DEVELOPMENT OF PORTION 250 OF FARM 745, GOED GELOOF, ST FRANCIS BAY

ENGINEERING SERVICES REPORT

Date: February 2023

Rev 0

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1. GENERAL ABBREVIATIONS/ ACRONYMS AND SYMBOLS

AADD	Annual Average Daily Water Demand
ADMD	After-Diversity Maximum Electricity Demand
ADWF	Average Dry Weather Sewer Flow
KLM	Kouga Local Municipality
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DWS	Department of Water and Sanitation
DoT	Department of Transport
DTM	Digital Terrain Model
GADD	Gross Average Daily Water Demand
GIS	Geographical Information System
Ha	Hectare
kl	Kilo liter
l	Liter
l/sec or l/s	Liters per second
l/min	Liters per minute
m	Meter
m^2	Square meter
m^3	Cubic Meter
Ml	Mega litre
m/s	Meters per second
m^3/s	Cubic Meters per Second
PDWF	Peak Dry Weather Sewer Flow
PVCu	Un-plasticised Polyvinyl Chloride
PWWF	Peak Wet Weather Sewer Flow
SANS	South African National Standards
SABS	South African Bureau of Standards
Summer Peak	Summer Peak Water Demand
SWMP	Stormwater Management Plan
WTW	Water Treatment Works
WWTW	Waste Water Treatment Works (Sewerage Works)

2. INTRODUCTION

An application for the development of Portion 250 of Farm 745, Goed Geloof, St Francis Bay has been prepared as per the Site Development Plan (SDP) in Annexure A. One of the first steps in the application process is to obtain Environmental Authorisation for the development of the land from the Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) via an Environmental Impact Assessment (EIA) process.

The following professional input is required for the EIA and is covered by this engineering services report:

- Water supply and reticulation
- Waste water management
- Access and internal roads
- Stormwater drainage and management
- Solid waste management
- Electrical services
- Construction method statements

The role players, design parameters, required bulk supply, scope of work and specifications for these elements are discussed in the sections that follow.

3. ROLE PLAYERS

The role players in the project would be as follows:

3.1 Developers

Goedgeloof Properties (Pty) Ltd
01 Porto Cervo Rd
St Francis Bay
6312

3.2 Architects

Jankes & Associates
174 Da Gama Road
Cape St Francis
6312

3.3 Town Planners

Route2EC Town Planning
Postnet Suite x121
Private Bag X0001
Sunridge Park
6008

3.4 Environmental Consultants

Eco Route Environmental Consultancy
www.ecoroute.co.za

3.5 Consulting Civil Engineers

Bara Consult
AFRISEC House
264 Walmer Boulevard
Gqeberha (Port Elizabeth)
6070

3.6 Consulting Electrical Engineers

Clinkscales Maughan-Brown
Consulting Mechanical & Electrical Engineers
39 Victoria Street
George
6529

4. PROJECT DESCRIPTION

4.1 Project Name

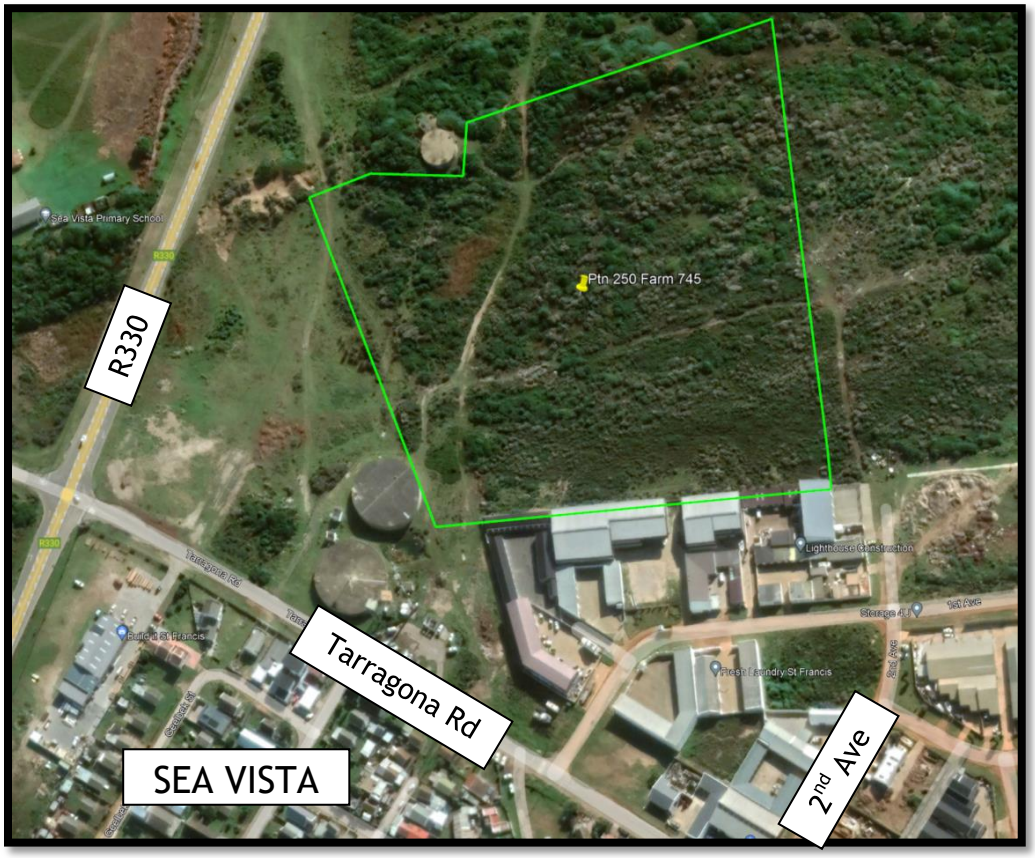
The name of the project would be: Development of Portion 250 of Farm 745, Goed Geloof, St Francis Bay: Engineering Services Report

4.2 Locality

The site is located in St Francis Bay and is accessed off Second Avenue via Tarragona Road and District Road R330 (MR 0381) as shown in Figure 1 below. The central point of the project is roughly defined by the following co-ordinate (WGS84 Lo 25):

Latitude: 34°10'14.2"S
Longitude: 24°49'14.5"E

Figure 1: Site Locality



4.3 Site Description

The site has a general slope direction from West and East and may be characterised as gentle slopes. The elevation is generally between 64m and 56m above mean sea level, as determined from historical aerial survey data (2006) carried out on the site.

There are no existing buildings on the site and the stormwater runoff from all proposed hardened surfaces on the site would be accommodated in the stormwater management design once the project proceeds to the detailed design stage. Preliminary inputs to the stormwater management design are however detailed in this report.

The site would be accessed off Second Avenue via Tarragona Road and District Road R330 (MR 0381).

4.4 Land Use

Details of the proposed land use for the development are shown on the Site Development Plan (SDP) in Annexure A and would include the following components:

- Approximate total site area would be 5.116 Ha
- The proposed development would be comprised of warehouse (±70%) and light industrial units (±30%) with approximate total floor areas of 12 274m^2 and 5 260m^2 respectively. The total development floor area would therefore be 17 534m^2 which excludes the proposed single security gate house.
- The proposed development would be implemented in a phased approach.

5. DESIGN PARAMETERS

The design parameters and specifications for the civil infrastructure for the proposed development would be in accordance with the following:

- Department of Human Settlements: Guidelines For Human Settlement Planning and Design ("Red Book") 2019
- Nelson Mandela Bay Municipality Sewer Design Requirements
- SANS 1200

The report provides details of the preliminary investigation and design of the above bulk services, the requirements for the bulk supply, and also provides

preliminary specifications for the materials to be used in the installation of the services. The report would be presented to the Client and Eco Route Environmental Consultants, and would form part of the Client's environmental application submission for the proposed development.

6. WATER SUPPLY

The preliminary design of the water supply to the proposed development allows for a bulk water connection to the site. The internal water reticulation design would be carried out at detail design stage. The calculated preliminary design water flow rate allows for peak hourly (instantaneous peak) water demand from proposed development, combined with the relevant fire flow demands.

An investigation was carried out at the site and surrounds on 23 January 2023, with input being provided by Kouga Local Municipality water operational staff. Kouga Municipality was not able to provide as-built layout drawings of the existing water reticulation network, however on-site information was recorded during the investigation, and components of as-built drawing information was obtained from other consulting engineers. This information is reflected on Drawing C-00-22252-10-001 in Annexure B.

6.1 Design Parameters

In agreement with the Kouga Municipality Engineering Department requirements, the design parameters used for the determination of water demand by the proposed development are provided in Table 1 below, and are in accordance with the Design Requirements of the "Red Book" Guidelines, and supplemented with other relevant guidelines where demand factors were not available from the "Red Book" guidelines.

Table 1: Water Demand Design Parameters

Description	Unit	Value
Applicable Design Standards		"Red Book"
Population Growth Rate Applied:	%	0
Warehousing	l/100m²/day	300
Light Industry	l/100m²/day	400
Gate house	l/day	300
Summer (seasonal) Peak Factor		1.5
Instantaneous (hourly) Peak Factor: Domestic		4.0
Instantaneous (hourly) Peak Factor: Industrial		3.3
Design Period	Years	20
Conveyance Losses	%	10
Minimum Working/ Dynamic Head (Excluding Fire Flow)	m	20

Description	Unit	Value
Minimum Working/ Dynamic Head (Excluding Fire Flow) For High Lying Areas Close to Reservoir Sites	m	15
Maximum Static Head	m	90
Design Velocities:		
Gravity mains (optimum)	m/s	0.6 – 1.2
Gravity mains (max during fire flow)	m/s	3.0
Minimum pipe pressure rating	m	90

The above design parameters would be used to calculate the design daily water requirements, fire flow requirements, and water storage requirements for the proposed development.

6.2 Design Daily Water Demand

Table 2 below provides details of the total daily water demand from the proposed development. The peak daily flow rate and the minimum working pressure for the area to be developed are based on the Design Parameters provided in Table 1 above. Based on preliminary design input it was determined that the minimum working/ dynamic pressure for the proposed development would be less than the required 20 metres pressure head.

As far as the domestic water supply to the development goes, it is proposed that rainwater harvesting be implemented as described in Section 6.6 below. The rainwater harvesting system would consist of internal rainwater storage combined with booster pump/s for domestic supply to the various proposed units to be developed on the site.

The municipal domestic supply to the site would provide a supplementary water supply and would be fed into the rainwater harvesting storage tank/s as and when required, with the pressure being internally boosted, thus meeting the design requirement of a minimum working/ dynamic pressure of 20m.

It is proposed that the domestic municipal water connection be provided from the existing Ø75mm pipeline at the First/ Second Avenue intersection. According to municipal and other sources, this pipeline is supplied from the two 50m^3 elevated reservoirs which are situated at the same site as the two existing 4000m^3 concrete reservoirs, all of which are adjacent to the site as indicated on Drawing C-00-22252-10-001 in Annexure B.

Table 2: Daily Water Demand

Land Use	Area or No. of Units	Demand Unit	Unit Demand	Ave Daily Water Demand Incl. Conveyance Losses (l/d)	Ave Daily Water Demand (l/s)	Summer Peak Daily Water Demand (l/s)	Instantaneous / Hourly Peak Daily Water Demand (l/s)
Total Warehouse & Light Industrial Floor Area (m^2)	17 534						
Warehouse Units (70%)	12 274	l/100m^2/day	300	40 504	0.469	0.703	1.547
Light Industrial Units (30%)	5 260	l/100m^2/day	400	23 145	0.268	0.402	0.884
Gate House	1	l/day	300	330	0.004	0.006	0.015
Total Domestic Water Demand				**63 978**	**0.740**	**1.111**	**2.446**

The Gross Annual Average Daily Water Demand (includes conveyance loss allowance) from the proposed development would therefore be 63,978 litres which equates to 0.74 l/s. The design flow rate for sizing of pipelines would be based on the daily instantaneous (hourly) peak demand of 2.446 l/s, in addition to the applicable fire flow demand.

6.3 Fire Flow

The area has been classified as being a Moderate Fire Risk 1 category in terms of the "Red Book" 2019 guidelines, and **Table 3** below provides details of the fire fighting design parameters applicable to the proposed development in terms of the "Red Book" 2019 guidelines for Design of Water Supply.

Table 3: Fire Fighting Design Parameters

Description	Unit	Value
Applicable Design Standards	"Red Book" 2019 & DPW	
Fire Risk Category	Moderate Risk 1	
Total Fire Flow	l/min	3000
Total Fire Flow	l/sec	50.0
Min Fire Flow Per Hydrant	l/sec	25.0
Min Head During Fire Flow At Fire Node	m	15
Min Head During Fire Flow At Rest of System	m	5
Max hydrant spacing	m	200
Min Pipe Size For Hydrant	mm	75
Max dist from hydrant to building	m	90
Duration of Design Fire Flow	Hrs	4
Min Clear Water Storage Required for Fire Flow	m^3	764
Fire flow per hose reel	l/sec	0.5
No. hose reels per building	No.	3

The peak water demand for the fire flow is therefore 50.00 litres / second from fire hydrants, plus 1.5 litres / second from fire hose reels. The total fire flow demand is therefore 51.5 l/s. The minimum required working pressure in the pipeline would be 15 metres.

Based on preliminary design inputs, it was determined that fire flow and pressure could not be provided directly via the municipal supply due to inadequate pressure availability. It is therefore proposed that the domestic supply and fire water supply be provided via two separate internal pipeline systems within the development. The fire water supply system would need to be boosted via an on-site fire pump.

It is proposed that a dedicated fire water supply municipal connection be provided from the existing Ø300mm pipeline which passes through the site on route to the St Francis Bay town area from the existing reinforced concrete ground reservoirs adjacent to the site as indicated on Drawing C-00-22252-10-001 in Annexure B. This being due to inadequate fire water flow and pressure from the proposed domestic water connection point. The required minimum fire storage of 742m^3 would therefore be provided in the two existing 4000m^3 municipal ground reservoirs as indicated on Drawing C-00-22252-10-001 in Annexure B.

Preliminary design calculations indicate that a Ø200mm internal fire water pipeline would be required, combined with a fire pump installation with a back-up power supply.

6.4 Bulk Water Pipeline Supply and Analysis

6.4.1 Pressure Testing

Pressure testing would need to be carried out in the vicinity of the proposed municipal system connection points to provide input to the detailed design hydraulic analysis during the detailed design stage of the project, prior to implementation.

6.5 Reservoir Storage

In terms of the "Red Book" Guidelines for water supply the required reservoir storage (excluding storage for fire demand) would be 36 hrs of annual average daily water demand which amounts to 96 m^3. It is assumed that this required storage for the domestic component of the water demand would be provided in the municipal supply reservoirs. It is therefore concluded that no on-site

storage for domestic water supply would need to be provided at the proposed development other than for rainwater harvesting storage.

The two 4000m³ concrete reservoirs and two 50m³ elevated reservoirs adjacent to situated between the site and Tarragona Road can be seen in Figure 2 below.

Figure 2: Municipal Water Reservoirs

Storage for rainwater would be provided on site as described in Section 6.6 below. It is proposed that the rain water be used as the primary domestic water source on the site, supplemented with municipal water as and when required.

6.6 Rainwater Harvesting

In light of the current extreme water shortages in the area, one of the Kouga Municipal requirements is for the implementation of alternative and sustainable water supply measures to be implemented so as to reduce the demand on the municipal water supply system. To this end it is proposed that rainwater harvesting be implemented on the site.

The proposed rainwater harvesting system would consist of the following:

- All roof areas to be drained into rainwater harvesting system via gutter pipes and conveyance pipework to storage facility.
- First-flush traps/ leaf and organic debris diverters
- Water storage facilities with a total capacity (once the site is fully developed) of approximately 1000m³ with overflow system linked to the stormwater drainage system. Storage would be implemented in a phased approach concurrently with the implementation of the various development phases.

- Filtration system and disinfection.
- Pressure pump and pipelines to convey the water to the warehouse and light industrial units.
- Rainwater would be utilised as the primary domestic water source, and supplemented with municipal water as and when required.

Rainwater harvesting calculations are summarised in Table 4 below.

Table 4: Rainwater Harvesting Calculations

1) INPUT PARAMETERS:

Total Development Roof Area (m^2) =	19 321
Total Annual Average Daily Demand (l) =	63 978
Total Annual Average Daily Water Demand (l) =	63 978
Summer Peak Factor =	1.5
Collection Efficiency (%) =	80
Occupancy Over Year (% Time) =	100
Proposed Communal Rainwater Storage Reservoir Size (kl) =	1000

2) CALCULATIONS (AVERAGE CONDITIONS):

Month	Ave Rainfall (mm)	Monthly Rainfall Volume (m^3)	* Conservative Monthly Rainfall Storage Volume (m^3)	Monthly Demand (m^3)	Excess / Deficit of Rainwater Volume (m^3)	% of Total Water Demand
Jan	41	633.7	633.7	2 975.0	-2 341.3	21%
Feb	50	772.8	772.8	2 687.1	-1 914.2	29%
Mar	51	788.3	788.3	1 983.3	-1 195.0	40%
Apr	57	881.0	881.0	1 919.4	-1 038.3	46%
May	52	803.8	803.8	1 983.3	-1 179.6	41%
Jun	62	958.3	958.3	1 919.4	-961.0	50%
Jul	63	973.8	973.8	1 983.3	-1 009.5	49%
Aug	78	1 205.6	1 000.0	1 983.3	-983.3	50%
Sep	58	896.5	896.5	1 919.4	-1 022.8	47%
Oct	75	1 159.3	1 000.0	1 983.3	-983.3	50%
Nov	56	865.6	865.6	1 919.4	-1 053.8	45%
Dec	46	711.0	711.0	2 975.0	-2 264.0	24%
Total	689		10 284.9	26 231.2	-15 946.2	39%

* Conservative monthly rainfall volume assumes all rain falls in a single rainfall event and therefore storage volume = lesser of actual rainfall volume and available storage capacity

Notes to Table 4 above

- The annual average rainfall used in Table 4 above was determined from the internet based sources.
- The collection efficiency of 80% is in terms of the "Red Book" guidelines.

From Table 4 above it is determined that rainwater harvesting would conservatively provide around 39% of the total annual average water demand,

thus reducing the average demand on the municipal water supply by around 10,285 m^3/year. The implementation of rainwater harvesting would also form a component of the stormwater management plan on the site as described in Section 8.4.3 below.

6.7 Ground Water Supply

Another alternative source of water that could be explored would be the abstraction of ground water. It is proposed that a geohydrological investigation, including a desktop study, followed by an on-site geophysical survey (pending the outcome of the desktop study), be undertaken to determine the potential for groundwater abstraction on the property.

If the potential was determined to be high during the investigation, then the next stage would be to carry out drilling of boreholes. Successful intersection of a viable and sustainable ground water supply could then be followed by testing of the boreholes to determine the sustainable yields via a stepped drawdown test, and 24 hour constant rate discharge test. This would be followed by water quality tests (chemical and bacteriological compliance) which should be conducted in terms of SANS 241-1:2011 standards for potable water supply.

If ground water was determined to be a viable alternative, this could then reduce the demand on the municipal water supply system even further.

6.8 Materials Specifications

Table 5 below provides details of the proposed specifications for the materials to be used for the water and fire reticulation. It is noted that the specifications provided are based on preliminary design input and would be finalised during the detailed design stage of the project. All materials would be in accordance with the relevant SANS code of practice and installation would be in accordance with SANS 1200.

Table 5: Specifications for Water Reticulation Materials

Material	Specification
Pipes with diameter of 75mm to 200mm	All Pipes: PVCu Class 9
Bedding for Pipes	As per SABS 1200 LB, Drawing LB-2 Pipe Bedding Details: Flexible Pipes and Typical Joint Sockets
Compaction of Backfilling	95% MOD AASHTO
Compaction of Backfilling under Roads	98% MOD AASHTO
Valves with diameter 75mm to 200mm	RSV valves to SABS 664-1974
Fire Hydrants	Underground Bayonet Type to SABS 589
Air Valves	Vent-O-Mat RBX Series
Minimum cover to pipes	Under roads: 1000mm Sidewalks and elsewhere: 800mm

7. SANITATION

The sewerage system to the proposed development would allow for a full water borne bulk sewer connection to the site which could connect to the St Francis Bay sewer reticulation network. The internal sewer reticulation design would be carried out at detail design stage.

7.1 Design Parameters

The design parameters used for the design of the sewer system are provided in Table 6 below.

Table 6: Design Parameters For Sewer System

Description	Unit	Value
Applicable Design Standards		"Red Book" and NMBM Standards
Return flow from water consumption - Warehouse and Light Industrial Units	%	80
Return flow from water consumption - Gate House	%	95
Dry Weather Peak Factor		3.8
Wet Weather Infiltration Factor		2.0

It is noted that the daily sewerage contribution values in Table 6 above is based on industry norm and "Red Book" Guidelines values of return flow of water utilized by the proposed development.

7.2 Design Daily Sewerage Volume

The daily sewerage volume that would be generated by the proposed development has been calculated as shown in Table 7 below.

Table 7: Calculation of Daily Sewerage Volume

Contributor Type	Area or No. of Units	*Ave Daily Water Demand (l/d)	**Proportional Return Flow (%)	Ave Daily Sewer Flow (l/d)	Ave Daily Sewer Flow (l/s)
Warehouse Units (70%)	12 274	36 821	80%	29 457	0.341
Light Industrial Units (30%)	5 260	21 041	80%	16 833	0.195
Gate House	1	300	95%	285	0.003
Total		**58 162**		**46 575**	**0.539**

*Ave daily water demand excludes water conveyance losses
**Based on industry norms of return flow to sewers from water consumption

The total Design Average Dry Weather Flow would therefore be 46,579 litres. The design flow for sizing of pipelines would be calculated as follows:

Design Flow = (ADWF ÷ 86 400) x PF x 2.0 = (46,575 ÷ 86,400) x 3.8 x 2.0 = 4.1 l/s

The peak wet weather sewerage discharge/ design flow from the proposed development would therefore be 4.10 l/s.

7.3 Sewerage Disposal

Three options for sewerage disposal from the site were considered and assessed as follows:

7.3.1 Gravity Connection To Municipal Sewer In Assisi Drive

The nearest existing municipal sewer is situated to the north east of the site in Assisi Drive as indicated on Drawing C-00-22252-001 in Annexure B. As-built information pertaining to the existing municipal sewer positions was obtained from the other consulting engineers who have previously done work in St Francis Bay. The existing municipal gravity sewer (assumed to be Ø160mm diameter) conveys the sewerage to the St Francis Bay Central Pump Station. The sewerage is then pumped via a rising main (dashed yellow line on Drawing C-00-22252-001 in Annexure B) to the outskirts of the suburb of Sea Vista from

where the sewerage flows under gravity in a Ø250mm outfall sewer to the St Francis WWTW.

Preliminary investigations and information provided by Kouga Municipality staff indicated that the sewer reticulation and rising main system should have adequate capacity to accommodate the sewerage flow from the proposed development. This would however need to be verified at detailed design stage of the project.

Kouga municipal staff reported that the St Francis WWTW has a treatment capacity of 2.2 ML/d and has a current average through-flow of 0.7 ML/d. The sewerage treatment works therefore has more than adequate capacity to accommodate the proposed development.

A portion of the St Francis WWTW is shown in Figure 3 below.

Figure 3: St Francis WWTW

This option would include the construction of a Ø160mm gravity sewer with a length of about 420m from the site to connect into the existing gravity sewer in Assisi Drive as indicated on Drawing C-00-22252-001 in Annexure B.

A preliminary sewer hydraulic model of this route has been prepared which is based on ground level data generated from aerial imagery, and a layout of the route indicated in Drawing C-00-22252-001 in Annexure B. This alternative would include sections of relatively deep sewer excavation of around ±3.0 to 3.5m. A detailed topographical survey of the site and the proposed route

would however be required to confirm the actual required excavation depths more accurately.

The following additional information would be required to confirm the viability of this alternative:

- Detailed topographical survey as mentioned above
- Confirmation that a servitude could be established along the proposed route
- Confirmation of capacity within the municipal sewer reticulation, Central Pump Station and pumping main
- Geotechnical investigation to determine on-site ground conditions.
- Wayleave investigation to determine more accurate details of affected existing services.

7.3.2 Utilising of On-site Conservancy Tank

The utilisation of an on-site conservancy tank/s is a possible alternative that could be considered by the developers. The drawback of this alternative would be the on-going periodic emptying of the tank that would be required.

The City of Cape Town conservancy tank capacity requirements were referred to for the sizing of the required conservancy tank. It was determined that the conservancy tank should provide a minimum capacity for two days of storage of the total average daily sewerage volume generated i.e. $93m^3$. It is proposed that a conservancy tank with a minimum capacity of $100m^3$ be provided.

7.3.3 Pumping of Sewerage To Tarragona Pump Station

Another alternative that was considered and investigated with transferring the sewerage to the small gravity system that feeds into the Tarragona Pump Station as indicated on Drawing C-00-22252-001 in Annexure B. A photo of the Tarragona Sewer Pump Station is shown in Figure 4 below. Kouga municipal sewerage staff however indicated that the Tarragona Pump Station, as well as the existing rising main would need to be upgraded to accommodate any additional flow. This information, combined with the fact that this alternative would most likely involve pumping the sewerage from the site indicated that it would not be viable.

Figure 4: Tarragona Sewer Pump Station

7.3.4 Proposed Sewerage Disposal Option

A possible solution could include the initial use of a conservancy tank during the initial stages of the development, and then later upgrade the system to provide a connection to the municipal gravity sewer reticulation as described in Section 7.3.1 above. This may be the most economically viable way of providing a viable sanitation system during the initial stages of the development.

Additional information for this alternative would be required as follows:

- Topographical survey of the site and proposed sewer route to determine actual existing ground levels, property boundaries, positions of affected existing services and depths and details of affected existing sewer lines.
- Confirmation that a servitude could be established along the proposed route
- Confirmation of capacity within the municipal sewer reticulation, Central Pump Station and pumping main
- Geotechnical investigation to determine on-site ground conditions.
- Wayleave investigation to determine more accurate details of affected existing services.

7.4 Materials Specifications

Table 8 below provides details of the proposed specifications for the materials to be used for the construction of the sewer reticulation. It is noted that the specifications provided are based on preliminary design input and would be finalised during the detailed design stage of the project. All materials would be in accordance with the relevant SANS code of practice and installation would be in accordance with SANS 1200.

Table 8: Specifications for Sewer Materials

Material	Specification
Pipes	PVCu Class 34 Heavy Duty to SANS 791:2002 300kPa Pipe Stiffness with fittings to SANS 791:2002. Connections: 110mm Diameter & Reticulation 160mm Diameter
Bedding for Pipes	As per SABS 1200 LB, Drawing LB-2 Pipe Bedding Details: Flexible Pipes and Typical Joint Sockets
Compaction of Backfilling	95% MOD AASHTO
Compaction of Backfilling under Roads	98% MOD AASHTO
Manholes inside and outside of road reserves	Pre-cast concrete with pre-cast concrete or polymer covers and lids
Minimum cover to pipes	Under roads and sidewalks: 1000mm Servitudes and elsewhere: 800mm

8. DRAINAGE AND STORMWATER MANAGEMENT PLAN

The site has a general slope direction from West and East and may be characterised as gentle slopes. The elevation is generally between 64m and 56m above mean sea level, as determined from historical aerial survey data (2006) carried out on the site as can be seen from the contours on Drawing C-00-22252-001 in Annexure B.

Internal stormwater drainage would be provided both along the roads/ parking areas, at buildings, as well as in the natural drainage channels. Cut-off drains could also be constructed above infrastructure where necessary.

8.1 The Dual Stormwater Drainage System

The basic requirement for the stormwater drainage system to provide protection from major and minor storm runoff is usually conflicting. For major storms the rate of runoff should be retarded to reduce flood peaks, while for

minor storms the runoff is best handled by rapid removal. The solution is to provide two separate and allied drainage systems (dual system), namely the MAJOR and the MINOR systems.

8.1.1 The Major Stormwater System

The major system would only become operative on rare occasions and serves as a flood control function. At such times, because of the severity of the storm, there will be a disruption of many of the normal activities in the drainage area. This would release facilities such as roads, recreational areas, parking areas and other open areas from their primary functions, allowing them to perform a stormwater management function. Similarly, facilities that are provided primarily for major stormwater control measures may have secondary functions, such as recreational of sociological functions.

The major system may thus consist of natural and artificial watercourses, large man-made conduits, roads, stormwater storage facilities (stormwater detention ponds in this case), servitudes and flood plains. In addition, the major system could include some less obvious drainage ways such as overland relief watercourses and infrequent temporary ponding at stormwater control appurtenances. The major system includes not only the trunk system, which receives the water from the minor system, but is also a natural or constructed support system which functions in case of overflow from, or failure of, the minor system.

8.1.2 The Minor Stormwater System

The function of the minor system can best be fulfilled by the rapid removal of the runoff from the area where it falls. Thus a system of effective water carriers, to cater for the minor storm of the frequency chosen for the design, must be designed and constructed to convey the runoff in a controlled manner to natural or artificial watercourses or ponds. This system typically consist of kerbs, channels, kerb inlets, culverts and underground pipework. It may also include small surface furrows and other means of conveying the runoff from minor storms. An underground pipework system may not be necessary where the runoff can be discharged directly into a major system.

8.2 Selection of Flood Return Period

The design flood return period or recurrence interval is defined as the average time which elapses between two events which equal or exceed a particular magnitude. It is established practice to design hydraulic structures for a specific flood event, commonly referred to as the "*standard design flood*".

The capacity of the stormwater structures would be determined in accordance with the design parameters. All minor system components such as stormwater pipes, side drains and minor stormwater drainage channels would be designed to accommodate the 1:5 year design flood. Any major stormwater drainage components would be designed for the 1:100 year floods in terms of the "*Red Book*" Stormwater Design Guidelines.

The maximum possible use would be made of lined drains and concrete stormwater pipes for culverts. All the new roads and parking areas would be constructed to accommodate the stormwater runoff. The stormwater would be accommodated on the surface of the road where possible, and piped to natural drainage channels where required based on the design.

Rainwater harvesting is proposed for utilising rain water from the proposed buildings on the site, and has be described in Section 6.6 above.

8.3 Design Parameters

The design parameters used for the design of the stormwater system are provided in Table 9 below.

Table 9: Design Parameters For Stormwater System

Description	Unit	Value
Applicable Design Standards		"Red Book"
Return period for minor stormwater system	Years	5
Return period for major stormwater system	Years	100

The Rational Formula would be used to determine the estimated runoff volume for smaller catchments as detailed in the SANRAL Drainage Manual. The stormwater would be managed as follows:

Stormwater from surrounding catchment: Based on the contour information provided on Drawing C-00-22252-001 in Annexure B and additional contour information outside of the immediate site area, the stormwater generated from surrounding catchment area to the west of the site should have limited impact on the site. More detailed verification will be carried out during the detailed design stage of the project.

Internal Stormwater: The internal stormwater would be controlled in the roads and parking areas and then conveyed to the low points of the roads and parking areas. The stormwater generated on the site would be conveyed to the proposed stormwater retention/ detention ponds as shown on Drawing C-00-

22252-001 in Annexure B. The stormwater flow through the retention ponds would be managed in a manner such that on-site containment for the 1:50 year post-development rainfall event with a controlled release of not more than the 1:5 year pre-development rainfall event would be achieved. The controlled outflow from the ponds would then follow the existing natural flow paths and should have limited impact on downstream properties and infrastructure due to the controlled nature of the flow release.

8.4 Stormwater Management Plan

8.4.1 Introduction and Legal Requirements

The Kouga Municipality Stormwater Management Bylaw (2006) for stormwater systems on private land states that "*An owner of property on which a private stormwater system is located may not carry out any activity which may impair the effective functioning of the stormwater system or which could reasonably be expected to impair the effective functioning of the stormwater system*".

The Department of Water and Sanitation (DWS) is the custodian of the country's water resources. Its legislative mandate seeks to ensure that the country's water resources are protected, managed, used, developed, conserved and controlled through regulating and supporting the delivery of effective water supply and the management of stormwater.

The National Environmental Management Act (NEMA), 1998 requires that all relevant factors be considered in stormwater management, including (among others) that pollution and degradation of the environment be avoided. In cases where this is not possible, the consequences must be minimised and remedied

The purpose of the Stormwater Management Plan (SWMP) is to provide details of the responsible and sustainable stormwater management measures that would be implemented on the site to mitigate potential negative effects of post development increased stormwater runoff on the surrounding environment in terms of quantity and quality of stormwater discharge.

8.4.2 Key Objectives of Stormwater Management Plan

The following key objectives should guide decisions regarding the planning and design of stormwater management systems:

- Minimise the threat of flooding to the area by maximising groundwater infiltration and/or to reduce peak runoff from artificially hardened development
- Protect the receiving water bodies in the area in terms of erosion protection and water quality assurance

- Preserve biodiversity in the area
- Promote the multi-functional use of stormwater management systems (provide amenity to communities)
- Promote the use of the stormwater itself as a water resource
- Develop sustainable stormwater systems through the implementation of sustainable drainage system (SuDS) measures.

8.4.3 Sustainable Drainage System (SuDS) Interventions

The following SuDS measures are proposed for the site:

a) Stormwater Retention/ Detention Through Constructed Wetland Facility

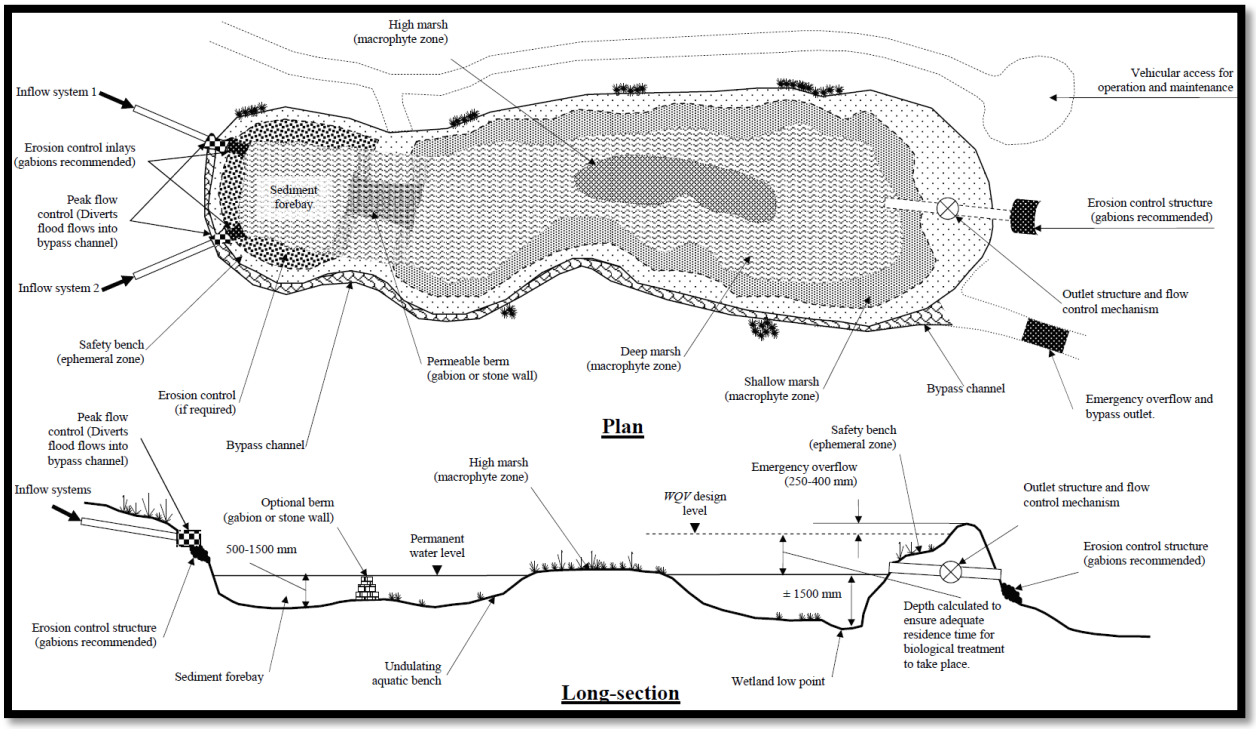
Depending on site practicalities and inputs from the environmental specialists on the project team, proposed stormwater retention and detention could be achieved through the implementation of a constructed wetland area in the lower-lying central area of the site.

Wetlands generally refer to marshy areas of shallow water partially or completely covered in aquatic vegetation. They may be categorised into: natural, modified natural or constructed wetlands. They can provide a vibrant habitat for fish, birds and other wildlife – potentially offering a sanctuary for rare and endangered species. Their aesthetic appeal encourages their recreational use. Constructed wetlands are man-made systems designed to mimic the natural systems in areas where they would not usually be found. They particularly useful in attenuating stormwater flood peaks and 'polishing' the runoff from built-up areas.

Constructed wetlands require relatively frequent and detailed inspections. The maintenance frequency can however be reduced through effective pre-treatment; e.g. by removing silt, litter and debris. A typical inspection would check for the accumulation of sediment, organic debris, litter, oils, weed growth, nuisances, algal blooms, and scour. There are several natural methods for controlling mosquitoes including: the introduction of predators such as fish and deliberately varying the water levels through the breeding season to disturb breeding cycles. The removal of invasive vegetation is critical to the sustainability of constructed wetlands.

A typical constructed wetland configuration is illustrated in Figure 5 below.

Figure 5: Typical Constructed Wetland Configuration (Source: SA SuDS Guideline)



It is proposed that the minimum size and outflow rate from the retention facility be in accordance with the Buffalo City Metropolitan Municipality (BCMM) stormwater by-law which stipulates that: "*All stormwater flows, over and above a 1:5 year flood event be contained on site (in a designed detention facility) and released to a suitable watercourse or stormwater system at a rate equal to or less than a 1:5 year pre-development flood peak, and the detention facility must be designed and constructed to accommodate a flood peak of at least equal to a 1:50 year post-development flood event.*"

Design Parameters:

In terms of BCMM requirements, the empirically derived Abott and Grigg Formula was used to determine the estimated detention storage volume in terms of the following formula:

$$V_{st} = 60 \left(\frac{1+m}{2}\right) q_{pa} . t_{ca} (1-\propto)^2$$

Where:

Storage Volume Required =	V_{st}
Ratio of Hydrograph Recession Time =	m
Post-development Peak Discharge (1:50)=	q_{pa}
Post-development Time of Concentration =	t_{ca}
Outflow Peak Discharge (1:5) Pre-development =	q_{pb}
q_{pa}/ q_{pb}=	α

The Time of Concentration (t_{ca}) in minutes) which is the time taken from the beginning of the rainfall event for the stormwater runoff to reach peak discharge which was calculated using the Rational Method. The retention pond would be sized to retain the 1:50 year post-development event and the outlet of the retention pond would discharge the 1:5 year pre-development event.

Table 10 below provides details of the Design Parameters that would be used for the calculation of the Peak Discharge for the 1:50 year post-development and 1:5 year pre-development return periods relating to the site. The design parameters listed in Table 10 below were obtained from Rational Method stormwater runoff calculations.

Table 10: Stormwater Retention Design Parameters (Calculated Using Rational Method)

Item No	Description	Unit	Value
1.	C_{pd} - Runoff Coefficient – pre-developed site		0.18
2.	C_d - Runoff Coefficient – developed site		0.72
3.	$I_{T-1:5}$ – Rainfall Intensive 1:5 year	mm/hour	42.3
4.	$I_{T-1:50}$ – Rainfall Intensive 1:50 year	mm/hour	98.2

The Peak Discharge would therefore be calculated in terms of the above design parameters.

Calculation of Peak Discharge:

The peak discharge for the pre-developed and post-developed site was determined in accordance with the above design parameters using the Abott and Grigg Formula. Details of the calculation are provided in the following sections. Table 11 below provides details of developable area on the site, which includes proposed buildings, surfaced roadways and parking areas:

Table 11: Applicable Site Areas

Item No	Description	Unit	Value
1	Total Site Area (m^2)	m^2	51 099
2	Undeveloped Area (m^2)	m^2	13 062
3	TOTAL AREA TO BE DEVELOPED	m^2	38 037

Table **12** below provides details of the calculation of pre and post development peak stormwater discharge.

Table 12: Peak Discharge Calculation

Total Site Area A (m^2) =	51 099
Hardening Factor C (1: 5 Yr Pre Dev) =	0.18
Hardening Factor C (1: 50 Yr Post Dev) =	0.72
1:5 Year Pre Development Intensity I (mm/hr) =	42.3
1:50 Year Post Development Intensity I (mm/hr) =	98.2
1:5 Year Pre-Development Flood, Q = CIA (m^3/sec) =	0.108
1:50 Year Post Development Flood, Q = CIA (m^3/sec) =	1.004

In terms of Table 12 above, the Peak Discharge was calculated for the pre-developed site for the 1:5 year rainfall event, and the post-developed site for the 1:50 year rainfall event. The results are as follows:

- Peak Discharge for pre-developed site: 0.108 m^3/sec
- Peak Discharge for post-developed site: 1.004 m^3/sec

The 1:5 year peak runoff rate (and detention facility allowable outflow rate) would therefore be 0.108 m^3/s (or 108 l/s).

<u>Calculation of Retention Volume</u>:

The Abott and Grigg Formula was used to determine the required retention storage volume as follows:

$V_{st} = 60\left(\frac{1+m}{2}\right) q_{pa}.t_{ca}(1-\propto)^2$

Where:

Storage Volume Required (m^3)=	V_{st}
Ratio of Hydrograph Recession Time =	m
Post-development Peak Discharge (1:50) (m^3/s) =	q_{pa}
Post-development Time of Concentration (min) =	t_{ca}
Outflow Peak Discharge (1:5) Pre-development (m^3/s) =	q_{pb}
q_{pa}/ q_{pb}=	α

$= 60\left(\frac{1+1}{2}\right)(0.898)(33)(1-0.108)^2$

$= 1582m^3$

Assumed available rainwater harvesting storage = 1000x(2/3) = $667m^3$

Actual pond storage volume required = $915m^3$

The total required volume of the Stormwater Detention Pond for this site is therefore 915 m^3 and the maximum discharge from the Stormwater Detention Pond would be 0.108 m^3/s. The discharge from the pond would be directed to the natural drainage path on the site as indicated on Drawing C-00-22252-001 in Annexure B.

b) Rainwater Harvesting

Rainwater harvesting is an essential element of effective water conservation where stormwater is utilised as a water supply. Conventional stormwater infrastructure results in pollution to, and the addition of millions of cubic metres of water into watercourses and oceans each year.

The utilisation of stormwater as a water source not only reduces potable water consumption, but also reduces stormwater discharge and peak flows from roofs and other hardened areas. Rainwater harvesting systems are particularly useful during extreme rainfall events as they help protect receiving watercourses by reducing the initial runoff volumes and the associated pollutants. Requirements for effective stormwater collection and reuse from buildings include the following:

- Strategic placement of roof gutters
- A first-flush trap and/or filter sock to catch leaves and other debris
- Leaf and organic debris diverters
- Rainwater storage facility (tank/s or sump/s)
- Means of getting the water to its point of use at suitable working pressure – usually pressure pump and pipeline
- In-line filter for removal of coarser particles
- UV or other disinfection and filtration device if water to be used as potable water
- Overflow system

General maintenance includes: the monitoring of the first flush diverters; the cleaning of roof gutters; and monitoring and removal of sediment in the storage tank/s and/ or sump/s.

Details of rainwater harvesting are provided in Section 6.6 above.

8.5 Materials Specifications

Table 13 below provides details of the proposed specifications for the materials to be used for the construction of the stormwater reticulation. It is noted that the specifications provided are based on preliminary design input and would be finalised during the detailed design stage of the project. All materials would be in accordance with the relevant SANS code of practice and installation would be in accordance with SANS 1200.

Table 13: Specifications for Stormwater Materials

Material	Specification
Pipes	Precast interlocking joint pipes to SABS 677 Min diameter = 450mm
Bedding for Pipes	Class C or B to SABS 1200 LB, compacted to 90% MOD AASHTO
Compaction of Backfilling	95% MOD AASHTO
Compaction of Backfilling under Roads	98% MOD AASHTO
Manholes inside and outside of road reserves	Pre-cast concrete with pre-cast concrete covers and lids
Minimum cover to pipes	Under roads and sidewalks: 600mm to 900mm Servitudes and elsewhere: 400mm to 600mm

9. ROADS AND ACCESS

There is currently no existing road infrastructure on the site as illustrated in Figure 6 below. The proposed site would be accessed off Second Avenue via Tarragona Road as shown on Drawing C-00-22252-001 in Annexure B. Figure 7 below shows the Tarragona Road / Second Avenue intersection, while Figure 8 below shows Second Avenue viewed from the site access point.

Figure 6: Panoramic View of Site East To West

Figure 7: Site Access Point Viewed From Tarragona Street

Figure 8: Site Access Point Viewed From Site Entrance

The design of the internal roadways, parking and access would be carried out at detailed design stage of the project. All radii of the roadways would be designed to allow for motor vehicles to move safely and without experiencing difficulties with turning movements. All roads would be designed in accordance with the "Red Book" Design Guidelines. The roads would be designed and constructed to ensure control of stormwater.

The design of the access into the site, as well as internal roadways and parking would take cognisance of the recommendations provided in a Traffic Impact Assessment (TIA) Report, should a TIA be required.

9.1 Design Parameters

The design parameters used for the design of the roadways are provided in Table 14 below.

Table 14: Design Parameters For Road Design

Description	Unit	Value
Applicable Design Standards		"Red Book"
Minimum Road Width At Entrance/ Exit Points	m	6.0
Standard cross-fall on roadways and parking areas	%	3.0

Internal roadways and parking areas would be surfaced, with the possible use of brick-paving as the final surface layer, with barrier kerbs on the low side of the road for channelling of stormwater runoff. The roadway and parking areas design would only be finalised during the detailed design stage of the project when possible road pavement alternatives would be evaluated and a preferred alternative selected.

Input from the detailed geotechnical investigation of the site would be utilised in carrying out the road pavement structural design work.

10. SOLID WASTE MANAGEMENT

10.1 Municipal Solid Waste Services

An investigation was carried out to determine the solid waste services currently rendered by Kouga Municipality. Input received from the Solid Waste Manager was as follows:

- The St Francis Bay landfill site is no longer operational
- Solid waste collected in St Francis Bay is transported to the landfill site in Humansdorp.
- Solid waste collection is generally carried out on a weekly basis.
- Arrangements can be made with the Municipality for more frequent collections, as well as for collection of refuse from on-site skips. Applicable tariffs would be levied for these additional services.
- The Municipality is planning to implement a recycling plant in St Francis Bay in fairly close proximity to the site.
- Recycling is currently collected and undertaken by private operators in the St Francis area.
- Hazardous waste would not be accommodated by Kouga Municipality and would need to be disposed of at a suitably registered Landfill site in Gqeberha (Port Elizabeth).

10.2 Solid Waste Management On-Site

At this early stage in the project life-cycle it is uncertain as to the type and estimated volumes of waste that would be generated on the site, as this would be very much industry-specific. The following is however proposed regarding solid management on the site:

1) A demarcated solid waste storage area near the entrance gate has been provided on the SDP as indicated on Drawing C-00-22252-001 in Annexure B.
2) It is proposed that the enclosed area would be suitably sized and roofed, and have a concrete floor and sluices which will connect to the sewer reticulation system. For ventilation and easy drop off/collection purposes the area would be walled in on three sides leaving one side “open” for steel access gates.
3) The solid waste storage area would be hosed down after collection and allowed to dry before the new bins are placed. A suitable, environmentally approved sanitiser and pest control chemical should be diluted into the water that is used to clean the area.
4) Solid waste should be collected on at least a weekly basis to minimise unwanted smells and pest infestation.
5) Options for on-site collection and storage include the following:
    a) Smaller quantities of waste could be collected in refuse bags and transferred to the storage area during the course of a week. These could then be collected by the Municipality on a standard weekly collection cycle.
    b) Wheelie bins could be used at individual businesses for collection and storage of larger quantities of general waste. Arrangements can be made with the Municipality to collect the contents of the wheelie bins on a weekly basis.

c) Skips could be used for more bulky/ larger solid waste items. The skips could either be collected or emptied by the Municipality by arrangement, or by private solid waste operators.

6) Business owners should be required, or at lease strongly encouraged to participate in recycling of waste products as far as possible.

As far as waste produced during the construction phase of the project goes, it would be the Contractor's responsibility to maintain a waste management practice in accordance with both national and local legislation. This would include compliance with Environmental Management Programme (EMPr) requirements in this regard.

11. ELECTRICITY SUPPLY

An investigation and report relating to the supply of electricity to the proposed development has been undertaken by Clinkscales Maughan-Brown Consulting Mechanical & Electrical Engineersand has been in Annexure D.

12. CONSTRUCTION METHOD STATEMENTS

A component of the submissions for the environmental authorisation for this project would entail the preparation of construction method statements. Typical construction method statements for various components of the anticipated civils construction works have been included in Annexure C. Please note that these method statements are of a fairly generic nature and may need to be fine-tuned once detailed design inputs and construction details have been finalised.

13. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be drawn and recommendations made from the above report:

13.1 Water Supply

1) Based on information received from Kouga Municipality staff, there appears to be adequate capacity in the St Francis Bay water supply network.
2) Two separate municipal water connections are proposed for domestic and fire water respectively, with the domestic supply and fire water supply being provided via two separate internal pipeline systems within the development.
3) The proposed domestic municipal water connection point from the existing Ø75mm pipeline at the First/ Second Avenue intersection and would provide a supplementary water supply that would be fed into the rainwater harvesting storage tank/s as and when required.
4) It is proposed that a dedicated fire water supply municipal connection be provided from the existing Ø300mm pipeline which passes through the site on route to the St Francis Bay town area from the existing reinforced concrete ground reservoirs adjacent to the site. This being due to inadequate fire water flow and pressure from the proposed domestic water connection point.
5) Required reservoir storage for the proposed development would be provided in the existing municipal water reservoirs.
6) In light of the prevailing drought conditions, development sustainability, and responsible stormwater management practice, a rainwater harvesting system from all roofs via gutter pipes and conveyance pipework to a storage facility is proposed for the site.

13.2 Sewerage

1) Based on initial investigation information and information received from Kouga Municipality staff, there should be adequate capacity in the affected portion of the St Francis Bay sewer infrastructure to receive the design flow from the proposed development.
2) A possible solution could include the initial use of a conservancy tank during the initial stages of the development, and then later upgrade the system to provide a connection to the municipal gravity sewer reticulation in Assisi Drive.
3) Topographical survey of the site and proposed sewer route to determine actual existing ground levels, property boundaries, positions of affected existing services and depths and details of affected existing sewer lines.
4) A wayleave investigation to determine details of affected existing services would also be required.

13.3 Stormwater Drainage

1) Initial investigation input showed that stormwater generated from surrounding catchment area to the west of the site should have limited impact on the site.
2) The internal stormwater would be controlled in the roads and parking areas and then channelled to the low points of the roads and parking areas.
3) Excess stormwater from the site would be discharged into the proposed stormwater retention/ detention ponds on the site, and then onwards to the natural drainage channel/s beyond the site at a controlled pre-development flow rate.
4) A stormwater management plan has been provided to ensure a framework for the responsible management of stormwater on the site.
5) Sustainable Drainage System (SuDS) interventions have been proposed for the site in the form of rainwater harvesting and a constructed wetland detention/ retention facility.

13.4 Roads and Access

1) The site would be accessed off Second Avenue via Tarragona Road.
2) All internal roadways and parking areas would be surfaced, with the possible use of brick-paving as the final surface layer, with barrier kerbs on the low side of the road for channelling of stormwater runoff.
3) Road details would only be finalised during the detailed design stage of the project.
4) Input from the detailed geotechnical investigation of the site would be utilised in carrying out any structural road design work.

13.5 Solid Waste Management

1) Solid waste collected by the Municipality in St Francis Bay is transported to the landfill site in Humansdorp.
2) Municipal solid waste collection is generally carried out on a weekly basis.
3) Arrangements can be made with the Municipality for more frequent collections, as well as for collection of refuse from on-site skips. Applicable tariffs would be levied for these additional services.
4) Hazardous waste would not be accommodated by Kouga Municipality and would need to be disposed of at a suitably registered Landfill site in Gqeberha (Port Elizabeth).
5) Recycling is currently collected and undertaken by private operators in the St Francis area, but may be included in the Municipal scope of services in the future.
6) A demarcated solid waste storage area near the entrance gate has been provided on the SDP and a proposed solid waste management plane for the site has been provided in the report.

13.6 Electricity

1) Kouga Municipality have indicated that there should be sufficient capacity in the existing electrical network to supply the development, but will be confirmed once they have obtained the data recordings from the relevant substations in the area, as detailed in the CMB report in Annexure D.

13.7 Construction Method Statements

1) Typical construction method statements for various components of the anticipated civils construction works have been included in Annexure C.
2) The method statements may need to be fine-tuned once detailed design inputs and construction details have been finalised.

14. SOURCES OF INFORMATION

1. Armitage, N, Vice, M, Fisher-Jeffes, L, Winter, K, Spiegel, A & Dunstan, J. The South African Guidelines for Sustainable Drainage Systems. WRC Report TT558/12. Pretoria: Water Research Commission 2013
2. Buffalo City Metropolitan Municipality By-Law Relating To Stormwater Management
3. Department of Human Settlements: Guidelines For Human Settlement Planning and Design ("Red Book"); 2019
4. Department of Public Works: Standard Specification For Domestic and Fire Water Storage and Fire Water Supply For Public Buildings, May 2004
5. Nelson Mandela Bay Municipality Sewer Design Standards
6. South African National Roads Agency Limited (SANRAL); Drainage Manual, Sixth Edition, 2006
7. Personal communications and investigation: The report is informed by several pieces of information sourced from Municipality representatives, as well as on-site investigation work.

15. ANNEXURES

ANNEXURE A: SITE DEVELOPMENT PLAN

ANNEXURE B: DRAWINGS

C-00-22252-001: CIVIL ENGINEERING BULK SERVICES LAYOUT PLAN

ANNEXURE C: METHOD STATEMENTS FOR THE CONSTRUCTION OF CIVIL ENGINEERING SERVICES

A) ROAD CONSTRUCTION METHOD STATEMENT

1. **Preliminary Survey**
   - Locate road reserve reference pegs.

2. **Environmental Survey**
   - The environmentalist is to check the road reserve and surrounding area.
   - The environmentalist is to compile a sensitivity list.
   - The surveyor is to co-ordinate any trees or other vegetation not to be removed.

3. **Bush Clearing**
   - All trees and bushes in the road reserve area, not identified as environmentally sensitive, are to be cleared and removed to designated areas.
   - Where bush clearing takes place by machine it will done by a TLB or dozer depending on the density of the area requiring clearing.
   - Where environmental issues are encountered the surrounding area of ±2m will be cleared by hand only.

4. **Clear and Grubbing**
   - The grass from the road reserve will be removed by dozer
   - A loader will load the trucks and/or dump trucks and it will be taken to stockpile in the designated topsoil areas.

5. **Initial Setting Out**
   - The road would be set out for line and level.

6. **Remove Topsoil**
   - The topsoil from the roadway will be removed by either an excavator or dozer and loader.
   - The topsoil will be loaded on trucks and/or dump trucks stockpiled in the designated topsoil areas.

7. **Cut to Fill or Spoil**
   - All cut areas are checked for suitable fill.
   - The cut is then either placed in the required fill areas or spoiled.
   - The spoil is taken to designated spoil sites or removed from site.

8. **Borrow to Fill**
   - Where suitable fill is not available material will be brought onto site from commercial sources.

9. **Setting Out Layerworks and Stormwater**
   - Set out the levels for the layerworks.

10. **Insitu Roadbed Preparation**

- Rip the existing material and compact to a minimum of 90% MOD AASHTO.
- Check the existing material for any areas requiring undercuts and inform the engineer.
- Remove unsuitable material (cut to spoil) and replace with either suitable fill or material from commercial sources as instructed by the engineer.

11. **Stormwater**
    - Excavate the stormwater trenches crossing the roads.
    - Bed, lay and backfill the stormwater road crossings.

12. **Layerworks**
    - Build the road up to the underside of the surfacing level from material either attained on site or from commercial sources.
    - Selected subgrade layer G9 to be compacted to 93% MOD AASHTO.
    - Subbase layer G7 to be compacted to 95% MOD AASHTO.
    - Basecourse layer C5 to be compacted to 98% MOD AASHTO.

13. **Block Paving Surfacing**
    - Sand is first spread, leveled and compacted over the layerworks.
    - The paving blocks are then laid to line and level.
    - A sand grouting is then spread over the paving blocks to seal the surface.

14. **Concrete Surfacing (Anchor Beams)**
    - The concrete for this operation will either be obtained from a ready mix supply or batched on site from the camp site.
    - Washing of concrete mixers, trucks, dumpers or tools will only take place at the designated area in the camp site.

15. **Topsoiling and Grassing**
    - Topsoiling will take place on the slopes of cuts and fills, the road verges and sidewalks.
    - Grass seeds will be placed as on topsoiled areas as required.

16. **Signage**
    - Signs will be placed as per the drawing.

17. **Road Marking**
    - Road marking will be done by a subcontractor as per the drawings.

18. **Access Roads**

- Where possible all vehicle access will be limited to the road reserve.
- No grass or vegetation will be removed outside the road reserve or pipe servitudes
- Weekly tool box talks will take place and incorporate vehicle access roads and environmental issues

B) WATER RETICULATION CONSTRUCTION METHOD STATEMENT

1. **Preliminary Survey**

- Locate and mark node points for the watermains that fall outside the road reserve.

2. **Environmental Survey**

- The Environmentalist is to check the water route that fall outside the road reserve and compile a sensitivity list.
- The method of clearing is then to be discussed and agreed with all involved, i.e. machine or hand clearing where specified.
- The surveyor is to co-ordinate and record the position of any endangered species that should not be removed.
- Discussion with all involved regarding which method of excavation to be used, should any sensitive growth fall within the pipeline servitude..
- All necessary signage is to be placed along watermains adjoining or intersecting public roads.

3. **Bush Clearing and Setting Out**

- All trees, bush and other vegetation not environmentally sensitive are to be cleared and removed to designated areas.
- Bush clearing in general will be by machine. In sensitive areas or where in-accessible by machine hand clearing will be utilised.
- Surveyor to set out node points and supervisor to set out from road reserve pegs.

4. **Excavations (By Hand or Machine)**

- Topsoil to be removed from the trench width and placed in a position where it will be used to cover the main backfill.
- The balance of excavated material will be placed on the opposite side of the excavation, between trees and open areas where applicable, and to be used for the main backfill in the trench.
- If necessary or as required in sensitive areas, hand excavation will be used with the methodology remaining the same.
- Care would be needed with the cleaning-up operation between trees or where there are over-hanging branches, etc.

5. **Bedding, Pipe Installation and Backfill**

- Bedding material will be imported material and will be stockpiled as close to the trench as possible.
- Water pipes will be transported to a point close to the trenches, then carted and installed by hand.
- The pipes will be laid first on a bedding layer. A selected fill layer is then placed on top of the pipes.
- Backfilling will be from the excavated material unless where imported selected material is required for road crossings.
- Compaction will be by hand equipment or self-propelled trench rollers.

6. **Chambers and Finishing**

- Concrete for in-situ bases and thrust blocks will be carted to the trench by tractor & trailer, wheelbarrow etc, any left-over concrete will be removed from site.
- Testing and disinfecting to take place once concrete thrust blocks have attained strength or temporary thrust blocks must be placed where required. (A discharging point for disinfected is required from CEO)
- Pre-cast sections will be transported by machine and installed by hand.
- Backfilling of the chambers, marker posts and topsoiling will all take place simultaneously before moving off and handing over each phase as programmed.
- Arrangements will be made with the Municipality for connection to the municipal water supply network as required.

C) SEWERS CONSTRUCTION METHOD STATEMENT

1. Preliminary Survey

- Locate and mark sewer manhole position pegs.

2. Environmental Survey

- The Environmentalist is to check the sewer route including working width of 5m and compile a sensitivity list.
- The method of clearing is then to be discussed and agreed with all involved, i.e. hand clearing to less than 5m where specified.
- The surveyor is to co-ordinate and record the position of any endangered species that should not be removed.
- Discussion with all involved regarding which method of excavation to be used (as detailed later on in the statement), should any sensitive growth fall within the 5m reserve.
- Access of at least 2.5m wide to certain points along the sewer route will be required and these need to be discussed and checked or moved to suit.

3. Bush Clearing and Setting Out

- All trees and bush not environmentally sensitive are to be cleared and removed to designated areas.
- Bush clearing will generally be by machine, otherwise by hand in sensitive areas or where in-accessible by machine.
- Surveyor to set out centre line and level profile / sighting rails.

4. Excavations

- Topsoil to be removed from the trench width and placed on the profile side of the excavation.
- The balance of excavated material will be placed on the opposite side of the excavation.
- If necessary or as required in sensitive areas, hand excavation will be used with the methodology remaining the same.
- Care would be needed with the cleaning-up operation or for over-hanging branches, etc.

5. **Bedding, Pipe Installation and Backfill**

- Bedding material will be imported material and will be temporary stockpiled as close to the trench as possible.
- Sewer pipe will be transported to a point close to the trenches, then carted and installed by hand.
- Backfilling will be from the excavated material unless where imported selected material is required for road crossings.
- Compaction will be by hand equipment or with self-propelled trench rollers.

6. **Manholes and Finishing**

- Concrete for in-situ bases will be carted to the manhole by tractor & trailer, wheelbarrow etc, no left over concrete to be left on site.
- Pre-cast sections will be transported and installed by machine. Only where this is not possible will manhole section be placed by hand.
- Backfilling of the manhole, final testing, marker posts and topsoiling will all take place simultaneously.
- Arrangements will be made with the Municipality for connection to the municipal sewer network as required.

D) STORMWATER CONSTRUCTION METHOD STATEMENT

1. Preliminary Survey

- Locate and mark manhole and kerb inlet position pegs.

2. Environmental Survey

- The Environmentalist is to check the water route that fall outside the road reserve and compile a sensitivity list.
- The method of clearing is then to be discussed and agreed with all involved, i.e. machine or hand clearing where specified.
- The surveyor is to co-ordinate and record the position of any endangered species that should not be removed.
- Discussion with all involved regarding which method of excavation to be used, should any sensitive growth fall within the 3m reserve.
- All necessary signage is to be placed along watermains adjoining or intersecting public roads.

3. Excavations (By Hand Or Machine)

- Topsoil to be removed from the trench width and placed in a position where it will be used to cover the main backfill.
- The balance of excavated material will be placed on the opposite side of the excavation, between trees and open areas, to be used for the main backfill in the trench.
- If necessary or as required in sensitive areas, hand excavation will be used with the methodology remaining the same.
- Care would be needed with the cleaning-up operation between trees or where there are over-hanging branches, etc.

4. Bedding, Pipe Installation and Backfill

- Bedding material will be imported material and will be temporary stockpiled as close to the trench as possible.
- Stormwater pipe will be transported to a point close to the trenches, then carted and installed by machine and hand.
- Backfilling will be from the excavated material unless where imported selected material is required for road crossings.
- Compaction will be by hand equipment or with self-propelled trench rollers.

5. Manholes and Finishing

- Concrete for in-situ bases will be carted to the manhole by tractor & trailer, wheelbarrow etc, no left over concrete to be left on site.
- Pre-cast sections will be transported and installed by machine. Only where this is not possible will manhole section be placed by hand.
- Backfilling of the manhole, final testing and topsoiling will all take place simultaneously.

ANNEXURE D: ELECTRICAL SERVICES REPORT

RE/180/745

248/745

180/745

249/745

PTN 250 OF FARM 745

102/745

172/745

88/746

RE/1

RE/2298

RE/2113

Exist MH

A10

A9

ASSISI DRIVE

A8

A7

A6

A5

A4

A3

A2

A1

Existing Disused Concrete Reservoirs

MH

RES

Proposed Gravity Sewer

Existing Sewer Rising Main From St Francis Central Pump Station

Approximate Stormwater Flow Path

PUBLIC OPEN SPACE

PRIVATE OPEN SPACE - INDIGENOUS LANDSCAPED AREA WITH DETENTION PONDS

Proposed Stormwater Retention Ponds

Proposed Gravity Sewer

BLOCK A WAREHOUSES

BLOCK B WAREHOUSES

BLOCK C WAREHOUSES

BLOCK D WAREHOUSES

ROAD SERVITUDE 16m

Proposed Surfaced Access Road To Development Site

SEWER RISING MAIN FROM ST FRANCIS TOWN

Inlet Pipe From St Francis Links Boreholes

Proposed Dedicated Fire Water Supply Connection Point To Existing Ø300mm Bulk Pipeline And Possible Fire Water Booster Pump Station Position

PS

Existing 2 x 4.0 ML Concrete Reservoirs

Inlet Pipe From Churchill Water Treatment Works

Existing 2 x ±50 KL Elevated Reservoirs On ±15m High Stands

ANTENNA

Ø300mm

Ø250mm

Ø110mm

Ø315mm

Ø160mm

Ø75mm

Proposed Refuse Storage Area

Proposed Domestic Water Supply Connection Point To Existing Ø75mm Municipal Pipeline

FIRST AVENUE

SECOND AVENUE

SEELBEK STREET

R330

SEA VISTA

2359 PARK

FH

+3782400 X

+3782600 X

+16800 Y

+16600 Y

+16400 Y

+16200 Y

NOTES:

20 m 0 m 20 m 40 m

A1 SIZE OF THIS DRAWING FOR FULL SCALE PRINTING

REVISIONS

		REVISION DETAILS
0	2022 06 27	FOR INFORMATION

DISCIPLINE CONSULTANT: CIVIL & STRUCTURAL

BARA CONSULT

SUITE 1, 5th AVENUE OFFICE PARK
5th AVENUE, NEWTON PARK
PORT ELIZABETH
6000

TEL 087 808 4432
EMAIL info@baraconsult.co.za

CLIENT

GOEDGELOOF PROPERTIES (PTY) LTD

PROJECT

DEVELOPMENT OF PORTION 250 OF FARM 745 (GOED GELOOF), ST FANCIS BAY

DRAWING

CIVIL ENGINEERING BULK SERVICES LAYOUT PLAN

INFORMATION

SCALE	1 : 1000	DESIGNED	AB
DATE	2023 02 01	DRAWN	AB

DRAWING NUMBER

DISCIP	ZONE	PROJECT No.	SERIES No.	DRAWING No.	REVISION
C	00	22252	10	001	0

MESSRS. GOEDGELOOF PROPERTIES (PTY) LTD

ELECTRICAL SERVICES REPORT

FOR

PROPOSED NEW WAREHOUSE AND STORAGE FACILITY ON PORTION 250 OF THE FARM GOEDGELOOF NO. 745, ST FRANCIS BAY

REPORT NO: G/19168/R

FEBRUARY 2023

cmb
CLINKSCALES MAUGHAN-BROWN
CONSULTING MECHANICAL
& ELECTRICAL ENGINEERS

INDEX

1.0 INTRODUCTION

This report has been compiled by Clinkscales Maughan-Brown at their George Office, who has been appointed as the Electrical Consultants for this project by the Developer, Messrs. Goedgeloof Properties (Pty) Ltd.

The purpose of this report is to provide the necessary information on the proposed extension to the existing Kouga Municipality electrical infrastructure to provide a bulk electrical supply to the proposed development on Portion 250 of the farm Goedgeloof No. 745 in St Francis Bay. This report can be included in the erven rezoning application and also form the basis of a services agreement on approval of the rezoning process.

2.0 DRAWING

Drawing No. 19168/E/01 is included under Annexure A of this report and contains information on the location and layout of the proposed development, the location of the existing municipal electrical infrastructure in the area and the proposed extension thereof.

3.0 LOCATION AND EXTENT OF DEVELOPMENT

The location of the development is depicted on the above-mentioned drawing and is situated in the Industrial Area of St Francis Bay. Access to the site is from 1st Avenue.

The development will consist of:

- One (1) gate house of area size 20m²
- Six (6) light industrial units of area size 297m² each
- Fourteen (14) warehousing units of area size 297m² each
- Three hundred and seventy-four (374) storage units of area size 31m² each

4.0 SUPPLY AUTHORITY

The Supply Authority for the area is Kouga Municipality and all electrical work will have to comply with their requirements.

5.0 BASIS OF REPORT

The report is based on the following:

(i) Plan layout drawings and general information received from Messrs. Philip Jankes Architects and Urban Designers.

(ii) Plans of the existing 22kV (22000 Volt) municipal electrical distribution network.

(iii) Meeting and discussions with Mr. Bennie Bosch, St Francis Bay Area Electrical Engineer, on 26 January 2023 and 10 February 2023 regarding the Municipality's preference on providing a bulk supply to the development.

6.0 DEMAND

The following Before Diversity Maximum Demand (BDMD) values has been allowed for:

• Gate house – 4kVA (17A, 1-phase) x 1		=	4kVA
• Light industrial unit – 21kVA (30A, 3-phase) x 6		=	126kVA
• Warehousing unit – 10,35kVA (45A, 1-phase) x 14		=	145kVA
• Storage unit – 2,3kVA (10A, 1-phase) x 374		=	860kVA
	Total		1135kVA

The After Diversity Maximum Demand (ADMD) values would then be:

• Gate house – 4kVA (17A, 1-phase) x 1 x	0.3 df	=	1kVA
• Light industrial unit – 21kVA (30A, 3-phase) x 6 x	0.3 df	=	38kVA
• Warehousing unit – 10,35kVA (45A, 1-phase) x 14 x	0.3 df	=	43kVA
• Storage unit – 2,3kVA (10A, 1-phase) x 374 x	0.3 df	=	258kVA
	Total		340kVA

This is only a provisional calculation and will be finalised after all the network load particulars have been concluded. Energy saving measures and alternative energy resources as mentioned hereunder will be investigated and implemented where economically viable, in order to reduce the demand on the national grid.

- Energy efficient lighting design, making use of LED lamps and motion / photo detectors to switch off lighting in un-used sections of buildings and to automatically adjust lighting levels according to the amount of natural lighting in buildings, etc.

- Solar Photo Voltaic (PV) Rooftop installations.

7.0 POINT OF CONNECTION

Since the exact power requirements for each type of unit is still to be finalised, it is proposed to allow for an initial Phase 1- and later upgrade to a Phase 2 Point of Connection. Phase 1 would be to take a maximum allowable 42kVA (60A, 3-phase) municipal LV supply from the existing Distribution Kiosk 2D/2, as indicated on Drawing No. 19168/E/01. Phase 2 would be for the total estimated ADMD of 340kVA (490A, 3-phase) at which stage a new 500kVA, 22/0,4kV miniature substation would need to be cut into the existing municipal 22kV network.

The Municipality has advised that there should be enough spare capacity available on their 22kV network for both phases, but this will be confirmed once they have obtained exact data recordings from the relevant sub-main substations in the area.

8.0 EXTERNAL NETWORK

The External Network is considered to be the network between the Point of Connection and the Point of Supply as defined hereafter, which is to be taken-over by the Municipality on completion for their ownership and operation.

In the case of Phase 1 the Point of Connection would be Kiosk 2D/2 and the Point of Supply would be a conventional- or pre-paid kWh consumption meter at the consumer's premises.

In the case of Phase 2 the Point of Connection would be the LV busbars of the new 500kVA, 22/0,4kV miniature substation and the Point of Supply would be a Bulk LV kWh meter situated inside a metering kiosk, located adjacent the latter substation.

All drawings and specifications of the External Network must comply with the Municipality's technical requirements and must be submitted to them for official approval before construction can commence.

9.0 INTERNAL NETWORK

The Internal Network between the relevant buildings will be designed by the Developer's Consulting Engineer.

10.0 TAKING-OVER OF INSTALLATION

As stated before, the Municipality should take-over the External Network on completion and the Developer the Internal Network, and respectively be responsible for the operation and maintenance thereof.

It is important that the External Network complies in all respect with the Municipality's requirements and their supply conditions.

Drawings and a specification for the work will be submitted to the Municipality for approval before construction work commences. On completion of construction, a full set of as-built drawings (electronic and hard copy) together with test certificates and manuals of the equipment will be handed over to the Municipality. The Consulting Engineer responsible for the project will also certify that all work has been completed in accordance with the drawings and specification approved by the Municipality.

It should not be a requirement for the Municipality to approve the Internal Network, but the drawings and specification for same will also be submitted to the Municipality for their records and information during the approval stage of the External Network.

11.0 ENVIRONMENTAL REQUIREMENTS

All work on site will comply in all respects with the Environmental Management Plan (EMP) to form part of the specification for the work, if applicable.

12.0 CAPITAL COSTS

It is assumed that the total construction cost of the External as well as the Internal Network will be for the account of the Developer, which will be done under the direction of the Developer's Consulting Engineer and by a suitably and qualified Electrical Contractor.

The Electrical Contractor shall be prior approved by the Municipality for those parts of the network to be taken over by them.

In addition to this cost, it is acknowledged that the Developer will also be responsible for the payment of an Augmentation Levy (future upgrade of the municipal primary 22kV network), which at the 2022/23 municipal rates has been calculated as follows:

Phase 1

Number of ERU's = (Notified Demand in kVA x Nf) ÷ (10,35 x Df)
= (42kVA x 0,5) ÷ (10,35 x 0,3)
= 6,76
= , say 7 ERU's

, where

ERU = Equivalent Residential Unit
Nf = Network factor
Df = Diversity factor

The Capital Cost would then be R 8 865.22 x 7 = R 62 056.54, say R 62 100.00, excl. VAT.

Phase 2

Number of ERU's = (Notified Demand in kVA x Nf) ÷ (10,35 x Df)
= (298kVA x 0,5) ÷ (10,35 x 0,3)
= 47,98
= , say 48 ERU's

The Capital Cost would then be R 8 865.22 x 48 = R 425 530.56, say R 425 531.00, excl. VAT

The above is only a provisional calculation and needs to be agreed upon by the Municipality when the final Services Agreement are completed. It is further to be noted that the municipal tariffs are revised annually on 1 July and the cost per ERU is likely to be increased again on 1 July 2023.

13.0 PROGRAMME

A programme for the completion of this project is to be made available to the Municipality once this has been finalised.

14.0 CONCLUSION

We trust that this information is sufficient to obtain the necessary statutory approvals for the development and to draw up the services agreement.

Please contact the writer should more information be required.

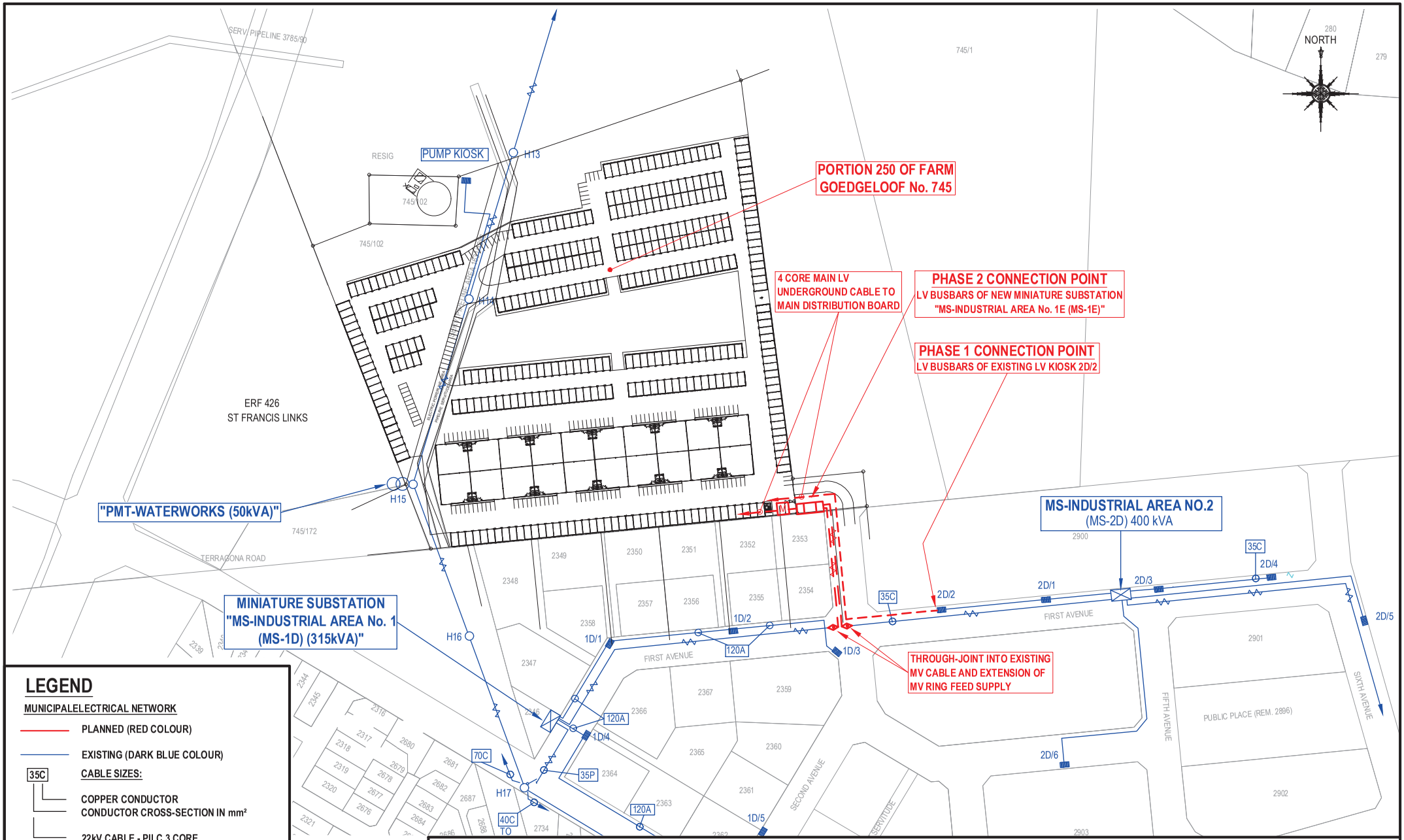
If you are in agreement with the above, we can forward a copy of this report directly to the Municipality's Electrical Department for their approval and any further comments that they may have.

Yours faithfully

Stiaan Adams Pr Tech Eng
CLINKSCALES MAUGHAN-BROWN

Annexure A

Drawing No. 19168/E/01



LEGEND

MUNICIPALELECTRICAL NETWORK

- PLANNED (RED COLOUR)
- EXISTING (DARK BLUE COLOUR)

35C — CABLE SIZES:

- COPPER CONDUCTOR
- CONDUCTOR CROSS-SECTION IN mm²
- 22kV CABLE - PILC 3 CORE

M — BULK LV METERING KIOSK

NOTE

THE POSITION OF ALL ELECTRICAL SERVICES ARE APPROXIMATE ONLY. THE EXACT POSITIONS MUST BE DETERMINED ON SITE BEFORE ANY WORK ASSOCIATED HEREWITH IS UNDERTAKEN.

cmb
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CLIENT: GOEDGELOOF PROPERTIES (PTY) LTD

PROJECT: PROPOSED NEW WAREHOUSE AND STORAGE FACILITY ON PORTION 250 OF THE FARM GOEDGELOOF No. 745, ST FRANCIS BAY

DRAWING TITLE: PLAN LAYOUT OF PROPOSED ELECTRICAL CONNECTION

DRAWN	DESIGNED	CHECKED	APPROVED
KJM	GSA	GSA	

SCALE	DATE	CAD REF No.	DWG-SIZE
1:2000	08/02/2023	19168-E-01	A3

DRAWING NO: 19168/E/01

REVISION: