located on the Aan de Meulen development footprint. Refer to figure 3 below.

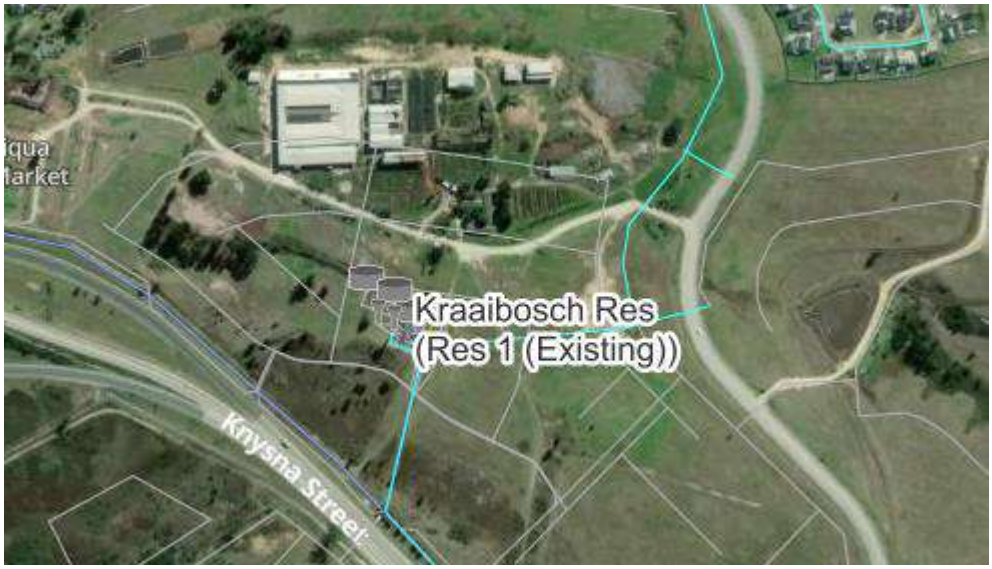

Figure 3: Existing water infrastructure in Kraaibosch development node

Proposals

The technical report by GLS includes 2 proposals for connection to the water network / system, which includes the master plan system (intended system – proposal 1) and an interim solution. The interim solution (refer to section 3.4.3 and 3.5.3 of the report) is not accepted by the Municipality as a solution for this development and will not be considered further.

Proposal 1 – master plan system:

To service the Kraaibosch development node, the master plan includes the construction of a future 4ML reservoir and tower. The current tower has sufficient capacity to service the development, however the future 4ML reservoir will require construction to service the development.

This proposal is included as part of the total cost discussed in section 5.

Explanation of principle of setting off cost against development charges: The cost for the construction of the reservoir only over and above the developer's pro-rata contribution can be off set against the development charges payable for water services, resulting in a balance of R1 533 419.00 excluding VAT payable by the developer, subject to any other off set that may also be applicable. Refer to table 1 below.

Table 1: Off-set of development charges example

Estimated total cost of reservoir only (item KBR_B01.03)	R17 550 000.00
Pro-rata contribution for reservoir (item KBR_B01.03)	R738 855.00
Balance	**R16 811 145.00**
Development charges: Water services	R18 344 564.00
Balance (payable by the developer)	**R1 533 419.00**

Note:

- Estimated and subject to annual escalation
- The full estimated cost of the reservoir only is considered in the above table and does not include/consider other infrastructure that require full implementation by the developer that is over and above the requirements of the development.

3.2. SANITATION INFRASTRUCTURE

General

All infrastructure beyond the extent of the current infrastructure (bulk and link services) as well as the reticulation internal to the development is considered development specific and is for the full cost of the developer (design and implementation and associated environmental cost etc.).

All such required link and internal sewer infrastructure will require the necessary maintenance and operation by the developer or subsequent HOA/POA and utility company.

Bulk services over and above the requirements of the development:
The alignment of these services will have to be coordinated and agreed to between the various surrounding developers (Garden Route City, Far Hills Country Hotel and Sasol Garage etc.) and the George Municipality for the connection of developed areas outside the urban edge.

The services agreement should include these costs and services for payment by other Developers once they make use of the service provided by this proposed development and, for the offsetting of development charges as applicable.

Alternatively:
- the Developer will have to wait until the construction of the bulk services to be implemented by the George Municipality which is subject to funding approval and prioritization by Council, or
- Implement alternative bulk solutions as described below to service the development until such time that the bulk services become available.

The services agreement should include these costs and services for payment by other Developers once they make use of the service provided for by this proposed development.

Existing infrastructure
The municipal sewer system only extends to the Kraaibosch pump station located Northwest of the proposed development.

Figure 4: Extent of Municipal Sewer Network / System

Proposals
The technical report by GLS includes 3 proposals for connection to the sewer network / system, which includes the master plan system (intended system – proposal 1) and 2 interim solutions. The interim solutions (refer to section 4.3.2, 4.3.4, 4.4.1 of the report) are not accepted by the Municipality as solutions for this development and will not be considered further.

Proposal 1:
The proposal includes the implementation of the master plan solution, and that all sewage from or generated by the proposed development be conveyed via the below system indicated in figure 5.

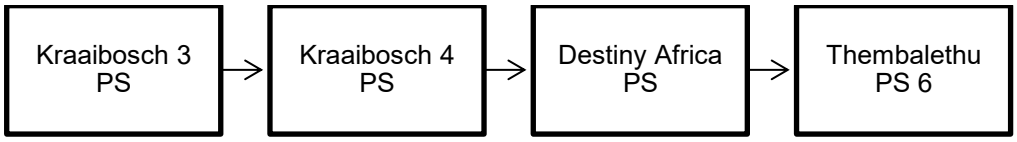

Figure 5: Proposed sewage conveyance system

The Kraaibosch 3 pump station and associated pipeline is development specific and are required irrespective of the proposal to be implemented.

The Kraaibosch 4 PS and associated pipelines is not a dedicated development specific infrastructure component as other developments and existing areas will be connecting to this pump station in future (date unknown). The implementation of this pump station and its pipelines are however required to drain to the Municipal network. A phased implementation approach can be considered to suit the needs of the development only, but is subject to design, review and approval by the George Municipality. The Developer will therefore be required to implement the portion required to service the development.

The Destiny Africa pump station and rising main is within the early planning stages and environmental authorization is required to implement the pump station and associated pipelines. Although the Municipality is planning to obtain approval for the ultimate pump station capacity, the Municipality will only implement the extent required. The Developer will therefore be required to implement the portion required to service the development.

The upgrade to Thembalethu pump station 6 and its associated rising main is underway and will be completed within the next 36 months.

Only once the infrastructure listed above have been implemented, will the Developer be in a position to connect to the municipal sewer system through this proposal.

Proposal 2 – alternative (not applicable to entire development):
The developer will be permitted to construct a conservancy tank, where practically possible to service parts of the development, in lieu of a connection to the Municipal network, and a discharge permit shall be issued permitting discharge of sewage at the Outeniqua WWTW.

Due to the extent of the development the proposal is not practical but could be considered for very limited parts of the development, subject to the approval of the Municipality and the Developers capacity to service the conservancy tanks.

Proposal 3 - alternative:
Alternatively, design, implement, operate and maintain an on-site wastewater treatment package plant.

The Developer should however note the requirements in terms of the National Water Act and registration as a Water Services Intermediary with the Municipality for compliance monitoring.

The Developer should note that this proposal includes the added advantage of treated effluent that could potentially be used for non-potable use that will reduce the potable water demand.

4. CONCLUSION

In conclusion:

a. The existing water infrastructure cannot accommodate the full proposed development without the implementation of the new Kraaibosch 4ML reservoir and associated pipelines and until the WTW has sufficient capacity, and
b. The existing sewer infrastructure cannot accommodate the proposed development until such time that the bulk sewerage system as described above have been implemented. The developer is therefore permitted to consider the implementation of alternative solutions in order to develop.
c. The Municipality has no short- or medium-term intention, plan or budget to implement any of the bulk water or sewer infrastructure specific to this development's requirements.

5. COST

The estimated pro-rata (excluding VAT) cost for water and sanitation infrastructure upgrades in support of the development amounts to:

Table 2: Associated estimated cost of water and sewer services

Description	Bulk System	Reticulation System	Total
Pro-rata cost only (3.4.1, 3.4.2 and 3.5.2):			
Water (pro-rata items)	R3 202 283.00	R417 517.00	**R3 619 800.00**
Associated pro-rata and full cost (3.4.1, 3.4.2 and 3.5.2):			
Water (pro-rata items)	R1 915 359.00	-	**R1 915 359.00**
Water (full cost items)	R25 376 000.00	R2 172 000.00	**R27 548 000.00**
Total estimated water cost			**R29 463 359.00** [1]
Associated pro-rata cost only (4.3.1, 4.3.3 and 4.4.2):			
Sewer (pro-rata items)	R8 883 145.00	R3 964 000.00	**R12 847 145.00**
Associated pro-rata and full cost (3.4.1, 3.4.2 and 3.5.2):			
Sewer (pro-rata items)	R780 850.00	-	**R780 850.00**
Sewer (full cost items)	R79 159 000.00	R3 964 000.00	**R83 123 000.00**
Total estimated sewer cost			**R83 903 850.00** [1]

The full cost and pro-rata cost indicated by GLS and captured in this letter is an estimated cost only, is not based on a detailed design and subject to change and is furthermore subject to change based on actual construction cost.

Development specific items are for the cost of the developer and cannot be off set against the development contributions, however the full infrastructure required to support the development must be installed.

Notes:

[1] The full cost of water and sewer infrastructure is applicable and those associated general upgrades. In order to connect to the Municipal sewer and/or water network / system the developer will have to design and construct the infrastructure. A cost apportionment model will have to be developed in order to reimburse the developer for cost incurred that was incurred over and above the required contribution. Should the developer spend less than the amount assigned to the developer, such shortfall shall be paid to the Municipality, or should the developer spend in excess of the required contribution, such excess amount shall be reimbursed

from the contributions of other developers and paid to the developer as and when such contributions are received by the Municipality. Such arrangements shall be covered in the service agreement.

6. DEVELOPMENT CHARGES

The current total Development Charges (DC's) relating to Civil Engineering Services (water services only), and in accordance with the current guidelines, for the proposed development were calculated on 14 August 2024 based on the site development plan and amount to R21 096 248.60 [2] including VAT.

[2] Exclusions:

a. Sewer development charges:
    - No charge is levied at this stage as the development is unable connect to the Municipal sewer network, the charges will however become payable once the development can connect to the sewer system. The development charges calculated for sewer services on 14 August 2024 based on the site development plan amount to R12 770 699.40 including VAT.
    - Shoulod the Developer elect to implement Proposal 3 to service the Development, the payment of sewer DC's may be excluded.
b. Road infrastructure: Development charges for roads are not determined as this will be determined in terms of the *Road based Development Contributions for the Welgelegen Area.*

The Developer is reminded of the following Clause relating to the calculation of development charges:
"Any amendments or additions to the proposed development which is not contained within the calculation sheet as stated in clause 2 above which might lead to an increase in the proportional contribution to municipal public expenditure, will result in the recalculation of the development charges and the amendment of these conditions of approval or the imposition of other relevant conditions of approval."

The DCs included in this letter is an indication of the charges due and are not confirmed as the final amount payable.

In addition, the DCs amount is subject to amendment based on annual escalation and applicable at the time that development contributions are due for payment. The Council has an approved Development Contributions Policy and guidelines for the calculation of DC's.

7. BULK INFRASTRUCTURE IMPLEMENTATION

The developer will be required to perform the necessary project management services from commencement to close out for implementation of the bulk infrastructure, excluding water and wastewater treatment works upgrades.

The deliverables per stage shall be submitted to the Civil Engineering Services Directorate (CES) for review and approval in line with Municipal standards and the CES Directorate shall be invited to attend all construction progress meetings.

8. COMMENCEMENT OF DEVELOPMENT

This letter confirms the status of capacity of infrastructure at the time of writing this letter. Capacity is not reserved for any development.

The development, in its entirety or in phases, is subject to confirmation by the Director: Civil Engineering Services regarding the availability of water supply & treatment capacity and sanitation bulk conveyance & treatment capacity at the time of the development implementation, or if developed in phases before the commencement of each phase.

A development/implementation program is to be provided by the Developer when requesting confirmation of the capacity from the Director: Civil Engineering Services. If the Developer does not adhere to the program provided and approved by the Director: Civil Engineering Services, the Director: Civil Engineering Services will be entitled to revise the availability of such bulk capacity.

No development may connect to the municipal water and sewer system unless the required bulk and link infrastructure is available, and a services agreement/memorandum of agreement (if applicable) is signed between the Developer and the Municipality.

Yours faithfully,

JANNIE KOEGELENBERG
DIRECTOR: CIVIL ENGINEERING SERVICES

ANNEXURES:

A Technical report and SDP
B Water and sewer masterplan items figures

ANNEXURE A

06 September 2024

Director: Civil and Technical Services
George Municipality
PO Box 19
GEORGE
6530

ATTENTION: Ms Lindsay Mooiman

Ma'am,

WATER AND SEWER MASTER PLANS: DEVELOPMENT OF PROPOSED TOWNSHIP/REZONING – GEORGE ERVEN 25537, 25538, 25541 AND PORTION 400 OF THE FARM KRAAIBOSCH 195 (AAN DE MEULEN & KRAAIBOSCH RIDGE)

The request from Neil Lyners and Associated dated 26 April 2024 with regards to accommodating the proposed development in the George water system has reference.

This report is a technical report stating upgrades required in the water and sewer networks in the vicinity of the proposed development. The George Municipal engineering professional (yourself) will make a final decision on works to be implemented by the proposed development.

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Directors: RL Pole, AG Hingeston, AN Umichand

1 INTRODUCTION

1.1 Brief

This report is a technical report stating upgrades required in the water and/or sewer networks in the vicinity of the proposed development. The George Municipal engineering professional (yourself) will make a final decision on works to be implemented by the proposed development.

The latest master plans used in this analysis were the m2024-03 master plans.

1.2 Disclaimer

The investigation has been performed and this report has been compiled based on the information made available to GLS. All efforts, within budget constraints, have been made during the gathering of information to ensure the highest degree of data integrity. The information supplied to GLS by George Municipality and other Consultants at the outset of this assessment is assumed to be the most accurate representation of the existing system up to date hereof.

GLS hereby confirms that any contributions of the developer to the required construction of infrastructure and/or the upgrading of existing infrastructure, whether it be in the form of a capital contribution or in the form of constructing sections of new infrastructure, is a matter to be discussed and agreed upon between the developer and the George Municipality.

All costs shown in this report are year 2023/24 Rand value **estimates** and **include** 50% surcharge for P&Gs, contingencies and fees but **exclude** VAT.

1.3 Version control

Issue Date	***Type***	***Version***	***Remarks***
2024/07/08	Draft	1	Issued for comments and approval
2024/07/10	Revision	2	Added summaries for interim/alternative options
2024/08/05	Revision	3	Added phases for the development, removed internal schematic items.
2024/09/06	Revision	4	Updated summary of sewer costing

2 WATER DEMAND & SEWER FLOWS

2.1 *Impact of the proposed development*

The proposed development was taken into consideration in the master plan as part of the Sawmill development area.

The water demand and sewer return flow contribution of the proposed development is outlined in the table below:

Land Use	Unit of measure (No/100m2/ha…)	No. Units (No/100m2/ha…)	UWD/unit (kL/unit/d)	Sewer ratio (% x UWD)	AADD Inc. UAW (kL/d)	PDDWF Excl. Infilt. (kL/d)
Phase 1	**Estimated Start Date:**			**Estimated Occupation Date:**		
Residential (George & Wilderness) - Medium density, medium sized Residential stands	unit	259	0.625	54%	210.44	113.64
Sub-Total		**259**			**210.4**	**113.6**
Phase 2	**Estimated Start Date:**			**Estimated Occupation Date:**		
Residential (George & Wilderness) - High density, small sized Residential stands	unit	207	0.625	63%	129.38	81.51
Flats (George & Wilderness) - Medium density Flat units up to 50 m² (Footprint=0.6 and Storeys=1)	unit	220	0.625	80%	68.75	55.00
Sub-Total		**427**			**198.1**	**136.5**
Total		**686**			**408.6**	**250.1**

2.2 *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 545.9 kL/d (theoretical demand).

The revised AADD, peak flow and fire flow calculated for the proposed development and used in this re-analysis of the water distribution network is 408.6 kL/d.

- Annual average daily demand of George Main zone = 198.1 kL/d
- Peak flow using a zone peak hour factor of 3.00‡ = 5.70 L/s
- Annual average daily demand for Kraaibosch Tower zone = 210.5 kL/d
- Peak flow using a zone peak hour factor of 4.60‡ = 11.20 L/s
- Fire flow (Low rise flats <= 3 storeys) using a peak hour factor of 2.0 = 20 L/s @ 10 m
- Fire flow (Residential) using a peak hour factor of 2.0 = 15 L/s @ 10 m

2.3 *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 422.4 kL/d (theoretical flow).

The revised PDDWF (excluding infiltration) calculated for the proposed development and used in the re-analysis of the sewer system is 250.1 kL/d. The design flow, or instantaneous peak wet weather flow (IPWWF), is 6.6 L/s.

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

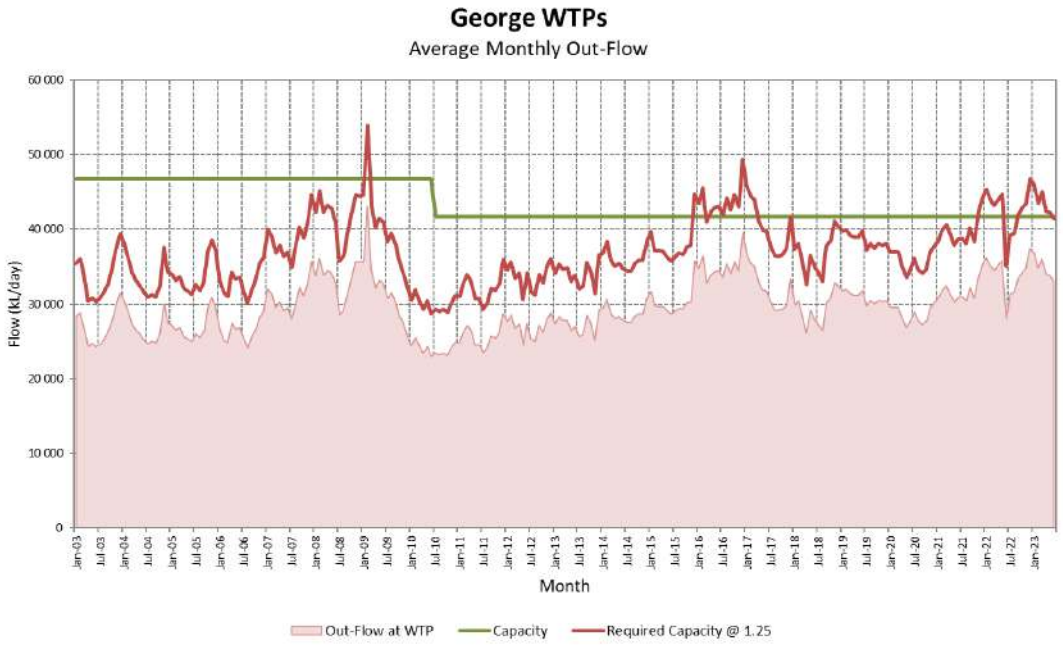
3 WATER DISTRIBUTION NETWORK

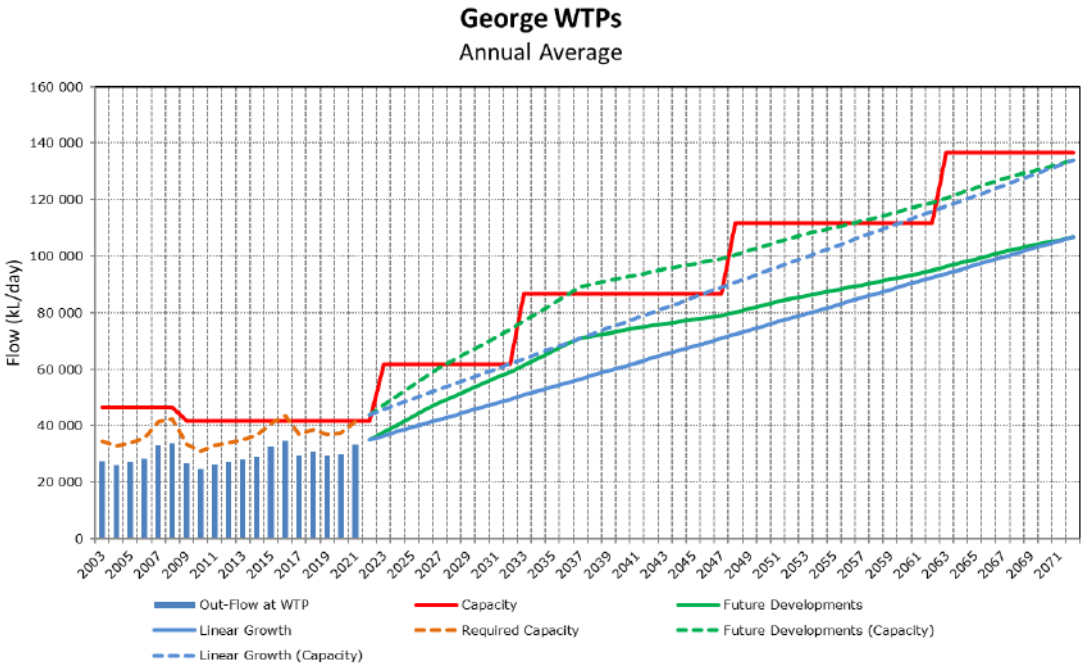
3.1 Water Resources

Water Treatment Plant capacity

The master plan indicates that the proposed development falls in the George Main zone and supplied from the Old and New George WTPs.

The two graph overleaf shows that the design capacity of the Old and New George WTPs (green line) has been exceeded by the average monthly required capacity (dark red line) a few times in the last decade. The WTPs are thus operating at risk and needs to be extended.





Based on available information the capacity, present flow and projected short-term flow are as follows:

George WTPs	Capacity	Comment
Existing Capacity	41 700 kL/d	Design capacity 46 200 kL/d
Measured Flow (incl. 1.25 factor)		
Annual Average (2003-2023)	43 537 kL/d	Maximum 2016/17
	-1 837 kL/d	No spare capacity available
Monthly Average (2003-2023)	56 022 kL/d	February 2009
	-14 322 kL/d	No spare capacity available
Monthly Average (2022/23)	48 599 kL/d	December 2022
	-6 899 kL/d	No spare capacity available
Modelled Flow (incl. 20% water loss and 1.25 factor)		
T_AADD (existing)	43 955 kL/d	m2024-03 MP
	-2 255 kL/d	No spare capacity available
3yr Projection	50 601 kL/d	
	-8 901 kL/d	No spare capacity available
5yr Projection	60 570 kL/d	
	-18 870 kL/d	No spare capacity available

Note: *T_AADD: Theoretical Annual Average Daily Demand*
The flow projections include all stands that are presently vacant but expected to be occupied over the next 5 years as well as all future areas likely to develop within the next 5 years

3.2 Distribution Zone

The master plan indicates that the proposed development falls partly in the George Main and Kraaibosch Tower zones as shown in **Figure 1 (Water)** attached.

An interim option was investigated to accommodate the Kraaibosch Ridge component of the development in the George Main zone until construction of the additional Kraaibosch reservoir.

3.3 Categorisation of required upgrades

The items are categorised as follows:

- General system specific MP Items – required to address capacity issues and backlogs in the bulk and reticulation systems serving the proposed development, but not specifically required for the development per sé.
- Development specific MP Items – new additions to (or deviations from) the existing Master Plan, required specifically for the proposed development, as a result of more accurate information relative to the original estimate of future development.

It is important to note that all proposed items are schematic in nature, final size and location is subject to a complete design by a suitably qualified engineer. The final locality in particular is subject to legislative requirements including but not limited to pipes not crossing private stands, no servitudes registered in private stands and no pipes in stands with an area less than 400m².

3.4 Bulk Water Supply

Reservoir storage capacity

One of the main considerations in bulk water supply is reservoir storage capacity and in the assessment of storage capacity, two demand scenarios are considered.

The first (Theoretical Current Demand) scenario represents the demand in the system as it is currently experienced, i.e. it only includes the demand for stands that are developed (vacant stands are ignored), and only due to land use rights currently being exercised. An allowance for 20% water losses is also included in the scenario.

The second (Theoretical Fully Occupied Demand) scenario is the planning scenario and represents the demand of all the existing stands, irrespective of whether they are developed or vacant. Most importantly, the demand is based on the zoning of each stand i.e. the maximum demand allowed for under existing land use rights (known as zoning rights). Ideally the existing system should have sufficient capacity for this scenario which represents all existing development rights. An allowance for 20% water losses is also included in this scenario.

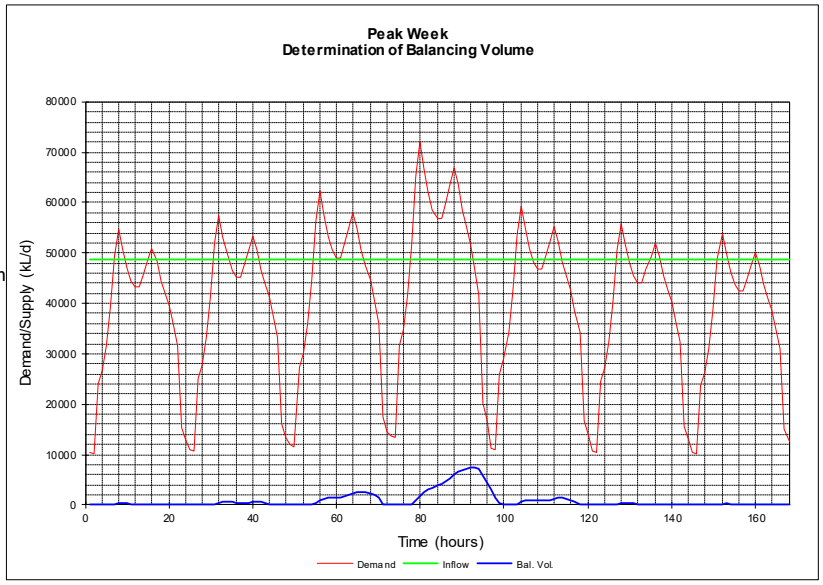
The difference between the two demand scenarios becomes relevant when there is “perceived” spare storage capacity in the Theoretical Current Demand scenario and no storage capacity in the Theoretical Fully Occupied Demand scenario. This means that the storage capacity allotted to all existing stands (in the Theoretical Fully Occupied Demand scenario) is currently not utilised in the Theoretical Current Demand scenario, it is however still committed to the water demands derived from the zoning rights.

Reservoir capacity assessment (Theoretical Current Demand)

The current George Main zone AADD plus 20% UAW (Theoretical Current Demand) in the m2024-03 water model is 28 705 kL/d. The capacity of the existing Reservoirs @ Old WTP is 36 120 kL. The FCV is set at 565 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity is 8 890 kL.

Type in values in shaded cells				
Full zone	28 705	kL/d		
Direct zone	19 811	kL/d		
AADD	**28 705**	kL/d		
PDF	**1.70**	* AADD		
PWF	**1.40**	* AADD		
P3DF	1.51	* AADD		
Supply	**1.70**	* AADD		
=	48 798	kL/d		
=	565	L/s	Pipe @ 1.8m/s	
			632	mm
Bal.Vol.	7 419	kL/d		
=	6.2	h*AADD		
			%	
Pattern 1	Large zone	Large	**69.0%**	
Pattern 2	Small zone	Medium	**0.0%**	
Pattern 3	LC Housing	Small	**0.0%**	
Pattern 4			**0.0%**	
Pattern 5			**0.0%**	
Pattern 6			**0.0%**	
Pattern 7	Even	To a res.	**31.0%**	
Must add up to 100 --> check			100.0%	

Res @ Old WTP Site



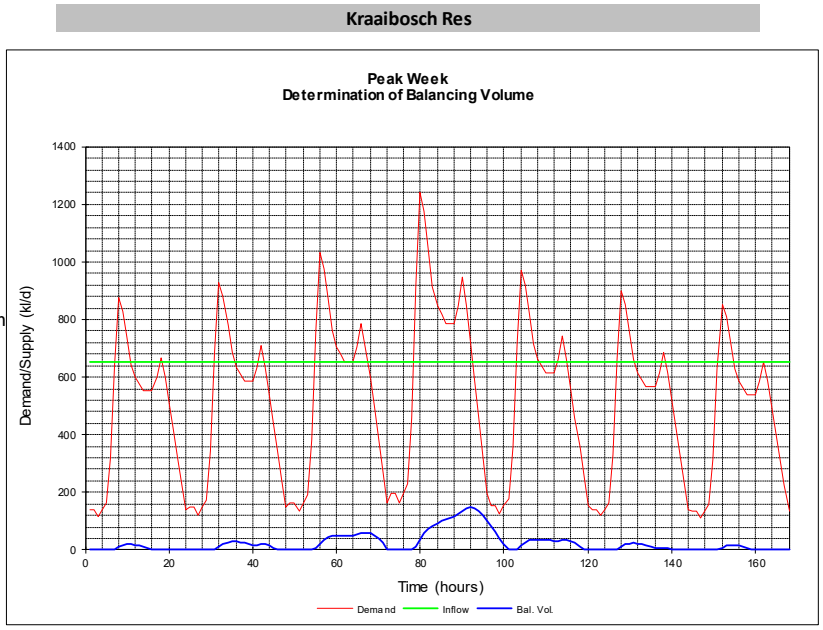
VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)

Capacity	**36 120**	kL	=	43.8 h x AADD
Required balancing	7 419	kL	=	9.0 h x AADD
Available volume	28 701	kL	=	34.8 h x AADD
Required emergency	19 811	kL	=	**24.00** h x AADD
Spare capacity	8 890	kL	=	10.8 h x AADD

Reservoir capacity assessment (Theoretical Current Demand)

The current Kraaibosch Reservoir zone AADD plus 20% UAW (Theoretical Current Demand) in the m2024-03 water model is 284 kL/d. The capacity of the existing Kraaibosch Reservoir is 1 000 kL. The FCV is set at 8 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity is 569 kL.

Type in values in shaded cells			
Full zone	284	kl/d	
Direct zone	284	kl/d	
AADD	**284**	kl/d	
PDF	**2.30**	* AADD	
PWF	**1.80**	* AADD	
P3DF	1.99	* AADD	
Supply	**2.30**	* AADD	
=	654	kl/d	
=	8	l/s	Pipe @ 1.8m/s
			73 mm
Bal.Vol.	147	kl	
=	12.4	h*AADD	
			%
Pattern 1	Large zone	Large	**0.0%**
Pattern 2	Small zone	Medium	**100.0%**
Pattern 3	LC Housing	Small	**0.0%**
Pattern 4			**0.0%**
Pattern 5			**0.0%**
Pattern 6			**0.0%**
Pattern 7	Even	To a res.	**0.0%**
Must add up to 100 --> check			100.0%



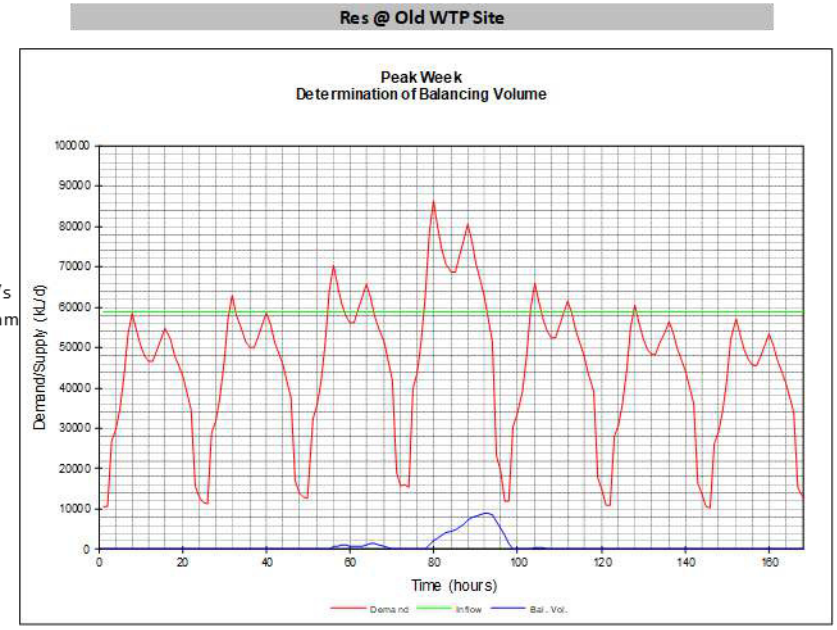
VOLUME ANALYSIS (applies only to area directly supplied, I.e. not to the Pattern 7 supply)

Capacity	**1 000**	kl	=	84.5 h x AADD
Required balancing	147	kl	=	12.4 h x AADD
Available volume	853	kl	=	72.0 h x AADD
Required emergency	284	kl	=	**24.00** h x AADD
Spare capacity	569	kl	=	48.0 h x AADD

Reservoir capacity assessment (Theoretical Fully Occupied Demand)

The current George Main zone AADD plus 20% UAW (Theoretical Fully Occupied Demand) in the m2024-03 water model is 34 671 kL/d. The capacity of the existing Reservoirs @ Old WPT is 36 120 kL. The FCV is set at 682 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity of 4 401 kL is sufficient to cater for the proposed development.

Type in values in shaded cells			
Full zone	34 671 kL/d		
Direct zone	22 831 kL/d		
AADD	**34 671** kL/d		
PDF	**1.70** * AADD		
PWF	**1.30** * AADD		
P3DF	1.42 * AADD		
Supply	**1.70** * AADD		
=	58 940 kL/d		
=	682 L/s	Pipe @ 1.8m/s	
		695 mm	
Bal.Vol.	8 888 kL/d		
=	6.2 h*AADD		
		%	
Pattern 1	Large zone	Large	**65.9%**
Pattern 2	Small zone	Medium	**0.0%**
Pattern 3	LC Housing	Small	**0.0%**
Pattern 4			**0.0%**
Pattern 5			**0.0%**
Pattern 6			**0.0%**
Pattern 7	Even	To a res.	**34.1%**
Must add up to 100 --> check			100.0%



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

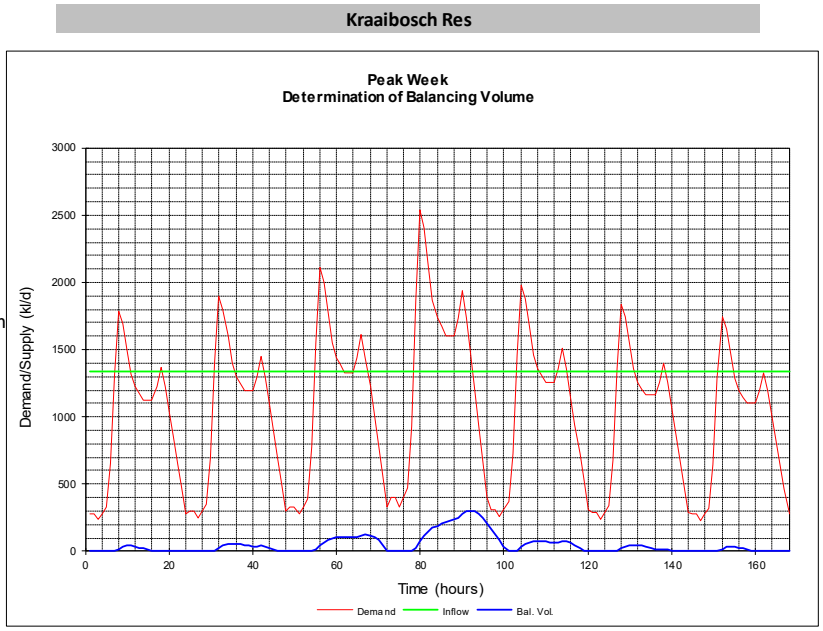
Capacity	**36 120** kL	=	38.0 h x AADD
Required balancing	8 888 kL	=	9.3 h x AADD
Available volume	27 232 kL	=	28.6 h x AADD
Required emergency	22 831 kL	=	**24.00** h x AADD
Spare capacity	4 401 kL	=	4.6 h x AADD

Reservoir capacity assessment (Theoretical Fully Occupied Demand)

The current Kraaibosch Reservoir zone AADD plus 20% UAW (Theoretical Fully Occupied Demand) in the m2024-03 water model is 34 671 kL/d. The capacity of the existing Kraaibosch Reservoir is 1 000 kL. The FCV is set at 15 L/s. Using these three input variables in a reservoir sizing analysis, it shows that the remaining spare capacity of 119 kL is insufficient to cater for the proposed development.

DETERMINATION OF RESERVOIR BALANCING VOLUME and/or REQUIRED SUPPLY RATE

Type in values in shaded cells			
Full zone	581	kl/d	
Direct zone	581	kl/d	
AADD	**581**	kl/d	
PDF	**2.30**	* AADD	
PWF	**1.80**	* AADD	
P3DF	1.99	* AADD	
Supply	**2.30**	* AADD	
=	1 335	kl/d	
=	15	l/s	Pipe @ 1.8m/s
			105 mm
Bal.Vol.	300	kl	
=	12.4	h*AADD	
			%
Pattern 1	Large zone	Large	**0.0%**
Pattern 2	Small zone	Medium	**100.0%**
Pattern 3	LC Housing	Small	**0.0%**
Pattern 4			**0.0%**
Pattern 5			**0.0%**
Pattern 6			**0.0%**
Pattern 7	Even	To a res.	**0.0%**
Must add up to 100 --> check			100.0%



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

Capacity	**1 000**	kl	=	41.3 h x AADD
Required balancing	300	kl	=	12.4 h x AADD
Available volume	700	kl	=	28.9 h x AADD
Required emergency	581	kl	=	**24.00** h x AADD
Spare capacity	119	kl	=	4.9 h x AADD

Tower storage capacity assessment and supply rate

Water towers serve merely to sustain pressure in a network and should not be regarded as facilities for balancing peaks and for emergency supply. Because of their relatively small volumes, the supply rates to towers must be such that they can be kept full at all times.

On the other hand, volumes must be large enough to allow room for operation of pumps filling the tower (where applicable) such that the number of pump cycles per day is limited. The following guidelines were used for evaluation and planning of water towers:

- Supply rate into tower : 1,0 to 1,1 x PHF x AADD
- Tower storage : 2 h to 6 h x AADD

The Kraaibosch tower has a capacity of 100 kL and the supply pump station has one operational and one standby pump set, each with a supply duty point of 55 L/s at 35 m head.

Scenario:	Theoretical Current Demand	Theoretical Fully Occupied Demand	Theoretical Fully Occupied Demand (incl. the proposed development)
Parameter:			
Existing Capacity (kL)	100	100	100
AADD (kL/d)	284	581	791
Peak Flow (L/s)	9.8	18.9	30.1
Peak Factor (current)	3.00	2.80	3.30
Storage (hours)	±8	±4	±3
Supply rate (L/s)	10.9	20.7	33.2
Existing Pump Station (L/s)	55.0	55.0	55.0

It is evident that both the Kraaibosch tower and its supply pump station has capacity to accommodate the proposed development.

3.4.1 Existing bulk water system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the bulk water system:

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing WTPs (Old WTP and New WTP)					
GMR_B01.01	Water Treatment Facility to install: New WTP	20 500 m³/d @	254 m EGL	R 287 482 000	R 1 888 334 0.66%
	Existing: Old WTP	20 000 m³/d @	254 m EGL	n.a.	n.a.
	Existing: New WTP	20 000 m³/d @	254 m EGL	n.a.	n.a.
	Existing: Ebb-and-Flow WTP	1 700 m³/d @	254 m EGL	n.a.	n.a.
GMR_B01.06	Pipe to install	7 m x	500 mm Ø	R 543 000	R 5 478 1.01%
GMR_B01.07d	Pump Only to install: New WTP PS	220 L/s @	55 m	R 2 136 000	R 21 548 1.01%
			Total	**R 290 161 000**	**R 1 915 359**

3.4.2 Accommodation of the proposed development in the bulk water system

Development specific items required in the bulk water system:

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (George Main zone)					
Development - Phase 2 (Aan de Meulen)					
GMR_01.02	Pipe to install	186 m x	450 mm Ø	R 2 057 000	R 128 033 6.2%
GMR_01.03	Pipe to install	128 m x	315 mm Ø	R 691 000	R 114 856 16.6%
GMR_01.04	Pipe to install	179 m x	355 mm Ø	R 1 224 000	R 121 791 10.0%
GMR_01.11a	Pipe to install	187 m x	450 mm Ø	R 1 926 000	R 102 221 5.3%
			Sub-Total	**R 5 898 000**	**R 466 901**
Existing external system (Kraaibosch Reservoir and Tower zone)					
Development - Phase 1 (Kraaibosch Ridge)					
KBR_B01.02a	Pipe to install	58 m x	500 mm Ø	R 1 065 000	R 44 837 4.2%
KBR_B01.03	Reservoir to install: Kraaibosch Res	4 000 m³ @	209 m TWL	R 17 550 000	R 738 855 4.2%
KBR_B01.04a	Pipe to install	34 m x	500 mm Ø	R 863 000	R 36 332 4.2%
			Sub-Total	**R 19 478 000**	**R 820 024**
			Total	**R 25 376 000**	**R 1 286 924**

3.4.3 Accommodation of the proposed development in the bulk water system (interim period)

Development specific items required in the bulk water system prior to the construction of the additional Kraaibosch reservoir:

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (George Main zone) - interim option					
Development - Phase 1 (Kraaibosch Ridge)					
GMR_01.03 #[1]	Pipe to install	128 m x	315 mm Ø	R 691 000	R 114 856 16.6%
GMR_01.04 #[1]	Pipe to install	179 m x	355 mm Ø	R 1 224 000	R 121 791 10.0%
			Sub-Total	**R 1 915 000**	**R 236 647**
Development - Phase 2 (Aan de Meulen)					
GMR_01.02	Pipe to install	186 m x	450 mm Ø	R 2 057 000	R 128 033 6.2%
GMR_01.11a	Pipe to install	187 m x	450 mm Ø	R 1 926 000	R 102 221 5.3%
			Sub-Total	**R 3 983 000**	**R 230 254**
			Total	**R 5 898 000**	**R 466 901**

Notes: #[1] An interim PRV was proposed for Kraaibosch 195-21 development. If not implemented under Kraaibosch 195-21, it can be moved as per Figure 1 (Water). Alternatively a new interim PRV connection can be made on the existing 250mmØ George main pipeline at either of the proposed connection points presented on Figure 1 (Water).

3.5 Water Reticulation System

Accommodation of the proposed development, with its revised AADD, requires implementation of the following additions and adjustments to the *existing* water system as indicated in **Figure 1 (Water)**.

3.5.1 Existing water reticulation system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the water distribution system:

Item No	MP Type	Description	Extent	Size	Cost	Pro-rata Cost
None						
				Total	**R -**	**R -**

3.5.2 Accommodation of the proposed development in the water reticulation system

Development specific items required in the water distribution system (**including** fire flow requirements):

Item No	Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (Kraaibosch Reservoir and Tower zone)					
Development - Phase 1 (Kraaibosch Ridge)					
KBT_F01.03	Pipe to install	395 m x	355 mm Ø	R 2 172 000	R 417 517 19.2%
			Total	**R 2 172 000**	**R 417 517**

3.5.3 Accommodation of the proposed development in the water reticulation system (interim period)

Development specific items required in the water distribution system (**including** fire flow requirements) prior to the construction of the additional Kraaibosch reservoir:

Item No		Description	Extent	Size	Cost	Pro-rata Cost
Existing external system (Kraaibosch Reservoir and Tower zone)						
Development - Phase 1 (Kraaibosch Ridge)						
KBT_F01.03	#[1]	Pipe to install	395 m x	355 mm Ø	R 2 172 000	R 417 517 19.2%
KBT_F01.04	#[3]	Pipe to install	147 m x	355 mm Ø	R 986 000	R 233 583 23.7%
KBT_F01.05	#[3]	Pipe to install	185 m x	355 mm Ø	R 1 171 000	R 277 410 23.7%
KBT_F08.01a	#[3]	Pipe to install	31 m x	160 mm Ø	R 187 000	R 187 000 100.0%
KBT_F08.01b	#[3]	Pipe to install	152 m x	160 mm Ø	R 283 000	R 283 000 100.0%
KBT_F08.03	#[2]	Pressure Reducing Valve to install	233 m EGL	100 mm Ø	R 304 000	R 304 000 100.0%
				Total	**R 5 103 000**	**R 1 702 511**

Notes:
#[1] The 355mm Ø is to be isolated from Kraaibosch tower supply until the additional Kraaibosch reservoir is constructed and the interim PRV decommissioned.
#[2] Interim PRV was proposed for Kraaibosch 195-21 development. If not implemented under Kraaibosch 195-21, it can be moved as per Figure 1 (Water).
#[3] Depending on the final position of the proposed interim PRV, these items can be omitted.

The proposed connection points to the existing water distribution system are shown in **Figure 1 (Water)**.

3.6 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 2.2 above on the internal networks.

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

Connection Point	Static		Residual		Fire Flow		Ground Level
	EGL (m a.s.l.)	Head (m)	EGL (m a.s.l.)	Head (m)	EGL (m a.s.l.)	Head (m)	(m a.s.l.)
Future system - George Main							
Point A	295.0	92.5	275.2	72.7	269.9	67.4	202.5
Future system - Kraaibosch Reservoir and Tower							
Point B	233.0	29.4	227.4	23.8	226.7	23.1	203.6
Future system - George Main (interim period)							
Point C	233.0	37.8	232.0	36.8	230.2	35.0	195.2
Point D	233.0	28.9	232.0	27.9	230.2	26.1	204.1

4 SEWER CONVEYANCE NETWORK

4.1 Sewer Drainage Area

The master plan indicates that the proposed development falls in the future Kraaibosch 3 PS drainage area as shown in **Figure 2 (Sewer)** attached. This drainage areas drains to the Outeniqua WWTW.

An interim option was investigated to accommodate the proposed development in the exiting sewer system via the existing Kraaibosch PS as the master plan option requires the construction of the Kraaibosch 3 PS, Kraaibosch 4 PS and the Destiny Africa PS.

4.2 Categorisation of required upgrades

The items are categorised as follows:

- General MP Items – required to address capacity issues and backlogs in the bulk and reticulation systems serving the proposed development, but not specifically required for the development per sé.
- Development specific MP Items – new additions to (or deviations from) the existing Master Plan, required specifically for the proposed development, as a result of more accurate information relative to the original estimate of future development.

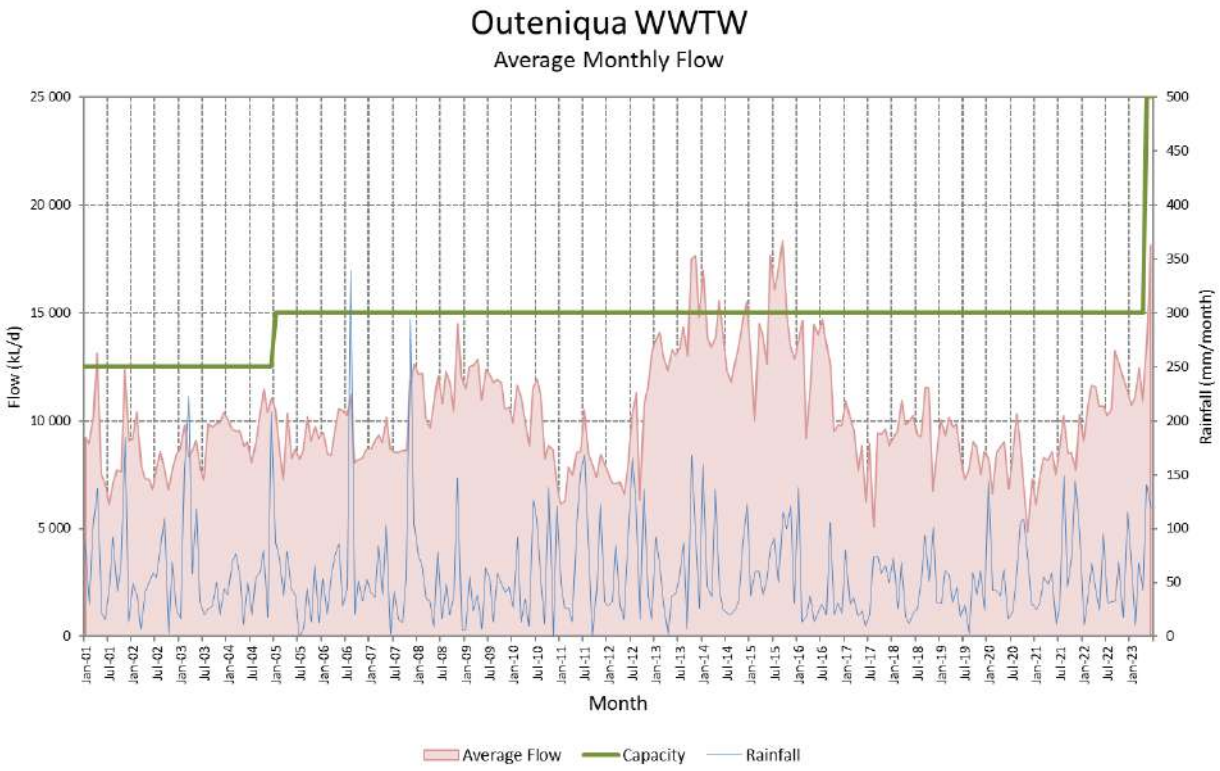
It is important to note that all proposed items are schematic in nature, final size and location is subject to a complete design by a suitably qualified engineer. The final locality in particular is subject to legislative requirements including but not limited to pipes not crossing private stands, no servitudes registered in private stands and no pipes in stands with an area less than 400m^2.

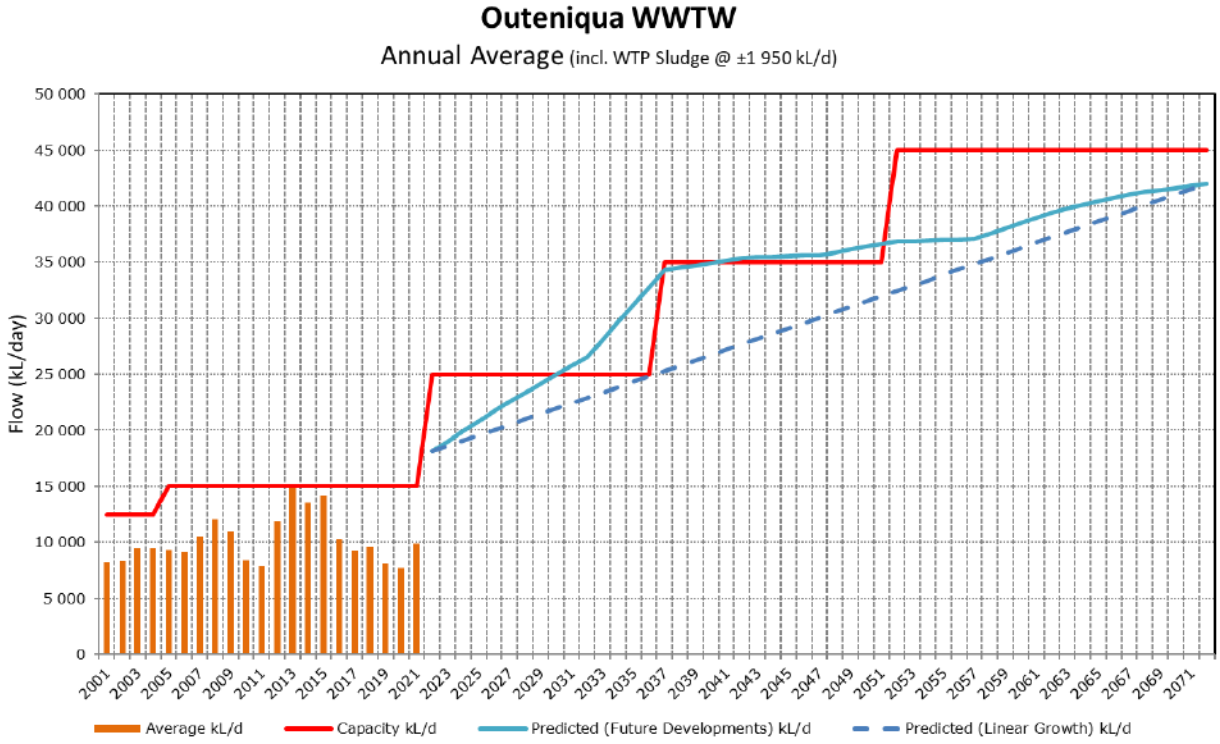
4.3 Bulk Sewer Drainage

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)**.

Wastewater Treatment Works capacity

The graph overleaf shows that the design capacity of the Outeniqua WWTW (green line) has been exceeded by the Average Monthly Flow (light red shaded area) a few times in the last decade. The WWTW has since been upgraded and is thus not operating at risk.


Outeniqua WWTW
Average Monthly Flow
Flow (kL/d)
Rainfall (mm/month)
Month
Average Flow
Capacity
Rainfall


Outeniqua WWTW
Annual Average (incl. WTP Sludge @ ±1 950 kL/d)
Flow (kL/day)
Average kL/d
Capacity kL/d
Predicted (Future Developments) kL/d
Predicted (Linear Growth) kL/d

Based on available information the capacity, present flow and projected short-term flow are as follows:

Outeniqua WWTW	Capacity	Comment
Existing Capacity	25 000 kL/d	
Measured Flow		
Annual Average (2001-2023)	14 846 kL/d	Maximum 2013/14
	10 154 kL/d	Spare capacity available
Monthly Average (2001-2023)	10 591 kL/d	September 2015
	14 409 kL/d	Spare capacity available
Monthly Average (2022/23)	13 761 kL/d	May 2023
	11 239 kL/d	Spare capacity available
Modelled Flow		
T_PDDWF (existing)	18 113 kL/d	m2024-03 MP - Incl. WTP sludge flow = 1 260 kL/d
	6 887 kL/d	Spare capacity available
3yr Projection	20 781 kL/d	Incl. WTP sludge flow = 1 260 kL/d
	4 219 kL/d	Spare capacity available
5yr Projection	22 561 kL/d	Incl. WTP sludge flow = 1 260 kL/d
	2 439 kL/d	Spare capacity available

Note: T_PDDWF: Theoretical Peak Daily Dry Weather Flow (Total Wastewater Flow, Peak day in week)
The flow projections include all stands that are presently vacant but expected to be occupied over the next 5 years as well as all future areas likely to develop within the next 5 years

4.3.1 Existing bulk sewer system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the bulk sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Existing bulk system (from Thembalethu 6 PS to Outeniqua WWTW)									
OT_20.02	MP	Upgrade existing Rising	400	800	4	873.6 L/s	R 1 278 000	R 15 715	1.23%
OT_20.03	MP	Upgrade existing Rising	500	800	12	873.7 L/s	R 1 453 000	R 17 864	1.23%
OT_37.04	MP	Upgrade existing Gravity	315	450	8	494.7 L/s	R 209 000	R 4 538	2.17%
OT_61.01 #[1]	MPi	Upgrade existing Pump Station (Investigate first): Thembalethu PS 6	-	-	-	494.7 L/s	R 20 573 000	R 446 726	2.17%
OT_61.02a #[1]	MPi	Upgrade existing Rising (Investigate first)	250	650	351	494.7 L/s	R 6 294 000	R 136 669	2.17%
OT_61.02b #[1]	MPi	Upgrade existing Rising (Investigate first)	250	650	31	494.7 L/s	R 1 368 000	R 29 705	2.17%
OT_61.02c #[1]	MPi	Upgrade existing Rising (Investigate first)	250	650	330	494.7 L/s	R 5 970 000	R 129 634	2.17%
						Sub-Total	**R 37 145 000**	**R 780 850**	
Existing WWTW (Outeniqua WWTW)									
	-	-	-	-	-	- -	R -	R -	1.00%
						Sub-Total	**R -**	**R -**	
						Total	**R 37 145 000**	**R 780 850**	

Notes: #[1] A first phase upgrade of the Thembalethu 6 PS to 240 L/s is planned in the short term .

4.3.2 Existing bulk sewer system considerations (interim period)

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the bulk sewer system for the interim connection prior to construction of the Kraaibosch 4 and Destiny Africa PSs:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Existing bulk system (from Meul PS to Outeniqua WWTW) - Interim option 1/2									
OT_03.01 #[1]	MP	Upgrade existing Pump Station: Meul PS	-	-	-	405.0 L/s	R 9 640 000	R 255 686	2.65%
OT_03.02 #[1]	MPi	Upgrade existing Rising (Investigate first)	450	650	484	405.0 L/s	R 8 341 000	R 221 232	2.65%
OT_09.01 #[2]	MPi	Upgrade existing Gravity (Investigate first)	700	1 000	18	475.4 L/s	R 718 000	R 16 224	2.26%
OT_09.02 #[2]	MPi	Upgrade existing Gravity (Investigate first)	700	1 000	26	476.0 L/s	R 889 000	R 20 062	2.26%
OT_09.03 #[2]	MPi	Upgrade existing Gravity (Investigate first)	600	900	14	498.1 L/s	R 553 000	R 11 926	2.16%
OT_09.04 #[2]	MPi	Upgrade existing Gravity (Investigate first)	700	825	260	483.5 L/s	R 4 638 000	R 103 043	2.22%
OT_10.01	MP	Upgrade existing Pump Station: Schaapkop PS	-	-	-	590.7 L/s	R 11 055 000	R 201 037	1.82%
OT_10.02	MP	Upgrade existing Rising	500	700	154	590.7 L/s	R 4 456 000	R 81 033	1.82%
OT_10.03 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	316	591.7 L/s	R -	R -	1.82%
OT_10.04 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	32	837.1 L/s	R -	R -	1.28%
OT_10.05 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	9	1 536.1 L/s	R -	R -	0.70%
OT_10.06 #[2]	MPi	Upgrade existing Gravity (Investigate first)	999	1 000	4	698.9 L/s	R -	R -	1.54%
						Sub-Total	**R 40 290 000**	**R 910 244**	
Existing bulk system (divert flow from Meul PS to Thembalethu 6 PS) - Interim option 1/2									
OT_20.02	MP	Upgrade existing Rising	400	800	4	873.6 L/s	R 1 278 000	R 15 715	1.23%
OT_20.03	MP	Upgrade existing Rising	500	800	12	873.7 L/s	R 1 453 000	R 17 864	1.23%
OT_37.04	MP	Upgrade existing Gravity	315	450	8	494.7 L/s	R 209 000	R 4 538	2.17%
OT_27.01 #[3]	MPa	Abandon existing Pump Station: Thembalethu PS 1	-	-	-	- L/s	R 287 000	R -	0.00%
OT_27.02 #[3]	MPa	Abandon existing Rising	200	250	867	- L/s	R 10 000	R -	0.00%
OT_38.01 #[3]	MPa	Abandon existing Pump Station: Thembalethu PS B	-	-	-	- L/s	R 287 000	R -	0.00%
OT_38.02 #[3]	MPa	Abandon existing Rising	79	90	99	- L/s	R 10 000	R -	0.00%
OT_39.01 #[3]	MPa	Abandon existing Pump Station: Thembalethu PS A	-	-	-	- L/s	R 287 000	R -	0.00%
OT_39.02 #[3]	MPa	Abandon existing Rising	79	90	91	- L/s	R 10 000	R -	0.00%
OT_50.01	MPa	Abandon existing Pump Station: Parkdene PS 2	-	-	-	- L/s	R 287 000	R -	0.00%
OT_50.02	MPa	Abandon existing Rising	150	200	227	- L/s	R 10 000	R -	0.00%
OT_51.01	MPa	Abandon existing Pump Station: Parkdene PS 3	-	-	-	- L/s	R 287 000	R -	0.00%
OT_51.02	MPa	Abandon existing Rising	150	200	151	- L/s	R 10 000	R -	0.00%
OT_58.02 #[2]	MPi	Upgrade existing Gravity (Investigate first)	200	450	47	22.9 L/s	R 458 000	R -	0.00%
OT_61.01	MPi	Upgrade existing Pump Station (Investigate first): Thembalethu PS 6	-	-	-	494.7 L/s	R 20 573 000	R 446 726	2.17%
OT_61.02a #[2]	MPi	Upgrade existing Rising (Investigate first)	250	650	351	494.7 L/s	R 6 294 000	R 136 669	2.17%
OT_61.02b #[2]	MPi	Upgrade existing Rising (Investigate first)	250	650	31	494.7 L/s	R 1 368 000	R 29 705	2.17%
OT_61.02c #[2]	MPi	Upgrade existing Rising (Investigate first)	250	650	330	494.7 L/s	R 5 970 000	R 129 634	2.17%
OT_62.01 #[3]	MP	Upgrade existing Pump Station: Thembalethu PS 7	-	-	-	50.0 L/s	R 5 670 000	R -	0.00%
OT_62.02 #[3]	MP	Upgrade existing Rising	200	250	1 170	50.0 L/s	R 3 169 000	R -	0.00%
OT_F91.02a	FM	New Gravity	-	160	109	2.8 L/s	R 279 000	R -	0.00%
OT_F91.02b	FM	New Gravity	-	160	80	2.8 L/s	R 546 000	R -	0.00%
OT_F91.03	FM	New Gravity	-	160	964	3.9 L/s	R 2 043 000	R -	0.00%
OT_F92.02a	FM	New Gravity	-	160	36	1.5 L/s	R 127 000	R -	0.00%
OT_F92.02b	FM	New Gravity	-	160	95	1.5 L/s	R 642 000	R -	0.00%
OT_F92.03	FM	New Gravity	-	160	157	2.5 L/s	R 377 000	R -	0.00%
OT_F93.02a	FM	New Gravity	-	160	56	1.5 L/s	R 169 000	R -	0.00%
OT_F93.02b	FM	New Gravity	-	160	89	1.5 L/s	R 605 000	R -	0.00%
OT_F94.02 #[3]	FM	New Gravity	-	200	514	35.6 L/s	R 1 265 000	R -	0.00%
OT_F94.03 #[3]	FM	New Gravity	-	250	515	35.9 L/s	R 1 512 000	R -	0.00%
OT_F94.04 #[3]	FM	New Gravity	-	250	211	36.2 L/s	R 654 000	R -	0.00%
OT_F94.05 #[3]	FM	New Gravity	-	315	1 631	52.8 L/s	R 5 801 000	R -	0.00%
OT_F95.02 #[3]	FM	New Gravity	-	160	9	0.1 L/s	R 72 000	R -	0.00%
OT_F96.02 #[3]	FM	New Gravity	-	160	24	0.1 L/s	R 102 000	R -	0.00%
OT_F97.02 #[3]	FM	New Gravity	-	160	25	16.2 L/s	R 104 000	R -	0.00%
						Sub-Total	**R 62 225 000**	**R 780 850**	
Existing WWTW (Outeniqua WWTW)									
	-	-	-	-	-	- -	R -	R -	0.22%
						Sub-Total	**R -**	**R -**	
						Total	**R 102 515 000**	**R 1 691 095**	

Notes:

#[1] Upgrading of the Meul PS is currently underway.

#[2] In the master plan an investigation of this pipe is proposed implying that not all information on slopes, inverts etc. was available. The pipe should therefore first be investigated through field inspections and surveys to verify that upgrading is in fact required.

#[3] Construction of an outfall sewer and upgrading to Thembalethu PS 7 is underway.

4.3.3 Accommodation of the proposed development in the bulk sewer system

Development specific items required in the bulk sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Future bulk system (from Thembalethu 6 PS to Outeniqua WWTW)									
OT_F04.03	FM	New Gravity	-	160	409	7.6 L/s	R 898 000	R 535 255	59.6%
OT_F04.04	FM	New Gravity	-	160	40	21.8 L/s	R 135 000	R 66 522	49.3%
OT_F05.01	FM	New Gravity	-	160	315	0.6 L/s	R 703 000	R 703 000	100.0%
OT_F05.02	FM	New Gravity	-	160	338	0.9 L/s	R 751 000	R 536 548	71.4%
OT_F06.01	FM	New Pump Station: Kraaibosch3 PS	-	-	-	26.3 L/s	R 5 452 000	R 2 226 821	40.8%
OT_F06.02a	FM	New Rising	-	160	655	26.3 L/s	R 1 077 000	R 439 891	40.8%
OT_F06.02b	FM	New Rising	-	160	39	26.3 L/s	R 206 000	R 84 139	40.8%
OT_F06.02c	FM	New Rising	-	160	309	26.3 L/s	R 518 000	R 211 572	40.8%
OT_F07.02	FM	New Gravity	-	160	235	13.5 L/s	R 538 000	R 221 776	41.2%
OT_F32.01	FM	New Gravity	-	315	218	93.2 L/s	R 992 000	R 114 335	11.5%
OT_F32.02	FM	New Gravity	-	200	612	94.6 L/s	R 1 838 000	R 208 708	11.4%
OT_F32.03	FM	New Gravity	-	315	251	157.7 L/s	R 1 133 000	R 77 176	6.8%
OT_F32.04	FM	New Gravity	-	315	72	207.8 L/s	R 367 000	R 18 972	5.2%
OT_F35.01 #[1]	FM	New Pump Station: Kraaibosch4 PS	-	-	-	207.8 L/s	R 14 168 000	R 732 400	5.2%
OT_F35.02 #[1]	FM	New Rising	-	450	1 442	207.8 L/s	R 12 631 000	R 652 946	5.2%
OT_F36.01	FM	New Gravity	-	315	214	210.5 L/s	R 977 000	R 49 857	5.1%
OT_F36.02	FM	New Gravity	-	525	213	257.8 L/s	R 4 844 000	R 201 840	4.2%
OT_F36.03	FM	New Gravity	-	315	20	336.1 L/s	R 144 000	R 4 602	3.2%
OT_F37.01 #[2]	FM	New Pump Station: Destiny Africa PS	-	-	-	336.1 L/s	R 18 685 000	R 597 186	3.2%
OT_F37.02 #[2]	FM	New Rising	-	550	1 214	336.1 L/s	R 13 102 000	R 418 749	3.2%
						Total	**R 79 159 000**	**R 8 102 295**	

Notes: *#[1] A potential first phase of Kraaibosch 4 PS could be 50 L/s and a 355mm Ø rising main.*

#[2] A potential first phase of Destiny Africa PS could be 100 L/s and a 450mmØ rising main.

4.3.4 Accommodation of the proposed development in the bulk sewer system (interim period)

Development specific items required in the bulk sewer system for the interim connection prior to construction of the Kraaibosch 4 and Destiny Africa PSs:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Future bulk system (from Meul PS to Outeniqua WWTW) - Interim option 1									
OT_F04.03	FM	New Gravity	-	160	409	7.6 L/s	R 898 000	R 535 255	59.6%
OT_F04.04	FM	New Gravity	-	160	40	21.8 L/s	R 135 000	R 66 522	49.3%
OT_F05.01	FM	New Gravity	-	160	315	0.6 L/s	R 703 000	R 703 000	100.0%
OT_F05.02	FM	New Gravity	-	160	338	0.9 L/s	R 751 000	R 536 548	71.4%
OT_F06.01	FM	New Pump Station: Kraaibosch3 PS	-	-	-	26.3 L/s	R 5 452 000	R 2 226 821	40.8%
OT_F06.02d #[3]	FA	New Rising (Alternative)	-	160	276	26.3 L/s	R 465 000	R 189 925	40.8%
OT_F06.02e #[3]	FA	New Rising (Alternative)	-	160	1 522	26.3 L/s	R 2 478 000	R 1 012 117	40.8%
OT_F07.02	FM	New Gravity	-	160	235	13.5 L/s	R 538 000	R 221 776	41.2%
						Total	**R 11 420 000**	**R 5 491 963**	

Notes: *#[3] The master plan proposes that the development area drain to the Thembalethu PS 6 with a prerequisite for this option being the construction of the Destiny Africa and Kraaibosch 4 pumping systems. As part if interim accommodation of the development, the proposed Kraaibosch 3 PS could pump to the existing Kraaibosch PS. In future a rising main to the future Kraaibosch 4 PS can be constructed.*

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Future bulk system (from Meul PS to Outeniqua WWTW) - Interim option 2									
OT_F04.05 #[4]	FA	New Rising (Alternative)	-	110	210	7.3 L/s	R 258 000	R 158 511	61.4%
OT_F04.06 #[4]	FA	New Pump Station (Alternative): Kraaibosch Ridge PS 4	-	-	-	7.3 L/s	R 3 162 000	R 1 942 681	61.4%
OT_F05.03 #[4]	FA	New Rising (Alternative)	-	90	186	3.0 L/s	R 211 000	R 211 000	100.0%
OT_F05.04 #[4]	FA	New Pump Station (Alternative): Kraaibosch Ridge PS 2	-	-	-	3.0 L/s	R 1 825 000	R 1 825 000	100.0%
OT_F06.02e #[4]	FA	New Rising (Alternative)	-	160	1 522	26.3 L/s	R 2 478 000	R 1 601 749	64.6%
OT_F07.03 #[4]	FA	New Pump Station (Alternative): Kraaibosch Ridge PS 3	-	-	-	17.0 L/s	R 3 738 000	R 3 738 000	100.0%
						Total	**R 11 672 000**	**R 9 476 941**	

Notes: *#[4] An alternative for the interim accommodation of the development without Kraaibosch 3 PS, is the construction of two pumping stations (Kraaibosch Ridge 2 and 4) to lift sewer flow over the watershed to a main Kraaibosch Ridge PS 3. This would include constucting the Kraaibosch 3 interim rising main up to Kraaibosch Ridge 3 PS. With further phased development Kraaibosch PSs 2 - 4 can be decommissioned in favour of Kraaibosch 3 PS and the rising main extended or decommisioned for a rising main to Kraaibosch 4 PS.*

4.4 *Sewer reticulation 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)**.

4.4.1 Existing sewer reticulation system considerations

Items presented here are for the attention of the George Municipal engineering professional (yourself) so as to highlight existing shortfalls or the imminent potential thereof.

General items required to alleviate existing problems in the existing sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Existing collector system (from Meul PS to Outeniqua WWTW) - Interim option 1/2									
OT_34.03	MPi	Upgrade existing Gravity (Investigate first)	315	450	42	89.9 L/s	R 425 000	R 50 783	11.9%
						Total	**R 425 000**	**R 50 783**	

4.4.2 Accommodation of the proposed development in the sewer reticulation system

Development specific items required in the existing sewer system:

Item No	MP Type	Description	Existing Diam (mm)	New Diam (mm)	Length (m)	Design Flow	Cost	Pro-rata Cost	
Development - Phase 1 (Kraaibosch Ridge)									
OT_F04.02	FM	New Gravity	-	160	681	5.2 L/s	R 1 458 000	R 1 458 000	100.0%
OT_F07.04	FM	New Gravity	-	160	743	9.6 L/s	R 1 587 000	R 1 587 000	100.0%
Development - Phase 2 (Aan de Meulen)									
OT_F04.01	FM	New Gravity	-	160	222	4.4 L/s	R 513 000	R 513 000	100.0%
OT_F07.05	FM	New Gravity	-	160	171	0.8 L/s	R 406 000	R 406 000	100.0%
						Total	**R 3 964 000**	**R 3 964 000**	

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

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

The above Design Flows (or IPWWF) and thus pipe sizes were calculated taking cognizance of future developments upstream of the proposed development. In this regard, sewer pipes within the proposed development must be designed (layout and sizing) to receive a Design Flow from the following future connection point (see Figure 2 (Sewer)).

Connection Point	Design Flow (L/s)
Point A	0.78

As the Design Flow already accommodates stormwater ingress, the pipes can be designed to flow 100% full with the Design Flows provided above.

5 SUMMARY

Water supply:

Summary of costing:	Cost	Pro-rata Cost
General items required to alleviate existing problems in the bulk water system	R 290 161 000	R 1 915 359
Development specific items required in the bulk water system	R 25 376 000	R 1 286 924
General items required to alleviate existing problems in the water distribution system	R -	R -
Development specific items required in the water distribution system (including fire flow requirements)	R 2 172 000	R 417 517
Total	**R 317 709 000**	**R 3 619 801**

Summary of costing - Interim option (Kraaibosch Ridge PRV):	Cost	Pro-rata Cost
General items required to alleviate existing problems in the bulk water system	R 290 161 000	R 1 915 359
Development specific items required in the bulk water system	R 5 898 000	R 466 901
General items required to alleviate existing problems in the water distribution system	R -	R -
Development specific items required in the water distribution system (including fire flow requirements)	R 5 103 000	R 1 702 511
Total	**R 301 162 000**	**R 4 084 771**

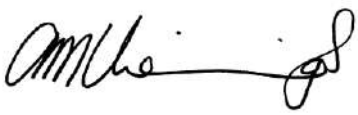
Sewer drainage:

Summary of costing (Master Plan):	Cost	Pro-rata Cost
General items required to alleviate problems in the bulk sewer system:	R 37 145 000	R 780 850
Development specific items required in the bulk sewer system:	R 79 159 000	R 8 102 295
General items required to alleviate problems in the existing sewer system:	R -	R -
Development specific items required in the existing sewer system:	R 3 964 000	R 3 964 000
Total	**R 120 268 000**	**R 12 847 146**

Summary of costing - Interim option 1 (Kraaibosch 3 PS):	Cost	Pro-rata Cost
General items required to alleviate problems in the bulk sewer system:	R 102 515 000	R 1 691 095
Development specific items required in the bulk sewer system:	R 11 420 000	R 5 491 963
General items required to alleviate problems in the existing sewer system:	R 425 000	R 50 783
Development specific items required in the existing sewer system:	R 3 964 000	R 3 964 000
Total	**R 118 324 000**	**R 11 197 840**

Summary of costing - Interim option 2 (Kraaibosch Ridge PSs):	Cost	Pro-rata Cost
General items required to alleviate problems in the bulk sewer system:	R 102 515 000	R 1 691 095
Development specific items required in the bulk sewer system:	R 11 672 000	R 9 476 941
General items required to alleviate problems in the existing sewer system:	R 425 000	R 50 783
Development specific items required in the existing sewer system:	R 3 964 000	R 3 964 000
Total	**R 118 576 000**	**R 15 182 818**

Yours sincerely,



_____

Per: A Vienings (Pr. Eng.)
GLS Consulting

(Report done by: J Rudolph)

REQUEST FROM CONSULTANT TO GLS

24051CG -Sawmill Development - George : GLS Services Availability Report

Reply | Reply All | Forward | ...

Fri 2024/04/26 13:04

GW George Wallace <gwallace@lyner

To Johann Rudolph

Cc Francois van Eck

You replied to this message on 2024/04/29 08:10.

Translate message to: English | Never translate from: Afrikaans | Translation preferences

Middag Johann,

Hoor by Flip jy hou bietjie wittebrood maar is weer Maandag terug op kantoor.

Ons benodig n beskikbaarheid van dienste verslag (water en riool) vir n nuwe otwikkeling op die ou 'Sawmill' langs die N2.
Kan ons dalk Dinsdag oggend 30April so 08h30 dalk n 'teams' meeting doen om net bietjie agtergrond te gee?

Bevestig asseblief.

Groete,

George Wallace B Tech | Civil Technologist | Tel: 044 887 0223 | Mobile: 084 569 5373

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ANNEXURE B

Kraaibosch 195/21 PS F1

Saasveld PS 6

Woodifields PS F3

Welgelegen PS

Kraaibosch PS

George Erf 195/325 PS

Kraaibosch Ridge PS 2
OT_F05.04

Kraaibosch Ridge PS 3
OT_F07.03

Kraaibosch3 PS
OT_F06.01

Kraaibosch Ridge PS 4
OT_F04.06

Kraaibosch5 P

Garden Route City PS

Victoria Bay PS 2
(Victoria Bay CT)

Garden Route City WWTP

Kraaibosch4 PS
OT_F35.01

Destiny Africa PS
OT_F37.01

Thembalethu PS 7
OT_62.01

Thembalethu PS 2
OT_00.01

Thembalethu PS A
OT_39.01

Thembalethu PS B
OT_58.01

Thembalethu PS 1
OT_27.01

Thembalethu PS 6
OT_61.01

Meul PS
OT_53.01

Blue Mountain PS 2

Blue Mountain PS 1

Parkdene PS 1
OT_49.01

Parkdene PS 2
OT_50.01

Parkdene PS 3
OT_51.01

Schaapkop PS

Tamsui PS

Rosedale PS 2

Rosedale PS 1

Pacaltsdorp Ext.3A PS

Outeniqua WWTP

Sludge PS

Pacaltsdorp PS F9

Pacaltsdorp PS 1

Pacaltsdorp PS 3

Thembalethu Ext.10 PS

Ballots Bay PS

Thembalethu Ext.11B PS

Thembalethu Ext.12A PS

Connection Point

Connection Point (Interim)

0 125 250 375 500 m

Scale 1:25000

Legend:

Proposed Master Plan

- Existing
- Proposed
- Proposed (Investigate first)
- Abandoned
- Investigate
- Future Main
- Future Schematic

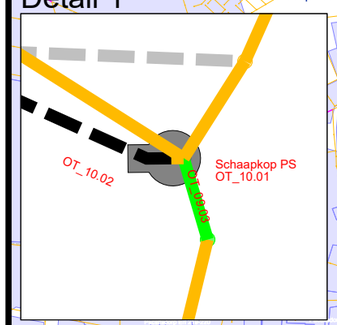
Pipes

- Gravity Mains
- Rising main

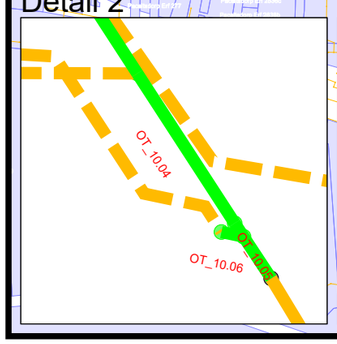
Future development areas

- Future Developments Areas
- Developable Area

Detail 1



Detail 2



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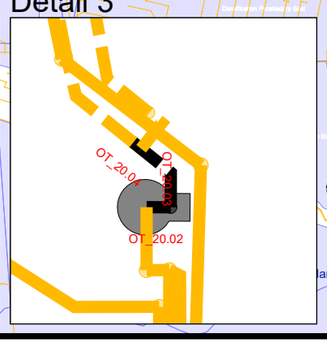

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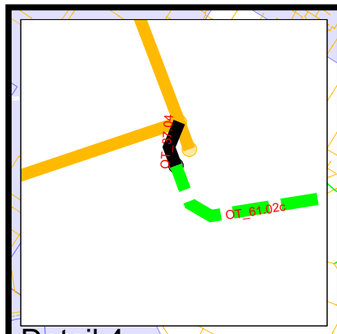

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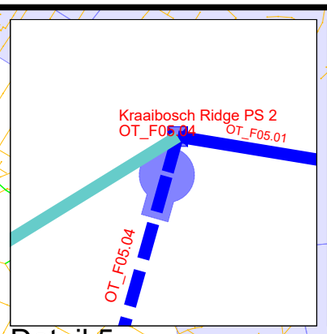

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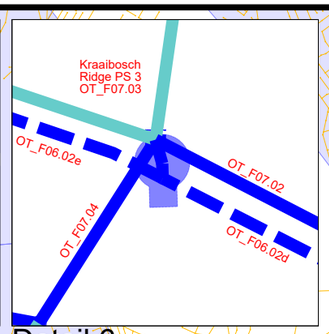

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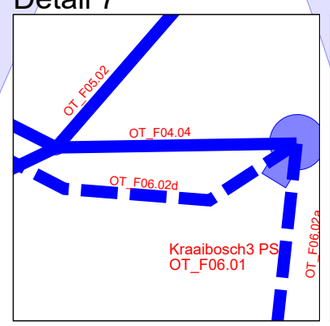

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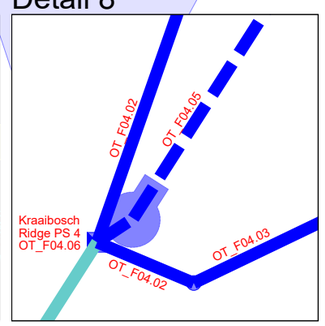
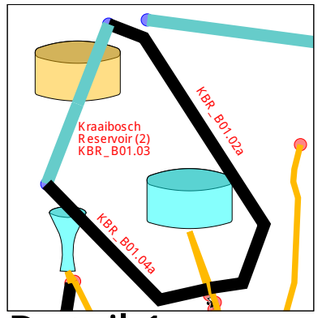


GEORGE
THE CITY FOR ALL REASONS

FIGURE 2 (Rev2)

Required Works:
George Erven 25537, 25538, 25541 and 195 Ptn 400
(Aan de Meulen and Kraaibosch Ridge developments)
Future George Sewer System
2024-03



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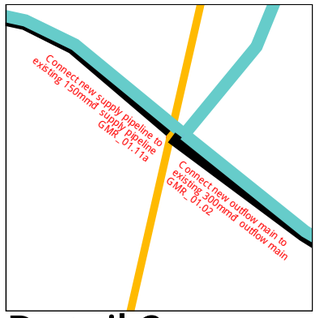


Detail 2

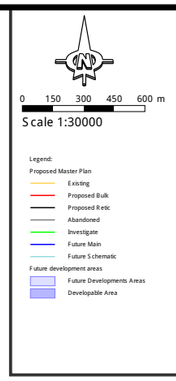


FIGURE 1 (Rev2)

Required Works:
George Erven 25537, 25538, 25541 and 195 Ptn 400
(Aan de Meulen and Kraaibosch Ridge developments)
Future George Water System
2024-03

George Wallace

From: Melanie Geyer <mgeyer@george.gov.za>
Sent: Tuesday, 15 October 2024 09:15
To: Francois van Eck
Cc: George Wallace; Ricus Fivaz
Subject: Aan de Meulen & Kraaibosch Ridge [Filed 15 Oct 2024 12:20]
Attachments: Outlook-npjsdqqw

Categories: Filed by Mail Manager

Dear Francois and George

Following our discussion on 01 October 2024, I have had further discussions with the Operational Departments and can confirm the following:

1. Reservoirs:
    a. Steel reservoirs are not accepted
    b. Smaller reservoirs will be considered, but no smaller than 2ML. I will send a separate email to Johann to look at locating only 1 4ML reservoir on teh Kraaibosch Ridge / Aan de Meulen sites and the other elsewhere.
    c. A reminder of the availability of land required to accommodate the reservoirs, and that a number of smaller reservoirs (2 x 2ML) to make up the master plan requirement (4ML) will require a larger footprint than just one 4ML reservoir.
2. Water connection: A connection from the PRV remains unacceptable and wont be considered by the operational department, even in the short term.
3. Accommodation of some sewage flows (43 erven) at the Welgelegen pump station: The sewer operational departments have extensive issues with the Welgelegen and Kraaibosch pump stations due to stormwater infiltration that have not been resolved and the timeframe for the resolution of this aspect is unknown at this stage. Connection for even a portion of the sewage outflow as discussed in the meeting cannot be considered at this stage, thus all sewage will have to be conveyed and treated to the on-site package plant

Please advise if there is anything that I have missed or that you require clarity on.

Regards,

Melanie Geyer
Manager: Infrastructure Planning
Civil Engineering Services Directorate

Office: 044 801 9268
Email: mgeyer@george.gov.za

ANNEXURE F

Traffic Impact Assessment from ITS

Transport Impact Assessment

Meulenzicht Landgoed

George, Western Cape

May 2025

5th Floor

Imperial Terraces

Carl Cronje Drive

Tyger Waterfront

Bellville, 7530

(021) 914 6211 (T)

e-mail: mail@itsglobal.co.za

SUMMARY SHEET

Report Type	Transport Impact Assessment
Title	Meulenzicht Landgoed
Location	George, Western Cape
Client	Atterbury
Reference Number	ITS 4730
Project Team	Christoff Krogscheepers
	Inge van Tonder
Contact Details	Tel: 021 914 6211
Date	May 2025
Report Status	Draft
File Name	G:\4730 TIA Saagmeule Welgelegen George\12 Reports\Issued\4730 TIA Meulenzicht_George_IvT_2025-05-14.docx

This transport study was prepared by a suitably qualified and registered professional traffic engineer. Details of any of the calculations on which the results in this report are based will be made available on request.

TABLE OF CONTENTS

LIST OF FIGURES

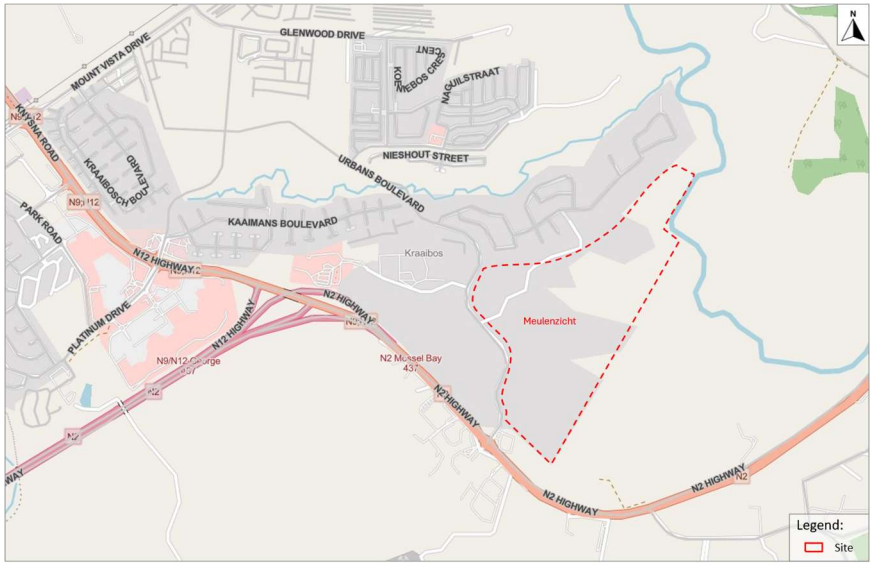
LIST OF TABLES

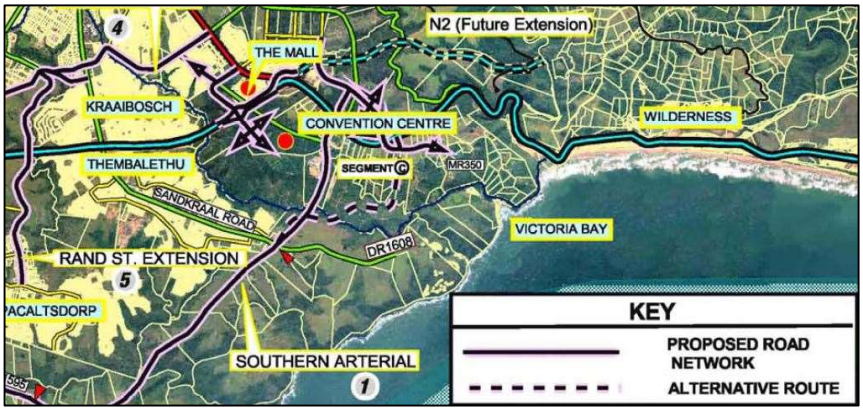
Annexures

Abbreviations

COTO	Committee of Transport Officials
Ha	Hectare
HCM	Highway Capacity Manual
LOS	Level of Service
NMT	Non-motorised Transport
SATGR	South African Trip Generation Rates
SQM	Square Meters (m^2)
TIA	Transport Impact Assessment
V/C	Volume to Capacity Ratio
WCG	Western Cape Government

Transport Impact Assessment

1 Purpose of Study	This report assesses the expected transport-related impact of the proposed Meulenzicht Development in George, Western Cape. These will be referred to as The Development. This study summarises the estimated transport impacts of the proposed land uses on the existing and future road networks within the vicinity. It provides an assessment of the transport impacts sufficiently so to identify any required mitigation measures.
2 Locality	The proposed development is in George, Western Cape, on Erf 25537. See the vicinity map below. It is adjacent to the Welgelegen Development. It is located east of the N2/Knysna Street interchange and straddles Urbans Boulevard also previously referred to as the Welgelegen Access Road. The alignment of the proposed future extension of the N2 is situated to the north and forms the northern boundary.  *Figure 1: Locality Plan*
3 Proposed Land Uses	The proposed development comprises of the following land uses: Meulenzicht Estate: • 227 Full Title Erven Refer to **Appendix A, Figure A1** for the site development plan. The Meulenzicht Landgoed development includes Phases B1-B4. Phase C does not form part of this investigation. The impact assessment is based on the development fully constructed by the year 2030.

4 Existing Roadways	The following roads are located in proximity of the development: • **N2:** Class 1 highway with two lanes per direction and a posted speed of 100/80 km/h. No parking is allowed along this road and there is a median and street lighting in both directions. • **Knysna Rd:** Class 2 primary arterial with two lanes per direction and posted speed varying between 60 km/h and 80 km/h. No parking is available along this median-divided road. Street lighting is provided in both directions. • **Urbans Boulevard:** Class 3 road with one lane per direction with shoulders and sidewalks on both sides of the road. Street lighting is provided in both directions. This road provides access to the Welgelegen Estate and the Outeniqua Family Market. It will also be the primary access to the proposed development.
5 Future Roadways	A significant amount of planning has gone into the road network within the vicinity of the proposed development, and this is documented in several studies of which the most noteworthy are: • George Roads Master Plan (See Figure 2) • Kraaibosch Roads Master Plan (See Figure 3) • Welgelegen Roads Master Plan (See Figure 4) An extract of the most recent George Roads Master plan is provided in **Figure 2** below and also refer to **Annexure C** for the larger George Roads Master Plan.  *Figure 2: Extract from the Approved George Roads Masterplan*  *Figure 3: Kraaibosch Roads Master Plan (SMEC 2022)*

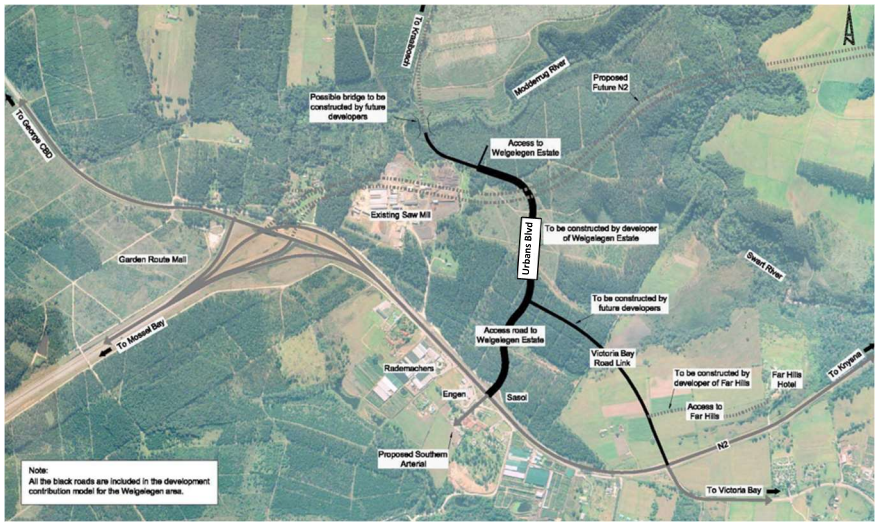


Figure 4: Welgelegen Roads Master Plan (ITS 2008)

The following are relevant based on the above long-term roads master plans:

- The extension of the N2 to the west across the existing Sawmill, south of the Welgelegen Estate and to the north of the proposed development. The timeframe for this future extension is unclear, but this was considered in the development of the SDP and this transport study.
- The extension of Urbans Boulevard across the Modderrug River to link up with Road 5.3 in the Kraaibosch Area in line with the roads planning in the areas. One key consideration is at what point is the link and the bridge across the river required.
- A link between Urbans Boulevard and the N2 at the Victoria Bay intersections.
- Primary Access in/out of the area is via Urbans Boulevard and the roundabout intersection with the N2. This intersection is currently being upgraded, and the roundabout is reconstructed as part of an upgrade project of the N2.
- It is planned to extend Urbans Boulevard to the west in what has been labelled the Southern Arterial.

During the development of the SDP for the proposed development, the long-term road plans were considered. This includes the public transport needs along these links which could in the future be used by the GoGeorge Bus system.

6 Analyses Hours

The traffic analyses for the TIA were based on the weekday AM and PM peak hours. The following peak hours are representative of the traffic in the study area:

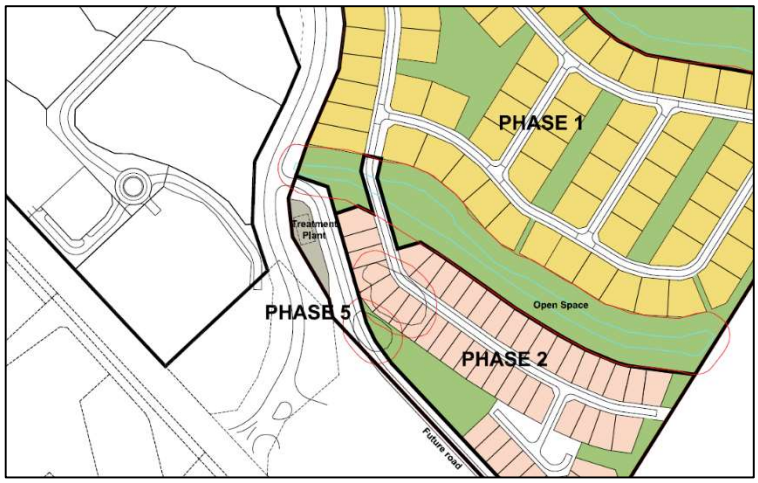
- Weekday AM peak hour: 07:15 to 08:15
- Weekday PM peak hour: 16:30 to 17:30

7 Scenarios Analysed

The transport impacts of the proposed development were analysed for the following scenarios:

1. 2025 Existing Traffic Conditions

	2. 2030 Background Traffic Conditions. Existing Traffic conditions with an additional 4% growth per year for 5 years along the major routes to account for other developments in the surrounding areas. 3. 2030 Total traffic conditions (Background traffic + Development trips) a) Background traffic plus Meulenzicht Landgoed development trip b) Background traffic plus the latent development trips (Oumeulen Village Landgoed) The traffic growth assumptions used to analyse future scenarios are discussed in Section 10.
8 Study Intersections (existing control)	The following intersections are included in the study: • Intersection 1: Knysna Road / St George's Road / Servitude Road • Intersection 2: Knysna Road / Garden Route Mall Access Road • Intersection 3: Knysna Road / N2 Off-ramp • Intersection 4: Knysna Road / N2 On-ramp • Intersection 5: N2 / Urbans Boulevard / Sasol Roundabout • Intersection 6: Urbans Boulevard / Development Access The existing geometry and control of the intersections included in the study are included in **Appendix A, Figure A2**.
9 Existing Intersection Operations	The evaluation of the existing intersection operations was based on the 2025 peak hour traffic volumes. All the intersection operation analyses were performed in accordance with the procedures stated in the latest Highway Capacity Manual (HCM). The intersections in the study area were analysed to determine the level of service (LOS), delay per vehicle (in seconds) and volume per capacity (V/C) for each intersection in the peak hour. Refer to **Annexure A, Figure A3** and **Figure A4** for the weekday AM and PM peak hour traffic operations for the existing traffic conditions. Based on the existing conditions analysis it is evident that all the intersections are operating acceptably during both the typical weekday AM and PM peak hours. There are no improvements required at any of the study intersections for the existing conditions.
10 2030 Background Conditions	The 2030 Background Conditions include the 2025 Existing Conditions with a 4% growth rate applied along the N2 for 5 years. A 4% growth was determined by comparing the October 2023 hourly flow on the N2 with the May 2024 hourly. These volumes are measured by a SANRAL counting station just south of the N2/Knysna Road I/C. This is a relatively high annual growth rate and is unlikely to be sustained over a prolonged period. It was used for this study to ensure that a conservative future demand scenario is tabled, specifically considering all the developments currently occurring in this area of George and Kraaibosch. A summary of the traffic volumes and the analysis based on the background traffic demand is included in **Appendix A, Figure A5** and **Figure A6.** Based on the background conditions analysis it is evident that all the intersections are operating acceptably during both the typical weekday AM and PM peak hours. There are no improvements required at any of the study intersections for the existing conditions.

11 Site Development Plan (SDP)	The SDP was developed together with the full professional team. The final version of the SDP is included in **Annexure A**. The salient points to note from a traffic perspective are the following: • Both developments will be getting access via a single access (Roundabout controlled) off Urbans Boulevard. The topography of Urbans Boulevard and the sight distance requirements for side road accesses necessitate a single access. This results in two substantial portions of land getting access via a single security entrance and a single roundabout access onto Urbans Boulevard. • The need and requirements to provide a link road through to the N2/Victoria Bay Intersection are provided to the north of the Sasol Property boundary. The Victoria Bay Link Road intersects with Urbans Boulevard within the inside of a horizontal curve. The location and the sight distances were checked and are acceptable. The link road turns back to the south to run along the property boundary of the neighbouring land (Sasol Property, Erf 197/278). The proposal is to build the road and define the road reserve around the property boundary so that both landowners provide equal land for the road. Access to the Sasol Property is shown indicatively on the SDP since it can be located at any reasonable location along the property boundary. The construction of this road is not included in the proposed development. It is not required by the development. The road reserve should be made available to the municipality. See the alignment below of the link road from an extract of the SDP.  *Figure 5: Alignment of future link road to N2/Victoria Bay intersection* • A temporary construction access is shown off Urbans Boulevard immediately to the south of the future N2 road reserve. This access will be temporary and will also in the meantime give access to the Garden Route Farmers Market. It will be closed at some point in the future. • The security gatehouses and storage lengths ahead of these gatehouses are illustrated and show sufficient storage space to avoid entering queues spilling back into the public right-of-way. • No specific land uses have been assigned to Phase A8 and Phase B6. These are future phases and will have to be treated as such in the approvals and conditions of approval.

12 Trip Generation Rates and Development Trips

All the trip generation rates used to determine the expected development trips are from the South African Trip Data Manual (COTO TMH17, 2013). The analysis of the trip generation for the proposed development is provided in **Appendix B, Table 4** and summarised below in **Table 1.**

Table 1: Expected Development Trips

Land Use	AM Peak Hour			PM Peak Hour		
	Total Trips	In	Out	Total Trips	In	Out
Meulenzicht Estate						
Full title erven	227	57	170	227	159	68
TOTAL	**227**	**57**	**170**	**227**	**159**	**68**

Note that the trips from Phase C were not included in the above trip generation estimate. The specific land uses on these areas have not been determined since they are future phases.

13 Trip Distribution

The expected trip distribution for the development during the AM and PM peak hours is based on the current traffic patterns, the type of development and the location of the major trip generators in the greater area. The estimated trip distribution is as follows:

AM and PM Trip Distribution for residential and retirement units:

- 80% to/from George CBD
- 15% to/from Knysna
- 5% to/from Cape Town

Refer to **Appendix A, Figure A7** for the future intersection lane configurations and controls as part of this development.

Refer to **Figures A8** and **A9** for a summary of the trip distribution on the network in the AM and PM peak hours for the Meulenzicht Landgoed development. The added volumes due to the trips that are expected to be generated by the proposed development and the assumed trip assignment are also provided in **Figures A8** and **A9** for the AM and PM peak hours respectively.

Note that for the analysis, no traffic was assigned across the planned route across the Modderrug River to/from the Kraaibosch area. This is a conservative approach assuming that all traffic will have to access the larger road network via the N2 Roundabout at the Urbans Boulevard intersection with the N2.

14 Latent Developments

It is also planned to develop towards the west of Urbans Boulevard, namely Oumeulen VIllagea, and the development will consist of the following land uses:

- 151 Full Title Erven
- 355 Apartments
- Restaurant, clubhouse, deli and gym – 2 500 m^2
- Nursery School – 1 000 m^2

Refer to **Figure 6** below for the location of the Oumeulen Village development in relation to Meulenzicht Landgoed.

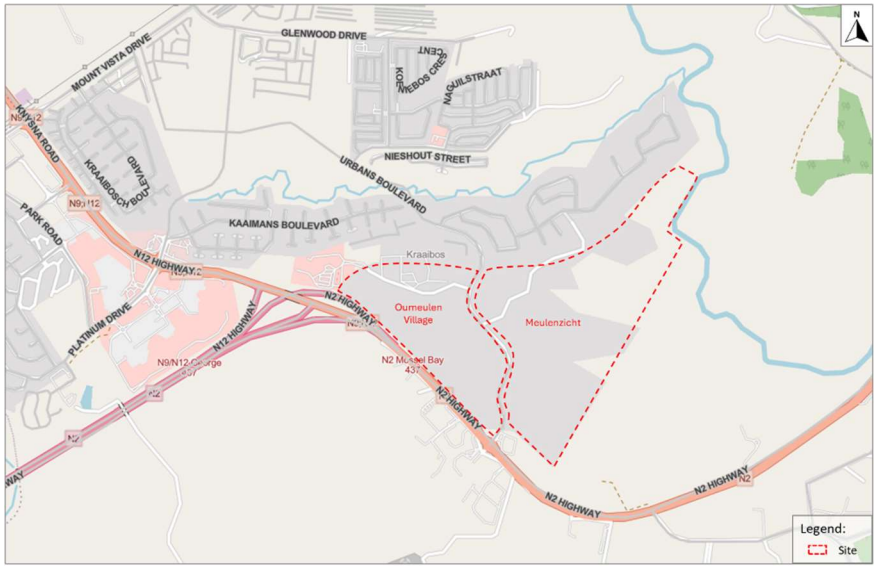


Figure 6: Meulenzicht Development

The following trips are expected as part of the development:

Table 2: Oumeulen Village Expected Trips

Land Use	AM Peak Hour			PM Peak Hour		
	Total Trips	In	Out	Total Trips	In	Out
Oumeulen Village						
Full title erven	151	38	113	151	106	45
Apartments	302	75	226	302	211	91
Nursery School	10	5	5	7	4	3
Restaurant, Deli, Gym and Clubhouse	25	13	13	25	13	13
Phase A8 and Phase B6 (Future)						
TOTAL	**488**	**131**	**357**	**484**	**333**	**151**

Refer to Annexure C for the site development plan for Oumeulen Village and the trip generation rates used for this development.

15 Site Access

Access to the development will be via Urbans Boulevard currently providing access to the Welgelegen Estate and the Outeniqua Family Market. The Meulenzicht development and the Oumeulen Village will both have separate access control gates. A single-lane roundabout is proposed along Urbans Boulevard providing access to both developments, refer to **Figure A7** and the discussion in Section 11 related to the SDP.

16 2030 Total Traffic Conditions

The 2030 total traffic includes the existing traffic volumes grown by 4% per annum for 5 years, plus the new traffic that will be generated by the development.

Scenario 3a:

Refer to **Appendix A, Figures A10** and **A11,** for the Total Traffic Conditions for this scenario based on the expected total traffic demand if Meulenzicht Landgoed is fully developed, with the future lane configurations and control as provided in **Figure A7**. Based on the operational analyses of the 2030 Total Traffic Conditions,

all intersections are expected to operate at acceptable levels of service.

The storage of the right-turn lane, southbound along Knysna Road at the N2 westbound on-ramp, should be increased from the current ±30m to at least 120m to accommodate the queue length. The space is available by repurposing the current painted island. No widening of the bridge is required.

The analysis and subsequent conclusions are based on all traffic assigned to the N2/Urbans Boulevard roundabout intersection and no trips being generated by Phases C. From the analysis, as summarised in **Figures A10** and **A11**, it is evident that the two key intersections are the following:

- N2/N9 Westbound onramp (Intersection 4): V/C = 0.68 during p.m. peak hour, ±647 right turning vehicles. Although the delays are still acceptable, the queue length will exceed available storage capacity and require more storage.
- The final design of the gatehouses to each of the estates in terms of the number of service lanes and storage requirements needs to be confirmed by a traffic statement.

Scenario 3b:

Refer to **Appendix A, Figures A12** and **A13**, for the expected trips and trip distribution of the Oumeulen Village development, with the future lane configurations and control as provided in **Figure A7**. Refer to **Appendix A, Figures A14** and **A15**, for the expected trips for the full development. The expected trips for the Oumeulen Village development do not include the future Phase 8A and B6, as indicated on the SDP in Appendix C. Refer to **Figures A16** and **A17** for the 2030 Total Traffic Conditions for this scenario.

Based on the operational analyses of the 2030 Total Traffic Conditions for this scenario, all intersections are expected to operate at acceptable levels of service and no additional mitigation measures would be required except for the following.

- N2/Urbans Boulevard Roundabout (Intersection 5): V/C = 0.76 during a.m. peak hour. The operations of this intersection are still acceptable, but marginal increases in demand could result in operational failures. Therefore, it would be prudent not to allow further development along Urbans Boulevard unless the bridge and link to the Kraaibosch area across the Modderrug River are established. Hence, the total traffic from Meulenzicht Landgoed and Oumeulen Village (Excluding Phase A8 and Phase C) can be accommodated without the link across the Modderrug River and hence without the requirement of a bridge. This should be verified through an updated TIA once most of the proposed uses on the property are operational.

17	**Public Transport and Non-Motorised Transport**	**Existing Public Transport (PT) Facilities:** There are no existing minibus taxi and/or bus routes within the immediate vicinity of the site. There are currently three phases of the GoGeorge bus service in operation in the George area. The existing bus routes can be seen in **Appendix D**. **Planned PT Network:** George Municipality/Western Cape Government is planning to extend the current GoGeorge Public Transport System services from George CBD to Victoria Bay in Phase 5 and the Nelson Mandela University (NMU) Phase 6. Planned route C59 to Victoria Bay will be running past the Sawmill site along the current N2. The bus route C59 between Vitoria Bay and George CBD can be routed to include the Welgelegen and Kraaibosch areas. Additionally, with the bridge over the Modder River, the M5 bus route to NMU can also be re-routed to include the Kraaibosch and Welgelegen Areas. **Proposed PT Facilities:** It is expected that public transport trips will be made to both estates and that there will be a need for dropping off and picking up facilities at the security gates or along Urbans Boulevard in dedicated public transport facilities. The latter would most probably only be feasible once Urbans Boulevard is constructed across the river to the Kraaibosch Area and the GoGeorge services are established along the boulevard. As part of the proposed roundabout along Urbans Boulevard, public transport laybys should be constructed on the downstream side of the roundabout. **Existing Non-Motorised Transport (NMT) Facilities:** Sidewalks and road shoulders are provided on both sides of Welgelegen Road. There are no dedicated cycle lanes on Welgelegen Road in the vicinity of the development site, forcing cyclists to either cycle on the shoulder of the roads or make use of the pedestrian sidewalk. **Pedestrian/NMT Movements** Pedestrians can access the Rademachers area via the existing sidewalks along Welgelegen Access Road which runs along the frontage of the proposed development and links to the N2 at the roundabout. There are sufficient pedestrian facilities at the roundabout to safely cross the N2. **Proposed NMT Facilities:** All new interior roads to be constructed as part of the proposed development need to provide sidewalks for pedestrians. Streetlights and traffic calming measures must also be provided in areas with high pedestrian movements/activity. It is not anticipated that dedicated cyclist facilities will be provided along the roads within the development. However, it is advisable to provide bike racks and bike storage facilities at the entrances to relevant buildings such as the gym. Cyclists can access the development via the existing shoulders along Urbans Boulevard but will have to use the normal traffic lanes within the development. The design speeds of the roadways within the development will be sufficiently low to ensure safe passage for cyclists.

18 Parking	No detailed SDPs have been developed for the individual phases of the development. The parking and parking ratios required by the George Municipal Planning By-Laws should be followed when these are developed.
19 Conclusion & Recommendations	The Meulenzicht Landgoed development is proposed on Erf 25537 in George, Western Cape. The access to the proposed development is planned to be off Urbans Boulevard which currently provides access to the Outeniqua Family Market and Welgelegen Estate. It is expected that the proposed development will generate 227 vehicle trips in the AM peak hour (57 in/ 170 out) and 227 vehicle trips in the PM peak hour (159 in/68 out). Significant future road planning for the George area is in place and the planning of the development was done in terms of this planning, including the future eastwards extension of the N2, the extension of Urbans Boulevard across the Modderrug River to the Kraaibosch Area and the future link road between Urbans Boulevard and the N2/Victoria Bay intersection. It is expected that the traffic that will be generated by the latent rights in the surrounding area of the proposed development will result in an average annual traffic growth rate of ±4%. This could be possible, at least over the short term, but unlikely sustainable over the longer term. However, it was used to allow for a conservative future scenario and taking into account the current growth in the area. It is planned to develop Oumeulen Village to the west of Urbans Boulevard. This development was included as part of the Total Traffic Conditions scenario (Scenario 3b). From the capacity analysis of the different scenarios, the following can be concluded: • **Existing Conditions:** All the intersections are operating acceptably during both the typical AM and PM weekday peak hours. No improvements are required at any of the study intersections. • **Background Conditions:** All the intersections are expected to operate acceptably during both the typical AM and PM weekday peak hours. No improvements are required at any of the study intersections. • **Site Development Plan:** The SDP was developed taking into account all the long-term road planning in the area, including the future extension of the N2, the need for a link road between Urbans Boulevard and the N2 at the Victoria Bay intersection and access to land-locked properties not included in the development. The alignment and topography of Urbans Boulevard and the need for access to the N2/Victoria Bay link road limit the number of access opportunities off Urbans Boulevard. The optimal solution to service the land on either side of Urbans Boulevard was a single access point, controlled by a single-lane roundabout. A temporary access is proposed as a construction access and to also provide access via the SANRAL road reserve to the Garden Route

Market.

- **Total Traffic Conditions Scenario 3a:** To accommodate the expected additional traffic that will be generated by the proposed development the following mitigation measures will be required:
  - Construct a single-lane roundabout (Intersection 6) to provide access to Meulenzicht Landgoed and Oumeulen Village.
  - Provide public transport laybys on either side of the roundabout along Urbans Boulevard. The design should be approved by the GoGeorge team.
  - Extend the ±30m southbound right turn lane at the N2/Knysna Road on-ramp to at least 120 m to accommodate the expected increase in queues.

- **Total Traffic Conditions Scenario 3b:**
  - Based on the expected total traffic from Phases A and B (excluding Phase C and Phase 8A from Oumeulen Village) it is not required to extend Urbans Boulevard across the Modderrug River. The operations of Intersection 5 are still acceptable, but marginal increases in demand could result in operational failures. Therefore, it would be prudent not to allow further development along Urbans Boulevard unless the bridge and link to the Kraaibosch area across the Modderrug River are established. This should be verified through an updated TIA once most of the proposed uses on the property are operational.

- Adequate provisions for cyclists and pedestrians should be made within the estates. These facilities should link logically to the sidewalks and shoulders along Urbans Boulevard. The public facilities such as the gym should also provide secure bicycle parking.

- The parking ratios required by the George Municipal Planning By-Laws should be followed to determine the parking requirements for each use as the detailed site plans are developed.

- Prior to the GoGeorge services operating along Urbans Boulevard, public transport users would be dropped off and picked up at the security entrances. Sufficient allowance should be made for these activities at the entrance gates.

- The proposed development should be capped at the uses and trips evaluated in this study. The evaluation excluded the trips to/from the portions labelled as Phases A8 (Oumeulen Village) and C (Meulenzicht Landgoed). The traffic from these portions would most likely require that Urbans Boulevard be extended across the Modderrug River to link to the Kraaibosch Area. This should be confirmed through an updated TIA once most proposed uses are completed and operational.

It is concluded that the additional traffic from the proposed development can be

	accommodated on the transport network with minor mitigation requirements. It is recommended that the proposed development be approved from a transportation point of view provided that the required mitigation as defined in this study is in place.

REFERENCES

1. Highway Capacity Manual (HCM), Quality and Level-of-Service Concepts, Transportation Research Board, 9 March 2015
2. South African Road Classification and Access Management Manual, TRH26, Version 1.0, August 2012
3. South African Trip Data Manual, TMH17, Version 1.1, COTO, September 2013
4. Smec, Kraaibosch Roads Master Plan and Cost Apportionment Rev 5.2, April 2022
5. Vela VKE, Apportionment of Cost for Improvements and Additions to the Road Infrastructure in the Kraaibosch Area, January 2006

Appendix A

Figures

MEULENZICHT LANDGOED			
		Units	GLA
Phase B1	**13,2258 ha**		
Main entrance / Gatehouse			
Full title erven		83	-
Phase B2	**3,9348 ha**		
Full title erven		49	-
Phase B3	**4,2971 ha**		
Full title erven		25	-
Phase B4	**15,2092 ha**		
Full title erven		70	-
Phase B5	**0,7482 ha**		
Treatment plant			-
Phase C	**28,5678 ha**		
Future Expansion			-
		227 units	0 m²

nuvorm

architecture | urban design | landscape architecture | interior design

Unit 305 Oude Postkantoor
c/o Plein Street and, Bird Street
Stellenbosch

studio@nuvorm.com

NOTES

MEULENZICHT LANDGOED
65.9788 ha
227 units

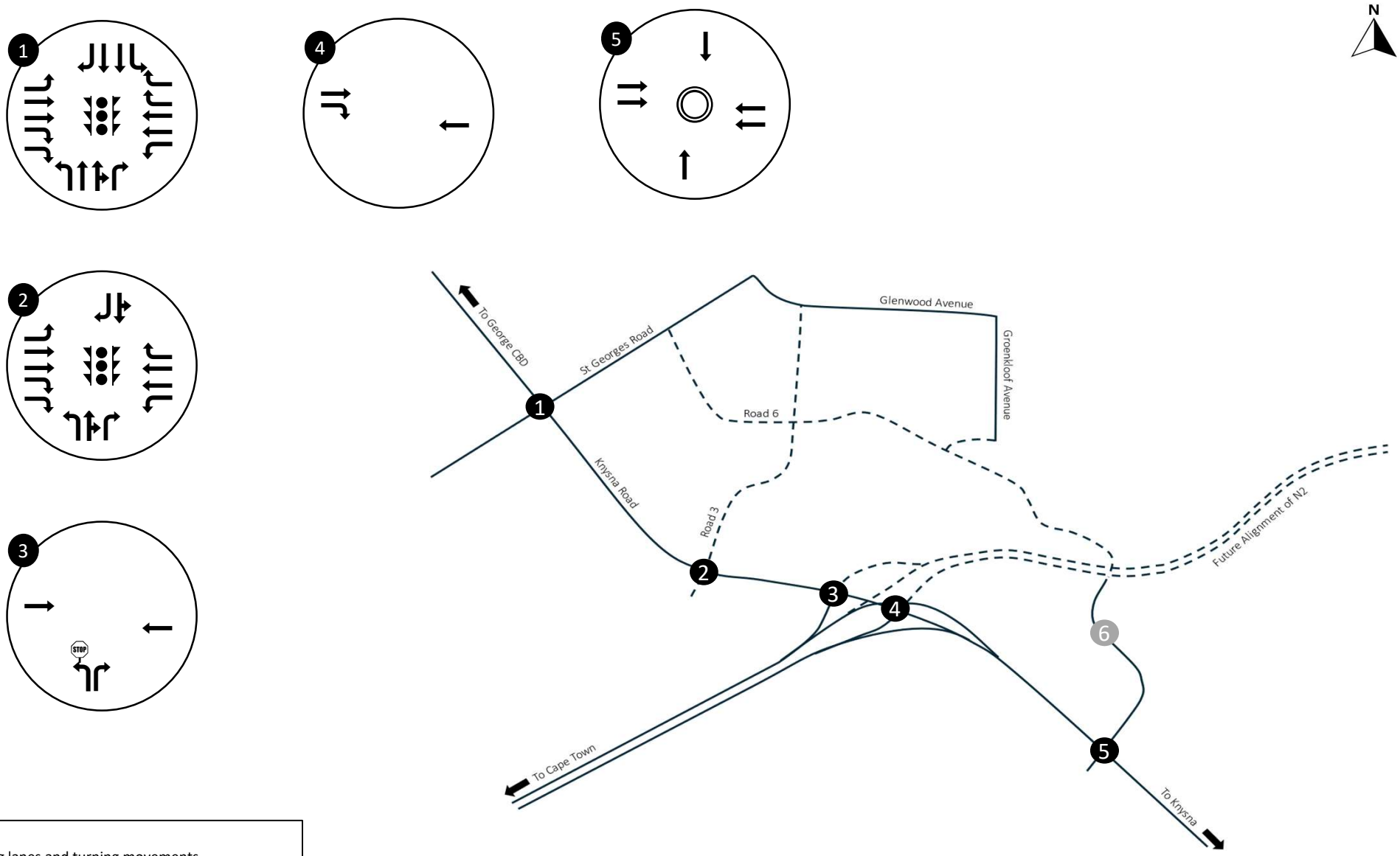
MEULENZICHT
ATTERBURY

25537, 25538, 25541
KRAAIBOSCH

GEORGE

CONCEPT MASTER PLAN

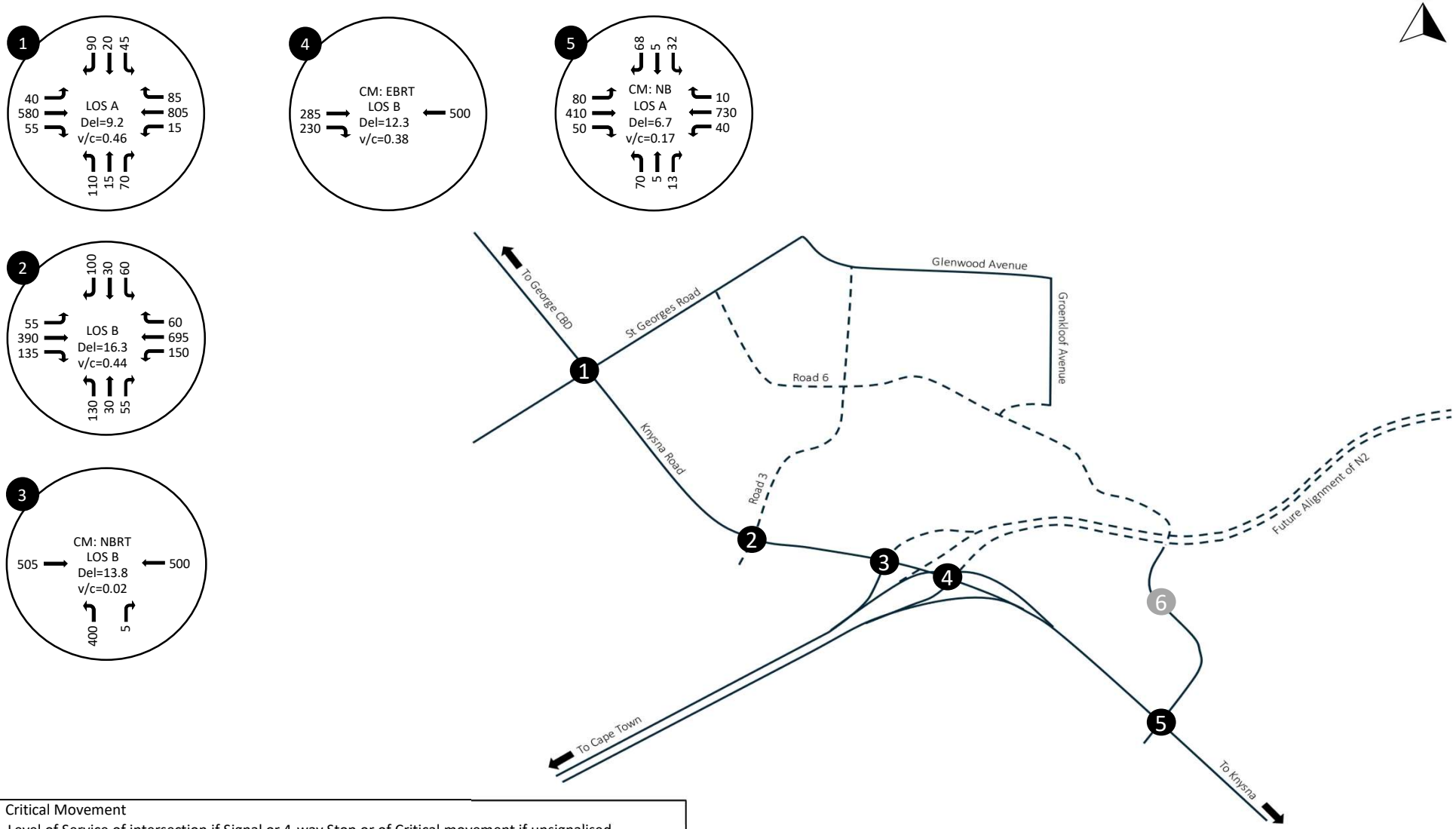
CODE	PHASE	DISCIPLINE	NUMBER	REV
24AA	01	UD	1003	P



Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Existing Conditions** Lane Configurations and Control	**Figure:** **A2**

Scenario: Ex AM, Run:Wed Dec 11 07:58:02 2024

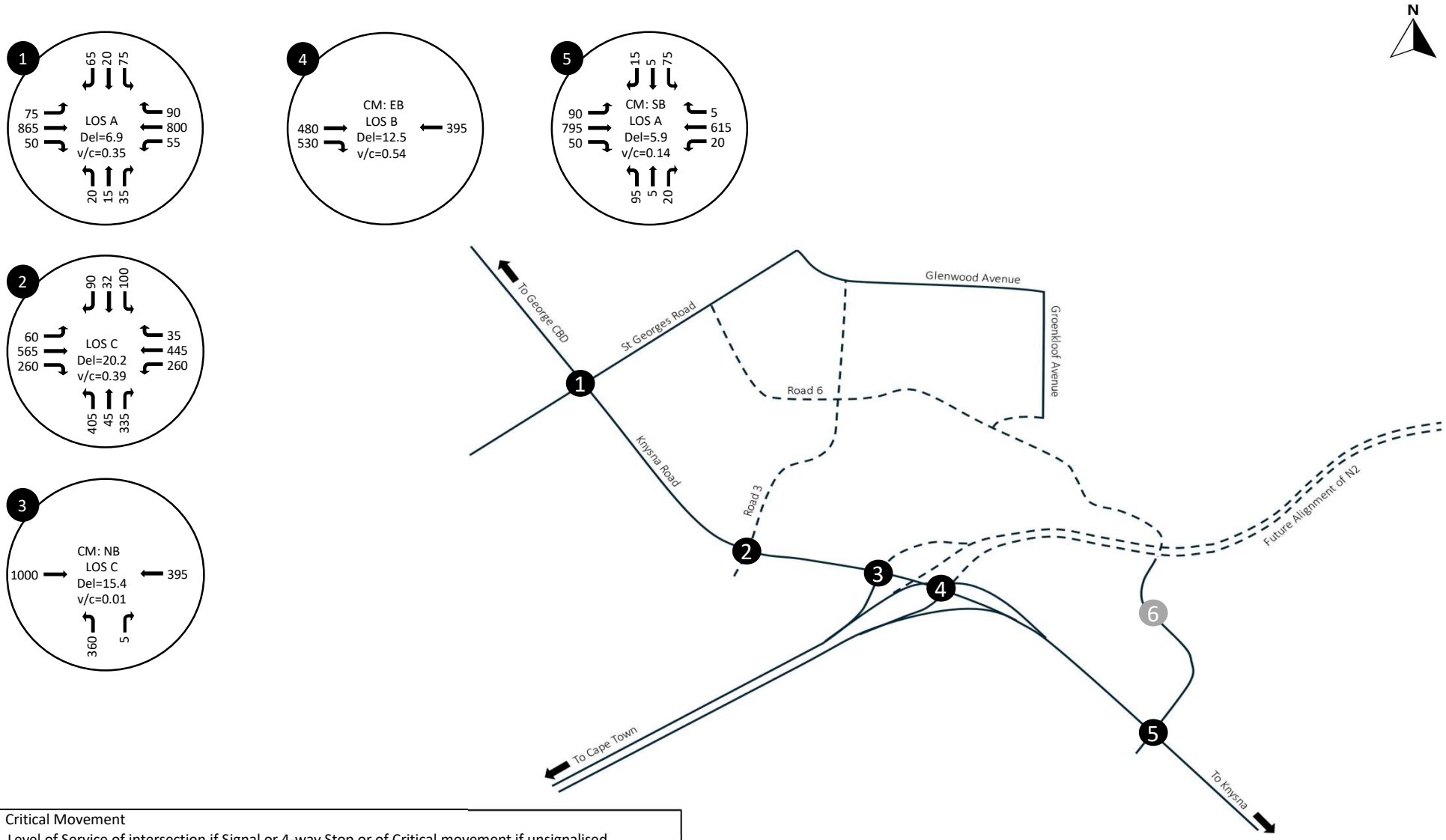


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Existing Conditions** AM Peak Hour Operations	**Figure:** **A3**

Scenario: *Ex AM, Run:Wed Dec 11 07:58:02 2024*

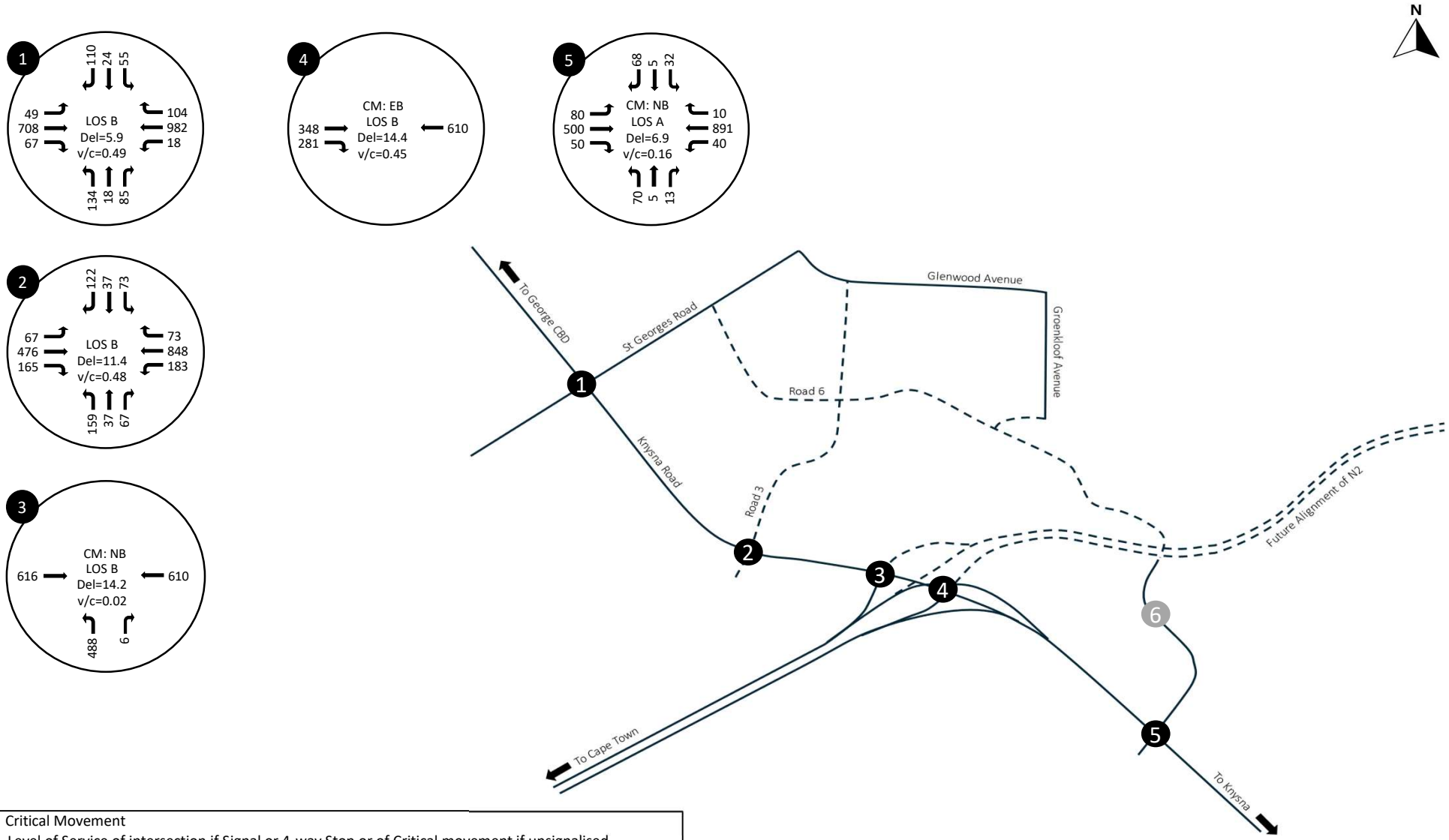


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Existing Conditions** PM Peak Hour Operations	**Figure:** **A4**

Scenario: *Ex PM, Run:Wed Nov 20 09:47:22 2024*

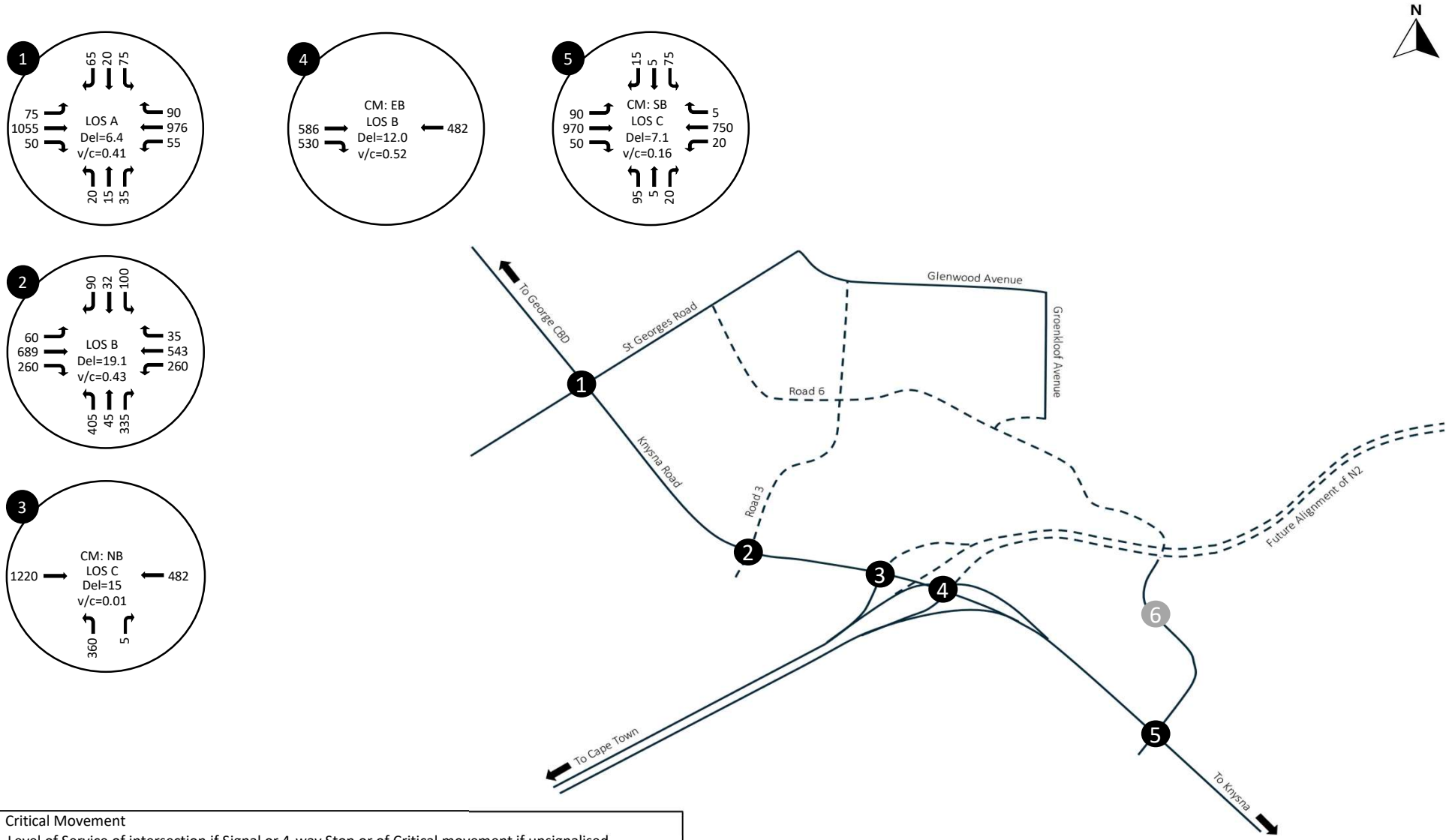


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Background Conditions** AM Peak Hour Operations	**Figure:** **A5**

Scenario: BG AM, Run:Wed Nov 20 09:51:00 2024

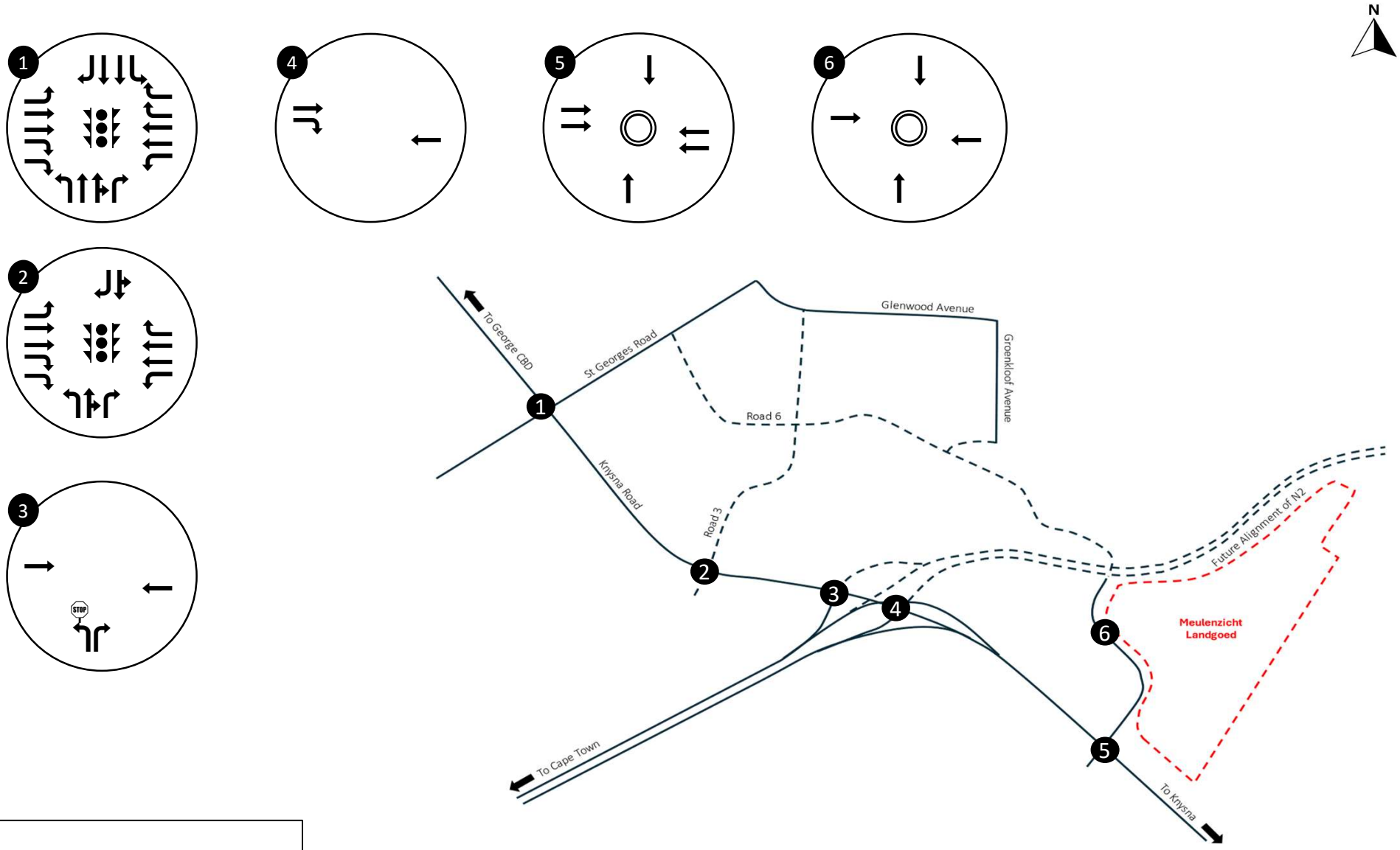


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Background Conditions** PM Peak Hour Operations	**Figure:** **A6**

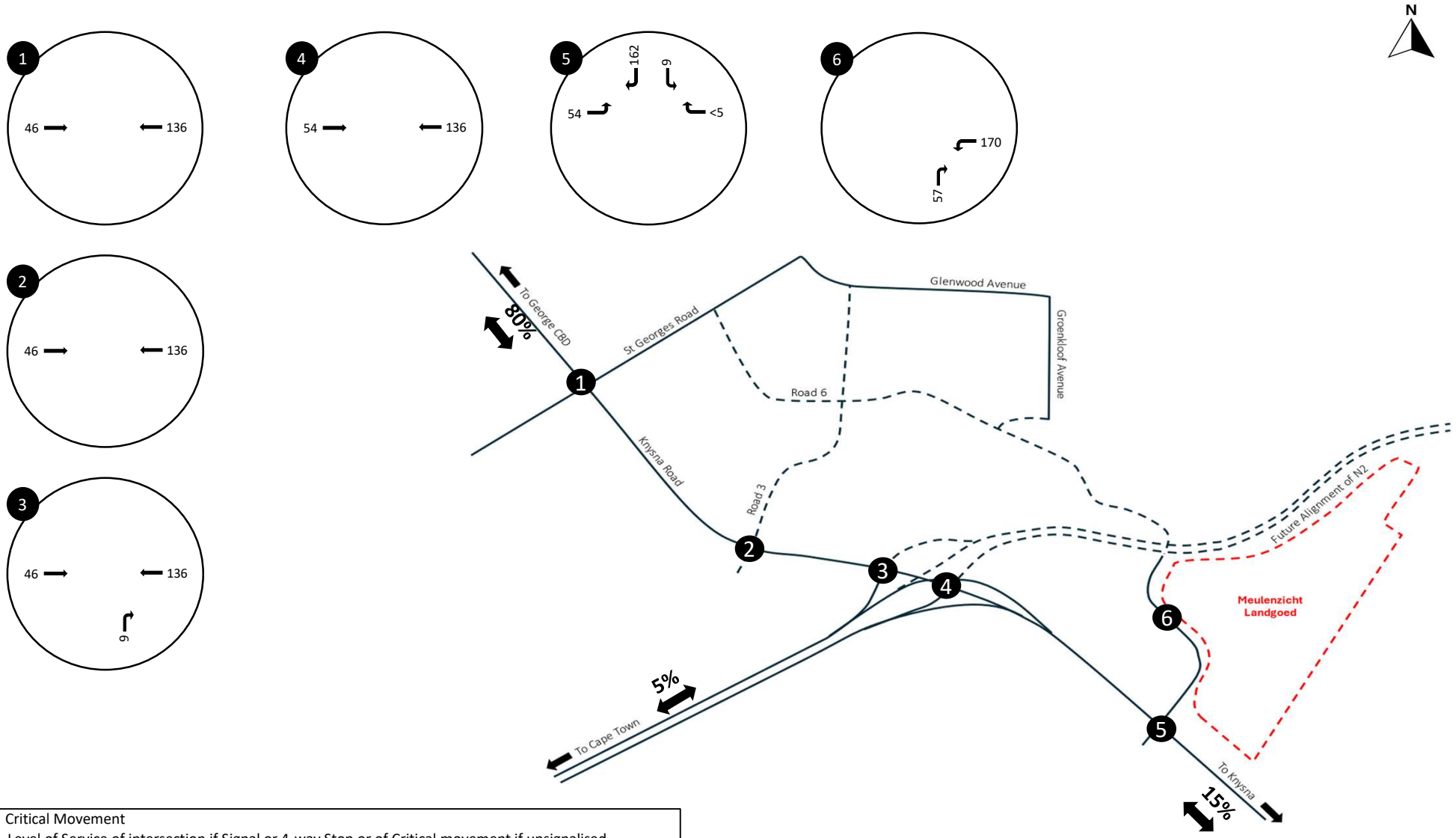
Scenario: BG PM, Run:Wed Nov 20 09:51:38 2024



Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Total Conditions** Lane Configurations and Control	**Figure:** **A7**

Scenario: TL AM, Run:Tue Feb 11 07:48:46 2025

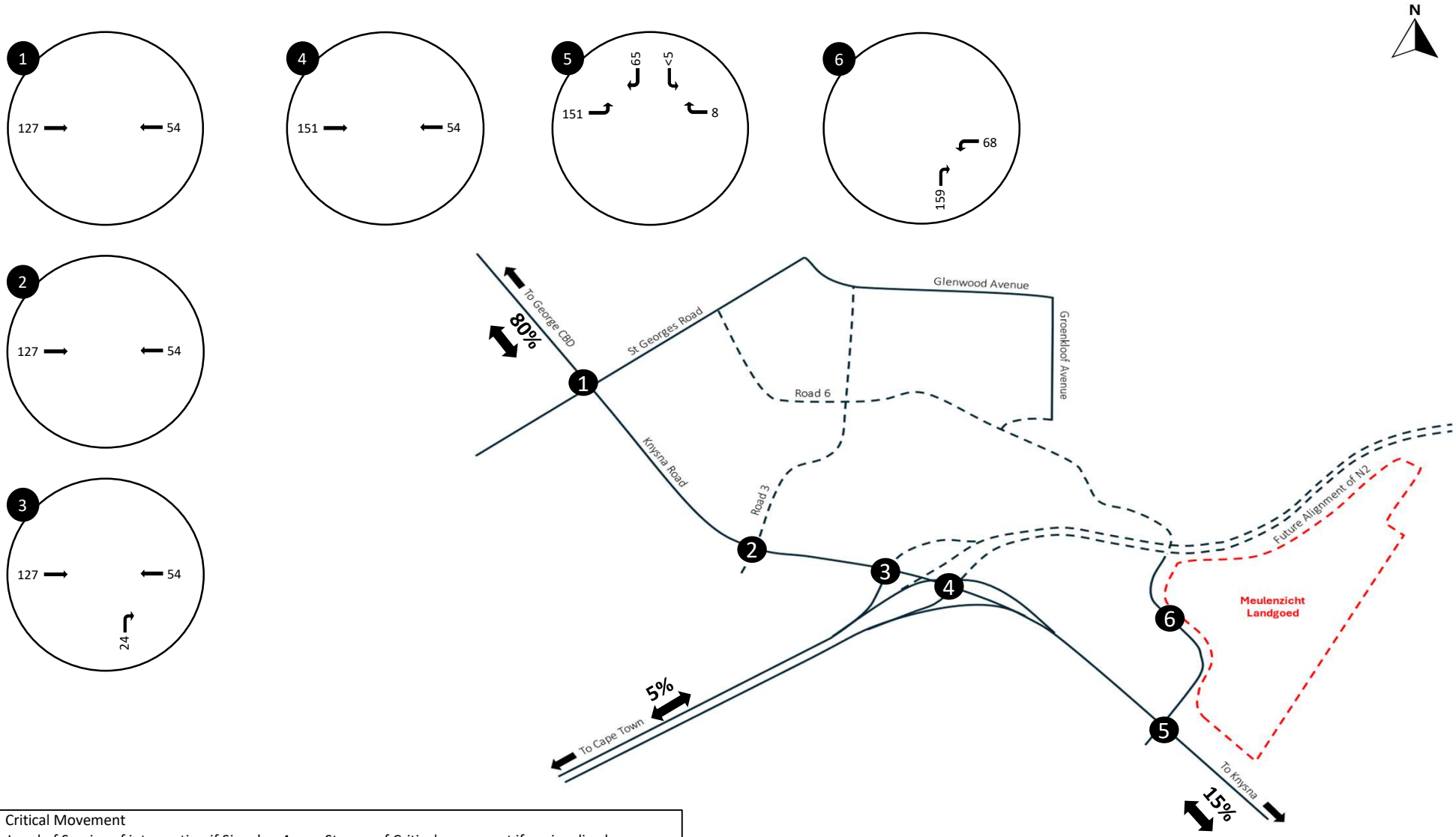


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Expected Development Trips: Meulenzicht Landgoed** AM Peak Hour	**Figure:** **A8**

Scenario: TL AM, Run:Tue Feb 11 07:48:46 2025

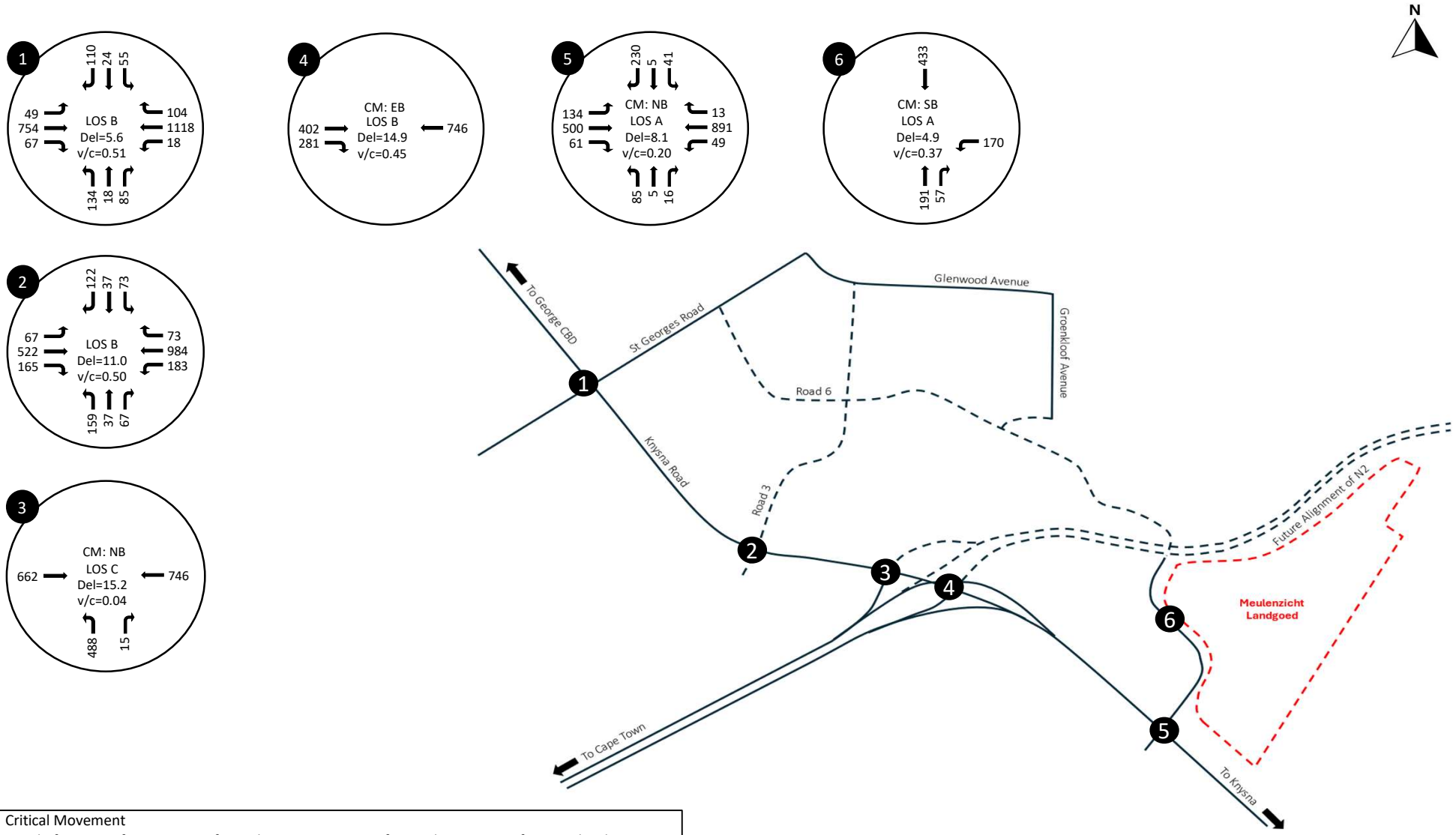


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Expected Development Trips: Meulenzicht Landgoed** PM Peak Hour	**Figure:** **A9**

Scenario: *TL PM, Run:Tue Feb 11 07:49:13 2025*

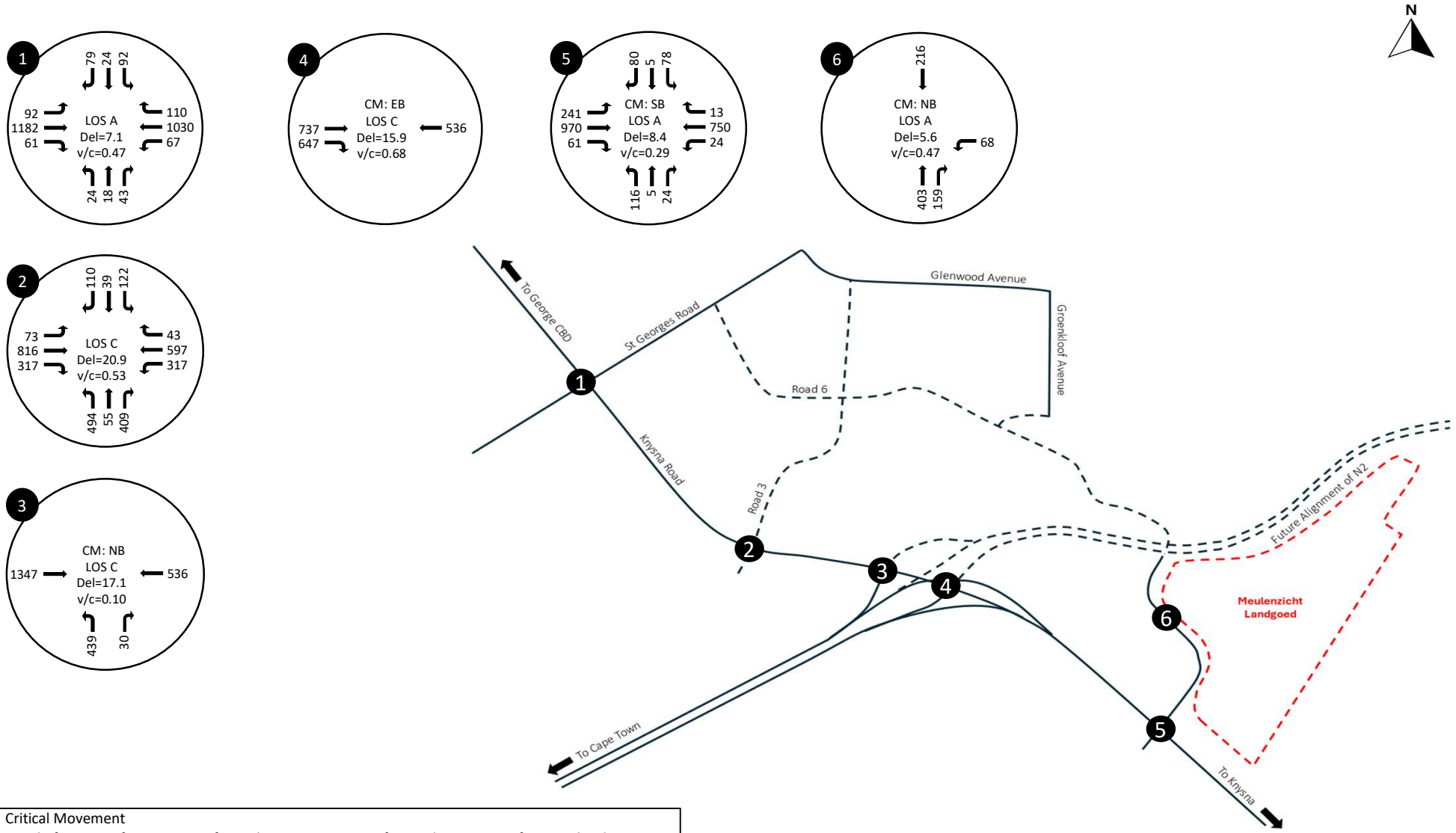


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Total Conditions: Meulenzicht Landgoed** AM Peak Hour Operations	**Figure:** **A10**

Scenario: *TL AM, Run:Tue Feb 11 08:00:16 2025*

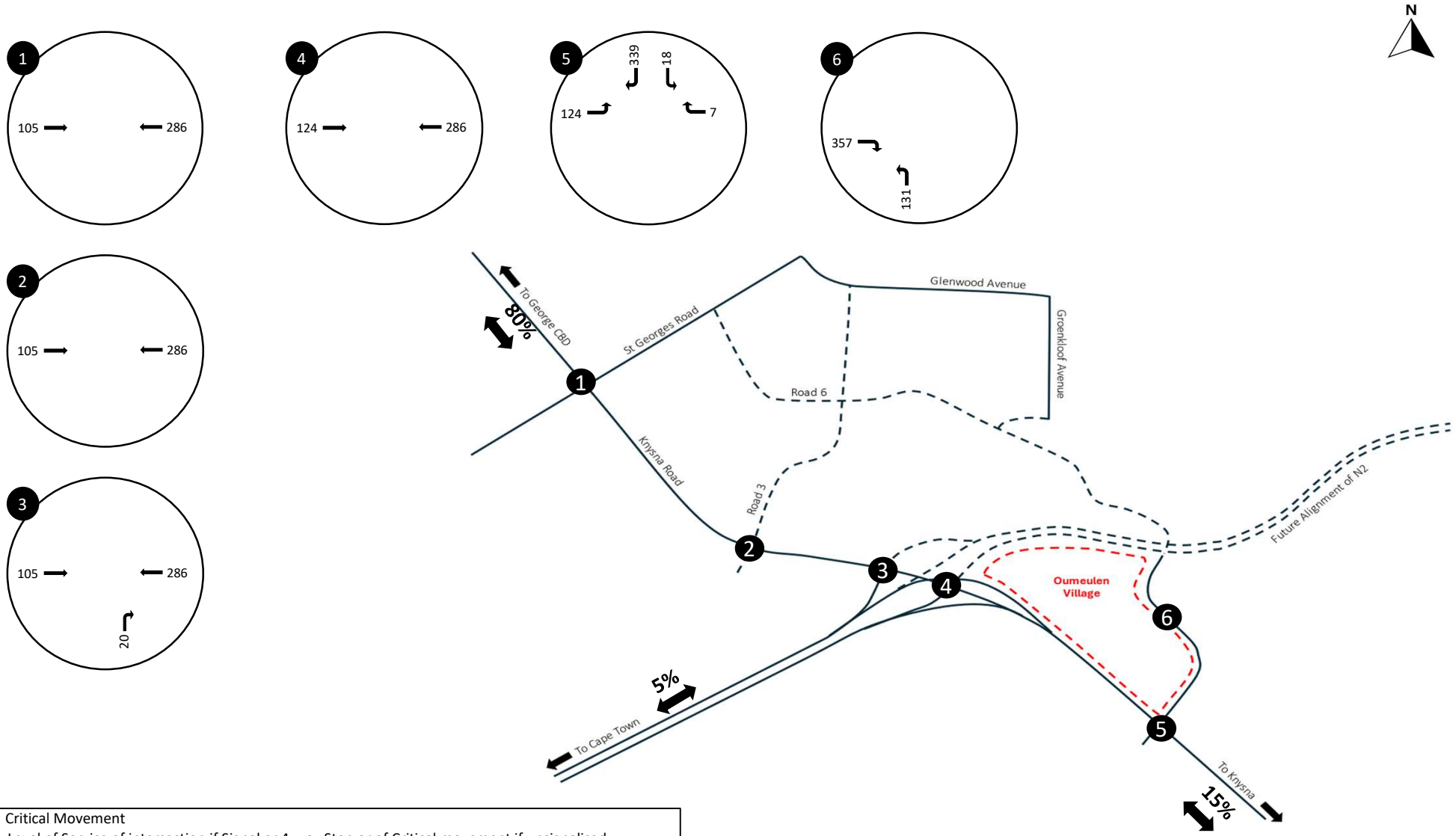


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Total Conditions: Meulenzicht Landgoed** PM Peak Hour Operations	**Figure:** **A11**

Scenario: TL PM, Run:Tue Feb 11 08:01:05 2025

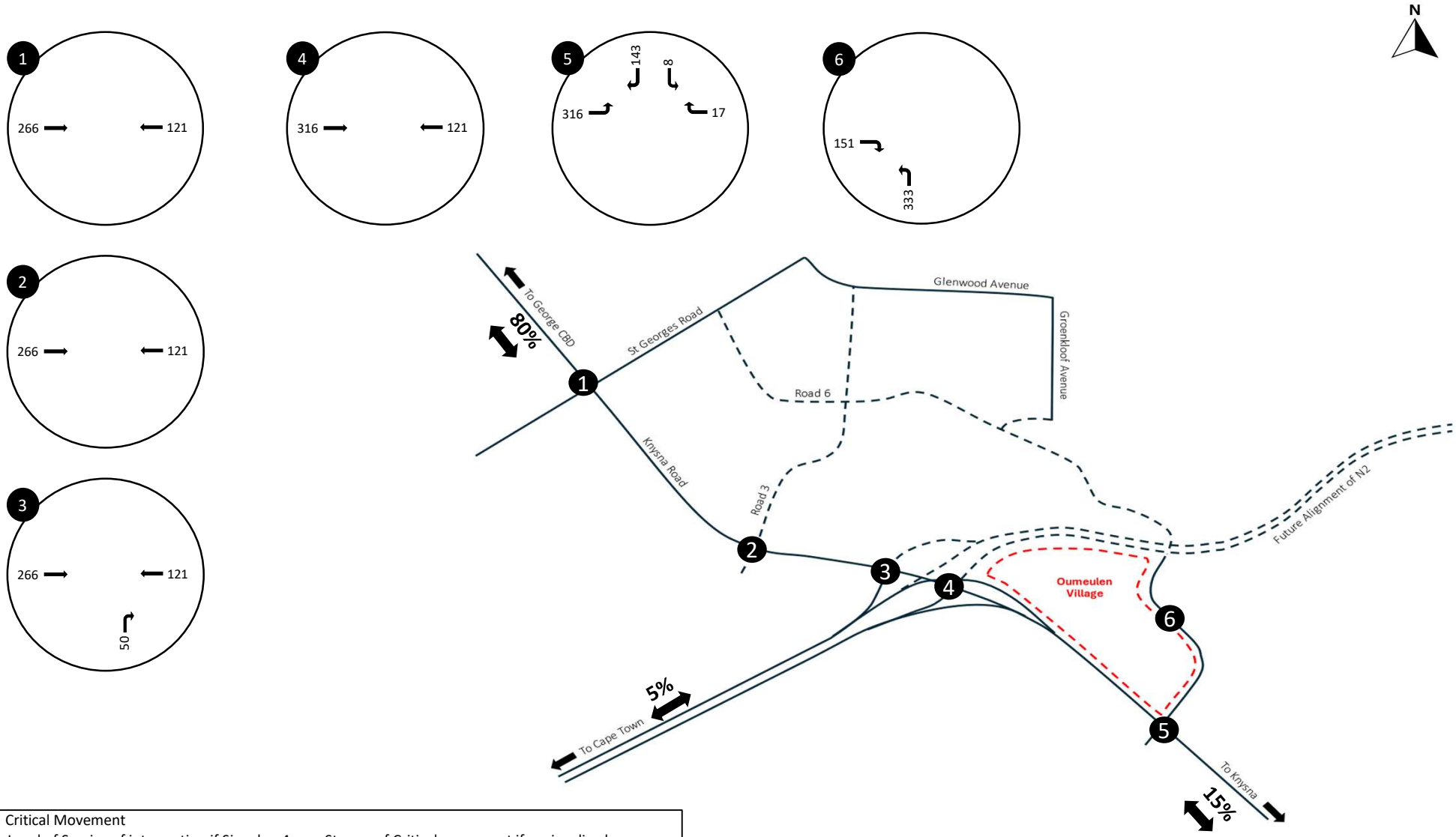


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Expected Latent Development Trips: Oumeulen Village** AM Peak Hour	**Figure:** **A12**

Scenario: *TL AM, Run:Tue Feb 11 07:44:41 2025*

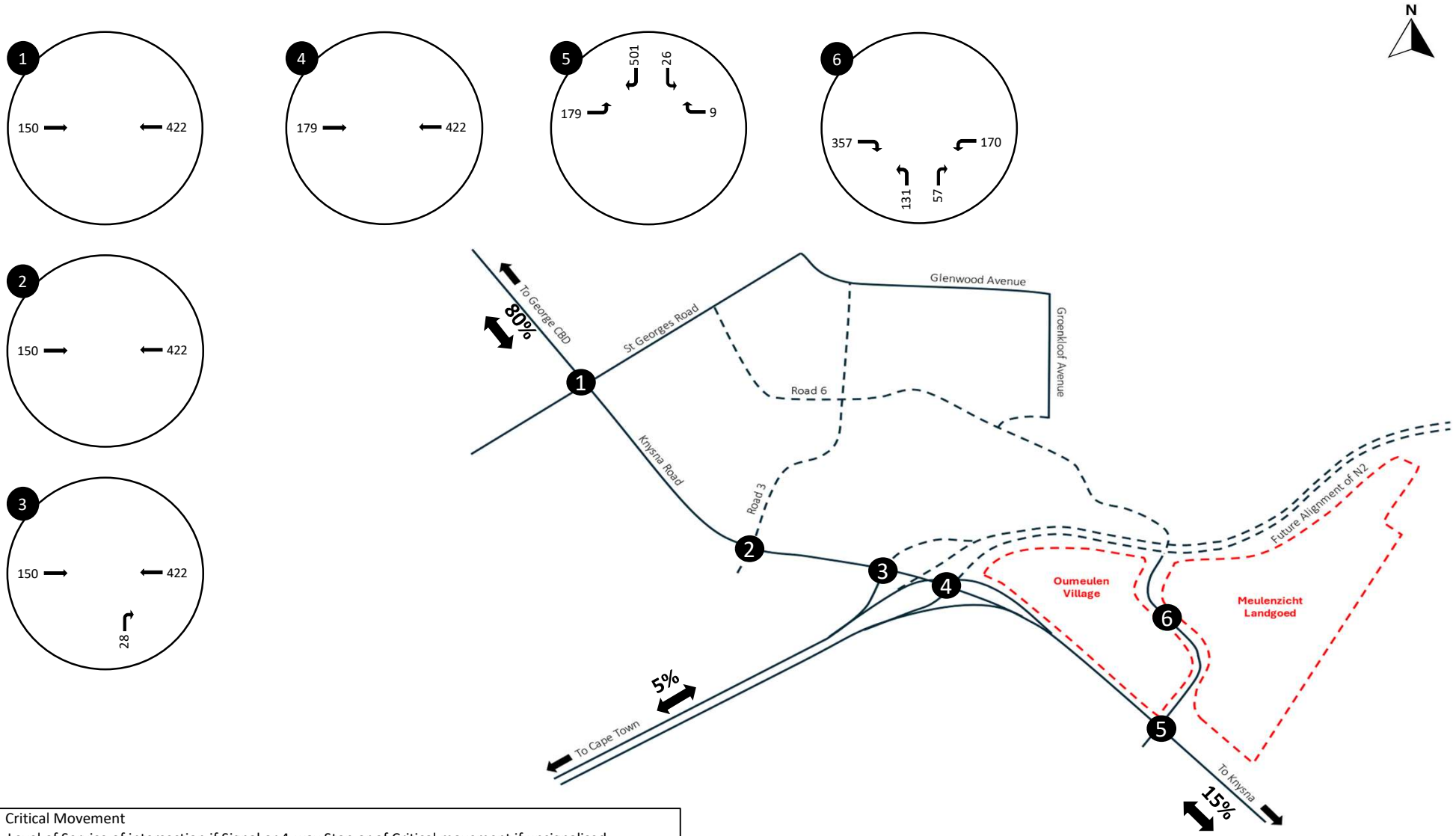


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Expected Latent Development Trips: Oumeulen Village** PM Peak Hour	**Figure:** **A13**

Scenario: *TL PM, Run:Tue Feb 11 07:45:42 2025*

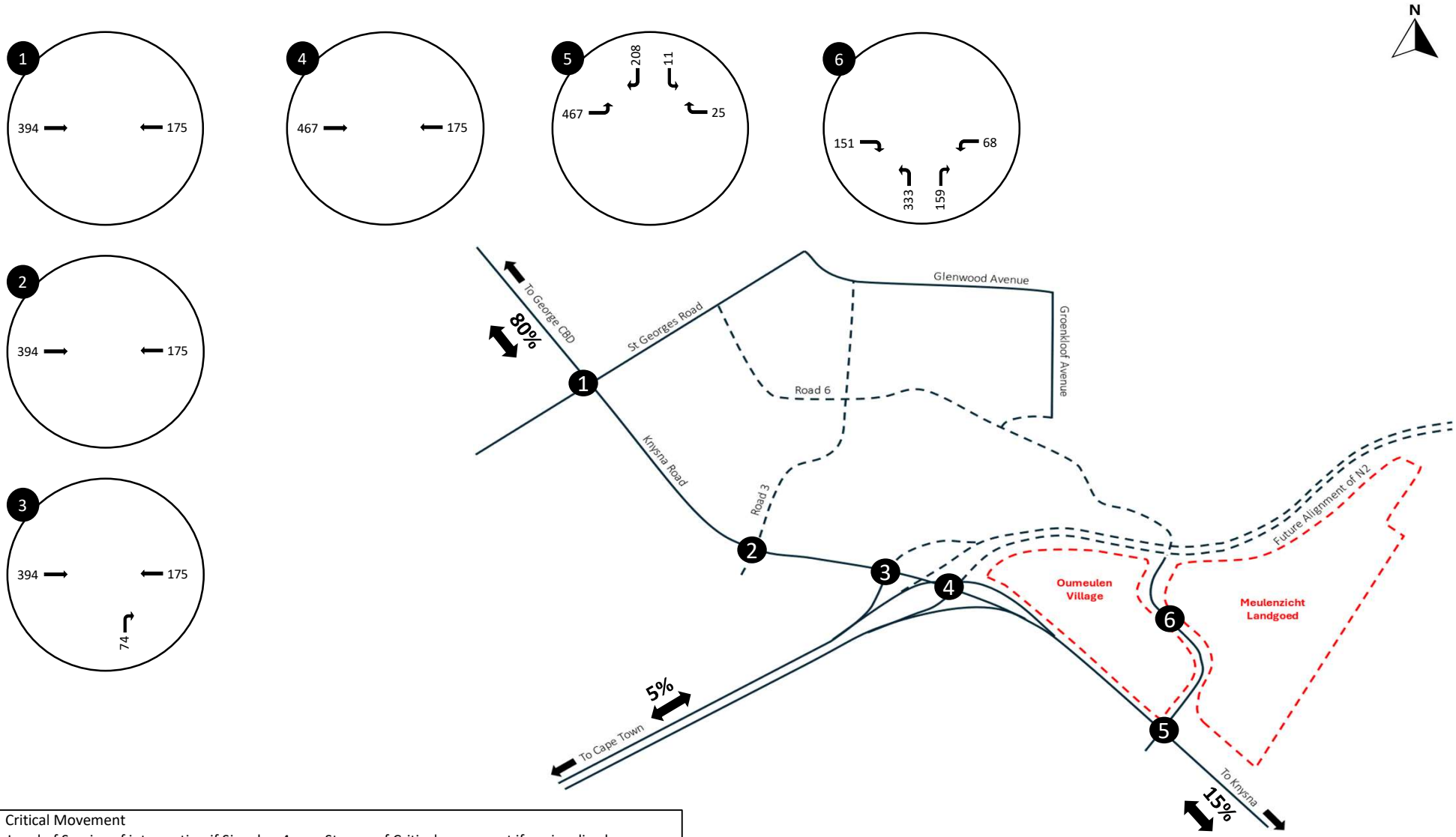


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Expected Full Development Trips** AM Peak Hour	**Figure:** **A14**

Scenario: *TL AM, Run:Tue Feb 11 07:52:05 2025*

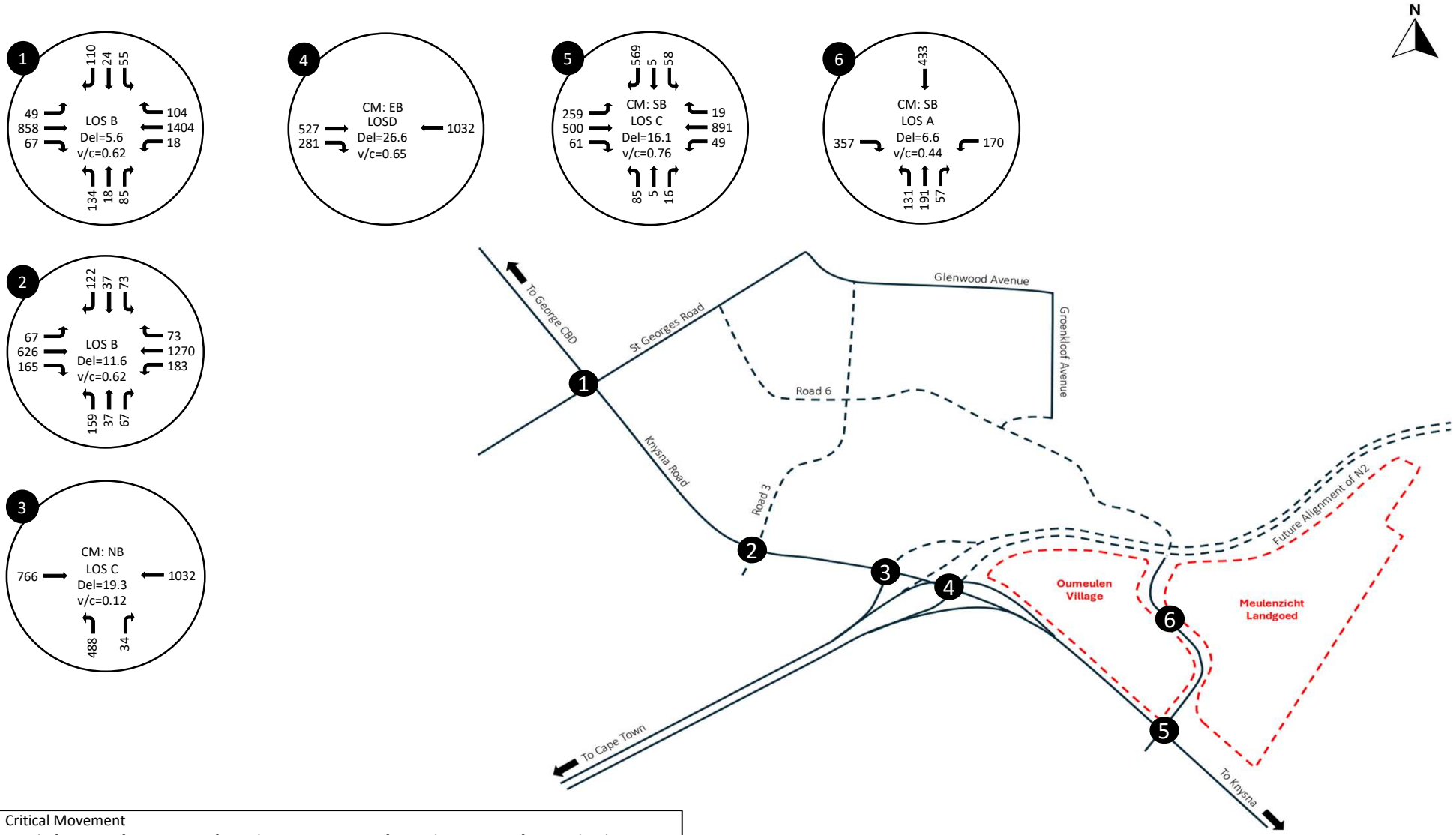


CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

its INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Expected Full Development Trips** PM Peak Hour	**Figure:** **A15**

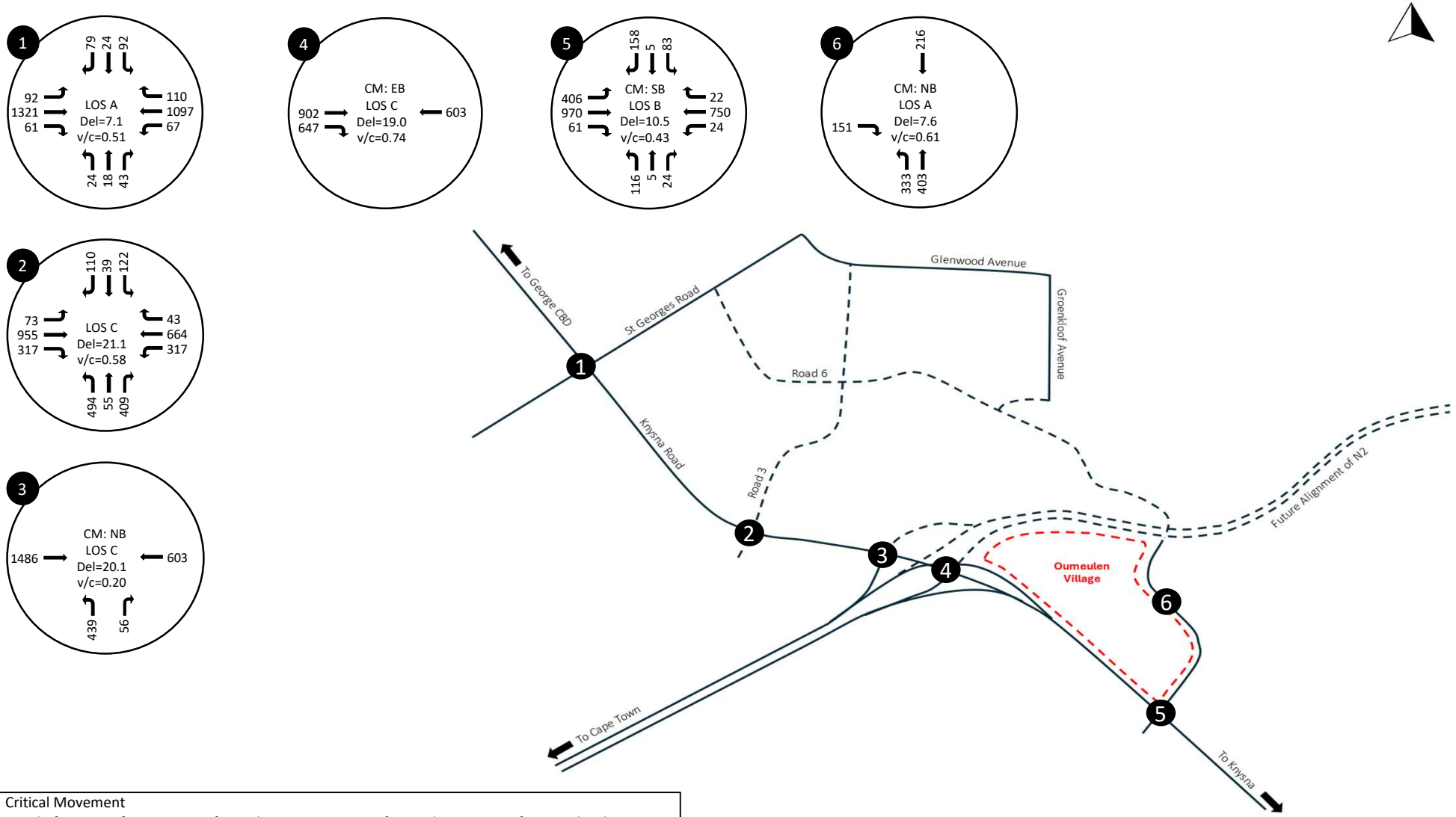
Scenario: *TL PM, Run:Tue Feb 11 07:53:05 2025*



Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Total Conditions Full Development** AM Peak Hour Operations	**Figure:** **A16**

Scenario: *TL AM, Run:Tue Feb 11 07:52:05 2025*



CM : Critical Movement
LOS: Level of Service of intersection if Signal or 4-way Stop or of Critical movement if unsignalised
DEL: Avg Delay per vehicle if signalised or for critical movement if unsignalised
V/C: Critical V/C Ratio
Turning movements — Critical Movement
Free Flow Left Turn — Overlap Left Turn

Diagramatic / Not to Scale

INNOVATIVE TRANSPORT SOLUTIONS	**Meulenzicht Landgoed, George**	**Total Conditions Full Development** PM Peak Hour Operations	**Figure:** **A17**

Scenario: *TL PM, Run:Tue Feb 11 07:58:00 2025*

Appendix B

Tables

Table 3: Proposed Land Use for Meulenzicht Landgoed

Land Use	Comment	Extent	Units
Meulenzicht Landgoed			
Full title erven		227	units

Table 4: Trip Generation Rates for the AM and PM Peak Hours for Meulenzicht Landgoed

Land Use	Extent	Units	Source	Weekday AM Peak			Weekday PM Peak		
				Base Rate	In	Out	Base Rate	In	Out
Meulenzicht Estate									
Full title erven	227	units	COTO 210	1.00	25%	75%	1.00	70%	30%

Table 5: Expected Trip Generation for Meulenzicht Landgoed

Land Use	Weekday AM Peak			Weekday PM Peak		
	In	Out	Total	In	Out	Total
Meulenzicht Estate						
Full title erven	57	170	227	159	68	227
Total	**57**	**170**	**227**	**159**	**68**	**227**

Appendix C

Latent Development: Oumeulen Village

Table 6: Proposed Land Use for Oumeulen Village

Land Use	Comment	Extent	Units
Oumeulen Village			
Full title erven		151	units
Apartments		355	units
Nursery School	For use by residents in the immediate area	1 000	sqm
Restaurant, Deli, Gym, Clubhouse		2 500	sqm

Table 7: Trip Generation Rates for the AM and PM Peak Hours for Oumeulen Village

Land Use	Extent	Units	Source	Weekday AM Peak			Weekday PM Peak		
				Base Rate	In	Out	Base Rate	In	Out
Oumeulen Village									
Full title erven	151	units	COTO 210	1.00	25%	75%	1.00	70%	30%
Apartments	355	units	COTO 231	0.85	25%	75%	0.85	70%	30%
Nursery School	1 000	sqm	See comment in Table 2	1.00	50%	50%	0.80	50%	50%
Restaurant, Deli, Gym, Clubhouse	2 500	sqm		1.00	50%	50%	1.00	50%	50%

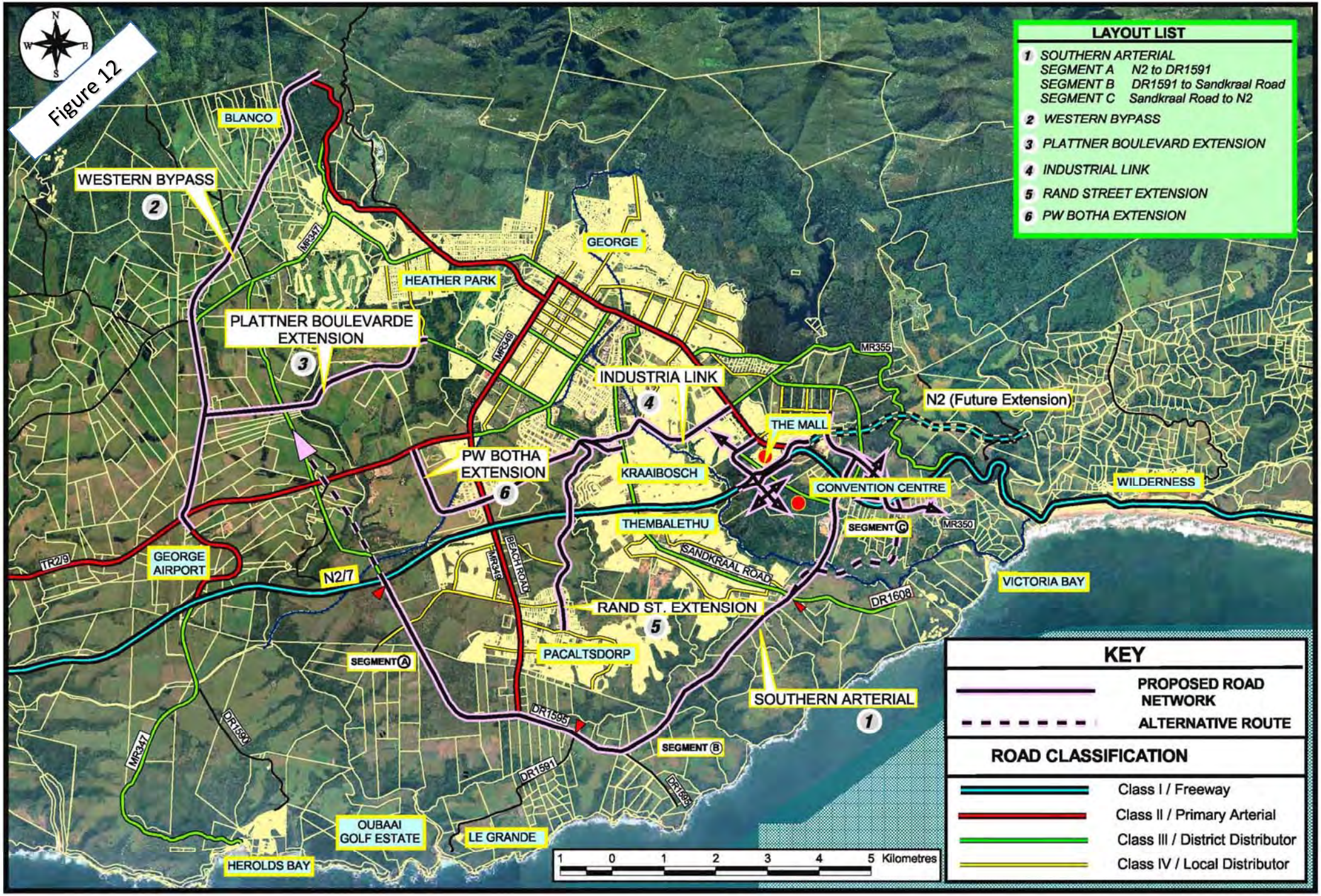
Table 8: Expected Trip Generation for Ouemeulen Village

Land Use	Weekday AM Peak			Weekday PM Peak		
	In	Out	Total	In	Out	Total
Oumeulen Village						
Full title erven	38	113	151	106	45	151
Apartments	75	226	302	211	91	302
Nursery School	5	5	10	4	3	7
Restaurant, Deli, Gym, Clubhouse	13	13	25	13	13	25
Total	**131**	**357**	**488**	**333**	**151**	**484**

Appendix D

Future Road Network

Figure 9-1: Kraaibosch Planned Development Accesses



K&T KANTEY & TEMPLER CONSULTING ENGINEERS	CLIENT GEORGE MUNICIPALITY	PROJECT GEORGE ROADS MASTER PLAN	TITLE KEY PLAN	PROJECT No R10602	SHEET No. 1

ANNEXURE G

Preliminary Geotechnical Soil Investigation

AAN DE MEULEN DEVELOPMENT
GEORGE

SOIL INVESTIGATION

JULY 2024

Author:

Llewelyn Heathcote

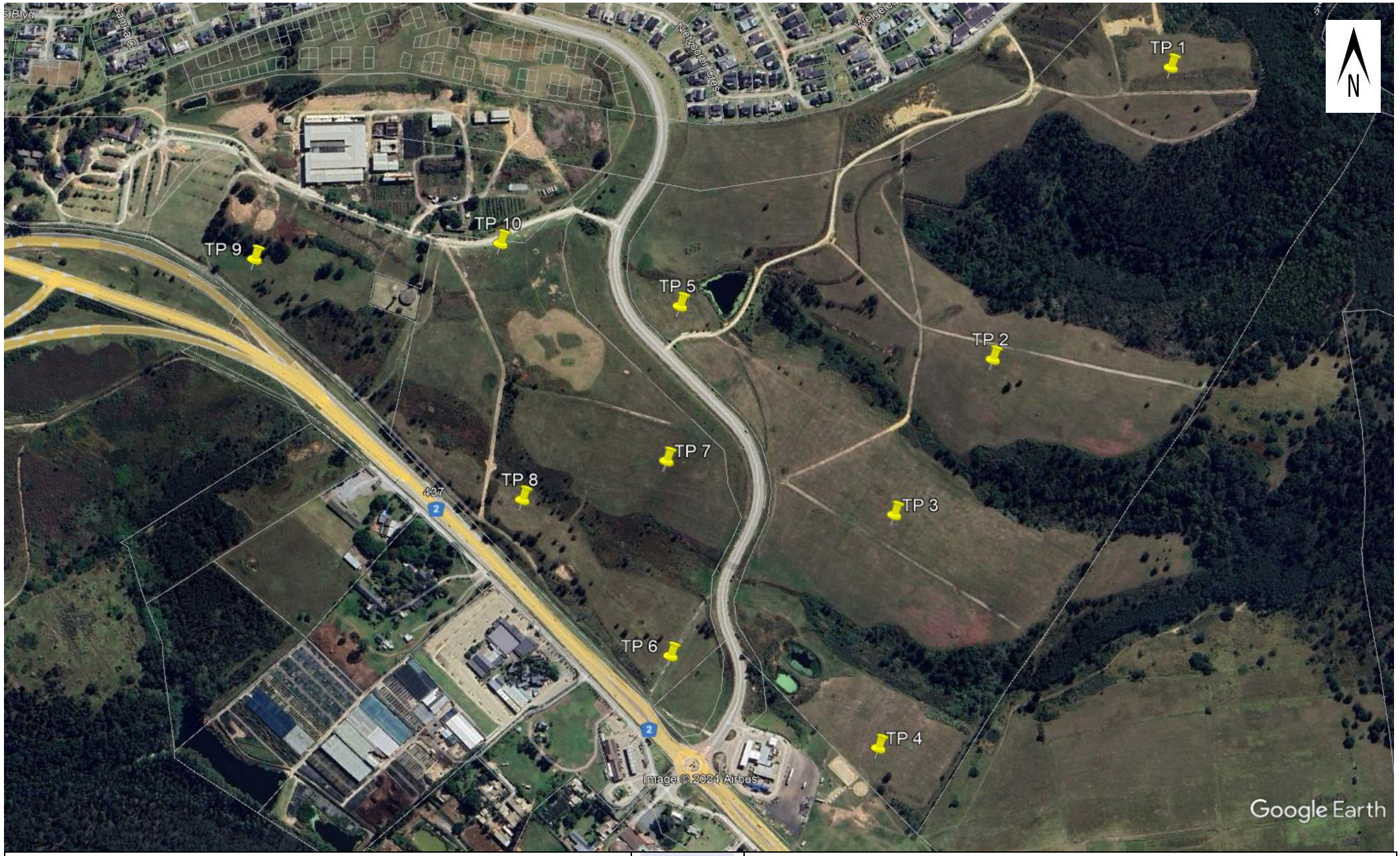


Figure 1:

Locality Plan

Scale:NTS

Outeniqua Lab (Pty) Ltd
Civil Engineering Laboratory

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

Materials Testing Laboratory

6 Mirrorball Street, George : PO Box 3186, George Industria, 6536

Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za

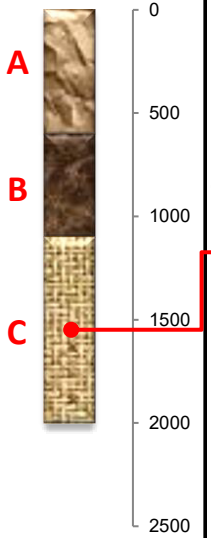
R-PROF-1-5
Jan-22

Customer :	Neil Lyners P O Box 757 George 6530
Project :	Aan de Meulen Development - George
Date Reported :	22/07/24

TP1

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 600)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(600 to 1100)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual.
(1100 to 2000)	Moist, light yellowish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual. (● Sample Taken: California Bearing Ratio & Moisture Content)

Dynamic Cone Penetrometer (DCP)

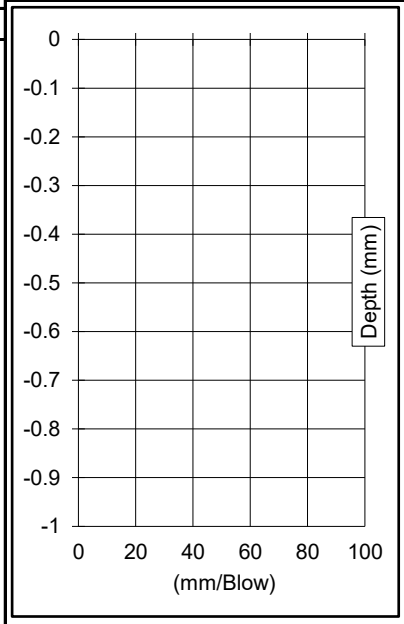
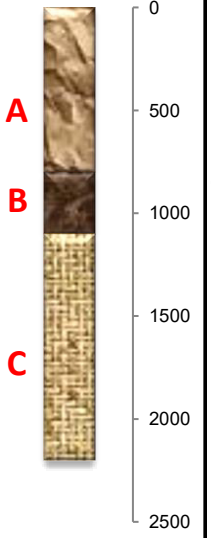


Photo of Test Pit

TP2

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 800)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(800 to 1100)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY , residual.
(1100 to 2200)	Slightly moist to moist, light yellowish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

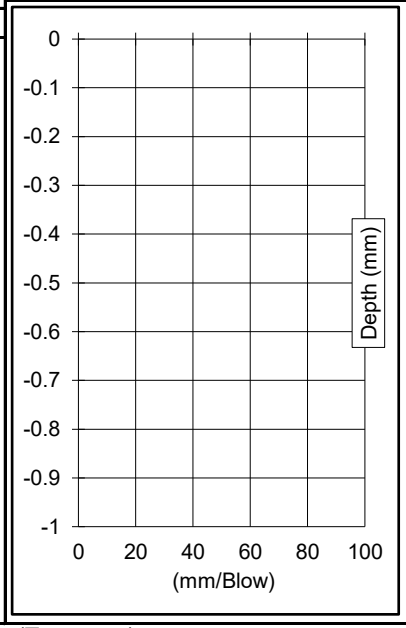


Photo of Test Pit

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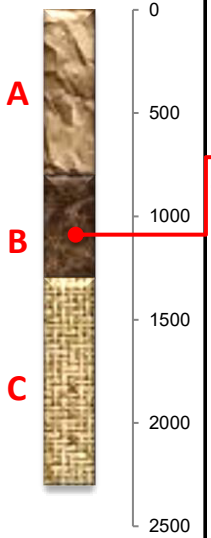
Jan-22

Customer :	Neil Lyners P O Box 757 George 6530
Project :	Aan de Meulen Development - George
Date Reported :	22/07/24

TP3

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 800)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(800 to 1300)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual.
	(● Sample Taken: Foundation Indicator & Moisture Content)
(1300 to 2300)	Slightly moist to moist, light reddish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

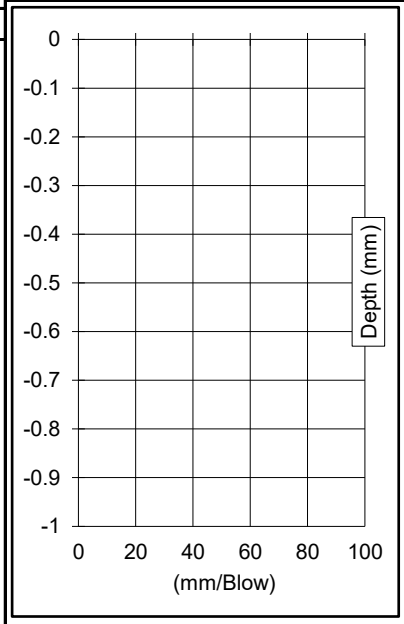
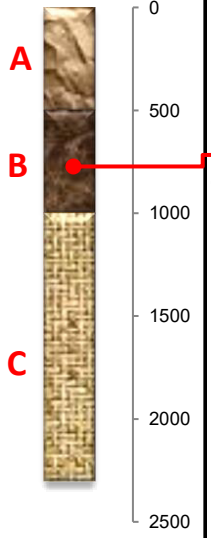


Photo of Test Pit

TP4

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 500)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(500 to 1000)	Slightly moist to moist, dark reddish brown, very dense, intact, FERRICRETE , pedogenic.
	(● Sample Taken: California Bearing Ratio & Moisture Content)
(1000 to 2300)	Slightly moist to moist, light reddish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

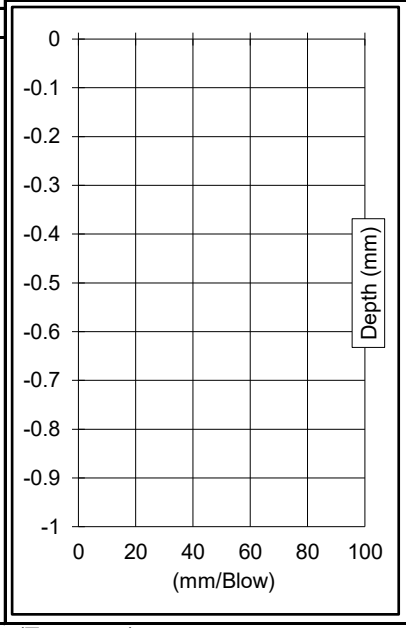


Photo of Test Pit

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Jan-22

Customer :	Neil Lyners P O Box 757 George 6530
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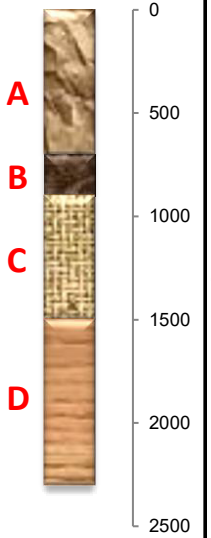
Date Reported :	22/07/24

TP5

Datum: @NGL Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 700)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(700 to 900)	Slightly moist to moist, dark reddish brown, very dense, intact, FERRICRETE, pedogenic.
(900 to 1500)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual.
(1500 to 2300)	Slightly moist to moist, light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

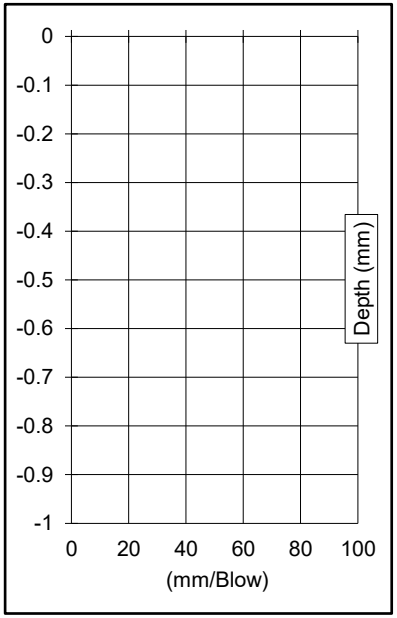
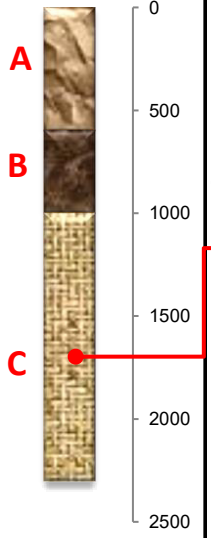


Photo of Test Pit

TP6

Datum: @NGL Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 600)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(600 to 1000)	Slightly moist to moist, dark red mottled light reddish orange, firm, slickensided, SILT/SILTY CLAY , residual.
(1000 to 2300)	Slightly moist to moist, light yellowish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual. (● Sample Taken: Foundation Indicator & Moisture Content)

Dynamic Cone Penetrometer (DCP)

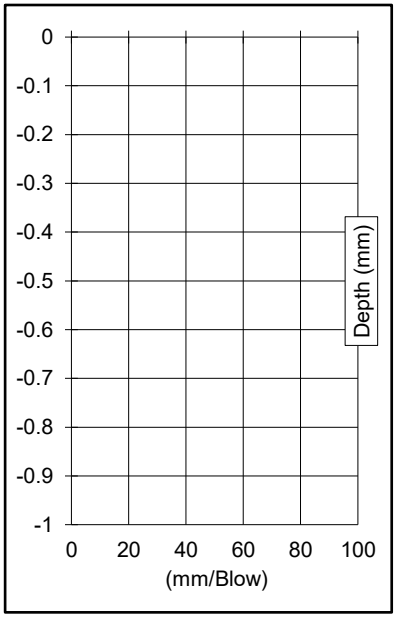


Photo of Test Pit

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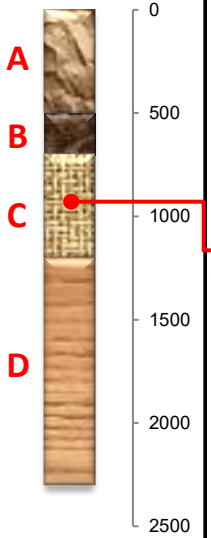
R-PROF-1-5
Jan-22

Customer :	Neil Lyners P O Box 757 George 6530
Project :	Aan de Meulen Development - George
Date Reported :	22/07/24

TP7

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 500)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(500 to 700)	Slightly moist to moist, dark reddish brown, very dense, intact, FERRICRETE, pedogenic.
(700 to 1200)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual.
	(● Sample Taken: California Bearing Ratio & Moisture Content)
(1200 to 2300)	Slightly moist to moist, light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

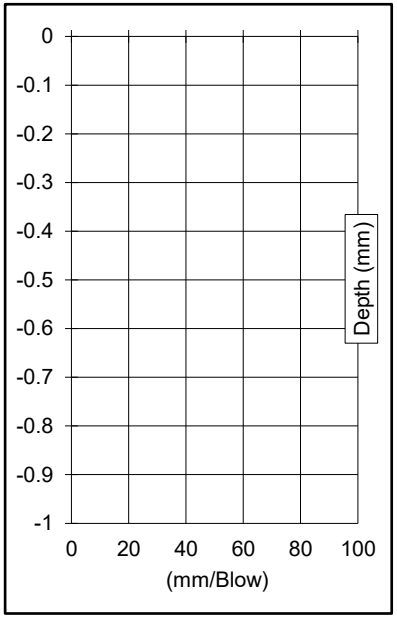
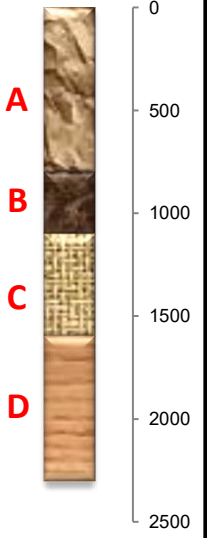


Photo of Test Pit

TP8

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 800)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(800 to 1100)	Slightly moist to moist, dark reddish brown, very dense, intact, FERRICRETE , pedogenic.
(1100 to 1600)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual.
(1600 to 2300)	Slightly moist to moist, light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

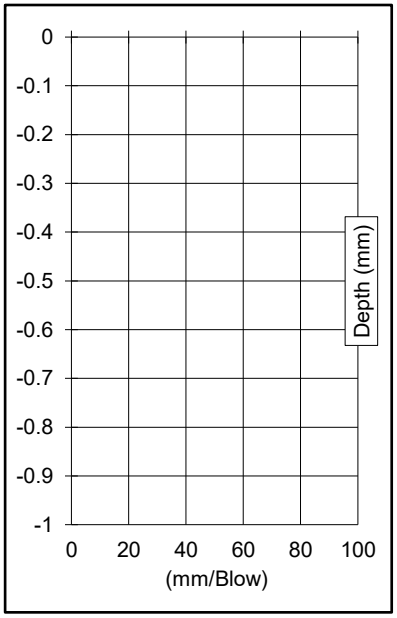


Photo of Test Pit

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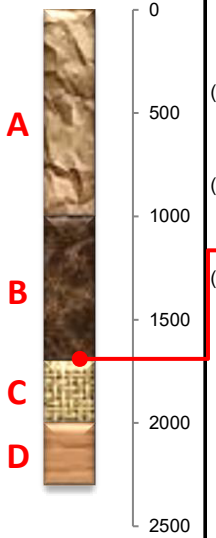
R-PROF-1-5
Jan-22

Customer :	Neil Lyners P O Box 757 George 6530
Project :	Aan de Meulen Development - George
Date Reported :	22/07/24

TP9

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 1000)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
(1000 to 1700)	Very moist to wet, dark reddish brown, very dense, intact, FERRICRETE, pedogenic. (Water Table @ 1700mm)
(1700 to 2000)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual. (● Sample Taken: California Bearing Ratio & Moisture Content)
(2000 to 2300)	Slightly moist to moist, light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.

Dynamic Cone Penetrometer (DCP)

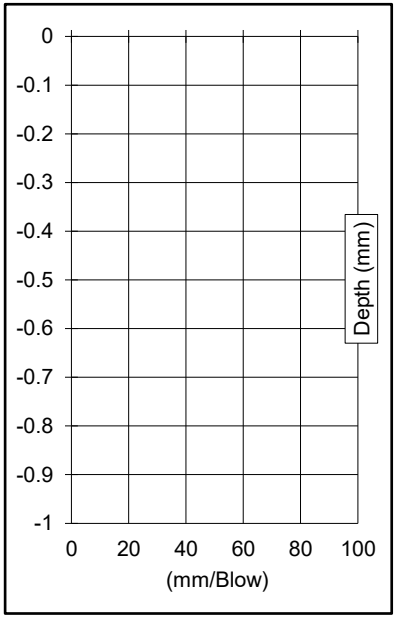
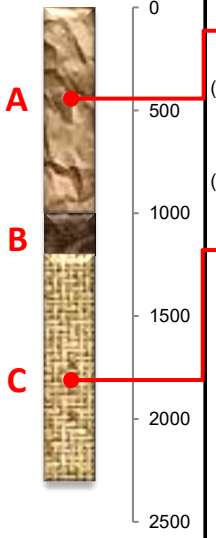


Photo of Test Pit

TP10

Datum: @NGL | Co-ordinates:

Key to symbols: ● Sample taken ▼ Water seepage



(0 to 1000)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported. (● Sample Taken: California Bearing Ratio & Moisture Content)
(1000 to 1200)	Slightly moist to moist, light yellowish orange, firm, slickensided, SILT/SILTY CLAY , residual.
(1200 to 2300)	Slightly moist to moist, dark red mottled light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY, residual. (● Sample Taken: Foundation Indicator & Moisture Content)

Dynamic Cone Penetrometer (DCP)

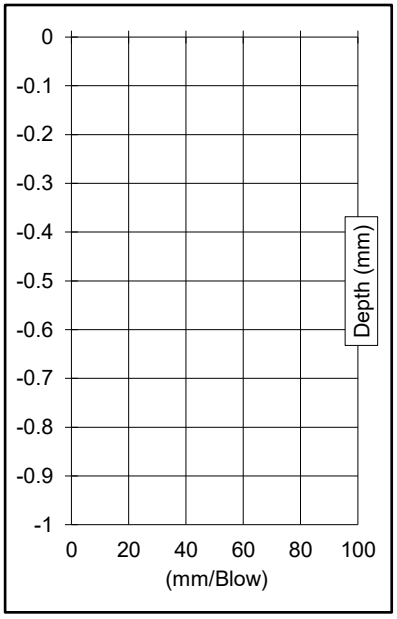


Photo of Test Pit

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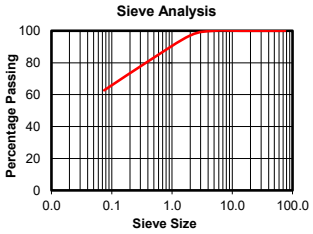
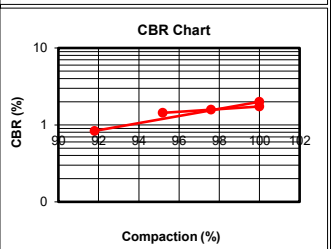
Customer :	Neil Lyners P O Box 757 George 6530	Project :	Aan de Meulen Development - George
		Date Received :	28/06/24
		Date Reported :	22/07/24
		Req. Number :	2335/24
Attention :	F van Eck	No. of Pages :	1 of 2

TEST REPORT
CALIFORNIA BEARING RATIO

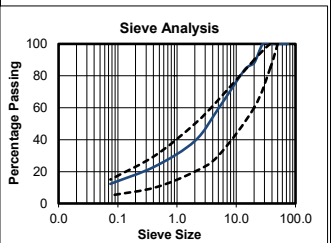
Sample Position (SV)		TP 1	TRH 14: Not Classified		TP 4	TRH 14: G4 Base (Natural)	
Depth (mm)		1100-2000			500-1000		
Sample No		88818			88820		
Materials Description	Source	Trial Pit			Trial Pit		
	Colour	Light Yellowish Orange			Dark Reddish Brown		
	Soil Type	Silt/Silty Clay Becoming Fine Gravel			Ferricrete		
	Classification	Insitu			Insitu		
Material Indicators - (SANS 3001 Method GR1)							
Percentage Passing	75 mm	100		Opinion	100		Opinion
	63 mm	100			100		
	50 mm	100			100	100 - 100	✳
	37.5 mm	100			100	85 - 100	✳
	28 mm	100			100		
	20 mm	100			88	60 - 90	✓
	14 mm	100			84		
	5 mm	100			60	30 - 65	✓
	2 mm	97			39	20 - 50	✓
	0.425 mm	81			23	10 - 30	✓
	0.075 mm	62.7			12.3	5 - 15	✓
Material Indicators - (SANS 3001 Method PR5)							
Grading Modulus *		0.59			2.25		
Coarse Sand Soil-Mortar (%)		16			41		
Atterberg Limits - (SANS 3001 Method GR10)							
Liquid Limit (%)		41			22	≤ 25	✓
Plasticity Index (%)		16			4	≤ 6	✓
Linear Shrinkage (%)		8.0			2.0	≤ 3	✓
Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)							
MDD	Max Dry Density (kg/m³)	1848			2414		
	Optimum Moisture Content (%)	9.7			4.9		
	Mould Moisture Content (%)	9.9			5.1		
A	Relative Compaction (%)	100.0			100.0		
	Swell (%)	4.6			0.0	≤ 0.2	✓
B	Relative Compaction (%)	95.2			94.6		
	Swell (%)	5.0			0.0		
C	Relative Compaction (%)	91.8			91.4		
	Swell (%)	7.5			0.1		
CBR	@100% Max Dry Density	2			156		
	@98% Max Dry Density	2			85	≥ 80	✓
	@95% Max Dry Density	1			35		
	@93% Max Dry Density	1			19		
	@90% Max Dry Density	1			8		
Material Condition - (SANS 3001 Method GR20)							
Insitu Moisture Content (%)		19.1			6.7		
Soil Classification Of The Material Based Only On The Tests Results Above							
TRH 14 Specification:		Not Classified			G1 Base (26.5mm)		
AASHTO System		A-7-6			A-1-a / A-1-b / A-2-4		
Unified System		CL			GP-GM		

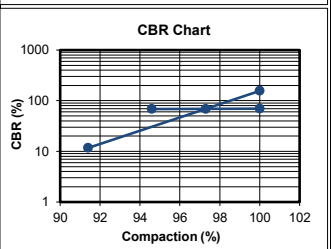
88818



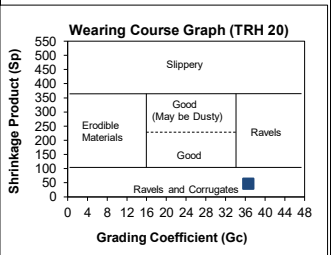


88820





● 88818 ■ 88820



- **Tests marked with a (*) are NOT SANAS Accredited results.**
- **Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MA2 (Trial Pit).**
- **Specimens sampled by Llewelyn Heathcote**
- **The weather conditions were such that there was no detrimental effect on the sample/s taken.**

Llewelyn Heathcote
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (✓), non compliant (×) and uncertain (✳) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
2. The uncertain (✳) indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (✓) or non compliant (×) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
3. This report (with attachments) is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Director of Outeniqua Lab (Pty) Ltd.
4. Measuring Equipment, traceable to National Standards is used where applicable. Results reported in this Test Report relate only to the items tested and are an indication only of the sample provided and/or taken.
5. While every care is taken to ensure the correctness of all tests and reports, neither Outeniqua Lab (Pty) Ltd nor its employees shall be liable in any way whatever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequence thereof.

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

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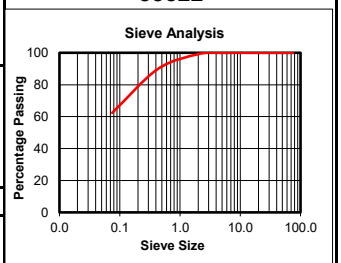
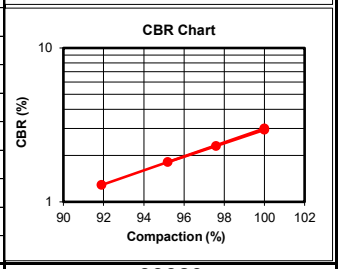
		Date Received :	28/06/24
		Date Reported :	22/07/24
		Req. Number :	2335/24
Attention :	F van Eck	No. of Pages :	2 of 2

TEST REPORT
CALIFORNIA BEARING RATIO

Sample Position (SV)		TP 7	TRH 14: Not Classified		TP 10	TRH 14: Not Classified	
Depth (mm)		700-1200			0-1000		
Sample No		**88822**			**88823**		
Materials Description	Source	Trial Pit			Trial Pit		
	Colour	Dark Red Mottled Light Yellowish Orange			Dark Brown		
	Soil Type	Silty/Silt Clay			Silty Sand		
	Classification	Insitu			Insitu		
Material Indicators - (SANS 3001 Method GR1)							
Percentage Passing	75 mm	100		Opinion	100		Opinion
	63 mm	100			100		
	50 mm	100			100		
	37.5 mm	100			100		
	28 mm	100			100		
	20 mm	100			100		
	14 mm	100			100		
	5 mm	100			100		
	2 mm	99			98		
	0.425 mm	90			77		
	0.075 mm	62.4			40.4		
Material Indicators - (SANS 3001 Method PR5)							
Grading Modulus *		0.49			0.84		
Coarse Sand Soil-Mortar (%)		9			22		
Atterberg Limits - (SANS 3001 Method GR10)							
Liquid Limit (%)		52			Undetermined		
Plasticity Index (%)		18			SP		
Linear Shrinkage (%)		9.0			SP		
Material Strength - (SANS 3001 Method GR30,GR40 - SCALPED)							
MDD	Max Dry Density (kg/m^3)	1704			2087		
	Optimum Moisture Content (%)	16.7			7.8		
	Mould Moisture Content (%)	16.9			7.9		
A	Relative Compaction (%)	100.0			100.0		
	Swell (%)	3.5			0.1		
B	Relative Compaction (%)	95.2			95.6		
	Swell (%)	4.6			0.1		
C	Relative Compaction (%)	91.9			92.8		
	Swell (%)	5.0			0.1		
CBR	@100% Max Dry Density	3			17		
	@98% Max Dry Density	2			12		
	@95% Max Dry Density	2			7		
	@93% Max Dry Density	1			5		
	@90% Max Dry Density	1			3		
Material Condition - (SANS 3001 Method GR20)							
Insitu Moisture Content (%)		25.1			8.3		
Soil Classification Of The Material Based Only On The Tests Results Above							
TRH 14 Specification:		Not Classified			Not Classified		
AASHTO System		A-7-5			A-4		
Unified System		MH			SM		

88822





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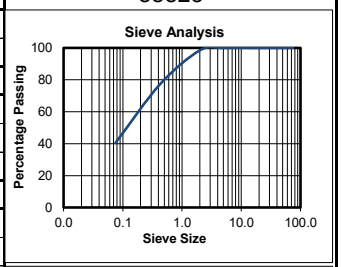
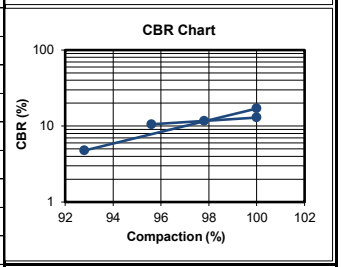
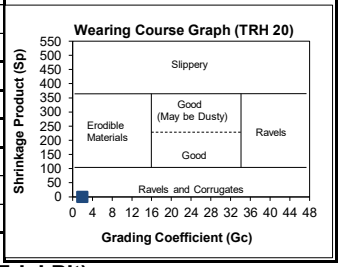




● 88822 ■ 88823



- **Tests marked with a (*) are NOT SANAS Accredited results.**
- **Specimens sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MA2 (Trial Pit).**
- **Specimens sampled by Llewelyn Heathcote**
- **The weather conditions were such that there was no detrimental effect on the sample/s taken.**

Llewelyn Heathcote
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

1. The opinion column is an interpretation of the direct comparison between the quoted specification and the single test sample results obtained. The compliant (✓), non compliant (×) and uncertain (∗) opinion indicators are based on an approximate 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
2. The uncertain (∗) indicates that the test result is either equal to or is above / below the specified limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliant (✓) or non compliant (×) based on a 95% level of confidence with reference to SAMM GUIDANCE 1, Issue 2 : 20 June 2007 Section 2.
3. This report (with attachments) is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Director of Outeniqua Lab (Pty) Ltd.
4. Measuring Equipment, traceable to National Standards is used where applicable. Results reported in this Test Report relate only to the items tested and are an indication only of the sample provided and/or taken.
5. While every care is taken to ensure the correctness of all tests and reports, neither Outeniqua Lab (Pty) Ltd nor its employees shall be liable in any way whatever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequence thereof.

OUTENIQUA LAB (Pty) Ltd.

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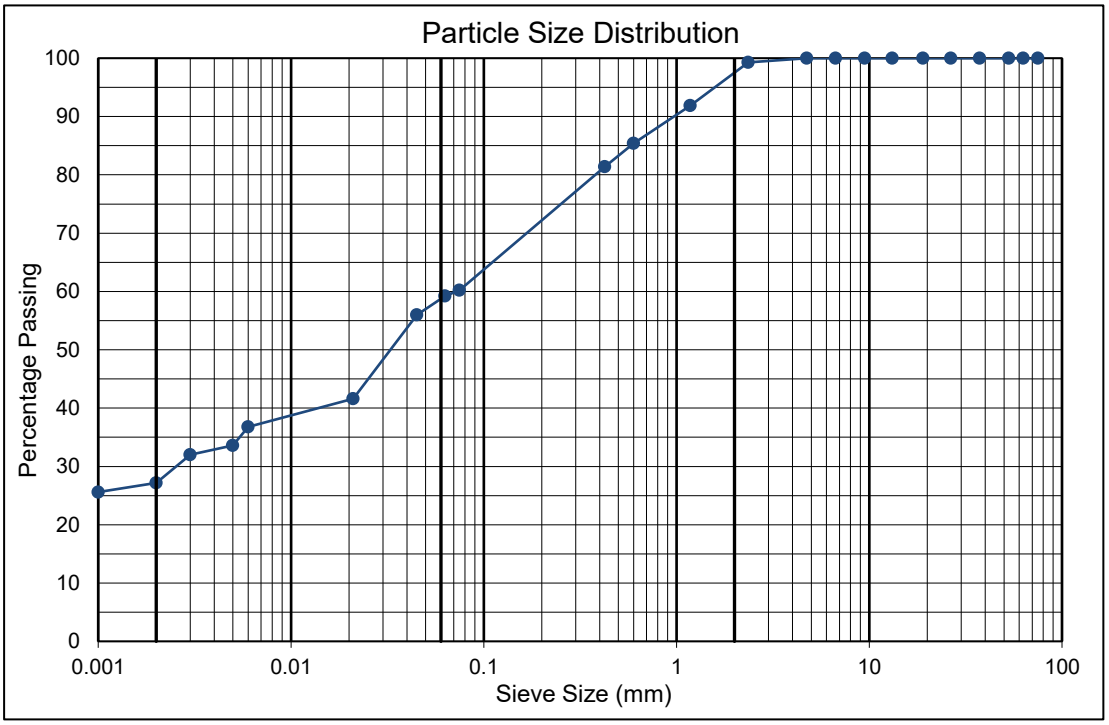
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqualab.co.za T0347

Customer :	Neil Lyners P O Box 757 George 6530	Project :	Aan de Meulen Development - George
		Date Received :	28/06/24
		Date Reported :	22/07/24
		Req. Number :	2335/24
Attention :	F van Eck	No. of Pages :	1 of 4

TEST REPORT
FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)		TP 1
Depth (mm):		1100-2000
Sample No.:		88818
Materials Description	Source	Trial Pit
	Colour	Light Yellowish Orange
	Soil Type	Silt/Silty Clay Becoming Fine Gravel
	Classification	Insitu

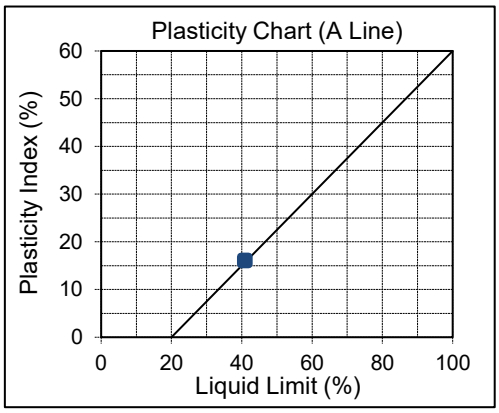
Percentage Passing	
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	99
1.18mm	92
0.6mm	85
0.425mm	81
0.075mm	60
0.063mm	59
0.045mm	56
0.021mm	42
0.006mm	37
0.005mm	34
0.003mm	32
0.002mm	27
0.001mm	26

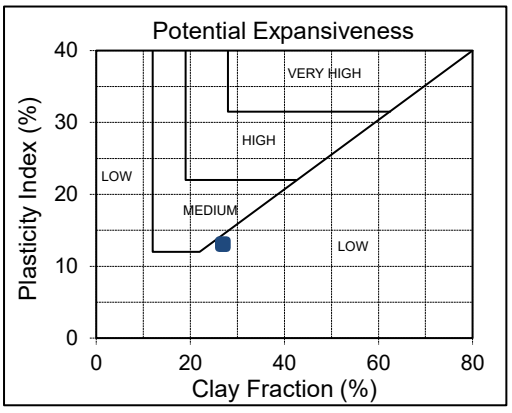


Liquid Limit (%)	41
Plasticity Index (%)	16
Linear Shrinkage (%)	8
Moisture Content (%)	19.1

% Clay	27
% Silt	32
% Sand	38
% Gravel	3

Unified Soil Classification	CL
AASHTO Soil Classification	A-7-6





- **Specimen sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 (Stockpile).**
- **Specimens sampled by Llewelyn Heathcote**
- **The weather conditions were such that there was no detrimental effect on the sample/s taken.**

Llewelyn Heathcote
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

OUTENIQUA LAB (Pty) Ltd.

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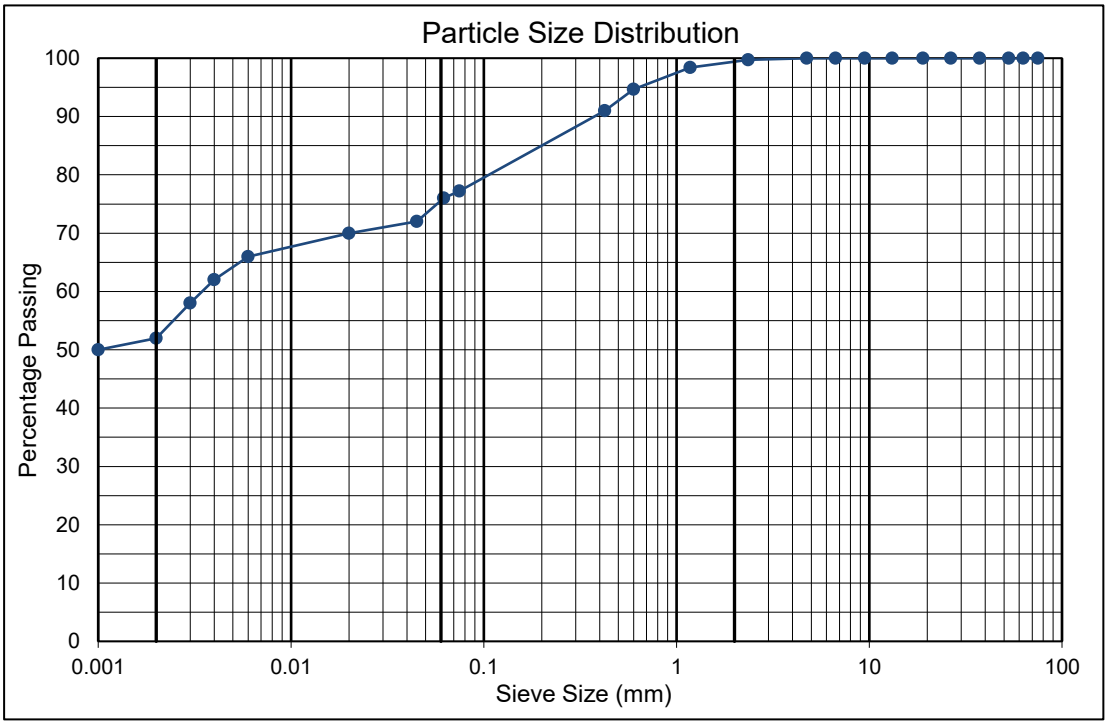
Attention :	F van Eck	No. of Pages :	2 of 4

TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)		TP 3
Depth (mm):		800-1300
Sample No.:		88819
Materials Description	Source	Trial Pit
	Colour	Dark Red Mottled Light Yellowish Orange
	Soil Type	Silty/Silt Clay
	Classification	Insitu

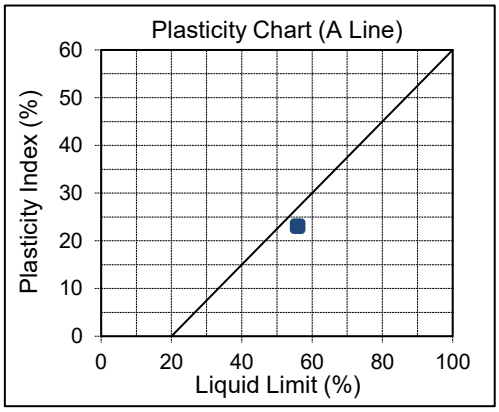
Percentage Passing	
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	100
1.18mm	98
0.6mm	95
0.425mm	91
0.075mm	77
0.062mm	76
0.045mm	72
0.02mm	70
0.006mm	66
0.004mm	62
0.003mm	58
0.002mm	52
0.001mm	50

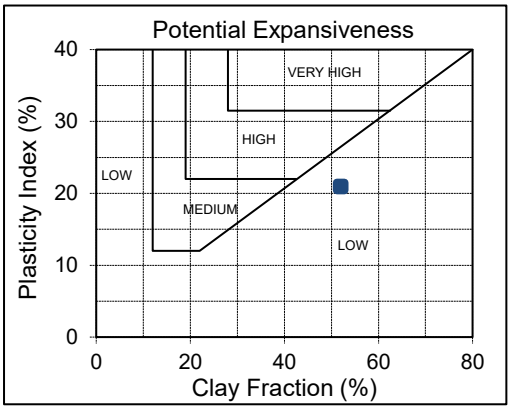


Liquid Limit (%)	56
Plasticity Index (%)	23
Linear Shrinkage (%)	12
Moisture Content (%)	25.5

% Clay	52
% Silt	23
% Sand	24
% Gravel	1

Unified Soil Classification	MH
AASHTO Soil Classification	A-7-5





- **Specimen sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 (Stockpile).**
- **Specimens sampled by Llewelyn Heathcote**
- **The weather conditions were such that there was no detrimental effect on the sample/s taken.**

Llewelyn Heathcote
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

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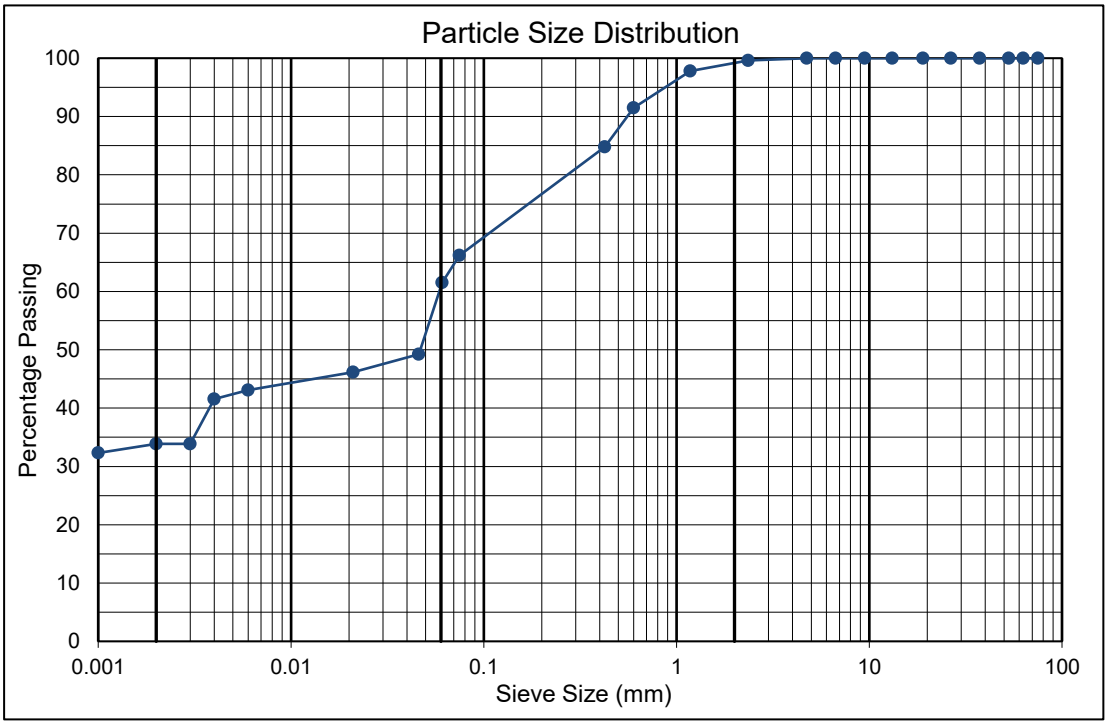
Attention :	F van Eck	No. of Pages :	3 of 4

TEST REPORT

FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)		TP 6
Depth (mm):		1000-2300
Sample No.:		88821
Materials Description	Source	Trial Pit
	Colour	Light Yellowish Orange
	Soil Type	Silt/Silty Clay Becoming Fine Gravel
	Classification	Insitu

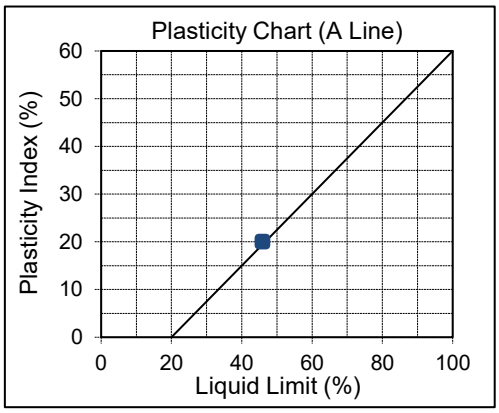
Percentage Passing	
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	100
1.18mm	98
0.6mm	92
0.425mm	85
0.075mm	66
0.061mm	62
0.046mm	49
0.021mm	46
0.006mm	43
0.004mm	42
0.003mm	34
0.002mm	34
0.001mm	32

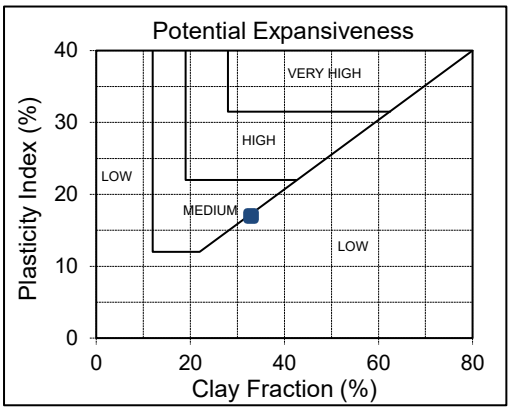


Liquid Limit (%)	46
Plasticity Index (%)	20
Linear Shrinkage (%)	10
Moisture Content (%)	22.4

% Clay	33
% Silt	28
% Sand	38
% Gravel	1

Unified Soil Classification	CL
AASHTO Soil Classification	A-7-6





- **Specimen sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 (Stockpile).**
- **Specimens sampled by Llewelyn Heathcote**
- **The weather conditions were such that there was no detrimental effect on the sample/s taken.**

Llewelyn Heathcote
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

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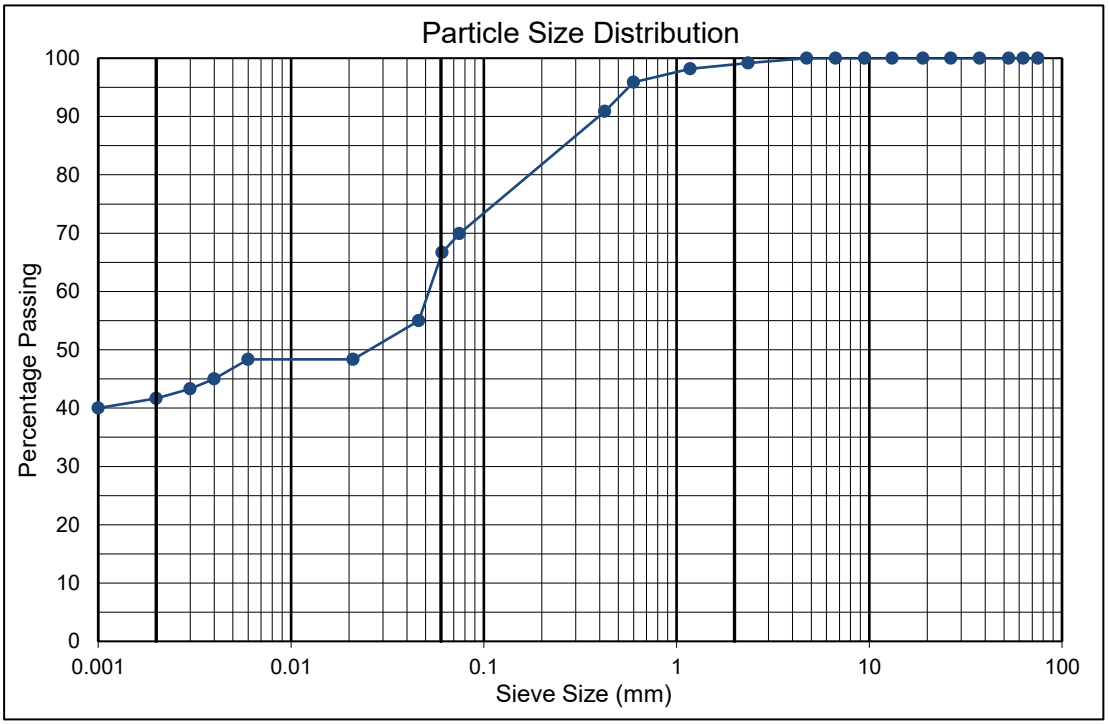
Attention :	F van Eck	No. of Pages :	4 of 4

TEST REPORT
FOUNDATION INDICATOR - (ASTM Method D422)

Sample Position (SV)		TP 10
Depth (mm):		1200-2300
Sample No.:		88824
Materials Description	Source	Trial Pit
	Colour	Dark Red Mottled Light Yellowish Orange
	Soil Type	Silty/Silt Clay
	Classification	Insitu

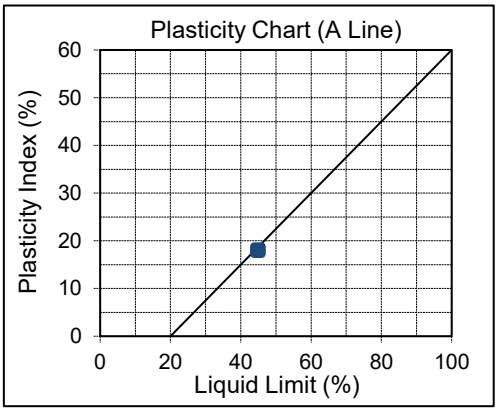
Percentage Passing	
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	99
1.18mm	98
0.6mm	96
0.425mm	91
0.075mm	70
0.061mm	67
0.046mm	55
0.021mm	48
0.006mm	48
0.004mm	45
0.003mm	43
0.002mm	42
0.001mm	40

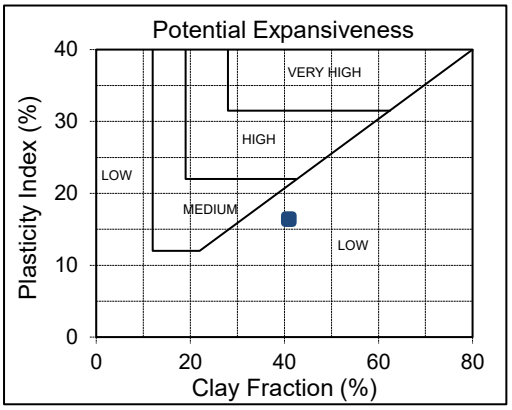


Liquid Limit (%)	45
Plasticity Index (%)	18
Linear Shrinkage (%)	9
Moisture Content (%)	29.0

% Clay	41
% Silt	25
% Sand	33
% Gravel	1

Unified Soil Classification	ML
AASHTO Soil Classification	A-7-6





- **Specimen sampled by Outeniqua Lab according to sampling Plan TMH 5 Methods MB1 (Stockpile).**
- **Specimens sampled by Llewelyn Heathcote**
- **The weather conditions were such that there was no detrimental effect on the sample/s taken.**

Llewelyn Heathcote
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

OUTENIQUA LAB (Pty) Ltd.

Registration No. 95/07742/07

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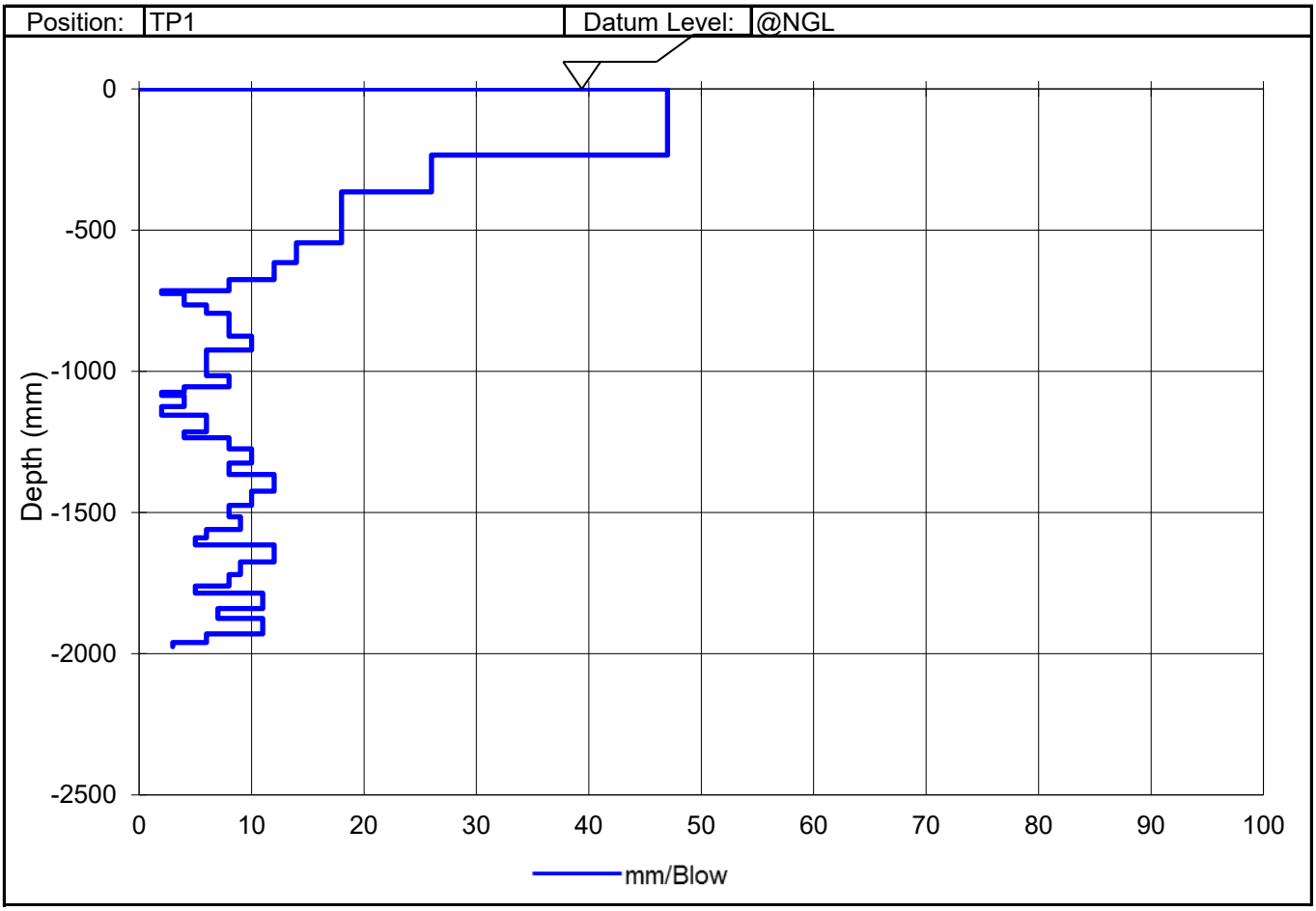
Attention :	F van Eck	No. of Pages :	1 of 4

TEST REPORT

DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)

Position: TP1 Datum Level: @NGL



Notes:

Ruaan Lesch
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

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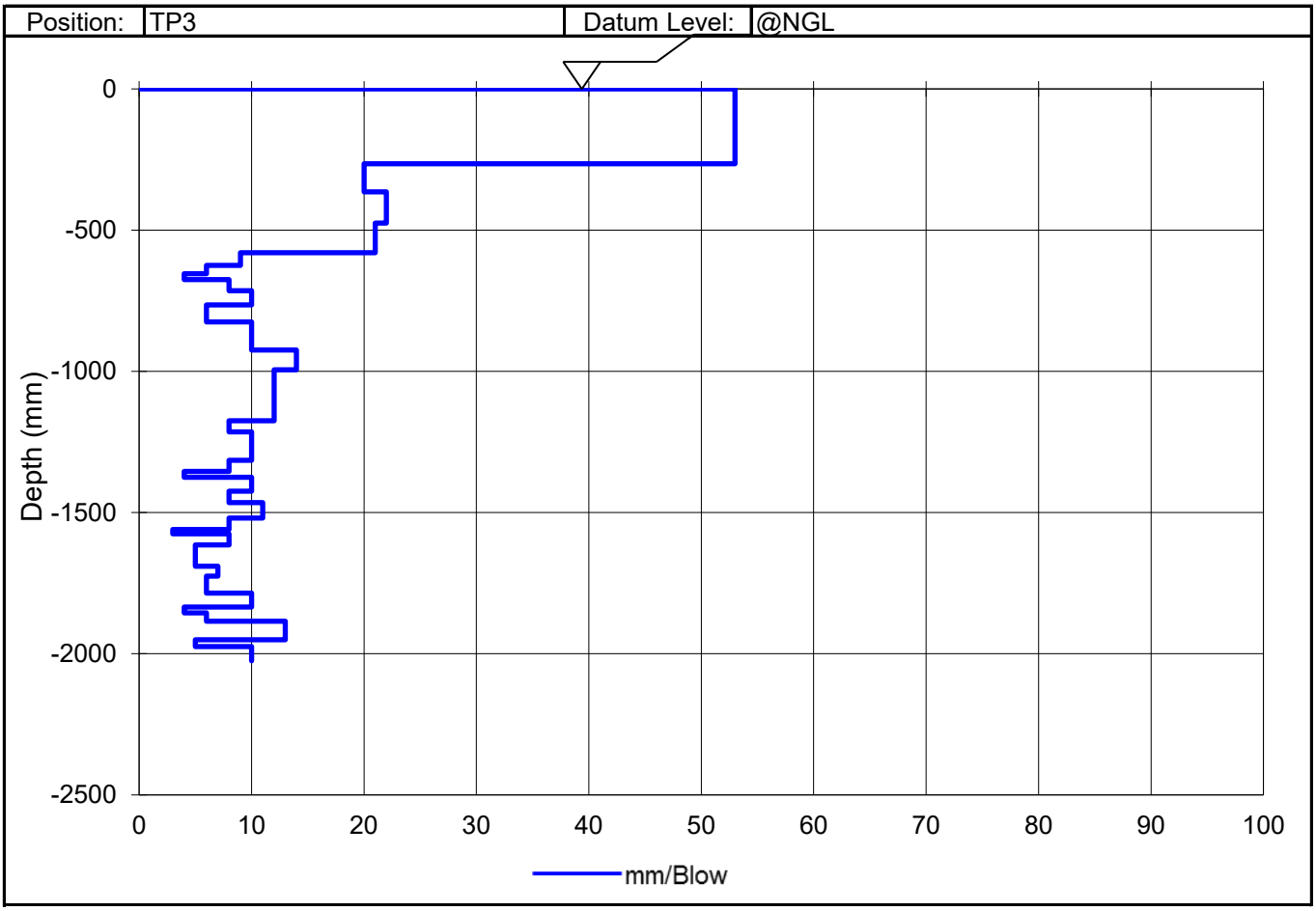
		Req. Number :	2335/24
Attention :	F van Eck	No. of Pages :	2 of 4

TEST REPORT

DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)

Position: TP3 Datum Level: @NGL



Notes:

Ruaan Lesch
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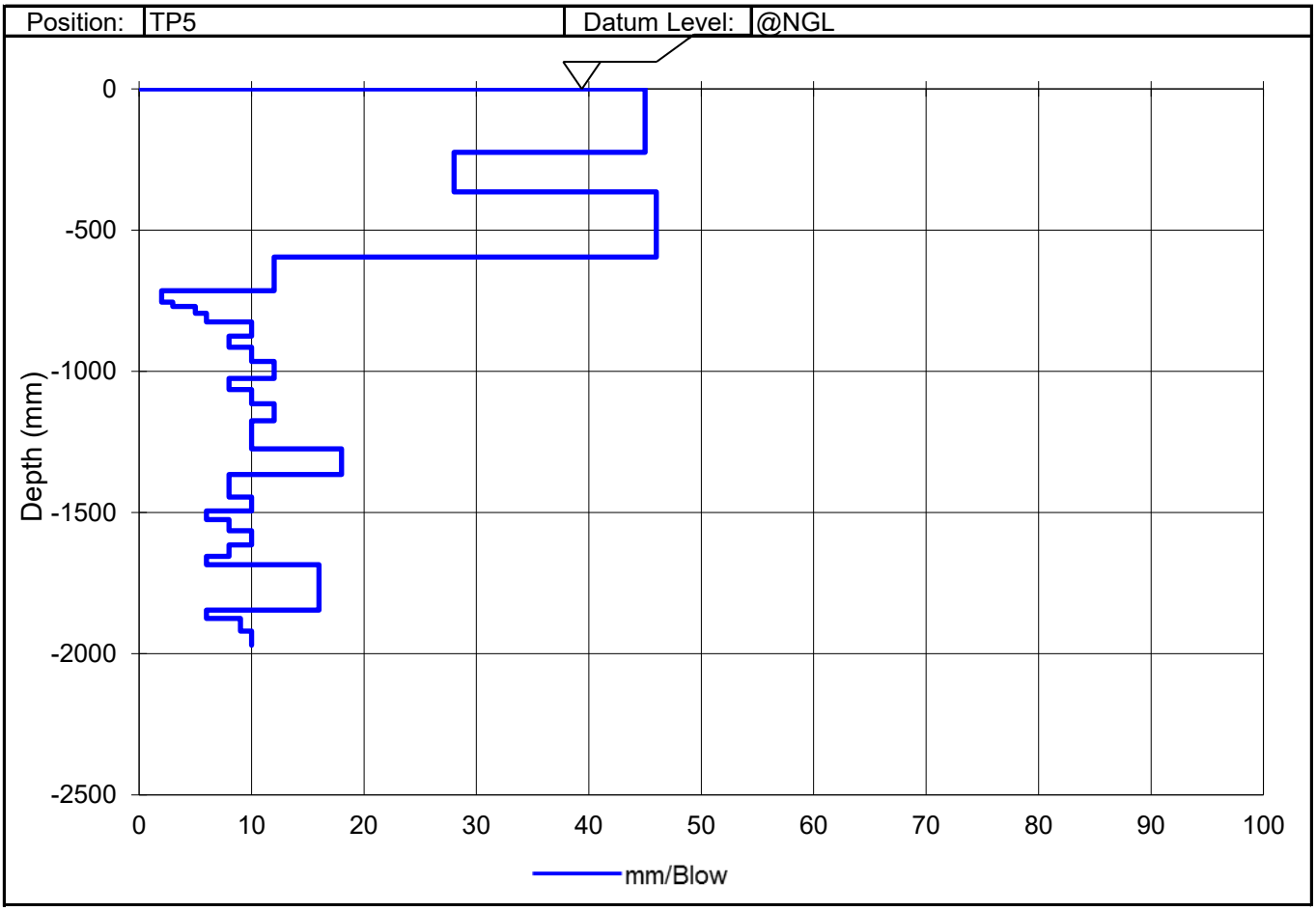
		Req. Number :	2335/24
Attention :	F van Eck	No. of Pages :	3 of 4

TEST REPORT

DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)

Position: TP5 Datum Level: @NGL



Notes:

Ruaan Lesch
Technical Signatory
For Outeniqua Lab (Pty) Ltd.

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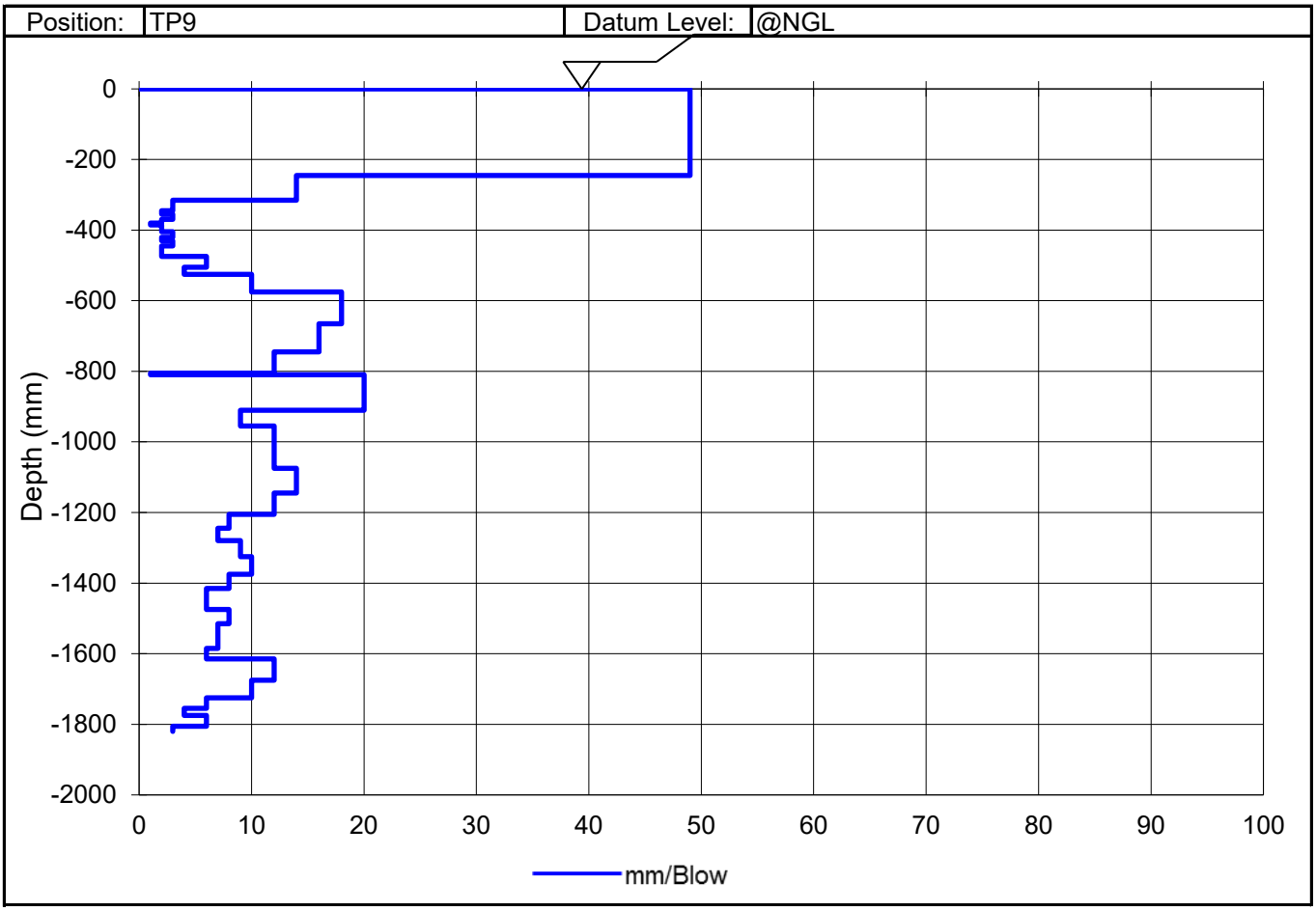
Attention :	F van Eck	No. of Pages :	4 of 4

TEST REPORT

DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)

Position: TP9 Datum Level: @NGL



Notes:

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1 **Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.**

2 This report (with attachments) is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Director of Outeniqua Lab (Pty) Ltd.

3 Measuring Equipment, traceable to National Standards is used where applicable. Results reported in this Test Report relate only to the items tested and are an indication only of the sample provided and/or taken.

4 While every care is taken to ensure the correctness of all tests and reports, neither Outeniqua Lab (Pty) Ltd nor its employees shall be liable in any way whatever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequence thereof.

ANNEXURE H

Stormwater Management Plan