Engineering Services Report
For Proposed Development at
Erf 1058, Hoekwil
Whites Road, Wildernis Heights

2 May 2024

Version 4

Prepared by AG Polson
082-481-9434
alexander@polsons.info

Contents

1. Terms of Reference 3
2. General Site Information 4
3. Available services 5
4. Water Demand 6
5. Sewage 7
6. Storm Water 9
7. Geotechnical Properties 10
8. Fire mitigation and suppression 11
9. Household Waste Removal 12
10. Appendix A – Site Development Plan 13
11. Appendix B – Municipal Water Correspondence 14
12. Appendix C - Water Consumption Calculations 16
13. Appendix D - Road Access Approval 19
14. Appendix E – Firescaping The Garden 21

1. Terms of Reference

This engineering and services report is in support of:

- the proposed rezoning from Agriculture 2 to Open Space Zone III
- development of this vacant land to allow for:
    - a house;
    - a free-standing garage with a studio;
    - three accommodation tourist units

This report will provide information regarding the following:

- Water, electricity, and sewerage;
- Storm water mitigation and erosion prevention;
- Geology and substrate of the site;
- Foundations and supports to be used for construction;

2. General Site Information

Erf 1058 Hoekwil, with location shown in the image below, is a vacant smallholding of 3.0108 hectare in extent, located in Hoekwil (Wilderness Heights). The zoning of the property is Agriculture Zone II in terms of the George Integrated Zoning Scheme By-law (2017). The property overlooks the Touw River and Ebb & Flow Rest Camp (Garden Route National Park) to the east, the Fairy Knowe area and the Indian Ocean to the south, and some views towards the Village of Wilderness to the west. Access to the property is from Whites Road leading from the Village around the Wilderness Heights area. The section of Whites Road passing Erf 1058 Hoekwil is a provincial road, Divisional Road 1621.

A low density residential and tourism development is proposed on Erf 1058, pending approval of rezoning from current Agriculture Zone II to Open Space Zone III, and will consist of the following:

- Main residential dwelling for the property owner
- Outbuilding with home office, garage, and storage space
- Driveway and parking for main dwelling
- Three tourist accommodation units with central parking

The site development plan is shown in ***Appendix A – Site Development Plan***

3. Available services

Below is a summary of services. Where needed, more detailed information is provided later in this document.

Electricity:

No connection to the grid will be made. The whole property will be electrically self-sufficient.

Electricity will be provisioned by means of roof mounted photo voltaic (PV) panels mounted on the main house and studio building, together with the centrally placed and requisite inverters and storage batteries. Electricity will be provisioned to the various buildings by underground armoured cable. The routes for burying the cables will be as far as possible be coincidental with the service road to the lower part of the property.

In case of extended overcast weather, a suitably sized generator will be installed at the Studio building to provide for the basic power requirements.

The owner is approaching various reputable companies that are active in the George area for plant sizing and quotations.

Gas:

Heating and cooking requirements will be met by usage of commercial gas stoves and geysers, supplied by reputable suppliers, and according to all applicable norms and standards.

Water:

Rainwater will be harvested from all roofs and stored in multiple 10,000 Liter or 5,000 Liter tanks. This water will be supplemented as needed from a new 25 mm connection to the George municipal water network. Please refer to ***Appendix B – Municipal Water Correspondence*** which confirms that:

1. a connection can be applied for, as well as the cost
2. confirmation of water services is also given

Road connection:

Approval for the road connection onto the property was obtained on 25 May 2023, and is shown in ***Appendix D - Road Access Approval***.

The owner takes note and undertakes to comply with the conditions listed in the approval document under points 3.1 to 3.5, and will make use of the services of a civil engineer that will be appointed in due course.

4. Water Demand

Analysis is shown below for domestic and fire suppression use.

Household:

The water demand is not calculated according to the Red Book, due to the following assumptions:

- That the owner and guests will adjust their water consumption habits cognisant that the water is rain harvested and is a limited resource.
- The main house will have two occupants most of the time, and up to 6 for short periods. Therefore, calculations are based on four occupants for the main house with a peak factor of 1.5 times.
- The tourist accommodation assumes on average two adults and a child, and with a higher peak factor of 2 times.
- Less water will be planned for than the Red Book recommendations by using water-economic toilets and shower heads. Further savings are possible when using correctly treated grey water for flushing of toilets but is not considered in the calculations.

The total water consumption for all the buildings per month is summarized below. The detailed calculations are show in ***Appendix C - Water Consumption Calculations***.

Buildings	Units	Liter per unit per day	Peak factor	Liter per day	Liter per month
Main	1.0	549.1	1.5	823.7	24,711.43
Studio office	1.0	150.0	1.0	150.0	4,500.00
Accommodation	3.0	369.0	2.0	738.0	22,140.00
			Total	**1,711.7**	**51,351.4**

Rainwater will be harvested from all roofs. Assuming an average rainfall of 85 mm per month, the calculation below shows that sufficient water can be collected to service all consumption without using any of the municipal water supply. It is planned to provision about 120,000 Liter of storage to collect any excess rain during the rainy season.

Rain harvesting	Roof m²	Liter per unit	Units	Liter per month
Main	200.0	17,000	1	17,000
Studio	170.0	14,450	1	14,450
Accommodation	80.0	6,800	3	20,400
			Total	**51,850.0**

Fire suppression:

Due to the predominantly indigenous vegetation, as well as the measures described in **Section 8 - Fire**, agricultural metal pipes and sprinklers will be used to provide an additional fire suppression by means of a total of 20 sprinklers placed strategically at the various buildings. Assuming one Liter/s consumption per sprinkler, the total consumption would be 72,000 Liter for one hour only. This will be supplied from the 120,000 Liter of stored wated mentioned above.

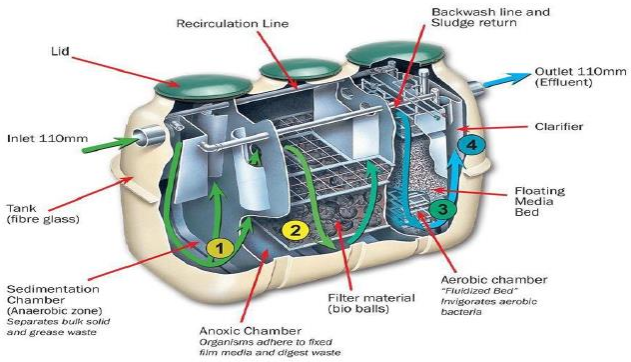
5. Sewage

There is no available infrastructure to connect to.

The solution proposed below intends to avoid the following problems:

- municipal capacity constraints on emptying conservancy tanks;
- environmental risk of possible spillage from septic tanks and soakaways;
- risk of build-up of sludge and difficulty of removing it;
- aesthetic degradation of surroundings – the plant is buried;

A Fusion® wastewater treatment plant from Maskam Water, a company based in Cape Town, with a proven track record, will be used, or if not available a similar product.



Below is a picture of their installation outside the boardrooms of the Department of Environmental Affairs and Development Planning in Cape Town CBD.

They have a large portfolio of successful installations and operations in ecological sensitive areas, and complies with City of Cape Town Water Amendment By-law, 2018.

Their recommendation is to size for the maximum expected usage, which is summarized below.

Main house	6 persons
Studio and office	10 day-visitors
3x accommodation units, 4 persons each	12 persons
TOTAL: **NOTE – this is sufficient for the number of persons for which water provisioning was calculated**	28 persons per day

No further up-factoring is used due to the modularity of the units, which makes it possible to grow capacity as needed, and so avoiding over-provision, with its associated costs.

It is also unlikely to always have 100% occupancy. Tourism average occupation is about 30%, which may cause the dilemma that if over-provisioned, there might not be sufficient effluent to nourish the microbial biome.

The largest unit handles 28 persons per day and is a good fit. Two smaller units are also available, which caters for 6 and 12 persons. The units are modular, which means that additional capacity can easily be added. This also gives the owner the option to spread out capital investment in a phased approach by starting out with smaller units, to which capacity can be added.

The package plant gives a timeous alarm whenever it needs attention or maintenance, and therefore it is expected that the effluent will consistently be of a high quality and that it can be safely diverted into a soakaway system. The units use between 60 Watt and 120 Watt, which will be supplied of the solar PV system for the property.

The final positioning and selection of capacity is still being determined, due to the distributed housing and steep gradient. This will be finalised by the time that building plans are submitted.

6. Storm Water

Referring to the site development plan in ***Appendix A – Site Development Plan***, the total area impacted by the proposed development is approximately 6.4 % (1,913 m^2) of an otherwise vacant natural area (30,108 m^2).

The provision for storm water mitigation is therefore aimed at mitigating the impact of the proposed development which is distributed over an otherwise natural area.

The owner's approach to storm water management is informed by "*considering stormwater as part of the urban water cycle, a strategy which is being increasingly known as Water Sensitive Urban Design (WSUD) with the stormwater management component being known as Sustainable Drainage Systems (SuDS)*" [1].

The negative impact of rainwater will be mitigated by:

- reducing its volume through harvesting and using permeable surfaces to absorb remaining water;
- dissipating energy by spreading out over a large area and reducing velocity by hydraulic coarse surfaces.

Rainwater will be harvested from all roofs after diverting first flush to improve quality of water.

The remaining water will be further reduced by encouraging absorption using permeable surfaces, such as gravel pavements, and permeable paving blocks.

The access road is made of permeable block paving, the parking areas from coarse gravel. The service road is made from two tracks of permeable paving blocks with coarse gravel in the middle and sides to break the speed of the water and to allow for absorption. The sides of these tracks and run-off from any other surfaces have shallow swales lined with coarse gravel and diversion channels to redirect water at regular intervals away from the road into the surrounding area.

Excess water will be directed to a pond to absorb any excess initial runoff. The slope of embankments and cut-outs will be stabilised by suitable concrete retainer wall blocks.

[1] Report to the Water Research Commission, "*Alternative Technology for Stormwater Management, The South African Guidelines for Sustainable Drainage Systems*", by Neil Armitage et al, 2013. Download link: https://www.wrc.org.za/wp-content/uploads/mdocs/TT%20558.pdf

7. Geotechnical Properties

A geotechnical survey was done at the property. The report, dated 24 July 2023, was not included in this document due to its length, but is available on request.

The main insights from the report are summarized here:

1. From the three test pits two refusals encountered at depths less than 1.5 meters
2. The average depth of the test pits were 1.38 meters.
3. Excavatability constraints may be expected for excavations exceeding 1.5 meters in depth.
4. The site is underlain by gneissic granite and granodiorite and albitite (intrusive) of the Maalgaten and related granites (Nmg) of the Namibian Period.
5. The soil horizons consisted of silty sand materials.
6. The study area drains well by sheetwash.
7. Generally, the materials encountered on site were silty sand.
8. The foundation indicators indicate ''low'' heave potential across the study area.
9. Three CBR tests were done, and the results varied between 6 and 19% @ 95% Mod AASHTO, reflecting low to medium bearing capacities of approximately 54 to 171 kPa.
10. The typical materials sampled on site classified as G8 to >G9 according to the COLTO classification system.
11. Five Dynamic Cone Penetration (DCP) tests were conducted on site. Based on the DCP results it is evident that consistency increases with depth. The material near the surface is more silty and less dense, while the lower layers were more consolidated and of higher consistency.
12. Engineering properties of soils:
    a. The NHBRC engineering geological zoning of this site is as follows: S. The Site Classes are S1 (100%).
    b. Site Class S1 – Reinforced strip foot foundations are recommended as will be decided upon by the Structural Engineer. All trenches have to be inspected by the appointed Structural Engineer before steel is placed (if required) and concrete is poured.
    c. Although none of the refusals encountered were shallow, excavation constraints may be expected in excavations exceeding 800 mm.
13. In terms of the SABS 1200 the excavations can be classified as soft to intermediate to 1 meter in depth. Excavations between 1.0 and 1.5 meters are considered as intermediate. Excavations in excess of 1.5 meters are considered to be intermediate to hard.
14. There were no signs of piping (erosion) visible on site.
15. No unstable geological materials that can move either gradually (creep) or suddenly as a slump or a slide are visually present.
16. Excavations are to be adequately drained should rainwater fill trenches during construction or if the water tables rise.
17. The low expansive materials found on this site are suitable for floor fill purposes. Where encountered, clayey materials should be cut to spoil.
18. Excavations were all stable and no side walls collapsed.

8. Fire mitigation and suppression

The owner has been a member of the Southern Cape Fire Protection Association (SCFPA) since 10 January 2023, and is well informed on the topic of being fire wise.

Buildings and infrastructure will be protected by means of

- Applying the building industry code for fire
- SCFPA recommended:
    - zoning of areas around the buildings; and
    - use of fire hardy or -retardant indigenous plants; and
    - fire-wise practices of keeping available fuel to a minimum.
- fire suppression with bronze agricultural sprinklers that are:
    - placed strategically around buildings; and
    - gravitation- or delivery pump-fed from water reservoirs

In consultation with the SCFPA, it was established that the planned access road to the lower part of the property, as well as the power line servitude will aid in granting access to firefighting personnel.

9. Household Waste Removal

This section addresses the estimation of the amount of waste that will be generated by the main household, as well as by the visitors of the three accommodation units.

Waste diversion will be introduced though recycling compostable organic kitchen waste and by separating out recyclable materials.

The total quantity of waste removal is estimated, based on information obtained from the *George Local Municipality Integrated Waste Management Plan*[2] as follow:

- Table 32, page 43 gives the total waste per person per day (kg/p/d). This is based on the assumption of a high-income category due to tourism, as 1.29 kg/p/d.
- We prefer using a more conservative value of 2 kg/p/d, which is also in line with the Western Cape average.
- We use an average tourism occupancy rate of 30 % for the "Other" accommodation category, which is slightly higher than monthly values reported in the STATS SA report of 2023[3] Table 5, page 7.
- Table 29, page 37 lists food and garden waste to make up about 25% and 13% of the waste profile. Through use of composting and mulching of the above organic waste at the premises, we estimate that a conservative reduction of at least 38% can be made to the waste that needs to be collected per person.
- Page 38 states that "*By volume, 38.3% of the waste stream is composed of mainstream recyclables (paper, plastic, cardboard, glass and metal)*".

The total waste per person is therefore estimated as:

2 kg [waste kg/p/d] x 30% [occupancy] x 28 (persons/d) x 7 [weekly quantity]

= 2 x 0.3 x 28 x 7

= 118 kg/week, of which 38% (45 kg) does not need to be collected because of composting, and 38% (45 kg) is recyclable.

This means that the quantity of refuse to be collected is:

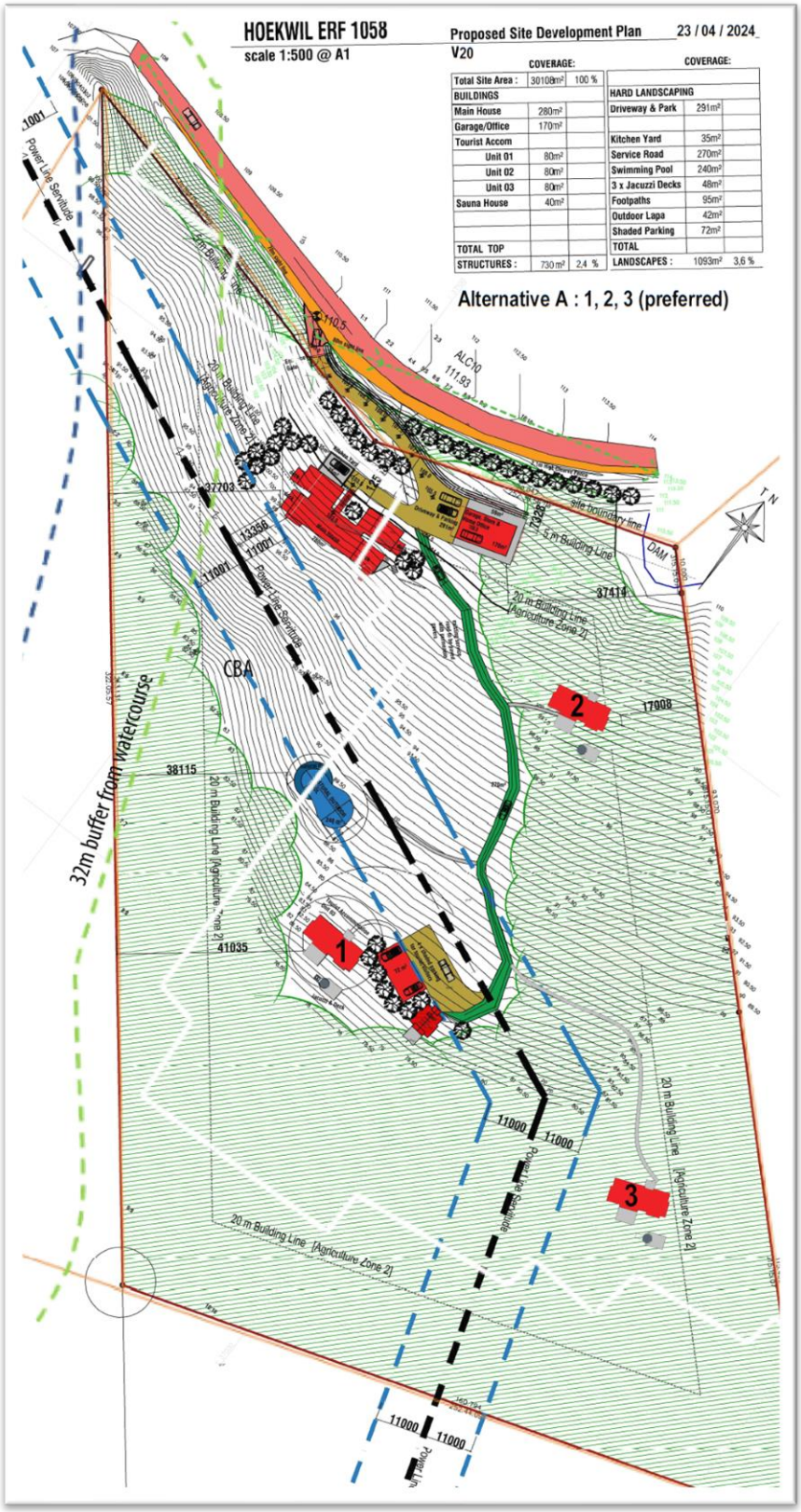
- 45 kg/week of recyclable material (blue bag system) and
- 28 kg/w non-compostable/recyclable material (black bag system)

A weekly refuse removal service is already available and being billed for at the address of the proposed development.

[2] *George Local Municipality Integrated Waste Management Plan*, 2020 – 2025, GE38216, March 2020
[3] STATISTICAL RELEASE, P6410, Stats SA, Nov 2023, online

10. Appendix A – Site Development Plan

Two alternatives are proposed within the environmental application processes. From an engineering planning point of view the differences are immaterial, and therefore only the preferred "Alternative A" is shown here.

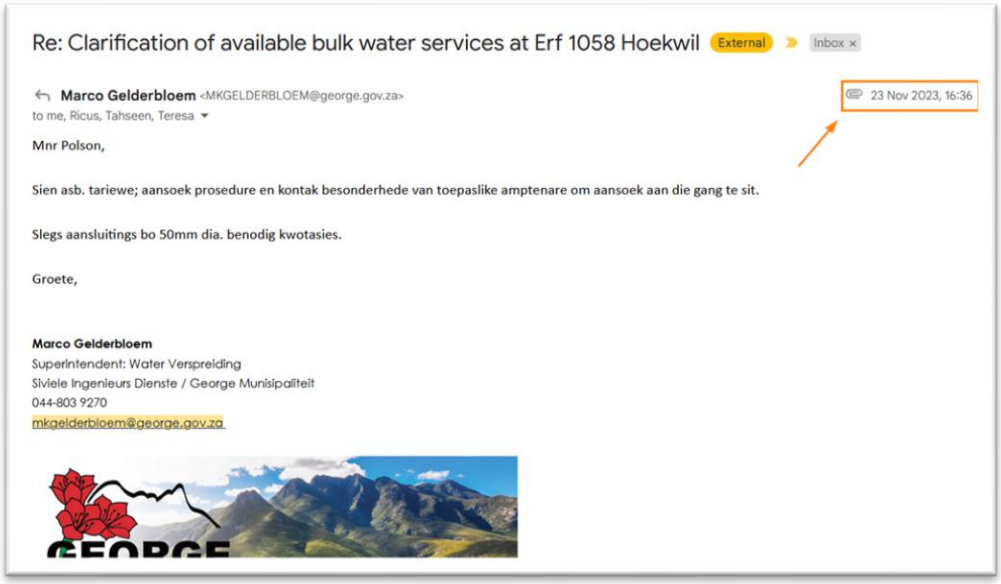


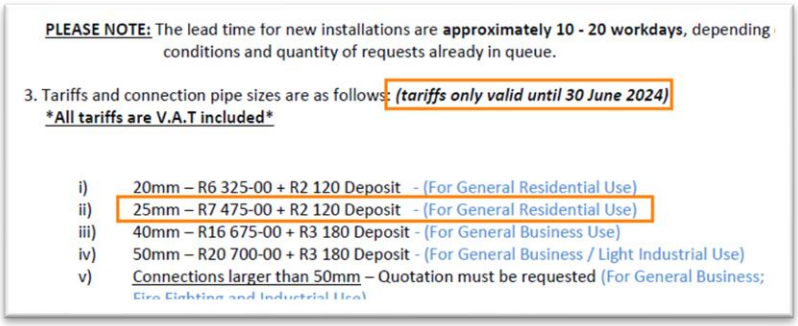
COVERAGE:			COVERAGE:		
Total Site Area :	30108m²	100 %			
BUILDINGS			HARD LANDSCAPING		
Main House	280m²		Driveway & Park	291m²	
Garage/Office	170m²				
Tourist Accom			Kitchen Yard	35m²	
Unit 01	80m²		Service Road	270m²	
Unit 02	80m²		Swimming Pool	240m²	
Unit 03	80m²		3 x Jacuzzi Decks	48m²	
Sauna House	40m²		Footpaths	95m²	
			Outdoor Lapa	42m²	
			Shaded Parking	72m²	
TOTAL TOP STRUCTURES :	730 m²	2.4 %	TOTAL LANDSCAPES :	1093m²	3.6 %

11. Appendix B – Municipal Water Correspondence

- The existence of a PVC-16 50 pipe near the property was confirmed, as shown:

- The procedure and list of tariffs for connection was received, as shown below:





- Confirmation of water services

GEORGE
THE CITY FOR ALL REASONS

Tahseen Raiman
Manager: Water Distribution
Civil Engineering Services
E-mail: traiman@george.gov.za
Tel: +27(0)44 801 9352

2 May 2024

Alexander Polson
Owner of Erf 1058
+27 82 481 9434

Confirmation of Water Services for Erf 1058, Hoekwil

To whom it may concern

Mr Polson has applied for a water connection to erf 1058, Hoekwil. This letter serves to confirm that George Municipality will provide water to the erf, subject to network conditions such as pipe bursts, peaks in demand and overall hydraulic capacity.

T. Raiman

Tahseen Raiman
Manager: Water Distribution

-

12. Appendix C - Water Consumption Calculations

Usage per main home resident:

Event	Liter	Events/day	Liter/person/day
Shower	25	1	25.0
Bath (twice a week)	120	2/7	34.3
Econo Flush	3	3	9.0
Full Flush	6	1	6.0
Water (drink, brews)	1.5	1	1.5
Washing hands	1	5	5.0
		Total (A)	**80.8**

Main house - cooking and cleaning:

Event	Liter	Events/day	Liter/person/day
Dishwasher (Energy Star Rated)	20	2	40.0
Washing machine incl visitors' linen (front loader)	80	2	160.0
Cooking	3	2	6.0
Cleaning	5	2	10.0
Hand washing of dishes	10	1	10.0
		Total (B)	**226.0**

Usage per accommodation unit resident:

Event	Liter	Events/day	Liter/person/day
Shower	37.5	1	37.5
Econo Flush	3	5	15.0
Full Flush	6	2	12.0
Water (drink, brews)	1.5	1	1.5
Washing hands	1	5	5.0
		Total (C)	**71.0**

Usage for accommodation - cooking and cleaning:

Event	Liter	Events/day	Liter/person/day
Cooking	3	2	6.0
Cleaning	5	2	10.0
Hand washing of dishes	10	2	20.0
		Total (D)	**36.0**

Using the above estimates per person and per building, these are summarized below per building type:

Main house

Event	Liter	Persons or Events/day	Liter/day
Personal use (A)	80.8	4	323.1
Cleaning and cooking (B)	226.0	1	226.0
		Total (E)	**549.1**

Accommodation unit:

Event	Liter	Persons or Events/day	Liter per day
Personal use (C)	71.0	3	213.0
Cleaning and cooking (D)	36.0	1	36.0
Bath	120.0	1	120.0
		Total (F)	**369.0**

Studio:

Event	Liter	Events/day	Liter per day
Econo Flush	3.0	15	45.0
Full Flush	6.0	10	60.0
Drinking	1.0	10	10.0
Hand washing of dishes	10.0	1	10.0
Hand washing	1.0	25	25.0
		Total (G)	**150.0**

Finally, the consumptions shown above are summarized below:

Building	Units	Liter per unit per day	Peak factor	Liter per day	Liter per month
Main (E)	1.0	549.1	1.5	823.7	24,711.43
Studio (F)	1.0	150.0	1.0	150.0	4,500.00
Accommodation (G)	3.0	369.0	2.0	738.0	22,140.00
			Total	**1,711.7**	**51,351.4**

13. Appendix D - Road Access Approval

Approval, shown below, for a road connection was received on 25 May 2023.

Western Cape Government

Infrastructure
Vanessa Stoffels
Chief Directorate: Road Planning
Vanessa.Stoffels@westerncape.gov.za | Tel: 021 483 4669

Ref: TPW/CFS/RP/LUD/REZ/SUB-12/166 (Job 30213)

Mr Alexander G. Polson
15 Ayton Street
Clydesdale
PRETORIA
0002

Dear Sir

ERF 1058, HOEKWIL (WILDERNESS AREA): ACCESS OFF DIVISIONAL ROAD 1621 (DR01621; WHITES ROAD), GEORGE MUNICIPALITY AND DIVISION

1. The following refer:

1.1 This Branch's unreferenced letter dated 19 May 2005 to George Municipality, which appears to have been compiled by the District Municipality on behalf of the District Roads Engineer - Oudtshoorn.

1.2 Your unreferenced letter dated 2 March 2023 to this Branch.

1.3 Your unreferenced letter dated 7 May 2023 to this Branch.

2. Although this Branch does not favour the approval of accesses that do not fully comply to this Branch's accepted minimum safe standards has this Branch supported and approved the subdivision of Erf 547, Hoekwil to create Erf 1058, Hoekwil without issuing approved access locations. Erf 1058 is in an area of rolling terrain, with its only access possibility off DR01621, for which this Branch is the Road Authority. DR01621 is a narrow gravel road, with numerous short radius horizontal curves, that do not allow fast vehicular operating speeds. DR01621 is frequently used by cyclists enjoying the surrounding pristine lush environment.

3. This Branch, in terms of Roads Ordinance 19 of 1976, approves the access off DR01621 at ±km4.89 LHS ("Left Hand Side"), provided that the following are adhered to:

3.1 Detailed design plans of the access and associated access road, which might be partially within the road reserve, must be submitted to this Branch's Chief Directorate Road Design (Attention: Mr M Hendrickse; e-mail: Michael.Hendrickse2@westerncape.gov.za Tel: 2721-4833107), and the approval must be obtained before any construction activities within the DR01621 road reserve may commence.

3.2 An agreement must be brought into place with this Branch permitting the owner of Erf 1058 to maintain the access and associated access road within this Branch's road reserve. This agreement must be ensured to not allow an owner of Erf 1058 to dispose of the property before any future owner signs a similar agreement with this Branch.

3.3 The required environmental approvals to construct the access and associated access road as well as to clear the required sight distances within the road reserve must be obtained before any construction activities within the DR01621 road reserve may commence.

3.4 In the letters this Branch noted that "the owner intends to build a residential home and a few small tourist accommodation units within the provisions of a contemplated "Open Area III" rezoning application", which is why the developer must - during the concept design stage (prior to submitting the detailed design for approval as per paragraph 3.1) clear with this Branch's Chief Directorate Road Design which land uses (that will differ from what is currently being supported) this Branch will allow to make use of this access with its substandard geometry.

3.5 All the costs towards construction of this access must be covered by the developer of Erf 1058. This Branch will not contribute in any manner.

Yours Sincerely

SW CARSTENS
***For* DEPUTY DIRECTOR-GENERAL: TRANSPORT INFRASTRUCTURE**
DATE: 25 MAY 2023

TPW/CFS/RP/LUD/REZ/SUB-12/166 (Job 30213)

ENDORSEMENTS

1. Mr AG Polson (e-mail: alexander@polsons.info)

2. Garden Route District Municipality

   Attention: Mr JG Daniels (e-mail)

3. District Roads Engineer, Oudtshoorn

4. Mr E Burger (e-mail)

5. Mr SW Carstens (e-mail)

14. Appendix E – Firescaping The Garden

Source: [SCFPRA - Firescaping]