Portions 4, 130, 131, 132, and 139

of the Farm Gwayang 208

SERVICES REPORT

October 2021

Prepared by : PG Joubert Pr Eng

Infrastructure Consulting Engineers cc
PO Box 186
Persequor Park
PRETORIA, 0020
Tel: +27 (012) 3492022
E-mail: flip@iceisp.co.za

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INFRASTRUCTURE CONSULTING ENGINEERS CC

Tel: 012 349-2022

Email: flip@iceisp.co.za

1. Background and purpose

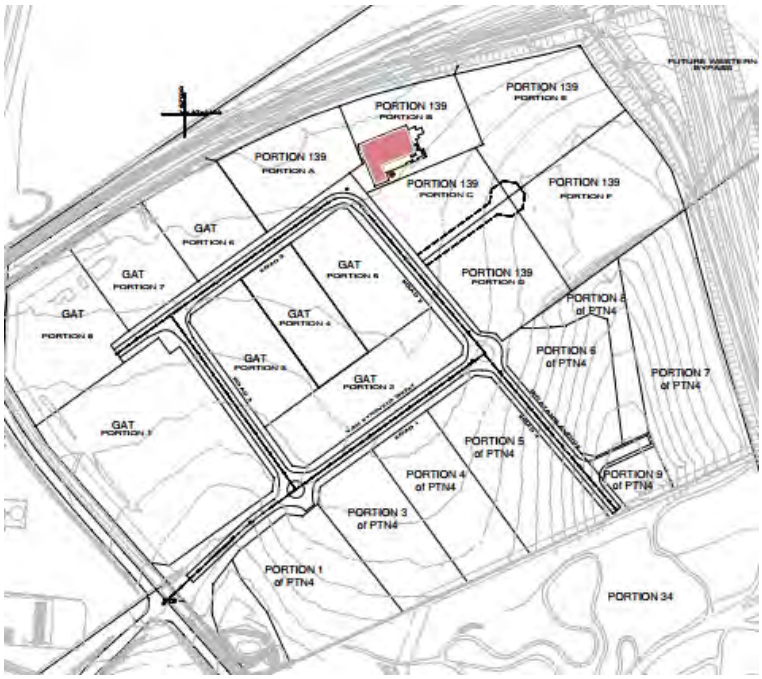
The owners of Portions 4, 130, 131, 132, and 139 of the Farm Gwayang 208, propose the development of a precinct aimed at supporting the George Airport. This area is referred to as the Airport Support Zone (ASZ) in the Local Spatial Development Framework. These portions are currently zoned for agricultural purposes.

The owners of the different portions are as follows:

- Portion 4 is owned Eight Mile Investments 236 (Pty) Ltd;
- Portions 130, 131 and 132 are owned by George Aerotropolis (Pty) Ltd (GAT);
- Portion 139 is owned by JD Wheeler.

The objective of the three owners is to coordinate the development of the Airport Support Zone. The three development proposals are attached in Annexure A. The drawing below combines the three development proposals. Proposed portions market GAT form part of the proposed development of Portions 130, 131 and 132. Portion 139 is proposed to be subdivided into 6 portions marked A to F. Portion 4 is proposed to be subdivided into 12 sub-portions as indicated on the drawing below. The street names Gwayang Avenue and Van Ryneveld Street are indicated on the layout of Portion 4 and are also indicated on the drawing below.

In order to develop the precinct, it is required to subdivide and rezone the properties. It will furthermore require the servicing of the properties with roads, stormwater systems, electrical supply, water supply and sanitation. Once the mentioned services have been installed the development of buildings on the stands can commence.



Layout of proposed Airport Support Zone

Resulting from the layout of the proposed ASZ the provision of services for the different land portions is interrelated to such an extent that it is feasible to develop the portions as one development as far as possible.

The purpose of this document is to report on the provision of access and civil engineering services to support the proposed zoning of the ASZ. It forms the base for services agreements to be concluded between the George Local Municipality and the Developers of the mentioned properties.

2. Structure of the report

The report is structured as following:

In Chapters 3 to 6 general background is provided on the proposed subdivision and zoning. There are critical documents and guidelines that guided the design of infrastructure and roads at a strategic level. These documents include the National Climate Change Response White Paper. The context of these documents is discussed in these chapters.

Chapters 7 to 10 discuss the provision of water, sanitation, stormwater master plan and the provision of access.

Chapter 11 is a summary of the conclusions of this report.

The report refers generously to drawings. These drawings are attached as Annexure A.

In some reference documentation the ASZ is referred to as the George Airport North Eastern Precinct or GANEP. In this report ASZ refers to the development of Portions 4, 130, 131, 132, and 139 of the Farm Gwayang 208 (unless otherwise indicated).

3. Gwayang Local Spatial Development Framework

The Gwayang Local Spatial Development Framework (GLSDF) guides the future development of the Gwayang area and the George Airport. The GLSDF states the objective as following:

" *The objective of the GLSDF is to compile a Local Spatial Development Framework with development guidelines for the orderly utilization of land and management of land uses along the airport corridor, with due regard to the current spatial development policies and the Council's Economic Revitalization Policy."*

With specific reference to the Airport, the GLSDF emphasises the significant role of the George Airport in the development of the Southern Cape. "*As demand for travel increases, modern economies expect and demand a range of services and facilities at these transport hubs to improve their travel experience and to support their businesses."* It also refers to the Airport as an urban gateway.

With reference to the provision of municipal services the GLSDF states that existing services in this area are not adequate to support new developments. All proposed developments must be taken into consideration in the water and sewer master planning.

The GLSDF includes for the development of the major road system. The George Western Bypass forms part of the future road masterplan. This road is planned to pass to the east of the ASZ. It bisects Portion 4 and Portion 139. An interchange is proposed to link the Western Bypass and the R102. Due to the grade separation, significant earthworks form part of the proposed road scheme in the vicinity of the interchange. These earthworks will impact on the natural drainage patterns.

The preliminary design of the Western Bypass was completed by consulting engineers Kantey and Templer. Implementation of the road scheme is currently expected to commence within 3 to 5 years. The detail design is expected to commence soon.

The GLSDF provides the context within which the ASZ must be developed. It is an objective of this report to coordinate with that guidance.

4. Zoning

In response to the GLSDF, the ASZ development is proposed. The land use proposed is primarily for light industrial. A fuel service station, convenience store, coffee shop and quick service restaurants are proposed on one stand at the entrance to the precinct (Erf 1 of Portion 4).

The proposed zoning and portion details are shown in the table below. The proposed layout of the development is indicated on the drawing above. There are also drawings attached in Annexure A that provide further detail. The layout shows a cul-de-sac across Portions C, D, E and F of Portion 139. This is not a proposed road reserve but the extent of servitudes of access proposed by the Developer of Portion 139.

LAND UNIT	ERF SIZE: m²	PROPOSED ZONING	BULK	COVE-RAGE	FLOOR AREA m²
Portion 1 of George Aerotropolis (GAT)	20 070	industrial zone 1	0,75	75%	15 053
Portion 2 of GAT	7 906	industrial zone 1	0,75	75%	5 930
Portion 3 of GAT	6 063	industrial zone 1	0,75	75%	4 547
Portion 4 of GAT	5 519	industrial zone 1	0,75	75%	4 139
Portion 5 of GAT	6 479	industrial zone 1	0,75	75%	4 859
Portion 6 of GAT	5 015	industrial zone 1	0,75	75%	3 761
Portion 7of GAT	5 404	industrial zone 1	0,75	75%	4 053
Portion 8 of GAT	9 157	industrial zone 1	0,75	75%	6 868
Portion 1 of 4	9 930	business zone	0,25	25%	2 483
Portion 3 of 4	7 790	industrial zone 1	0,75	75%	5 843
Portion 4 of 4	7 852	industrial zone 1	0,75	75%	5 889
Portion 5 of 4	9 837	industrial zone 1	0,75	75%	7 378
Portion 6 of 4	7 266	industrial zone 1	0,75	75%	5 450
Portion 7 of 4	13 436	industrial zone 1	0,75	75%	10 077
PORTION A of 139	5 943	industrial zone 1	0,75	75%	4 457
PORTION B of 139	6 613	industrial zone 1	0,75	75%	4 960
PORTION C of 139	5 030	industrial zone 1	0,75	75%	3 772
PORTION D of 139	7 600	industrial zone 1	0,75	75%	5 700
PORTION E of 139	7 977	industrial zone 1	0,75	75%	5 982
PORTION F of 139	10 011	industrial zone 1	0,75	75%	7 509

Table showing proposed erf detail of the ASZ

5. National Climate Change Response White Paper

The National Climate Change Response White Paper is the national response to the threat of climate change. The Paper specifically refers to water scarcity. The Paper promotes medium and long term measures to limit the impact of climate change on the availability of water. It calls for "*Implementing best catchment and water management practices to ensure the greatest degree of water security and resource protection under changing climatic conditions and, in particular, investment in water conservation and water demand management".*

This aim of implementing best practice related to water management has to be integrated into the planning and design of engineering infrastructure for the ASZ. In particular, it requires new thinking about stormwater management and sustainable use of water resources. Roads form an integral part of the stormwater system in an urbanised environment such as the ASZ. It therefore requires a new and innovative approach to the planning and design of roads and stormwater systems.

6. Services master plan and implementation strategy

George Local Municipality (GLM) developed a scheme of master planning for roads, provision of water and sanitation for the next 40 to 50 years. This scheme is proposed to support the proposed spatial development framework for George. Developers of new projects that are in accordance with the spatial development framework, contribute in a fair way to the development of the relevant infrastructure master plans.

The following is a high level description of the development contribution (DC) calculation methodology:

- A model of the **existing system** is compiled, with actual current loads.
- **Backlog** areas (with suppressed loads) and areas with spare capacities are identified.
- A **model of the future system is compiled, based on the SDF**, probable land uses, and probable loads in accordance with norms and standards. (Which norms are based on the "Red Book" but with specific adjustments based on the experiences in and statistics for George Local Municipality (GLM)
- A master plan for the future system is compiled, that in accordance with norms and standards will eliminate backlogs, uses spare capacity, and creates additional future capacity for the SDF developments.
- The **increase in load** from the current situation to the future SDF scenario is **calculated** – this includes the increase of suppressed loads in current backlogged areas.
- A master plan **total capex** over the horizon of the SDF is determined – based on current construction unit prices.
- The **total increase in load is divided into the master plan capex** to result in a unit master plan cost – this is the average cost for the Municipality to create additional capacity for future developments and restore capacity in backlog areas.
- The master plan unit cost is used as the basis for the DC's – e.g. Rand per kL/d water load (Annual Average Daily Demand - AADD)
- Over and/or under expenditure in the past is taken into consideration since the master plan eliminates the backlogs (past underspending) and utilises any existing spare capacity (past overspending).

Escalation related to construction is possible by every year updating the construction unit prices. The development contributions of the Developers of the ASZ is calculated in accordance with this framework, since it follows a transparent and logical approach.

The intention of the master plan is to have bulk services available to support any development proposed within the Spatial Development Framework.

This document shows what elements of the master plan will form part of the internal network required to serve each stand.

The Municipality determines what additional elements of the master plan have to be implemented to support the proposed development. On receiving the Development Contributions, implementation of external bulk infrastructure required, becomes the responsibility of the Municipality as provided for in the Service Agreements between the Municipality and Developers.

7. Water supply

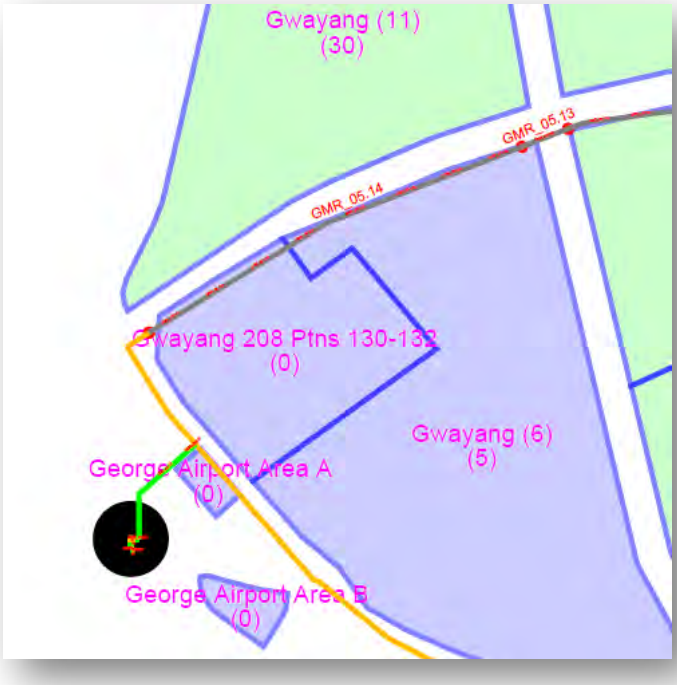
7.1. General

In this Chapter proposals for the provision of water to the ASZ is discussed.

7.2. Applicable guiding documents

The planning of water supply to the precinct is informed by the following documents:

- Guidelines – Development Contributions for Water.
  The guidelines explain the methodology related to the calculation of Development Contributions as mentioned above. (This document is referred to as the George Guidelines later in this document.)
- The part of the masterplan that impacts on the development of the ASZ. This drawing was obtained from GLS. The relevant part of the planning is as indicated below.



Extract from the current water master plan (obtained from GLS)

- The Neighbourhood Planning and Design Guide, Section J, Water Supply;
- Guidelines for the Provision of Engineering Services in Residential Townships;
- SANS 10400-W:2011 (Edition 3) South African National Standard, Part W: Fire installation.

7.3. Existing bulk infrastructure

The existing and proposed bulk municipal water infrastructure, relating to the ASZ, is indicated on the GLS drawing above. It shows an existing 200mm dia supply line, indicated in brown, that runs along the R102 and the R404 (not titled on the drawing). It shows the Airport Reservoir in black. There is no local expansion of the network proposed by the master plan. The detail of this will be confirmed with GLS. The mentioned reservoir is owned and operated by ACSA for use by the Airport.

GLS is currently in process to revise the water master plan with the benefit of information of the proposed layout and zoning of the ASZ. GLS confirmed, in discussions, that water supply for the ASZ is available. This will be confirmed in writing.

7.4. The Average Annual Daily Demand

The Average Annual Daily Demand (AADD) refers to the average annual daily water requirement by the user at the point of connection. The Neighbourhood Planning and Design Guide does not give any specific AADD for industrial land use. The George Guidelines proposes an AADD of 400 litre per 100 m² of industrial building size. It allows for a further 10% for water loss. The total demand is therefore 440 litre per 100 m².

The AADD for the service station stand (erf 1 of Portion 4) is based on its zoning of Business VI. The George Guidelines do not specifically refer to this zoning. The unit demand for service stations is however 800 litres per 100 m² or 889 if allowance for pipe losses is added. The total proposed floor area for Erf 1 of Portion 4 is 2 483 m². This equates to and AADD of 22 m³. This is unrealistically high for a service station.

The total average annual daily demand for the ASZ is calculated at 538 m³. This includes the demand for Erf 1 of Portion 4.

7.5. Peak factor

The Neighbourhood Planning and Design Guide proposes a peak factor for hourly flow of 3,3 for business and industrial stands with size ranging between 5 000 and 10 000 m². Likewise, the peak day factor proposed is 1,6.

The George Guideline proposes a peak hour factor of 3 and a peak day factor of 1,7. The peak factors as proposed by The Neighbourhood Planning and Design Guide is accepted for use in the design of the water supply system of the ASZ.

7.6. Provision of water for firefighting

The criteria for the provision of fire flow is related to the risk classification. ICE discussed the risk of fire with insurance companies. This lead to the understanding that risk of loss is not only related to the building structures erected on the stands but also depends on the activities that may take place inside the buildings. The loss associated with damage to equipment and stored material inside buildings often exceeds the potential damage to buildings. It can be expected that many of the buildings erected within the precinct will be used for packaging and storage of goods. This increases the risk related to fire considerably.

The George Guidelines propose that the fire flow demand be treated in accordance with The Neighbourhood Planning and Design Guide.

The supply of fire water is limited by the capacity of the major supply system. GLS confirmed that a maximum of 50 l/s fire flow will be available.

This will support a moderate risk 1 as proposed by the Neighbourhood Planning and Design guide. Moderate risk 1 is relevant to Industrial and Business developments. This risk classification requires a total fire flow of 50 l/s.

In cases where the fire flow exceeds moderate risk 1, additional on-site storage facilities will be required.

7.7. Preliminary network layout

The George Guideline proposes that the network design be based on the fire flow plus 2 times the AADD. The Guideline proposes maximum allowed flow velocity of 1,8 m/s, but an absolute maximum of 2,2 m/s.

Based on the proposed design flow, minimum pressure at the fire node and the limitation on flow velocity, the distribution system was determined. The proposed resulting pipe sizes are indicated on the attached Preliminary Water Layout Plan (GASZ-WLP-01). See Annexure A. The connection to the external municipal bulk supply system up to the main ring supply pipe is 200 mm diameter uPVC Class 10 pipes. The ring main and other pipes are as indicated on the layout drawing.

The size of the pipe along Gwayang Avenue to the south of Van Ryneveld Street intersection, required to serve the ASZ is 110 mm. This pipe will however form part of a future ring main that will serve the proposed industrial development on Portion 34, located to the south of Portion 4. This industrial development is in accordance with the GLSDF. For this purpose, the pipe diameter is increased to 160 mm dia.

Extract from GLSDF

Due to the larger network function of this pipe that runs along Van Ryneveld Street and Gwayang Avenue, serving not only the ASZ, it should form part of the George water master plan.

7.8. Development contributions

The policy of the George Local Municipality is that developers have to contribute to the provision and development of the bulk master plan for services. The George Guideline document stipulates the

estimation of these contributions. The table below shows the calculation of development contributions for water and sanitation. The total amount for water is **R19 544 737.**

Due to the water main along Van Ryneveld Street and Gwayang Avenue forming part of the George Water Master Plan, the development cost of the mentioned infrastructure must be off-set against development contributions for Water. The fair and reasonable way of calculating this cost is to base it on the unit rates used by GLS in the calculation of the implementation cost of the George Water Master Plan. ICE will estimate this based on the GLS rates when made available.

Attached is a drawing of Kantey and Templer showing the alignment of the proposed Western Bypass. A note on the drawing states that the existing 200 mm dia. water main and the 160 mm dia. sewer rising main, that run along the southern edge of the R102, must be relocated to a position to the south of the freeway interchange. The practical position to relocate these services in order to comply with the requirement mentioned, is to the South of Portion 139 and Portion 4. This alignment is indicated in blue (added by ICE to the drawing by Kantey and Templer). This alignment is proposed for consideration by the GLM and their consultants GLS for the purpose of the master planning. This infrastructure development forms part of the implementation of the scheme of the Western Bypass. The preliminary water layout plan provides more detail on the location of the proposed line.

The owners of both mentioned portions expressed their approval of such an arrangement if this construction work takes place as part of the development of the infrastructure of the ASZ in order to minimise future disruptions. This is not a condition for the supply of water for the ASZ. Water will be supplied via the existing master network until the proposed system is implemented.

8. Sanitation

8.1. General

This Chapter discusses the provision of sanitation for the proposed development of the ASZ.

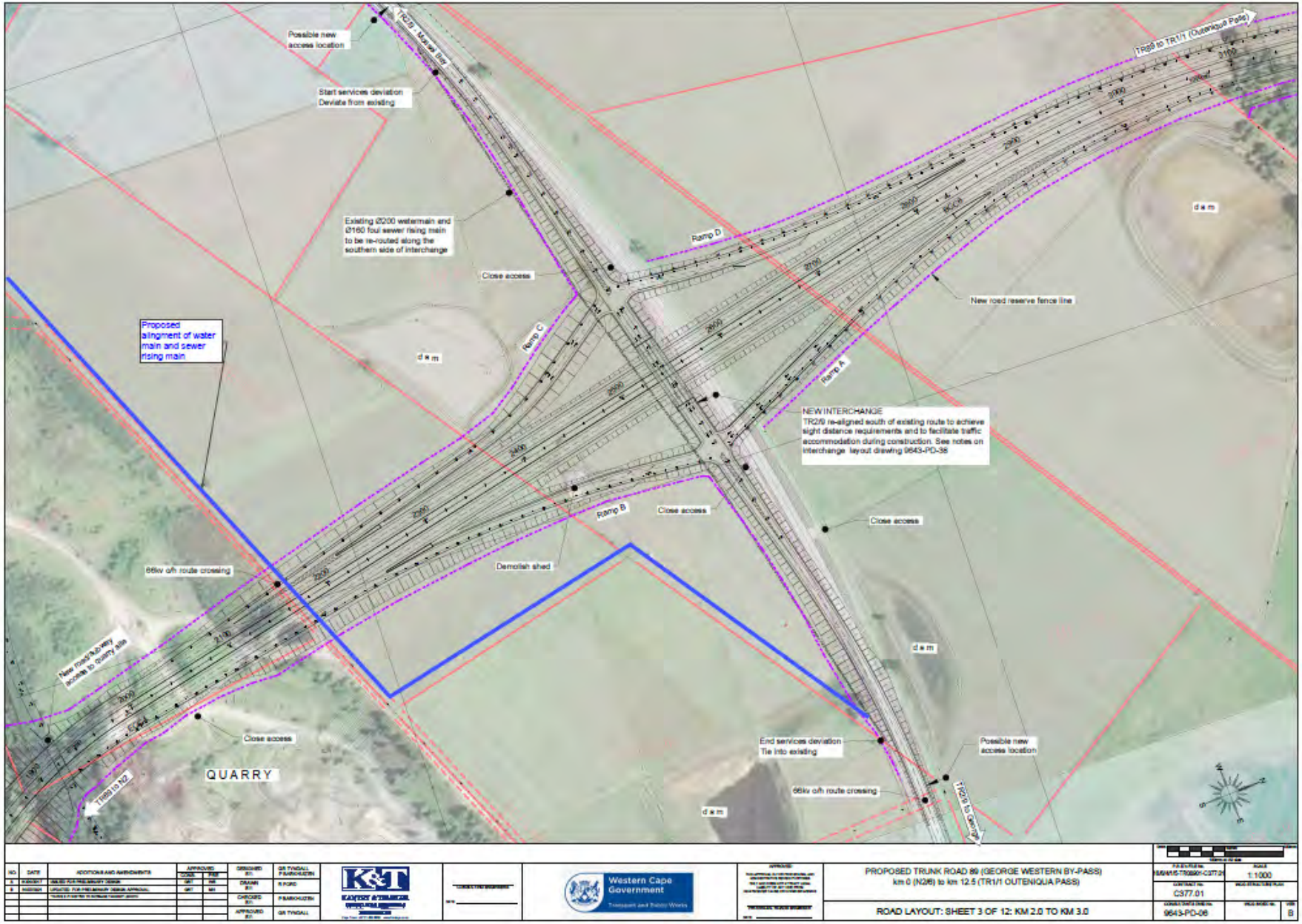
8.2. Applicable guiding documents

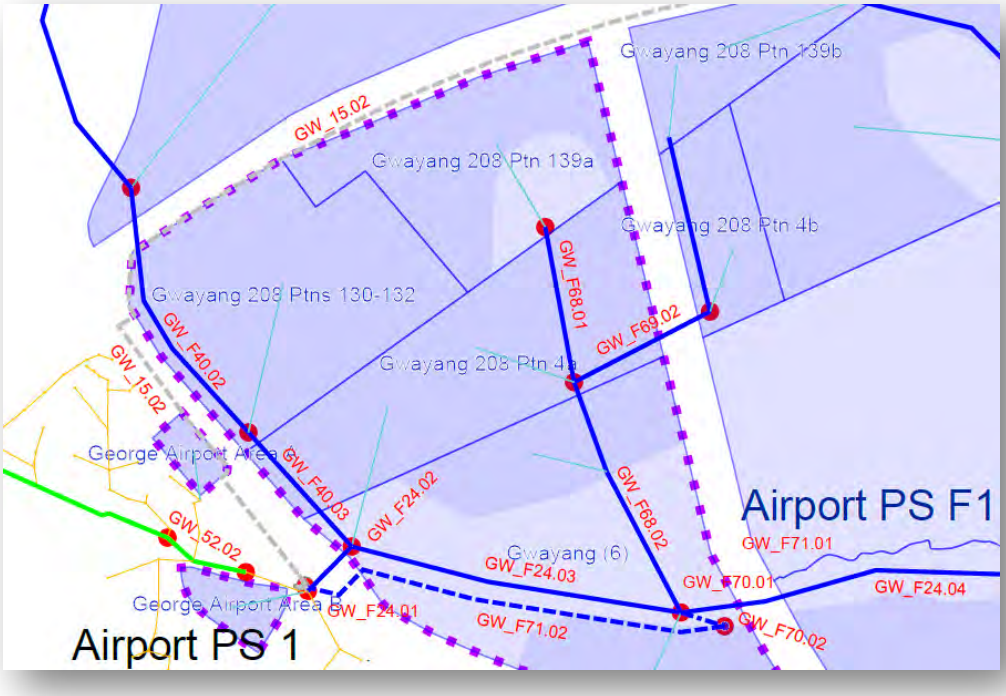
The planning of the wastewater drainage system for the ASZ precinct is informed by the following documents:

- Guidelines – Development Contributions for Sewer (George Guidelines).
  As in the case of water, the guidelines explain the methodology related to the calculation of Development Contributions. These contributions are towards the development of sewer infrastructure external to the ASZ Precinct. The development contributions are based on the expected cost of external infrastructure required to serve George Municipal area for the next 40 to 50 years. A sewer masterplan was developed by GLS Consulting Engineers to guide the development of the infrastructure required to serve future sanitation requirements over the next 40 to 50 years.
- The part of the masterplan that impacts on the development of the ASZ. The drawing below was obtained from GLS. The relevant part of the planning is indicated.
- The Neighbourhood Planning and Design Guide, Section J, Water Supply;

LAND UNIT	ERF SIZE: m²	PROPOSED ZONING	BULK	COVE-RAGE	FLOOR AREA m²	UNIT OF MEASURE	WATER DEMAND kL/unit/day)	WATER DEMAND INCLUDING LOSS (kL/unit/day)	SEWER FLOW RATIO OF AADD	SEWER FLOW FACTOR	WATER AADD	SEWER (AVERAGE ADF)	DC WATER	DC SEWER
Portion 1 of George Aerotropolis (GAT)	20 070	industrial zone 1	0,75	75%	15 053	100 m²	0,40	0,444	80%	0,36	66,83	53,47	R 2 427 445	R 1 862 505
Portion 2 of GAT	7 906	industrial zone 1	0,75	75%	5 930	100 m²	0,40	0,444	80%	0,36	26,33	21,06	R 956 222	R 733 680
Portion 3 of GAT	6 063	industrial zone 1	0,75	75%	4 547	100 m²	0,40	0,444	80%	0,36	20,19	16,15	R 733 313	R 562 649
Portion 4 of GAT	5 519	industrial zone 1	0,75	75%	4 139	100 m²	0,40	0,444	80%	0,36	18,38	14,70	R 667 517	R 512 166
Portion 5 of GAT	6 479	industrial zone 1	0,75	75%	4 859	100 m²	0,40	0,444	80%	0,36	21,58	17,26	R 783 628	R 601 254
Portion 6 of GAT	5 015	industrial zone 1	0,75	75%	3 761	100 m²	0,40	0,444	80%	0,36	16,70	13,36	R 606 559	R 465 394
Portion 7of GAT	5 404	industrial zone 1	0,75	75%	4 053	100 m²	0,40	0,444	80%	0,36	18,00	14,40	R 653 608	R 501 494
Portion 8 of GAT	9 157	industrial zone 1	0,75	75%	6 868	100 m²	0,40	0,444	80%	0,36	30,49	24,39	R 1 107 529	R 849 774
Portion 1 of 4	9 930	business zone	0,25	25%	2 483	100 m²	0,80	0,889	80%	0,71	22,07	17,66	R 801 584	R 615 031
Portion 3 of 4	7 790	industrial zone 1	0,75	75%	5 843	100 m²	0,40	0,444	80%	0,36	25,94	20,75	R 942 192	R 722 915
Portion 4 of 4	7 852	industrial zone 1	0,75	75%	5 889	100 m²	0,40	0,444	80%	0,36	26,15	20,92	R 949 691	R 728 669
Portion 5 of 4	9 837	industrial zone 1	0,75	75%	7 378	100 m²	0,40	0,444	80%	0,36	32,76	26,21	R 1 189 775	R 912 878
Portion 6 of 4	7 266	industrial zone 1	0,75	75%	5 450	100 m²	0,40	0,444	80%	0,36	24,20	19,36	R 878 815	R 674 288
Portion 7 of 4	13 436	industrial zone 1	0,75	75%	10 077	100 m²	0,40	0,444	80%	0,36	44,74	35,79	R 1 625 070	R 1 246 867
PORTION A of 139	5 943	industrial zone 1	0,75	75%	4 457	100 m²	0,40	0,444	80%	0,36	19,79	15,83	R 718 799	R 551 513
PORTION B of 139	6 613	industrial zone 1	0,75	75%	4 960	100 m²	0,40	0,444	180%	0,36	22,02	17,86	R 799 847	R 621 992
PORTION C of 139	5 030	industrial zone 1	0,75	75%	3 772	100 m²	0,40	0,444	80%	0,36	16,75	13,40	R 608 349	R 466 768
PORTION D of 139	7 600	industrial zone 1	0,75	75%	5 700	100 m²	0,40	0,444	80%	0,36	25,31	20,25	R 919 163	R 705 246
PORTION E of 139	7 977	industrial zone 1	0,75	75%	5 982	100 m²	0,40	0,444	80%	0,36	26,56	21,25	R 964 761	R 740 232
PORTION F of 139	10 011	industrial zone 1	0,75	75%	7 509	100 m²	0,40	0,444	80%	0,36	33,34	26,67	R 1 210 868	R 929 062
Total area	**164 898**									**Total for ASZ**	**538**	**431**	**R 19 544 737**	**R 15 004 376**

Table showing the calculation of development contributions for water and sanitation


Possible new access location
TR2/8 - Mossel Bay
Start services deviation
Deviate from existing
Existing Ø200 watermain and Ø160 foul sewer rising main to be re-routed along the southern side of interchange
Close access
Proposed alignment of water main and sewer rising main
Ramp C
Ramp D
Ramp A
Ramp B
TR8/8 to TR1/7 (Outeniqua Pass)
New road reserve fence line
NEW INTERCHANGE
TR2/9 re-aligned south of existing route to achieve sight distance requirements and to facilitate traffic accommodation during construction. See notes on interchange layout drawing 9643-PD-36
Close access
Close access
Demolish shed
66kv o/h route crossing
New road to quarry access to quarry site
Close access
QUARRY
TR8/8 to N2
End services deviation
Tie into existing
Possible new access location
66kv o/h route crossing
TR2/9 to George
d e m
d e m
d e m
d e m
2100
2000
2200
2400
2600
2700
2800
2900
3000
3100
PROPOSED TRUNK ROAD 80 (GEORGE WESTERN BY-PASS)
km 0 (N2/8) to km 12.5 (TR1/1 OUTENIQUA PASS)
ROAD LAYOUT: SHEET 3 OF 12: KM 2.0 TO KM 3.0
1:1000
C377.01
9643-PD-06
B



8.3. Existing and proposed bulk infrastructure

The existing and proposed bulk municipal sewer infrastructure (master plan) is indicated on the GLS drawing above. Wastewater from the Airport drains towards the Airport Pump Station (Airport PS 1). From there the wastewater is pumped towards the R102. The dotted grey line marked GW_15.02 represents this rising main. The main runs to the east along the R102 and eventually leads to the Gwayang Wastewater Treatment Works.

The proposed bulk network in the immediate vicinity of the ASZ is indicated in blue. A main sewer is proposed to run from the north of the R102 along the eastern side of the R404. See GW_40.02 and GW_40.03. This main then runs along a tributary of the Gwayang River to a proposed pump station at a point directly to the north of the N2. See GW_F24.02 to GW_F24.04.

From that point it joins with a rising main from Herolds Bay (not indicated on drawing). The proposed system will then pump wastewater from Herolds Bay and the Airport to the Gwayang Wastewater Treatment Works. The pump station at the Airport will then be de-commissioned. The proposed system will also serve areas to the north of the R102. The proposed main traverses the ASZ. See GW_F40.02 and GW_F40.03 on the attached Preliminary Sewer Layout Plan. See annexure A.

A further main is proposed to drain the eastern part of the ASZ. See GW_F68.01 to GW_F68.02 and also GW_F69.02. The last mentioned pipe drains areas to the east of the proposed Western Bypass.

GLS confirmed that the capacity of the existing pump station is 20 l per second of which 8 l per second is available for use by the ASZ.

8.4. Peak day dry weather sewage flow

The peak day dry weather flow (PDDWF) is estimated as a factor of the AADD for water. In the case of industrial and business zonings the ratio stipulated by the George Guideline is 80%. This figure

estimates the volume of wastewater discharged as a ratio of water supplied. The AADD for water is 538 m³ as indicated in the table above. The peak day dry weather sewage flow is therefore 431 m³.

Sizing of the sewer reticulation is based on the peak hourly flow. The George Guideline proposes the use of an Instantaneous Peak Dry Weather Flow (IPDWF). Pipes are then sized to cope with the instantaneous flow when running 70% full. The remaining 30% of the pipe cross section is allowed for stormwater ingress. The George Guideline however do not specify the ratio between peak day dry weather flow and instantaneous peak dry weather flow. The Neighbourhood Planning and Design Guide however addresses this matter. It proposes a peak factor of between 2.5 and 4 for light industrial land uses. In this case a conservative peak factor of 4 is allowed in the design of local pipes.

As in the case of the water demand for the service station stand (Erf 1 of Portion 4), the sewage flow of 80% of is 22 m³ or 18 m³, is unrealistically high for a service station.

8.5. Preliminary network design

The instantaneous peak dry weather flow is calculated by applying a peak factor of 4 as discussed above. Flow rates in all pipes at 70% of flow depth, are low enough to be accommodated in a 110 mm dia pipe. For ease of maintenance all pipes are sized at 160 mm diameter.

The proposed sewer layout as attached, includes for pipes that form part of the sewer masterplan. These pipes are GW_F40.02 and GW_F40.03 along the western boundary and GW_F68.01.

GW_F69.02 is a proposed sewer main to drain areas to the east of the proposed Western Bypass. From the preliminary design drawings of the Western Bypass it is clear that the freeway will be in a deep cut at that position. ICE requested the detail design drawings from Provincial Roads Department. The drawings are however not available yet. For that reason, it is proposed that GW_F69.02 be omitted from the planning of the internal sewage draining system until the exact profile of the Western Bypass is available. The preliminary sewer layout plan shows a proposed position for GW_F69.02 based on available limited information. This pipe is not required for the servicing of the ASZ.

This report proposes that the western part of the ASZ drains along GW_F40.2 and WG_F40.3 to the Airport pump station until the gravity main between the pump station and the Groeneweide Ext. PS F2, is constructed. ICE requested GLS to verify the feasibility of this temporary arrangement. GLS provisionally indicated that 8 litre per second capacity is available in the existing rising main (GW_15.02) that leads from the Airport Pump Station 1. The peak hourly flow from the western part of the ASZ that is proposed to drain to the Airport Pump Station 1, is less than 8 litre per second.

The eastern part of the ASZ will however have to drain via the mentioned proposed drain to the Groeneweide Ext. PS F2. As an alternative to this, GLS proposes a temporary pump station marked Airport PS F1 on the drawing below.

The proposed internal sewer reticulation was sent to GLS in order to determine the impact that it may have on the sewer master planning.

The preliminary design layout as well as the longitudinal sections for the sewer scheme is attached in Annexure A. The average depth of sewer pipes is between 1,3 and 1,7 m.

The Developers of the ASZ is available to discuss any possible cooperation with the Municipality in order to expedite the implementation of the master plan downstream of the ASZ. The section of the master plan that traverses the ASZ will however be constructed by the Developers.

8.6. Development contributions

As in the case of the supply of water, the policy of the George Municipality is that developers have to contribute to the provision and development of bulk master plan for services. The George Guideline document stipulates the estimation of these contributions. The table above shows the calculation of development contributions for sewer. The total amount for sewer is **R 15 004 437.**

The implementation cost of the sections of the master plan that falls within the boundaries of the ASZ, as mentioned above, will be subtracted from the mentioned development contributions. The estimation of this cost will be done based on the unit rates used by GLS in the calculation of the implementation cost of the master plan.

The provision of external elements of the master plan required to service ASZ is the responsibility of the Municipality on receiving of the Development Contributions.

9. Stormwater management plan

9.1. General

This Chapter discusses the proposed stormwater master plan for the proposed development of Portions 4, 130 to 132 and 139 of the Farm Gwayang 208 (ASZ).

9.2. National Climate Change Response White Paper

The White Paper proposes: "*Implementing best catchment and water management practices to ensure the greatest degree of water security and resource protection under changing climatic conditions and, in particular, investment in water conservation and water demand management".* This compels designers to investigate international best practice and to apply it within the South African context. It therefore impacts on the design philosophy of the stormwater master plan for the ASZ.

9.3. Fresh water studies

Confluent Environmental was appointed by George Aerotropolis (Pty) Ltd to undertake a site verification for the development of the proposed George Aerotropolis, near George Airport. The development will cover Portions 130, 131 and 132 of the Farm 208. The scope of work for this report is guided by the legislative requirements of the National Environmental Management Act (NEMA) and the National Water Act (NWA). The report is titled *Freshwater Compliance Statement*. The author is Dr. James M. Dabrowski. Dr. Dabrowski reaches the following conclusions:

"The main factors influencing the statement include the following:

- *No freshwater features were identified within the footprint area of the site or in close proximity to the site; and George Aerotropolis Freshwater Compliance Statement August 2021*

- *While the development falls within a SWSA, it will in no way affect the supply of water or the ecological condition of any watercourses responsible for supplying water from this SWSA."*

He proposes compliance with industry best practice standards related to storm water management as impact management action.

A further study report titled *Aquatic Assessment for The Proposed Light Industrial Development On Portion 139 Of Farm 208 Gwayang, George* by Ms Toni Belcher, refers to the eastern part of the ASZ. Toni Belcher concludes that "t*he watercourses within the site are considered to be in a seriously to critically modified ecological condition with extensive loss of ecological functionality as a result of the cultivation of the area as well as the instream dams".* She recommends that a 20 m wide strip be allowed in the planning of the layout of the site to accommodate stormwater runoff. This area can be incorporated into the stormwater master plan.

The conclusions of these reports are integrated in the stormwater management plan.

9.4. Existing drainage system

The extract from Cape Farm Mapper below shows the topography in the immediate vicinity of the ASZ. The blue lines indicate the drainage lines and the yellow dotted line the proposed Western Bypass. The drainage system of the Western Bypass will impact on the drainage of the area.

It is clear that the ASZ is situated in close proximity of the crest of the drainage area. Only a small area to the north of the R102 drains towards the ASZ. The dotted blue line is the watercourse referred to in the report of Toni Belcher.

General arrangement of current drainage system

Rainwater runoff from the area to the north of the R102 drains into the side drain on the northern side of the R102. The R102 has side drains on either side of the paved area of the road.

Side drains on both sides of R102

The road reaches a crest at a position approximately 150 m from (to the East) the R102/ R404 intersection. To the west of that point, runoff drains towards the west. It crosses the R404 via a culvert.

Inlet of culvert draining underneath R102

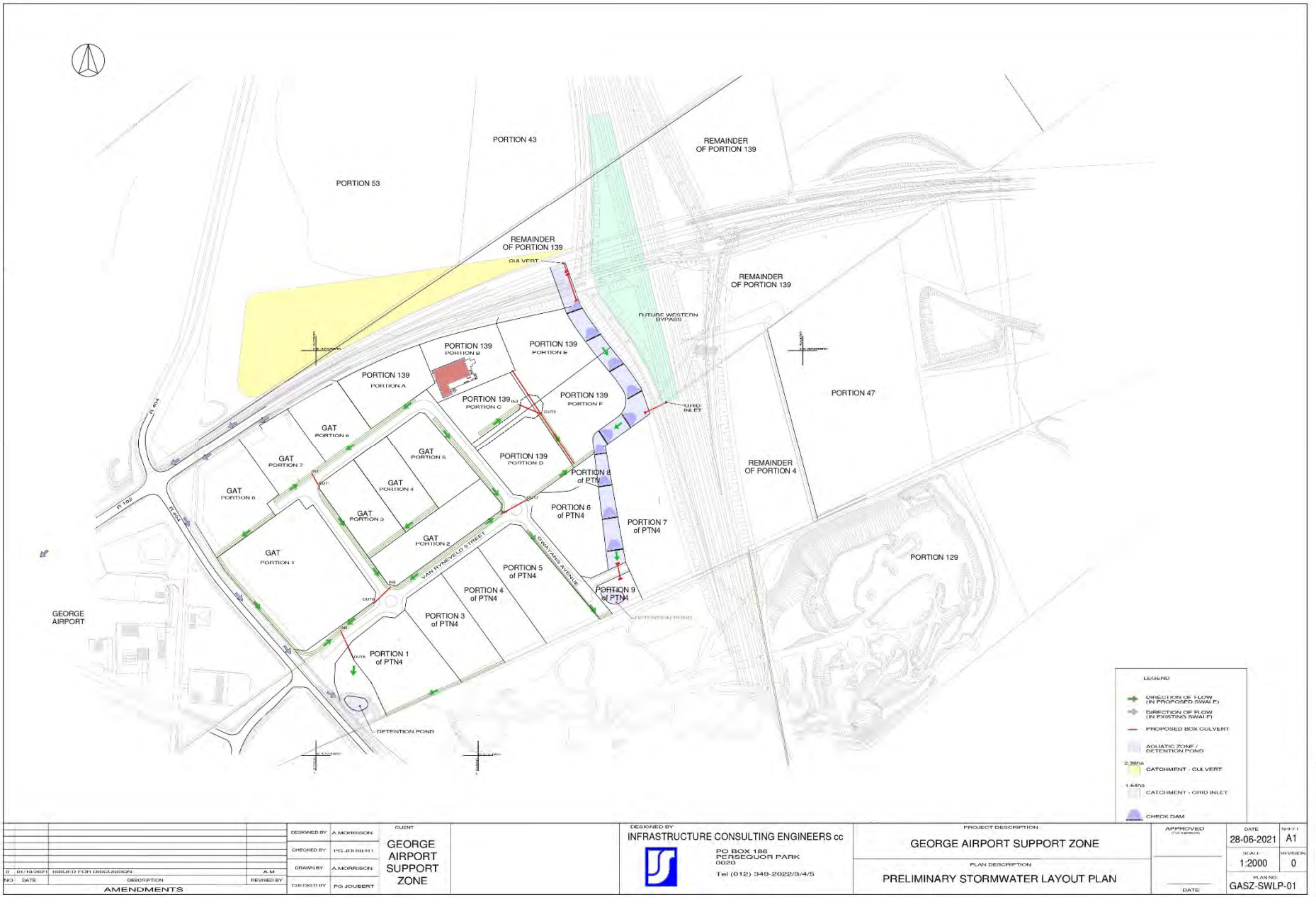
Culvert inlet draining from east to west under R404

To the east of the crest, runoff drains to the east and eventually crosses from north to south via a culvert underneath the R102. See drawing of Preliminary Stormwater Layout Plan attached in Annexure A.

To the south of the culvert outlet, runoff drains along a natural drainage line to an existing small dam on the southern boundary of Portion 4. This aquatic zone is protected by the development measures limiting the development of the drainage line.

Small dam in the drainage channel

The total size of the ASZ catchment area is approximately 24 ha. The freshwater studies reported on the disturbed nature of the natural vegetation of the catchment area. It however remains important to protect the quality of water flowing down the drainage lines.



NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

DESIGNED BY: A.MORRISON
CHECKED BY: PG.JOUBERT
DRAWN BY: A.MORRISON
CHECKED BY: PG.JOUBERT

CLIENT: GEORGE AIRPORT SUPPORT ZONE

DESIGNED BY: INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION: GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION: PRELIMINARY STORMWATER LAYOUT PLAN

APPROVED (PG Joubert)

DATE

DATE: 28-06-2021
SHEET: A1
SCALE: 1:2000
REVISION: 0
PLAN NO: GASZ-SWLP-01

The catchment of the ASZ is subdivided into two areas. The eastern area drains along the drainage line from the culvert passing underneath the R102 southwards. This area also receives runoff from the Western Bypass. This catchment area measures approximately 14 ha.

The western part of the catchment area drains toward the existing dam situated directly to the east of R404 on Portion 1 of Portion 4. This area measures approximately 10 ha.

9.5. Design guideline and rainfall data source

The planning and design of the stormwater master plan is guided by the following documents:

- The Neighbourhood Planning and design Guide, Section L, Stormwater;
- Drainage Manual of the National Road Agency Limited.

The *Drainage Manual* provides detail on storm events. A further source of rainfall data is a document titled *Design Rainfall and Flood Estimation in South Africa* by JC Smithers and RE Schulze. The latter document was used in the design of the stormwater system.

The Neighbourhood Planning and Design Guide proposes that stormwater designs accommodate minor as well as major storms. The objectives of the minor and the major systems differ. The minor incident design objective is associated with convenience whereas the objective of the major storm design is protection of property and life. The Guide proposes a minor storm design flood recurrence interval of 5 years for industrial and business zoning. Likewise, a recurrence interval of 100 year is proposed for major storms.

Design Rainfall and Flood Estimation in South Africa was used to select appropriate rain storm intensities for different storm durations. This was verified with data from the Drainage Manual. The following results are applicable:

- 15 minute storm duration based on *Design Rainfall and Flood Estimation in South Africa:*
    - 1 in 5 year storm recurrence interval – 50 mm per hour;
    - 1 in 100 year storm recurrence interval – 100 mm per hour.
- 15 minute storm duration based on data obtained from the Drainage Manual:
    - 1 in 5 year storm recurrence interval – 44 mm per hour;
    - 1 in 100 year storm recurrence interval – 80 mm per hour.

For the purpose of the design of the minor and major systems the higher values of the *Design Rainfall and Flood Estimation in South Africa* are used.

The *National Climate Change Response White Paper* is a high level response document that guides development in South Africa. It proposes that best practice be applied in the search of more sustainable systems with specific reference to water quality. Water as a resource must be protected. *The Neighbourhood Planning and Design Guide* is aligned with this approach. This document states the key objectives of a stormwater management system as follows:

- Minimise the threat of flooding to the area;
- Protect the receiving water bodies in the area;
- Preserve biodiversity in the area;
- Promote the multi-functional use of stormwater management systems;
- Promote the use of the stormwater itself as a water resource;
- Develop sustainable stormwater systems.

The document furthermore promotes water sensitive urban design. This is an approach to urban water management with the aim to manage the urban water cycle in a sustainable manner. The document promotes water harvesting and secondary use of treated wastewater.

9.6. Impact of urbanisation of runoff hydrograph

There are two critical consequences that results from urbanisation with specific reference to the runoff hydrograph. These are:

- The runoff characteristics of the catchment area changes. This is due to surfaces becoming less pervious due to roofs and surfacing of parking and circulation areas as well as roads. In the case of the ASZ the ratio of runoff increases from pre-development of approximately 53 % to post development of approximately 75%.
- The second impact is that the hydrological response time reduces due to quicker runoff of the catchment area. This results in the reduction in the critical storm duration which in return increases the design storm intensity.

The combined impact of these two impacts can be seen on the diagram below. It shows how the peak flow increases significantly from pre-development levels to post-development levels.

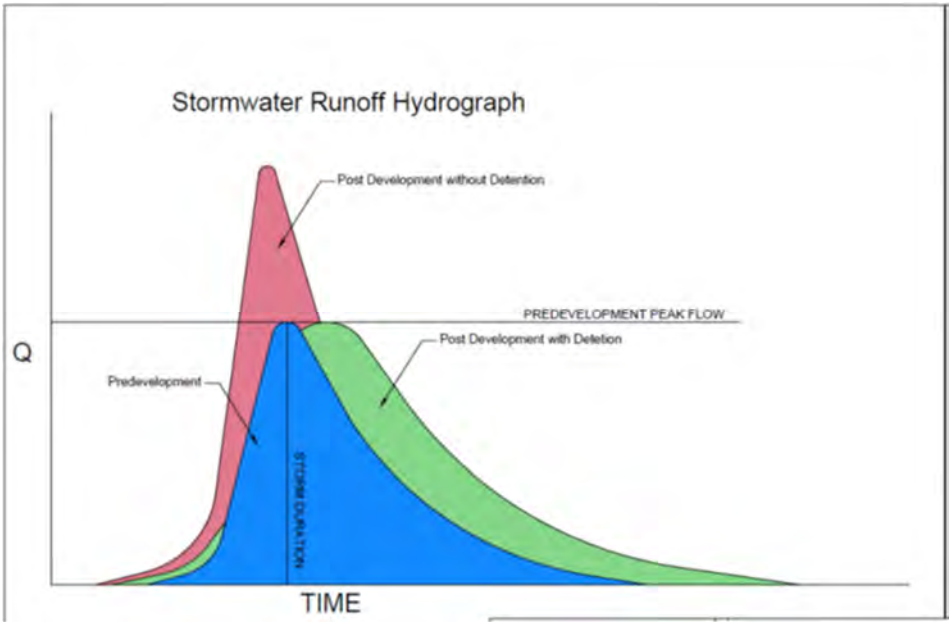


Diagram showing the impact of development on the runoff hydrograph of a catchment

The increased peak flows result in flooding of downstream areas with potential damage to property and risk of loss of life in extreme cases. The stability and biodiversity of the receiving water bodies are also at risk.

In order to meet the objectives of the stormwater master plan as stated above, the impacts of urbanisation must be mitigated. A common way to cope with this is the introduction of detention structures.

9.7. Rainfall patterns

The graph below shows the rainfall distribution in George. The total annual average rainfall is approximately 660 mm. The rainfall statistics show that George receives rain throughout the year.

9.8. International best practice

A literature study of international best practice resulted in an understanding of feasible alternatives to conventional urban drainage systems. Conventional systems refer to the conveyance of runoff on road surfaces and then into a subsurface culvert system, also referred to as the curb-and-gutter system.

The utilization of stormwater detention structures to mitigate the impact of urbanisation on stormwater runoff has been implemented in South Africa over the past 40 to 50 years, with great success. Detention dams have a limited impact on the quality of runoff. The photo below shows the difference between typical stormwater runoff on the left and clean stormwater runoff. The literature study draws attantion to tested stormwater management measures to protect the quality of runoff.

Turbid and Clean Storm Water

Turbidity is complex and expensive to remove from runoff. Turbidity should therefore be prevented from accumulating in runoff from the point of source – where rainwater falls on the surface.

The literature study showed how bio-swales are commonly being used to transport water from point of source. The photos below are examples of bio-swales implemented as best practice measures of stormwater management.

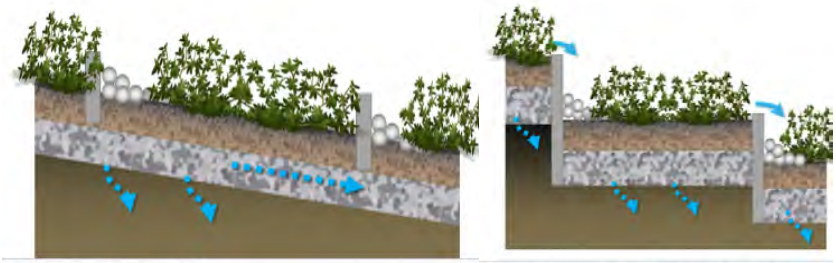
Examples of swales in City of Duluth and Wisconsin USA

Bio-swales are however not new to South Africa. The photos below shows bio-swales along the main road running through Franschhoek.

Bio-swales in Franschhoek

Research in the USA showed that*: "The regular maintenance costs for swales can be higher than a traditional curb-and-gutter system. However, the greater environmental benefits, lower initial capital costs, and positive aesthetic components of grass swales, make them an attractive alternative. (Elsevier Journal of Environmental Management)."*

The research on best practice worldwide reveals practical measures to mitigate any possible impacts that the swales could have. The drawings below show measures to mitigate the risk of erosion in swales, where roads have steep grades, through energy dissipation structures.



Bioswale with check dams
(vertical scale exaggerated)

Stepped bioretention cells alternative for slopes >6 %
(vertical scale exaggerated)

In order to limit flow velocity in swales the following measures are proposed in the literature. Check dams in swales limit flow velocity and can be used for flood attenuation.

Lake Superior Duluth Streams

Research by the University of Maryland, Department of Civil and Environmental Engineering shows that grass swales significantly reduce pollutant mass and mean concentrations for several of the water quality constituents considered, including TSS and the metals lead, copper, zinc, and cadmium.

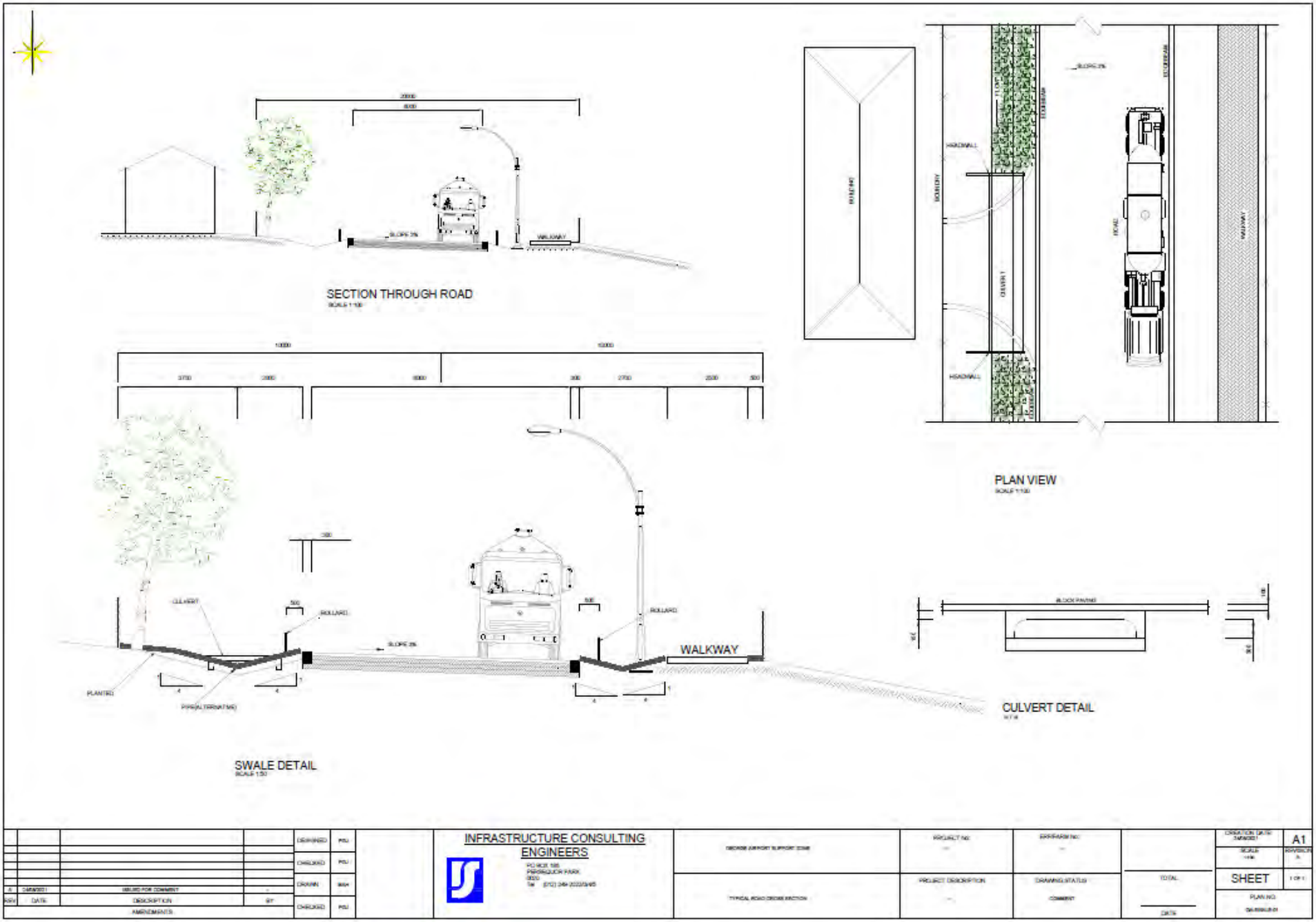
9.9. Proposed drainage system

Resulting from research into international best practice as well as applying principles proposed in national design guidelines such as Guidelines for Human Settlement Planning and Design, the following measures are proposed to form part of the stormwater management system for the ASZ:

- Runoff accumulating on properties through on site bio swales. These swales can be incorporated in parking and circulation areas;
- Runoff along on-site swales to drain into a debris trap before discharging into the communal (municipal) system, thereby treating pollutants at the source;
- Bio swales to be positioned adjacent to roads in the form of shallow V- drains;
- Runoff drains via bio swales to detention dams at the low ends of the ASZ;
- At road crossings bio swales are channelled into culverts to pass underneath the road surface;

- Outlet structures from culverts to be treated to dissipate energy, where necessary, in order to protect the downstream swale;
- Access to stands is the responsibility of property owners. This can be effected through culverts or low water crossings;
- Detention dams to be utilized to limit runoff onto adjacent properties to pre-development levels;
- Swales to be vegetated with appropriate indigenous plants to promote trapping of contaminants;
- Flow velocities to be retained at levels that will prevent turbidity in runoff;
- Subsurface soil drainage system to be installed below grass swales where swales are located along roads. The objective of this drainage is to protect the road pavement from water.
- Aquatic zones along the eastern edge of the ASZ to be protected and redeveloped. Protection will be through the use of check dams to limit flow velocity to levels that can be sustained by vegetation;
- Natural vegetation to be introduced in aquatic zones. The objective of this is also to integrate aquatic zones into the industrial space for recreational uses of workers;
- Check dams to be used as detention structures to mitigate the impact of the industrial development on runoff intensity;
- Aquatic zones and bio-swales to lead to existing detention dams along the southern boundary of Portion 4;
- Outlet structures of existing detention dams to be upgraded to cope with 1 in 100 year flood conditions.

The typical cross section below shows the positioning of swales and culvert crossings within the context of the road.


SECTION THROUGH ROAD
PLAN VIEW
SWALE DETAIL
CULVERT DETAIL
WALKWAY
INFRASTRUCTURE CONSULTING ENGINEERS
A1
SHEET


PORTION 139
PORTION B
PORTION 139
PORTION E
PORTION 139
PORTION A
PORTION 139
PORTION C
PORTION 139
PORTION F
GAT
PORTION 6
GAT
PORTION 7
GAT
PORTION 5
PORTION 139
PORTION D
PORTION 6
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GAT
PORTION 8
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PORTION 4
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PORTION 3
PORTION 6
of PTN4
PORTION 7
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PORTION 2
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PORTION 1
PORTION 5
of PTN4
PORTION 4
of PTN4
PORTION 9
of PTN4
PORTION 3
of PTN4
PORTION 1
of PTN4

9.10. Proposed stormwater layout

The concepts referred to in the above paragraph, were integrated into the design of the stormwater system for the ASZ. The Preliminary Stormwater Layout Plan attached in Annexure A shows the outcome of this. The major features of the drainage system are the following:

- Due to the topography of the ASZ, it can be divided into two sub catchments. The eastern side of the ASZ drains via the aquatic zone on the eastern side of the development. The mentioned aquatic zone drains to a dam at the low point on Erf 9 of Portion 4.
- The western part of the drainage system drain down to the existing small dam located on Erf 1 of Portion 4.

Stormwater dam on Erf 1 of Portion 4

- The proposed **George Western Bypass** is shown on the Preliminary Stormwater Layout Plan, passing along the eastern edge of the ASZ. The road is planned in a position more or less on the watershed. Areas to the east of the freeway drains primarily to the east and likewise for areas to the west of the freeway.

  ICE requested information from Provincial Roads Department regarding the proposed drainage design for the freeway in the vicinity of the ASZ. This information is currently not available. The basic planning of the geometry of the road is however available and many fair deductions can be made about the future drainage of the freeway by studying the geometric design drawings.

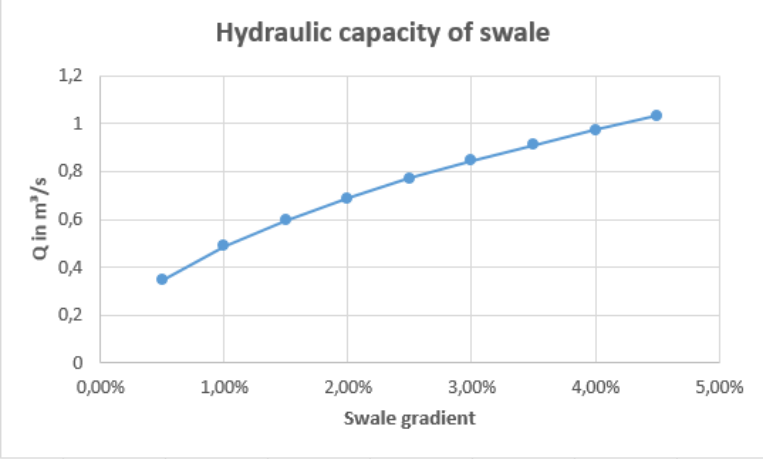
  Where the Western Bypass borders Portion 4, the Bypass is in cut. For that reason, runoff from the road surface will probably not drain onto Portion 4.

  The area marked in green inside the proposed interchange is expected to drain via a culvert at the gore area of the interchange. This culvert is indicated on the drawing above. The runoff from this area of the interchange is accommodated in the aquatic zone. This culvert will be constructed as part of the development of the Western Bypass.

- The **area to the north of the R102** (marked in yellow) drains along existing side drains (grass swales) on the northern side of the R102. This area drains via an existing culvert as indicated on the Layout Plan. This culvert will be extended to pass underneath the new R102 alignment as proposed for the Western Bypass interchange.

This runoff is also received by the aquatic zone along the eastern edge of the ASZ. Energy dissipation structures will be required at the outlet of the culvert in order to protect the downstream aquatic zone.

- The layout plan shows a network of bio-swales mostly alongside roads but also inside properties where required. The typical cross section shows swales with a side slope of 1:4 and a maximum depth of 500 mm. At a depth of 500 mm below the invert level of swales, a subsurface drain will be installed to limit moisture ingress into the pavement layers of the road.



One must obviously consider the velocity of water in swales. If the swales are too steep, scouring will occur and if too flat, water will pond and the risk of damage to the road pavement could be significant. Scouring can be mitigated by using appropriate vegetation with root systems that cope with higher velocities and with plant structure that limits the velocity of the flow of water. This will be developed in cooperation with a horticulturist. In general, flow velocities will be kept to less than 2m/s.

Flow velocities in excess of 2 m/s may occur in cases where grades are steeper than 2% and under full flow conditions. These conditions are expected to only occur for a short section of the swale alongside Van Ryneveld Street along the southern boundary of Portion 1 of GAT. This is also just expected during major storm events. In this case special measures such as placing of riprap surfacing inside the swale, will be implemented to protect the stability of the swale.

- The detail of the aquatic zone is of importance in order to meet the objectives of the Aquatic Assessment Report by Ms Toni Belcher. She found" watercourses *to be in a seriously to critically modified ecological condition with extensive loss of ecological functionality as a result of the cultivation of the area as well as the instream dams".* In order to address this, the aquatic zones will be revegetated with the assistance of a horticulturist.

  Portions E and F of Portion 139 and Erven 4 and 7 of Portion 4, drain directly into the aquatic zone.

  The natural flow regime of runoff flowing via the aquatic zone will be adjusted by the introduction of check dams. The check dams will limit flow velocity to below 2 m/s. It will also act as detention facilities to mitigate the impact of the industrial development on runoff.

Check dams will be spaced between 20 and 40 m. This close spacing is proposed to enhance infiltration of runoff.

Indigenous trees will be planted along this zone so that the zone can be utilised for recreational purposes of employees at the proposed industrial buildings.

- The existing dam on Portion 1 of Portion 4 will be utilised as a detention facility. Approximately 9,5 ha of the total catchment of the ESZ drains towards this dam. The dam has adequate capacity to attenuate sufficient runoff to reduce post development runoff to pre-development runoff, in case of a major storm. The outlet structure of the dam will be upgraded to ensure the stability of the wall in case of a major storm.
- The existing dam on Portion 9 of Portion 4 will be used for the purpose of detention to a limited extent, due to the significant contribution of the check dams in this regard. The outlet of the dam will however be upgraded as in the case of the dam on Portion 1 as mentioned above.

This stormwater master plan responds to the objectives of the National Climate Change Response White Paper. It follows international best practice as proposed by the White Paper and as included in national guideline documents.

10. Roads and access

10.1. General

The ASZ gains access from the R404. This is a provincial road. The George Municipality developed the GANEP road masterplan with the assistance of consulting engineers ITS. The masterplan shows the road upgrades required along the R404 as well as the detail of the main access road into the ASZ that gives access to all the land portions that make up the ASZ. The main access road is a class 4 road. It is the only possible access to Portion 139. This road is referred to as Van Ryneveld Street.

The upgrading of the R404 and the intersection of the R404 with the R102, does not form part of this report since it is part of the road master plan of the GLM. In terms of the road master plan, ACSA is responsible for the upgrades to the R404.

10.2. Applicable guiding documents

The planning of roads to the precinct is informed by the following documents:

- The Neighbourhood Planning and Design Guide – Transportation and road pavements;
- GANEP - Road Master Plan and Cost Apportionment by ITS:
- UTG 5 - Geometric Design of Urban Collector Roads;
- UTG 2 – Structural Design of Segmental Block Pavements for Southern Africa;
- Guidelines for the Provision of Engineering Services in Residential Townships.

10.3. Road network

Access to the ASZ is from the R404. It is currently functioning as a class 3 road. After construction of the Western Bypass the function of this road will be class 4. As mentioned above, Van Ryneveld Street is classified as a class 4 road in terms of the GANEP road master plan. All the other roads are classified as class 5 roads. There is however a motivation to classify Gwayang Avenue to the south of the

intersection with Van Ryneveld Street as a class 4 road, due to its link function to Portion 34 located to the south of Portion 4.

The proposed road network for the ASZ consist of a square layout as seen on the Preliminary Road Layout Plan below. Road lengths are in general short and limited to below 330 m. Links are typically shorter than 180 m. Operating speeds are therefore expected to be low. A speed of 60 km/h was accepted for the design of the roads.

The proposed intersection control at the intersections along Van Ryneveld Street is traffic circle control. The radius of these circles are proposed to be 18 m to accommodate heavy vehicle movement.

Approaches to intersections are flared in order to cope with the turning movements of heavy vehicles.

The proposed minimum road reserve is 18 m. Due to its link function as a class 4 road, the reserve of Van Ryneveld Street is proposed to be 20 m. Likewise, the reserve of Gwayang Avenue to the south of the intersection with Van Ryneveld Street is also proposed as 20 m.

The minimum road width proposed for industrial townships is 8 m. This, in combination with 300 mm wide cast in situ edge beams, makes for generous space for movement of heavy vehicles. Experience has however shown that heavy vehicle drivers require prompt guidance to remain on the paved section of the roadway even in cases when generous allowance is made for road surfacing. For this reason, bollards are proposed alongside all roads. An alternative will be to provide planter boxes to guide drivers. See photo below.

Planters used to guide traffic

10.4. Environmental and socio-economic considerations

The impact on the development of the road system on the environment must be considered. For that purpose, it is important to make due allowance for non-motorised transport modes and public transport.

The selection of road building materials also has an impact on the environment. Research shows that block paved roads have a lessor impact on the environment than bitumen asphalt roads. For that and other reasons segmental concrete block pavement technology was selected. The detail of the road pavement is discussed in following paragraphs.

A critical consideration in the selection of road design is generating job opportunities. This is currently a matter of national priority in South Africa. This also lead to the selection of segmental block pavements as the preferred technology. 80 mm, 35 MPa blocks will be used.

This consideration also determined the choice of in situ cast concrete edge beams to contain block movement. The construction of edge beams is labour based to a large extent. The reinforced concrete edge beams are 300 mm. The depth of beams extends to the bottom of the subbase layers. It is

therefore 350 mm deep. Edge beams are constructed before commencement of the construction of subbase layers.

The reason for this depth of edge beams is that it allows for the construction of stabilised subbase layers utilising unskilled and semi-skilled labour. These labourers use the edge beams as a guide to level the top of subbase layers. Compaction of two 125 mm subbase layers is achieved using walk behind compaction equipment.

Culverts are commonly constructed using pre-cast concrete units. A feasible alternative is to construct box culverts using reinforced brick walls and cast in situ reinforced concrete floors and cover slabs. ICE made use of this alternative method of construction with great results in terms of cost as well as labour content. This will be the preferred technology in the case of the development of the ASZ infrastructure.

Sidewalks are proposed for the convenience of non-motorised transport modes. The width will vary between 2 and 2,5 m depending on the location. Some sections along Van Ryneveld Street may be 2,5 m wide. The typical cross section shows the sidewalks separated from the road by a swale. This separation of vehicles and pedestrians and cyclists is critical in the prevention of road deaths. Lateral or vertical separation in the interest or road safety, is widely supported by international research to protect NMT road users.

The photo below shows the surfacing of the sidewalks at the Green School, between Paarl and Franschhoek. This is a stabilised gravel and it seems to work quite well. Timber beams (110 by 38 mm) are proposed as edge restraints for the sidewalk pavement.

Stabilised gravel sidewalk surfacing

10.5. Road pavement

The geotechnical report by **Outeniqua Geotechnical Services** investigated the geotechnical conditions of Portion 4. Due to the relative size of Portion 4 to the extent of the ASZ, it is viewed to be representative for the purpose of preliminary design of roads and infrastructure. The report proposes pavements as shown in the table below.

The road classification for purposes of structural design is U3-B in terms of The Neighbourhood Planning and Design Guide. Due to the expected high ratio of heavy vehicles, ICE propose the following pavement;

- 80 mm Segmental concrete interlocking blocks 35 MPa on 20 mm sand;
- 125 mm C3 layer;
- 125 mm C4 layer;
- 150 mm upper selected G7;

- 150 mm lower selected G9 layer. This layer to be omitted in locations where in situ material yields CBR values higher than 7 % at compaction of 90% Modified AASHTO density.

The proposed pavement is therefore heavier than the pavement in the table below. The geotechnical report indicates that G7 quality material can be expected in bulk excavations for use of road construction. All efforts will be made to utilize selected cut material for the lower and upper selected layers.

Layer	*Material*	*Thickness*	*Required Compaction*
Pavers*	Cement interlock paving on 25mm sand bedding	60 / 80 mm	25 / 35 MPa
Subbase	Imported G4/5 gravel	150mm	95% Mod AASHTO
SSG	Imported G7 gravel	300mm	93% Mod AASHTO
		OR	
Seal	13.2mm Cape Seal or 40mm HMA		
Base course	Imported G2/4	150mm	98% Mod AASHTO
Subbase	Imported G4/5 gravel	150mm	95% Mod AASHTO
SSG	Imported G7 gravel	300mm	93% Mod AASHTO

Road pavement proposed by Outeniqua Geotechnical Services

The typical cross section shows the road with a 3% cross fall away from the main bio-swale. This swale is located on the higher side of the road in order to collect runoff from adjacent stands, thereby preventing it from running onto the roads. The higher than normal (2%) cross fall ensures the proper draining of the surface of the segmental block pavement. It also coordinates well with the drainage of intersections and traffic circles.

10.6. Development contributions

The George Local Municipality policy for development contributions, also propose development contributions for roads and stormwater systems.

The ITS GANEP report proposes that Van Ryneveld Street be funded and constructed by the developers of the ASZ as their contribution to the road master plan. The report proposes further that the upgrading of the R404 and the R404 / R102 intersection be funded by ACSA. The developers of the ASZ concur with this view. The portion of Gwayang Avenue to the south of the intersection with Van Ryneveld Street however also fulfils a link function to the southern part of the Airport Support Zone, to be developed on Portion 34 of the Farm Gwayang. This land also belongs to ACSA.

It is therefore fair that this section of Gwayang Avenue, that was specifically provided for in the planning of the ASZ, be offset against any development contributions for roads. The only purpose of this road is to provide for a link to Portion 34. Although it does not provide for the primary access route to Portion 34, it provides for alternative access, which is of critical importance in case of an emergency.

The proposal of ITS regarding cost sharing is therefore supported.

The development contribution guideline of George for roads requires some outstanding determinants that are not included in the guideline. For this reason, the development contributions for roads are not calculated and reported in this document.

11. Summary

The owners of Portions 4, 130, 131, 132 and 139 of the Farm Gwayang 208, propose the development of the land in accordance with the guidance of the Gwayang Local Spatial Development Framework. The proposed zoning is Industrial Zone 1. One stand will be zoned Business VI and will be used for the development of a service station.

The development is guided by the National Climate Change Response White Paper. It impacts specifically on the stormwater management plan. Innovative measures are proposed to enhance the quality of rainwater runoff through the introduction of bio-swales for the conveyance of stormwater from the point of source.

George Local Municipality developed services master plans to cope with the demand for municipal services over the next 40 to 50 years. These master plans aim to support the Spatial Development Framework of George. Developers contribute towards the implementation of these master plans. For that purpose, development contributions become payable. The estimate development contributions are R 19 544 737 for water and R 15 004 376 for sanitation. The Developers of the ASZ will implement some elements of the master plans. The costs of these elements of the infrastructure will be offset against the development costs.

Adequate bulk water supply capacity is available to support the proposed development of the ASZ. The available capacity for sanitation can serve approximately 50 % of the ASZ. Significant master plan implementation will be required to support the remaining 50%. The Developers are available to cooperate with the GLM to implement these external services.

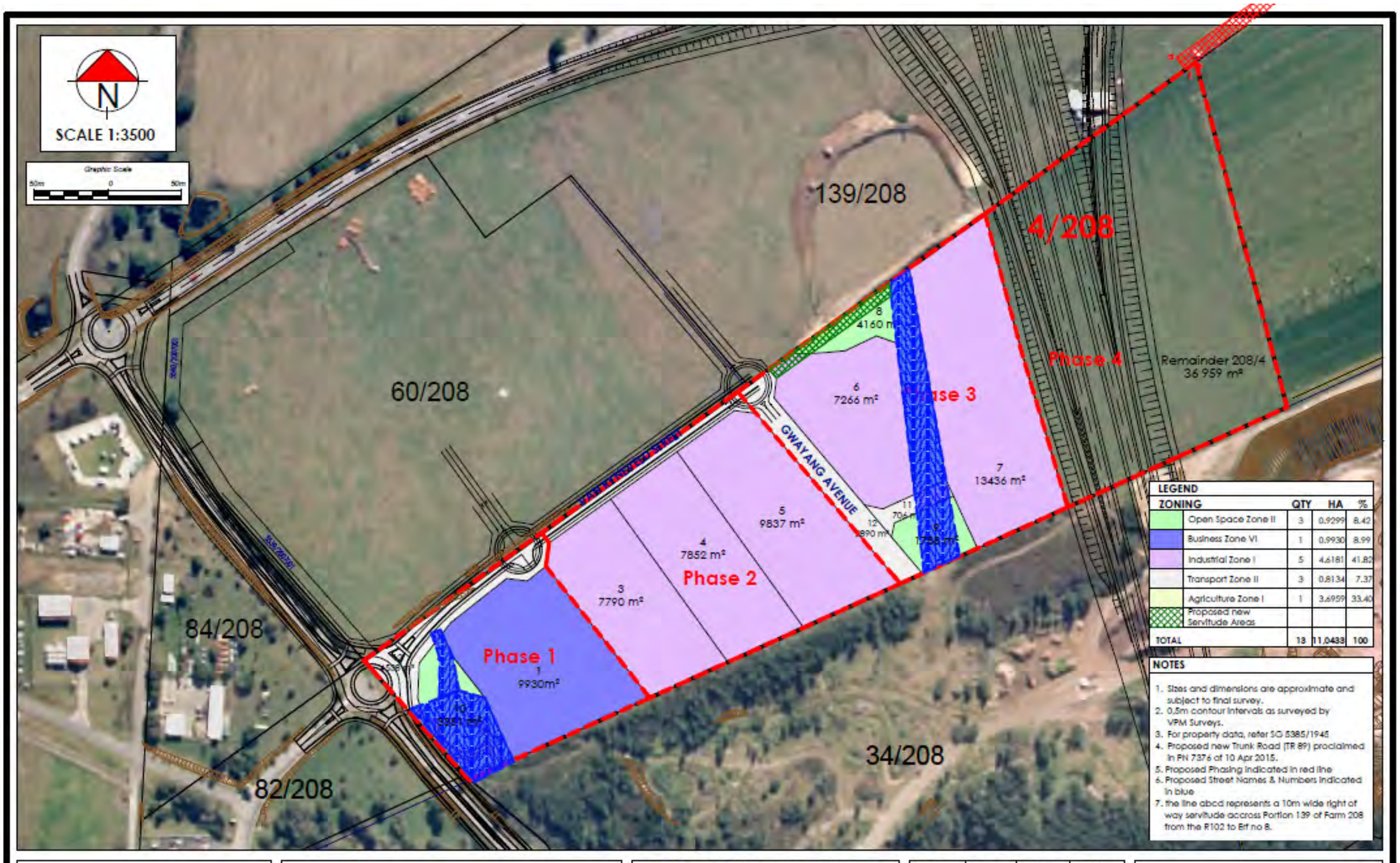
Access to the ASZ will be in accordance with GANEP road master plan. The main access road into the ASZ is Van Ryneveld Street. This road forms part of the road master plan.

The Developers are ready to proceed with the implementation of the infrastructure required to support the proposed land uses. In order to facilitate this a services agreement must be concluded between the GLM and the Developers.

Annexure A – Preliminary design drawings

The preliminary design drawings for the roads and civil engineering services are attached in Annexure A as A3 size. Some of these drawings are included in the main body as A4 size. Some detail is however lost on A4 and for that reason the drawings are included in Annexure A as A3 size.

a) Portion 4 of the Farm Gwayang No 208, Division George – Marike Vreken Town Planners
b) Proposed Subdivision Layout – BAM Architects
c) Proposed layout division 139 – Marlize de Bruyn Consulting Town & Regional Planning
d) Preliminary Water Layout Plan
e) Preliminary Sewer Layout Plan
f) Preliminary Sewer Longitudinal Sections 1
g) Preliminary Sewer Longitudinal Sections 2
h) Preliminary Sewer Longitudinal Section 3
i) Preliminary Stormwater Layout Plan
j) Road Network Long Term by ITS
k) Road Layout by Kantey and Templer
l) Preliminary Road Layout Plan
m) Preliminary Road Longitudinal Sections



PLAN 5

PHASING PLAN

Portion 4 of the Farm Gwayang No 208, Division George

APPROVED IN TERMS OF SECTION 23(1) OF THE GEORGE MUNICIPALITY'S BY-LAW ON MUNICIPAL PLANNING AS PUBLISHED IN P.N. 7481/2015 ON 1 SEPTEMBER 2015

MUNICIPAL MANAGER

DATE: _____

DRAWN:	MV	CHECKED:	MV
PLAN NO:	P16/469/208Ptn4Sub10		
PLAN DATE:	2 August 2021		
STORED:	z:\drawings\App\Pr16\469208Ptn4Sub10.drg		

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Marike Vreken
URBAN & ENVIRONMENTAL PLANNERS
21 Trotter Street, PO Box 2180
KNYSNA 6570
(044) 382 0420
086 459 2987
e-mail: marike@vreken.co.za
www.vreken.co.za

Site Layout
Scale 1:500

LAND UNIT	ERF SIZE	PROPOSED ZONING	PERMITTED USE	CONSENT USE	BULK	COVERAGE	HEIGHT	REQUIRED HEIGHT	STREET SETBACK	LATERAL SETBACK	REAR SETBACK	PARKING REQ (normal areas)	LOADING REQ
PORTION 1	20 070 m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	10.5m	4m	3m	4m	4/100 industrial hive/service trade	per zoning scheme
PORTION 2	7906 m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	10.5m	5m	3m	3m	4/100 industrial hive/service trade	per zoning scheme
PORTION 3	6063 m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	22m	5m	3m	3m	2/100 warehousing/light industry/industry	per zoning scheme
PORTION 4	5 519 m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	22m	5m	3m	3m	2/100 warehousing/light industry/industry	per zoning scheme
PORTION 5	6 479 m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	22m	5m	3m	3m	2/100 warehousing/light industry/industry	per zoning scheme
PORTION 6	5 015m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	18m	5m	3m	3m	2/100 warehousing/light industry/industry	per zoning scheme
PORTION 7	5 404m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	18m	5m	3m	3m	2/100 warehousing/light industry/industry	per zoning scheme
PORTION 8	9 157m2	Industrial 1	LIGHT INDUSTRY incl Industrial hive, warehouse, service trade, restaurant, car lot	convenience shop, liquor store, office	0,75	75%	two storeys (height TBC)	10.5m	5m	3m	5m	4/100 industrial hive/service trade	per zoning scheme
ELECTRICAL SWITCHING	150m2	LRB/v	UTILITY										
ROAD RESERVE	37 499m2	TRANSPORT II	private road										

REV.	DATE	DESCRIPTION
A	02-08-2021	ISSUED FOR DISCUSSION
B	02-08-2021	ISSUED FOR DISCUSSION
C	10-08-2021	ISSUED FOR DISCUSSION
D	23-08-2021	ISSUED FOR DISCUSSION
E	06-09-2021	ZONING ON TABLE UPDATED DETAILS ADDED TO BUILDING FOOTPRINTS ADJUSTED 4
F	15-09-2021	DRIVE THROUGH 4 ENTRANCES TO PORTIONS 1& 2 RELOCATED
G	17-09-2021	ZONING ON TABLE UPDATED
H	23-09-2021	BULK FACTOR ON TABLE UPDATED
I	29-09-2021	ZONING ON TABLE UPDATED
J	20-10-2021	PROJECT TITLE UPDATED

SIGNED

CLIENT

ARCHITECT

FOR DISCUSSION

All building work to be carried out in compliance with all acts of parliament and all regulations and by laws of local authorities having jurisdiction regarding the execution of works shown on these drawings and the contractor indemnifies the employer in this regard. Before making use of these drawings for the purpose of obtaining tenders or quotations, the contractor shall give written notice to the architect stating the reason for such change and requesting instructions in this regard.

The contractor is to check all dimensions and levels on site before any work is put in hand and shall immediately report any discrepancies for rectification, and shall correct at his own cost any work incorrectly performed as a consequence of his failure to observe this instruction. In the case of alterations and additions to existing buildings, the contractor must check all levels and dimensions against the existing structures. Figured dimensions take preference over scaled dimensions. These drawings are copyright protected.

bam ARCHITECTS

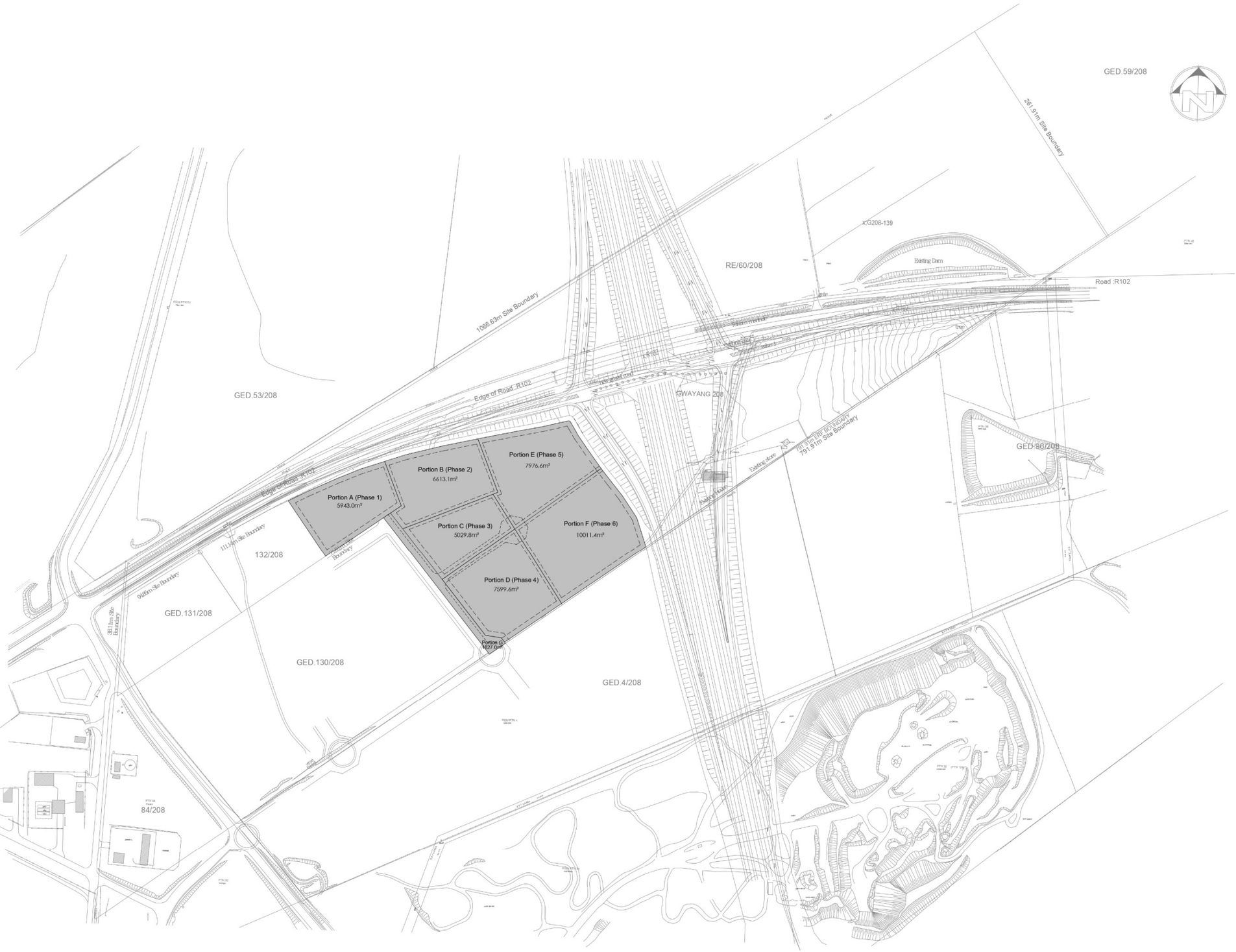
Telephone: + 27 (0)21 465 6007
Facsimile: + 27 (0)21 465 6008
Email: info@bamarchitects.co.za
www.bamarchitects.co.za

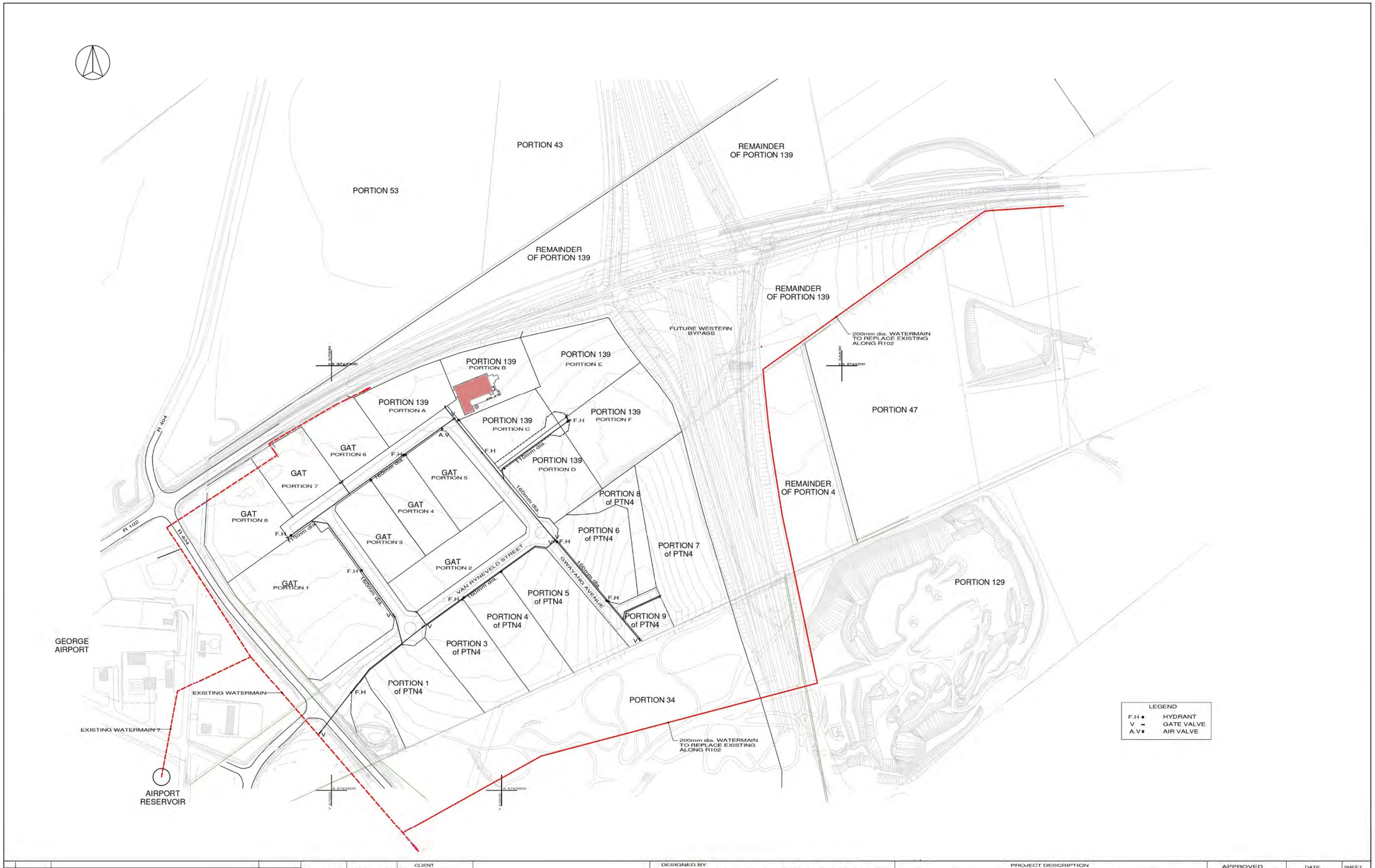
BAM Architects
7 Esplanade Road
Century City, Cape Town, 7441
P.O. Box 2660, Cape Town, 8000

PROJECT
GEORGE AEROTROPOLIS
PORTION 130, 131 & 132 OF THE FARM GWAYANG 208, GEORGE

DRAWING DESCRIPTION
PROPOSED SUBDIVISION LAYOUT

SCALE	DATE
1:500 @ A0	02-08-21
DRAWN: CM	CHECKED: CB
DRAWING NUMBER: 2113 1101	REVISION: J


GED.59/208
2619m Site Boundary
RE/60/208
xG208-139
Existing Dam
Road :R102
1066.63m Site Boundary
Edge of Road :R102
GED.53/208
GWAYANG 208
Portion A (Phase 1)
5943.0m²
Portion B (Phase 2)
6613.1m²
Portion C (Phase 3)
5029.8m²
Portion D (Phase 4)
7599.6m²
Portion E (Phase 5)
7976.6m²
Portion F (Phase 6)
10011.4m²
Portion G
1807.0m²
Existing Store
Existing House
737.91m Site Boundary
GED.98/208
111.46m Site Boundary
132/208
946m Site Boundary
381.11m Site Boundary
GED.131/208
GED.130/208
GED.4/208
84/208



NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

DESIGNED BY A.MORRISON
CHECKED BY PG JOUBERT
DRAWN BY A.MORRISON
CHECKED BY PG JOUBERT

CLIENT
GEORGE AIRPORT SUPPORT ZONE

DESIGNED BY
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION
GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION
PRELIMENARY WATER LAYOUT PLAN

APPROVED
DATE

DATE 28-06-2021
SHEET A1
SCALE 1:2000
REVISION 0
PLAN NO. GASZ-WLP-01

NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

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INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION: GEORGE AIRPORT SUPPORT ZONE

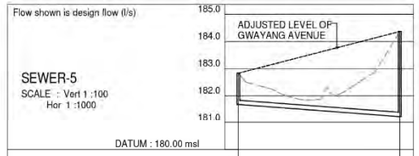
PLAN DESCRIPTION: PRELIMINARY SEWER LAYOUT PLAN

APPROVED (Full signature)

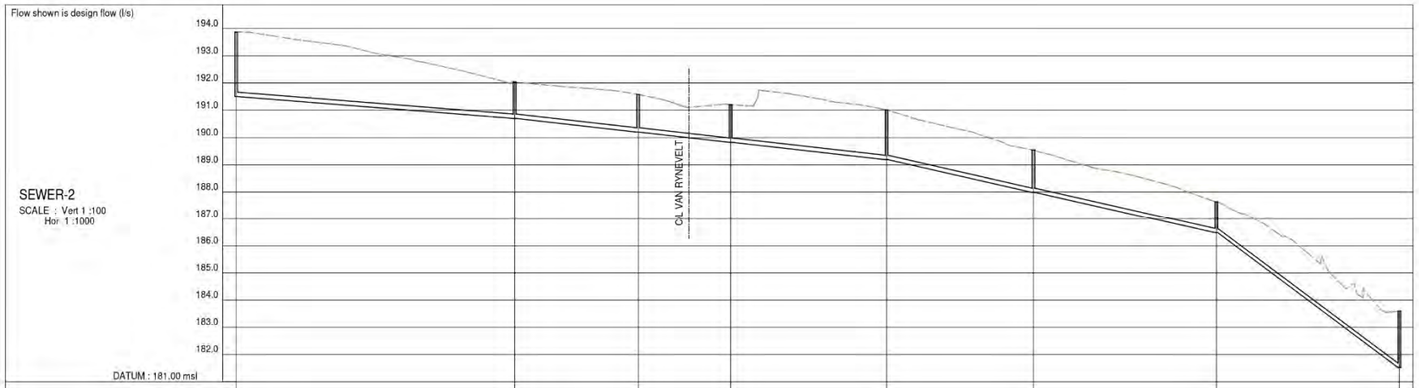
DATE

DATE: 28-06-2021
SHEET: A1
SCALE: 1:2000
REVISION: 0
PLAN NO.: GASZ-RLP-01

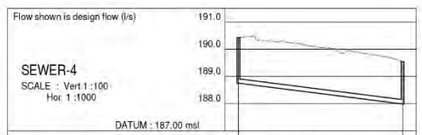
Manhole		R5		R4		R3	R2		R1	
Ground Level	194.90		194.16		193.53		193.27		192.51	
Invert Level	192.80		192.26	0.59	191.57		191.45		190.75	
Depth	2.10		1.89		1.95		1.81		1.76	
Grade (1:_)			129.0		129.0		129.0		129.0	
Flow	(l/s)		0.59		1.07		1.55		1.55	
Capacity(80%D)	(l/s)		14.8		14.8		14.8		14.8	
Pipe Description			160mm dia. UPVC - SEWER PIPE							
Peg Distance	0.0		69.6	69.6	88.8	158.4	15.3	173.7	90.8	264.5



Manhole		R14-1		R14
Ground Level	182.83			184.37
Invert Level	181.68			181.24
Depth	1.16			3.13
Grade (1:_)		136.2		
Flow	(l/s)	0.88		
Capacity(80%D)	(l/s)	14.4		
Pipe Description		160mm dia. UPVC - SEWER PIPE		
Peg Distance	0.0	59.5		59.5



Manhole		R6		R7		R8	R9	R10	R11	R12	R13
Ground Level	193.86		192.03		19`.58	19`.21	19`.01	189.54	187.64	183.60
Invert Level	191.50		190.70		190.20	189.82	189.19	187.99	186.48	181.52
Depth	2.36		1.33		1.38	1.38	1.82	1.55	1.16	2.07
Grade (1:_)			128.2		90.8	90.8	90.8	44.9	44.9	13.6
Flow	(l/s)		1.08		1.63	1.63	1.63	1.63	3.91	3.91
Capacity(80%D)	(l/s)		14.9		17.7	17.7	17.7	25.1	25.1	45.7
Pipe Description			160mm dia. UPVC - SEWER PIPE							
Peg Distance	0.0		102.6	102.6	45.5	148.1	34.0	182.1	57.5	239.6	54.1	293.7	67.4	361.0	67.4	428.4



Manhole		R11-1		R11
Ground Level	190.42			189.54
Invert Level	188.75			187.99
Depth	1.67			1.55
Grade (1:_)		80.0		
Flow	(l/s)	1.39		
Capacity(80%D)	(l/s)	18.8		
Pipe Description		160mm dia. UPVC - SEWER PIPE		
Peg Distance	0.0	60.5		60.5

NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

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CHECKED BY	PG JOUBERT

CLIENT

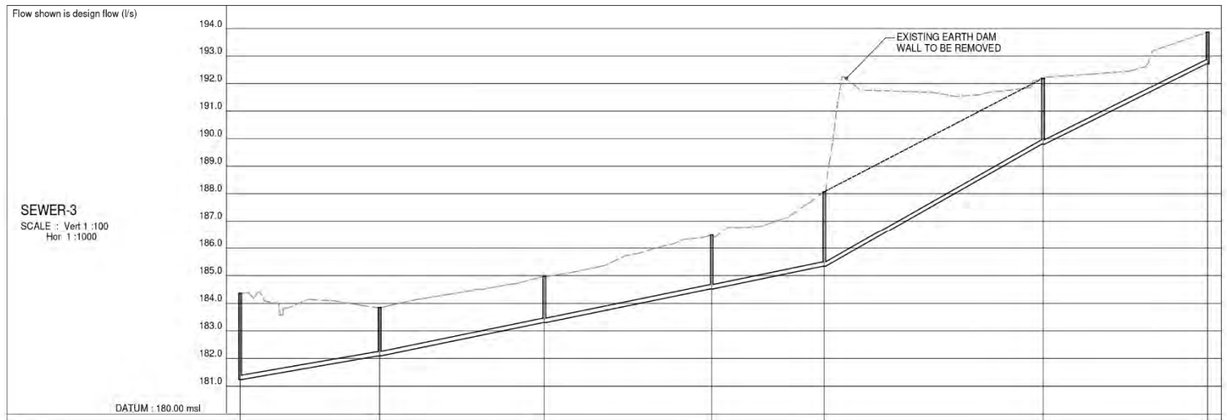
DESIGNED BY
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION
GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION
PRELIMINARY SEWER LONGITUDINAL SECTIONS

APPROVED
DATE

DATE	28-06-2021
SHEET	A1
SCALE	AS SHOWN
REVISION	0
PLAN NO.	GASZ-PSLS-01



Manhole	R14		R15		R16		R17		R18		R20		R21
Ground Level	184.37		183.84		184.97		186.48		188.07		192.19		193.87
Invert Level	181.24		182.10		183.30		184.52		185.34		189.80		192.71
Depth	3.13		1.74		1.67		1.96		2.73		2.39		1.16
Grade (1:_)		59.2		50.0		50.0		50.0		17.8		20.6	
Flow (l/s)		3.64		3.64		3.64		3.64		3.64		1.94	
Capacity(80%D) (l/s)		21.9		23.8		23.8		23.8		38.5		37.0	
Pipe Description		160mm dia./ClassPVC - SEWER PIPE											
Peg Distance	0.0	50.9	50.9	60.0	110.9	61.1	171.9	41.0	213.0	79.7	292.7	60.0	352.8

NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

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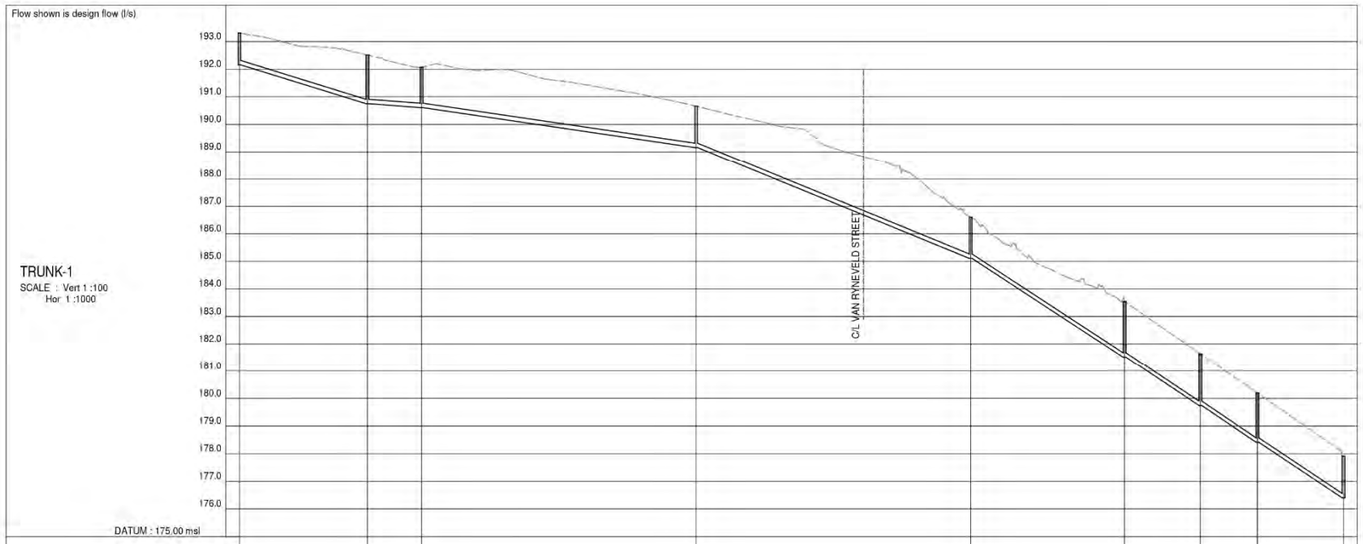
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION
GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION
PRELIMINARY SEWER LONGITUDINAL SECTION

APPROVED (For signature)
DATE

DATE 28-06-2021
SHEET A1
SCALE AS SHOWN
REVISION 0
PLAN NO. GASZ-PSLS-02



Manhole	NR1		R1		NP2		NP3		NP4		R13		NR5		NR6		NR7	
Ground Level	193.31		192.51		192.07		190.66		186.61		183.54		181.64		180.20		177.91	
Invert Level	192.15		190.75		190.61		189.16		185.11		181.52		179.75		178.41		176.40	
Depth	1.16		1.76		1.46		1.50		1.50		2.03		1.89		1.79		1.51	
Grade (1:_)		33.2		140.0		69.0		24.7		15.6		15.6		15.6		15.6		
Flow	(l/s)																	
Capacity(80%D)	(l/s)	29.2		14.2		20.3		33.9		42.6		42.6		42.6		42.6		
Pipe Description		160mm dia.UPVC - SEWER PIPE																
Peg Distance	0.0	46.6	46.6	19.7	66.3	100.0	166.3	100.0	266.3	56.0	322.3	27.6	349.9	20.8	370.7	31.4	402.1	

NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

DESIGNED BY A.MORRISON
CHECKED BY PG JOUBERT
DRAWN BY A.MORRISON
CHECKED BY PG JOUBERT

CLIENT

DESIGNED BY
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION
GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION
PRELIMINARY SEWER LONGITUDINAL SECTION

APPROVED (Print signature)
DATE

DATE 28-06-2021
SHEET A1
SCALE AS SHOWN
REVISION 0
PLAN NO. GASZ-PSLS-03

NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

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DRAWN BY	A MORRISON
CHECKED BY	PG JOUBERT

CLIENT: GEORGE AIRPORT SUPPORT ZONE

DESIGNED BY:
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

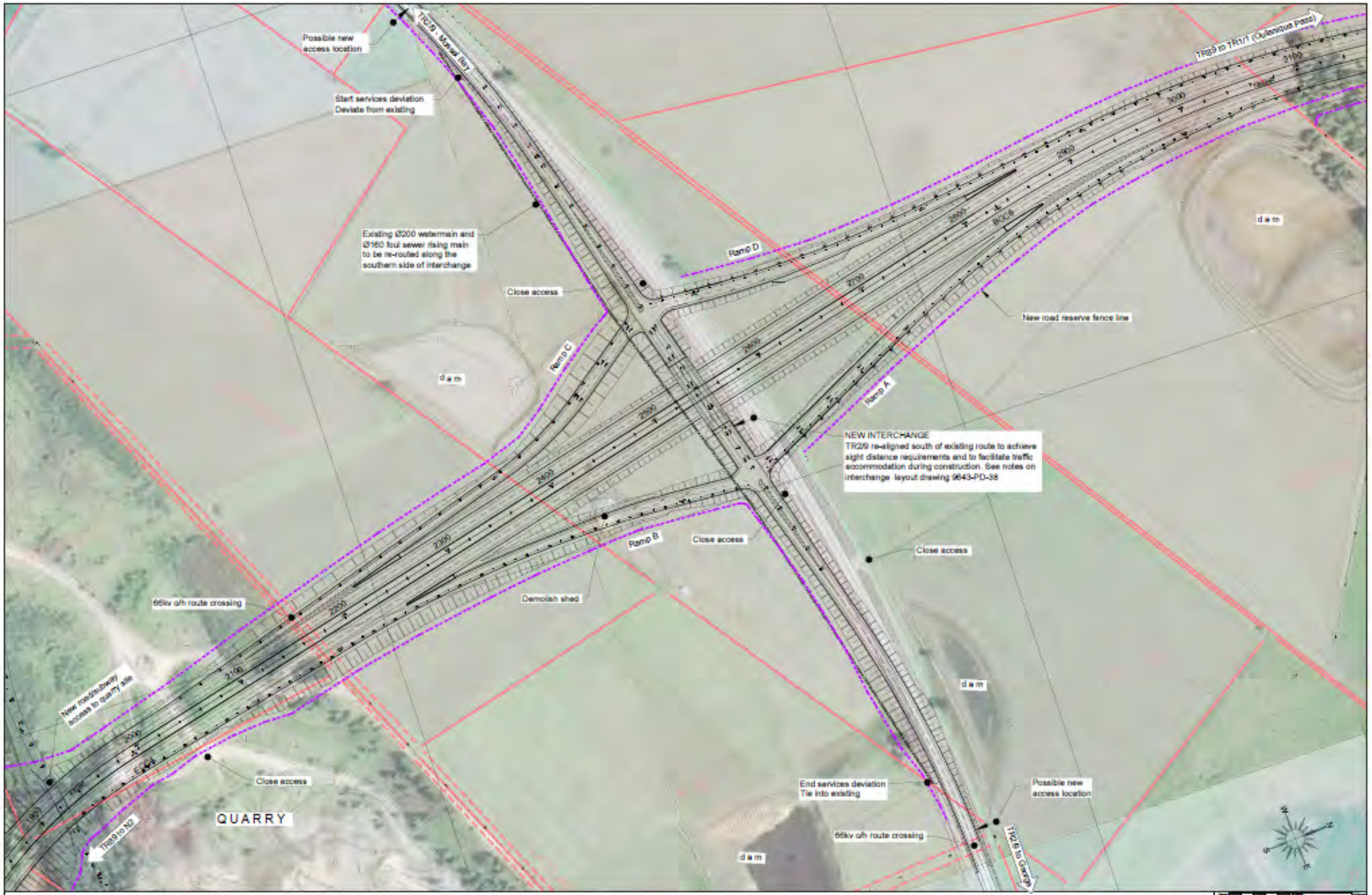
PROJECT DESCRIPTION: GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION: PRELIMINARY STORMWATER LAYOUT PLAN

APPROVED (Full signature) _____ DATE

DATE	SHEET
28-06-2021	A1
SCALE	REVISION
1:2000	0
PLAN NO.	
GASZ-SWLP-01	

its INNOVATIVE TRANSPORT SOLUTIONS	GEORGE	Road Master Plan: George Airport North Eastern Precinct	1:2500 @ A1
		Road Network - Long Term	3980 /LT / 2



NO.	DATE	ADDITIONS AND AMENDMENTS	APPROVED	
			CONS	PRE
A		ISSUED FOR PRELIMINARY DESIGN	GAT	HB
B		UPDATED FOR PRELIMINARY DESIGN APPROVAL	GAT	MT

DESIGNED BY	DR TYNDALL / P MARAIS-LEWIS
DRAWN BY	K FORD
CHECKED BY	P MARAIS-LEWIS
APPROVED BY	DR TYNDALL

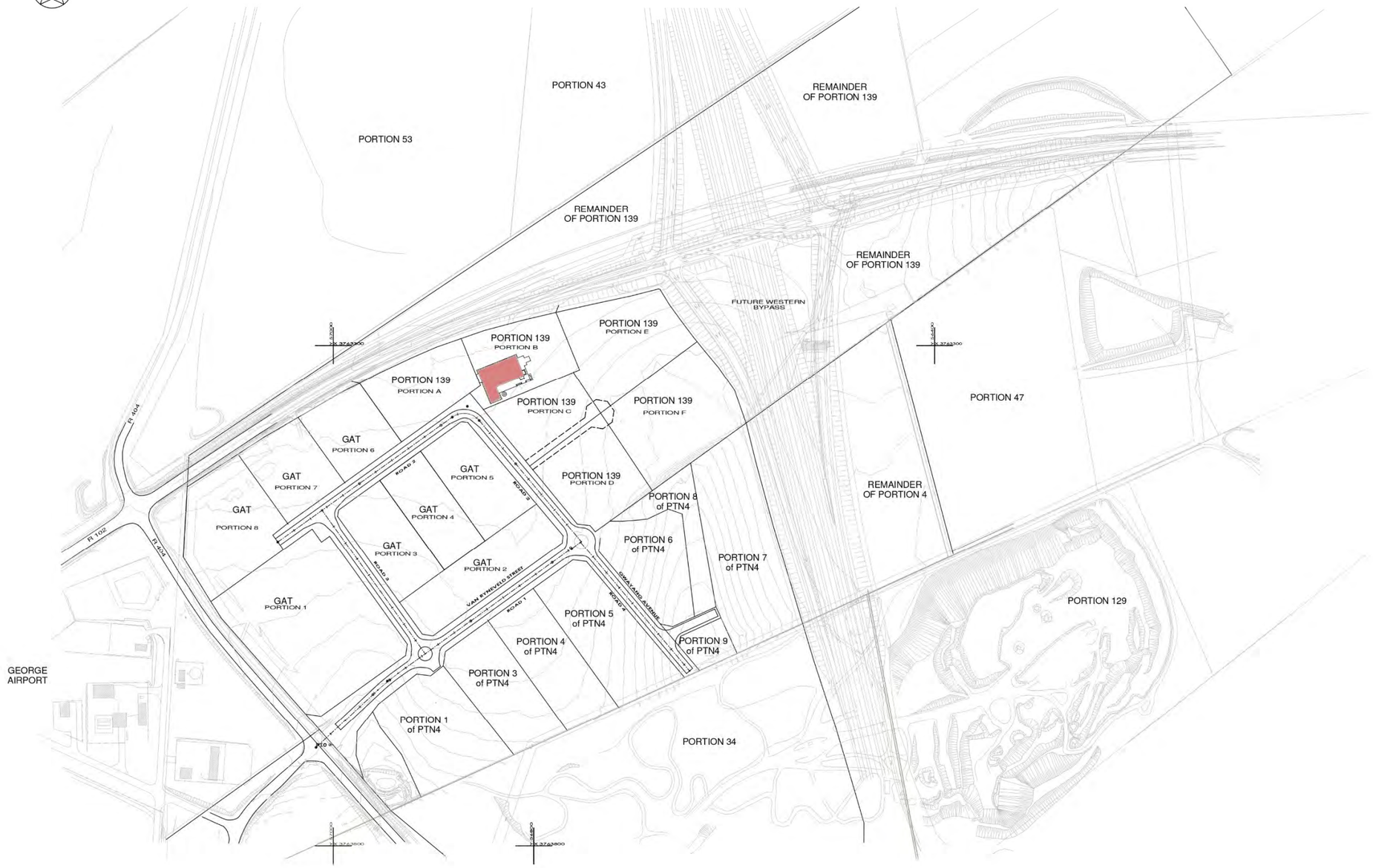
K&T Lacey & Tyndall

Western Cape Government
Transport and Public Works

PROPOSED TRUNK ROAD 89 (GEORGE WESTERN BY-PASS)
km 0 (N2/8) to km 12.5 (TR1/1 OUTENIQUA PASS)

ROAD LAYOUT: SHEET 3 OF 12: KM 2.0 TO KM 3.0

	1:1000
C377.01	
9643-PD-06	B



NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

DESIGNED BY	A. MORRISON
CHECKED BY	PG JOUBERT
DRAWN BY	A. MORRISON
CHECKED BY	PG JOUBERT

CLIENT: GEORGE AIRPORT SUPPORT ZONE

DESIGNED BY
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

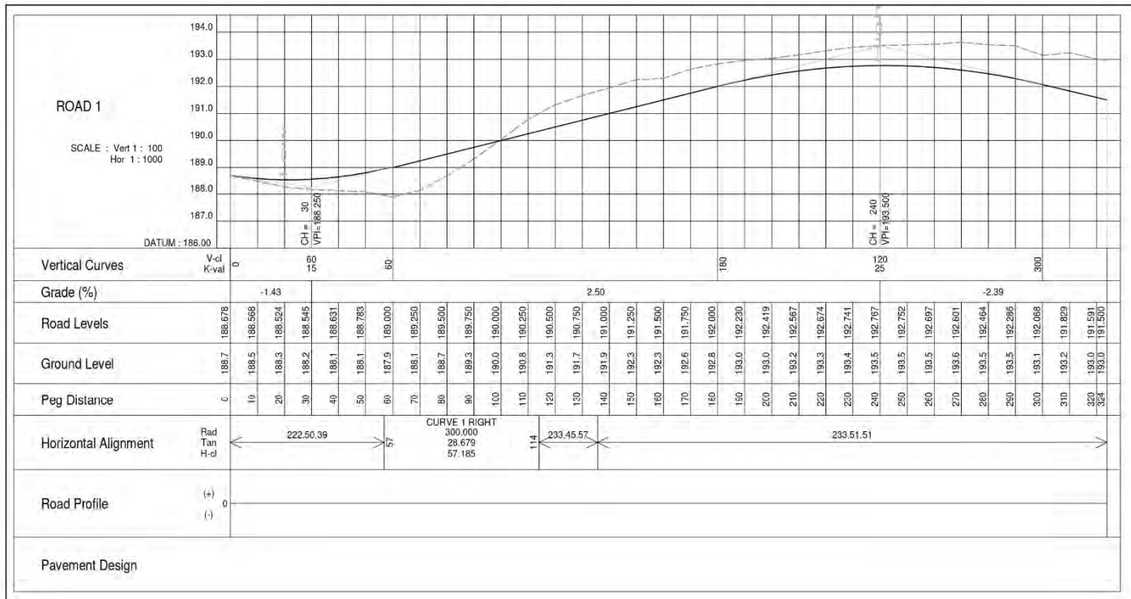
PROJECT DESCRIPTION: GEORGE AIRPORT SUPPORT ZONE

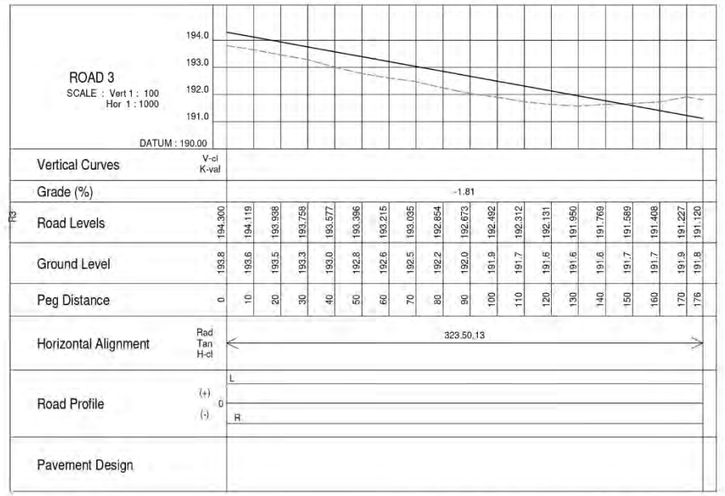
PLAN DESCRIPTION: PRELIMINARY ROAD LAYOUT PLAN

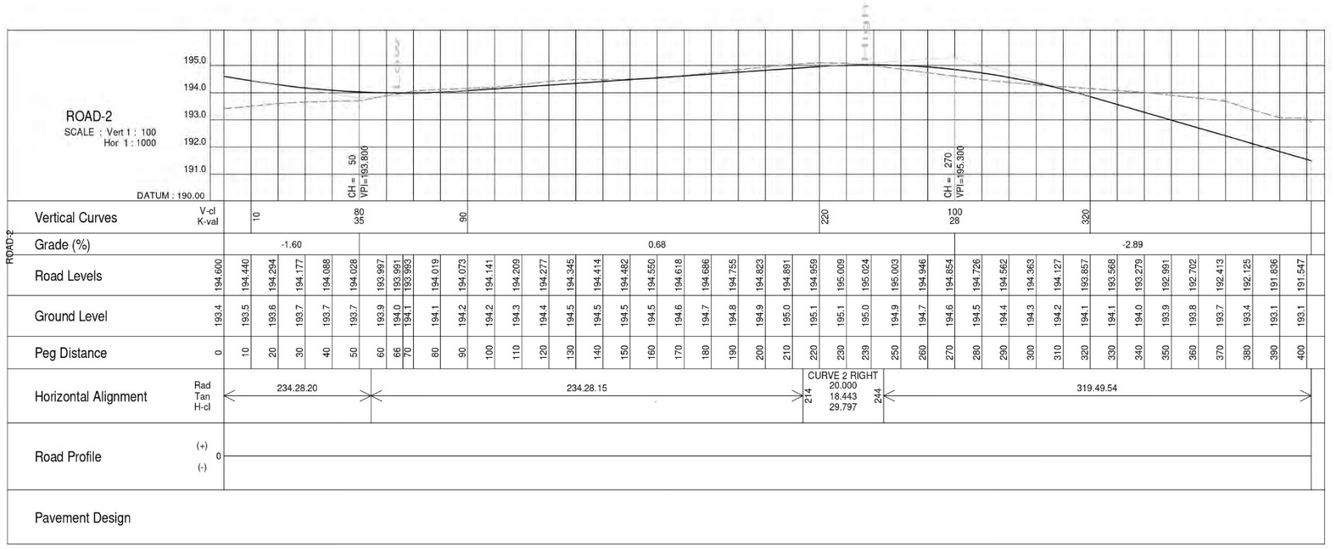
APPROVED (Full signature)

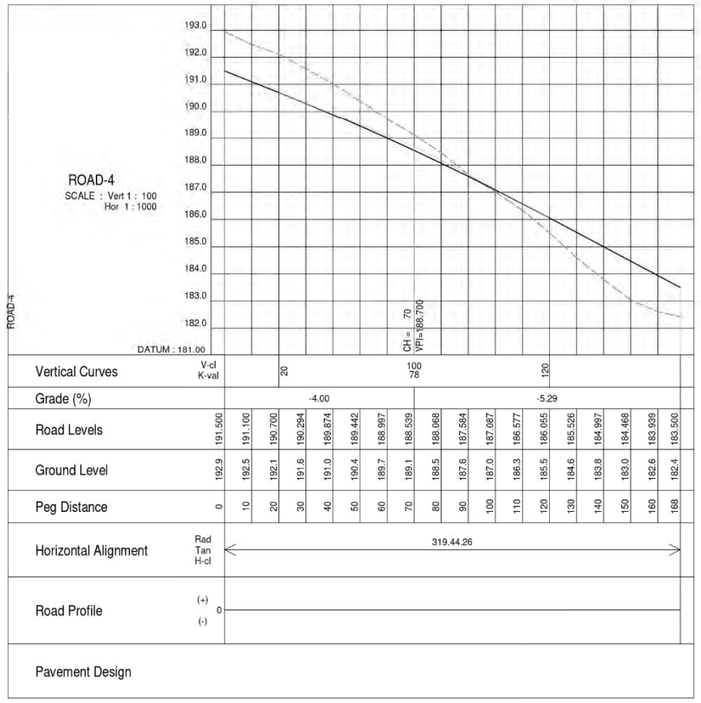
DATE

DATE	SHEET
28-06-2021	A1
SCALE	REVISION
1:2000	0
PLAN NO.	
GASZ-RLP-01	









NO	DATE	DESCRIPTION	REVISED BY
0	01/10/2021	ISSUED FOR DISCUSSION	A.M

AMENDMENTS

DESIGNED BY A.MORRISON
CHECKED BY PG JOUBERT
DRAWN BY A.MORRISON
CHECKED BY PG JOUBERT

CLIENT

DESIGNED BY
INFRASTRUCTURE CONSULTING ENGINEERS cc
PO BOX 186
PERSEQUOR PARK
0020
Tel (012) 349-2022/3/4/5

PROJECT DESCRIPTION
GEORGE AIRPORT SUPPORT ZONE

PLAN DESCRIPTION
PRELIMENARY ROAD LONGITUDINAL SECTIONS

APPROVED (Full signature)
DATE

DATE 28-06-2021
SHEET A1
SCALE AS SHOWN
REVISION 0
PLAN NO. GASZ-PRLS-01