status homes

building communities

CIVIL ENGINEERING SERVICES REPORT

FOR THE

PROVISION OF ROADS AND CIVIL ENGINEERING SERVICES FOR RESIDENTIAL DEVELOPMENT

PORTION 9 OF THE FARM No.432, KRANSHOEK

SEPTEMBER 2020 **REVISION 2**

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PROJECT SUMMARY

This report describes the provision of roads and civil engineering services for the residential development on Portion 9 of Farm 432 for affordable housing at Kranshoek in Plettenberg Bay.

The purpose of this Civil Engineering Services Report is to:

- Prepare an existing site plan showing all the existing civil engineering services in and around the site.
- Establish the proposed road and civil engineering service requirements to serve the developed site.
- Prepare a stormwater management plan to accommodate runoff from the site.
- Provide measures to improve the quality of the runoff and control the discharge into the downstream valley & watercourse.
- Provide engineering input for the development of the site.

This report was compiled and has been reviewed in accordance with Bau-afrika's Quality Management System.

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II. REPORT AMENDMENTS

DESCRIPTION	REVISION	DATE
1st Issue – Civil Engineering Services Statement for Kranshoek to develop Portion 7, 8 & 9 of Farm 432 consisting of 1361 dwelling houses with 316 apartment units and confirm service provision	-	8 September 2018
2nd Issue – Civil Engineering Services Report for developing Portion 9 of Farm 432 consisting of 479 dwelling houses with 408 apartment units and confirm service provision	1	2 December 2019
3RD Issue – Address preliminary comments from Western Cape DEA&DP, Region 3 dated 28 July 2020	**2**	**17 September 2020**

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1. INTRODUCTION

Status Homes Property Developers (Pty) Ltd appointed Bau-afrika Consulting Engineers for the preparation of a civil engineering services design to develop Portion 9 of Farm 432 into residential erven suitable for the low cost housing market, which would include subsidised and/or incremental housing at Kranshoek, Plettenberg Bay.

Information in this report was obtained from the following sources:

- Phase 1 Geotechnical Investigation of Portion 9 of Farm 432, Kranshoek – May 2020, Geotechnics Africa Western Cape Consulting Engineering Geologists

- Electrical Services Report of Portion 9 of Farm 432, Kranshoek – November 2019, Clinkscales Maughan-Brown (Pty) Ltd Consulting Mechanical & Electrical Engineers

- Proposed Subdivision & Rezoning Plan of Portion 9 of the Farm Kranshoek No.432, Knysna Road, Revision 5 – September 2020, Metroplan Town and Regional Planners.

- Freshwater Habitat Impact Assessment for Portion 9 of Farm 432, Kranshoek – March 2019, Sharples Environmental Services cc (SES) Environmental Practitioners

- Traffic Impact Assessment of Portion 9 of Farm 432, Kranshoek – March 2019, Engineering Advice and Services (Pty) Ltd

- Ecological Assessment Report, Kranshoek – February 2019, Engineering Advice and Services (Pty) Ltd

- Topographical Survey of Portion 9 of Farm 432, Kranshoek – October 2016, Geomatics (Cape), Land Surveying Consultants

2. STUDY AREA

Portion 9 of Farm 432, Kranshoek is a 25.95ha track of undeveloped land located east of the existing Kranshoek settlement in Garden Route District Municipality, Plettenberg Bay. The property is located 8km west of Plettenberg Bay and forms part of the Bitou Local Municipality. The proposed development constitutes an extension of the existing township of Kranshoek.

The site is bounded by:

- **West** – Asphalt surfaced road (Trekkers Road) and residential erven of Kranshoek.
- **East** – undeveloped land forming Portion 8 of Farm 432
- **South** – undeveloped land forming Portion 7 of Farm 432
- **North** – Portion 10 of Farm 432 currently housing Dagbreek Eiers poultry farm

Refer to Figure 1: Site Locality Plan

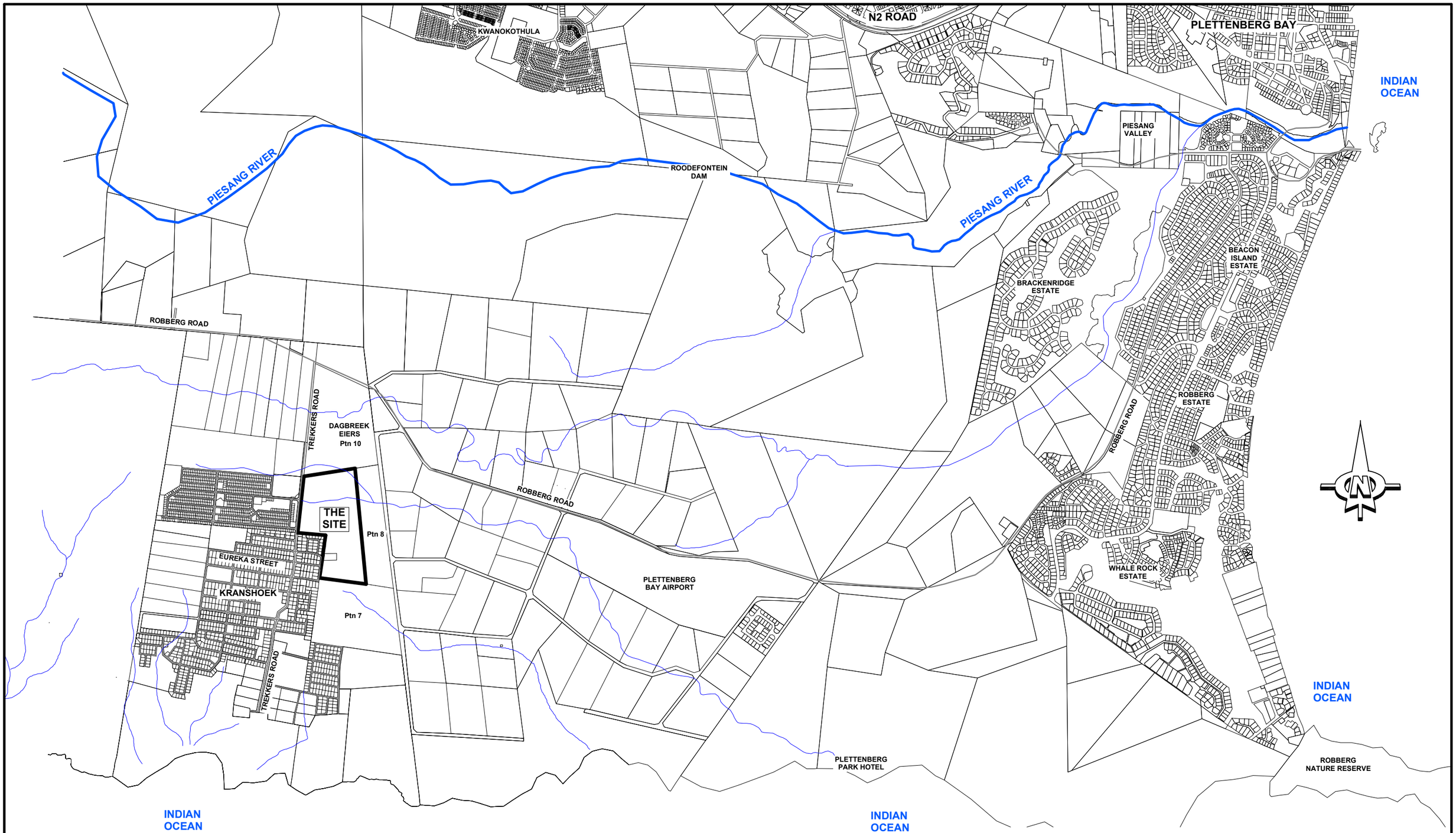

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FIGURE 1
KRANSHOEK LOCALITY PLAN
SCALE 1: 25000

3. PROPOSED SITE PLAN

The rezoning and subdivision of the property was prepared by Metroplan Town and Regional Planners and in context will form part of a larger integrated development inclusive of neighbouring Portions 7 and 8 of Farm 432.

Only Portion 9 of Farm 432 is dealt with in this report.

The proposal is to roll out the development in phases and include the following:

- Phase 1 – Winifred Lane inclusive of a Business Zone for a shopping centre and Residential Zone for social housing in the form of apartment units to a density of 100 units/ha
- Phase 2 – Stella Drive inclusive of a Residential Zone for 98 residential erven
- Phase 3 – Extension of Stella Drive inclusive of a Residential Zone for 96 residential erven
- Phase 4 – Further extension of Stella Drive inclusive of a Residential Zone for 104 residential erven
- Phase 5 – Road tie-in to existing Kranshoek road inclusive of a Residential Zone for 159 residential erven

Refer to Figure 2: Site Development Arrangement

A detailed description and motivation of the proposed development layout is covered by the Town Planning report prepared by Metroplan Town and Regional Planners.

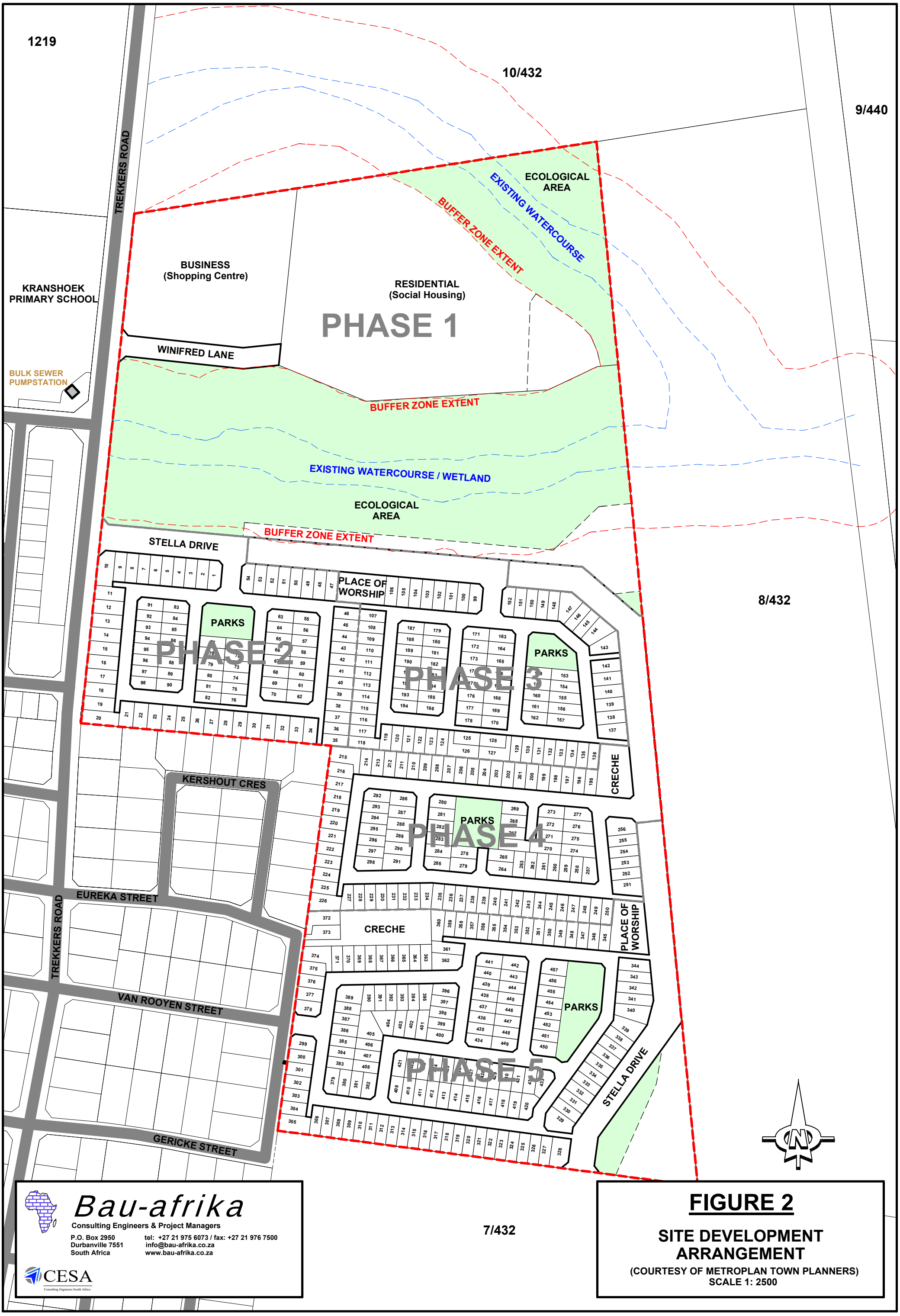

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FIGURE 2

SITE DEVELOPMENT ARRANGEMENT

(COURTESY OF METROPLAN TOWN PLANNERS)
SCALE 1: 2500

4. SITE DESCRIPTION

Based on the available information, the following site characteristics are summarised:

4.1. TOPOGRAPHY

A topographical survey was provided by Geomatics (Cape) covering a portion of the study area and providing “spot-shots” for preliminary service designs.

Based on the survey of the site, the following topographical characteristics are noted:

- The site slopes in an easterly direction and has an average gradient of 2%
- The site drains toward 2 areas located in the north-eastern and south-eastern corners of the site and has a watershed midway, from west to east.
- Low-lying valley areas (natural watercourses) traverse the northern reaches of the site and follow a drainage path eastwards towards the sea.
- The southern reaches of the site forms the ridge of the drainage basin for a separate natural watercourse located south-east of the study area.
- Both watercourses mentioned above are at best streams that intermittently have water within its valley areas with both meandering east towards its separate mouths at the sea.
- The northern areas slopes on average 2,5% into the valleys while the southern areas are flatter and averages 1,2% slope

  (Courtesy of Geomatics (Cape), 2016)

4.2. GEOTECHNICAL CONDITIONS

A limited Phase 1 geotechnical investigation was undertaken based on test pit excavations, available geological and geotechnical information on the study area during February and March 2020 by Geotechnics Africa Western Cape.

The following geotechnical characteristics are noted:

- The general soil profile is that of clayey silty sand of humified sheetwash origin and is found to be up to 300mm deep with fine roots within the top 200mm.
- A sandy clayey silt to sandy silt clay soils underlie the above-mentioned transported soils and is up to 1,4m deep below ground level.
- A predominant 0,15m to 0,5m thick pebble marker layer of ferricrete or calcrete is evident and found across the site at between 1 to 1,6m below the ground surface.
- The excavated test pits reveal stiff to very stiff sandy clay-silt below the pebble marker and no bedrock is encountered

- No groundwater is encountered in the test pits dug but slight water seep was evident in an abandoned cultivated area.

- Groundwater is expected in the wetland areas located along the drainage features (watercourses) that traverse the northern areas of the site and no boreholes were found on the property

- Surface ponding water was evident within the northern parts of the site and located within the drainage features (watercourses). No ponding water is evident from present or past data within the buffer areas.

- All materials assessed on the site have a high plastic fines content (clay or silt nature) and therefore have low permeability allowing groundwater recharge or movement. A permanent water table is expected to occur deep below the assessed layers presumably in the underlying sandstone.

- Excavation in the clayey soils up to 3m deep can be done with conventional earthmoving plant. Unsupported temporary trenches should be stable unless it is subjected to standing water or persistent wet weather conditions, in which case the sidewalls would have to be shored or battered back.

- The clay dominated soils of the site will tend to swell or shrink with seasonal moisture fluctuations. Differential settlement is therefore possible and is estimated to differ between 10 to 30mm if the soil profile dry more than half the current moisture content. Foundation designs for top structures need accommodate for this anticipated movement.

- The sandy clay silt soils located 500mm below the surface are generally firm and possess sufficient bearing capacity to support the anticipated light weight house foundations when the disturbed surface is compacted. A granular layer compacted to 93% Mod AASHTO can be placed on the soil to improve working conditions in persistent wet weather.

- Consideration should be given to implement a moisture management strategy below the foundation area of buildings to mitigate settlement or soil heaving.

- Heavily loaded buildings should be founded on the pebble marker layer located 1 to 1,5m below the surface and limited to 200kPa bearing pressure.

- The soils on site are fine grained and consist of >60% clay and silt which is unsuitable as a general backfill material. The preliminary indication is that the material is similar to that of a G10 quality in terms of TRH14 Guidelines.

- Importation of granular materials (G7 quality) is recommended for backfilling trenches, placement of soil rafts, replacing in-situ subgrade beneath roads and paved surfaces and backfilling beneath surface beds.

(Courtesy of Geotechnics Africa, 2020)

4.3. NATURAL ECOSYSTEMS

The following ecological studies have been undertaken to guide the development of Portion 9 of Farm 432 layout planning.

4.3.1 Summarised comments from Freshwater Habitat Assessment Report – Mrs D. (Debbie) Bekker of Sharples Environmental Services, March 2019

- A screening assessment identified 7 wetland systems within 500m radius of the study area

- The watercourses feeding the wetland systems and potentially impacted by the site's development were assessed by taking soil samples, documenting vegetation species and highlight key landscape features

- Two wetland systems are located within the development extent, named WET/3 & WET/4 and are directly affected by site construction while another wetland, WET/7, is located along the southern boundary and will be affected indirectly

- The site's development will impact the above-mentioned wetlands habitat (natural home and environment), biota (animal & plant life) and water quality and are the focus of the assessment

- The report concludes that the presented site development proposal, even with mitigation measures, will result in unacceptable impacts and irreversible resource loss

- Recommendations include layout amendments to avoid wetland areas and to adopt a 42m buffer area around them

- The town planning changes recommended were implemented and presented in this Civil Engineering Services Report with the following mitigation measures considered:

    - Diffuse the stormwater inflow pattern and remove pollutants from entering the wetland areas
    - Collect and treat stormwater from the site prior to discharge into wetlands
    - Develop a stormwater management plan based on SUDS
    - Soft infrastructure must be considered in the form of permeable surfaces such as armorflex blocks, stone chips and gravel to slow surface flow and enhance water storage
    - Porous channels or swales to be positioned parallel to contours along the edge of development
    - Forebays or removal of urban pollutants be provided and attenuated flows to reduce energy of stormwater flows
    - Consider more frequent outlets to reduce concentrated erosion and provide energy dissipaters in the form of Reno mattresses
    - Trap any suspended solids prior to entering wetland areas inclusive of litter and maintain efficiently during lifespan
    - Stockpiles to be positioned 50m from wetland areas

- Reduce vegetation removal during construction processes and ensure no clear & grubbing is done unnecessarily
- Implement silt fences, soil berms or shutter boards to limit sediment wash-off or erosion
- Increase habitat function by removing invasive plant species, plant indigenous plants for rehabilitation, remove solid waste in public open spaces and active monitoring of health of existing and proposed stormwater infrastructure

(*Courtesy of Sharples Environmental Services - 2019)*

4.3.2 Summarised comments from Ecological Assessment Report – Mr J. (Jamie) Pote of Engineering Advice & Services, February 2019

- The clearing of vegetation to establish the residential development will result in localised vegetation cover and the loss of a few species of conservation concern (fauna & flora) within the development footprint

- The impact will be confined and limited to the development area and the implementation of a Search & Rescue Plan is advised to limit the loss and rehabilitate with local obtained plant life

- The temporary increase of erosion due to vegetation clearing need to be mitigated, especially during the construction phases and the use of contouring or cut-off drains are encouraged

- Plant growth should be encouraged after construction phases and a weed and invasive species removal plan should be implemented to ensure indigenous plant regeneration

- The residential development will have a low impact on fauna, flora and terrestrial vegetation if recommended mitigation measures are implemented

- The development should focus on remediating during the early stage of the construction process so that the impacts are reversible and not rehabilitate after hard surfacing is completed

- The invasion of alien vegetation will continue and expand in the current site scenario and intervention is needed to remediate ongoing degradation of the area

- The following mitigation measures need to be considered at the early stages of the development:

    - The removed topsoil should be used in the rehabilitation of the constructed areas
    - Flora permits must be obtained timeously (2 – 3 months) prior to clearing the site and implementing Search & Rescue Plan
    - Rescued plants should be replanted into nearby disturbed areas of similar habitats
    - A suitable weed management strategy should be implemented to eradicate and control weed regeneration
    - After clearing, an appropriate cover crop should be planted where any weeds or exotic plants once where

- Suitable measures must be implemented in areas that may be susceptible to erosion, including and not limited to gabions or cut-off drains
- Open space rehabilitation and removal of invasive plants should commence before site clearing processes
- Rescued fauna should be released in nearby areas of similar habitats away from construction activities

(*Courtesy of Engineering Advice and Services (Pty) Ltd - 2019)*

4.4. HERITAGE FEATURES

The report provided by Engineering Advice and Services (Pty) Ltd makes no mention of any buildings older than 60 years. A further reassessment might be necessary.

(*Courtesy of Engineering Advice and Services (Pty) Ltd - 2019)*

5. EXISTING CIVIL ENGINEERING SERVICES

The service information sourced, identified the following existing services.

Refer to Figure 3: Existing Site Service Plan

5.1. EXISTING STORMWATER DRAINAGE

5.1.1 On Site

- The site slopes in an easterly direction and discharge sheet flow toward the low valley areas.
- The site drains towards two areas with one located in the north-eastern and other south-eastern corners of the study area and is separated by a watershed midway.
- Low valley areas (natural watercourses) traverse the northern reaches of the site and follow a drainage path eastward to the sea.
- The southern reaches of the site forms the ridge of the northern drainage basin and a separate natural watercourse located south-east of the study area accommodates the runoff from the southern reaches
- Both watercourses mentioned above are at best streams that intermittently have water within its valley areas and meanders east toward its separate mouths at the sea.

5.1.2 Adjacent to the Site

- Both watercourses mentioned provide the drainage path for upstream, neighbouring developments of the existing Kranshoek settlement.
- No stormwater management facilities are evident within the existing settlement and it is assumed that the road network provides the drainage path for the area.
- A road low point is evident along Trekkers Road and forms the source of the watercourse within the northern reaches.
- Another road low point can be found along Gericke Street and forms the source of the watercourse located along the southern boundary of the site

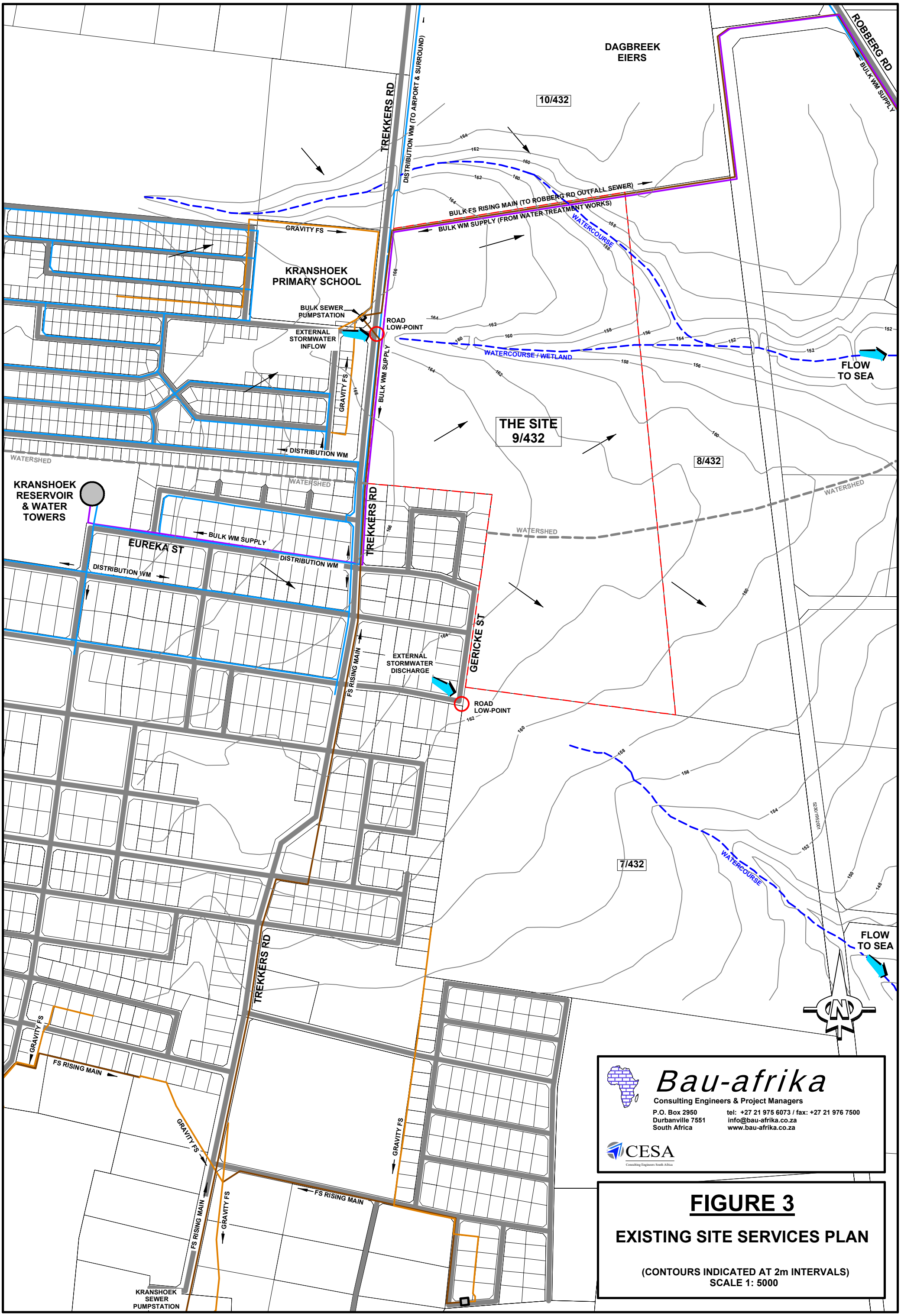
DAGBREEK
EIERS
10/432
ROBBERG RD
BULK WM SUPPLY
TREKKERS RD
DISTRIBUTION WM (TO AIRPORT & SURROUND)
BULK FS RISING MAIN (TO ROBBERG RD OUTFALL SEWER)
BULK WM SUPPLY (FROM WATER TREATMENT WORKS)
WATERCOURSE
GRAVITY FS
KRANSHOEK
PRIMARY SCHOOL
BULK SEWER
PUMPSTATION
ROAD
LOW-POINT
EXTERNAL
STORMWATER
INFLOW
GRAVITY FS
BULK WM SUPPLY
WATERCOURSE / WETLAND
FLOW
TO SEA
THE SITE
9/432
8/432
DISTRIBUTION WM
WATERSHED
KRANSHOEK
RESERVOIR
& WATER
TOWERS
EUREKA ST
BULK WM SUPPLY
DISTRIBUTION WM
TREKKERS RD
WATERSHED
FS RISING MAIN
EXTERNAL
STORMWATER
DISCHARGE
GERICKE ST
ROAD
LOW-POINT
7/432
WATERCOURSE
FLOW
TO SEA
GRAVITY FS
FS RISING MAIN
GRAVITY FS
FS RISING MAIN
GRAVITY FS
FS RISING MAIN
TREKKERS RD
KRANSHOEK
SEWER
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FIGURE 3
EXISTING SITE SERVICES PLAN
(CONTOURS INDICATED AT 2m INTERVALS)
SCALE 1: 5000

5.1.3 External Catchments

- Portion 9 of Farm 432 is influenced by runoff generated from external catchments located to the west of the site.
- These catchments span an area of 25ha to the north and 22ha to the south of Portion 9 and are made up of serviced affordable housing erven complete with buildings
- The external catchments discharges onto the site via the road low points located at Trekkers Road and Gericke Street.

5.2. EXISTING SEWER

The following sewer services are located in and around the site:

- Most of Kranshoek's sewer network discharges into the Kranshoek Sewer Pump Station located 1350m South West of the study area at the Trekkers Road cul-de-sac.
- The Kranshoek sewer network is predominantly a ø160mm pipe network with short ø110mm links along the upper reaches.
- A sewer rising main (pipe size to be confirmed) along Trekkers Road connects Kranshoek Sewer Pump Station with a Bulk Sewer Pump Station located adjacent to Kranshoek Primary School, opposite the study area.
- The Kranshoek bulk sewer rising main (pipe size to be confirmed) traverses the study area along the western and northern boundary and connects into a ø200mm bulk sewer outfall located within Robberg Road
- This outfall sewer becomes part of the outfall network for Piesang Valley and the greater Plettenberg Bay area.

5.3. EXISTING POTABLE WATER

The following potable water services are located in and around the site:

- A bulk water supply main (pipe size to be confirmed) exist and traverses the study area along its northern and western boundary.
- A water distribution main (pipe size to be confirmed) exist along the western boundary within Trekkers Road verge and follows a path north toward Robberg Road.
- This water distribution main is fed from the Kranshoek Reservoir located along Eureka Street approximately 450m west of the study area and supplies developments along Robberg Road inclusive of the Plettenberg Bay Airport.

6. WATER

The following existing municipal water services were considered to accommodate the Portion 9 of Farm 432 development:

- The water distribution main situated along Trekkers Road that is routed north and serving developments along Robberg Road.

An internal water reticulation will be provided to achieve the required fire flow conditions as per the ***"Guidelines for Provision of Engineering Services and Amenities in Residential Developments"*** as published by the CSIR.

6.1 WATER SUPPLY STRATEGY

The existing Kranshoek settlement and developments along Robberg Road are being supplied from the Kranshoek reservoir currently consisting of the following:

- A 1.35 Ml reservoir (Top water level = 174.8m)
- A 0.63 Ml water tower (Top water level = 191.2m)
- A 0.50 Ml Steel water tower (Top water level = 191.2m)

Although the Bitou Municipality has plans for future water supply improvements as developed by GLS Consulting in their Water Master Plan dated April 2016, the development of Portion 9 of Farm 432 is exploring utilising the current infrastructure for service delivery.

The bulk water supply for the site is proposed as follows:

- A connection is to be made on Trekkers Road onto the existing water distribution main to service Phase 1 along Winifred Lane

- A 2nd connection is proposed on the above-mentioned main located south to service Phase 2 to 5 along Stella Drive

Preliminary discussions with the Bitou Municipality suggests that the above proposal will require confirmation in consultation with GLS Consulting.

6.2 WATER PARAMETERS AND ASSUMPTIONS

The water supply to Portion 9 of Farm 432 is based on the anticipated water demand for the different land uses and consist of the following:

- The land use table as per the development layout provided by the Town Planner

- The annual average daily demands (AADD) for different land uses are based on the Guidelines for Human Settlement Planning and Design compiled by the CSIR:

    - Residential units = **600 l/day/unit**
    - ECD (learners) = **20 l/day/learner** with ECD @ 40 learners/ECD (max)
    - Place of Worship = **2 000 l/day/erf**
    - Business (Office, shops and civic buildings) = **400 l/day for 100m²/GLA** with GLA @ 60% of land area

- The peak flows are calculated on **residential units only**, as it will equate for the highest water demand scenario for this proposed development

- Water peak demands are based on peak factors read off the "equivalent erven" figure *(Reference: Fig 9.11 of Guidelines for Human Settlement Planning)*

6.3 WATER DEMAND RESULTS

Refer to Figure 4: Proposed Water & Sewer Arrangement

Portion 9 of Farm 432 will develop in 5 phases and provide the following demand on the water infrastructure:

PHASE 1		**Potable Water Demand**		
Portion 9	Number	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Residential (100 u/ha)	223	133.8	8.70	16.4
Business (100m²)	73	29.2		
Sub-Total		163.0		

Table 1: Phase 1 Water Results

PHASE 2		**Potable Water Demand**		
Portion 9	Number	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Residential Units	98	58.8	11.20	7.6
Sub-Total		58.8		

Table 2: Phase 2 Water Results

PHASE 3		**Potable Water Demand**		
Portion 9	Number	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Residential Units	96	57.6	10.90	7.5
Place of Worship	1	2.0		
Sub-Total		59.6		

Table 3: Phase 3 Water Results

1219

10/432

9/440

8/432

7/432

TREKKERS ROAD

EXISTING DISTRIBUTION WM FROM EXISTING RESERVOIR

EXISTING BULK WM (SUPPLY)

BULK FS RISING MAIN (TO ROBBERG RD OUTFALL SEWER)

EXISTING WATERCOURSE

NEW GRAVITY NETWORK

EXISTING GRAVITY SEWER PIPE

BUSINESS
(Shopping Centre)

RESIDENTIAL
(Social Housing)

KRANSHOEK
PRIMARY SCHOOL

NEW SEWER CONNECTION TO EXISTING GRAVITY MAIN (STILLING CHAMBER)

NEW MUNICIPAL WATER CONNECTION OFF EXISTING PIPE

PHASE 1

WINIFRED LANE

NEW SEWER PUMP STATION

NEW RISING MAIN

EXISTING BULK SEWER PUMPSTATION

EXISTING WATERCOURSE / WETLAND

NEW SEWER CONNECTION TO EXISTING GRAVITY MAIN (STILLING CHAMBER)

NEW RISING MAIN

STELLA DRIVE

NEW MUNICIPAL WATER CONNECTION OFF EXISTING PIPE

EXISTING GRAVITY SEWER PIPE

EXISTING SEWER RISING MAIN

PARKS

PLACE OF WORSHIP

PHASE 2

PHASE 3

PHASE 4

PHASE 5

CRECHE

KERSHOUT CRES

EUREKA STREET

VAN ROOYEN STREET

GERICKE STREET

NEW GRAVITY NETWORK

NEW RISING MAIN

STELLA DRIVE

NEW SEWER PUMP STATION

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FIGURE 4

PROPOSED WATER & SEWER ARRANGEMENT

SCALE 1: 2500

PHASE 4		Potable Water Demand		
Portion 9	Number	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Residential Units	104	62.4	9.80	7.1
ECD (learners)	40	0.8		
Sub-Total		63.2		

Table 4: Phase 4 Water Results

PHASE 5		Potable Water Demand		
Portion 9	Number	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Residential Units	159	95.4	9.20	10.4
ECD (learners)	40	0.8		
Place of Worship	1	2.0		
Sub-Total		98.2		

Table 5: Phase 5 Water Results

FULLY DEVELOPED		Potable Water Demand		
Portion 9	Number	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Phase 1		163.0		
Phase 2		58.8		
Phase 3		59.6		
Phase 4		63.2		
Phase 5		98.2		
Total		442.8	6.1	31.2

Table 6: Portion 9 of Farm 432 Water Results

A service capacity request has been forwarded to Bitou Municipality for review and we are waiting on their response.

The internal water reticulation will be finalised at detail design stage and will:

- Comply with **Guidelines for Human Settlement Planning and Design (CSIR, 2000)**
- Address the **Minimum Standards for Civil Engineering Infrastructure** as required by the Bitou Municipality **(Bitou, 2017)**
- Achieve the fire flow conditions as listed below:
  - The fire risk category of the development being **low risk** (Group 2 & 3)
  - A minimum design fire flow of 500 l/min.
  - A design fire flow duration of 1 hour
  - Only 1 hydrant will be discharging during a fire event.
  - A minimum hydrant flow rate 500 l/min with a residual head of 6m
  - A maximum hydrant location spacing of 240m apart

6.4 WATER CONCLUSION

Based on the results, the following conclusion is made:

- Two municipal connections are proposed for the development
- Pipe sizes foreseen to range from ø110mm to ø160mm
- The working water velocity and pressure will be reviewed at detail design stage to inform the water design for fire flow conditions.
- Water saving measures are being considered by the developer and will be communicated during detail design.

7. SEWER

The following existing municipal sewer services were considered to accommodate the Portion 9 of Farm 432 development:

- The gravity sewer pipe located within the public open space and Kranshoek Primary School along Trekkers Road that discharge into the Bulk Sewer Pump Station situated adjacent to the school

- The Kranshoek bulk sewer rising main that traverse the study area along the western and northern boundary and connect to Robberg Road

- The ø200mm bulk sewer outfall located within Robberg Road that becomes part of the outfall network for Piesang Valley and the greater Plettenberg Bay area

Although the Bitou Municipality has plans for future bulk sewer improvements as developed by GLS Consulting in their Sewer Master Plan dated April 2016, the development of Portion 9 of Farm 432 is exploring utilising the current infrastructure.

7.1 SEWER DESIGN STRATEGY

The internal sewer reticulation for the development is divided into two catchment areas, namely a northern and southern area.

The sewer design for the site proposes the following:

- The **Northern area** discharge into a new gravity system linked to new sewer pump station serving only Phase 1 of the Portion 9 development and will be pumped to the existing gravity main along Trekkers Road

- The **Southern area** discharge into a new gravity system proposed to serve Phase 2 to 5 and will be linked to a new sewer pump station located in Phase 5 and will be pumped along Stella Drive to the existing gravity main along Trekkers Road

Refer to Figure 4: Proposed Water & Sewer Arrangement

Preliminary discussions with the Bitou Municipality suggests that the above proposal will require confirmation in consultation with GLS Consulting.

7.2 SEWER DESIGN PARAMETERS AND ASSUMPTIONS

The sewer of the site is based on the anticipated discharge from the different land uses of the development and makes use of the following:

- The land use table as per the development layout provided by the Town Planner
- The annual average daily flow (AADF) for different land uses are based on the water demand results and is calculated as **85% of water demand:**
    - Residential units = **510 l/day/unit**
    - ECD (learners) = **18 l/day/learner** with ECD @ 40 learners/ECD (max)
    - Place of Worship = **1 700 l/day/erf**
    - Business (Office, shops and civic buildings) = **340 l/day for 100m²/GLA** with GLA @ 60% of land area
- The peak flows are calculated on **residential units only**, as it will equate for the highest sewer discharge scenario for this proposed development
- Sewer peaks are based on the Harmon equation (Assuming 7 people per residential unit)
- Allowance made for 15% stormwater infiltration

7.3 SEWER RESULTS

Portion 9 of Farm 432 will develop in 5 phases but will result in 2 distinct systems:

PHASE 1		**Sewer Flow Discharge**		
Portion 9	Number	AADF (kl/d)	Peak Factor	Peak Flow (l/s)
Residential (100 u/ha)	223	113.7	3.67	5.7
Business (100m²)	73	24.8		
Sub-Total		138.5		

Table 7: Phase 1 Sewer Results

Phase 1 reflects the system serving the **Northern area** and is limited to the development within this phase. The resultant sewer infrastructure will only be limited to serve this phase.

PHASE 2		Sewer Flow Discharge		
Portion 9	Number	AADF (kl/d)	Peak Factor	Peak Flow (l/s)
Residential Units	98	49.9	3.90	2.2
Sub-Total		49.9		

Table 8: Phase 2 Sewer Results

PHASE 3		Sewer Flow Discharge		
Portion 9	Number	AADF (kl/d)	Peak Factor	Peak Flow (l/s)
Residential Units	96	48.9	3.90	2.2
Place of Worship	1	1.7		
Sub-Total		50.6		

Table 9: Phase 3 Sewer Results

PHASE 4		Sewer Flow Discharge		
Portion 9	Number	AADF (kl/d)	Peak Factor	Peak Flow (l/s)
Residential Units	104	53.0	3.88	2.4
ECD (learners)	40	0.7		
Sub-Total		53.7		

Table 10: Phase 4 Sewer Results

PHASE 5		Sewer Flow Discharge		
Portion 9	Number	AADF (kl/d)	Peak Factor	Peak Flow (l/s)
Residential Units	159	81.1	3.77	3.5
ECD (learners)	40	0.7		
Place of Worship	1	1.7		
Sub-Total		83.5		

Table 11: Phase 5 Sewer Results

Phase 2 to 5 represents the system serving the **Southern area**. The resultant sewer infrastructure will include for these 4 phases in total.

Fully Developed		**Sewer Water Demand**		
Portion 9	Phase	AADD (kl/d)	Peak Factor	Peak Demand (l/s)
Northern	1	138.5	3.67	5.7
Southern	2	237.7	3.42	9.2
	3			
	4			
	5			
Total		376.2		

Table 12: Portion 9 of Farm 432 Sewer Results

A service capacity request has been forwarded to Bitou Municipality for review and we are waiting on their response.

The internal sewer reticulation will be finalised at detail design stage and will provide:

- Optimum pipe gradients to ensure a self-cleansing system and reduce the maintenance on the system.
- Be water tight by using precast sewer manholes with pre-manufactured pipe connections to inverts to reduce stormwater ingress into the system.
- Achieve the minimum pipe gradients prescribed by **Minimum Standards for Civil Engineering Infrastructure** as required by the Bitou Municipality
- Accommodate the peak sewer flows.

7.4 SEWER CONCLUSION

Based on the results, the following conclusion is made:

- Two (2) sewer pump stations are proposed for the development
- The pump stations will be positioned at each area's gravitational low point
- The new rising mains will be positioned within the road reserves and follow a path to Trekkers Road to tie into the existing gravity mains in close proximity
- All gravity mains in the Kranshoek area discharges into the Bulk Sewer Pump Station located adjacent to Kranshoek Primary School

8. STORMWATER

Portion 9 of Farm 432 has three catchment areas of different sizes and outlines the drainage area for the development.

The external stormwater follows the road drainage pattern of the existing Kranshoek settlement along the western boundary and discharge onto the study area at the Trekkers Road & Gericke Street low points into the natural watercourse through and along the site before exiting at its eastern boundary.

Refer to Figure 5: Existing Site Drainage Pattern

All existing stormwater runoff from the study area occurs overland as sheet flow and enters the natural watercourse along its banks.

8.1. STORMWATER MANAGEMENT STRATEGY

The stormwater management plan is to provide a sustainable urban drainage system (SUDS) for the development through applying the following strategy:

- Control the quantity and rate of stormwater runoff to reduce flooding threats downstream of the site
- Improve the quality of stormwater runoff to protect the natural aquatic environment (natural watercourses) and maintain the recreational water quality downstream of the site
- Encourage ground water recharge (if geologically possible) to reduce the volumes of stormwater to be accommodated

The proposed stormwater system will be designed for minor and major storm events and is categorised as provided below.

8.1.1 Primary System

- The underground stormwater pipes and catchpits are designed to accommodate the more frequent storms up to 1:2 year RI (minor storm events)
- The development runoff is conveyed along kerbs and channels of roads entering the underground system at catchpits and other inlet structures
- Catchpits are constructed with silt traps for sediment removal purposes
- The underground system conveys stormwater to the gravitational low area of the catchment and discharges into a stormwater management area.
- External runoff from storms up to 1:½ year RI is captured along the western boundary and proposed to be channelled to link up with the stormwater management area along perimeter of the ecological protected area.

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TREKKERS ROAD

BULK SEWER PUMPSTATION

INFLOW

ROAD LOW-POINT

CONCENTRATED STORMWATER FLOW WITHIN PIPES & ROAD KERBS (±25ha Catchment)

SHEET FLOW TO WATERCOURSE

BUFFER ZONE EXTENT

EXISTING WATERCOURSE

EXISTING WATERCOURSE / WETLAND

OUTFLOW

SHEET FLOW TO WETLAND/ WATERCOURSE

SHEET FLOW TO WATERCOURSE

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WATERSHED

KERSHOUT CRES

EUREKA STREET

TREKKERS ROAD

VAN ROOYEN STREET

GERICKE STREET

CONCENTRATED STORMWATER FLOW WITHIN PIPES & ROAD KERBS (±22ha Catchment)

INFLOW BYPASSES THE SITE

ROAD LOW-POINT

SHEET FLOW TO WATERCOURSE/ OUTFALL DRAIN

INFORMAL OUTFALL DRAIN TO WATERCOURSE

7/432

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FIGURE 5

EXISTING SITE DRAINAGE PATTERN

(CONTOURS SHOWN AT 2m INTERVALS)
SCALE 1: 2500

8.1.2 Secondary System

- The road network is designed with high and low areas to direct runoff from storms greater than 1:2 year RI to stormwater management areas (major storm evens)

- The roads are designed to accommodate runoff of storms up to 1:50 year RI within its cross section to road low points and overflow into spillways to the management areas.

- Swales are proposed to meander alongside the ecological protected areas constructed with weirs to reduce flow rates within the hydraulic channel.

The proposed **stormwater management areas / structures** are designed to improve runoff quality and control the runoff quantity into the receiving system.

Refer to Figure 6: Post Development Drainage Plan

8.2. IMPROVE RUNOFF QUALITY

- The post-development runoff is to be treated to remove at least **80%** of the calculated average annual **total suspended solids** (TSS) accumulated on the site.

- The treatment should include for the reduction of **total phosphorus** (TP) to at least **45%**.

- The requirement is quantified and expressed as the **water quality volume** (WQV) and equals the runoff generated from a 1:½ year RI storm.

- Based on best management practice (BMP) the above-mentioned treatment criteria can be achieved through implementing a Micropool Extended Detention pond with the following structures:

  - Pre-Treatment Forebay
  - Aquatic bench
  - Micro Pool

  Refer to Figure 7: Example of Micropool Extended Detention Pond

- The above-mentioned will achieve a reduction of 80% TSS and 45% TP

- Treatment loads can be further reduced by implementing the following:

  - Swales (dry),
  - Grass channels (open drains),
  - Litter traps (at inlet points to watercourse),
  - Silt or sediment traps (built into catchpits),
  - Street cleaning (at regular intervals).

- Further treatment measure will be discussed with Bitou Municipality at detail design stage

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TREKKERS ROAD

KRANSHOEK PRIMARY SCHOOL

BUSINESS (Shopping Centre)

RESIDENTIAL (Social Housing)

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5

EXISTING WATERCOURSE

EXISTING WATERCOURSE / WETLAND

FOREBAY OUTLET

PRE-TREATMENT FOREBAY

ENHANCED SWALE (DRY)

WINIFRED LANE

PRIMARY SYSTEM (PIPE)

AQUATIC BENCH

MICROPOOL

POND 'A'

POND 'B'

POND 'C'

ATTENUATED OUTFLOW INTO WETLAND

OUT-A

OUT-B

OUT-C

ROAD LOW-POINT

EXTERNAL

INFLOW CONCENTRATED INTO WETLAND

INFLOW BYPASSES THE SITE

STELLA DRIVE

SECONDARY SYSTEM (ROAD)

PLACE OF WORSHIP

PARKS

CRECHE

KERSHOUT CRES

EUREKA STREET

VAN ROOYEN STREET

GERICKE STREET

WATERSHED

INFORMAL OUTFALL DRAIN TO WATERCOURSE

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FIGURE 6

POST DEVELOPMENT DRAINAGE PLAN

SCALE 1: 2500

RENO MATTRESS

1:100 YEAR FLOODLINE

OUTLET IL=42.250

DESIGNATED WETLAND AREA & WATERCOURSE

POND OUTLET STRUCTURE

WEIR

1:2 SIDE SLOPES

SUBSOIL DRAIN DISCHARGE IL=42.045

RENO MATTRESS

ø100mm SOLID PVC PIPE @ 1:60.74

STONE PITCHING

MICROPOOL
(RENO MATTRESS)

GABIONS (TOP AT 43.050)

GABIONS (TOP AT 43.700)

GABIONS (TOP AT 44.200)

FALL

AQUATIC BENCH

RIP-RAP CHANNEL

FOREBAY

VEGITATED EMBANKMENT

GABIONS (TOP AT 43.400)

PERFORATED PIPE (START) IL=42.650

PERFORATED PIPE END IL=42.586

HW104 IL=43.101

ø525mm SW @ 0.50%

MH-91 CL=45.333 IL=43.168

ø525mm SW @ 5.66%

DEVELOPMENT BOUNDARY

PHOTO OF NEAR-COMPLETED POND

PHOTO OF PONDS ALONG WETLAND

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FIGURE 7

EXAMPLE OF MICROPOOL EXTENDED DETENTION POND

SCALE 1: 250

CONTOURS ARE SHOWN AT INTERVALS OF 500mm

8.3. CONTROL RUNOFF QUANTITY

- The post-development runoff is to be managed to mitigate the effects of increased runoff peak rates, -volumes and –velocities.

- The stormwater management areas are controlled with an outlet structure to provide **downstream channel protection** (CPV), **overbank flood protection** (Qp) and extreme flood protection (Qf)

- The control of runoff quantity should provide the following:

  - For CPV, the runoff from a 1:1 year RI storm is to be detained and gradually released over a 24 hour period to protect the downstream channels from eroding

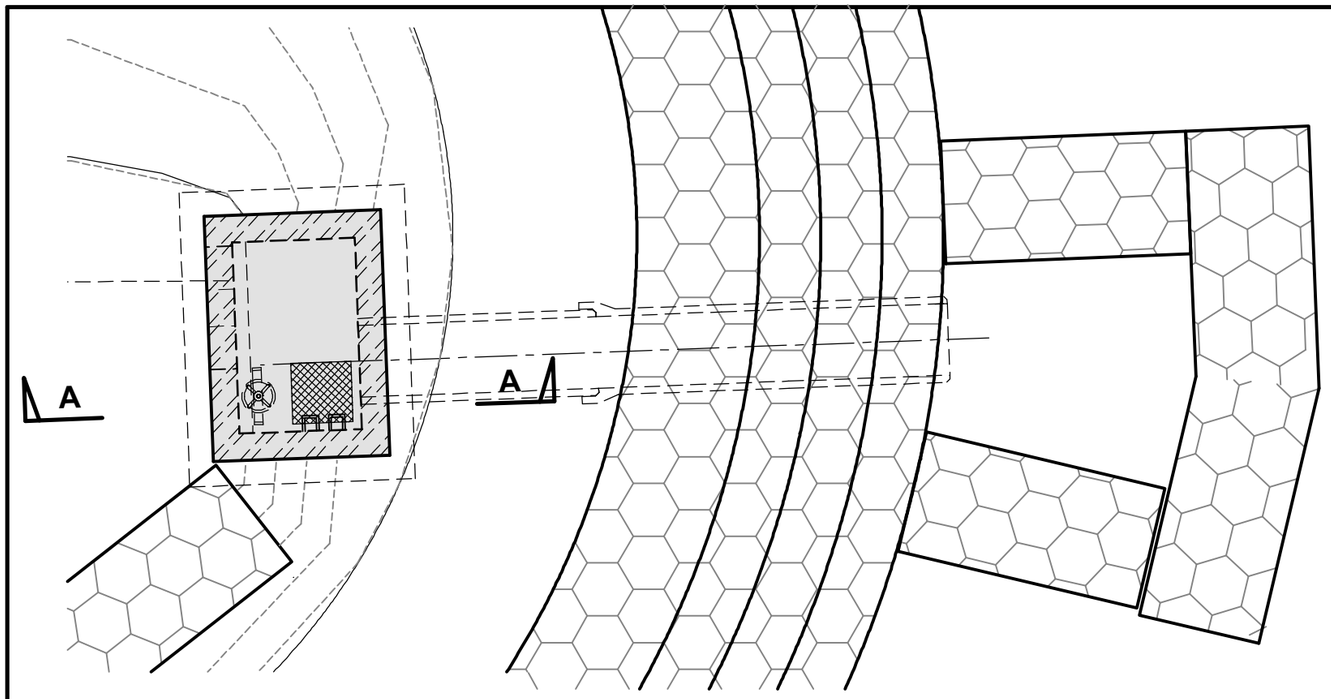
  - For Qp, the peak flow rate of a 1:10 year RI storm is to be reduced to its pre-development peak flows to protect downstream properties from frequent nuisance flooding

  - For Qf, the peak flow rate of a 1:50 year RI storm is to be reduced to its pre-development peak flows to protect floodplain properties from extreme flooding conditions

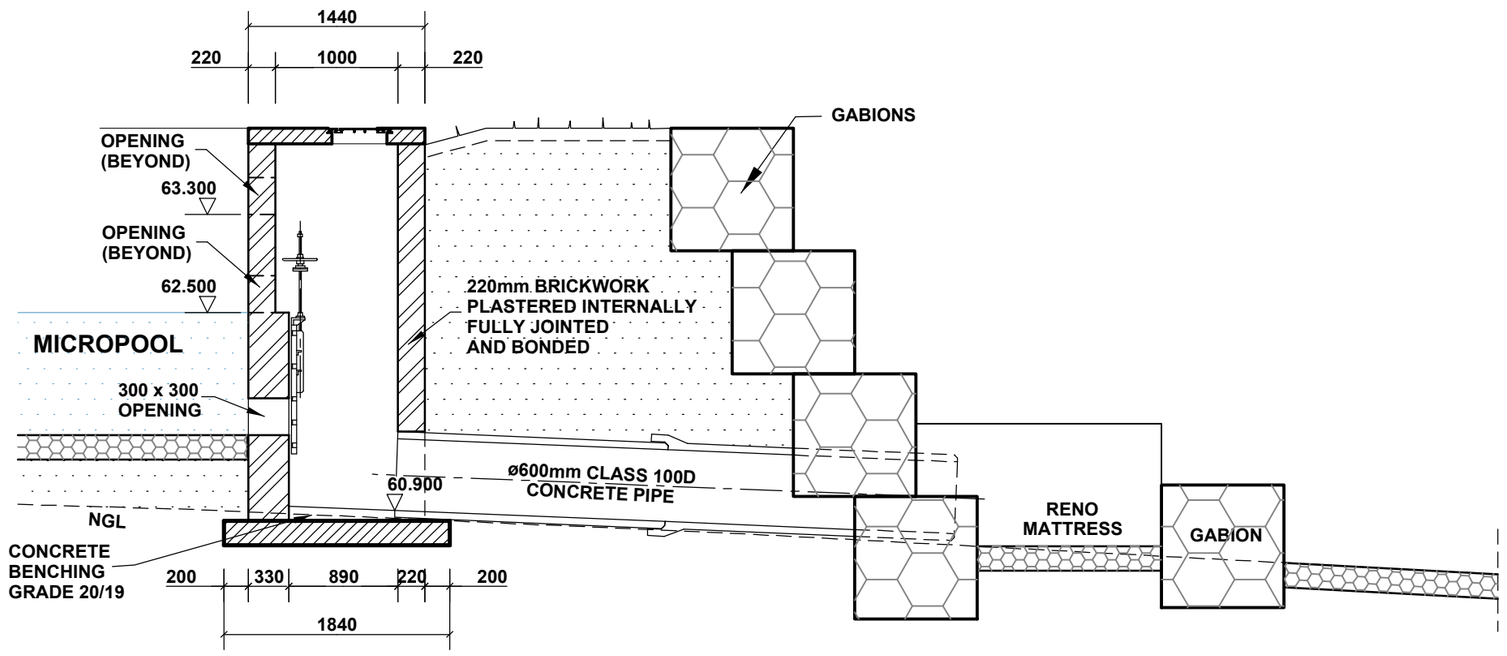
  - The effects of a 1:100 year RI storm will to be assessed to finalise the development's unit floor levels and provide guidance for future downstream developments

- The design of the above-mentioned pond's outlet structure will achieve the desired control rates

  Refer to Figure 8: Example of Pond Outlet Structure



PLAN - POND OUTLET STRUCTURE



SECTION A - A

PHOTO OF NEAR-COMPLETED OUTLET

PHOTO OF OUTLET COMPLETED

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FIGURE 8

EXAMPLE OF POND OUTLET STRUCTURE

SCALE 1: 50

8.4 STORMWATER MODELLING PARAMETERS

8.4.1 Stormwater Modelling

- The computer software used for the hydrological model is **PC-SWMM 2019 version 7.2.2785**
- Analysis and modelling utilised **dynamic wave routing**

8.4.2 Design Storm Events

- The storm event rainfalls were simulated by using an **SCS-storm** over a **24-hour (1 day) period** at various return intervals (RI)
- The rainfall intensity map confirms that the storm should mimic a Type-2 rain storm

8.4.3 Rain Station Data

- The rain station data was determined by using the Visual SCS programme to verify data within the site vicinity
- The site is located at **34°45'11'' Latitude, 23°18'11'' Longitude**
- 5 Rain stations were identified within a 23km radius from the site
- Plettenberg Bay (Station 14633) is the closest and at the altitude of the site

8.4.4 Design Storm Depths

- The rainfall depths at various rainstorm recurrence intervals was determined for a **1 day period** as being the below

Data Source	Recurrence Intervals (RI)							
	1:½ year	**1:1 year**	**1:2 year**	**1:5 year**	**1:10 year**	**1:20 year**	**1:50 year**	**1:100 year**
Station 14633	25*	35*	58	84	104	126	159	188

Table 13: Rainfall depths for 24-hour storms

***** Denotes the assumed rainfall depths because of insufficient data

8.4.5 Soil Characteristic Assumptions

- The **Green-Ampt Infiltration Model** was used to simulate the existing soil condition.
- Based on the description provided within the Geotechnical report, the soil texture class resembles a **Sandy Clay Loam** soil with characteristics of:

  - Suction Head = 220mm
  - Hydraulic Conductivity = 2mm/hr
  - Initial Deficit = 0.154 (assuming well-drained soil conditions)

  (Reference: Rawls, W.J., Brakensiek D.L. and Miller, N., 1983)

8.5 STORMWATER MANAGEMENT

In reference to the ***Figure 6: Post Development Drainage Plan,*** the stormwater runoff from the developed site is designed to follow the road drainage paths to the proposed road low points of the site.

At the road low points, overland drainage chutes / spillways are proposed to discharge overland stormwater into **pre-treatment forebays**. It should be noted that all internal pipe networks follow a similar path to these forebays.

The pre-treatment forebays provide the following stormwater management functions:

- Dissipate flow velocities by stilling water flow
- Accumulate sediments in its “basin”
- Provide a debris removal area through its coarse “basin” surfacing
- Allow for gross pollutant filtration through its subsurface drains

The overflow from the above-mentioned forebays passes through a **shallow submerged aquatic bench**. Shallow water pooling is anticipated within these bench areas, which provide the following stormwater management functions:

- Provide a pond buffer around the permanent pool of water (micro pool)
- Enhance pond safety due to its flatter graded areas
- Stimulate a habitat for wetland vegetation
- Augment pollutant removal
- Provide area for debris removal and conceals debris build up due to plants
- Improve the removal of soluble nutrients due to wetland plant growth
- Encourage infiltration for groundwater recharge

The build-up of stormwater within the above-mentioned structures will enter the **micro pool**.

This area in conjunction with the previous mentioned structures forms the extended attenuation volume for the management of stormwater quantity, which will outflow into the adjacent watercourse via the pond outlet structure.

The outlet control structure will be an intake tower with sized orifices and weirs to manage the attenuated outflows to pre-development flow rates.

The development of Portion 9 of Farm 432 has been modelled and provided preliminary runoff results to size the stormwater management areas.

Refer to Figure 9: Stormwater Attenuation Modelling Results

FIGURE 9: STORMWATER ATTENUATION MODELLING RESULTS

PONDS	PRE-DEVELOPMENT INFLOW						POST-DEVELOPMENT INFLOW						ATTENUATION			OUTLET			ATTENUATED OUTFLOW					
	Dynamic Wave Flow Results						Dynamic Wave Flow Results						Proposed Pond Dimensions			Proposed Pond Outlet Sizes			Dynamic Wave Flow Results					
	1:2	1:5	1:10	1:20	1:50	1:100	1:2	1:5	1:10	1:20	1:50	1:100							1:2	1:5	1:10	1:20	1:50	1:100
	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	D	AREA	VOL	OFF SET	H	W	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Peak Flow
	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m	m^2	m^3	m	m	m	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s
Pond-A	0.253	0.492	0.693	0.915	1.257	1.505	0.631	1.009	1.291	1.576	1.888	2.287	2.700	2133	1986	0.000	0.30	-	0.250	0.425	0.507	0.581	0.880	1.238
																1.300	0.20	0.20						
																1.700	0.20	1.00						
																2.400	0.30	1.00						
Pond-B	0.283	0.594	0.860	1.158	1.591	1.821	0.648	1.097	1.437	1.794	2.212	2.583	3.100	2492	3335	0.000	0.30	-	0.240	0.468	0.590	0.688	0.787	0.836
																1.200	0.20	0.20						
																1.600	0.20	1.00						
Pond-C	0.528	1.078	1.494	1.907	2.272	2.420	0.940	1.528	1.905	2.181	2.391	2.606	3.500	3430	5782	0.000	0.30	-	0.152	0.352	0.457	0.541	0.597	0.810
																1.200	0.20	0.20						
																1.600	0.20	0.60						

8.5 STORMWATER CONCLUSION

Based on the stormwater modelling, the following conclusions may be drawn:

- Three ponds are required to provide stormwater management for the development.
- The three ponds are located on the downstream side of the catchments.
- The development layout accommodates the required space for the stormwater management areas in order to achieve the management strategy
- The peak attenuated flows from the developed property will not exceed the pre-developed flows for the 1:2, 1:5, 1:10, 1:20 and 1:50 year RI
- An emergency outlet will be designed to accommodate flows from storm events greater than 1:50 year RI and up to 1:100 year RI without overtopping the banks of the pond
- The stormwater outflow into the watercourse will require further discussions with Freshwater specialists and Bitou municipality to determine the ecological treatment of the outfall into the watercourse

9. ROADS AND ACCESS

A Traffic Impact Assessment (TIA) was prepared by Engineering Advice and Services (Pty) Ltd to provide the following:

- Determine the extent and nature of traffic generated by the development
- Assess the impact of the above-mentioned traffic on existing road network
- Advise on solutions on any traffic issues identified

The proposed development layout prepared by Metroplan Town and Regional Planners utilises recommendations provided in the TIA and satisfy the Bitou Local Municipality's minimum road standards.

9.1. ACCESS

Access to the proposed development is influenced by the following:

- New intersections of the development to Trekker Road
- Intersection of Trekker Road to Robberg Road
- Intersection of Robberg / Plettenberg Bay Airport Road to the N2

Traffic volumes through the above intersections are relatively low and will require little improvements. However, the following is being considered for future use:

- Higher traffic volumes during school drop-off and pick-up times
- Further development east of Portion 9 of Farm 432 utilising the proposed access onto Trekker Road

The access off Trekker Road serving Phase 2 to 5 (Stella Drive) will have space to accommodate both current development traffic and future anticipated growth in the area.

9.2. INTERNAL NETWORK

The geometric design, cross section and structural design of the roads will be designed to municipal standards and allow for the following:

- Stella Drive will be constructed as a collector road (Class 4 – Major Bus Route) that is minimum 7.4m wide (blacktop)

- The residential phases will be constructed as access streets (Class 5a) with mountable kerbs to allow easy access to erven

9.3. PUBLIC TRANSPORT

The Bitou Municipality's Integrated Transport Plan indicates a minibus taxi route serving Kranshoek that uses Trekker Road to an existing taxi rank.

The development of Portion 9 of Farm 432 may result in an adjustment of this route and in future, with developments eastward, can use Stella Drive as a public transport link that loops back to Trekker Road further south.

The above recommendation is subject to an Operating Licence Board agreement but the road will be available to accommodate this change, if required.

9.4. PEDESTRIAN ARRANGEMENT

Pedestrian linkage to public transport will be key for this development and the following is proposed:

- Provide sidewalks along 20m collector roads (at least)
- Construct ramps at road crossings for the disabled

10. TELECOMMUNICATION

Telecommunication and data sleeves will be provided in accordance with the reticulation layouts of future service providers.

The installation of telecom sleeves will be covered with the detail design of the development and form part of the construction of the civil engineering services.

The installation of all telecommunication sleeves will comply with the requirements of SABS 1200 LC.

11. ELECTRICAL

An Electrical Services Report was compiled by Clinkscales Maughan-Brown to inform on the electrical services needed for the development and advise on the connections needed onto existing Eskom infrastructure in the area.

The installation of electrical sleeves will be covered with the detail design of the development and form part of the construction of the civil engineering services.

The installation of all electrical sleeves will comply with the requirements of SABS 1200 LC.

12. CONCLUSION

Based on the contents of this report, the following conclusions are drawn:

- Acceptable civil engineering services can be provided for Portion 9 of Farm 432, Kranshoek.
- No major engineering constraints are foreseen that will make Portion 9 of Farm 432, Kranshoek unsuitable for development.

Prepared by:

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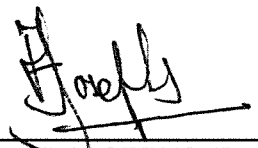
Checked by:



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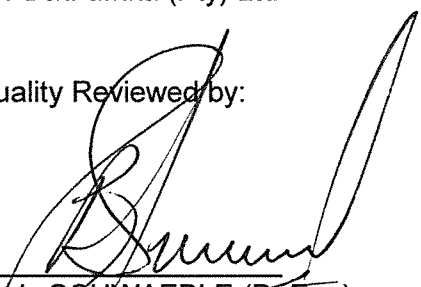

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22 October 2020

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Attention: Shireen Pullen

Dear Madam

BULK SERVICES: PROPOSED MIXED - USE DEVELOPMENT ON PORTIONS 9 ON THE KRANSHOEK FARM NO.432, KNYSNA ROAD, PLETTENBERG BAY

Your letter dated 28 July 2020 (reference 16/3/3/2/D1/8/0001/19) refers.

The purpose of this letter is to address the queries relating to the bulk services under 4.2 of your letter.

WASTEWATER SERVICES
We confirm that there is bulk sanitation services in the Kranshoek area.

WATER SERVICES
We confirm that there is bulk water services in the Kranshoek area.

ELECTRICITY SERVICES
This is an Eskom supply area.

However, having confirmed the existence of bulk services, it remains the responsibility of the developer to submit detailed designs and requirements for the development to GLS Consulting Engineers to analyse the networks in order to confirm which upgrades, if any, is required to accommodate the proposed development.

From an Engineering Services point of view, there is no objection to the proposed development of this property, provided that a services agreement is concluded with the Municipality.

It is to be noted that the above information is provided in good faith and without any prejudice to the rights of the municipality.

Yours faithfully

2020/10/22

Michael J Rhode
Acting DIRECTOR: ENGINEERING SERVICES