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## **STORMWATER MANAGEMENT PLAN**

**FOR**

**MEULENZICHT LANDGOED DEVELOPMENT, GEORGE**

**APRIL 2025**

**REVISION 0**

**COMPILED FOR:**



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## Table of Contents

<b>1. INTRODUCTION</b>	<b>1</b>
1.1 APPOINTMENT	1
1.2 AVAILABLE INFORMATION AND INVESTIGATIONS	1
1.3 EXECUTION OF THE APPOINTMENT	1
1.4 LEGAL ASPECTS REGARDING STORMWATER	2
1.4.1 General	2
1.4.2 Prevailing norms of stormwater drainage	2
<b>2. TERRAIN</b>	<b>3</b>
2.1 LOCATION OF THE WORKS	3
2.2 SITE TOPOGRAPHY, DRAINAGE AND VEGETATION	3
2.3 EXISTING STORMWATER INFRASTRUCTURE	3
2.4 REHABILITATION OF EXISTING EROSION DONGA	4
<b>3. HYDROLOGY</b>	<b>4</b>
3.1 STORMWATER RUNOFF CALCULATIONS	4
3.2 RISKS – COST CONSIDERATIONS AND DESIGN FLOOD FREQUENCIES	4
<b>4. STORMWATER DRAINAGE AND CONTROL SYSTEMS</b>	<b>5</b>
4.1 GENERAL	5
4.1.1 Purpose and principles	5
4.1.2 Minor system	6
4.1.3 Major system	6
4.1.4 Recommendations regarding design principles and considerations	6
4.2 SUSTAINABLE URBAN DRAINAGE SYSTEMS	7
4.2.1 General	7
4.2.2 SUDS Processes	7
4.2.2.1 Water quantity management	8
4.2.2.2 Water quality management	8
4.2.2.3 Biodiversity management	8
4.2.3 SUDS Selection	8
4.2.3.1 Selection Basics	8
4.3 WATER QUANTITY MANAGEMENT	11
4.3.1 General	11
4.3.2 Building on individual lots	11
4.3.3 Site area	11
4.4 WATER QUALITY MANAGEMENT	12
<b>5. CONCLUSION</b>	<b>14</b>
<b>6. REFERENCES</b>	<b>14</b>



**ANNEXURES:**

**Annexure A: Locality Plan**

**Annexure B: Study Area Drawing**

**Annexure C: George Municipality 's General Conditions for Stormwater Management Plans**

**Annexure D: Stormwater Runoff Calculations**

**Annexure E: Stormwater Layout Plan**

**Annexure F: Stormwater Details**

**Annexure G: Preliminary Geotechnical Soil Investigation**



**REPORT DETAILS:**

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**SYNOPSIS:**

Neil Lyners and Associates (Pty) Ltd was appointed by Atterbury (Pty) Ltd for the preparation of a Stormwater Management Plan for the proposed Development Meulenzicht Landgoed located on Erf 25537 in the George Municipal Area. The area under investigation was analysed with relevant codes of practice, policy and guidelines in mind. The need to provide a system that is effective, sustainable and that results in runoff of acceptable water quality was foremost when approaching the concept of the drainage system. For this reason, the design is reviewed using “The South African Draft Guidelines for Sustainable Urban Drainage Systems”. Sustainable Urban Drainage Systems (SUDS) focuses on sustainability by attempting to imitate the natural hydrological cycle.

The upfront delineation of sensitive and wet areas to inform the development layout, the large open spaces incorporated into the development, the proposed dissipation of energy and partial retention of runoff all supports the inclusions of SUDS for the proposed development.

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## 1. INTRODUCTION

### 1.1 APPOINTMENT

Atterbury (Pty) Ltd appointed Neil Lyners & Associates (Pty) Ltd (hereafter referred to as Lyners) for the preparation of a Stormwater Management Plan for the Meulenzicht Landgoed Development located on Erf 25537 in George.

### 1.2 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;
- Existing services information received from George Municipality and GLS;
- Detail and topographic survey of the entire property completed in November 2024;
- Geotechnical conditions from preliminary geotechnical soil investigation (See **Annexure G**).

Field observations and testing were done in August 2024 and October 2024 by the freshwater specialist, James Dabrowski from Confluent, in addition to the above information to delineate wet areas in order to confirm sensitive stormwater drainage patterns. A layout drawing was generated, showing contour and cadastral information of the study area (See **Annexure B**).

### 1.3 EXECUTION OF THE APPOINTMENT

The area under investigation was analysed with relevant codes of practice, policy and guidelines in mind. Current stormwater management systems were assessed in order to reduce the impact of the proposed development on future operations. Local control mechanisms for the required flood return periods will be implemented where necessary, in order to ensure that capacities of regional drainage systems are not exceeded. The need to provide a system that is effective, sustainable and that result in runoffs of acceptable water quality was foremost when approaching the design of the drainage system.

The report takes into account legal requirements and constraints, management of stormwater runoff and recommendations regarding best practices relating to stormwater drainage systems.



## 1.4 LEGAL ASPECTS REGARDING STORMWATER

### 1.4.1 General

Along with the 2023 George Municipality By-laws amended from time to time, the applicable legal rules or norms with respect to drainage in South Africa are mainly contained in three sources, namely the common law, amended law (law announcement) and the statute law. The interpretation and quotation of the above fall outside the scope of this report, but a few essential points, regarded as important in the planning of drainage systems, often appear in the amended law and are summarised as follows:

- Nobody shall interfere with the natural flow of water in rural areas without statutory authority (authorised regulation);
- Statutory authority is no remission of responsibility to provide drainage works in a reasonable way. The conception “reasonable way” is determined and evaluated on the basis of three factors, namely the environmental factor, the cost factor and the degree of safety;
- To refrain from acting in a “reasonable way” where it is required, will be considered as illegitimate conduct.

In order to stay within the law and act in a legitimate way, should the possibility of interfering with natural flow exist, it will be advisable to negotiate with lower lying property owners and to conclude an agreement before any construction works commence.

Provisions of the following environmental standards, legislation as well as municipal regulations are applicable:

- National Water Act, Act No 36 of 1998;
- National Environmental Management Act, Act No 107 of 1998;
- Environmental Conservation Act, Act No 73 of 1989;
- Water Services Act, Act No 30 of 2004;
- George Municipality 's General Conditions for Stormwater Management Plans.

### 1.4.2 Prevailing norms of stormwater drainage

Comprehensive guidelines known as “Guidelines for the Provision of Engineering Services in Residential Townships” (July 1983) by the former Department of Community Development, as well as “Guidelines for the Provision of Engineering Services and Amenities in Residential Township Development” (1994) by the National Housing Council were published and have in general been accepted as the norm for the provision of engineering services in urban areas.

The following documents have been accepted in addition to the above-mentioned guidelines:

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- The Neighbourhood Planning and Design Guidelines (2019 edition) and Municipal standards and specifications;
- The South African Draft Guidelines for sustainable Urban Drainage Systems (SUDS) that was drafted for as part of the Water research Commission of South Africa (WRC) project K5/1826: Alternative technology for Stormwater Management;
- George Municipality's General Considerations to be included in a Stormwater Management Plan. (See **Annexure C**).

In the light of the general application and support of the above-mentioned guidelines, it is accepted as minimum acceptable standards for stormwater drainage. Any deviation from these standards should be justified on the basis of environmental, economic and risk analysis.

For the purpose of this report these guidelines will thus apply throughout as reference and any deviation from that will be motivated.

## 2. TERRAIN

### 2.1 LOCATION OF THE WORKS

The proposed development, Meulenzicht Landgoed, are located on Erf 25537, situated north of the National Route 2 (N2) and on the western side 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 the Meulenzicht Landgoed site are 33°59'12.31"S, 22°31'21.69"E.

### 2.2 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 development and agricultural activities.

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

### 2.3 EXISTING STORMWATER INFRASTRUCTURE

The natural drainage patterns of the site channel the surface water flow towards existing watercourses situated in three valleys running through the centre of the two areas, which ultimately drain to 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. The existing stormwater dam on Meulenzich Landgoed will be utilised as a wet stormwater pond. The wet stormwater pond will be a partial retention and polishing pond to reduce flow velocities and remove sediment and other contaminants.

#### **2.4 REHABILITATION OF EXISTING EROSION DONGA**

The erosion donga situated in the watercourse on the proposed Meulenzicht Landgoed will be rehabilitated to prevent any further erosion. The rehabilitation work will consist of filling the donga with large rocks of size 300mm diameter below the stream bed. A layer of 300mm thick topsoil will be placed and compacted on top of the rock fill. A mixture of endemic, indigenous grass seeds will be placed in the topsoil layer to quickly establish vegetation and reduce the risk of future erosion. Gabion structures will be placed along the rehabilitated area to reduce the stormwater flow velocity and to assist with sediment build up. Refer to drawing 24051-C-005-02 and 24051-C-005-102 in **Annexure F**. The construction footprint inside the water course will be kept to a minimum.

### **3. HYDROLOGY**

#### **3.1 STORMWATER RUNOFF CALCULATIONS**

Various approved methods are used to execute hydrological calculations, with each based on its own method of calculation runoff from the catchment data. The results of these calculation methods can vary considerably as they only provide an approximation of actual events. Computer models, utilising various acceptable methods, will be used to calculate peak flows for the site under investigation. These results can then be compared to calculations based on the rational method and the most appropriate results will be applied in the design of the stormwater system. Please see **Annexure D**.

#### **3.2 RISKS – COST CONSIDERATIONS AND DESIGN FLOOD FREQUENCIES**

Although runoff calculations are performed with great care, it is still possible that the capacity of a system could be exceeded because of non-hydrological reasons such as poor management and insufficient maintenance. There are limits to the elimination of probabilities, mitigation or reduction in risk, as costs could become unattainably high in comparison with the benefit or reduced risks of options that are considerably cheaper.



Although the relationship between function, risk, capital development cost and maintenance cost plays a major role in determining the design flood frequency, it is assumed in general that the following flood frequencies should be provided for under normal circumstances:

- a) Minor system which is the system of pipes, culverts and channels, with stilling basins and erosion protections on the downstream ends, which provides capacity for more regular storms of a smaller nature. See **Annexure D**.
- |      |   |   |                   |
|------|---|---|-------------------|
| i)   | Residential   | : | 1:2 to 1:5 years  |
| ii)  | Institutional   | : | 1:5 years         |
| iii) | High value general business, industrial areas<br>and public works | : | 1:5 years         |
| iv)  | Central business district   | : | 1:5 to 1:10 years |
- b) Major system which usually consists of streets, pipe culverts, box culverts and open channels, with erosion protection at the downstream ends, and is in place to deal with more severe storms. See **Annexure D**.

The major system will be designed to accommodate the 1:50 year storm.

## 4. STORMWATER DRAINAGE AND CONTROL SYSTEMS

### 4.1 GENERAL

#### 4.1.1 Purpose and principles

As mentioned in paragraph 3.2, stormwater systems can be categorised into two systems, namely major and minor systems. The purpose and principles of stormwater control does not always necessitate minor and major floods being accommodated in a single system. In relatively small catchments the peak runoff and runoff volume of both the minor and major floods are usually of such low magnitude that they can be accommodated in a single system. As catchment areas increase in size, so it becomes less practical and more expensive to retain a single system. In such cases separate minor and major systems should be provided.



#### 4.1.2 Minor system

The primary goal of minor systems is to ensure convenience of nearby residents and the safety of traffic during normal rain showers.

The minor system usually consists of road drainage channels and kerbs, kerb inlets, grid inlets, manholes, pipes, box culverts and small open channels for the rapid discharge of runoffs to the major drainage system.

The sizing of the elements are determined on the basis of short duration, high intensity storms taking into account concentrated flow entering the minor system.

Considering the occurrence of steep slopes in some of the proposed stormwater pipes, which will relate to high velocities, drop manholes and flatter sloped pipes will be introduced, where possible. Discharge headwalls at the ends of pipes will be equipped with stilling basins and erosion protection to decrease storm water velocities, spread the flows and prevent erosion. See **Annexure E** for a typical detail of the headwall installation

#### 4.1.3 Major system

The major system will seldom be utilised to its full capacity as its purpose is to convey and control large floods.

If justified by costs or natural conditions, the major and minor flows could be accommodated in the same facility. Natural or manmade channels and large diameter culverts are examples. In this case the roads will convey the major storm water events and gabion mattresses will be installed at the down stream ends of the roads and stormwater outlet structures to decrease the flow velocities, dissipate the energy, spread the water and prevent erosion. See **Annexure E**.

#### 4.1.4 Recommendations regarding design principles and considerations

Although dealt with in the “The Neighbourhood Planning and Design Guidelines (2019 edition) and Municipal standards and specifications.” it is imperative to emphasize a few aspects viewed as policy standpoints with regards to higher lying developments:

- New developments shall not adversely affect the safety risk within existing surrounding developments;
- Pollution of the major discharge system as a result of sedimentation, refuse, effluent and other chemical waste shall be actively controlled;



- In order to exercise a degree of control over new developments, the design assumptions, calculations and results shall be submitted to the Local Authority at completion of the detail design phase of the project.

## **4.2 SUSTAINABLE URBAN DRAINAGE SYSTEMS**

### **4.2.1 General**

In order to ensure the sustainability and environmental integrity of a stormwater management plan, it is advisable to consult “The South African Draft Guidelines for Sustainable Urban Drainage Systems”.

Sustainable Urban Drainage Systems (SUDS) focuses on sustainability by attempting to imitate the natural hydrological cycle, something that conventional drainage systems does not focus on. Once an area is developed, the natural permeability of the area is generally reduced as free draining surfaces are replaced with impermeable surfaces such as roofs, roads and paved areas. This process, together with the fact that subsoil is usually compacted during development reduces the infiltration capacity of the area. As development also results in loss of vegetation, the evapotranspiration of the area is also reduced.

Conventional drainage systems are more focused on reducing flooding and possible flood damage to an area (flood attenuation). The focus of the SUDS process is on flood attenuation as well as promoting more natural, sustainable drainage systems.

Great care will be taken during construction to demarcate the open spaces to prevent entry and compaction of the ground to retain the natural permeability to allow continued infiltration and to retain the vegetation to support evapotranspiration and natural polishing of runoff

### **4.2.2 SUDS Processes**

The SUDS principle can be broken up into the following three key areas:

- Water quantity;
- Water quality;
- Biodiversity.

These key areas are elaborated on as follows:



#### 4.2.2.1 *Water quantity management*

Stormwater quantities can be managed through inter alia the following processes that will be implemented:

- Capturing rainwater for supplementary water uses on site;
- Conveyance of stormwater (transfer from one location to another);
- Retention of large open areas within the development to allow infiltration, natural retention and groundwater recharge;
- Localized stormwater detention at outlet headwalls to protect receiving watercourses in the event of flooding and during high intensity rainfall events.

#### 4.2.2.2 *Water quality management*

Water quality is promoted through cleaning or polishing of stormwater. This can be achieved through inter alia the following processes that will be implemented:

- Sedimentation – reducing flow velocities of stormwater runoff to allow sediment particles to fall out of suspension;
- Removal of nutrients and metals through plant-uptake;
- Disinfection/oxidation – breakdown of organic pollutants through extended exposure to ultra-violet light.

#### 4.2.2.3 *Biodiversity management*

Biodiversity management is promoted through the following controls that will be implemented:

- Health and safety plans and implementation to prevent injury or death to people;
- Environmental risk assessment and management to promote longevity of the system;
- Recreation and aesthetics – enhancing visual appearance by creating attractive open spaces;
- Education and awareness – distribution of knowledge about stormwater management among interested and affected parties.

### **4.2.3 SUDS Selection**

#### 4.2.3.1 *Selection Basics*

To successfully manage stormwater a number of treatment processes may be required. This multiple process treatment is referred to in the SUDS guideline as a treatment train. A variety of



options or combinations of options may be necessary according to the individual requirements of the site. The three key points where intervention is required are as follows:

- Source controls – manage stormwater runoff as close to its source as possible;
- Local controls – manage stormwater runoff in the local area and;
- Regional controls – manage combined stormwater runoff from several developments. *(Not applicable to this area since the final run-off is discharged directly into river systems and no regional controls are available downstream of the site.)*

#### a) Source Controls

Source control alternatives that were considered include:

- Green roofs and sand filters;
- Retention of large open areas within the development to allow infiltration, natural filtration and evapotranspiration;
- Soakaways;
- Stormwater collection and reuse.

Green roofs are roofs covered in vegetation. The vegetation serves to delay runoff peaks as well as decrease runoff volumes. Green roofs also improve the biodiversity of post development areas. The limitations of this method of control includes a high set up cost due to the need to contract experienced professionals regarding the effects on the structure as well as vegetative requirements; the need for regular maintenance; and the possibility of roof failure if detained water leads to failure of waterproofing membranes. Due to these limitations this alternative will not be implemented.

Sand filters are generally utilised to improve the quality of stormwater runoff. They comprise of a sedimentation chamber as well as a filtration chamber. Filtration through the sand bed coupled with microbial action in the medium leads to removal of suspended particles, heavy metals and smaller particulates in stormwater runoff. Sand filters are expensive to implement, are generally unattractive and prone to clogging. Due to these reasons as well as the underlying clay conditions this alternative will not be recommended.

Soakaways are excavated pits filled with a porous medium, like coarse aggregate. Soakaways are used for temporary storage of stormwater, which is then allowed to infiltrate into the ground. Soakaways are suitable in most climatic conditions; significantly reduces runoff volume; and has design lives of up to 20 years if maintained correctly. This control is only suitable to small areas where infiltrating water will not adversely affect foundations of adjacent structures. There is also a need for regular maintenance. Due to the proposed development's large areas and quantities of run-off as well as the clay soils this alternative cannot be used.



Stormwater collection and reuse reduces runoff which reduces the potable water consumption rates of a development. Stormwater collection is also a good way to attenuate flood peaks. Storage facilities are easy to find and quick to install but may not be aesthetically pleasing. Rain water harvesting will therefore be implemented by means of water tanks that will be required at the proposed buildings on the site as per building regulation legislation requirements.

Unusually large open natural areas will also be retained in this development in support of SUDS principles. Regular corridors to these open areas allow frequent discharge points to the natural open areas which:

- Prevent the accumulation of all the stormwater of the development and one or two high concentrated release of stormwater points;
- Instead, regular points of release allow for the infiltration of stormwater in wide open natural drainage areas supporting the subsoil moisture requirements of the natural vegetation, which in turn polish the water and ensures a sustainable system with continued evapotranspiration;
- The large open spaces, kept in their natural state will naturally slowdown the run-off release and retain the flows and allow efficient infiltration.

#### b) Local controls

Local control alternatives as per “*The South African Draft Guidelines for Sustainable Urban Drainage Systems*” that were considered inter alia include:

- Headwalls with energy dissipators, refuse traps, stilling basins and gabion mattresses to decrease the stormwater velocities and spread the flow in order to reduce the risk of erosion. (See **Annexure F**);

As part of the on-site water quantity and water quality management, the Stormwater Management Plan considerations of the George Municipality, as included in **Annexure C**, will be incorporated in the Services Report and the detail stormwater design phase of the development.

The mitigation recommendations mentioned in the *Aquatic Biodiversity Site Sensitivity Verification and Impact Assessment Report* prepared by Confluent will be investigated and implemented, if necessary, during the detail design stage of the project.



### 4.3 WATER QUANTITY MANAGEMENT

#### 4.3.1 General

The natural drainage patterns of the site channel the surface water flow towards existing watercourses situated in three valleys running through the centre of the two developments, which ultimately meet with the Swart River along the eastern boundary of the site. As mentioned above a far wider area is retained around these drainage channels in support of the SUDS principles to contribute to a sustainable stormwater drainage solution. The natural drainage direction of the site will be incorporated in the internal network's detail design phase.

Careful attention was given to the layout of the road reserves to drain, retain/captured roof runoff, regularly release stormwater to the oversized open spaces and allow larger runoffs to drain in an and overland manner away from the proposed development. This retained/captured water can then be utilised to supplement the irrigation water demand. At major outlet points, stormwater outlet structures will make provision for energy dissipation, refuse intercepting and erosion protection where required. During construction, special attention will be paid to the use of silt traps at storm water inlets and at natural low points to prevent silt and rubbish from entering the river. The Study Area Drawing in **Annexure B** depicts the planned direction of stormwater flows.

#### 4.3.2 Building on individual lots

As per "*The South African Draft Guidelines for Sustainable Urban Drainage Systems*", in order to create a more sustainable stormwater management system, a source control in the form of stormwater collection tanks at the buildings, will be used on site in order for stormwater to be reused for irrigation purposes. These tanks will be placed "in-line" on the building's gutter system. The tanks will make use of an inlet by-pass system which ensures that the initial roof runoff is not collected in the tanks.

The buildings on the individual lots will be equipped with a surrounding pipe network to accommodate downpipes. The remainder of the stormwater on site will be accumulated within catch pits and grid inlets.

#### 4.3.3 Site area

An underground piped or open channel storm water system will collect the internal minor flood stormwater from the individual lots in several locations (to minimize concentrated flows) and convey these waters to the proposed stormwater head wall outlet stilling basins / detention facilities at the downstream ends of the developed areas before discharged at a reduced run-off rate onto the undeveloped natural vegetated areas.



The following measures to detain the post development stormwater runoff will be:

- Rainwater harvesting: The capturing of rooftop runoff from single residential units into water tanks are required by the Municipal building regulations and supported by the developers in order to save on individual erf water demands and to detain rainfall run-off volumes on each erf.
- Sheet flow: The stormwater runoff volume from erven will be reduced when sheet flowing overland through the extraordinary large vegetated open spaces allowed for between erven and the natural vegetation in valleys. The reduced flow velocity of stormwater will assist in detaining the volume of run-off and mitigate the risk of erosion.
- Stormwater headwalls: The stormwater headwalls will be equipped with energy dissipators, refuse traps, stilling basins and gabion mattresses to reduce the stormwater flow velocity, detain the increased run-off quantities and spread out the stormwater flow over a larger area. These measures will mitigate the risk of erosion at the stormwater outlets. (See **Annexure F**)
- Stormwater control at existing dam: Small diameter stormwater outlet pipes will be installed in the existing stormwater pond on the proposed Meulenzicht Development to allow the stormwater of both developments to flow through the pond at a reduced run-off rate. A larger stormwater pipe and overflow structure will be installed on a higher level to accommodate the larger rainfall event run-off.

The proposed road system, parking areas and open channels will be designed to make provision for conveyance of larger storms (storms in excess of the minor flood) towards existing vegetated open spaces and water courses situated in two valleys running through the centre of the developments. From there the stormwater run-off ultimately meet with the Swart River past the eastern boundary of the site. (See Study Area Drawing in **Annexure B**).

The detained stormwater from the proposed development is received directly by the Swart River to the East and should not potentially cause damage to or unduly inconvenience neighbouring properties.

#### 4.4 WATER QUALITY MANAGEMENT

SUDS water quality design is based on the implementation of various control methods which forms a treatment train. If water goes through more than one treatment process there is more chance of prevention of pollution at a particular site.



Utilising the concept of a treatment train, water quality will first be addressed by street and parking cleansing for removal of litter and sand sized particles. Secondly the detention facility will control pollution as well as flooding by causing biological transformations and the settlement of solids. Thirdly the water quality will be improved by the many vegetated open spaces and by the natural vegetation in the valleys which are capable of absorbing pollutants within certain limits. They also have the added advantage of producing a unique eco-system.

As a fourth and final measure the storm water discharged from ponds will be further cleansed by the vegetated, erosion protected open channel systems downstream of the ponds.

Regular sweeping of paved areas will act as preventative measures, preventing litter and other pollutions from entering the stormwater system in the first place.

The pollutant removal capabilities of inter alia ponds as listed in “The South African Draft SUDS Guideline” are tabulated below:

**Table 1: Pollutant removal capability of permeable pavements and detention ponds**

Pollutant removal capability (%)	Control Measure: Detention ponds*
Total Settleable Solids	45 – 90
Hydro-carbons	30 – 60
Total Phosphorous	20 – 70
Total Nitrogen	20 – 60
Faecal Coli Forms	50 – 70
Heavy Metals	40 – 90

\* Estimated values based on similar SUDS options

**Disclaimer:**

*The values quoted in this table may be used to assess the general relative performance of selected SUDS options and technologies to minimise the risk of stormwater runoff pollutants entering receiving watercourses. The values should **not** be considered or used as absolute values as the performance of SUDS and SUDS Treatment trains is subject to many complex variables that are site specific. These values should be used to support judgement when assessing the risk of system failure and to compare the relative performance between combinations of different SUDS Treatment trains.*



## 5. CONCLUSION

A minor stormwater system will be provided to improve safety and to reduce inconvenience during smaller rainfall events and a major system will be included to protect properties from flooding.

The upfront delineation of sensitive and wet areas which informed the initial development layout together with the further retention of large open areas and regular stormwater release points to these natural and vegetated areas are the main contributors to the effective and sustainable stormwater drainage system, which support the SUDS principles, for this proposed development.

In addition, refuse traps, stilling basins and erosion protection at these outlets are possible and will be included to further enhance the proposed solution of detaining increased run-off and mitigating erosion risks of rainfall events.

The extraordinary large open areas, which will be protected and vegetated during and after construction, will allow infiltration to sustain the ground water, natural filtration of runoff, spread out overland sheet flow and retention and reduction of peak flows to support the vegetation and evapotranspiration while detaining increased run-off and mitigating erosion risks of rainfall events.

The capturing of roof runoff from single residential units in tanks, will augment water for irrigation purposes and reduce the overall domestic water demand of the development. The tanks will also serve as a run-off detention facility on each erf.

The proposed stormwater system will thus provide an acceptable level of service to residents, reduce peak run-off, mitigate erosion risks, manage and improve water quality to an acceptable standard and support biodiversity.

We would like to thank Atterbury (Pty) Ltd, the George Municipality, various specialists and the Department of Environmental Affairs & Development Planning for their valuable contribution to the report and willing assistance in gathering information to prepare this stormwater management plan.

## 6. REFERENCES

- Water Research Commission of South Africa, Project K5/1826: Alternative technology for Stormwater Management, The South African Draft Guidelines for Sustainable Urban Drainage Systems (SUDS);
- George Municipality's General Considerations to be included in a Stormwater Management Plan;



- The Neighbourhood Planning and Design Guidelines (2019 edition) and Municipal standards and specifications;
- 2023 George Municipality By-laws.

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

Yours faithfully

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**Francois van Eck, Pr Eng  
for LYNERS**



# ANNEXURE A

## Locality Plan



0 62.5 125 250 375 500 625  
Meters

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A	ISSUED FOR INFORMATION	2024-12-09	HMV		
<b>REVISIONS</b>					

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PROJECT  
**OUMEULEN VILLAGE AND  
MEULENZICHT LANDGOED DEVELOPMENT  
(GEORGE)**

TITLE  
**LOCALITY LAYOUT**

SCALE <b>1:10 000</b>	SHEET <b>1</b>
CONTRACT No	PROJECT No <b>CG24051</b>
DRAWING No <b>24051-C-000-01</b>	REV <b>A</b>
COORDINATE SYSTEM: WGS84/Lo23°	



# **ANNEXURE B**

## **Study Area Drawing**





# **ANNEXURE C**

**George Municipality 's General Conditions for Stormwater Management Plans**

## GEORGE MUNICIPALITY

### STORMWATER MANAGEMENT PLAN - GENERAL CONSIDERATIONS TO BE INCLUDED

1. Storm water control systems for construction purposes will be constructed before any construction commences on the site. As construction progresses, the storm water control measures are to be monitored and adjusted to ensure complete erosion control and appropriate runoff control at all times during construction. Construction activities should be undertaken in such a manner earthworks on site are to be kept to an absolute minimum.
2. All services required by the development shall be designed to withstand the effects of flooding without risk of environmental pollution, or risk of damage, injury or loss to the property owner, residents and general public.
3. An owner of a property on which a private/public storm water system is located-
  - a) May not carry out any activity which will or which, in the opinion of the HOA/Governing Body/Municipality, could reasonably be expected to adversely affect the functioning of such storm water system;
  - b) Must keep such storm water system functioning effectively (at own cost); and
  - c) The HOA/Governing Body is responsible for (in the case of a private service) the refurbishment and reconstruction of storm water systems when required.
4. For a private service, the HOA/Body Corporate / Private entity shall ensure that no person will be permitted to –
  - i) Discharge, place or permit to enter into the storm water system –
    - a) Anything other than storm water;
    - b) Anything likely to damage the storm water system or interfere with the operation thereof;
    - c) Anything likely to pollute the water in the storm water system.
  - ii) Discharge from any place, or place onto any surface, any substance other than stormwater, where that substance could reasonably be expected to find its way into the storm water system;
5. The internal vehicle driveways and parking areas shall be designed and constructed to direct run-off away from the buildings/residences to eliminate the potential impact of storm water on property.
6. The developer will ensure the registration of a servitude on the property title for the public/private storm water drains for the purposes of maintenance and access.

7. The owners/body corporate must keep such storm water servitude open and accessible for purposes of maintenance; and ensure the system functions effectively.
8. For the maintenance of private drainage systems, it is the responsibility of a HOA / Body Corporate / private entity to-
  - a) Properly maintain in good working order at all times, the private storm water drainage network on the premises. This includes all pipes, gutters, storm water detention devices or other components as well as the drainage network itself.
  - b) Ensure that all open storm water drains are kept clear of any obstruction that impedes or is likely to impede the free flow of water, for a distance of at least 3 meters from the nearest margin of the storm water drain;
  - c) Ensure there will be no adverse effect on the quality of storm water which previously flowed beyond the boundaries of the property on which the activity occurs; or,
  - d) Ensure the flow of an storm water entering the property will not be adversely effected; or,
  - e) Ensure the point of discharge from the property is not altered.
  - f) Ensure no owner or occupier of the land on either side of any open drain shall deposit, or cause or permit to be deposited any material or thing that could cause or likely to cause obstruction within the drain.



# **ANNEXURE D**

## **Stormwater Runoff Calculations**

Project Number:	C24051
Project Title	Oumeulen and Meulenzicht Development
Date	Wednesday, 04 December 2024
Calculation undertaken by:	GW
Verification by:	FVE
Catchment:	Meulenzicht



### CALCULATION OF RUN-OFF WITH THE RATIONAL METHOD FOR PRE DEVELOPMENT

**NOTE:**  
 1. ALTER ONLY GREEN CELLS  
 2. CELL No'S F26, F45 & L69 CONTAIN NOTES WITH APPLICABLE FACTORS

#### 1 PHYSICAL CHARACTERISTICS OF THE SITE:

AREA km2	WEIGHTED AREA FACTORS (a+b+c=1)		
	Rural 1 a	Urban 0 b	Dams 0 c
0.65935			

WATER DROP LENGTH (km)  
 L1=URBAN AREA= 0 L2=STREAM FLOW= 0.32 L3=OVERLAND/SHEET= 0.48 L4=PIPE FLOW= 0

TOTAL LENGTH=(L1+L2+L3+L4)= 0.8 km

MAP= 850

#### 1.1 RURAL PART

Refer to tabel 1 for values of Cs Cp and Cv

AVERAGE SLOPE %	Factor			PERMEABILITY	Factor			VEGETATION	Factor		
	%1	2	1*2		%1	2	1*2		%1	2	1*2
Veils and pans (<3%)	0.4	0.03	0.012	Very permeable	0	0.04	0	Thick bush/plantation	0	0.04	0
Flat Areas (3 to 10%)	0.1	0.08	0.008	Permeable	0.7	0.08	0.056	Light bush/farm lands	0.5	0.11	0.055
Hilly (10 to 30%)	0.5	0.16	0.08	Semi permeable	0.3	0.16	0.048	Grass lands	0.5	0.21	0.105
Steep Areas(>30%)	0	0.26	0	Impermeable	0	0.26	0	No vegetation	0	0.28	0
<b>Total</b>	<b>1</b>	<b>0.1</b>	<b>0.104</b>	<b>Total</b>	<b>1</b>	<b>0.104</b>	<b>Total</b>	<b>1</b>	<b>0.16</b>	<b>0.16</b>	

C1= 0.364

CHOOSE Ff Flat and permeable catchments Form Table 3.8 in Tab 11. Lyners doc extract

INFLUENCE OF RETURN PERIOD			
T(a)	F	C1	F*C1
2	0.5	0.364	0.182
5	0.55	0.364	0.20
10	0.6	0.364	0.22
20	0.67	0.364	0.24
50	0.83	0.364	0.30
100	1	0.364	0.36

#### 1.2 URBAN PART

Refer to tabel 2 for Cu

DESCRIPTION	Factor		
	%1	2	1*2
Lawns and parks	0	0.13	0
Residential	0	0.6	0
Industrial	0	0.7	0
Streets	0	0.9	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>

C2= 0

#### COMBINED C VALUES

DESCRIPTION	T(a)	2	5	10	20	50	100
Rural (a*F*C1)		0.18	0.20	0.22	0.24	0.30	0.36
Urban (b*C2)		0.00	0.00	0.00	0.00	0.00	0.00
Dams (c*1)		0.00	0.00	0.00	0.00	0.00	0
<b>COMBINED C VALUES</b>		<b>0.18</b>	<b>0.20</b>	<b>0.22</b>	<b>0.24</b>	<b>0.30</b>	<b>0.36</b>

#### 2 CONCENTRATION TIME (Tc)

URBAN FLOW	STREAM FLOW (Channel)	OVERLAND/SHEET FLOW	PIPE FLOW
Bransby Williams tc1=0.96*L1 <sup>0.5</sup> *(H <sup>0.2</sup> *A1 <sup>0.1</sup> )	USBR tc2=((0.87*L2 <sup>2</sup> )/(1000*S2)) <sup>0.385</sup> S2=H2/0.75L2 (m/m)	Kerby tc3=0.604*(r*L3)/(S3 <sup>0.5</sup> ) <sup>0.467</sup> S3=H3/L3	Manning tc4=1/3600*L4/((1/n)*R <sup>2/3</sup> *S4 <sup>0.5</sup> )
L1= 0.00 km H1= 0.00 m A1= 0.00 km2	H2= 11.50 m S2= 0.05 m/m L2= 0.32 km	H3= 27.00 m S3= 0.06 m/m r= 0.30 L3= 0.48 km	L4= 0.00 km H4= 0.00 m S4= 0.00 m/m d= 0.00 m n= 0.000 tc4= 0.00 h
tc1= 0.00 h	tc2= 0.09 h	tc3= 0.48 h	
TOTAL CONCENTRATION TIME (Tc)= 0.57			

#### 3 RAINFALL INTENSITY

RETURN PERIOD	T (a)	2	5	10	20	50	100
POINT RAINFALL	h (mm)	16	21	28	32	43	55
POINT INTENSITY I=htc	i mm/h	28.20	37.02	49.36	56.41	75.80	96.94883499
AREA REDUCTION FACTOR	a	1	1	1	1	1	1
AVERAGE INTENSITY I=ai	I mm/h	28.20	37.02	49.36	56.41	75.80	96.94883499

OBTAIN THESE FIGURES FROM CCT GRID RAINFALL FOR THE TIME FRAME CLOSEST TO Tc OR INTERPOLATE AS NECESSARY  
 READ FIGURE FROM ATTACHED GRAPH 3.7 ON TAB 12 GRAPHS

#### 4 PEAK RUN-OFF

T(a)	2	5	10	20	50	100
Q=0.278*CIA	0.940875332	1.3583888	1.975838	2.521545889	4.19748	6.468518

Project Number:	C24051
Project Title	Oumeulen and Meulenzicht Development
Date	Wednesday, 04 December 2024
Calculation undertaken	GW
Verification by:	FvE
Catchment:	Meulenzicht



### CALCULATION OF RUN-OFF WITH THE RATIONAL METHOD FOR POST DEVELOPMENT

**NOTE:**  
**1. ALTER ONLY GREEN CELLS**  
 2. CELL No'S F26, F45 & L69 CONTAIN NOTES WITH APPLICABLE FACTORS

#### 1 PHYSICAL CHARACTERISTICS OF THE SITE:

AREA km2	WEIGHTED AREA FACTORS (a+b+c=1)		
	Rural 0.3 a	Urban 0.7 b	Dams 0 c
0.65935			

WATER DROP LENGTH (km)  
 L1=URBAN AREA= 0.21 L2=STREAM FLOW = 0.59 L3=OVERLAND/SHEET = 0.02 L4=PIPE FLOW = 0.065

TOTAL LENGTH=(L1+L2+L3+L4)= 0.885 km

MAP= 850

#### 1.1 RURAL PART

Refer to label 1 for values of Cs Cp and Cv

AVERAGE SLOPE %	Factor %1	Cs 2	1*2	PERMEABILITY	Factor %1	Cp 2	1*2	VEGETATION	Factor %1	Cv 2	1*2
Vleis and pans (<3%)	0	0.03	0	Very permeable	0	0.04	0	Thick bush/plantation	0.1	0.04	0.004
Flat Areas (3 to 10%)	0.5	0.08	0.04	Permeable	0.7	0.08	0.056	Light bush/farm lands	0.2	0.11	0.022
Hilly (10 to 30%)	0.5	0.16	0.08	Semi permeable	0.3	0.16	0.048	Grass lands	0.7	0.21	0.147
Steep Areas(>30%)	0	0.26	0	Impermeable	0	0.26	0	No vegetation	0	0.28	0
<b>Total</b>	<b>1</b>	<b>0.12</b>	<b>0.104</b>	<b>Total</b>	<b>1</b>	<b>0.104</b>	<b>0.173</b>	<b>Total</b>	<b>1</b>	<b>0.173</b>	

C1= 0.397

**CHOOSE Ft** Flat and permeable catchments Form Table 3.8 in Tab 11. Lyners doc extract

INFLUENCE OF RETURN PERIOD			
T(a)	F	C1	F*C1
2	0.5	0.397	0.1985
5	0.55	0.397	0.22
10	0.6	0.397	0.24
20	0.67	0.397	0.27
50	0.83	0.397	0.33
100	1	0.397	0.40

#### 1.2 URBAN PART

Refer to label 2 for Cu

DESCRIPTION	Factor %1	Cu 2	1*2
Lawns and parks	0.7	0.13	0.091
Residential	0.05	0.3	0.015
Industrial	0	0.65	0
Streets	0.25	0.8	0.2
<b>Total</b>	<b>1</b>	<b>0.306</b>	

C2= 0.306

#### COMBINED C VALUES

DESCRIPTION	T(a)	2	5	10	20	50	100
Rural (a*F*C1)		0.06	0.07	0.07	0.08	0.10	0.12
Urban (b*C2)		0.21	0.21	0.21	0.21	0.21	0.21
Dams (c*1)		0.00	0.00	0.00	0.00	0.00	0
<b>COMBINED C VALUES</b>		<b>0.27</b>	<b>0.28</b>	<b>0.29</b>	<b>0.29</b>	<b>0.31</b>	<b>0.33</b>

#### 2 CONCENTRATION TIME (Tc)

URBAN FLOW		STREAM FLOW (Channel)		OVERLAND/SHEET FLOW		PIPE FLOW	
Bransby Williams		USBR		Kerby		Manning	
tc1=0.96*L1*1.05/(H*0.2*A1*0.1)		tc2=(0.87*L2*2)/(1000*S2)*0.385		tc3=0.604*((L3)/(S3*0.5))^0.467		tc4=1/3600*L4/(1/h*R^2/3*S4^0.5)	
L1=	0.21 km	H2=	27.00 m	H3=	0.50 m	L4=	0.07 km
H1=	4.00 m	S2=	0.06 m/m	S3=	0.03 m/m	H4=	4.00 m
A1=	0.00 km2	L2=	0.59 km	r=	0.40	S4=	0.06 m/m
				L3=	0.02 km	d=	0.38 m
						n=	0.15
						tc4=	0.01 h
tc1=	0.22 h	tc2=	0.13 h	tc3=	0.15 h		
TOTAL CONCENTRATION TIME (Tc)=							

#### 3 RAINFALL INTENSITY

RETURN PERIOD	T (a)	2	5	10	20	50	100
POINT RAINFALL	h (mm)	16	20	28	32	45	51
POINT INTENSITY i=h*tc	i mm/h	31.56	39.45	55.24	63.13	88.77	100.61
AREA REDUCTION FACTOR	a	1	1	1	1	1	1
AVERAGE INTENSITY I=ai	i mm/h	31.56	39.45	55.24	63.13	88.77	100.61

OBTAIN THESE FIGURES FROM CCT GRID RAINFALL FOR THE TIME FRAME CLOSEST TO Tc OR INTERPOLATE AS NECESSARY  
 READ FIGURE FROM ATTACHED GRAPH 3.7 ON TAB 12 GRAPHS

#### 4 PEAK RUN-OFF

T(a)	2	5	10	20	50	100
Q=0.278*CIa	1.58379208	2.0228062	2.892221	3.401863892	5.093947	6.146523
	m³/s					

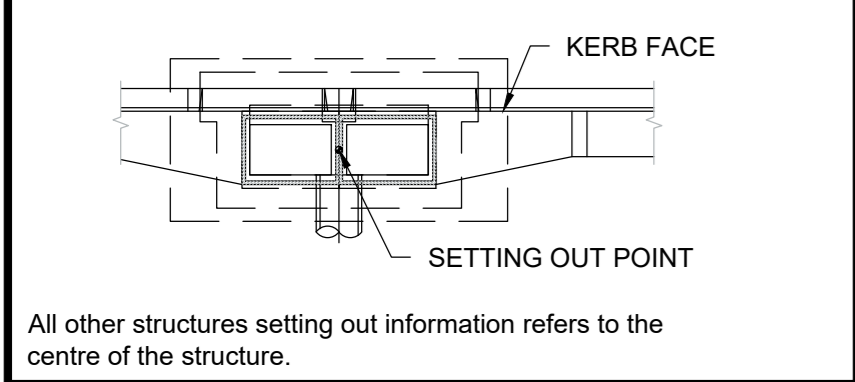


# **ANNEXURE E**

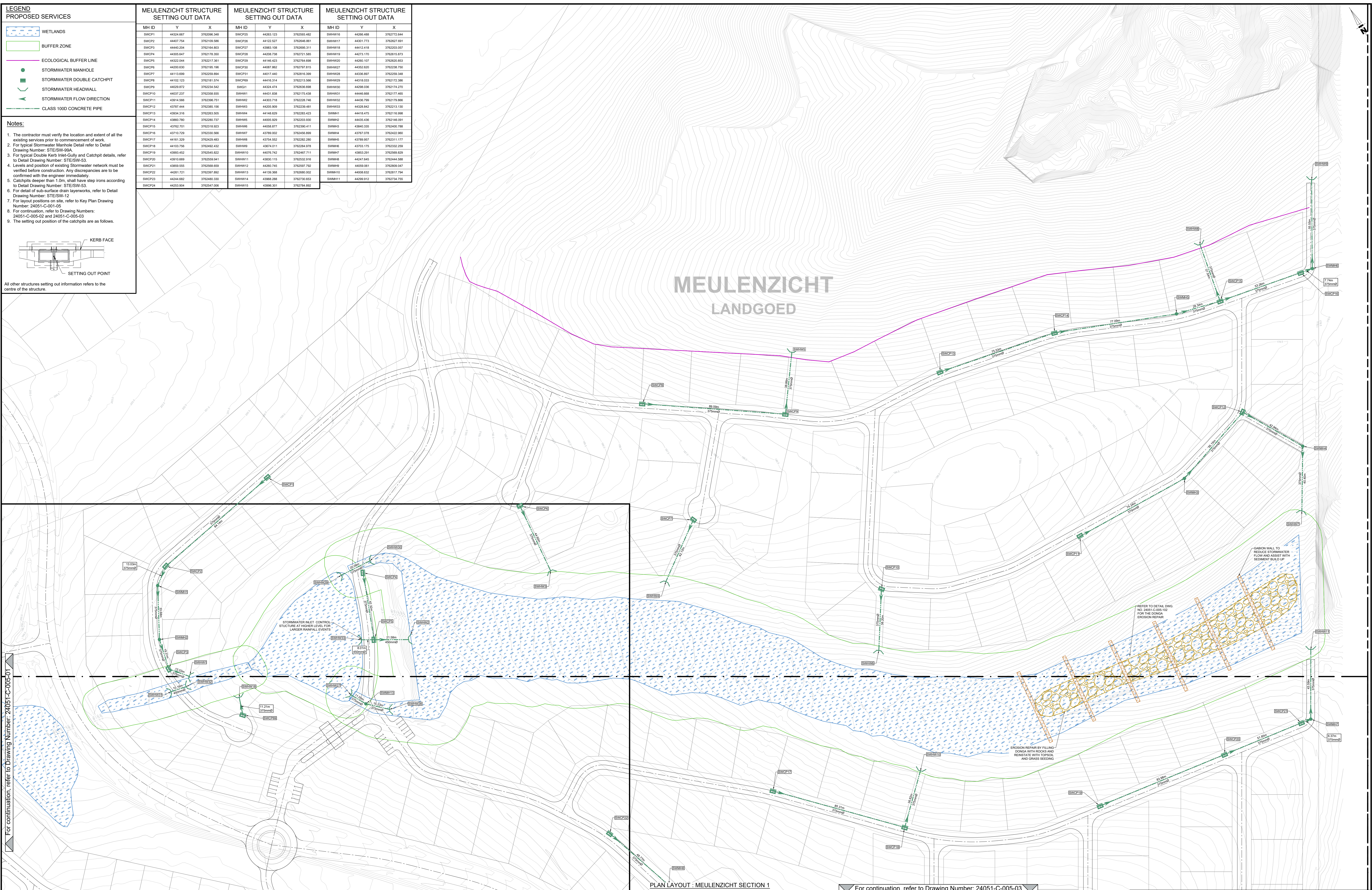
## **Stormwater Layout Plan**

LEGEND	
PROPOSED SERVICES	
	WETLANDS
	BUFFER ZONE
	ECOLOGICAL BUFFER LINE
	STORMWATER MANHOLE
	STORMWATER DOUBLE CATCHPIT
	STORMWATER HEADWALL
	STORMWATER FLOW DIRECTION
	CLASS 1000 CONCRETE PIPE

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



MEULENZICHT STRUCTURE SETTING OUT DATA				MEULENZICHT STRUCTURE SETTING OUT DATA				MEULENZICHT STRUCTURE SETTING OUT DATA			
MH ID	Y	X		MH ID	Y	X		MH ID	Y	X	
SWCP1	4424.867	376296.348	SWCP25	44205.123	376294.482	SWHW19	44206.488	376277.641			
SWCP2	4407.754	376295.196	SWCP26	44212.527	376294.561	SWHW17	44201.773	376282.691			
SWCP3	4446.204	376264.803	SWCP27	43983.108	376290.311	SWHW18	44412.418	376293.057			
SWCP4	44305.647	3762178.350	SWCP28	44208.738	376271.585	SWHW19	44273.170	3762815.873			
SWCP5	44322.044	3762217.361	SWCP29	44146.423	376274.698	SWHW20	44260.107	3762820.853			
SWCP6	44206.630	3762195.196	SWCP30	44087.862	3762787.815	SWHW27	44362.620	376228.750			
SWCP7	44113.899	376229.894	SWCP31	44017.440	3762816.399	SWHW28	44336.897	376229.340			
SWCP8	44102.125	3762191.574	SWCP32	44182.314	3762713.598	SWHW29	44311.033	3762713.598			
SWCP9	44229.872	376234.542	SWD1	44268.474	376268.699	SWHW30	44268.096	3762142.270			
SWCP10	44207.237	376299.935	SWHW1	44431.838	3762175.438	SWHW31	44446.998	3762177.465			
SWCP11	43914.566	376296.751	SWHW2	44303.718	376228.746	SWHW32	44436.799	3762179.866			
SWCP12	43787.444	376285.156	SWHW3	44205.909	376229.481	SWHW33	44288.842	3762213.130			
SWCP13	43934.316	376283.505	SWHW4	44148.629	376283.423	SWHW41	44418.475	3762116.998			
SWCP14	43869.780	3762280.737	SWHW5	44005.929	3762203.930	SWHW42	44435.436	3762148.091			
SWCP15	43792.791	3762191.629	SWHW6	44028.877	3762294.411	SWHW43	44340.336	3762487.788			
SWCP16	43712.729	376233.368	SWHW7	43799.002	376246.899	SWHW44	44287.078	3762432.260			
SWCP17	44181.329	376249.483	SWHW8	43754.052	376282.280	SWHW45	43789.987	3762311.177			
SWCP18	44103.756	3762492.432	SWHW9	44074.011	376284.978	SWHW46	43703.175	3762332.259			
SWCP19	43953.452	3762545.822	SWHW10	44076.742	376287.711	SWHW47	43853.291	3762589.829			
SWCP20	43910.669	3762559.941	SWHW11	43830.115	376252.916	SWHW48	44247.645	3762444.588			
SWCP21	43859.555	3762558.659	SWHW12	44265.745	3762597.792	SWHW49	44059.061	3762809.047			
SWCP22	44261.771	3762297.882	SWHW13	44178.368	3762680.002	SWHW10	44068.652	3762877.794			
SWCP23	44244.682	3762460.330	SWHW14	43968.288	3762730.653	SWHW11	44299.912	3762734.795			
SWCP24	44253.904	3762547.006	SWHW15	43966.301	3762784.892						



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

REV	ISSUED FOR INFORMATION	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:	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

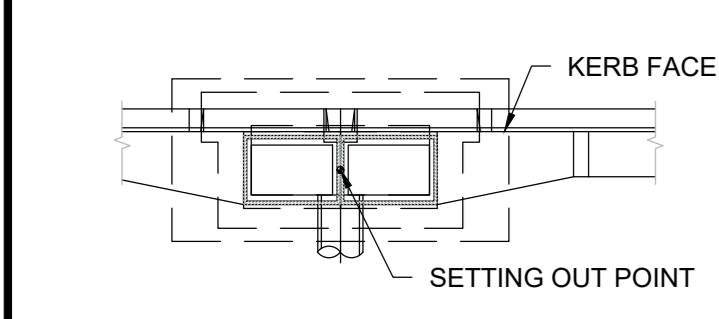
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CONTRACT No.		PROJECT No.	24051 CG	
DRAWING No.	24051-C-005-02		REV	A
COORDINATE SYSTEM: WGS84 / Lo 2°				



For continuation, refer to Drawing Number: 24051-C-005-02

For continuation, refer to Drawing Number: 24051-C-005-01

- 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 1000 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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All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

REV	DESCRIPTION	DATE	REV'D	CHK'D
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:
		2025-02-20
APPROVED	CLIENT:	DATE:

**CLIENT**

**ATTERBURY**  
*It's a matter of association*

<b>PROJECT</b>	OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)
<b>TITLE</b>	STORMWATER LAYOUT: MEULENZICHT SECTION 2

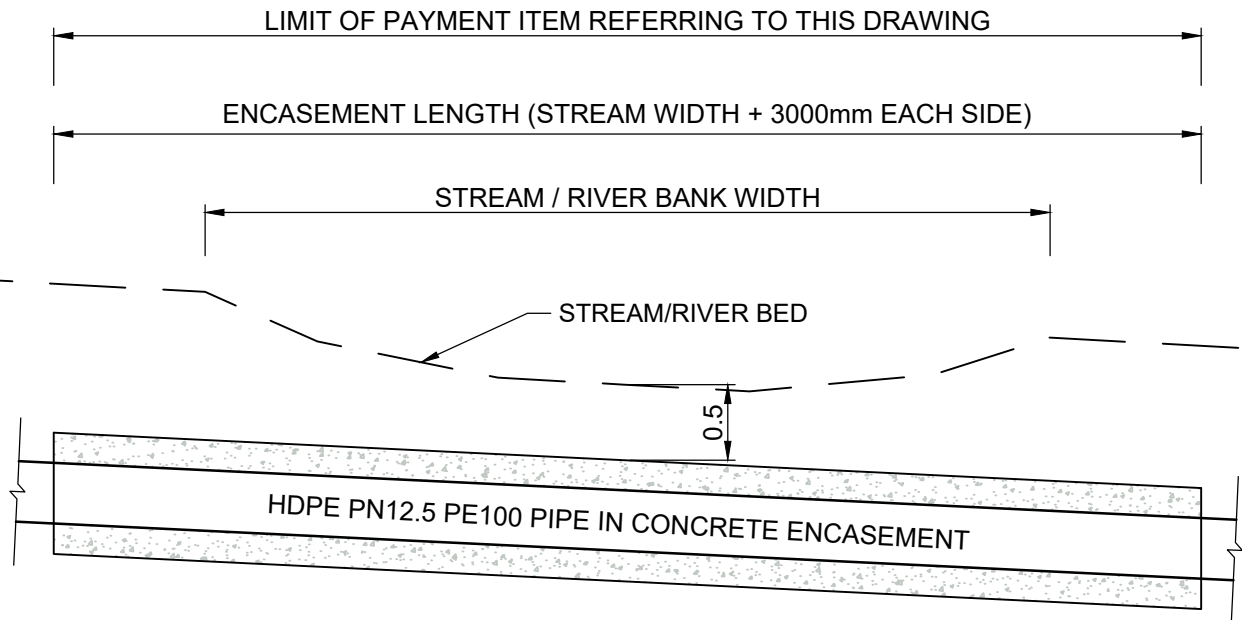
SCALE	1:750	ON A0	SHEET	1 OF 1
CONTRACT No.		PROJECT No.	24051 CG	
DRAWING No.	24051-C-005-03			REV
COORDINATE SYSTEM	WGS84 / Lo 23°			



# ANNEXURE F

## Stormwater Details



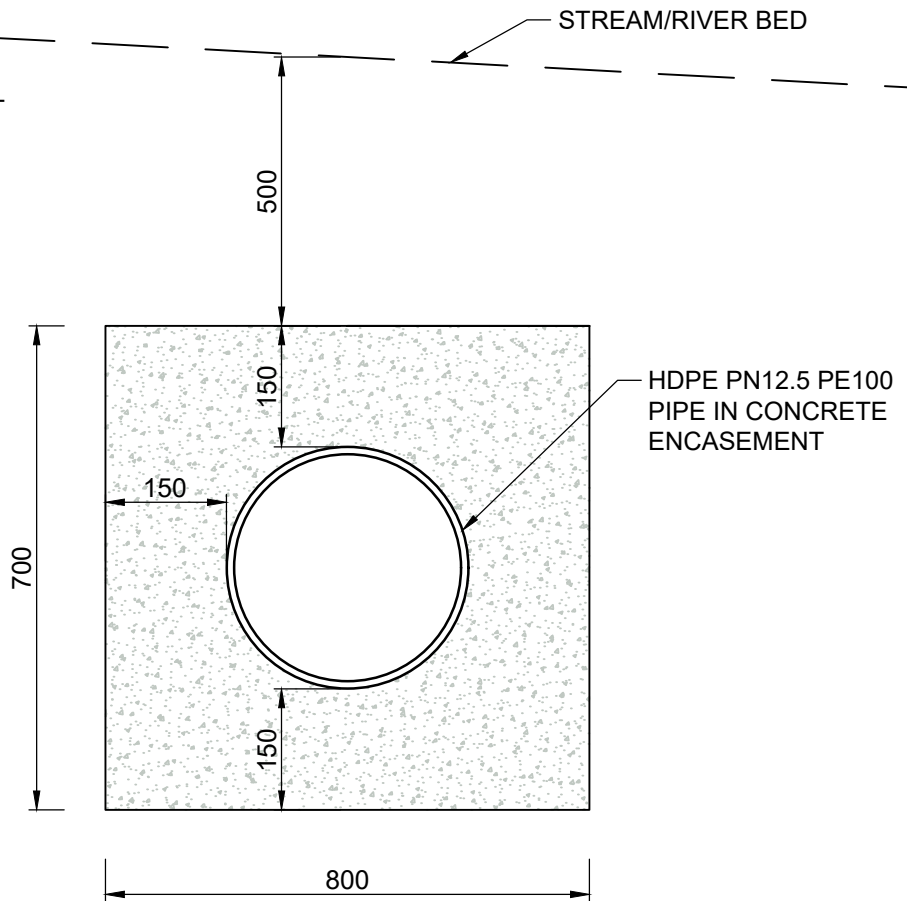


**WATER CROSSING - LONGITUDINAL SECTION**

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  
email: george@lyniers.co.za

TITLE

**WATER CROSSING DETAIL**

PROJECT No.  
C24051

SCALE on A4  
ON\_DRAWING

DRAWING No.  
**24051-C-003-01**

REV  
A

APPROVED :  
FVE

DRAWN  
GW

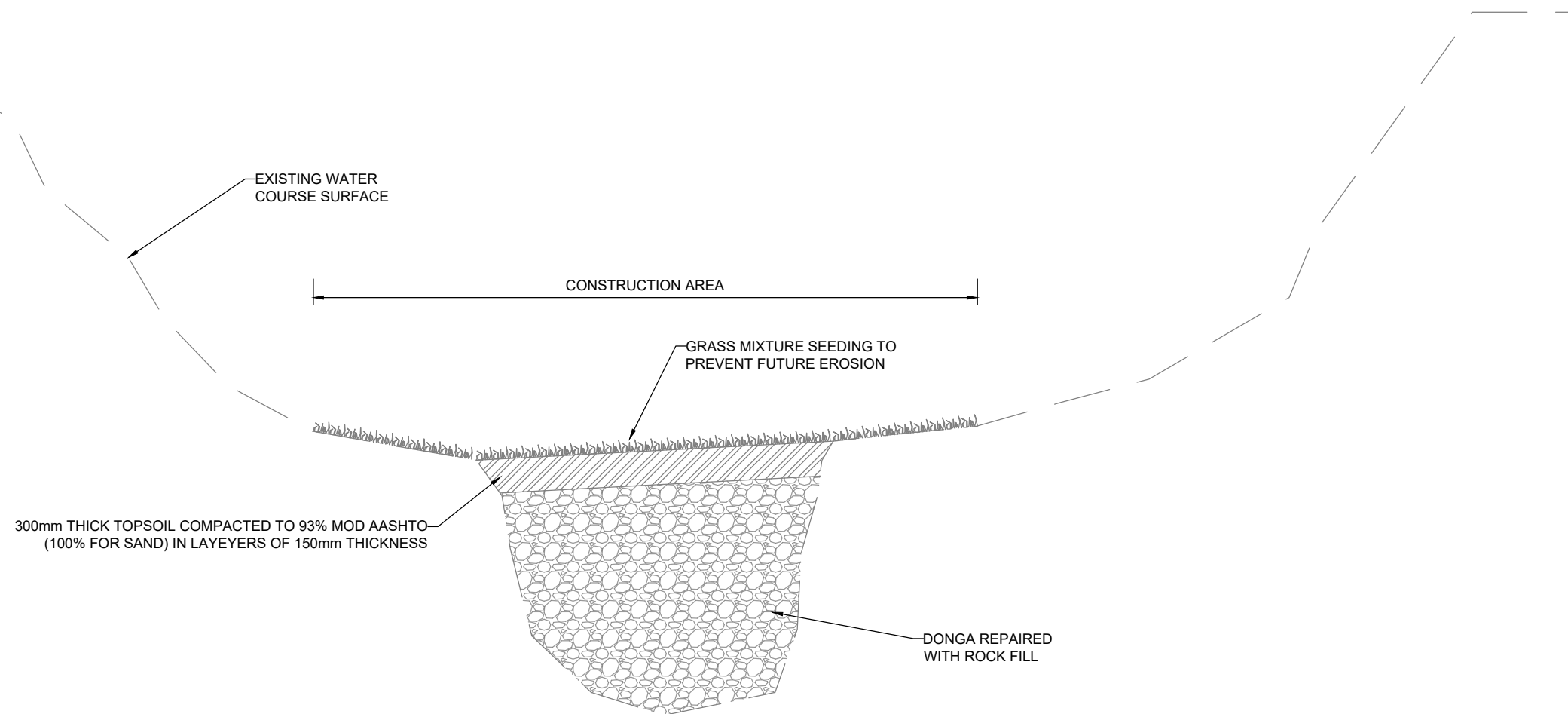
DATE  
'25-02

CHECKED  
FVE

DATE  
'25-02

**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

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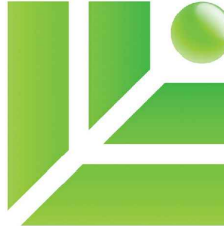
All dimensions must be verified on site before the works commence. Refer any discrepancies to the Engineer.

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

CONSULTING ENGINEERS



**LYNERS**

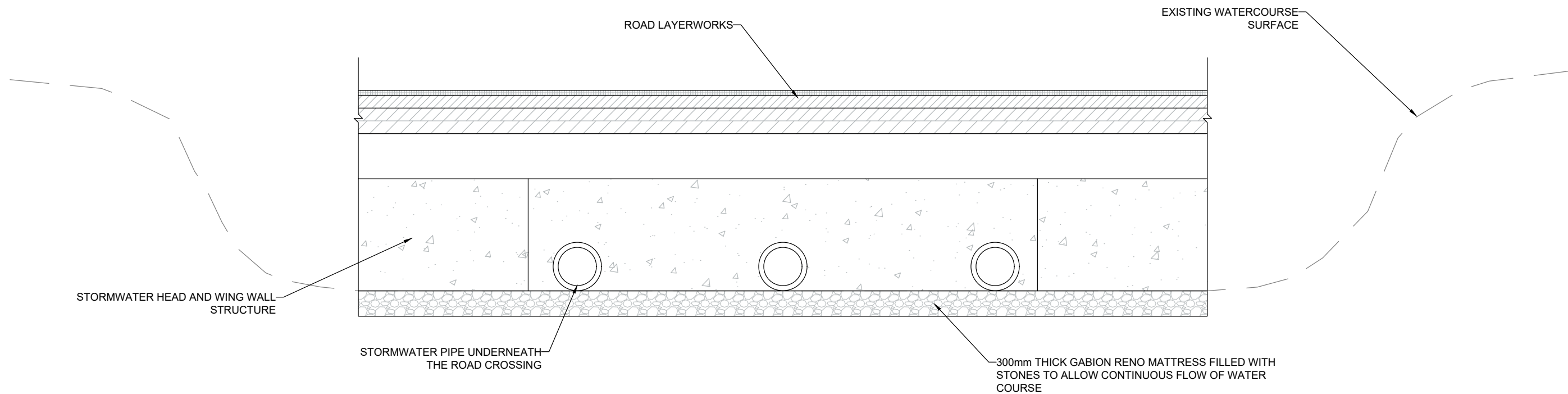
PO Box 757  
GEORGE  
6530

Tel: 044 887 0223/Fax: 044 887 0741  
email: george@lyners.co.za

PROJECT  
**OUMEULEN VILLAGE AND MEULENZICHT  
LANDGOED DEVELOPMENT (GEORGE)**

TITLE  
**TYPICAL DETAIL OF  
DONGA EROSION REPAIR**

SCALE 1:50	on A3	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

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

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

CONSULTING ENGINEERS

### LYNERS

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GEORGE  
6530

Tel: 044 887 0223/Fax: 044 887 0741  
email: george@lyners.co.za

<p>PROJECT</p> <p style="text-align: center;">OUMEULEN VILLAGE AND MEULENZICHT LANDGOED DEVELOPMENT (GEORGE)</p>	<p>SCALE on A3</p> <p style="text-align: center;">1:50</p> <p>SHEET</p> <p style="text-align: center;">1 OF 1</p>
<p>TITLE</p> <p style="text-align: center;">TYPICAL DETAIL OF ROAD STREAM CROSSING</p>	<p>CONTRACT No.</p> <p style="text-align: center;">24051CG</p> <p>PROJECT No.</p> <p style="text-align: center;">24051CG</p>
<p>DRAWING No.</p> <p style="text-align: center;">24051-C-005-103</p> <p style="text-align: right;">REV <span style="border: 1px solid black; padding: 2px;">A</span></p>	
<p>COORDINATE SYSTEM: WGS84 / Lo 23°</p>	



# **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

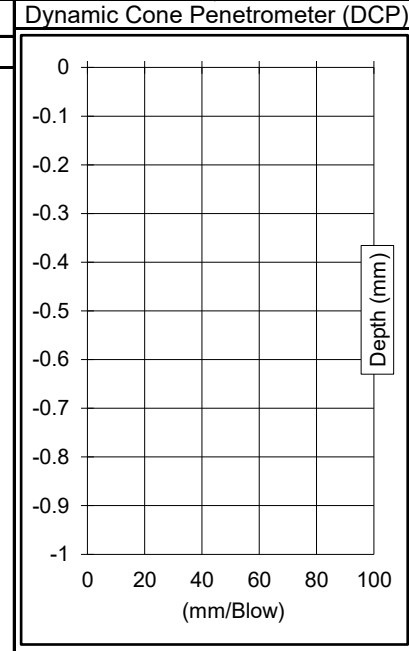
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqua.co.za

R-PROF-1-5

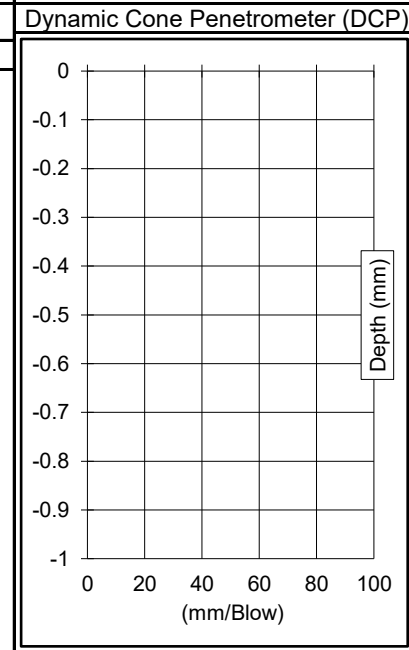
Jan-22

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)			



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.			





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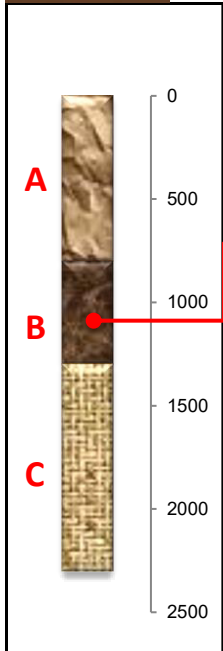
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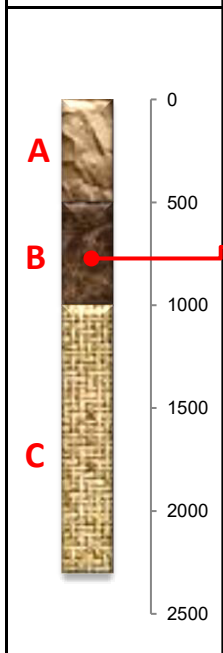
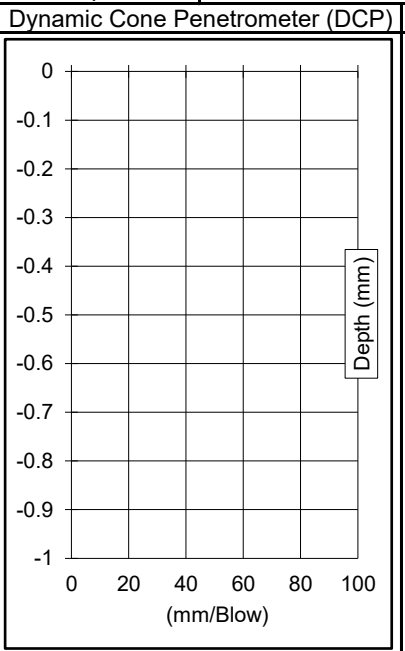
R-PROF-1-5

Jan-22

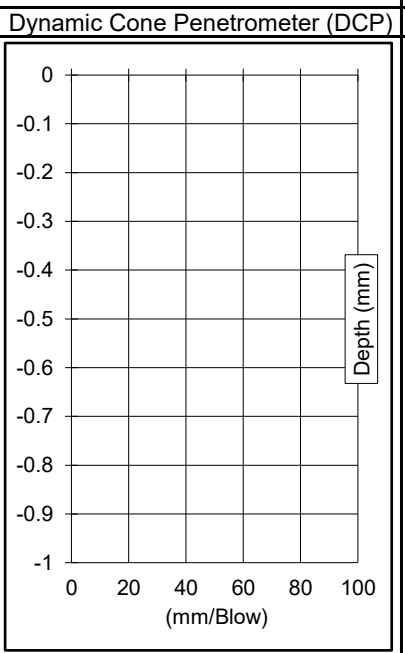
Customer :	Neil Lyners P O Box 757 George 6530
Project :	Aan de Meulen Development - George
Date Reported :	22/07/24



<b>TP3</b>		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.		
(1300 to 2300)	Slightly moist to moist, light reddish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.		



<b>TP4</b>		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.		
(1000 to 2300)	Slightly moist to moist, light reddish orange, firm, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.		





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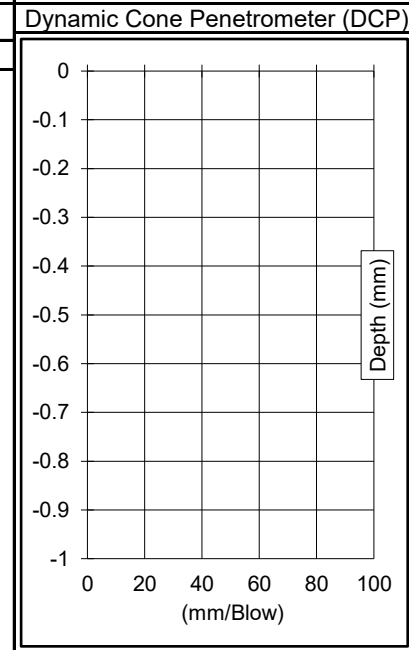
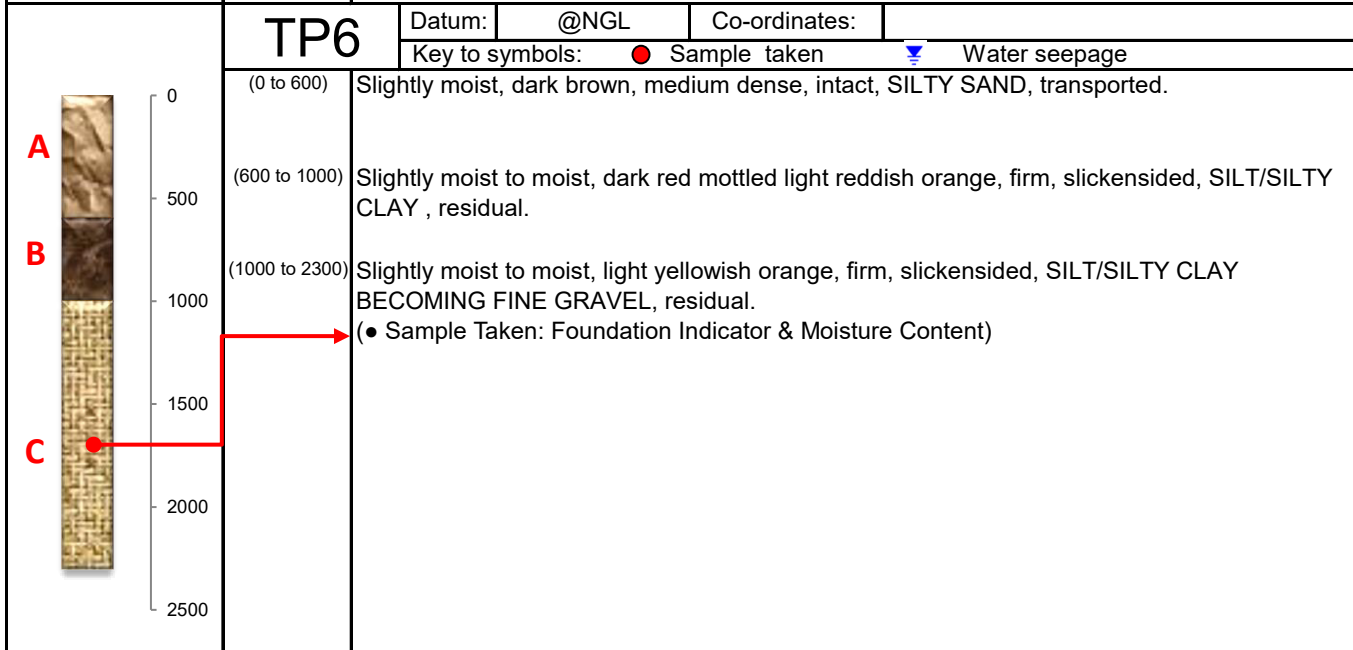
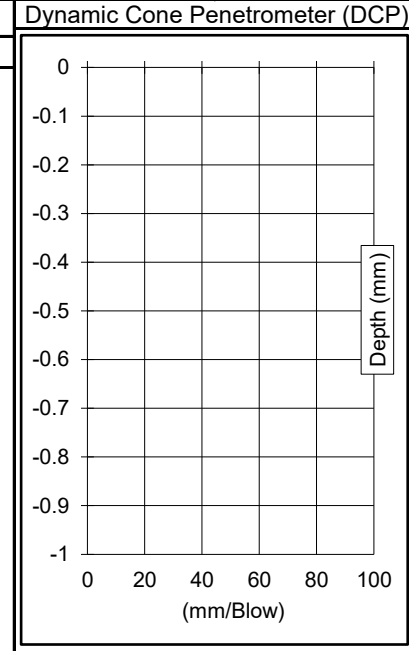
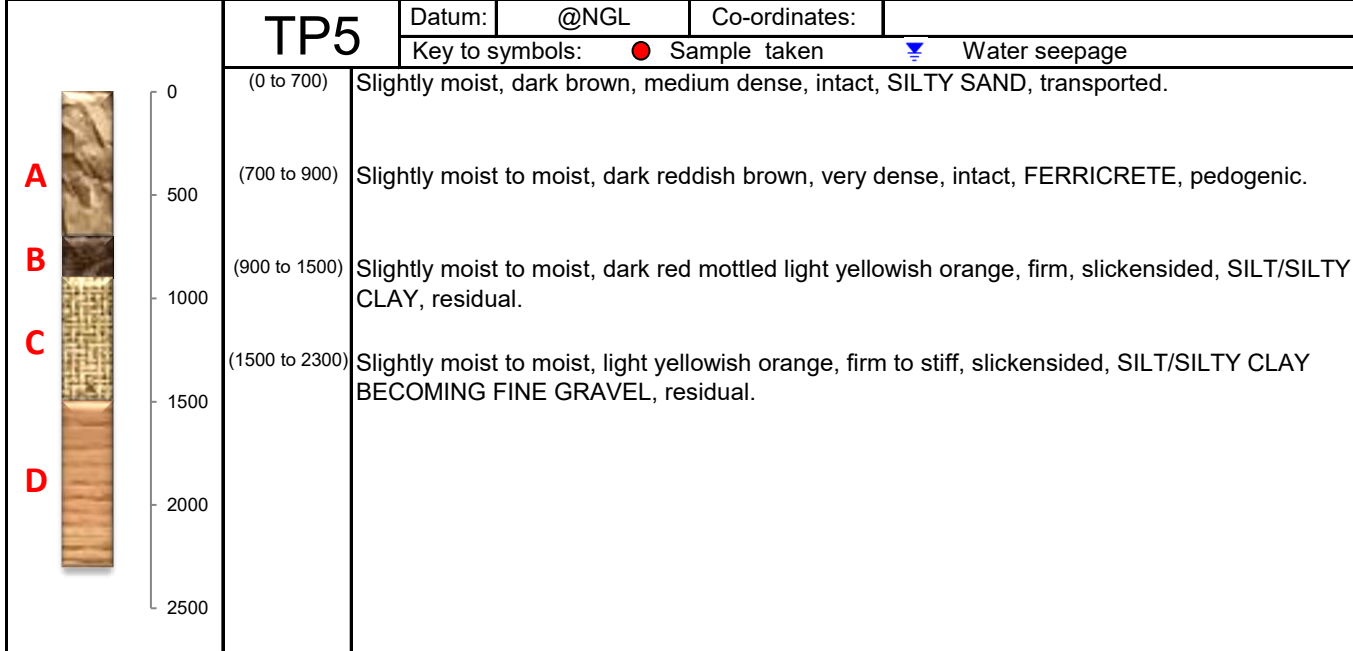
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Jan-22

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

## TP7

Datum:	@NGL	Co-ordinates:	
Key to symbols: ● Sample taken    ▽ Water seepage			

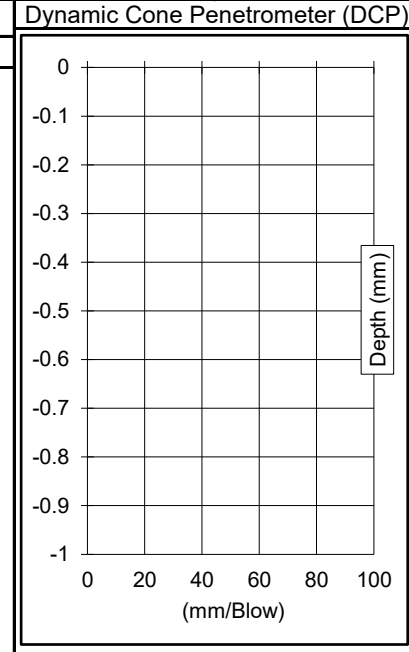
**A**

**B**

**C**

**D**

0	(0 to 500)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
500	(500 to 700)	Slightly moist to moist, dark reddish brown, very dense, intact, FERRICRETE, pedogenic.
1000	(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)
1500	(1200 to 2300)	Slightly moist to moist, light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.
2000		
2500		



## TP8

Datum:	@NGL	Co-ordinates:	
Key to symbols: ● Sample taken    ▽ Water seepage			

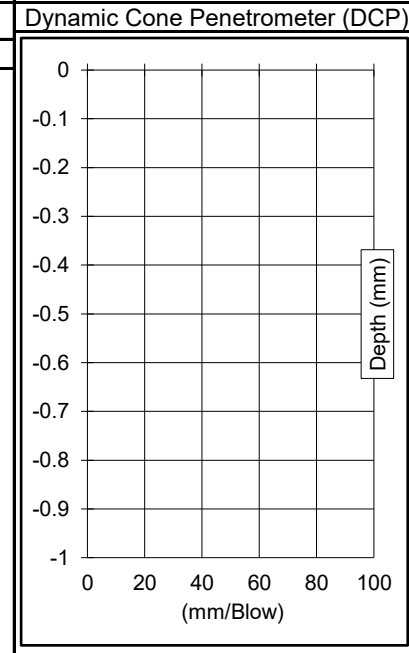
**A**

**B**

**C**

**D**

0	(0 to 800)	Slightly moist, dark brown, medium dense, intact, SILTY SAND, transported.
500	(800 to 1100)	Slightly moist to moist, dark reddish brown, very dense, intact, FERRICRETE , pedogenic.
1000	(1100 to 1600)	Slightly moist to moist, dark red mottled light yellowish orange, firm, slickensided, SILT/SILTY CLAY, residual.
1500	(1600 to 2300)	Slightly moist to moist, light yellowish orange, firm to stiff, slickensided, SILT/SILTY CLAY BECOMING FINE GRAVEL, residual.
2000		
2500		





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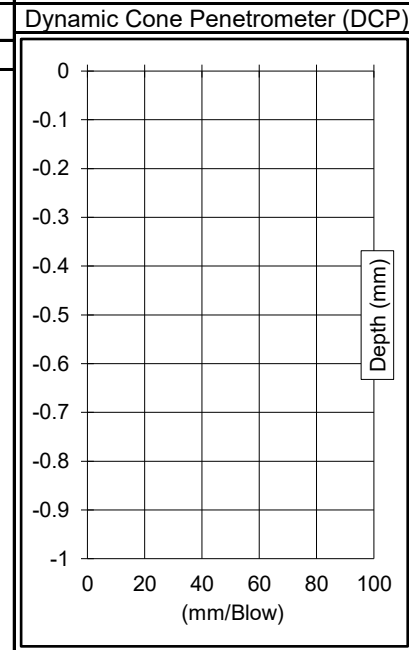
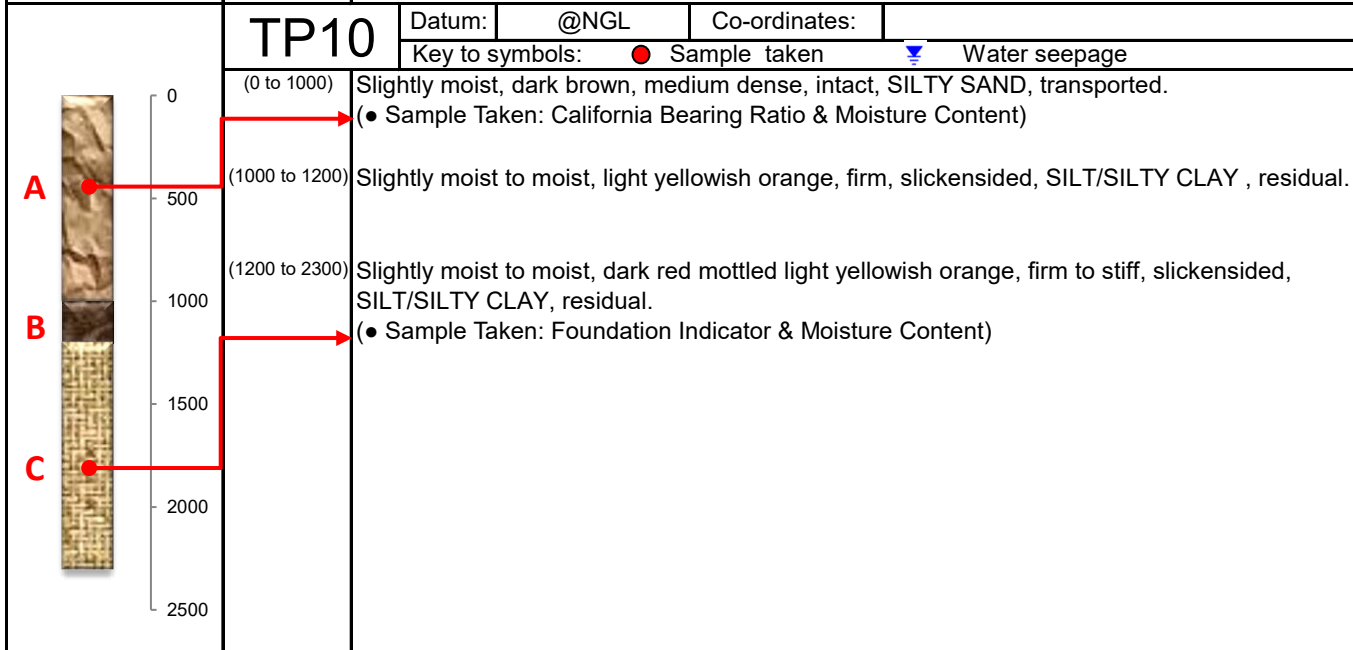
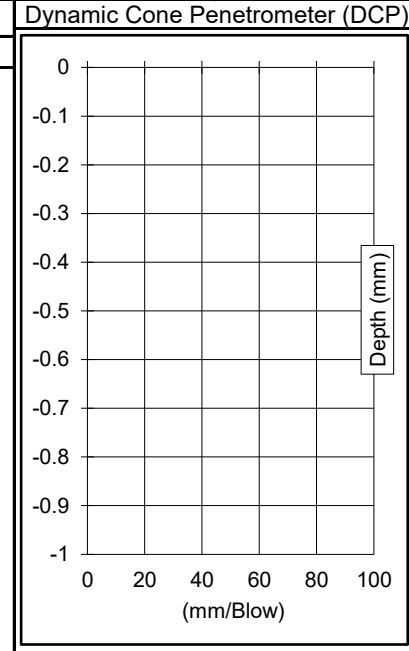
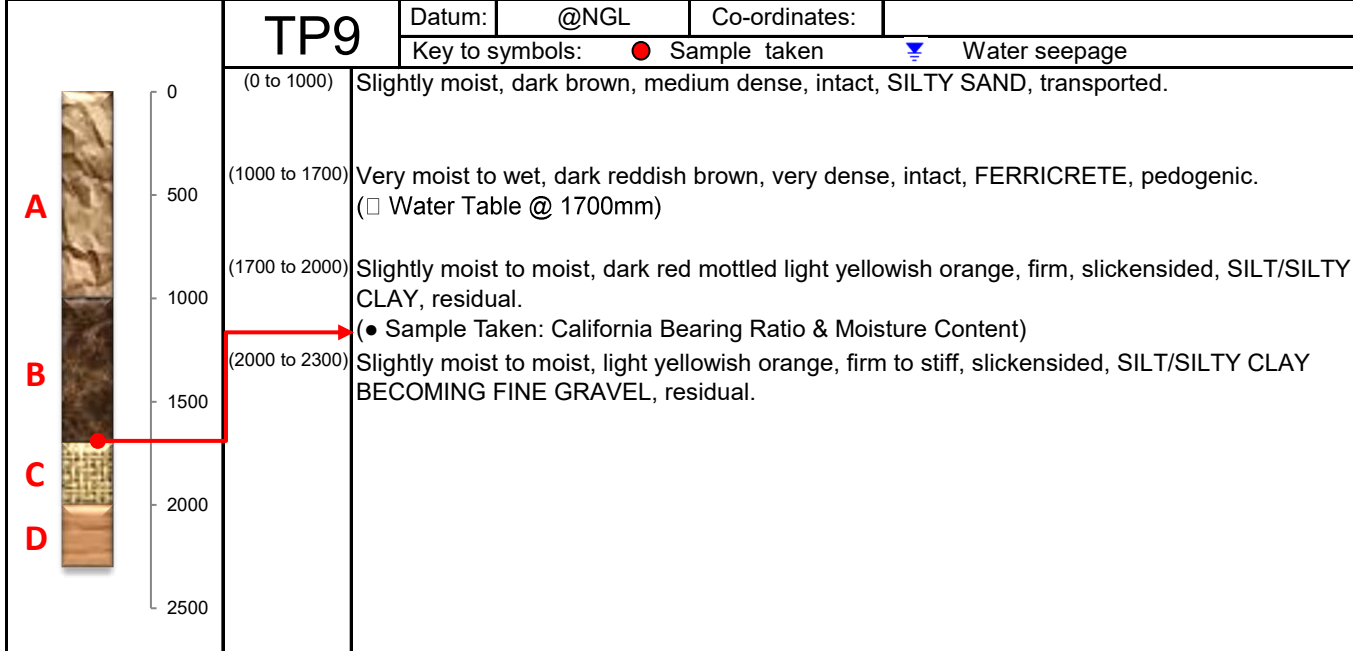
6 Mirrorball Street, George : PO Box 3186, George Industria, 6536

Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqua.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





Customer :	Neil Lyners	Project :	Aan de Meulen Development - George
	P O Box 757	Date Received :	28/06/24
	George	Date Reported :	22/07/24
	6530	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:	TP 4	TRH 14:		
Depth (mm)		1100-2000	Not	500-1000	G4 Base		
Sample No		88818	Classified	88820	(Natural)		
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		100			
	63 mm	100	Opinion	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/m <sup>3</sup> )	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			

- 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.

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- 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.
- 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.
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Customer :	Neil Lyners	Project :	Aan de Meulen Development - George
	P O Box 757	Date Received :	28/06/24
	George	Date Reported :	22/07/24
	6530	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:	TP 10	TRH 14:	
Depth (mm)		700-1200	Not	0-1000	Not	
Sample No		88822	Classified	88823	Classified	
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/m³)	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		

- 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.

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- 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.
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Registration No. 95/07742/07

Materials Testing Laboratory

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



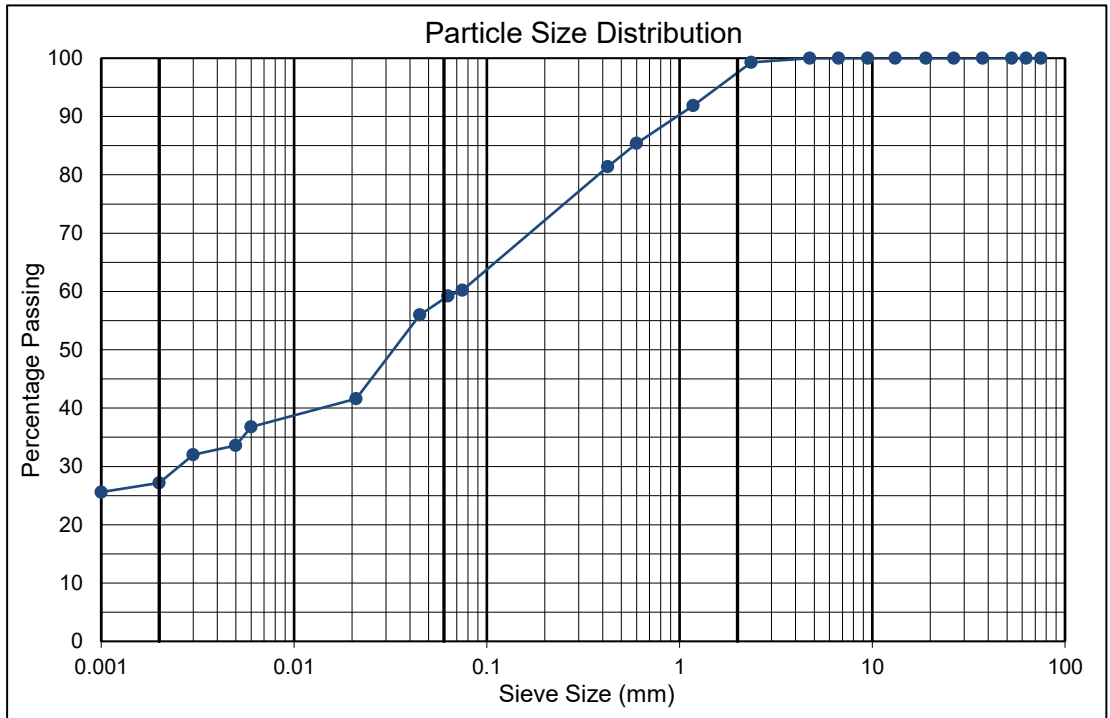
T0347

Customer :	Neil Lyners	Project :	Aan de Meulen Development - George
	P O Box 757	Date Received :	28/06/24
	George	Date Reported :	22/07/24
	6530	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	Trial Pit Light Yellowish Orange Silt/Silty Clay Becoming Fine Gravel Insitu

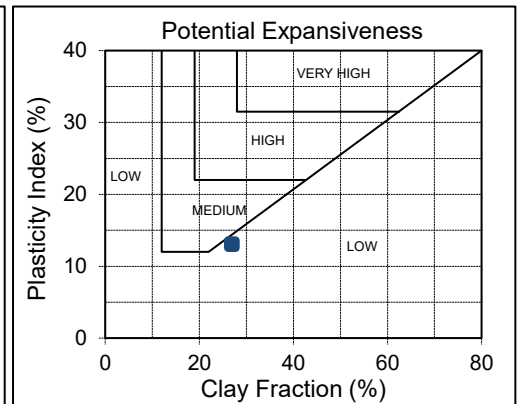
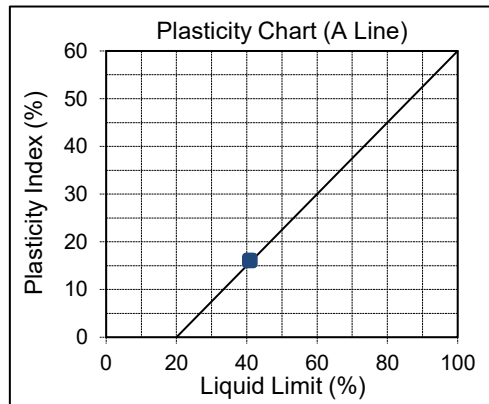
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	99
1.18mm	92
0.6mm	85
0.425mm	81
0.075mm	60
0.063mm	59
0.045mm	56
0.021mm	42
0.006mm	37
0.005mm	34
0.003mm	32
0.002mm	27
0.001mm	26



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.

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# OUTENIQUA LAB (Pty) Ltd.

R-FIND-1-6 Jan-22



Registration No. 95/07742/07

## Materials Testing Laboratory

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

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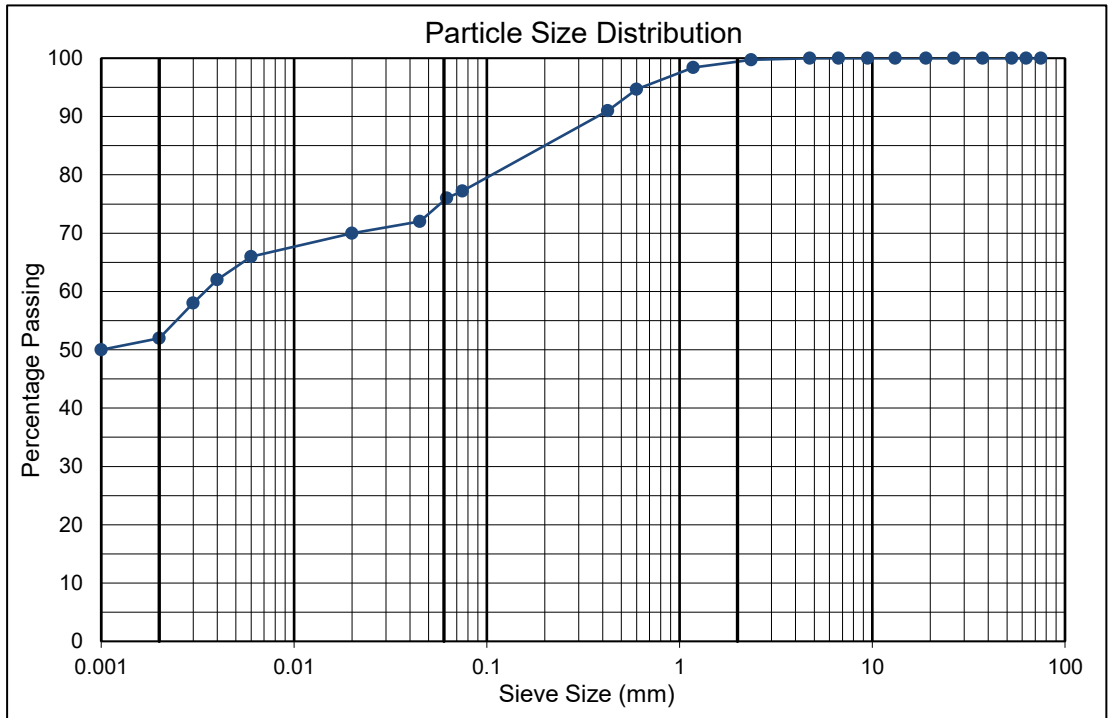
T0347

Customer :	Neil Lyners	Project :	Aan de Meulen Development - George
	P O Box 757	Date Received :	28/06/24
Attention :	George	Date Reported :	22/07/24
	6530	Req. Number :	2335/24
	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	Trial Pit
Colour	Dark Red Mottled Light Yellowish Orange
Soil Type	Silty/Silt Clay
Classification	Insitu

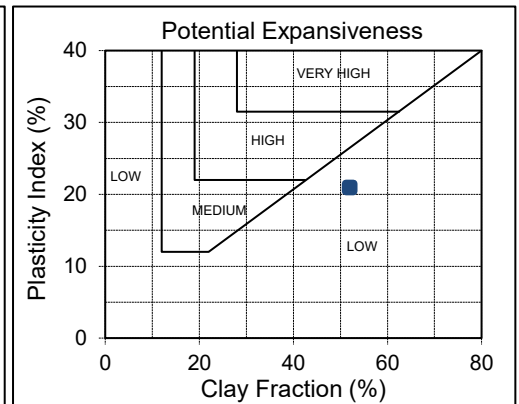
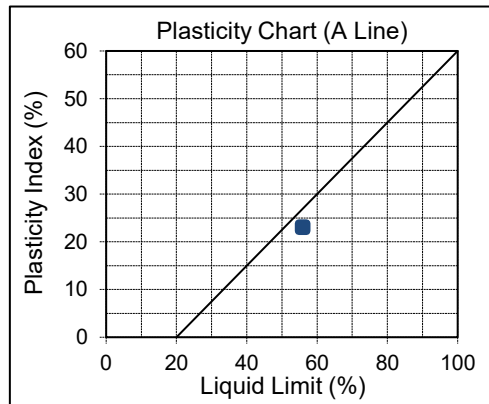
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	100
1.18mm	98
0.6mm	95
0.425mm	91
0.075mm	77
0.062mm	76
0.045mm	72
0.02mm	70
0.006mm	66
0.004mm	62
0.003mm	58
0.002mm	52
0.001mm	50



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.

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Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)



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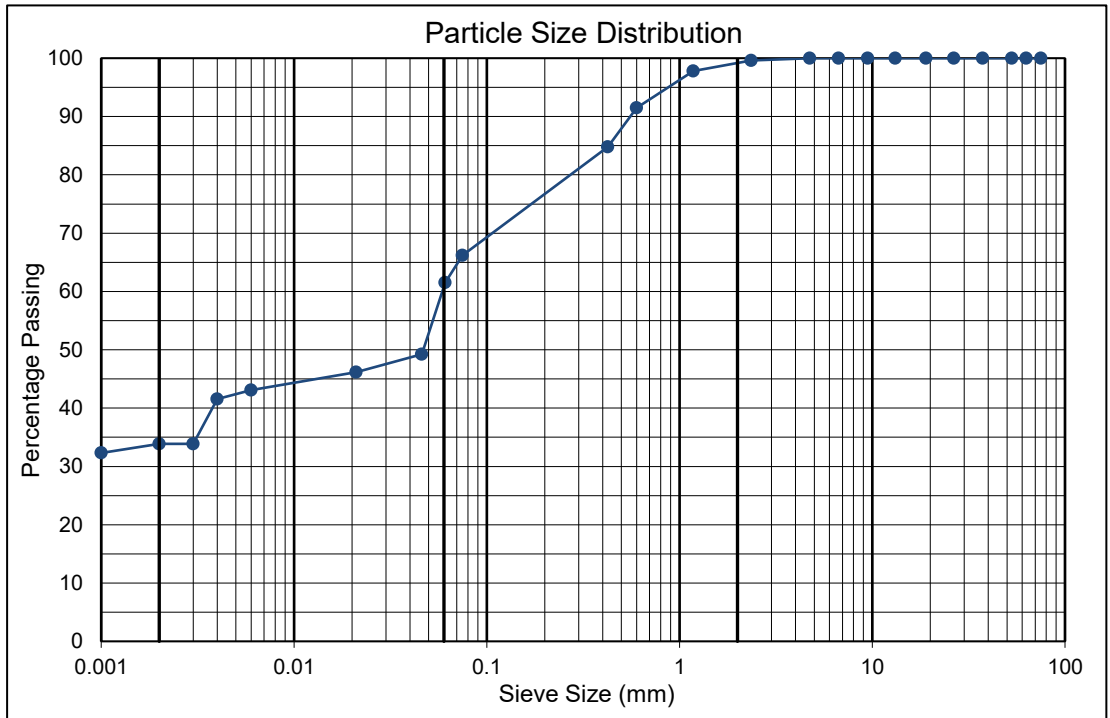
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Customer :	Neil Lyners P O Box 757 George 6530	Project :	Aan de Meulen Development - George
	Attention : F van Eck	Date Received :	28/06/24
		Date Reported :	22/07/24
		Req. Number :	2335/24
		No. of Pages :	3 of 4

## TEST REPORT FOUNDATION INDICATOR - (ASTM Method D422)

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

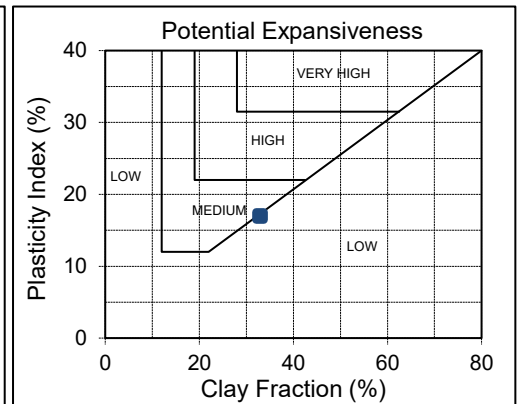
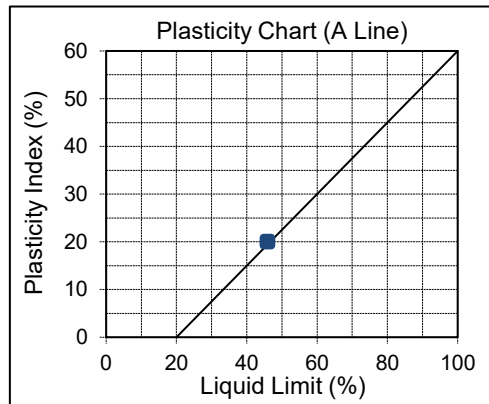
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	100
1.18mm	98
0.6mm	92
0.425mm	85
0.075mm	66
0.061mm	62
0.046mm	49
0.021mm	46
0.006mm	43
0.004mm	42
0.003mm	34
0.002mm	34
0.001mm	32



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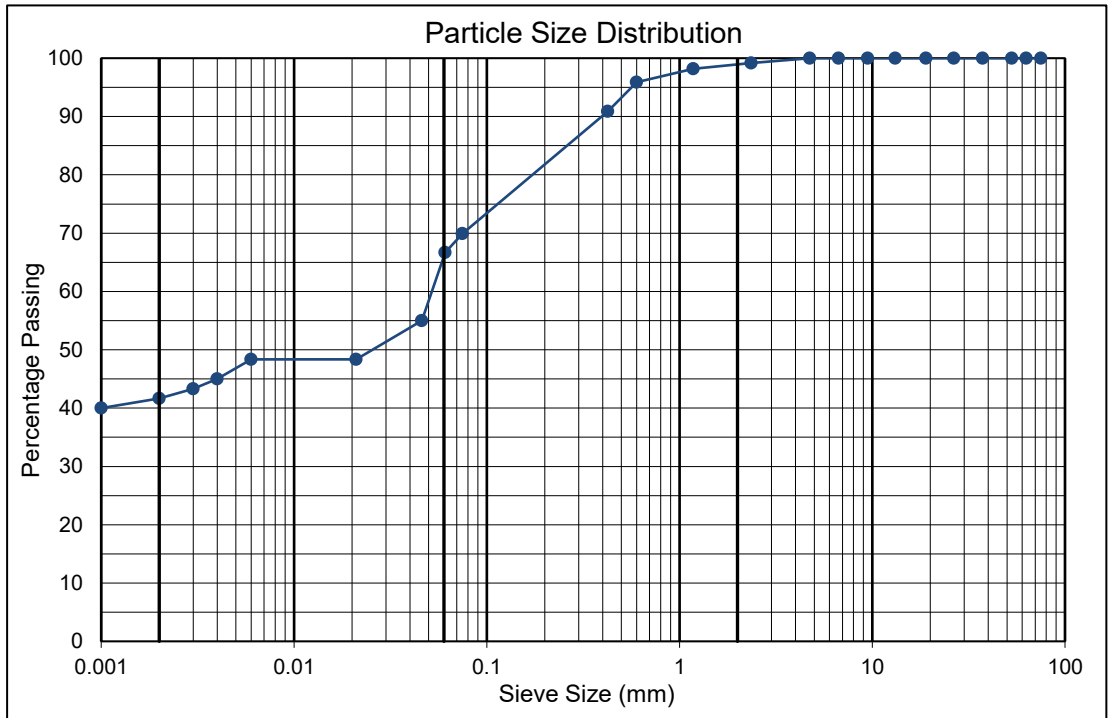
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Customer :	Neil Lyners P O Box 757 George 6530	Project : Date Received : Date Reported : Req. Number : No. of Pages :	Aan de Meulen Development - George 28/06/24 22/07/24 2335/24 4 of 4
	Attention : F van Eck		

## TEST REPORT FOUNDATION INDICATOR - (ASTM Method D422)

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

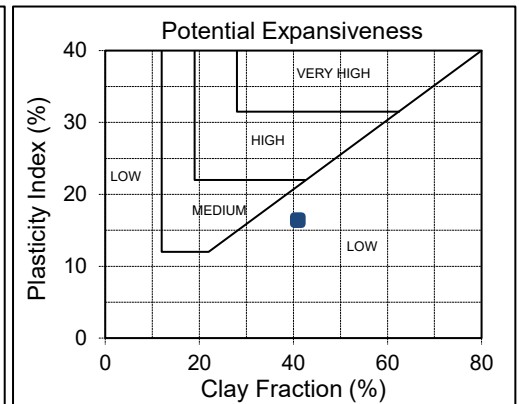
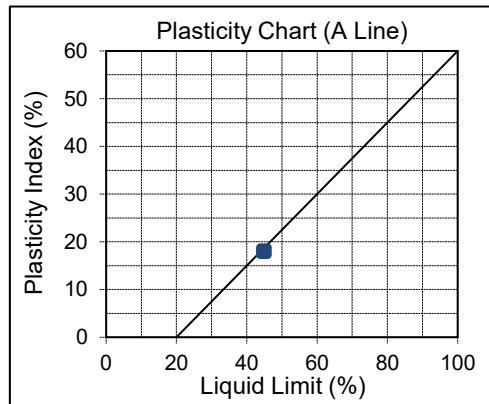
75.0mm	100
63.0mm	100
53.0mm	100
37.5mm	100
26.5mm	100
19mm	100
13.2mm	100
9.5mm	100
6.7mm	100
4.75mm	100
2.36mm	99
1.18mm	98
0.6mm	96
0.425mm	91
0.075mm	70
0.061mm	67
0.046mm	55
0.021mm	48
0.006mm	48
0.004mm	45
0.003mm	43
0.002mm	42
0.001mm	40



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.

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Technical Signatory  
For Outeniqua Lab (Pty) Ltd.

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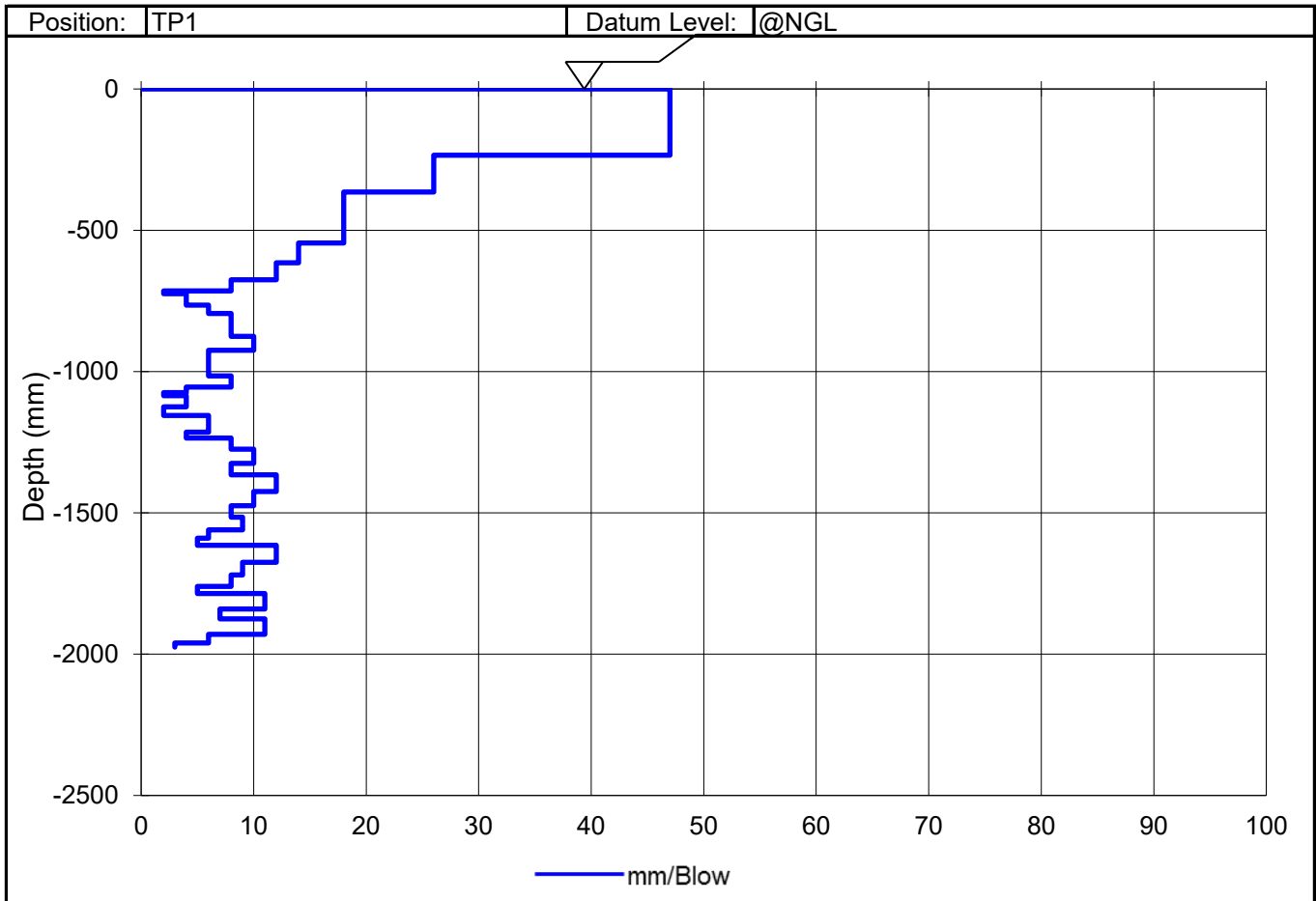
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	P O Box 757	Date Received :	28/06/24
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Attention :	F van Eck	No. of Pages :	1 of 4

**TEST REPORT**  
**DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)**



Notes:

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

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Director:

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R-DCP-1-6

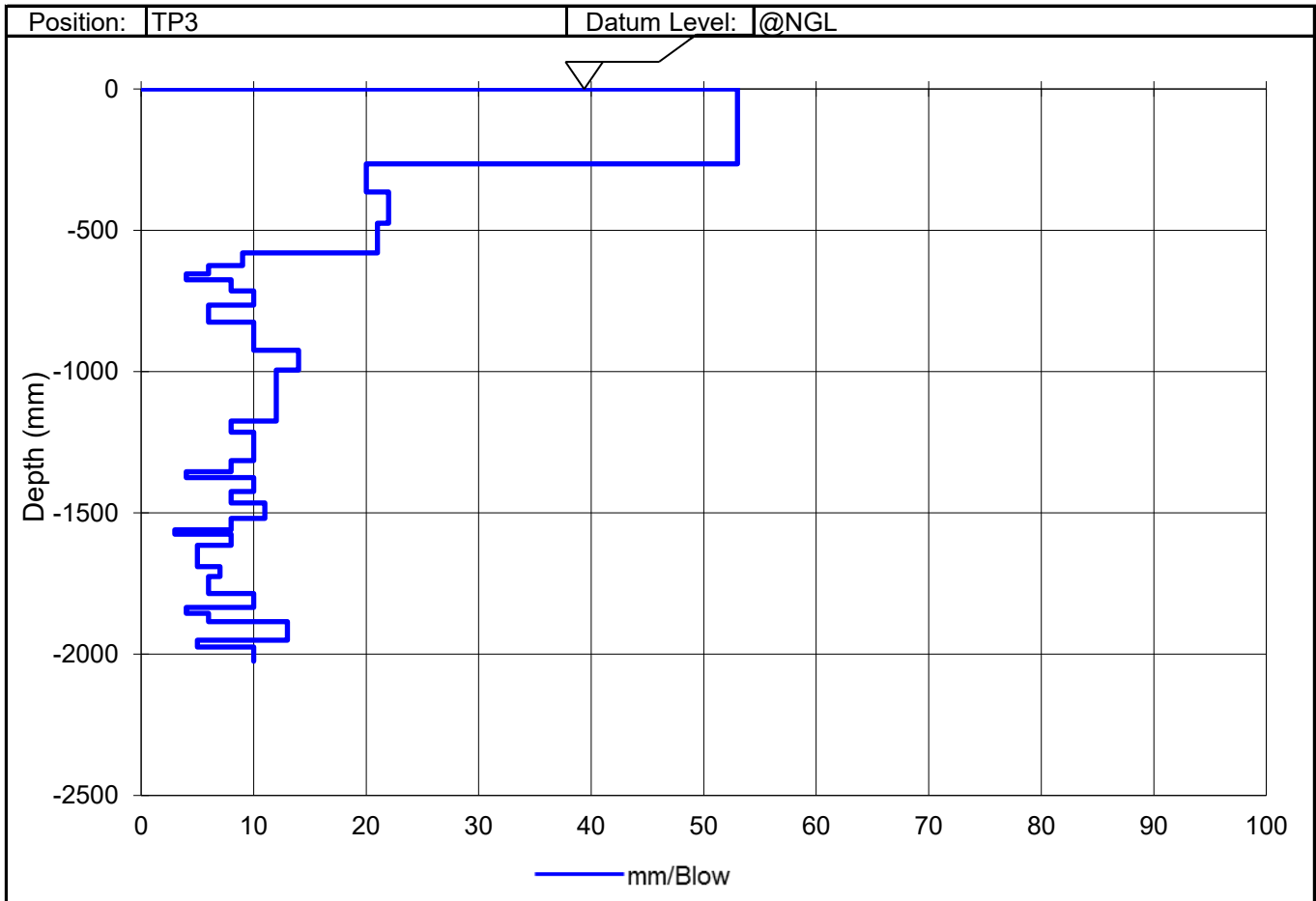
Jun-21



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### TEST REPORT DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)



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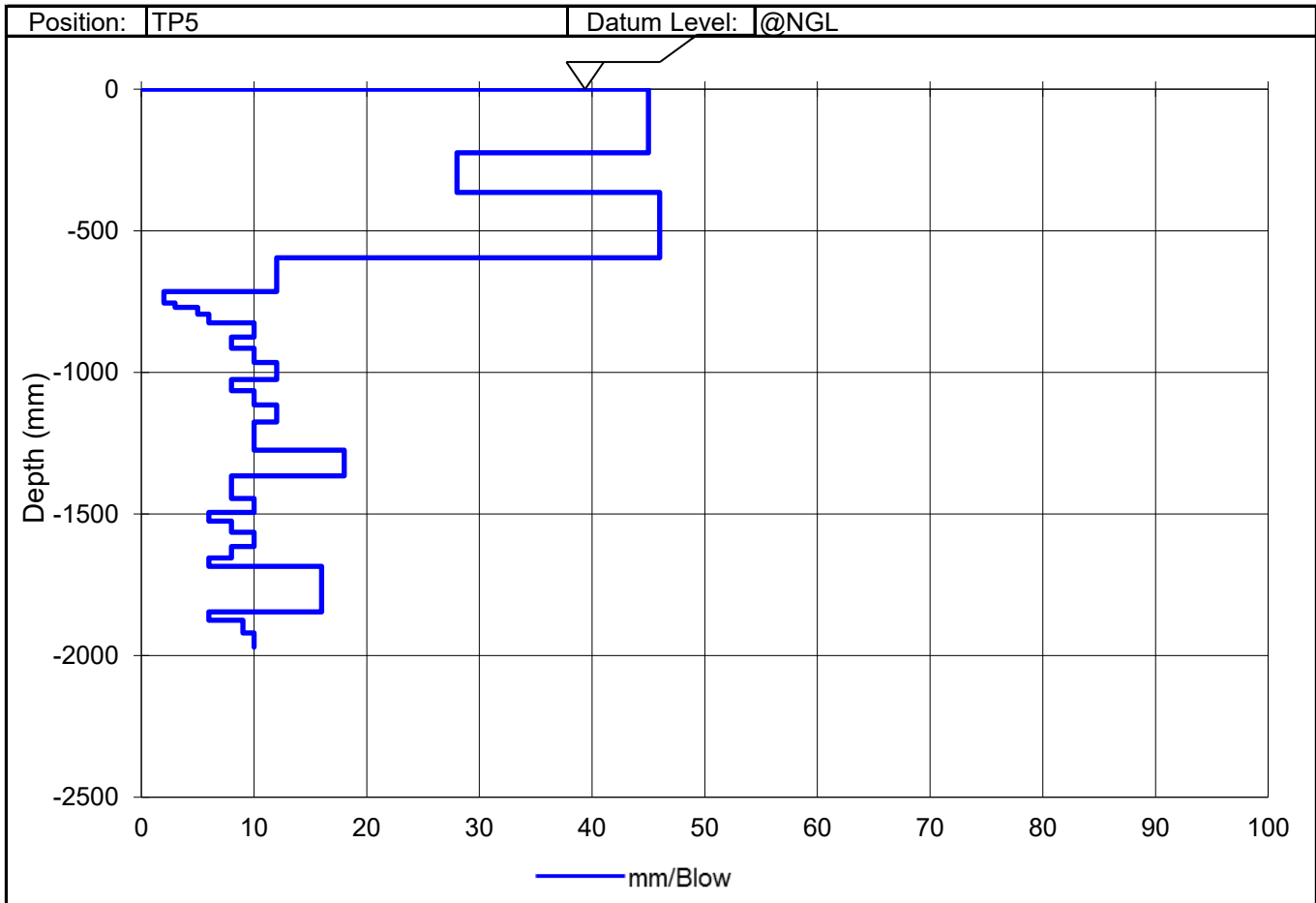
Ruaan Lesch  
 Technical Signatory  
 For Outeniqua Lab (Pty) Ltd.

Director: L Heathcote B-Tech. (Civil Eng.) & BSc Hons (Transport)



Customer :	Neil Lyners	Project :	Aan de Meulen Development - George
	P O Box 757	Date Received :	28/06/24
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Attention :	F van Eck	No. of Pages :	3 of 4

### TEST REPORT DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)



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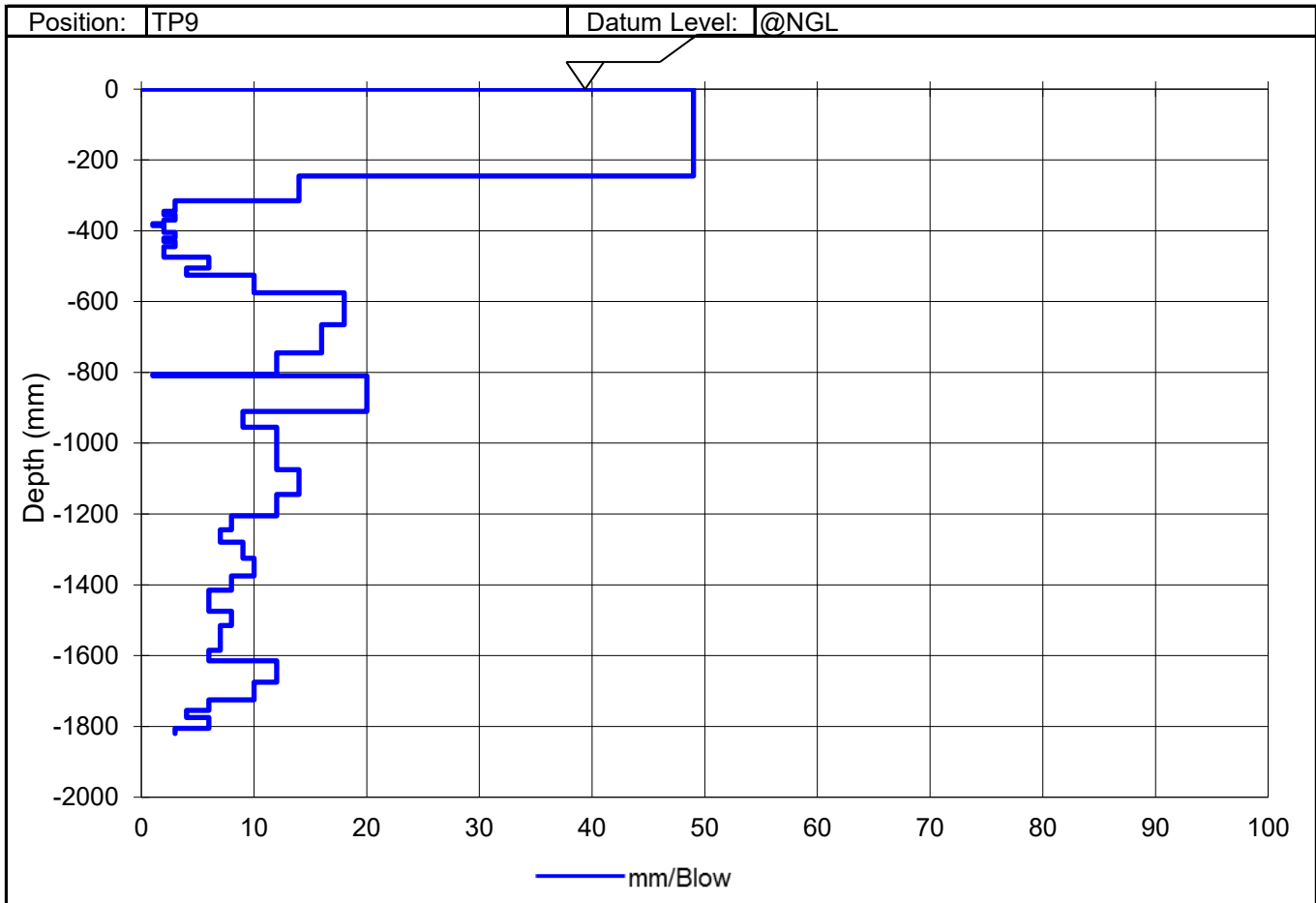
Tel: 044 8743274 : Fax: 044 8745779 : e-mail: llewelyn@outeniqua.co.za



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

**TEST REPORT**  
**DYNAMIC CONE PENETROMETER (DCP) - (TMH 6 Method ST6)**



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