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6 July 2022

ENGINEERING SERVICES REPORT FOR PROPOSED TOURIST FACILITY, ERF 2003, WILDERNESS

A. INTRODUCTION

Background

Our offices were appointed by Wentzel Christoffel Coetzer & Wessel Philippus Wessels to provide an Engineering Services report in support of an application for the proposed tourist facilities to be constructed on erf 2003, Wilderness, in the George Municipal Area.

It was requested by the George Municipality that an Engineering Services Report be submitted along with the development application.

Locality

The site is located in Wilderness, within the George Municipal area. The site is bordered to the north by a servitude road and to the east, south and west by natural forest.



Figure 1: Locality plan

The proposed development

The proposed development will consist of the following tourist facilities:

- a) New main house 200m², 175m² deck & 30m² pool
- b) Four new cottages of 98m², each with a 42m² deck

Please refer to **Annexure A** for the site development plan.

B. ENGINEERING SERVICES

Water demand for the proposed development

The water demand for the development is calculated (in accordance with the Guidelines for Human Settlement Planning and Design) as follows:

WATER DEMAND						
DEVELOPMENT	Units	l/ unit/ day	Area (m ²)	l/ 100m ²	TOTAL (l/d)	TOTAL (l/s)
Main House	1	1 000			1 000	0.012
Cottages	4	800			3 200	0.037
TOTAL					4 200	0.049
Annual Average Daily Demand (AADD)		4 200 l/d 0.049 l/s				
Peak Factor		4.0				
Peak Demand		16 800 l/d 0.194 l/s				

From a fire water requirement perspective, the site is classified as low risk, therefore a minimum total water flow of 15 l/s will be required for a design period of one hour.

There is an existing municipal 50mm Class 12 uPVC pipe located on the western side of Remskoek Street. Refer to **Annexure B** for the position.

It is proposed that a 25mm connection is made to supply the proposed development with both domestic and fire water.

The internal water reticulation network of the proposed development must comply with the minimum specification as given in the Red Book - Guidelines for Human Settlement Planning and Design and the minimum standards of George Municipality.

Sewer run-off for the propose development

The sewerage flow for the development is calculated (in accordance with the Guidelines for Human Settlement Planning and Design) as follows:

SEWER FLOW	
Average Dry Weather Flow (ADWF) (90% of annual average daily water demand)	3 780 l/d (0.04375l/s)
Peak Factor	4.0
Peak Dry Weather Flow (PDWF)	0.175 l/s
Peak Wet Weather Flow (PWWF)	0.201 l/s

Currently there is no sewer reticulation in close proximity to the site. In light of this it is proposed that a package plant is installed to accommodate the sewerage generated on site.

Please refer to **Annexure C** for the proposed package plant designs. A BEPAC 5C design is provided or a Kingspan Klargestar Biodisc. Both of these package plants produce effluent treated to a general limit.

The BEPAC 5C is a system installed partially above ground, while the Kingspan Klargestar Biodisc is installed below ground. Taking into consideration the total running cost of each package plant over 20 years, the Kingspan Package Plant will be more cost effective. See the table below for a summary of the total cost (capital and operational) over a 20 year cycle.

	<u>BEPAC</u>	<u>KINGSPAN</u>
Total cost of plant (capex + opex)	R889 956.48	R630 944.93

The water from the pool outlet will need to backwash round the sewer system and connect to the outlet of the package plant as the chlorine levels will kill off any biological treatment.

It is proposed that the effluent is retained in an open pond with a fountain pump for at least 24 hours to allow chlorine to dissipate before it is discharged into the surrounding forest.

The internal sewer reticulation network of the proposed development must comply with the minimum specification as given in the Red Book - Guidelines for Human Settlement Planning and Design and the minimum standards of George Municipality.

Roads

Access to the proposed development will be off the existing servitude road linking to Remskoek Street. One access gate will be provided at the northern most corner of the site and a second access gate at the north eastern corner of the site, both linking to existing servitude road.



Figure 2: Servitude roads (highlighted yellow)

A total of eight parking bays will be provided on site. One parking bay will be provided per cottage and four parking bays will be provided at the main house. This is deemed to be adequate for dealing with the parking requirements of the proposed development.

All internal roadways will comply with the minimum specification as given in the Red Book - Guidelines for Human Settlement Planning and Design.

Stormwater

The addition of the main house and the cottages, will have a minimal impact (less than 4%) on the stormwater runoff generated from site.

It proposed that where possible, that roof water in gathered and stored in tanks. From the tanks outlets will be provided onto a stone pitched base (1m x 1m x 0.2m thick), before stormwater is dissipated into the forest.

C. CONCLUSION

We trust that the abovementioned information provided relating to the engineering services is sufficient for the application of the proposed tourist facility on erf 2003, Wilderness.

Please do not hesitate to contact the undersigned should you require any additional information.

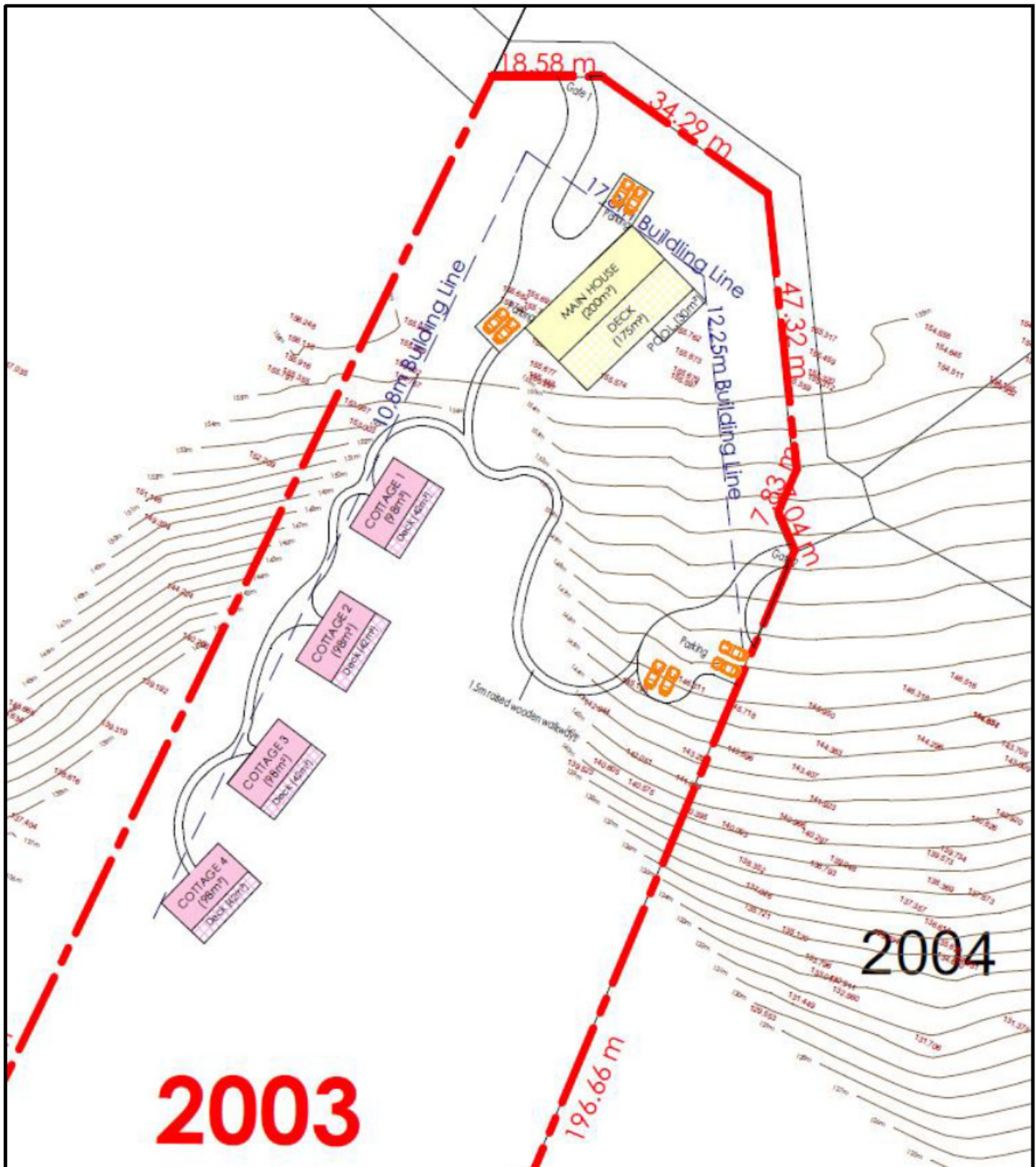
Yours faithfully



Christiaan Mostert

ANNEXURE A

Site Development Plan



ANNEXURE B

Existing services



Erf 2003 Wildernis

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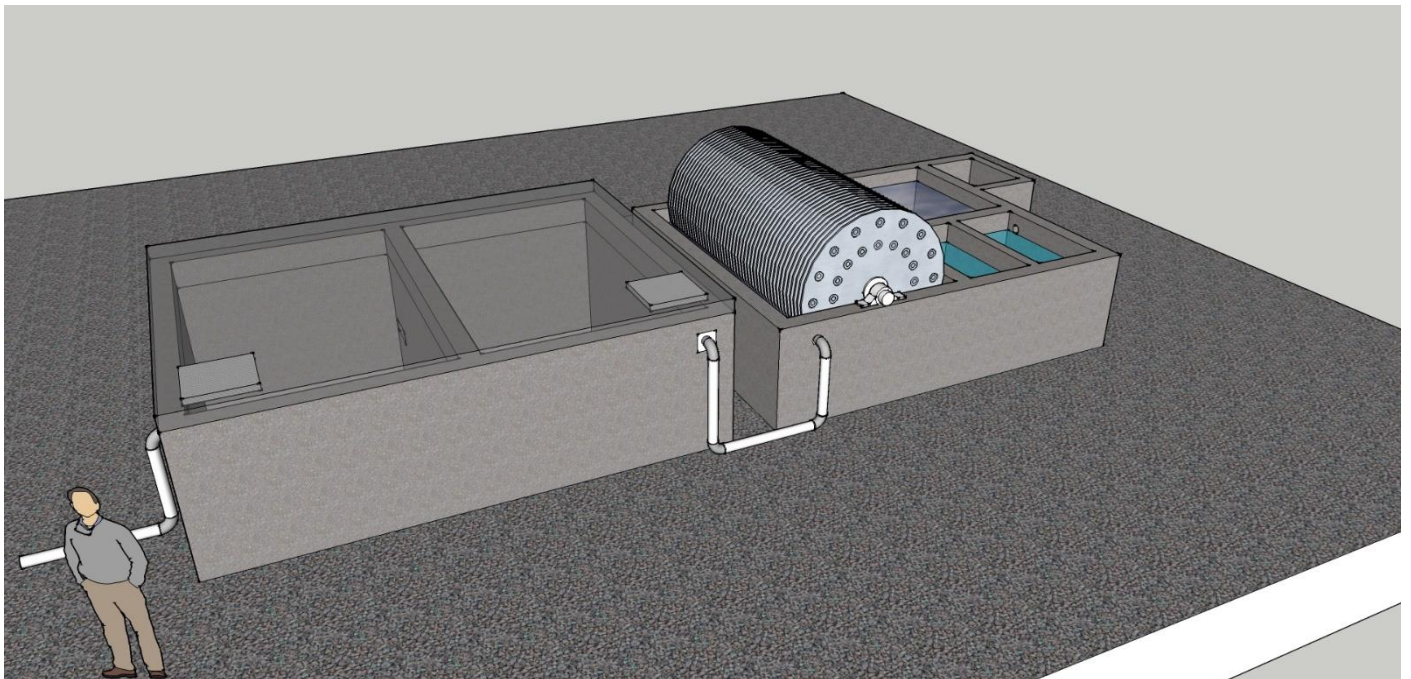


ANNEXURE C

Package plant design

Proposal to :
Proposal date : 30/06/2022
Project name : Wilderness ERF2003
Internal number : T4570
Contact person :
Contact number :
E-mail address :
Prepared by : **Stuart Napier**

BePac 5C (5KI/day)



Tel: +27 11 752 1191

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Directors W.P Van der Merwe | W. Olivier



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1) About Becon Watertech

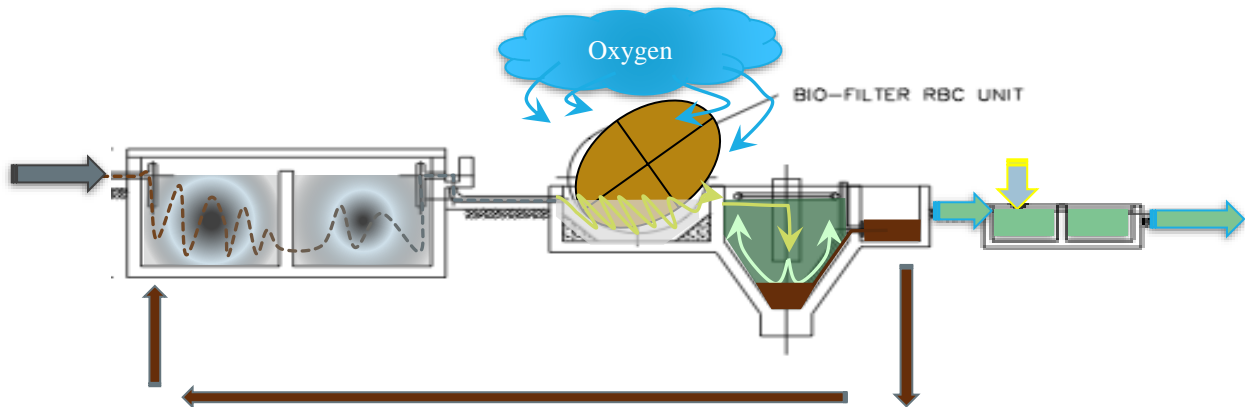
Becon Watertech is part of the Tecroveer group which is a technology driven Company that design processes and equipment, manufacture, install and commission world class turnkey solutions for all Wastewater Treatment related industries.

Becon Watertech has been treating sewage and maintaining this process for over 40 Years on a Design and Supply turnkey basis and as an Own Equipment Manufacturer (OEM).

During this period, more than 1,900 units have been installed in Africa and across the Indian Ocean Islands to local & national government departments (including schools, hospitals, small towns and developments, prisons, border posts, shopping malls, police stations, private estates, hotels and holiday developments, private sector industrial locations, power stations and mining sites and villages.

The Becon configured Bio-Filter domestic sewage treatment process is capable of producing treated effluent quality that meets the South African General Authorization Standard as prescribed in the South African National Water Act, No. 36 of 1998.

2) Process description



The Becon Watertech configuration is based on the Trickling Filter Process and deploys the rotating biological contactor (RBC) derivative. The Becon Watertech process includes the following process stages:

- Primary Phase Separation via septic tanks.
The septic tank allows for the gross removal of organic material by settlement and anaerobic oxidation. The septic tank makes provision for the accumulation of this material and has design features incorporated to ensure that this activity does not cause unnecessary blockages across the tank.
- All septic tanks do require servicing and desludging at some stage since the rate of sludge accumulation exceeds the slow growth rate of the anaerobic bacteria and hence their capacity to break down organic material.
- The settled sewage from the septic tank is then discharged under gravity to the RBC stage where further organic reduction and ammonia nitrification is achieved under aerobic conditions. The aerobic conditions are achieved by the rotation of the discs, on which the micro-organisms are attached and growing, at a low speed of approximately 3 to 4 RPM. The Becon Watertech discs are manufactured from a polyurethane base and are 2m diameter discs assembled onto a 60mm steel shaft. The discs are high density and impermeable, and tend to float in the RBC basin, reducing the load imposed on the shaft. End bearings are provided to secure the unit to the RBC basin. The energy requirement per rotor is 0.75kW and each rotor contains around 130 discs, providing adequate surface area for the corresponding organic load.
- A secondary settling tank, or humus tank, is required for the collection and removal of surplus bacteria that is removed from the discs by the rotating action of the discs in and out of the water. The Becon Watertech design utilises the standard Dortmund type tank for this application. The collected humus is returned to the septic tank for anaerobic digestion, eliminating the need for sludge drying beds on site. A small desludge pump of approximately 0.35kW is provided for this purpose.
 - Since pathogenic bacteria are not removed by the micro-organism population generated in any sewage treatment process by any adequate degree, a tertiary disinfection stage is typically deployed to eliminate the potentially disease forming bacteria. Provision has been made for disinfection (sodium hypochlorite dosage recommended).

BECON BIO-FILTER ROTOR, COMPLETE

The rotary disc filter will comprise of a series of 2m diameter discs, fitted to a central shaft, compressed between two spider arm configurations on either side of the shaft and suitably drawn up to form a unit rotor construction. The rotor unit will be fitted into its own individual shaft mounted drive. An adequate number of discs will be provided to meet the corresponding sewage organic load.

a) Biological Discs

The biological discs shall be 2 meters in diameter x 10mm thick monolithically cast; incorporating integrally cast reinforced hard plastic bosses which fit over the central shaft. The discs shall be formed from polyurethane plastic material having a density of not less than 200 kg/m³ and shall be free of significant water absorbent properties (less than 5%). The discs will be complete with integrally cast spacers to provide 15mm spacing between discs and to ensure sustained compression of the discs on assembly. Loose, individual spacers and alternate fastening of discs to each other and/or onto the shaft will not be accepted. This minimum spacing between discs is deemed critical to support aerobic biological conditions across the entire rotor.

The above ensures the most formidable compression to sustain effective rotation and action of the rotating disc unit, against horizontal and vertical pressures that it is subjected to during rotation and establishment of biomass on the disc surface.

b) Shafts

The rotor shafts will comprise of fabricated square profile mild steel shafts, suitably reinforced and capable of withstanding the stresses experienced by forces on the rotors. Each shaft will be fitted with high-grade axel-steel stub shafts at either end, and will be fitted with suitable splash plates and compression nuts.

The shafts will be cleaned, primed and treated with two coats of high quality epoxy paint for corrosion protection.

c) Spiders

The spiders comprising of two units per shaft will be fabricated from a 8mm mild steel compression plate to which 50mm x 35mm galvanised mild steel spider arms are fitted. The spiders will also be finished off with two coats of high quality epoxy paint.

d) Through Rods

Each rotor will be fitted with at least 24 x 12mm mild steel tensioning rods. The tension rods are to be correctly adjusted together with the central compression nuts to ensure a solid rotor construction and must be positioned through the cast spacers as provided by the disc.

e) Bearings

Each rotor will be mounted on one pair of self-aligning sealed type plumber block bearings which will be mounted on the disc filter basin walls on mild steel bearing plates by means of high tension foundation bolts cast into the walls. Grease application points will be provided.

f) Drive Motors

Each rotor is to be fitted with a direct shaft mounted geared unit, driven by a flanged direct drive electric motor. The geared motor is to be adequately rated to drive the disc rotor under all operating conditions at approximately 3-4 rpm.

The drives are to be capable of operating on a 24 hour/day basis and should therefore be rated for this duty cycle.

An adequate fastening torque plate to support the installed drive unit will be provided.

g) Rotor Covers

Each rotor shall be fitted with a semi-circular rotor cover consisting of a GRP unit complete with lifting handles, where a cover is required.

ELECTRICAL CONTROL PANEL & EQUIPMENT

The plant will be supplied complete with a weather-proof electrical control panel, accommodating all the control equipment for the plant.

This equipment comprises of the following:

- a) Mains interlock able isolating switch.
- b) A suitable direct-on-line starter for each individual motor unit, complete with inverse time-overload, and anti-single-phase protection, and circuit breaker.
- c) Pilot control circuits as required for the plant.
- d) Emergency stop lock buttons at each RBC unit and isolating switches at each pump unit.
- e) A level control float in the humus tank return pump sump.
The panel is to be fully wired and tested prior to dispatch and installation at site.
- f) Three phase 380VAC / 400 VAC power supply POINT with neutral must however be supplied

3) Features

- 1) RBC plants are not affected by overloading, as the plant will readily remove the rate percentage of organic matter from the system.
- 2) Bacteria attach themselves to the rotating discs and therefore cannot be washed out of the system by flash floods or shock loads.
- 3) No daily de-sludging is required as in Activated Sludge Plants. Sludge is continuously returned to the septic tank and this tank may only require to be de-sludged every 12-months or longer.
- 4) RBC plants have separate sealed septic tanks to eliminate any smell or odour.
- 5) The capacity of the septic tank is designed in accordance with recommendations laid down by the South African Institute of Water Pollution Control and the disc area rating designed as specified by CSI

4) Quality Specifications

a) **Influent Quality**

The following list indicates the acceptable limits of determinates in influent sewage to be treated in a Becon Watertech sewage treatment plant:

- Ammonia (as N): 40 mg/l
- Anionic surface active agents: 250 mg/l
- Chemical Oxygen Demand (Expressed as COD)<600mg/L
- Electrical conductivity not greater than: 350mS/m at 25°C of mineral origin < 50 mg/l
- of vegetable/animal origin< 200 mg/l
- pH at 25°C ≥6 and ≤9
- Phenols (expressed as phenol) : 10 mg/l
- Substances not in solution including fat, oil, grease, waxes and like substances
- TKN 45 mg/l

b) **Effluent Quality**

The STP will deliver treated water that meets the requirements of DWA general limit.

(Safe for release into the environment)

C) **Discharge Quality**

Substance / Parameter	Limit
Faecal Coliforms (per 100 ml)	1000
Chemical Oxygen Demand (mg/l)	75
PH	5.5 – 9.5
Ammonia (ionised and un-ionised) as Nitrogen)mg/l)	6
Nitrate/Nitrite as Nitrogen (mg/l)	15
Chloride as Free Chloride (mg/l)	0.25
Suspended Solids (mg/l)	25
Electrical Conductivity (mS/m)	70 Above intake, max 150
Ortho-Phosphate as phosphorous (mg/l)	10
Fluoride (mg/l)	1
Soap, oil or grease (mg/l)	2.5
Dissolved Arsenic (mg/l)	0.02
Dissolved Cadmium (mg/l)	0.005
Dissolved Chromium (VI) (mg/l)	0.05
Dissolved Copper (mg/l)	0.01
Dissolved Cyanide (mg/l)	0.02
Dissolved Iron (mg/l)	0.3
Dissolved Lead (mg/l)	0.01
Dissolved Manganese (mg/l)	0.1
Mercury and its compounds (mg/l)	0.005
Dissolved Selenium (mg/l)	0.02
Dissolved Zinc (mg/l)	0.1
Boron (mg/l)	1

5) Size and Power Requirements

Plant	Treatment Volume kl/day	Organic Load BOD Kg/day	No Of Rotors	Power required
Be-Pac 5	5kl/d	1.5	1	0.5kW

6) Offer

We offer our standard civil works rotor basin and secondary humus settling tank, together with associated M&E package that comprises of the rotor units, each rotor unit complete with discs assembled onto a 60mm shaft with a 220V geared motor drive, end bearings, electrical control panel, internal humus tank equipment, desludge pump and chlorine dispensing unit.

Please note the low operating cost of this technology, as outlined in the attached document.

	M&E	Civil Works Estimate	Total
Be-Pac 5C	R 204 495.00	R 116 854.00	R 321 349.00

7) Inclusions:

- Delivery
- Installation
- Commissioning
- Training

8) Exclusions

- Taxes & duties
- Civil works

9) Validity

- Prices are valid for 90 days.
- Even though the quote may be accepted within this period, due to the volatility in raw material prices, we may adjust our base rates to the date of manufacture/delivery.

10) Lead Time (Excluding standard non-working days and contractor's annual shut down)

- GA drawings 2 - 3 weeks post formal order.
- Detailed manufacturing drawings 3 - 6 weeks.
- Procurement & Manufacturing 4 - 6 weeks subject to availability of materials.
- Installation & commissioning 1 - 2 weeks subject project loading at the time of approval

Delivery will only commence once the employer has certified that the site is ready for installation in terms of all the interfacing on site, access to site & specific areas of work, as-build drawings / measurements of structures confirmed, availability of electricity and other services that might be required.

11) General Terms and Conditions

A) Payment Terms

- Full payment will be required for the following portions:
 - 50 % on order
 - 40 % prior delivery
 - 10 % Commissioning
- On placement of the order, it may be required that an agreement be signed with the employer to directly pay Becon Watertech, alternatively a Bank Issued payment guarantee (Letter of Credit) from a reputable institution to the full value of the contract to be supplied to Becon Watertech.

B) Ownership & Access to site

- All equipment remains the property of Becon Watertech until fully paid.
- We reserve the right to have access to site, at any time where our equipment is located or stored.

C) Orders

- The only acceptable manner is an official purchase order, on a company letterhead signed by an authorised signatory of the company. VAT and & Company registrations are required.

D) Cancellation

- Order cancellation or variation will not be considered without written consent from a Becon Watertech Authorised Signatory.
- In the event of equipment being manufactured or already completed for a specific order, the employer will be liable to pay the portion of the price according to the stage of completion of the equipment ordered.

E) Installation & Commissioning

- Adequate access to alongside the installation site for the crane and its transport vehicle must be provided.
- Any additional site visits caused by circumstances beyond our control, stand time due to weather elements, access or structures not being ready, inaccurate measurements on as build drawings, delays in commissioning and others will be for the cost of the employer.
- The 12 month Defects Liability period will commence on completion of installation of equipment.

F) Surety Bond & Guarantee

- A Surety Bond of 10% can be provided for the agreed contract amount, at an additional cost, if not specifically requested with the original request.
- All Becon Watertech equipment carries a 12 month limited warranty from the date of delivery.
- This guarantee would become null and void if the plant is not commissioned/operated and/or maintained in accordance with our instructions during the maintenance period.

- Maintenance checks must be done in accordance with the operating and maintenance manuals and proof of this must be documented. This service can be provided by Becon Watertech at an additional cost to the contract.

G) Proprietary equipment, Price & Technical Information

- Becon Watertech equipment, datasheets and drawings may neither be modified nor copied in any manner whatsoever.
- This offer & its supporting documents may not be shared with third parties without the written permission from a Becon Watertech Authorised Signatory.
- This offer & its supporting documents are valid for the addressee of this document only.

We trust the above meets your approval and look forward to your instruction in this regard.

Yours sincerely,

Stuart Napier

For: Becon Watertech



Proposal to : Kingspan Klargestep
Proposal date : 30/06/2022
Project name : Wilderness ERF2003
Internal number : T4570
Contact person : Stuart Napier
Contact number : 082 900 1000
E-mail address : stuart.napier@kingspan.co.za
Prepared by : **Stuart Napier**

BioDisc Domestic



1) About Becon Watertech (Pty) Ltd

Becon Watertech is part of the Tecrover group which is a multinational technology driven company that design processes and equipment, manufacture, install and commission world class turnkey solutions for all Wastewater Treatment related industries.

Becon Watertech has been treating sewage and maintaining this process for over 40 Years on a Design and Supply turnkey basis and as an Own Equipment Manufacturer (OEM).

During this period, more than 1,900 units have been installed in Africa and across the Indian Ocean Islands to local & national government departments (including schools, hospitals, small towns and developments, prisons, border posts, shopping malls, police stations, private estates, hotels and holiday developments, private sector industrial locations, power stations and mining sites and villages.

The Becon configured Bio-Filter domestic sewage treatment process is capable of producing treated effluent quality that meets the South African General Authorization Standard as prescribed in the South African National Water Act, No. 36 of 1998.

Becon Watertech is the distributor of the Kingspan Klargester product in Sub-Sahara Africa and the Indian Ocean Islands.

2.) Product Description:

BIODISC® DOMESTIC SEWAGE TREATMENT PLANT

Kingspan Klargester BioDisc is ideal for location where discharge is to sub-surface irrigation (soakaway), or to suitable watercourse where approved by the Regulator, and where a septic tank will not meet the required standards.

All our robust BioDisc models cater for properties housing between 4-20 people. The premium BioDisc sewage treatment system is available in four sizes for all types of domestic applications. For single house applications we offer the BA and BAX models and, for multiple homes, the Kingspan Klargester BB and BC BioDisc models are ideal. Because various inlet and outlet options are available, we carry out a free comprehensive site assessment to ensure the correct system model and size for your home.

The BioDisc can be used for discharge to either a watercourse or soak away. Effluent can be reused for drip irrigation.

Features

- Certified to European standard BS EN 12566 Part 3.
- Utilises Rotating Biological contactor technology.
- Low running costs.
- Low level visibility with a lockable child proof cover- safe for children and pets.
- Performance certified to achieve 10mg/l BOD, 15mg/l SS and 3.8mg/l ammonia.
- Delivers better than 95% pollution removal.
- 10 Year warranty option available when purchased with a service and maintenance plan.
- Supplied with a control panel and alarm.
- Managed Flow System.
- Totally silent in operation.
- The most stable process in the market.
- Controls the discharge volume.

	BD
ADWF kl/d	5
Population equivalent	25 pax
Overall Length (mm)	3340
Overall Width (mm)	2450
Standard drain Invert Inlet (mm)	600
Depth to base(mm)	2485
Motor Rating	75w

Pricing:

PRODUCT	PRICE PER UNIT
BD	R 398 903.00
Delivery to site using crane truck	R 15 000.00
Installation	R 20 000.00
TOTAL	R 433 903.00

Inclusions

- Training
- Delivery
- Commissioning

Exclusions

- TAX and duties
- Civil works

Validity

- Prices are valid for 60 days.
- Even though the quote may be accepted within this period, due to the volatility in raw material prices, we may adjust our base rates to the date of manufacture/delivery.

Payment Terms

- 50% deposit
- Balance on commissioning

Ownership & Access to site

- All equipment remains the property of Becon Watertech until fully paid.
- We reserve the right to have access to site, at any time where our equipment is located or stored.

Orders

- The only acceptable manner is an official purchase order, on a company letterhead signed by an authorised signatory of the company. VAT and & Company registrations are required.

Cancellation

- Order cancellation or variation will not be considered without written consent from a Becon Watertech Authorised Signatory.
- In the event of equipment being manufactured or already completed for a specific order, the employer will be liable to pay the portion of the price according to the stage of completion of the equipment ordered.

Surety Bond & Guarantee

- A Surety Bond of 10% can be provided for the agreed contract amount, at an additional cost, if not specifically requested with the original request.
- All Becon Watertech equipment carries a 12 month limited warranty from the date of delivery.
- This guarantee would become null and void if the plant is not commissioned/operated and/or maintained in accordance with our instructions during the maintenance period.
- Maintenance checks must be done in accordance with the operating and maintenance manuals and proof of this must be documented.
This service can be provided by Becon Watertech at an additional cost to the contract.

Proprietary equipment, Price & Technical Information

- Becon Watertech equipment, datasheets and drawings may neither be modified nor copied in any manner whatsoever.
- This offer & its supporting documents may not be shared with third parties without the written permission from a Becon Watertech Authorised Signatory.
- This offer & its supporting documents are valid for the addressee of this document only.

We trust the above meets your approval and look forward to your instruction in this regard.

Yours sincerely,

Stuart Napier

For: Becon Watertech