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STRUCTURAL & CIVIL ENGINEERING DESIGN CONSULTANTS

PROPOSED NEW RESIDENTIAL 2 DEVELOPMENT ON PORTION 91 OF FARM 304 MATJIESFONTEIN

BULK SERVICES AND CIVIL ENGINEERING INFRASTRUCTURE REPORT

Project No 23G210

ISSUED FOR REZONING APPROVAL

Version 7 January 2025

CONSULTING ENGINEER:
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PROPOSED NEW RESIDENTIAL 2 DEVELOPMENT ON PORTION 91 OF FARM 304 MATJIESFONTEIN

BULK SERVICES AND CIVIL ENGINEERING INFRASTRUCTURE REPORT

1. INTRODUCTION

Portion 91 of the Farm 304 Matjiesfontein is to be rezoned for Residential 2 development.

The total area of the site is 14.725 hectares. Approximately 8.6 hectares of the site comprises steep forested area which will be preserved in its natural state. The Development area, covering a total of 5.28 hectares, will be situated within the remaining area. The development will comprise 60 Residential 2 erven of average size 510 square meters.
The Developer has appointed Poise Consulting Engineers to attend to the design of the civil engineering services for the development.

This report addresses the sewer and water connection requirements and capacities for the new development and summarizes the proposed road access and stormwater management principals to be adopted.

This report is submitted for Re-Zoning approval purposes.

2 SITE DESCRIPTION

The site is situated on the northern side of Keurboomstrand Road MR394 approximately 2 kilometers west of Keurboomstrand Village.

Access will be off Road MR394

The approximate coordinate of the centre of the site is 34° 00' 18" S and 23° 26' 10" E.

2.1 Topography:

The northern forested area of the site is extremely steep at a gradient of approximately 50%. This area will be preserved and not affected by the development.

The area of the site to be developed slopes from north to south at an average gradient of approximately 1,5%, with a small area in the north east corner increasing to 12%.

2.2 Soils:

The site to be developed is blanketed by estuarine/alluvial sand deposits overlying sandstones. The soil drainage characteristics are permeable.

2.3 Vegetation:

The northern area of the site which will be preserved and not be affected by the development is densely forested.

The southern area of the site is generally grassed lands.

3. DESIGN STANDARDS

The following design standards will be applicable:

- Guidelines for Human Settlement Planning and Design, compiled for the Department of housing by the CSIR (RED BOOK)
- The Neighbourhood Planning and Design Guidelines, Department of Human Settlements (NPDG)
- SANRAL Drainage Manual
- Relevant specific specifications of the Bitou Engineering Services Department

4. WATER RETICULATION

a. Water Connection

The water connection for the development will be off the existing 200mm watermain in Keurboomstrand road. See Figure 1 of the attached GLS report

4.2 Water Demand

The projected water demand takes consideration of the following recommendations for daily water consumption

- RED BOOK Chapter 9, Table 9.4 Residential 2 stands 600 to 1000 litres per day
- NPDG Section J , Table J2 High Density Residential 600 to 800 litres per day
- The GLS Report recommendation for the Development 600 litres per day

With due consideration to the proposed recycling and rainwater harvesting for toilet flushing and irrigation usage (see Alternative Water Sourcing below), and the low projected average occupancy, the water demand is based on average daily demand of 600 litres per erf and 60 erven

Average Daily Demand: 36 kl
Based on a peak factor of 4 the maximum peak flow demand will be 1,7 litres per second. The fire flow criteria is Low Risk Group 1 which requires provision for a fire flow of 15 litres per second with a minimum residual head of 10 meters.

4.3 Impact on Capacity

The development falls within the Matjiesfontein Reservoir distribution zone with a static head of 55.5m MSL.

The GLS Capacity Analysis Report confirms that the existing reticulation system and reservoir has sufficient capacity to service the Development

There is however insufficient capacity in the bulk water mains serving the reservoir, to maintain the required reservoir storage during peak seasonal periods. The Bitou Municipality have confirmed that design is in progress for the necessary upgrades to the

bulk supply system. However the implementation of upgrades is entirely dependent on the availability of finance, and no time frame can be guaranteed for such implementation.

Notwithstanding Bitou have confirmed they are able to supply bulk water to the Development. See attached letter of confirmation.

4.4 Alternative Water Sourcing

The Developer's intent is to optimise the use of rainwater harvesting for domestic use and the use of treated greywater for irrigation purposes, within economic feasibility.
Based on a minimum roof area of 175 square meters an average of 106 kilolitres of rainwater per year could be harvested per stand. With due cognizance to rainfall patterns, subject to efficient management of storage draw off, an average in excess of 170 litres per day per stand, could be sourced from rainwater harvesting.

Detailed solutions will be addressed in the detailed design stage and will be to Bitou Engineering Department approval.

4.5 Internal Reticulation

The internal water pipes will remain the property of the development and will not be taken over by Bitou Municipality. The domestic internal water reticulation system will be of Class 9 UPVC pipes of up to 110mm diameter. Minimum cover to watermains will be 800mm.
Fire Hydrants will be provided at maximum 180m intervals
The reticulation system will be designed to provide for a minimum residual head of 24m under peak domestic flow conditions, and 15m under peak domestic plus fire flow conditions.

Construction of all watermains and connections will be in accordance with Bitou Municipality and SABS 1200 specifications.

5. SEWER RETICULATION

5.1 Sewer Connection

The sewer connection for the Development will be to the existing 160mm reticulation pipe situated immediately opposite the site on the southern side of Keurboomstrand Road. See attached GLS Figure 4.

5.2 Sewerage Discharge

The projected sewerage discharge takes consideration of the following recommendations for daily sewerage discharge:

- RED BOOK Chapter 10, Table C1 Middle Income Group 750 litres per day based on 6 people per dwelling
- NPDG Section K , Table J2 High Density Residential 480 to 560 litres per day

With consideration to the expected average occupancy of 3 only persons per stand the sewerage discharge is based on average daily discharge of 500 litres per erf. This equates to an average of 3,3 persons per stand.

Average Daily Discharge for 60 stands: 30 kl
Based on a peak factor of 2.5 the maximum peak discharge will be 0,86 litres per second.

5.3 Impact on Capacity

The Development falls within the drainage area of the Keurboomstrand main pump station. Effluent from this pumpstation is routed to the Municipal Ganse Valley wastewater treatment plant through the Matjiesfontein and Aventura pump stations and their respective rising mains.
The GLS Capacity Analysis report confirms that the pump stations have sufficient capacity to accommodate the Development.
However certain rising main upgrades are required and the wastewater treatment plant is currently at full capacity.

The Bitou Municipality have confirmed that Masterplanning is in place for the necessary upgrades to the bulk sewerage system. However the implementation of upgrades is entirely dependant on the availability of finance, and no time frame can be guaranteed for such implementation.

5.4 Interim Alternative Sewerage Treatment

Until such time as the necessary upgrades have occurred to the Bitou bulk sewerage system, the sewerage will be treated using an on site sewerage package plant. The proposed plant type to be used will be a Bio Sewage Systems 30 kilolitres per day plant or similar approved.

5.4.1 The Bio Sewage Plant:

The Bio Sewage Systems plant is a containerized bio reactor plant which delivers treated sewerage to the DWAS special limits water quality standard. Bio Sewage Plants are environmentally friendly, chemical free, robust and have been proven to be reliable and simple and easy to maintain. Sludge is recycled within the plant system and there is therefore no requirement for cleaning and sludge removal. This is confirmed by Bio Sewage Systems plants which have been operational for in excess of 15 years with no sludge removal requirements.

The raw sewage will discharge to an anaerobic underground tank from where it will be pumped to the containerised plant. The plant will operate on an “equals in equals out” basis, however, the preceding anaerobic tank will be designed with sufficient capacity to cater for offline situations and will include for emergency storage of 48 hours. That is 60 kilolitres.

5.4.2 Plant Effluent:

The treated discharge from the plant will be pumped to an elevated holding reservoir, also of capacity 60 kilolitres, and situated in the north west corner of the developed area. From this reservoir the effluent will be reticulated with each erf being provided with a connection for irrigation and toilet flushing.

The estimated total average daily usage for toilet flushing will be approximately 7,5 kilolitres, based on an average of 3 occupants per house.

It is intended that the remaining 22,5 kilolitres per day be utilized for irrigation of common property and homeowner's gardens. Excluding road surfaces and pond areas this amounts to a total irrigatable area of approximately 2,5 hectares. Based on a typical garden sprinkler irrigation application rate of 10mm over a 15 minute session, the daily irrigation area required would be 2250m2. If each area was to be irrigated once per week, only 62% of the irrigatable area would be required.

Should it be required, excess effluent will be discharged to the stormwater infiltration ponds system. This will be environmentally acceptable, the effluent being to DWAS Special Limits quality.

Effluent quality will be tested on a monthly basis.

Permanent groundwater sampling wells will be installed, strategically positioned for the purposes of regular monitoring of the quality of groundwater which has been subjected to irrigation infiltration.

5.4.3 Plant Maintenance

The Bio Sewage Systems plant is designed to be fully automated, and simple in operation. Regular inspections are only required to ensure it is running to specification.

A Plant maintenance manager will be appointed, who will be given comprehensive up front training and will visit site and inspect the plant on a daily basis. Bio Sewage Systems do also have support teams available at short notice should any unusual issues arise.

Pre-treatment screening will be provided which will facilitate the cleaning and removal of non bio-degradables. The frequency of cleaning will be determined once the plant is in operation and the amount of non-biodegradables being screened. The non-biodegradables removed would be sent for incineration at a recognised waste disposal site.

To enable the monitoring of any potential failure and consequential overflow of the system, an emergency alarm will be installed which will be activated once effluent level rises in the emergency storage component of the system.

All required regular maintenance can be done within the 48 hour emergency storage period Spares will be kept on site for all critical mechanical and electrical components.

5.4.4 Power

The plant will be powered by a Solar/Eskom charged battery system with a backup generator for emergency supply in the event of extended Eskom down time.

5.4.5 Plant Approvals:

The detailed designed of the overall system will be to Bitou Engineering Department approval

Bio Sewage Systems have been established for over 20 years and have over 800 plants, of size ranging from 5 to 200m3 per day, operating in Southern Africa. Whilst the majority of their plants are outside of Municipal areas, it is notable that that they have had plants approved by both eThekwini and Cape Town Municipalities.

The preliminary positioning of the plant and effluent storage reservoir are indicated on attached DWG No: 23G210 S01. The Bio Sewage method statement and Activated Sludge Handling Process is also attached.

5.4.6 Containment of Leakage

The anaerobic tank will be the only underground component of the Plant. The tank will be constructed of reinforced concrete including Penetron Admixture. The durability will therefore be in excess of 50 years, but effectively infinite.

The containerised plant is a fully contained unit, sealed against leakage. It is equipped with overflow protection back to the anaerobic tank in the event of an unlikely blockage within the system

A subsurface drainage system will be installed beneath the anaerobic tank, including a pump sump from which any leakage can be returned to the tank. The drainage system will have an impermeable lining beneath it designed such that that no leakage will infiltrate the ground below.

As stated above the anaerobic tank will include for 48 hours of emergency storage. Furthermore a gravity overflow pipe will be installed to link the anaerobic tank to the Bitou municipal sewerage system located on the opposite side of Keurboomstrand Road MR395. This overflow will only become operational in the event of the overflow of the emergency storage.

There will therefore be no possibility of ground contamination through leakage or overflow.

5.4.7 Odour Control

The plant is a sealed unit ensuring that no unpleasant odours are present. Additionally the introduction of sufficient oxygen mitigates the odour and the Bio Sewage System has backup blowers to ensure that the plant is always correctly oxygenated. Bio Sewage System plants have a track record of odour free operation.

5.4.8 Management of Volume Overload

Should seasonal volume overload occur, this is generally absorbed by the larger anaerobic/septic tank that is sized to take at least 48hrs of influent and the plant will continue to process at the design rate and meet the output specification. Additionally, should the need arise, the plant can be run for an extended period. The plant will normally only need to run 14 hours per day so, if required, additional hours of processing can be added in peak periods.

5.5 Internal Reticulation

The internal sewer pipes will be the property of the development and will not be taken over by Bitou Municipality.

The internal sewer reticulation system will be of 160mm Class 34 UPVC sewer pipes. Manholes will be of precast concrete ring structures, in accordance with SABS 1200D standards. Manholes will be provided at a maximum of 80 meter intervals.

Minimum cover to sewers will be 1000mm under roadways and 700mm elsewhere.

The internal system will drain to the Bio Sewage Systems Plant positioned centrally on the southern boundary of the site.

In the future, when the necessary municipal upgrades have been implemented the system will be connected to a pump station adjacent to the sewerage plant, from where the discharge will be pumped to the connection point on the existing reticulation system situated immediately opposite the site on the southern side of Keurboomstrand Road.

Construction of all sewers, connections and manholes will be in accordance with SABS 1200 specifications

6. ACCESS

The site access will be off Keurboomstrand Road MR395

A Traffic Impact Study, undertaken by Engineering Advice and Services Consultants, has assessed the peak season peak hour traffic impact of the Development to be insignificant.

7. INTERNAL ROADS

Internal roads will be private roads and will not be taken over by Council
Roads will be constructed of permeable paving or grass block paving to facilitate infiltration. See Paragraph 8.4 below.

Pavement and Geometric Standards

The development will include the following roads which will be classed as follows:

Description	Width	Category/Class
Main Access Collector	5,5m	UC/ES1

Internal Access Roads	4,0/5.0m	UC/ES0,3

The minimum bellmouth radii will be 7.5m

Kerbs

The main access will have standard SABS figure 7 pre-cast concrete semi mountable on both sides. The internal roads will have edgings on the high side and mountable kerbing on the low side of the crossfall.

8. STORMWATER MANAGEMENT

8.1 Floodlines:

The site is situated approximately 3 kilometers east of the eastern bank of the Keurbooms River Estuary. The site falls outside of the 1in 100 year Estuary backwater floodline.
The 1 in 100 year floodline of the estuary reaches to approximately 30 meters from the southern boundary of the site and terminates opposite the eastern boundary of the site. The level of the floodline is estimated at maximum 3.2m MSL. The Keurboomstrand Road provides a barrier between the site and the floodline at minimum level 3.65 m MSL opposite the western site boundary.
The 1 in 50 year floodline is not of significance to the site, terminating approximately 0,95 kilometers west of the site.

8.2 Catchment Areas:

The site is characterized by 2 catchment areas. See attached Figure 1.

The northern Catchment Area 1 consists of the northern forested area with gradients as steep as 50% and a flatter strip at the southern bottom end of the slope. This flat strip has a crest along its southern edge which falls across the site from west to east, and contains the runoff from the northern slope from flowing southward. This strip has a very slight fall eastwards towards a natural spring surrounded by a natural depressed pond area.

The southern Catchment Area 2 is very flat by nature, generally less than 3 percent and falling southwards towards Keurboomstrand Road. The lowest point is in the south eastern corner of the site.

There are no defined runoff exit positions from the site and the permeable conditions of the site allow that in the current state all rainwater falling on the site discharges through infiltration within the defined area of the site.

Keurboomstrand Road along the southern boundary of the site forms a barrier to runoff to the south in the unlikely event of extreme flooding conditions and insufficient discharge through infiltration.

The sites to the west and east of the site have similar characteristics and there is no significant overland discharge to or from either side boundary.

8.3 Site Area Excluded from Development

The total area of the site to be excluded from development is approximately 9.45 hectares

In the post-development state, rainfall over the undeveloped areas will continue to discharge via infiltration over those areas and toward the natural spring and pond. Under flooding conditions overflow from the spring pond will be discharged via the road surface to the Pond P1, the volume capacity of which will be designed accordingly.

8.4 Stormwater Management of Site Development Area

The total area of the site to be developed is 5,28 hectares

The stormwater will be managed such that roof areas will drain to gardens which will fall towards roads or directly to one of three infiltration attenuation ponds P1, P2 and P3 to be provided.

The main access roads will be surfaced with permeable paving and secondary roads with grass block paving. In either case infiltration will occur through the road structure and roadbed to the natural ground below. Excess runoff to the road surfaces which does not infiltrate will be surface discharged to the infiltration ponds.

Based on an average roof area of 225m2 the overall impermeable roof area will be approximately 25 percent of the road reserve and landscaped areas. This impermeable proportion does not increase the total discharge volume of the site, but does reduce the available infiltration area, and therefore increases the required duration of infiltration. Containment of the excess discharge within the ponds, will allow for the longer discharge infiltration time.

Site levels will be designed to ensure the effective implementation of the stormwater management system. The minimum floor level of any stand will be 4.0m MSL.
The site slopes and road levels will be designed to flat gradients to enable maximum infiltration whilst draining on surface to the ponds.

The levels will also be designed to contain flood runoff within the ponds.

The preliminary estimated pond invert levels are such that they will be a minimum of 1.5m above the existing watertable.

The site design levels will protect homes from flooding and will also detain excess site runoff from flooding over the Keurboomstrand Road.

8.5 Stormwater Modelling

The runoff and retention calculations have been done utilising the CBA Hydrograph Generation program, adapted.

The average annual precipitation is taken as 710mm.

In calculating the run-off coefficient for the site in its current state, with consideration to the Road Drainage Manual recommendations, the following factors were used for runoff calculations:

- Slope C_S 0.03
- Permeability C_P 0.08
- Vegetation C_V 0.21

Using adjustment factors of 0.83 and 1.0 the Cd coefficients for the 50 and 100 year storms are 0,27 and 0,32 respectively.

Based on the projected post development impermeability ratio of 25% the post development discharge coefficients for the 50 and 100 year storms are 0,45 and 0,49 respectively.

The post-development runoff time of concentration is 20 minutes. The generated runoff data is however based on the storm durations which render the maximum required retention conditions. These are 420 minutes for Pond P1 and Pspring, and 360 minutes for Ponds 2 and 3.

For calculation of the discharge from the ponds, an infiltration rate of 2,0 centimeters per hour has been adopted. This figure is considered conservative with consideration to the sandy nature of the underlying soils and on site drainage observations and an on site infiltration test. Further infiltration tests will be undertaken in the detailed design phase.

8.6 Rainfall Volumes and Retention Data

The attached Stormwater Management Data Table indicates the catchment areas, the pond areas, the 24 hour runoff volumes and the maximum stored volumes, for the 1 in 50 and 1 in 100 year return interval storms.

The data indicates that the infiltration ponds will have considerably more storage capacity than the modelled requirements for the 1 in 50 year storm, and will accommodate the 1 in 100 year storm.

The total pond volumes also exceeds the overall 1 in 50 year storm 24 hour runoff volume.

Because there is no current and will be no post development discharge of stormwater to outside of the site boundaries the normal required stormwater attenuation parameters are not applicable to the stormwater management plan.

The post-development Catchment Areas and ponds are indicated on attached Figure 1.

8.7 Sustainable Drainage Systems (SUDS)

The principals of discharge of runoff by infiltration through permeable paving and grass block roads surfaces and infiltration ponds will enhance simple adherence to the regulatory SUDS reduction specifications.

9. SERVICES AGREEMENT

A pre-requisite for implementation of the Development will be the conclusion of a Services Agreement with the Bitou Municipality.

The services agreement will define the applicable development parameters relating to sewerage, water, electricity, stormwater management, internal roads and access.

10. ATTACHMENTS

DWG No: 23G210 S01	General Layout: Roads, Stormwater, Sewer and Water Reticulation.
Figure 1	Stormwater Catchment Areas

Stormwater Management Data Table 1
GLS Bulk Services Analysis Report
GLS Figure 1
GLS Figure 4
Bitou Letter of Confirmation of Services
Bio Sewage Method statement
Activated Sludge Handling Process

Prepared By: Date: 03 January 2025

D Botes Pr.T Eng.

PLAN: Scale 1:1000

LEGEND

- ROADWAY
- ROAD/POND SW OUTLET
- UPVC WATER
- FIRE HYDRANT
- GATE VALVE
- BULK WATER METER
- ø160 UPVC SEWER
- SEWER MANHOLE
- TREATED EFFLUENT RISING MAIN
- EFFLUENT IRRIGATION RETICULATION
- BIO SEWAGE TREATMENT PLANT
- FUTURE SEWER PUMP STATION

DETENTION POND AREAS AND VOLUMES

POND 1	2515m2	4024m3
POND 2	1283m2	1283m3
POND 3	945m2	567m3
P spring	3370m2	1984m3

POTENTIAL IRRIGATION AREAS

INDIVIDUAL GARDENS 60 @ Ave 250m2	15000 m2
ROAD VERGES	5000 m2
GREENBELT AREAS EXCLUDING PONDS	5500 m2
TOTAL	25500 m2

Project

PORTION 91 OF THE FARM 304
MATJIESFONTEIN

Description

GENERAL LAYOUT
ROADS STORMWATER SEWER AND WATER RETICULATION

REV.		DATE
F	LAYOUT UPDATED SEWER PLANT CONFIGURATION REV2, NORTHERN SWALE ADDED	04 12 24
E	POND AND IRRIGATION AREA TABLE REVISED	18 06 24
D	POND AND IRRIGATION AREA TABLE ADDED	01 06 24
C	LAYOUT REVISED FOR BIO SEWER	09 04 24
B	LAYOUT REVISED RE-ISSUED FOR APPROVALS	28 10 23
A	ISSUED FOR APPROVAL	02 04 23

DRAWN BY: PB CELL:

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JOB No	DRW No	REV	DATE
23/G210	S01	F	08-04-2024

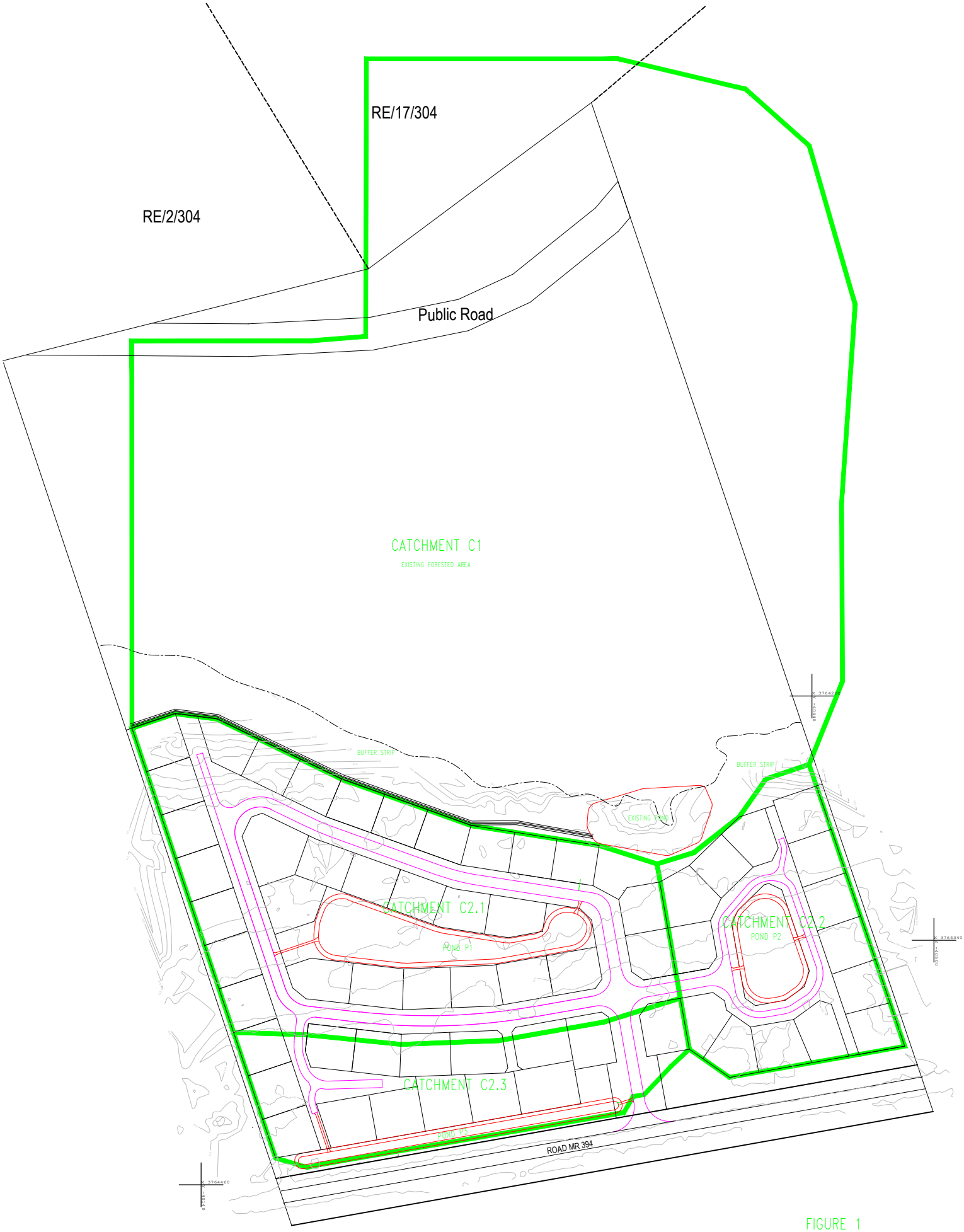
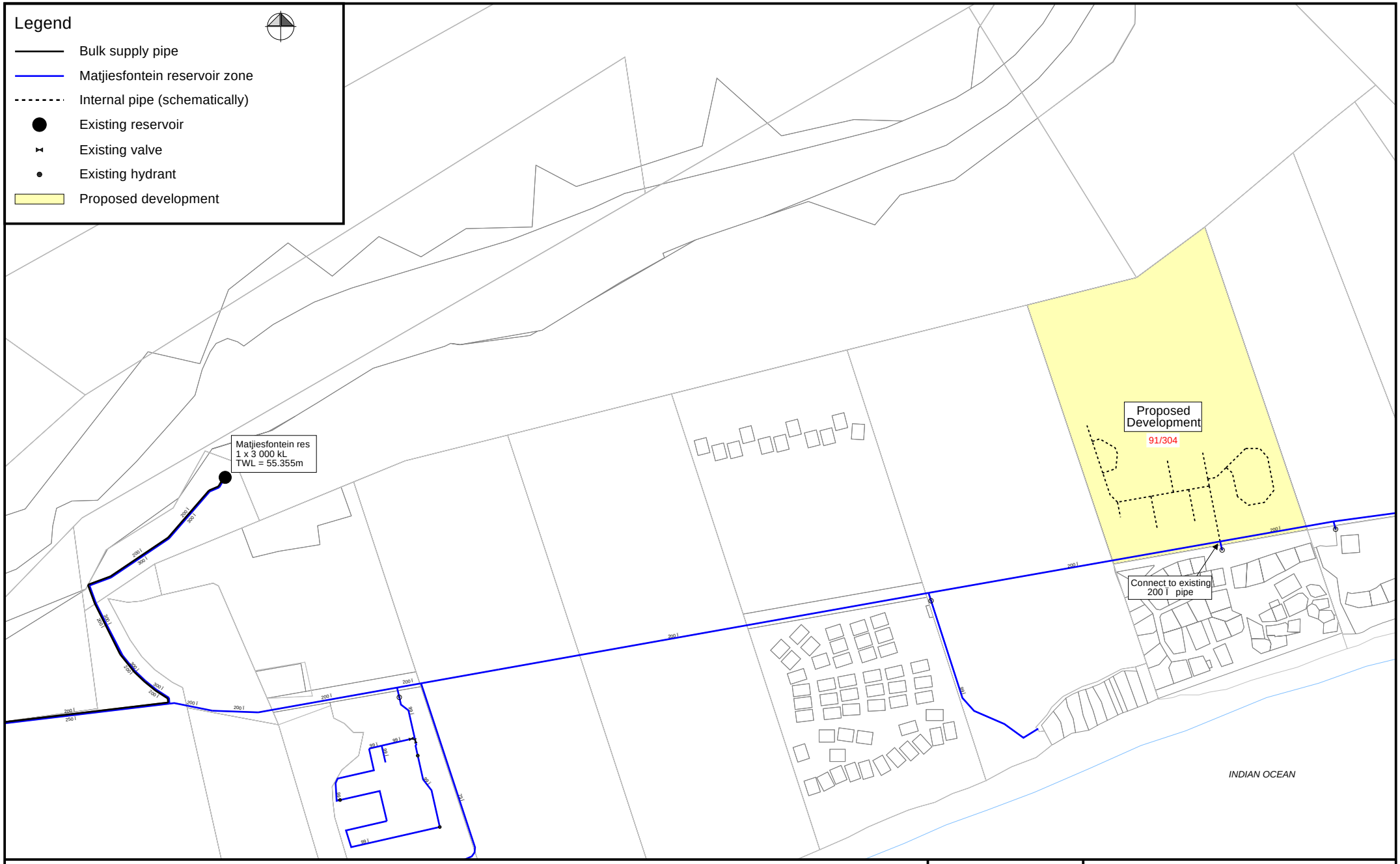


FIGURE 1

PORTION 91 OF FARM MATJIESFONTEIN 304
POST DEVELOPMENT CATCHMENT AREAS



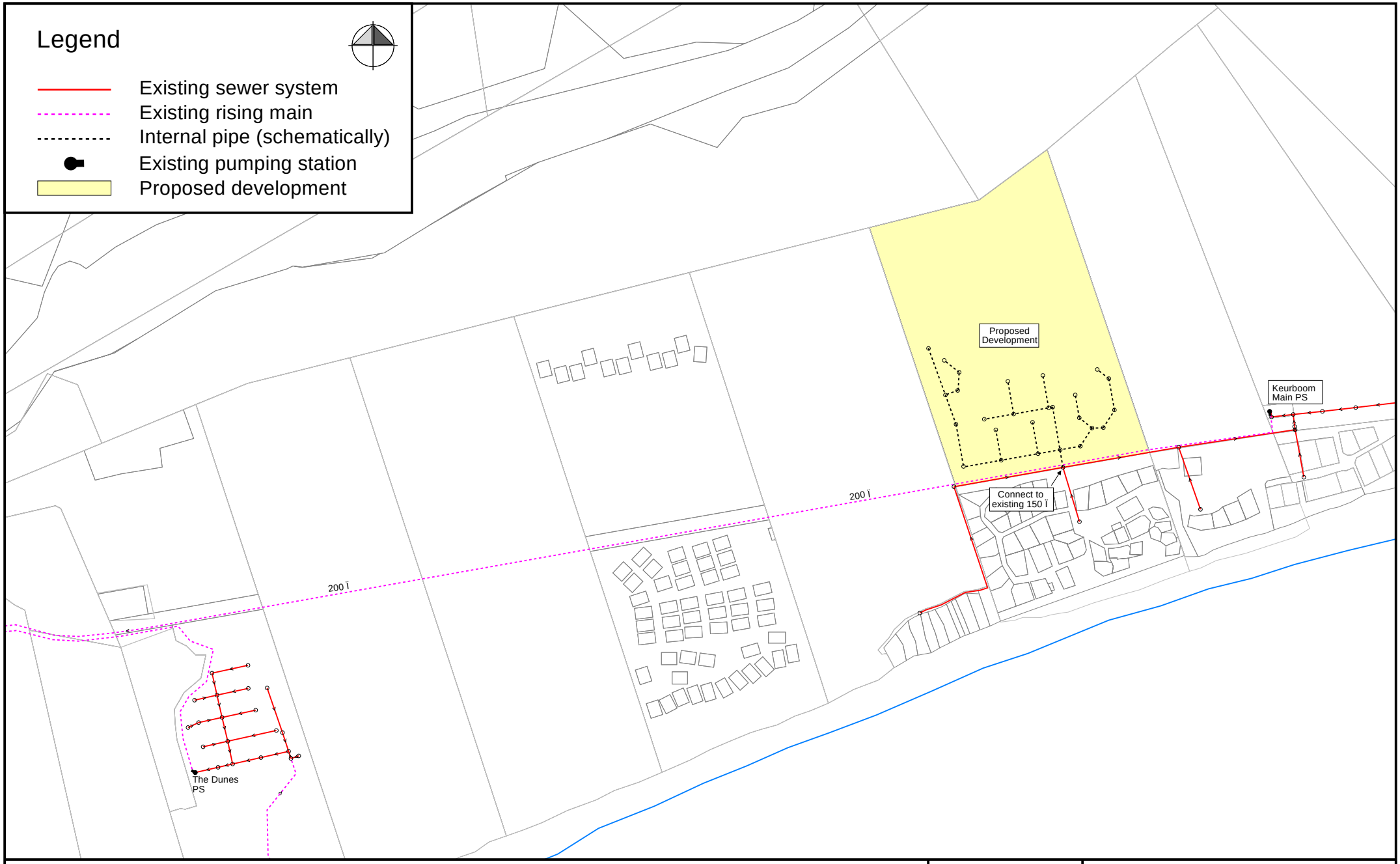
February 2023

Portion 91 of Farm 304 - Keurboomstrand

GLS Infrastructure planning

Figure 1 (Draft)

Proposed Development
Farm 304/91 - Keurboomstrand
Existing Water System



February 2023

Portion 91 of Farm 304 - Keurboomstrand

GLS Infrastructure planning

Figure 4 (Draft)
Proposed Development
Farm 304/91 - Keurboomstrand
Existing Sewer System

TABLE 1

STORMWATER MANAGENT DATE TABLE: PORTION 91 OF FARM 304 MATJIESFONTEIN

CATCHMENT AREA	AREA	POND NO	POND AREA	POND DEPTH	TOTAL POND VOLUME	1 in 50Yr PEAK RETENTION VOLUME	1 in 100Yr PEAK RETENTION VOLUME	1 in 50Yr 24hR RAINFALL RUNOFF VOLUME
No	Ha		m2	m	m3	m3	m3	m3
C1	9,45	P spring Overflow to P1	3370,00	2,50	1984	1984 943	1984 2281	4509
C2.1	2,75	P1 Inflow from P spring Total	2515,00	1,60	4024	965 943 1908	1261 2281 3542	1815
C2.2	1,15	P2	1283	1,00	1283	378	488	759
C2.3	1,05	P3	945	0,60	567	359	491	693
TOTALS	14,40				7858	4629	6505	7776

BIO Sewage Systems
The way nature does it.

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SBR Sludge Handling

In a traditional SBR (sequential batch reactor) a flocculant is introduced into the process to facilitate sludge separation. After flocculation the clear treated effluent is drawn off from the reactor and a portion of floating and settled sludge is decanted into sludge drying beds where the sludge is dried out. As this dried sludge is not sterilized it is either disposed of in a municipal dump site or it goes through an extruder and oven to sterilize.
This is obviously very inefficient, expensive and time consuming to achieve. Additionally, it requires a large footprint for the drying beds as well as labour intensive to process the dried sludge.

Activated Sludge Handling

Activated sludge consists of sludge particles, teeming with living organisms, produced in either raw or settled wastewater by the growth of organisms (which include bacteria) in aeration tanks where dissolved oxygen is present.

The Activated Sludge Process is one of several biological wastewater treatment alternatives in Secondary Treatment. When Activated Sludge is added to wastewater, the organisms in this mixed liquor quickly decompose the wastes in the wastewater being treated. After a required period of aeration and agitation in the aeration reactor, the mixed liquor flows to a separate tank called a clarifier where the activated sludge is allowed to settle out and the remaining liquid is discharged as effluent.
The settled waste activated sludge is then reused in the aeration tank as return activated sludge. This sludge must always be returned to the aeration reactors to maintain an adequate population of organisms.

Oxidation and removal of soluble or suspended solids is the result of the activated sludge process. This treatment takes place in a few hours in an aeration tank.
Stabilized soluble or suspended solids occur when organisms partially oxidize solids. Organism activity forms carbon dioxide, water, sulphate, and nitrate compounds.

The MBBR (moving bed bio reactor) process, as used by **Bio Sewage Systems,** uses these microorganisms to speed up decomposition of wastes. This “food” is known as Biochemical Oxygen Demand (BOD). BOD is the measure of oxygen demand in the incoming wastewater. A strong wastewater will have a high demand, whereas a weak wastewater will have a lower demand.
BOD is the measure of how much oxygen it will take to stabilize the waste (or food) that is in the wastewater.

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Organism mass is called Mixed Liquor Volatile Suspended Solids (MLVSS). The overall concentration of suspended solids in an aeration tank is called Mixed Liquor Suspended Solids (MLSS). This consists mostly of microorganisms and non-biodegradable suspended matter. When wastewater is added to activated sludge, microorganisms feed and grow on waste particles in the wastewater. As the organisms grow and reproduce, waste is removed and wastewater is partially cleaned. Organisms need a balance of food (BOD) and oxygen. BOD is inherent in the wastewater and oxygen is added by aeration equipment.

By this process the activated sludge harvested is fed back to the beginning of the process, which initiates the ammonia breakdown, the nitrification and denitrification processes and is ultimately reduced to nothing. The BSS system is therefore a closed loop system mitigating any expensive sludge processing requirements.

BIO Sewage Systems
The way nature does it.

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Method Statement of Bio Sewage Systems Waste Water Treatment Plant Operation

1) The primary treatment consists of a septic/collection tank with two chambers that receives the raw untreated sewage from source. Most of the settleable solids accumulate in the first compartment from where the settled sewage flows into the second compartment. The inorganic material (items that can't be processed) remains in the first chamber.
   The organic material in the sewage is reduced as a result of sedimentation and anaerobic digestion. The septic tank is designed to have sufficient storage capacity to act as a buffer and thereby smooth out fluctuations in flow and to store waste water in the event of a power interruption.

2) The septic/collection tank is fitted with a submersible pump which is used to transfer the settled and partially treated waste water into the sewage treatment plant.

   The plant consists of various processing stages.

   a) Ammonia (NH_3) is a nitrogenous compound that is oxidized in a process called **nitrification**. The nitrification of wastewater is necessary to remove or reduce the amount of nitrogen compounds in wastewater. These compounds act as environmental pollutants. Nitrification occurs when nitrifying bacteria converts ammonia and other nitrogen compounds into **nitrite** (NO_2) and the conversion of nitrite into **nitrate** (NO_3). The nitrification process converts ammonia into nitrate. After nitrification, **denitrification** must occur to remove nitrate from wastewater. Denitrification is an anaerobic process that reduces nitrate into molecular nitrogen (N_2) gas that vents to atmosphere.
      This process occurs in the septic/collection tank and bioreactors. The number of bioreactors is dependant on inflow volume and are arranged in series. In each of the biological reactors, floating media is used to provide sufficient surface area to support the attached biomass required to facilitate the nitrification process of the sewage. The bioreactors are fitted with aeration devices. Aeration of the wastewater is necessary to remove ammonia before the effluent is discharged. Surface turbulence caused by aeration releases or strips the ammonia molecules from the wastewater solution into the atmosphere through bacterial process. Due to this aeration a high concentration of biomass (bacteria) is retained in the reactors improving efficiency.

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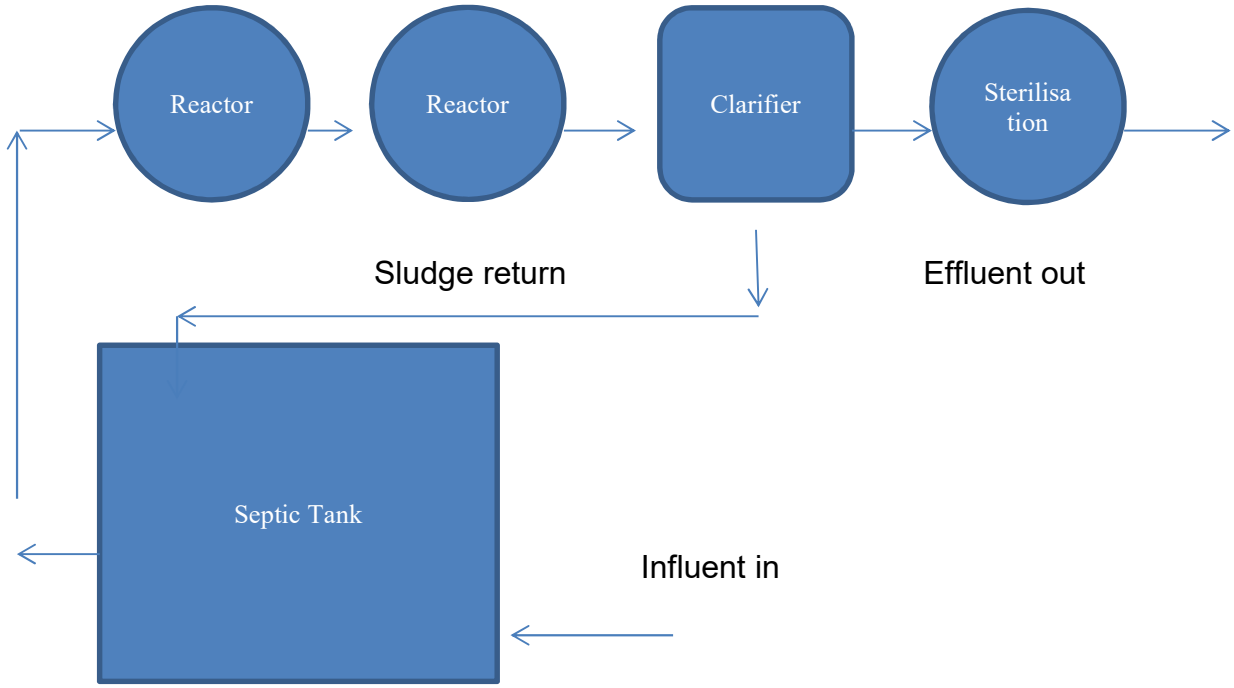
The majority of the biomass is attached to the media while a small fraction remains in suspension. By reducing the suspended solids concentration in this manner, the settling rate of sludge will be higher and a low sludge volume will be ensured. The settling time is reduced while a high effluent quality will be ensured. Another advantage is that the time for nitrification, which contributes largely to the reaction time, is significantly reduced.

b) The flow from the final aerated bioreactor enters a clarification/settling tank. The suspended solids (sludge) is allowed to settle and collect in the hopper of the clarifier. The sludge is then returned to the septic/collection tank daily where the activated sludge begins the nitrification/denitrification of the raw sewage. With this process it ensures the system is a closed loop system with no sludge generation as it is reprocessed. This mitigates the necessity of sludge drying beds and sludge handling which is onerous and requires a large footprint and is labour intensive.

c) The clear effluent then flows into a sterilisation tank for disinfection. Ozone is used for disinfection. The ozone destroys any remaining coliforms, hormones and any other harmful by-products of sewage. The benign disinfected water is then either stored for irrigation, released into the environment or can be re-used as grey water for flushing.



BIO Sewage Systems
The way nature does it.

Advantages

GREEN

- Recycles Black and Grey water - Allows greatly reduced consumption of municipal water
- Environmentally friendly - No sewerage contamination of the environment, underground water or open water sources
- No chemicals used at all in the process
- Very small footprint

ECONOMICAL

- Very cost effective, the R/litre rate is a fraction of a commercial system
- Very quick to install with minimal civil works
- Simple and 100% natural process
- Very light on electrical consumption
- Can be run off solar power
- Fully designed and manufactured in South Africa

SOCIO-ECONOMIC BENEFITS

- Human dignity
- Better Sanitation for WASH program, especially in areas that have no water borne sewage systems.
- Job creation through micro-contractors
- Can be used in both rural and densely populated urban areas

LOW MAINTENANCE

- No sludge handling required
- Unskilled monitoring of plant
- No chemicals or additives
- Replacement of any failed pumps simple and economical

WATER USAGE

- Low fresh water consumption
- Processed water can be re-used for toilet flushing
- Processed water can be used for irrigation or gardens, lawns and crops
- One litre of sewage produces one litre of processed water

Bitou

munisipaliteit umasipala municipality

to be the best together

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23 July 2024

Dear Madam

CONFIRMATION OF BULK SERVICES: PORTION 91 OF 304 MATJIESFONTEIN

We confirm that Bitou Municipality has bulk infrastructure capacity in its networks and can accommodate the proposed development, subject to the following conditions.

1. That the developer enters into and sign a Service Level Agreement with Bitou Municipality,
2. That the developer makes payment of the prescribed Augmentation contributions in order for the municipality to implement the bulk upgrade of services as detailed and required.
3. That the developer implements and maintain a temporary wastewater treatment plant until the upgrades to the Ganzevallei WWTW has been completed. The temporary wastewater treatment plant must be approved by the relevant authorities as part of the civil engineering services for the development. A bulk connection to the Bitou sewer network must be commissioned once the Ganzevallei WWTW has been upgraded and the temporary WWTP must be decommissioned and removed from site. All costs for construction, operation, maintenance and decommission will be for the account of the developer.
4. That the developer duly communicate point 3 above with all future owners/Homeowners Associates and or Body corporate.

Please contact the official dealing with this project for any further information in this regard.

Yours faithfully

MR. VW. FELTON
HEAD OF DEPARTMENT: ENGINEERING SERVICES

Official dealing with this;
Miss Asiphe Mgoqi: Engineering Services: Project Manager: Planning & Development