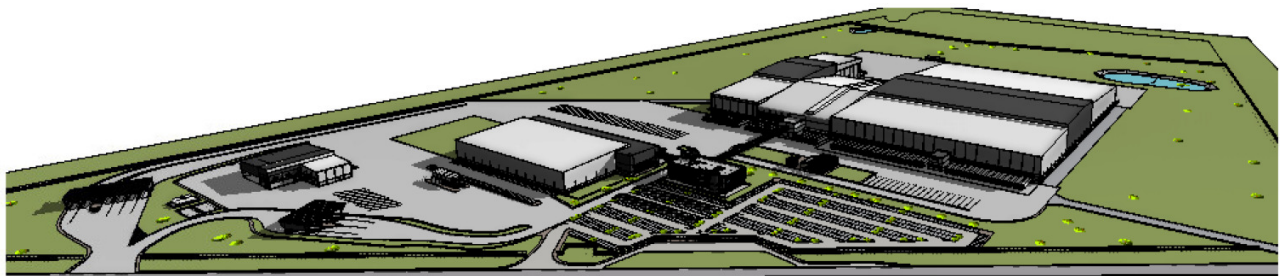




**CONSULTING  
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## Proposed Phase 2 Development

Erf 8741, part of erf 409, Wells Estate, Gqeberha



## Phase 2 Civil Engineering Services Report

Ref. 21056 - Revision B

March 2022

Prepared for:

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CIVIL | STRUCTURAL | ELECTRICAL

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**APPENDIX A** : Site Development Plan

**APPENDIX B** : Water and Sewage Demand Calculations

## 1 INTRODUCTION

KLS Consulting Engineers has been appointed by Shoprite Checkers (Pty) Ltd and Equites to compile the Civil Engineering Services Report for the proposed additions and alterations to the existing Distribution Centre on Erf 8741, Wells Estate, Gqeberha.

The purpose of this report will be to provide an overview of the existing municipal services and to address all civil engineering issues generated from the proposed development. The following documents and guidelines have been used in the civil services infrastructure design and management implementation of this development:

- The Topographical survey of the proposed development site
- Geotechnical report for Erf 8741, compiled by R. A Bradshaw & Associates
- The Site Development Plan compiled by Empowered Spaces Architects
- The standard guidelines for residential developments as stipulated in the "GUIDELINES FOR HUMAN SETTLEMENT PLANNING AND DESIGN" (CSIR "Red Book")
- The SANS 10252-1:2004 code for water demand
- The "ROADS DRAINAGE MANUAL" as published by the South African National Roads Agency

## 2 DESCRIPTION OF THE PROPOSED SITE

### 2.1 Locality

Refer to Appendix A for the preliminary site development plan layout.

The existing and proposed development is situated on Erf 8741, Wells Estate, Gqeberha. The property is located between Motherwell (north) and the railway line (south) with General Motors to the east.

The total size of the proposed development is approximately 35ha.



Figure 1 - Locality Plan (Google Earth)

## 2.2 Existing Topography

The ground slopes southward with a fall from approximately 44,5m AMSL to 41m AMSL from the northern to the southern boundary.

## 2.3 Cover Type

From the original geotechnical report done prior to the original development, it was noted that the southwestern parts of the site are relatively densely vegetated with indigenous grasses, and particularly exotic scrub and small trees. Scattered vegetation and concentration of scrub also occur in the other parts.

### 3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The proposed Development is for additions and alterations to the existing distribution centre, including a new office building, new workshop and truck wash, new guardhouses and additions to the dry goods warehouse; returns warehouse and perishables warehouse.

#### **EXISTING AREAS**

VEHICULAR GATEHOUSE	38 m <sup>2</sup>
PEDESTRIAN GATEHOUSE	18 m <sup>2</sup>
ELECTRICAL ROOMS	73 m <sup>2</sup>
TRUCKWASH	195 m <sup>2</sup>
PUMP ROOM AND TANKS	128 m <sup>2</sup>
BOILER ROOM	14 m <sup>2</sup>
COUNCIL SWITCH ROOM	64 m <sup>2</sup>
PERISHABLES	4251 m <sup>2</sup>
DRY GOODS	3152 m <sup>2</sup>
RETURNS	1194 m <sup>2</sup>
STAFF FACILITIES	408 m <sup>2</sup>
RECEIVING OFFICE	276 m <sup>2</sup>
PLANT AREA	110 m <sup>2</sup>
<b>EXISTING AREA</b>	<b>9921 m<sup>2</sup></b>

#### **AREAS TO BE DEMOLISHED**

VEHICULAR GATEHOUSE	38 m <sup>2</sup>
PEDESTRIAN GATEHOUSE	18 m <sup>2</sup>
TRUCKWASH	195 m <sup>2</sup>
<b>DEMOLISHED AREA</b>	<b>251 m<sup>2</sup></b>

<b>REMAINING EXISTING AREA</b>	<b>9670 m<sup>2</sup></b>
--------------------------------	---------------------------

#### **NEW AREAS**

##### **MAIN BUILDING**

OFFICE	3075 m <sup>2</sup>
NEW DRY GOODS WAREHOUSE - TOTAL	37568 m <sup>2</sup>
NEW FRESHMARK/ PERISHABLES - TOTAL	8944 m <sup>2</sup>
RETURNS WAREHOUSE - TOTAL	9294 m <sup>2</sup>
WORKSHOP	2801 m <sup>2</sup>
TRUCK WASH	141 m <sup>2</sup>
REFUSE YARD	152 m <sup>2</sup>
ENTRANCE GUARDHOUSE	38 m <sup>2</sup>
EXIT GUARDHOUSE	38 m <sup>2</sup>
<b>PROPOSED NEW AREAS</b>	<b>59098 m<sup>2</sup></b>

<b>GRAND TOTAL AREA</b>	<b>68768 m<sup>2</sup></b>
-------------------------	----------------------------

Access to the property will be from the R102, directly opposite M. Kaulela Street. Refer to Appendix A for Proposed Site Development Plan.



Figure 2 – Proposed Site Plan

#### 4 SITE CLEARANCE & PREPARATION

The original Geotechnical report indicates that the site is overlain with a thin layer of topsoil which is not suitable for fill material underneath building structures or use in road pavement structures. The report indicates that the thickness of this thin topsoil layer varies in thickness from 50mm to 150mm.

Allowance has been made for the top 100mm of the insitu material across the entire footprint of the development to be stripped and stockpiled on-site. The stockpiled material will be used as landscaping material at the end of the project.

## **5 BULK EARTHWORKS**

### **5.1 In-situ Soil Profiles**

The natural soil profile at the site generally comprises of combinations of silty sand overlaying calcrete (hardpan or gravel), overlaying calcareous sand, overlaying shelly silty sand or clayey sand, which in turn overlies shale bedrock. Fill material occurs in the north-eastern and south-eastern corners of the site and in the north-eastern corner of the greater site. Groundwater was only found in two trial holes in close proximity of the stormwater canal to the south of the site.

### **5.2 Final Floor Levels**

The levels for the existing warehouse's bulk earthworks platforms were governed by the stormwater retention pond level as well as cut-to-fill quantities. The new warehouse floorlevel will tie into the existing floorlevel. The Returns Facility and Workshop floor levels still need to be finalised.

### **5.3 Bulk Earthworks Roads & Buildings**

A cut to fill operation will be carried out to the marshalling yards and G7 fill will be imported for the raised building platform. The floorlevel is 1,4m above the marshalling yards for offloading purposes with some on-grade offloading bays where required.

### **5.4 Subsoil Drainage**

The Geotechnical report indicates that groundwater was observed in two trail pits close to the canal. Subsoil pipes will be installed if and when required.

## **6 ROADS, ACCESS AND PARKING AREAS**

### **6.1 Traffic Impact Assessment**

Greg Pryce Lewis from GPL Consulting has been appointed to provide the transport and traffic related services for the application. The original TIA (Traffic Statement) was compiled by SSI Engineers in 2012.

### **6.2 External Roads & Access**

Access to the property will be gained from the Old Grahamstown Road (R102). The access will be opposite M. Kaulela Street. The existing access south of M. Kaulela Street will remain open for access to the staff and visitors carpark.

### **6.3 Internal Roads and Parking Areas**



The internal road and parking area infrastructure consist of the following:

- 80mm Interlocking Pavers (40 Mpa) to roadways
- 30 Mpa concrete to high traffic areas and loading bays
- Asphalt surfacing to the light vehicle parking area

The stormwater detail design makes allowance for the creation of low and high points to the proposed roads, marshalling yards & parking areas in order to cater for adequate crossfalls and longitudinal slopes to meet the minimum standards for effective stormwater drainage.

## **7 STORMWATER DRAINAGE**

### **7.1 Existing Stormwater Network**

There is an existing stormwater canal to the south of the property. Pre- and post runoff will be detained on site in a series of detention ponds.

A separate Stormwater Management Report (SWMP) will be submitted by KLS.

### **7.2 Internal Stormwater Network**

The standard stormwater principles, as set out by the guidelines mentioned in section 1 of this document, will be employed for the design of the internal stormwater system.

The existing internal stormwater system consist of an underground gravity pipe network and inlet structures that drain the paved areas. This system is designed to have sufficient capacity to convey a 1:5 year rainfall event (*this is defined as a rain storm which will statistically only occur once in every five years*).

The proposed new additions to the development will create relatively large impervious areas that will substantially increase the stormwater run-off from the site. Stormwater from the additional development will be handled in the same manner as described above. The installation of the internal stormwater system as described above will concentrate stormwater run-off in certain areas, for example at low and high points in the parking areas and in the roadside channels.

The underground stormwater infrastructure will consist of Box Culverts and Concrete spigot & socket pipes, grids and side inlet structures as well as round precast concrete stormwater manholes.

The following minimum specifications have been implemented in the stormwater infrastructure design:

- 75 D Concrete spigot & socket pipes
- Minimum pipe size - 375mm diameter
- Minimum cleansing velocity inside a half full pipe – 0.9m/s
- Maximum spacing between manholes, inlets, catchpits – 90m

The standard stormwater principles, as stipulated by the relevant guidelines of this document & the guidelines of the local authority, will be employed for the design of the internal stormwater network. A detailed Stormwater Management Plan will be submitted separate from the Services Report.

The underground network will be designed to have sufficient capacity to effectively manage a 1:5 year rainfall event. During rainfall events with a return period larger than 1:5 years, the proposed roads, walkways, parking areas and channels will act as overland flow routes which will channel, attenuate and ultimately discharge the surface run-off via a predetermined escape route into the existing attenuation facility or existing stormwater canal located to the south of the property.

The existing stormwater retention dam to the south of the development will be increased to accommodate run-off from the bigger development. The main function of the dam will be to attenuate the effect of stormwater run-off, during rainfall return periods larger than 1:5 years, on the downstream stormwater networks. During these heavy rainfall events, stormwater run-off will be detained inside the enlarged retention dam and discharged into the existing stormwater canal to the south at a flow rate equal to a 1:5 year storm.

### **7.3 Stormwater Treatment**

The floor of the retention pond is 300mm deeper than the in- and outlet pipes. The 'first flush' will be retained in the retention pond and it will be planted with approved vegetation.

## **8 SANITATION**

### **8.1 Existing Foulsewer Network**

The existing internal sewage network has one bulk connection to the sewage network, at the north-eastern boundary.

Capacity of the downstream sewer network need to be confirmed by Nelson Mandela Bay Municipality. The additional flow should not be a problem as the Warehouse will operate 24 hours a day and the flow will be contra-cyclic from residential peak flows.

Projected staff numbers in 24 hr shift:

<b>Staff Count Estimation</b>			
<b>Staff Structure</b>	<b>FY2028</b>		<b>FY2028</b>
	<b>Wells (per shift)</b>	<b>Shifts</b>	<b>Wells (total)</b>
SHOPRITE - SITE	65	3	125
ADFUSION - Dry Goods	154	3	462
ADFUSION - Cold Storage	55	3	165
ADFUSION - Return Centre	40	3	120
SECURITY	35	3	105
CLEANING	32	3	94
FRESHMARK	61	2	119
TRANSRITE	45	2 or 3	98
DRIVERS	220	1	220
<b>Total Staff Compliment (all)</b>	<b>707</b>		<b>1508</b>



Item no	Description	Total no. of staff/day	Area	Sewage Yield per day			TOTAL (litre)
				Per unit litre per unit/room	Area litre per 100m <sup>2</sup>	Per person litre per person	By area/ number
1	Warehouse Facility	1508			-	45	67 860 -
Annual Average Daily Sewage Yield (AADSY) Flow over 10 hour day = daily flow/24/60/60							67 860 l/day 0.79 l/s
Peak Factor = 1							
Peak Daily Dry Weather Sewage Yield (PDDWSY)							0.79 l/s
Infiltration = 15%							
Peak Daily Wet weather Sewage Yield (PDWWSY)							0.90 l/s

**Design Methodology:**

- a Units: Yield in litre per unit per day - SANS 10252-1 and CSIR Red Book Table C.1 Chapter 10 Appendix C
- b Yield in litre per m<sup>2</sup> per day - Assume 90% of water consumption for Units and ablution facilities and 80% for restaurants and kitchens
- c Peak factor calculation: The flow from commercial developments are contra-cyclic from residential and calculated during an 24 hour day (zero peak)
- d Assume infiltration of 15%: During Heavy Rainfall in Winter

**Table 1 - Sewage Yield**

The estimated sewage runoff figures for the proposed development is 0.9 l/s (peak factor 1) and is summarized in Table 1 above.

## 8.2 Internal Foul Sewer Network

The internal sewage network consists of 160mm diameter uPVC Class 34 pipes, and round precast concrete manholes. The bulk connections to the building structure will be 110 mm uPVC Class 34 pipes. Sewage pipes will be gravitation lines with a small pumpstation to the south of the building and a main sewage pumpstation in the carpark to the north of the building. From here sewage will be pumped to the sewage connection in the north east of the erf. The pipes will be laid at a minimum gradient of 1:120 to ensure that the minimum self-cleaning flow is maintained. The bedding and blanket material for the internal sewage pipe trenches will be imported clean sand

from commercial sources. This material will comply with SABS 1200 specification for Class C bedding and blanket

## 9 WATER RETICULATION

### 9.1 Existing Water Network

The internal potable water, fire hydrant and sprinkler water network will be connected to the existing ringmains of Shoprite. The main water connection for the site is at the entrance in Old Grahamstown Road (R102).

The estimated water and fire demand figures for the proposed development is summarized in Table 2 below.



Item no	Description	Total no. of staff/day	Area	Water demand per day			TOTAL (litre)
				Per unit litre per unit/room	Area litre per 100m <sup>2</sup>	Per person litre per person	By area/ number
1	Warehouse Facility	1508				50	75 400 -
Gross annual average daily water demand (GAADD)							75 400 l/day
Demand over 24 hour day = daily demand/24/60/60							0.87 l/s
<b>Instantaneous Peak Demand (P(i) = 1)</b>							<b>0.87 l/s</b>
<b>Fire Flow (Fire Engineer to confirm)</b>							<b>25.00 l/s</b>

**Design Methodology:**

- Units: Yield in litre per unit per day - SANS 10252-1 and CSIR Red Book Table 9.14 Chapter 9
- Peak factor calculation: The flow from Industrial Developments are contra-cyclic from residential and calculated during an 24 hour day (zero peak)
- Fire Flow (Moderate Risk): 6000l/min for 4 hours = 25 l/s (Fire Engineer to confirm)

**Table 2 - Water Demand**

Note: Allowance was made for fire flows, but the fire water reticulation will be designed by a Fire Consultant and does not form part of the civil engineering scope of works. There are existing fire tanks which will be enlarged if necessary.

The water demand of commercial and industrial developments are contra-cyclic from residential developments and are calculated over a 24 hour day, without applying a peak factor. The demand for the proposed development is 0.87 liter/second. This is calculated on a total staff compliment of 1,508 heads and a demand of 50 liter per person over an 8 hour shift.

### 9.2 Internal Potable Water & Fire Reticulation

The proposed internal water reticulation network will consist of the following ring mains:

- Potable water and fire hydrant ring main (160mm uPVC Class 16)

- Fire sprinkler water ring main (300mm uPVC Class 16)

The internal water reticulation network will connect to the existing booster pumps and tanks constructed under the first phase.

The fire sprinkler ring main will have a separate booster connection at the sprinkler water tanks. The Fire Consultant is Mr E Johns of TEA Consulting Engineers.

Gate valves will be installed at the start of all sub branches (junctions) of the internal network.

**Note: Internal sprinklers and fire hydrants will be included under the fire services contract**

The bedding and blanket material for the ring mains and connections will be clean sand imported from commercial sources. This material will comply with SABS 1200 regulations for Class C bedding and blanket.

Report prepared by:



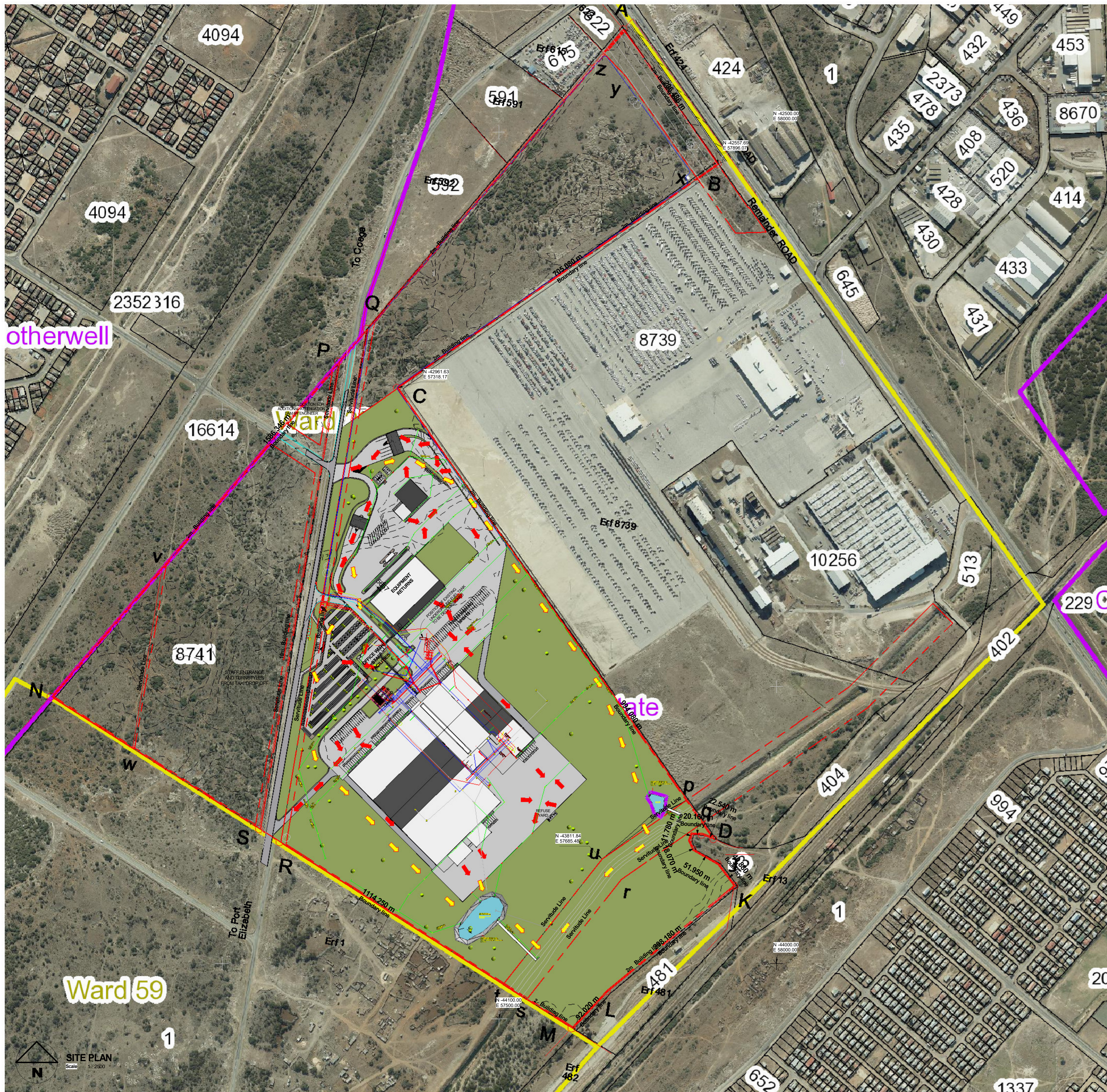
**C. Visser**

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APPENDIX A  
Site Development Plan



### SCHEDULE OF RIGHTS

USE ZONE	INDUSTRIAL 2
OFFICES	WAREHOUSE
WORKSHOP	
SITE AREA	820348 m <sup>2</sup>
BULK AREA	86788 m <sup>2</sup>
DENSITY ZONE	N/A
BUILDING LINES	0 m along street boundaries
HEIGHT ZONE	0 m
COVERAGE	PERMISSIBLE: 100% (820348 m <sup>2</sup> ), ACTUAL: 9.38% (76920 m <sup>2</sup> )
F.A.R.	0.7 (574243.6 m <sup>2</sup> )
F.S.R.	0 m <sup>2</sup> (0.077966 63959 m <sup>2</sup> )
HEIGHT	2 storeys
PARKING RATIO	4 bays per 150 square meters
OFFICES	4 (3954 158.16)
WAREHOUSE	1 (55308 553.08)
WORKSHOP	1 (2607 26.07)
PARKING	157 bays (157 157)

EXISTING AREAS	
VEHICULAR GATEHOUSE	38 m <sup>2</sup>
PEDESTRIAN GATEHOUSE	18 m <sup>2</sup>
ELECTRICAL ROOMS	73 m <sup>2</sup>
TRUCKWASH	195 m <sup>2</sup>
PUMP ROOM AND TANKS	128 m <sup>2</sup>
BOILER ROOM	14 m <sup>2</sup>
COUNCIL SWITCH ROOM	64 m <sup>2</sup>
PERSHABLES	4251 m <sup>2</sup>
DRY GOODS	3152 m <sup>2</sup>
RETURNS	1194 m <sup>2</sup>
STAFF FACILITIES	408 m <sup>2</sup>
RECEIVING OFFICE	276 m <sup>2</sup>
PLANT AREA	110 m <sup>2</sup>
EXISTING AREA	9921 m <sup>2</sup>

AREAS TO BE DEMOLISHED	
VEHICULAR GATEHOUSE	38 m <sup>2</sup>
PEDESTRIAN GATEHOUSE	18 m <sup>2</sup>
TRUCKWASH	195 m <sup>2</sup>
DEMOLISHED AREA	251 m <sup>2</sup>

REMAINING EXISTING AREA	9670 m <sup>2</sup>
NEW AREAS	
MAIN BUILDING	
OFFICE	3075 m <sup>2</sup>
NEW DRY GOODS WAREHOUSE - TOTAL	37568 m <sup>2</sup>
NEW FRESHMARK/ PERSHABLES - TOTAL	8944 m <sup>2</sup>
RETURNS WAREHOUSE - TOTAL	9294 m <sup>2</sup>
WORKSHOP	2801 m <sup>2</sup>
TRUCK WASH	141 m <sup>2</sup>
REFUSE YARD	152 m <sup>2</sup>
ENTRANCE GUARDHOUSE	38 m <sup>2</sup>
EXIT GUARDHOUSE	38 m <sup>2</sup>
PROPOSED NEW AREAS	59098 m <sup>2</sup>
GRAND TOTAL AREA	68768 m <sup>2</sup>

### SANITARY POPULATION SCHEDULE

OFFICE	Area 3954 m <sup>2</sup>	Population 264
WAREHOUSE	Area 59098 m <sup>2</sup>	Population 1000
Area per Person = 15 m <sup>2</sup>	Male 132	Female 132

REQUIRED					
MALE			FEMALE		
WC	U	WHB	S	WC	WHB
4	7	6	0	10	6

PROVIDED					
MALE			FEMALE		
WC	U	WHB	S	WC	WHB
6	4	8	0	7	6

### PARALEGIC PROVIDED

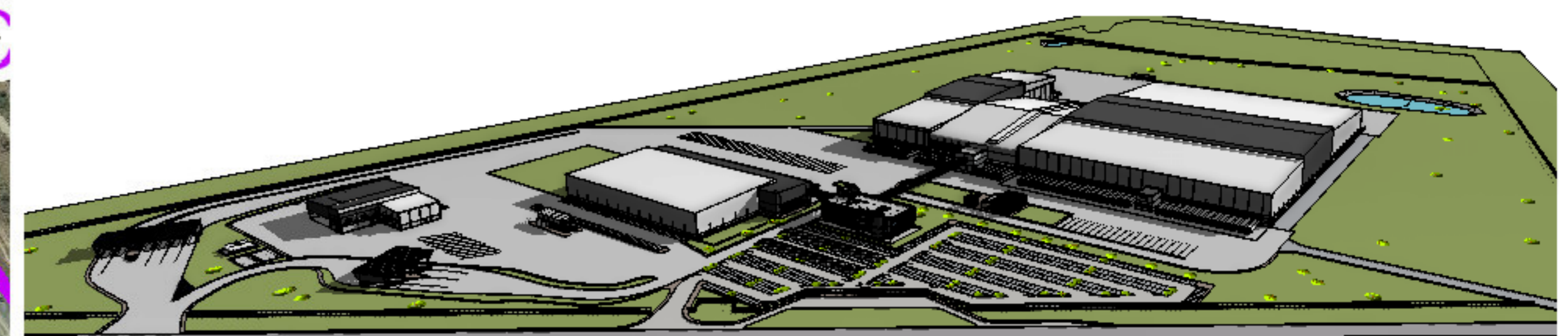
WC	WHB
1	1

**GENERAL NOTES**  
 ALL WORKS TO COMPLY WITH SANS 10400 OR BY RATIONAL APPROVED DESIGN TO COMPLY WITH FOLLOWING GUIDELINES:  
 B: Structural Design SANS 10400-B, Structural design  
 C: Dimensions SANS 10400-C, Dimensions  
 D: Public Safety SANS 10400-D, Public safety  
 E: Site Operations SANS 10400-E, Site operations  
 F: Excavations SANS 10400-F, Excavations  
 G: Foundations SANS 10400-G, Foundations  
 H: Floors SANS 10400-H, Floors  
 I: Roofs SANS 10400-I, Roofs  
 J: Stairways SANS 10400-J, Stairways  
 K: Walls SANS 10400-K, Walls  
 L: Glazing SANS 10400-L, Glazing  
 M: Lighting and Ventilation SANS 10400-M, Lighting and ventilation  
 N: Drainage SANS 10400-N, Drainage  
 O: Non-water-borne means of Sanitary Disposal SANS 10400-O, Non-water-borne means of Sanitary Disposal  
 P: Stormwater Disposal SANS 10400-P, Stormwater disposal  
 R: Stormwater Disposal SANS 10400-R, Stormwater disposal  
 S: Facilities for Persons with Disabilities SANS 10400-S, Facilities for persons with disabilities  
 T: Fire Protection SANS 10400-T, Fire protection  
 U: Space Heating SANS 10400-U, Space Heating  
 V: Fire Installation SANS 10400-V, Fire installation

### REFUSE CALCULATIONS

TYPE OF BUILDING	Area	(Volume)m <sup>3</sup> /week	Total Bins	Total Skips
OFFICES	3954 m <sup>2</sup>	8.93 m <sup>3</sup>	35.712528	1.116017
WAREHOUSE	59308 m <sup>2</sup>	209.65 m <sup>3</sup>	838.597595	26.206175
FACTORY	2607 m <sup>2</sup>	12.32 m <sup>3</sup>	49.293886	1.540434
SHOPS	0 m <sup>2</sup>	0.00 m <sup>3</sup>	0	0
FLATS	0 m <sup>2</sup>	0.00 m <sup>3</sup>	0	0
<b>TOTAL:</b>	<b>61869 m<sup>2</sup></b>	<b>230.90 m<sup>3</sup></b>	<b>923.604009</b>	<b>28.862625</b>

**NOTE:** REFUSE TO BE COMPACTED AND CLEARED DAILY BY PRIVATE CONTRACTOR



0	07/02/21	LW	TOTAL STORMWATER LAYOUTS REVISION
1	08/12/21	LW	POSITION OF EXISTING UNDERGROUND UTILITIES REVISION
2	09/11/21	LW	LAYOUTS UPDATED
3	09/11/21	LW	ISSUED FOR APPROVAL
4	19/09/21	LW	BUILDING SECTIONS INDICATED AND ISSUED FOR INFORMATION
5	06/09/21	LW	ISSUED FOR DISCUSSIONS AND INFORMATION

**empowered spaces**  
 1111 1111 Street, 1111 1111 Street, 1111 1111 Street  
 PO Box 5178, Floor 2/208 98@empowerspaces.co.za, www.empowerspaces.co.za

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 Drawings not to be scaled, report any discrepancies to architect before construction or manufacturing.

**client**  
**EQUITES**

**signature**

**project**  
**PROPOSED ADDITIONS AND ALTERATIONS TO EXISTING FACILITY**  
**stand number**  
**ERF 8741, WELLS ESTATE, GOEBERHA**

**engineer**  
 REWRIVER  
**contact**  
 REWRIVER  
**signature**  
 REWRIVER

**project architect**  
 REWRIVER  
**contact**  
 REWRIVER  
**signature**

**drawing description**  
**SITE PLAN**

**job number**  
**P037**

**drawing number**  
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**drawn**  
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**scale**  
 As Indicated

**date**  
 Issue Date

**revision number**  
**F**

**issued for**  
**INFORMATION**



LOCALITY PLAN





## APPENDIX B

Water and Sewage demand calculations

Item no	Description	Total no. of staff/day	Area	Water demand per day			TOTAL (litre)
				Per unit litre per unit/room	Area litre per 100m2	Per person litre per person	By area/ number
1	Warehouse Facility	1508				50	75,400 -

Gross annual average daily water demand (GAADD) 75,400 l/day  
 Demand over 24 hour day = daily demand/24/60/60 0.87 l/s

Instantaneous Peak Demand {P(i) = 1} 0.87 l/s

Fire Flow (Fire Engineer to confirm) 25.00 l/s

**Design Methodology:**

- a) Units: Yield in litre per unit per day - SANS 10252-1 and CSIR Red Book Table 9.14 Chapter 9
- b) Peak factor calculation: The flow from Industrial Developments are contra-cyclic from residential and calculated during an **24** hour day (zero peak)
- c) Fire Flow (Moderate Risk): 6000l/min for 4 hours = 25 l/s (Fire Engineer to confirm)

Item no	Description	Total no. of staff/day	Area	Sewage Yield per day			TOTAL (litre)
				Per unit litre per unit/room	Area litre per 100m <sup>2</sup>	Per person litre per person	By area/ number
1	Warehouse Facility	1508			- -	45	67,860 -

**Annual Average Daily Sewage Yield (AADSY)** 67,860 l/day  
**Flow over 10 hour day = daily flow/24/60/60** 0.79 l/s

*Peak Factor = 1*

**Peak Daily Dry Weather Sewage Yield (PDDWSY)** 0.79 l/s

*Infiltration = 15%*

**Peak Daily Wet weather Sewage Yield (PDWWSY)** 0.90 l/s

**Design Methodology:**

- a Units: Yield in litre per unit per day - SANS 10252-1 and CSIR Red Book Table C.1 Chapter 10 Appendix C
- b Yield in litre per m<sup>2</sup> per day - Assume 90% of water consumption for Units and ablution facilities and 80% for restaurants and kitchens
- c Peak factor calculation: The flow from commercial developments are contra-cyclic from residential and calculated during an 24 hour day (zero peak)
- d Assume infiltration of 15%: During Heavy Rainfall in Winter