PROPOSED DEVELOPMENT ON REMAINDER OF PORTION 101, ZWARTE JONGERSFONTEIN 486, JONGENSFONTEIN

ENGINEERING SERVICES REPORT

REVISION 3

FEBRUARY 2024

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CONTENTS

1 INTRODUCTION AND BACKGROUND

Element Consulting Engineers has been appointed for the rendering of professional engineering services for the proposed development of Remainder of Portion 101, Zwarte Jongersfontein 486, Jongensfontein, Stilbaai.

The proposed development envisages 6 self-catering single room units as holiday accommodation properties.

This report will detail and discuss the engineering services of the proposed development in terms of firstly the bulk engineering services and secondly the internal engineering designs in parallel with the engineering standards and technical design criteria applicable to the project.

2 PROPOSED LAND USE

The proposed development envisages 6 self-catering single room units as holiday accommodation properties.

The Site Development Plan (SDP), is presented in the figure below.

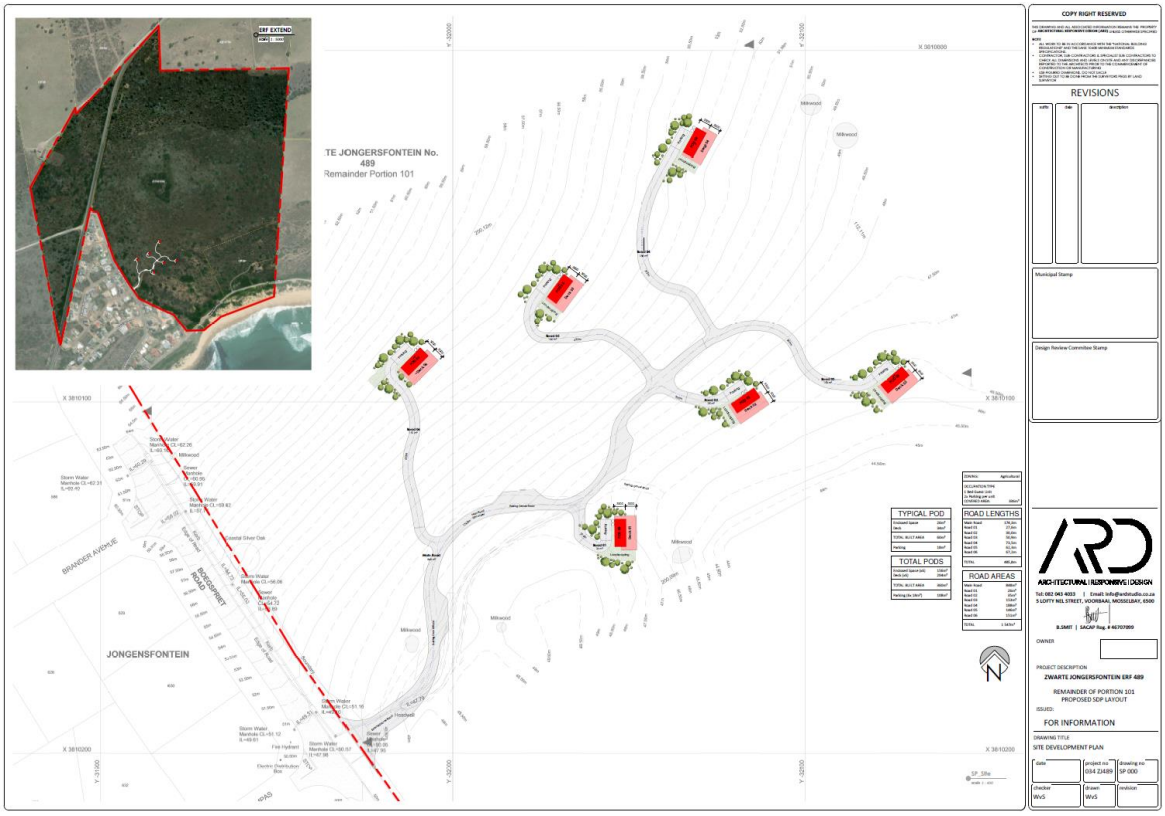

Figure 1: Site Development Plan (SDP)

3 LOCALITY

The proposed development is located directly north-east of- and borders onto Jongensfontein as depicted on the locality plan below.

Figure 2: Locality Plan

4 GEOTECNICAL INVESTIGATION

A formal geotechnical investigation has not been performed yet and will be performed during the detail design stage. A visual inspection of the site was conducted in order to assess conditions on site.

Holistically, the conclusion reached is that the in-situ materials found on site are adequate for the construction of engineering services and foundations for residential development.

General Soil Profile

Inspection of the site indicated relatively consistent soil horizons throughout with a light brown silty sand present. The materials appear dry and are fairly loose. No perched water table is evident and a moderate water retention rate is expected. Undulating gradients are evident.

Slope Stability

No natural slope instability is present.

Ground water and stormwater

No ground water and/or perched water are evident. A moderate water retention rate is expected. Lateral movement of stormwater will be moderate due to the undulating gradient. Erosion of the silty sands may occur if not properly managed.

Engineering Services

A TLB will suffice for trenching and excavations of all services and foundations in all materials. Although the possibility of rock is deemed to be small, rock may be present at deeper depths. This will be determined by a formal geotechnical investigation.

Foundations for development

The visual investigation indicated that the in-situ materials are adequate to support residential development. Reinforced strip footings will be adequate for the development.

Construction materials

A number of commercial operators are located in close proximity to the site for the provision of imported construction materials.

5 PRELIMINARY ENGINEERING SERVICES DESIGN

This chapter will discuss the engineering services of the proposed development in terms of firstly the bulk engineering services and secondly the internal engineering designs in parallel with the engineering standards and technical design criteria applicable to the project.

5.1 Water

5.1.1 Water Demand

The Average Annual Daily Demand (AADD) for this proposed development in line with accepted design consumptions, assumptions, criteria and standards, is calculated and estimated at approximately **3.6kl/day**. Peak factors will be considered during the detail design stage of the project.

5.1.2 Bulk Availability and Connection Point

Municipal bulk water is not available for this development, nor is it required.

Bulk water for the development will be obtained from a borehole, Jongensbaai Beleggings BH1, situated on the property. The long-term sustainable yield of the borehole is **43.2kl/day** and is hence sufficient for the proposed development. An extract from the report by the Geohydrologist (John Weaver Geohydrologist; July 2006) is presented in the following table and is available upon request:

Borehole number	Sustainable yield (L/sec)	Sustainable yield (m^3/day)
Bh 1	0.5	43.2
Bh 2	1.0	86.4
Existing borehole[1]	1.0	86.4
Total	**2.5**	**216**

Table 1: Long-term sustainable yield of BH2

The quality of the water is also acceptable for domestic use in accordance with the report.

The water abstracted will be filtered and stored in a 10kl tank from where it will be gravity fed to the proposed development.

The borehole will be registered in terms of the Water Act.

The locality of the borehole is indicated on the following diagram:

Figure 3: Approximate locality of existing Jongensbaai Beleggings BH1 which will service the site

5.1.3 Design Criteria and Standard of Engineering Services

- Design consumption.
  - Luxury single room chalet – 600l/unit/day.
- Peak factors as prescribed.
- Minimum pressures for the network to be calculated during design stage.
- Maximum of 3 valves to isolate a pipe section.
- Maximum length of 600m of main pipe per isolated section.
- Air valves to be provided where applicable.
- Minimum cover to pipes to be 900mm.
- Pipe type and class to be uPVC class 6 to 12, depending on existing network pressure.
- Pipe diameters varying between 50mm and 63mm depending on pressure available and flow required.
- Unit connections to be HDPE Class 10.
- Units to be serviced with a 20mm connection and Aqua-Loc box and meter.

5.1.4 Concept design

The concept design of the water layout is presented in the diagram below. Water will be pumped and filtered from BH1 (on the right) from where it will be pumped (purple line) to the top of the development (left) where it will be stored in a 10kl tank. Water will be gravity fed from here to the development (blue network).

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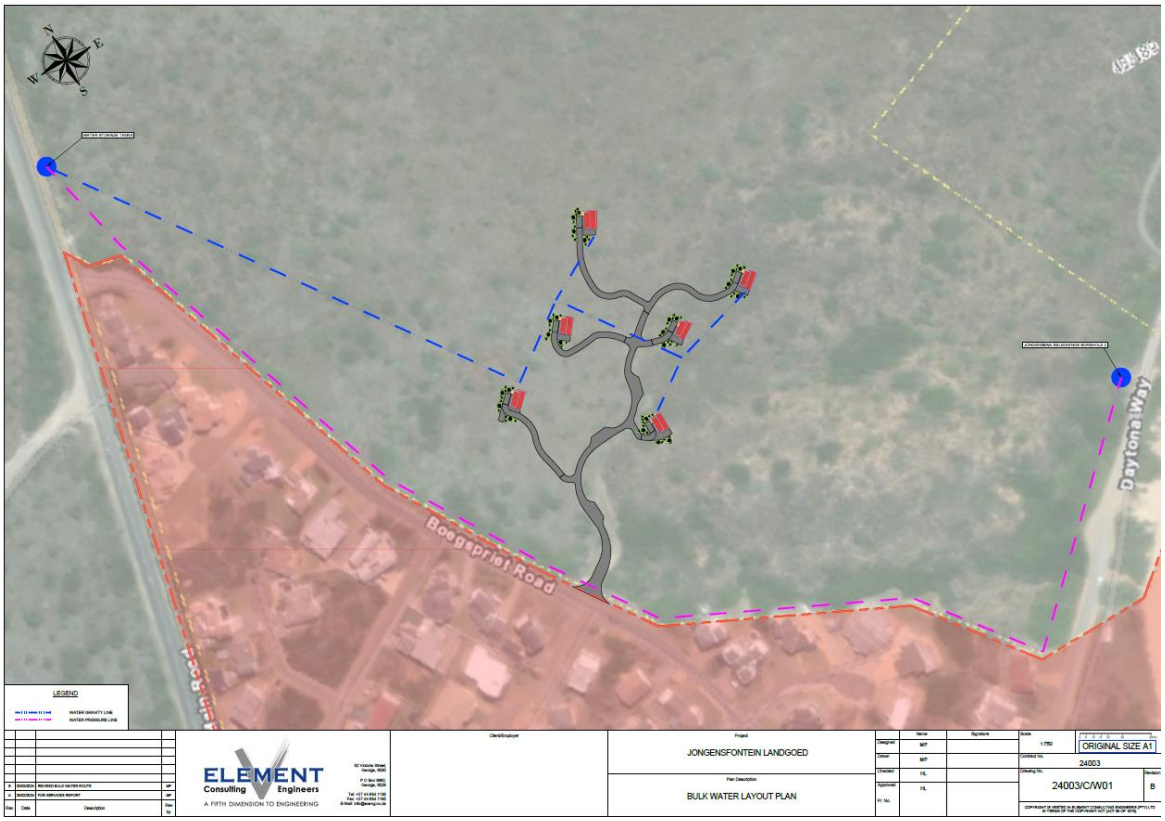

Figure 4: Internal water layout

5.2 Sewer

5.2.1 Bulk availability and connection point

Municipal bulk sewer is not available for this development, nor is it required.

5.2.2 Sewer treatment solution

Sewer from each unit will be treated by an individual package plant per unit.

5.2.3 Package plant specification

The package plant identified and specified for this development will be a Fluidco BioBloo system. The BioBloo is a complete Biological Wastewater Treatment plant, based on submersed bio-media with return activated sludge. Treated water can be released into the environment. Plants are hygienic and odor free, cost effective, hardy, and with the best product lifespans in the market. Electricity consumption is very low.

The package plant reduces environmental risk as no raw sewer is accumulated and pumped from any low points and no environmental spill can subsequently occur.

5.2.4 Package plant process description

The BioBloo is a combination of anaerobic/aerobic Moving Bed Biological Reactor. The design concept has proven itself over the last 10 years to be reliable and cost effective. The biological process uses bacteria to reduce the BOD load as well as provide nitrification and denitrification of ammonia. The disinfection process ensures further water quality and filtration up to 1.6 micron as well as total removal of all coliforms. This allows treated effluent to be safely discharged to the environment. **Treated effluent conforms to the Department of Water and Sanitation (DWS) General Standards Limits**. A pre-treatment and post-treatment process are also prescribed.

Pre-treatment will firstly entail a screen for retaining non-sewage matter (plastic bags, rags, sanitary products, etc.) and notices will be published in the units that persons should refrain from flushing any of these items into the system. Pre-treatment will secondly entail a buffer-tank.

The first tank of the package plant (anaerobic process) allows for digestion of sewage and the separation of solids i.e., those that settle and those that float. The middle cut of the effluent then flows through to the second tank. The Anaerobic phase breaks down the fine sewage particles and alters to carbon dioxide and water. This ideal effluent then passes into the aerobic chamber for aeration. The de-nitrification cycle takes place in this phase. This function is responsible for the breaking down of nitrates to nitrogen gas.

In the second tank (aerobic process), the digestion takes place in an aerated environment. This phase takes the smaller solids and bio-degrades them further. In the aerobic phase nitrification takes place. This process breaks down the ammonia to nitrites and the nitrites to nitrates. Aeration takes place by blowers and fine bubble diffusers, which are quiet and efficient.

In the third tank, secondary settling takes place. The cell material and settle able solids settle in this phase and form the so-called “sludge blanket“. When the blanket matures, it is re-circulated to the primary settling tank in phase one to “seed” or inoculate the raw sewerage entering the plant and to alter the nitrates to nitrogen gas. This cycle is called the re-activated sludge cycle.

In the fifth and final phase the final effluent is prepared for final discharge. The effluent is disinfected by means of Chlorine, Ozone, or dosing system.

Treated effluent (approximately 550l/day or 0.38l/min) will be released as surface water into the environment and will **conform to the Department of Water and Sanitation (DWS) General Standards Limits.**

A diagrammatical process flow description is presented below:

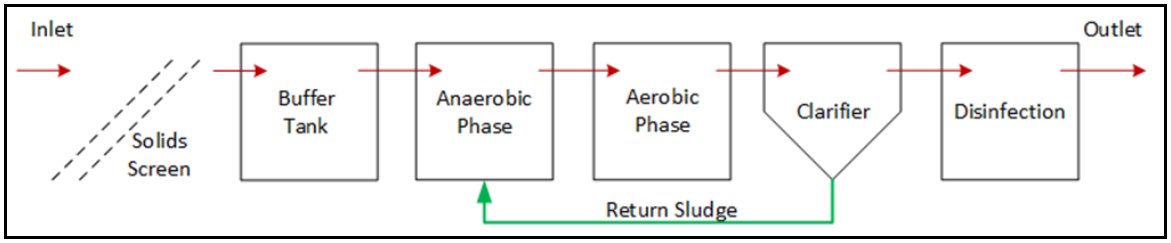

Figure 5: Process flow

A diagrammatical section through the unit is presented below:

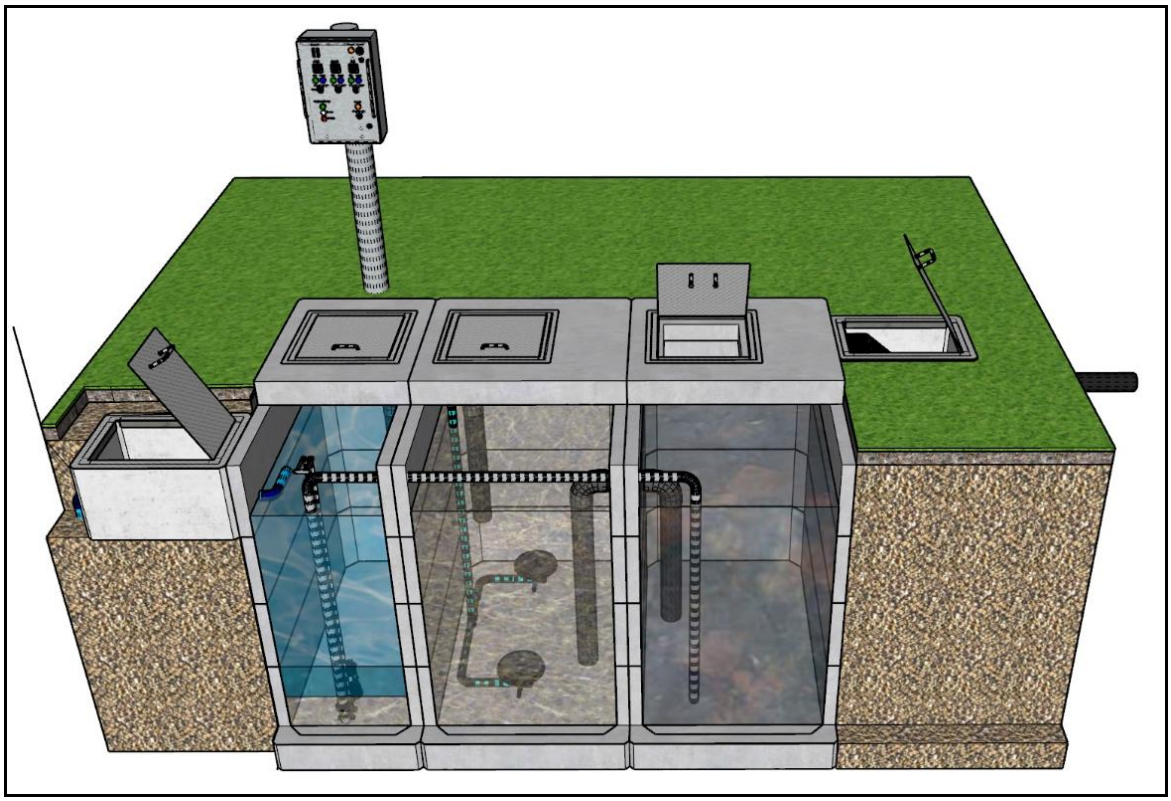

Figure 6: Section through the unit

5.2.5 Operation & Maintenance

The plant has a low capital cost outlay, a low operational & maintenance cost and hence a low lifecycle cost of ownership. The plant is gravity fed and have a low energy requirement for the treatment process lifecycle. The treatment media is highly resistant to degradation and remains stable over the long-term resulting in little maintenance requirements. Scraping or scarifying is not required. The plant has a small footprint and is quiet in its operation.

Visual inspection of the system will be performed by the supervisor on a daily basis.

Monthly samples of treated effluent will be submitted for laboratory analysis as per legislative requirements and responsible custodianship.

The plant will be serviced on a six-monthly basis through a maintenance contract.

5.2.6 Design flow

The Average Dry Weather Flow (ADWF) of each unit, in line with accepted design criteria and standards, can be estimated as 550l/day.

5.3 Roads and access

5.3.1 Access

Proposed access to the development is obtained via Boegspriet Road at the intersection with Kompas Close. Access will be controlled by remote-controlled sliding gate. Stacking distance of two vehicles will be provided in front of the gate.

The access point is indicated in the diagram below.

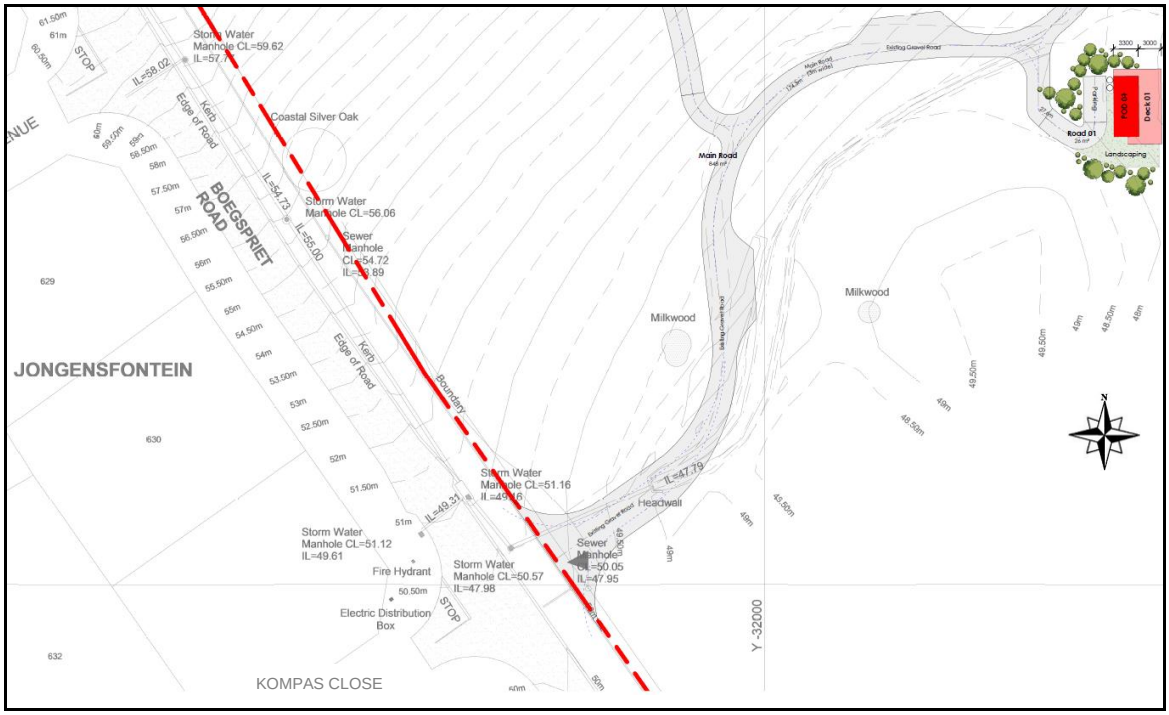

Figure 7: Proposed access to the development

5.3.2 Sight distance

Sight distances at the proposed access point are excellent in both the horizontal and vertical alignments and satisfactory for development purposes.

5.3.3 Traffic Impact Statement

A Traffic Impact Statement (TISt) is not required due to the insignificant number of trips generated by this proposed development. The trip generation of the eventual fully developed proposed development is estimated at approximately 4 trips for the peak hour of the adjacent road network. The traffic impact of the proposed development will be negligible from a traffic engineering perspective. The proposed development will be used as holiday accommodation, further reducing the impact during the peak hour.

5.3.4 Internal Standards and Design Criteria

Internal standards and design criteria are specified as follows:

- Internal road widths of 3.0m
- Passing zones of 5.2m.
- Gravel surfacing.
- Pavement structural materials to be imported from commercial sources.
- All minimum radii at bellmouths to be 8m.
- Minimum road grade of 0.4% and camber of 2%.
- Road design life of 20 years.

5.3.5 Preliminary design

The preliminary design is presented in the following diagram and is attached as addendum to the report.

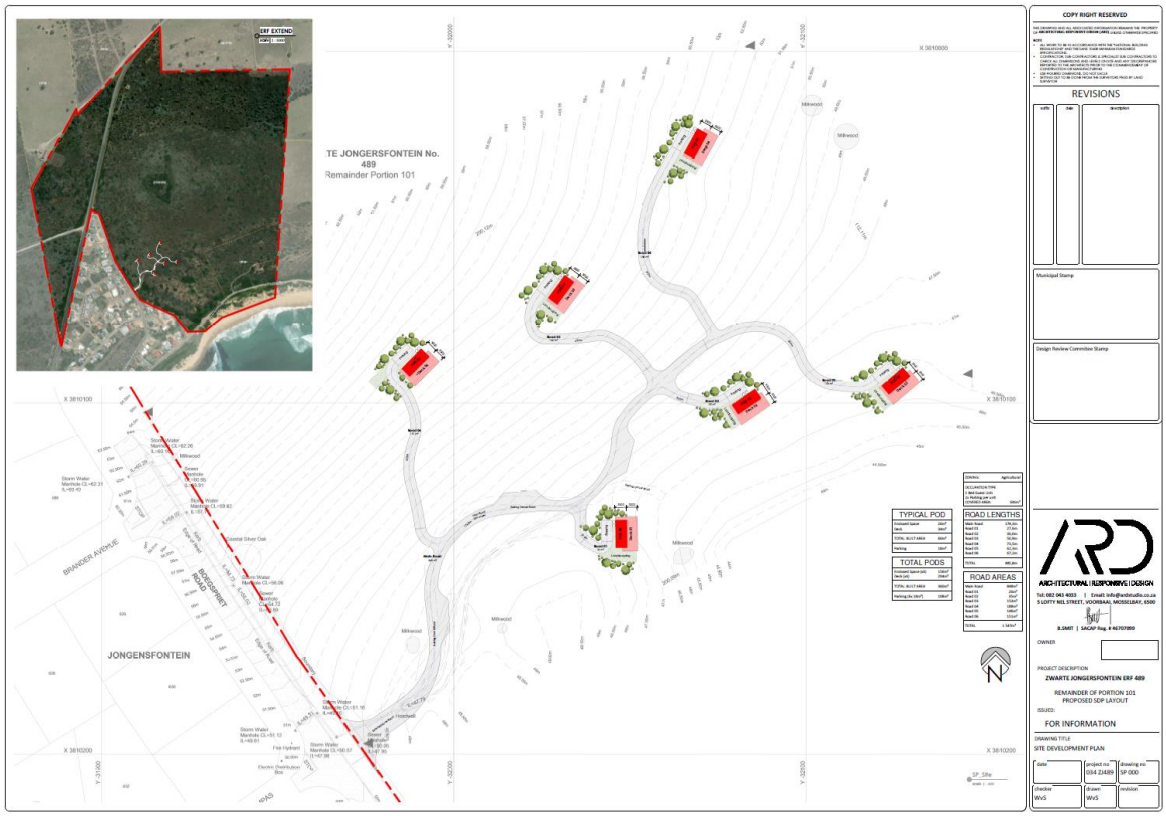

Figure 12: Internal roads layout

5.4 Stormwater

5.4.1 Site layout considerations

The proposed development drains in a south-easterly direction. The drainage direction is indicated in the figure below:

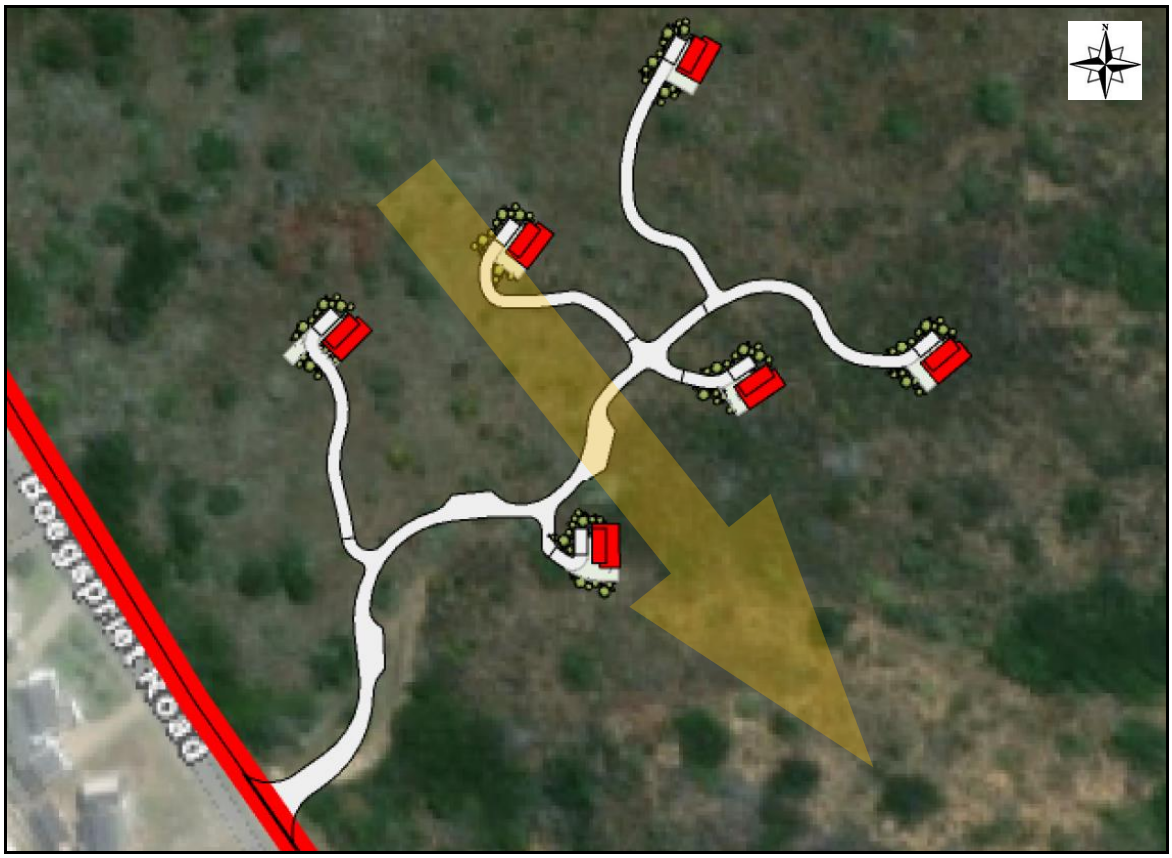

Figure 13: Stormwater drainage direction

5.4.2 Design background, standards and criteria

Stormwater design on this proposed development will utilize the zero concentration methodology. No concentration or accumulation of stormwater will hence be allowed. All internal roads and parking areas will be constructed in line with the gradient, using well compacted gravel surfaces. Stormwater will hence run over the roads as part of the landscape.

Energy dissipation will be performed at all gutter outlets to further limit concentration.

All the above will result in negligible increased stormwater runoff from the site.

5.5 Solid Waste

Solid waste will be removed from units by the caretaker on a daily basis. A formal solid waste collection area will be provided adjacent to the main access gate. The facility will

be enclosed to avoid attracting vermin. A formal arrangement for the removal of solid waste needs to be entered into with the Hessequa Municipality.

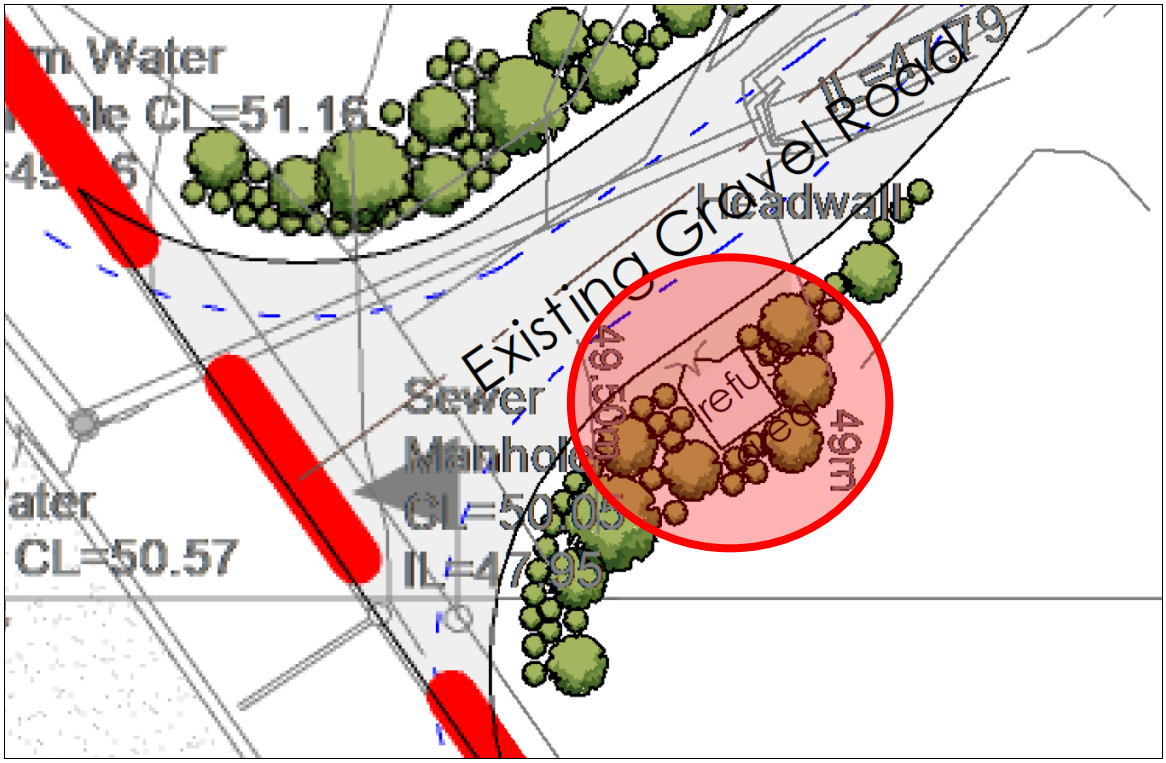

Figure 14: Solid waste collection area adjacent to access gate

5.6 Electrical

A Bulk electrical supply to the proposed development is not available from the municipality and is not required. Each unit will be supplied with an individual roof mounted PV Solar and battery system. Units will be equipped with gas stoves and gas geysers in order to limit the design requirements of the PV Solar system.

Individual solar and battery operated terrain lighting will be provided along the access road and at the access gate.

The access gate will be operated by solar and battery backup gate motor.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following conclusions can be reached:

1. The proposed development envisages 6 self-catering single room units as holiday accommodation properties.
2. The proposed development is located directly north-east of- and borders onto Jongensfontein.
3. The in-situ materials found on site are adequate for the construction of engineering services and foundations for the development.
4. Water:
    a. The Average Annual Daily Demand (AADD) for this proposed development is calculated at approximately 3.6kl/day. Peak factors will be considered during detail design stage.
    b. Bulk water for the development will be obtained from a borehole, BH1, situated on the property, that has been tested for yield and quality. The yield and quality of the borehole are acceptable for the proposed development.
    c. The water abstracted will be filtered and stored in a 10kl tank from where it will be gravity fed to the proposed development.
5. Sewer:
    a. Sewer from each unit will be treated by an individual package plant per unit.
    b. The Average Dry Weather Flow (ADWF) of each unit, in line with accepted design criteria and standards, can be estimated as 550l/day.
    c. The package plant identified and specified for this development will be a Fluidco BioBloo. Treated effluent will be clear and odorless and will meet the Department of Water and Sanitation (DWS) General Standards. Treated effluent (approximately 550l/day or 0.38l/min) will be released as surface water into the environment. The package plant reduces environmental risk as no raw sewer is accumulated and pumped from any low points and no environmental spill can subsequently occur. Visual inspection of the system will be performed by the supervisor on a daily basis. Monthly samples of treated effluent will be submitted for laboratory analysis as per legislative requirements and responsible custodianship. The plant will be serviced on a six-monthly basis through a maintenance contract.
6. Roads & access

a. Proposed access to the development is obtained via Boegspriet Road at the intersection with Kompas Close. Access will be controlled by remote controlled sliding gate. Stacking distance of two vehicles will be provided in front of the gate.
b. Sight distances at the proposed access point are excellent in both the horizontal and vertical alignments and satisfactory for development purposes.

7. A Traffic Impact Statement (TISt) is not required due to the insignificant number of trips generated by this proposed development. The trip generation of the eventual fully developed proposed development is estimated at approximately 4 trips for the peak hour of the adjacent road network. The traffic impact of the proposed development will be negligible from a traffic engineering perspective. The proposed development will be used as holiday accommodation further reducing the impact during the peak hour.
8. Stormwater:
    a. The proposed development drains in a south-easterly direction.
    b. Stormwater design on this proposed development will utilize the zero concentration methodology. No concentration or accumulation of stormwater will hence be allowed. All internal roads and parking areas will be constructed in line with the gradient, using well compacted gravel surfaces. Stormwater will hence run over the roads as part of the landscape.
    c. Energy dissipation will be performed at all gutter outlets in order to further limit concentration.
9. Solid waste will be removed from units by the caretaker on a daily basis. A formal solid waste collection area will be provided adjacent to the access gate. A formal arrangement for the removal of solid waste needs to be entered into with the Hessequa Municipality.
10. Electricity
    a. A Bulk electrical supply to the proposed development is not available from the municipality and is not required.
    b. Each unit will be supplied with an individual roof mounted PV Solar and battery system. Units will be equipped with gas stoves and gas geysers in order to limit the design requirements of the PV Solar system.
    c. Individual solar and battery operated terrain lighting will be provided along the access road and at the access gate.
    d. The access gate will be operated by solar and battery backup gate motor.

With reference to all the conclusions above, it can holistically be concluded that the proposed development can be designed and constructed to acceptable specifications and standards from an engineering design perspective.

6.2 Recommendations

With reference to the conclusions above, the following is recommended:

1. That the proposed development be approved from an engineering design perspective.
2. That all conceptual design specifications and standards be accepted and approved.
3. That all detail designs be performed to the satisfaction of the local municipality and other authorities, in line with the proposals contained in the report.