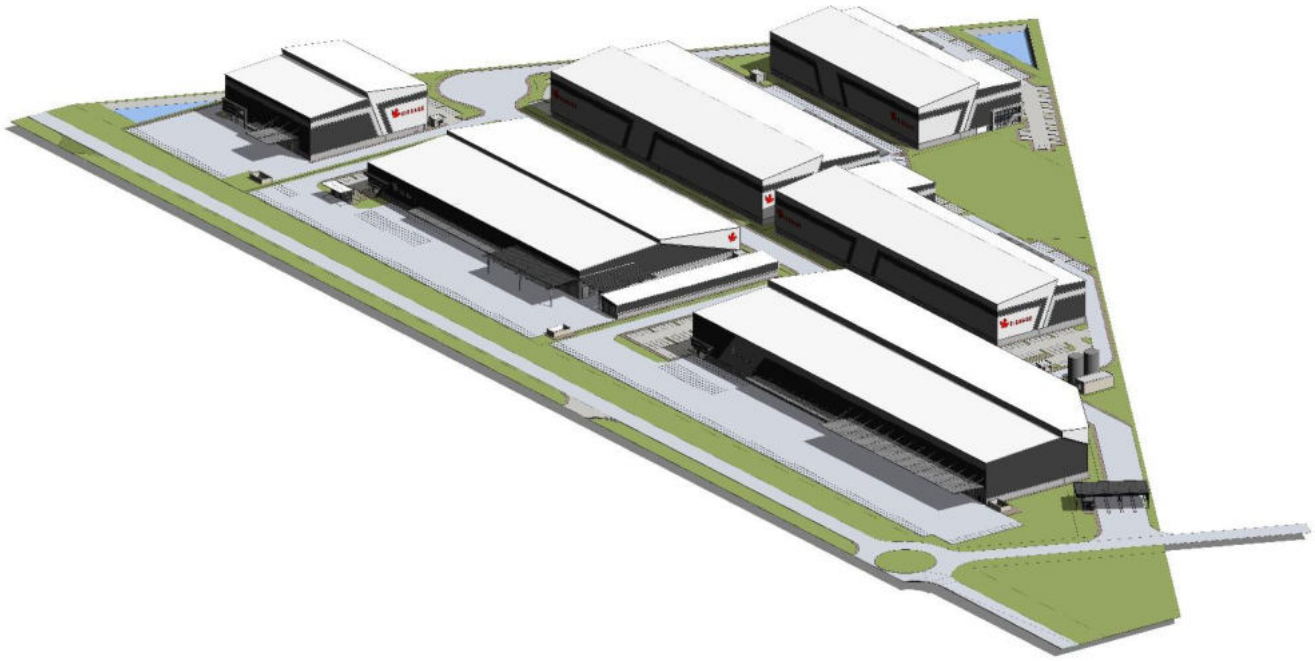
Proposed Industrial Park on Erf 10301, Wells Estate, Gqeberha



Conceptual Stormwater Management Plan

Revision A – March 2026

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Contents

1. INTRODUCTION

KLS Consulting Engineers has been appointed by Equites as the Consulting Civil Engineers for the proposed Industrial Park on Erf 10301, Wells Estate, Gqeberha. The purpose of this report is to address the stormwater management practices to be implemented within the constraints of the development to adhere to all authoritative policies and guidelines.

The KLS-strategy for the effective management of stormwater, is to implement a sustainable urban drainage system for the effective reduction of runoff generated from the post-development site, to ensure the protection of downstream infrastructure, watercourses, and ecosystems against events of abnormally high rainfall.

The following guidelines and references were used in the design of the internal stormwater network and the compilation of this report:

- *The Topographical Survey by Matt Pepe & Associates cc*
- *The Site Development Plan and proposed building layout of the Industrial Park by Empowered Spaces Architects*
- *The Neighbourhood Planning and Design Guide (2019).*
- *The Roads Drainage Manual (South African National Roads Agency Limited, 2006).*

2. SITE DESCRIPTION

Figure 1: Locality Plan

The proposed development is situated on the R102 (Old Grahamstown Road) opposite the Shoprite Checkers Distribution Centre, Wells Estate. Access to the site will be off M. Kaulela Road. The development site has a total size of approximately 16.6 ha. ***Figure 1*** shows a *Google Earth* aerial image of the site location.

2.1. Existing site conditions

The site has height ranging from 46.50 MSL to 42.26 MSL, in the southeastern corner of the property. The site is covered in grass and bush shrubs. Signs of fill material consisting of building and general rubble is scattered on site and will need to be further investigated. ***Figure 2*** and ***Figure 3*** indicates the current, typical site conditions.

Figure 2: Existing Site Coverage (a)

Figure 3: Existing Site Coverage (b)

Refer tot the Topographical Survey in ***Appendix A***.

2.2. Geotechnical Conditions

A site-specific geotechnical investigation has not been conducted to date. A geotechnical report was done by SRK Consulting for the Shoprite DC to the east of the site, and it is anticipated that the same conditions will prevail. The Shoprite soil conditions are summarised in the SRK Geotechnical report, available on request.

Refer to ***Figure 4*** the test pit soil profiles and ***Figure 5*** for and extract from the SRK report describing soil conditions.

Groundwater seepage was encountered in two of the twelve test pits. This will be taken into consideration for final design of stormwater bodies. Provision will be made for subsoil drainage, or as required, in all areas in cut.

Soil Origin	Material Type	Estimated relative density/consistency	Basal Contact (m) TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	TP11	TP12
Imported Rubble	Sand with rubbish	*Loose*	-	-	-	-	-	-	-	-	2.0	-	-	-
Topsoil	Silty sand with Gravel	*Loose*	0.2	0.2	0.3	0.6	0.3	0.2	0.6	0.2	-	0.3	0.3	0.3
Mixed Origin	Sand	*Medium dense to Dense*	-	-	-	1.4	-	-	-	-	-	-	-	-
Pedogenic	Hardpan Calcrete	*Medium hard rock*	-	0.4	0.5	-	-	-	-	-	-	-	-	-
Aeolian	Sand	*Medium dense*	-	0.7	1.8	-	-	-	-	-	-	-	-	
Pedogenic	Hardpan Calcrete	*Medium hard rock*	0.4	0.9	2.0	1.7	0.6	0.7	1.5	0.6	-	-	-	1.2
Aeolian	Sand	*Loose*	-	1.3	-	-	-	-	-	-	-	-	-	-
Pedogenic (calcretised)	Sand with Gravel	*Medium dense to Dense*	1.0	1.9	-	-	1.9	2.5	4.0	2.3	3.8	2.1	-	2.3
	Calcrete	*Strongly cemented*	-	-	-	-	2.0	-	-	-	-	-	-	-
Residual Alexandria Formation	Sand with limestone and/or shell	*Loose to Dense*	2.8	3.0	3.1	3.6	-	-	-	3.0	-	-	2.3	-
	Silty clay	*Firm*	3.1	-	-	-	-	-	-	-	4.3	3.3	3.0	2.8
Residual Sundays River Formation	Silty clay	*Very stiff*	4.5	5.0	4.7	4.4	-	-	-	4.1	4.4	4.1	3.5	4.4
	Sand	*Very Dense*	-	-	-	-	-	-	-	-	-	-	4.5	-

Figure 4: Test Pit Soil Profile Summary

3.4.2 Pedogenic

An off-white, slightly- to moderately weathered, moderately- to highly fractured hardpan CALCRETE horizon was intersected within most of the excavations. Typically, only one hardpan horizon is present from 0.2 m to 0.6 m (occasionally as deep as 1.4 m, except at TP2 and TP3, where moist, light khaki brown, *loose,* intact sand of inferred Aeolian origin is 'sandwiched' between two hardpan calcrete horizons. The hardpan calcrete varies in thickness from 0.2 m to 0.9 m, with a variable basal contact intersected between 0.4 mbgl and 2.0 mbgl.

The hardpan calcrete horizon is predominantly underlain by a dry to slightly moist, light greenish grey to off-white, *medium dense to very dense,* intact, calcareous silty fine SAND with abundant, coarse gravel of calcrete origin and limestone nodules. Occasionally, this pedogenic horizon has undergone moderate- to strong cementation, resulting in refusal of excavations.

3.4.3 Residual Alexandria Formation

The strongly calcretised (pedogenic horizon) is underlain by the residual Alexandria Formation which is discontinuous across the site (intersected at a depth ranging from 1 m to 2 m below surface) and is described as moist to very moist (or wet) green-grey stained off-white (with occasional orange mottling), *medium dense to very dense,* intact calcareous silty fine- to medium grained SAND with limestone nodules, and minor to abundant shelly fragments. Coquinite, a rock-type characterised by shell fragments strongly-cemented by calcium carbonate, was intersected in TP8 only.

3.4.4 Residual Sundays River Formation

The Alexandria Formation is underlain by residual soils derived from the in situ weathering of Sundays River Formation. Residual Sundays River soils were intersected within most of the test pits. The horizon is typically described as a slightly moist, orange-brown stained grey, *very stiff,* silty CLAY with relic horizontal bedding and joints.

Figure 5: SRK Geotech – soil profile

3. PROPOSED DEVELOPMENT

The Erf is zoned as *Industrial 1* and the primary land-use of the development will be Warehousing with ancillary buildings and offices. ***Figure 6*** indicates the layout of the proposed development. The total Warehouse area is 58,082m² with 6,025m² office area. Approximately 5352m² will remain undeveloped to protect the natural state of the identified area.

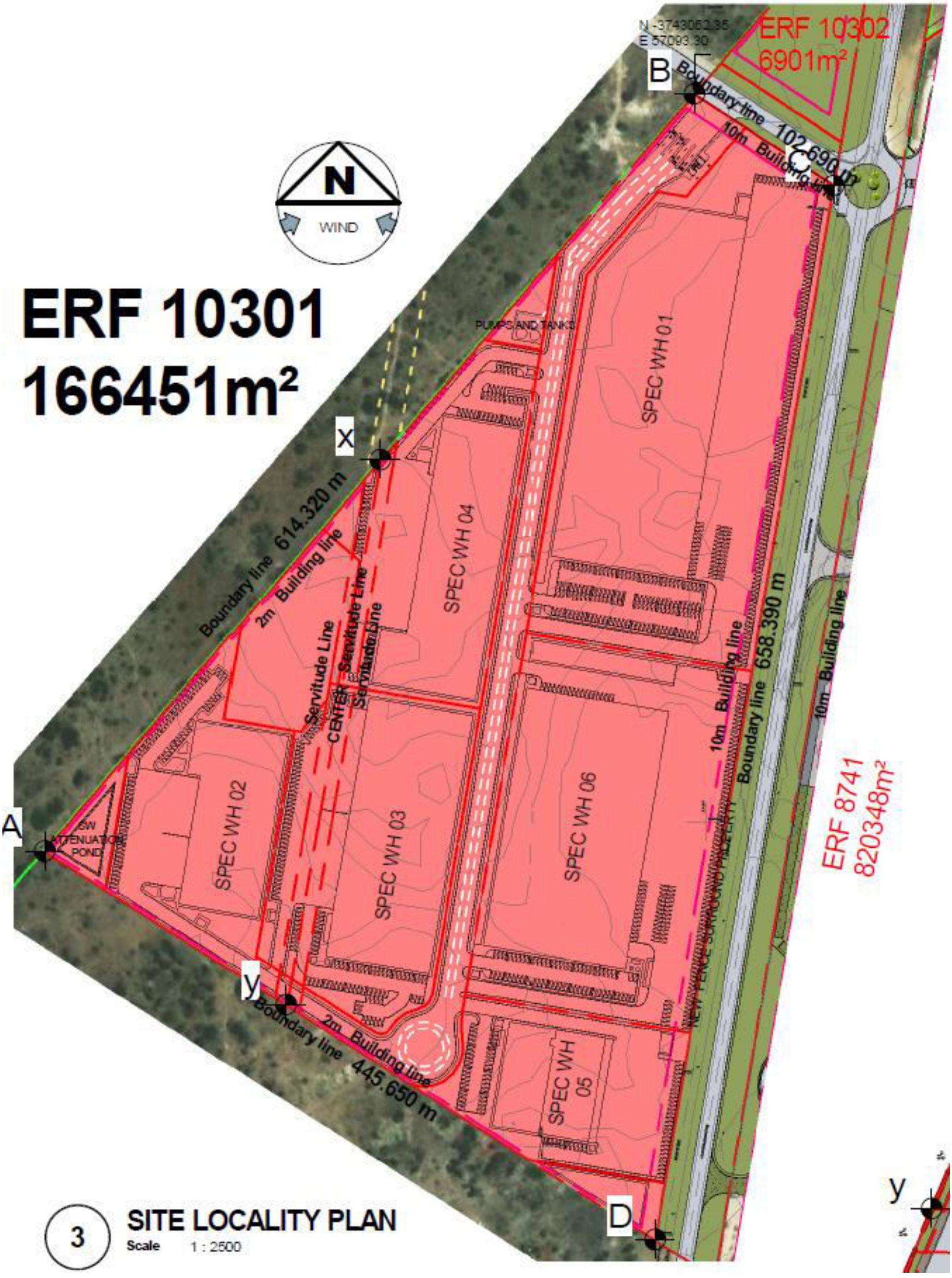

Figure 6 Site Development Plan

4. STORMWATER MANAGEMENT

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

Climate data from SAWS are used in runoff calculations. Parameters are summarized in Table 1:

Erf 10301, Wells Estate	
Reference Coordinates	33°50' S; 25°37' E
MAP (mm)	423
Total Catchment Size (m²)	166000
Peak Storm Duration (minutes)	15

Table 1: Site specific climate and parameters

The development will create large impervious areas that will substantially increase the stormwater run-off from the site. Stormwater run-off will be concentrated to low points in the parking areas and marshalling yards, from where the minor portion of runoff will be conveyed via a conventional underground system. The internal roads, marshalling yards, parking areas and channels will act as overland flow routes for major storm events.

The stormwater detail design will consist of low and high points within the roads, parking areas and marshaling yards, to make provision for adequate crossfalls and longitudinal slopes for effective stormwater drainage.

The following minimum specifications will be implemented in the stormwater infrastructure design:

- 100 D Concrete Spigot & Socket pipes
- Minimum minor system pipe diameter (roof water collection) - 300mm
- Minimum major system pipe diameter - 450mm
- Minimum velocity inside a half full pipe - 0.9m/s
- Maximum spacing between manholes/inlets/catch pits – 90m

There is no formal stormwater system in the direct vicinity of the site. The recommendation would be to do a new SW connection from the existing stormwater canal to the south and crossing the R102 to the site (refer green line in ***Figure 7***)

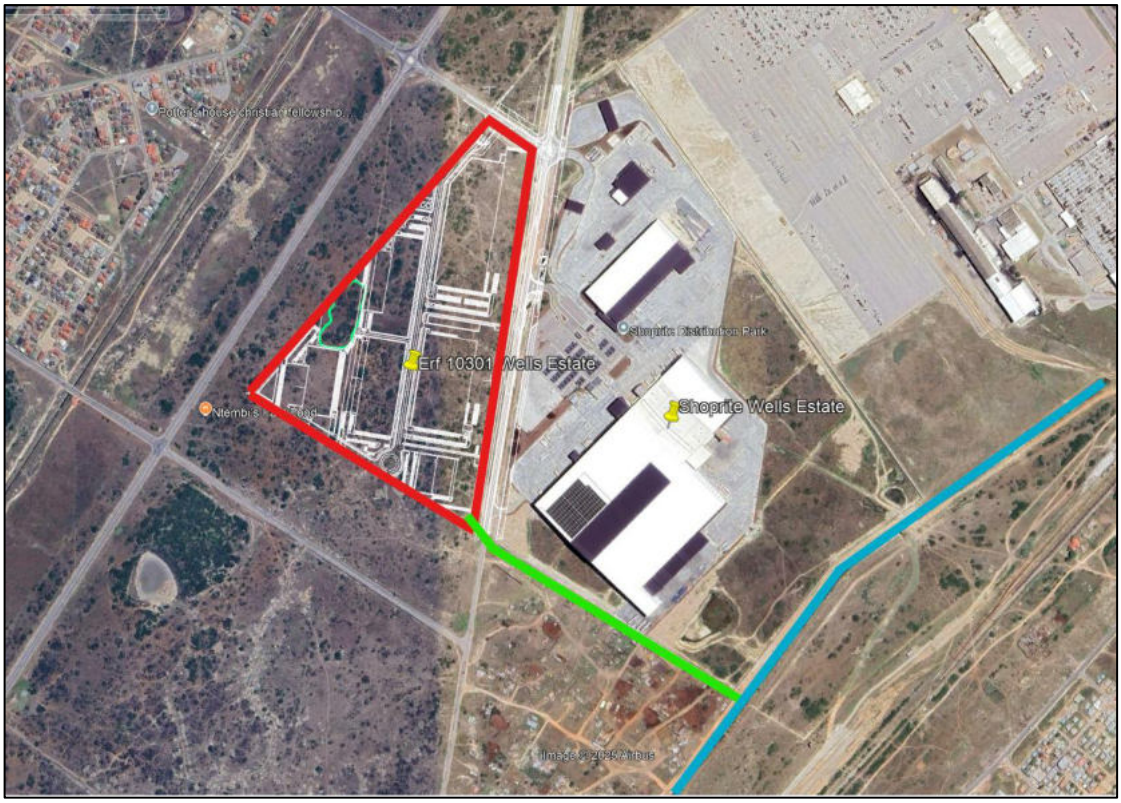

Figure 7: Proposed stormwater connection

The existing canal is shown in blue with the proposed culvert in green. The pipe route is across NMBM land, and it is recommended that the culvert be laid within an 8m wide servitude along the south-western Shoprite erf boundary.

Two attenuation ponds are proposed within the development, sized adequately to reduce peak flows to pre-development levels, reducing strain on the downstream infrastructure.

Table 2 gives a summary of the preliminary runoff calculations for the entire site, as per the SANRAL Drainage Manual Rational Method, Alternative 3.

Runoff Summary: Rational Method Alternative 3							
Return Period,	*years*	2	5	10	20	50	100
Runoff Coefficier	C_{pre}	0.3					
	C_{post},	0.79					
Rainfall Intensi	*mm/h*	34.0	50.0	62.8	76.4	96.4	114.0
Pre-Development Flo	m^3/s	0.470	0.692	0.869	1.057	1.334	1.577
Post-Development Flo	m^3/s	1.239	1.821	2.288	2.783	3.512	4.153

Table 2: Runoff Summary, Rational Method

Refer to ***Appendix B*** for preliminary calculations.

Refer to the preliminary services layout in ***Appendix C***, indicating the proposed stormwater infrastructure related to the development.

4.1. Minor Flows (1:5 year and smaller rainfall events)

The internal stormwater system will consist of a conventional underground gravity pipe and culvert network, roadside channels in the parking area and inlet structures to drain the impervious areas. This system will be designed to have sufficient capacity to convey up a 1:5-year rainfall event towards the on-site attenuation ponds.

4.2. Major Flows (Larger than 1:5-year rainfall events)

During rainfall events with a return period larger than 1:5-years, the proposed roads, marshalling yards, parking areas and channels will act as overland flow routes which will channel and discharge the surface run-off via predetermined routes into the attenuation facilities. The design of these dams will make allowance to adequately attenuate the 1:50-year rainfall event and convey runoff from a 1:100-year rainfall event from the site.

4.3. Attenuation

Two stormwater attenuation facilities/dams will be constructed on the south-western and south-eastern boundaries, respectively. The attenuation dams will act as dry detention basins, with a combined extended storage available to effectively attenuate up to a 1:50-year post development flood, to 1:5-year pre-development flood levels.

These facilities will effectively manage and convey stormwater run-off of up to 1:100-year rainfall events to minimize the risk of flooding of internal and downstream properties.

The attenuation dam outlets will be connected to the existing stormwater channel to the south-east of the site, via a new culvert. The outlet capacity of the attenuation dams will be limited to 692l/s. The outlet structure of the attenuation facility will be designed to govern the outflow to not exceed the 1: 5-year pre-development flow for the overall development.

The dam sizing calculations using the ABT Grigg method is summarized in Table 3. A minimum combined storage volume of 2038m³ is required.

$V_{st} = 60\left(\frac{1+m}{2}\right) q_{pa} t_{ca} (1-a)^2$		
Ratio Hydrograph Recession Time =	m	1
Post-dev Peak Discharge (1:50) =	q_{pa} (in m^3/s)	3.512
Post-dev Time of Concentration =	t_{ca} (in min)	15.000
Peak Discharge (1:5 Pre) =	q_{pb} (in m^3/s)	0.692
q_{pb}/q_{pa} =	a	0.197
Storage Volume Required V_{st} =	**V_{st} (in m^3)**	**2038**

Table 3: Dam Sizing Calculations

The attenuation dams will be constructed with an emergency overflow which has the capacity to discharge the run-off generated from rainfall events larger than 1:50 years, up to a maximum of a 1:100-year rainfall event. The emergency outflow will release excess run-off as surface discharge onto the surrounding area which discharges into the existing open stormwater canal to the south-east of the site.

The total attenuation volume provided on site is 2359m^3. Split between:
1) Dam A – 1146m^3 and
2) Dam B – 1213m^3

This satisfies the minimum requirement, and the internal catchments will be shaped to contribute proportionally to the respective ponds.

4.4. BEST MANAGEMENT PRACTICES

Best Management Practices (BMP's) will be incorporated in the stormwater design to reduce the strain on existing infrastructure, and aid in improvement of runoff quality. This includes, but is not limited to the following:

- Settling of suspended solids within attenuation ponds
- Promotion of infiltration and recharge of water table due to raised outlet.
- Landscape design in support of stormwater control and quality improvement.
- Sufficient erosion control at all emergency escapes, in- and outlets
- Shaping of landscaped areas to function as open channels to convey runoff.

4.5. MAINTENANCE PROCEDURES

It is imperative that the stormwater infrastructure is maintained and cleaned at regular intervals to ensure that the system operates according to the design specifications and guidelines. In order to achieve this desired level of operation, regular inspections will be required to assess and survey the state of the stormwater infrastructure.

It is imperative that the personnel that conducts the routine inspections and maintenance procedures adhere to proper Health and Safety standards, as per the Occupational Health and Safety Act (*Act 85 of 1993*).

On completion of the project, the developer will accept responsibility for the maintenance of all internal stormwater infrastructure.

A typical stormwater infrastructure operation and maintenance schedule is included in ***Appendix D.***

5. CONCLUSION

The proposed stormwater design, as discussed in this document, indicates that the development's stormwater design will aim to improve stormwater run-off in terms of water quality and quantity, as to not increase strain on the existing municipal system.

The stormwater design and management plan complies with the policies and guidelines outlined in Section 1 of this document and is considered to be aligned with the requirements of the local municipality.

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APPENDIX A

Topographical Survey

LEGEND

CL	COVER LEVEL
EP	ELECTRIC POLE
IL	INVERT LEVEL
LP	LIGHT POLE
TOD	TOP OF DUCT
TOP	TOP OF PIPE

CONTROL CO-ORD LIST WG 25

NAME	Y CONST -0	X 3 700 000	Z	DESCRIPTION
LP1	57783.97	42324.38	46.072	12MM RIP IN TAR
LP2	57900.88	42495.77	44.276	12MM RIP IN TAR
T429	56641.80	43751.24	50.400	TRIG BEACON
T428	57763.82	44244.43	52.200	TRIG BEACON

CADASTRAL CO-ORD LIST WG 25

NAME	Y CONST -0	X 3 700 000	Z	DESCRIPTION
A	−57726.19	42314.70	44.93	20mm Iron Peg
B	−57896.09	42557.68	44.32	15mm Iron Peg
C (B)	−57318.19	42961.62	44.33	"
D	−57888.28	43775.99	42.12	"
E	−57867.30	43767.74	42.45	20mm Iron Peg in Concrete Block
F	−57847.16	43766.75	42.34	"
G	−57843.28	43777.87	42.42	"
H	−57850.56	43794.41	42.50	"
J	−57895.69	43820.14	43.99	"
K	−57925.77	43859.93	46.33	20mm Iron Peg in Concrete
L	−57696.04	44050.02		Pipe in Concrete
M	−57633.08	44117.13		"
N	−56693.20	43518.65	45.41	20mm Iron Peg in Concrete Block
P	−57212.01	42913.97	45.12	15mm Iron Peg
Q (A)	−57262.56	42855.06	44.76	"
R	−57105.73	43781.33		"
S	−57069.11	43758.01	43.23	"

CLIENT

KLS

PROJECT

ERF 8741
WELLS ESTATE

MATT PEPE & ASSOCIATES cc

TOPOGRAPHICAL & ENGINEERING SURVEYORS

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SURVEY PLAN

SCALE 1:500 SYSTEM: WG 25 DATUM: MSL

SURVEYOR A & LA PEPE	DRAWN LA PEPE	DATE 4 FEBRUARY 2011

DRG No. JB2757 REV No

APPENDIX B

Preliminary Stormwater Calculations

CONSULTING ENGINEERS
progress delivered

POST DEVELOPMNET FLOOD RUNOFF CALCULAITONS

Project no:	25067		
Project:	Erf 10301, Wells Estate		
Calculation Method:	Rational, Alternative 3		
Calculated by:	TK		
Date:	2025/10/2		
Checked By:	HK		Rev A
Date:	2025/10/2		

Catchment characteristics (All methods)

Description of catchment	Warehouse & Loading Yard, primarily impermeable surface
Name of watercourse (If applicable)	

Physical characteristics			Meteorological characteristics		
Size of catchment (A)	0.166	km^2	Rainfall region:		
Longest watercourse (L)	0.550	km	SAWS Rainfall Grid Coordinates	33°50' S; 25°37' E	
Average slope (S_{av})	0.010	m/m	Nearest Weather Station number	N/A	
Dolomitic area ($D_{\%}$)	0%	%	Mean annual precipitation (MAP)	423	mm
			2-year return period daily rainfall (M)		mm
Area distribution factors			Days of thunder per year (R)	3	days/year
Rural (α)	Urban (β)	Lakes (γ)	Notes:		
0.000	1.000	0.000			

Time of concentration (T_c) (All Methods)

Overland/Sheet flow $(= P_{IT} \times ARF_T)$		Defined watercourse		Notes:
$T_c = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$		$T_c = \left(\frac{0{,}87L^2}{1000S_{av}}\right)^{0.385}$		Minimum Tc of 15minutes (0.25 hours).
				Choose Between Defined and Overland for TC
0.250	hours	0.250	hours	

Catchment run-off coefficients (Rational Methods)

Rural				Urban			
Surface slope	%	Factor	C_S	**Description**	%	Factor	C_S
Vleis and pans (<3%)	0.0%	0.03	0.000	Lawns in sandy soil, flat grade(<2%)	10.00%	0.10	0.010
Flat Areas (3-10%)	0.0%	0.08	0.000	Lawns in sandy soil, steep grade(>7%)	0.00%	0.20	0.000
Hilly (10-30%)	0.0%	0.16	0.000	Lawns in heavy soil, flat grade(<2%)	0.00%	0.17	0.000
Steep Areas (>30%)	0.0%	0.26	0.000	Lawns in heavy soil, steep grade(>7%)	0.00%	0.35	0.000
Total	0.0%	-	0.000	Residential: Houses	0.00%	0.50	0.000
Permeability	%	Factor	C_p	Residential: Flats	0.00%	0.70	0.000
Very permeable	0.0%	0.04	0.000	Light industry	50.00%	0.80	0.400
Permeable	0.0%	0.08	0.000	Heavy industry	0.00%	0.90	0.000
Semi-permeable	0.0%	0.16	0.000	Business complexes in the city centre	0.00%	0.95	0.000
Impermeable	0.0%	0.26	0.000	Business complexes in suburban areas	0.00%	0.70	0.000
Total	0.0%	-	0.000	Street area	40.00%	0.95	0.380
Vegetation	%	Factor	C_v	Maximum Flood	0.00%	1.00	0.000
Thick bush and plantation	0.0%	0.04	0.000	Total (C_2)	100.00%	-	0.790
Light bush and farm-lands	0.0%	0.11	0.000	Notes:			
Grasslands	0.0%	0.21	0.000				
No vegetation	0.0%	0.28	0.000				
Total	0.0%	-	0.000				

Adjustment of run-off coefficients (Rational Methods)

Return period (years), T	2	5	10	20	50	100	
Rural run-off coefficient, C_1 $(C_1 = C_S + C_P + C_V)$	0.000	0.000	0.000	0.000	0.000	0.000	
Adjustment of above for dolomitic areas, C_{1D} $\left(= C_1(1 - D_{\%}) + C_1 D_{\%}\left(\sum\left(D_{factor} \times C_{S\%}\right)\right)\right)$	0.000	0.000	0.000	0.000	0.000	0.000	
Adjustment factor for initial saturation of rural areas, F_t	0.750	0.800	0.850	0.900	0.950	1.000	
Adjusted rural run-off coefficient, C_{1T} $(= C_{1D} \times F_t)$	0.000	0.000	0.000	0.000	0.000	0.000	
Combined run-off coefficient, C_T $(= \alpha C_{1T} + \beta C_2 + \gamma 1)$	0.790	0.790	0.790	0.790	0.790	0.790	

Flood run-off: Rational method (Alternative 3)

Return Period (years), T	2	5	10	20	50	100	
Point rainfall (mm), P_T	8.5	12.5	15.7	19.1	24.1	28.5	33.3
Point intensity (mm/hour), P_{IT} (= P_T/T_C)	34.00	50.00	62.80	76.40	96.40	114.00	
Area reduction factor (%), ARF_T	100	100	100	100	100	100	
Average intensity (mm/hour), I_T	34.00	50.00	62.80	76.40	96.40	114.00	
Peak flow (m^3/s) $Q_T = \frac{C_T I_T A}{3{,}6}$	1.24	1.82	2.29	2.78	3.51	4.15	

APPENDIX C

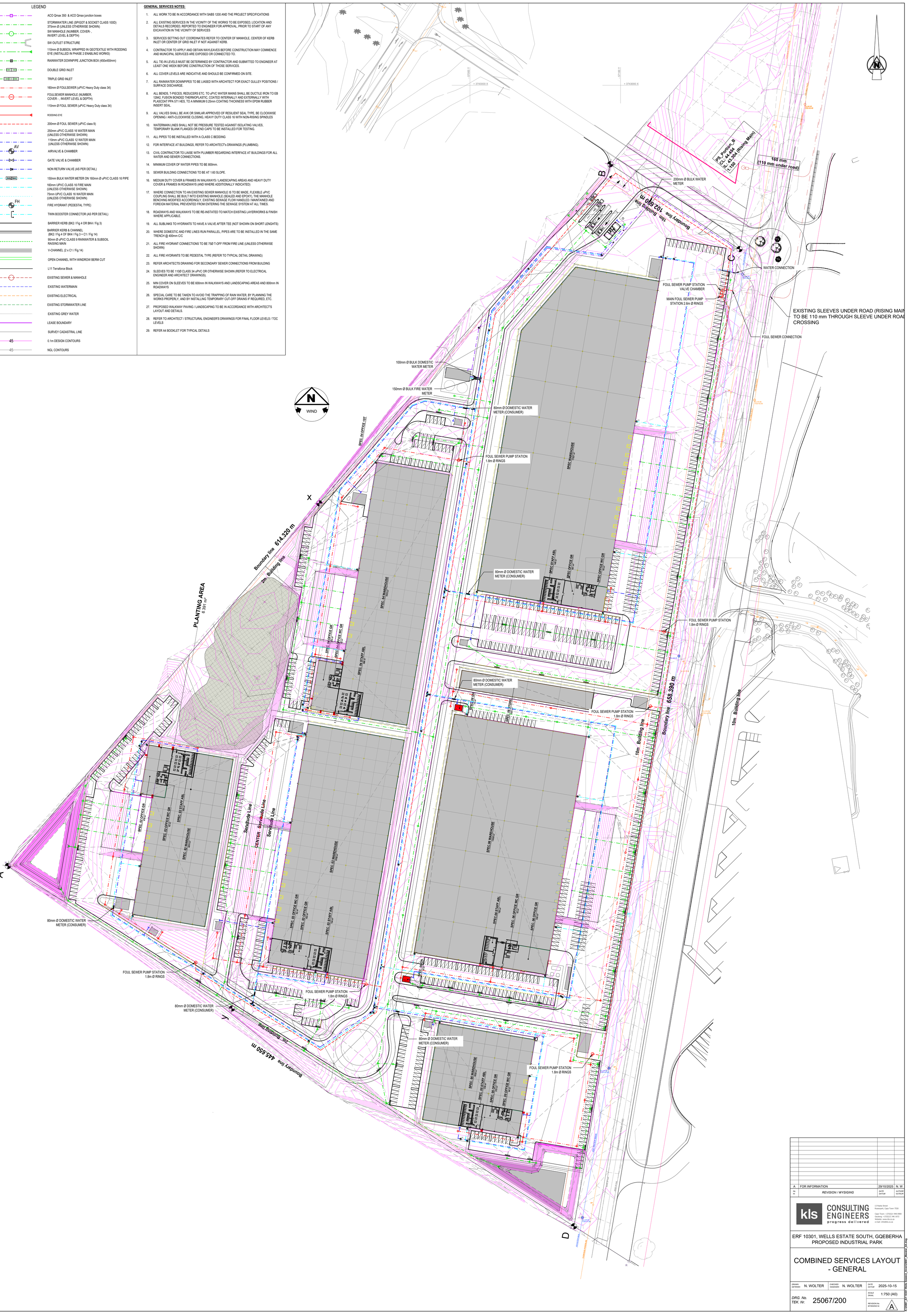
Preliminary Services Layout

LEGEND

- ACO Qmax 350 & ACO Qmax junction boxes
- STORMWATER LINE (SPIGOT & SOCKET CLASS 100D) 375mm Ø (UNLESS OTHERWISE SHOWN)
- SW MANHOLE (NUMBER, COVER- , INVERT LEVEL & DEPTH)
- SW OUTLET STRUCTURE
- 110mm Ø SUBSOIL WRAPPED IN GEOTEXTILE WITH RODDING EYE (INSTALLED IN PHASE 2 ENABLING WORKS)
- RAINWATER DOWNPIPE JUNCTION BOX (450x450mm)
- DOUBLE GRID INLET
- TRIPLE GRID INLET
- 160mm Ø FOULSEWER (uPVC Heavy Duty class 34)
- FOULSEWER MANHOLE (NUMBER, COVER - , INVERT LEVEL & DEPTH)
- 110mm Ø FOUL SEWER (uPVC Heavy Duty class 34)
- RODDING EYE
- 200mm Ø FOUL SEWER (uPVC class 9)
- 250mm uPVC CLASS 16 WATER MAIN (UNLESS OTHERWISE SHOWN)
- 110mm uPVC CLASS 12 WATER MAIN (UNLESS OTHERWISE SHOWN)
- AV — AIRVALVE & CHAMBER
- GATE VALVE & CHAMBER
- NON RETURN VALVE (AS PER DETAIL)
- 150mm BULK WATER METER ON 160mm Ø uPVC CLASS 16 PIPE
- 160mm UPVC CLASS 16 FIRE MAIN (UNLESS OTHERWISE SHOWN)
- 75mm UPVC CLASS 16 WATER MAIN (UNLESS OTHERWISE SHOWN)
- FH — FIRE HYDRANT (PEDESTAL TYPE)
- TWIN BOOSTER CONNECTOR (AS PER DETAIL)
- BARRIER KERB (BK2 / Fig 4 OR BK4 / Fig 3)
- BARRIER KERB & CHANNEL (BK2 / Fig 4 OF BK4 / Fig 3 + C1 / Fig 14)
- 90mm Ø uPVC CLASS 9 RAINWATER & SUBSOIL RAISING MAIN
- V-CHANNEL (2 x C1 / Fig 14)
- OPEN CHANNEL WITH WINDROW BERM CUT
- L11 Terraforce Block
- EXISTING SEWER & MANHOLE
- EXISTING WATERMAIN
- EXISTING ELECTRICAL
- EXISTING STORMWATER LINE
- EXISTING GREY WATER
- LEASE BOUNDARY
- SURVEY CADASTRAL LINE
- 45 — 0.1m DESIGN CONTOURS
- 45 — NGL CONTOURS

GENERAL SERVICES NOTES:

1. ALL WORK TO BE IN ACCORDANCE WITH SABS 1200 AND THE PROJECT SPECIFICATIONS
2. ALL EXISTING SERVICES IN THE VICINITY OF THE WORKS TO BE EXPOSED, LOCATION AND DETAILS RECORDED, REPORTED TO ENGINEER FOR APPROVAL, PRIOR TO START OF ANY EXCAVATION IN THE VICINITY OF SERVICES
3. SERVICES SETTING OUT COORDINATES REFER TO CENTER OF MANHOLE, CENTER OF KERB INLET OR CENTER OF GRID INLET IF NOT AGAINST KERB.
4. CONTRACTOR TO APPLY AND OBTAIN WAYLEAVES BEFORE CONSTRUCTION MAY COMMENCE AND MUNICIPAL SERVICES ARE EXPOSED OR CONNECTED TO.
5. ALL TIE-IN LEVELS MUST BE DETERMINED BY CONTRACTOR AND SUBMITTED TO ENGINEER AT LEAST ONE WEEK BEFORE CONSTRUCTION OF THOSE SERVICES.
6. ALL COVER LEVELS ARE INDICATIVE AND SHOULD BE CONFIRMED ON SITE.
7. ALL RAINWATER DOWNPIPES TO BE LIASED WITH ARCHITECT FOR EXACT GULLEY POSITIONS / SURFACE DISCHARGE.
8. ALL BENDS, T-PIECES, REDUCERS ETC. TO uPVC WATER MAINS SHALL BE DUCTILE IRON TO EB 12842, FUSION BONDED THERMOPLASTIC, COATED INTERNALLY AND EXTERNALLY WITH PLASCOAT PPA 571 HES, TO A MINIMUM 0.25mm COATING THICKNESS WITH EPDM RUBBER INSERT SEAL.
9. ALL VALVES SHALL BE AVK OR SIMILAR APPROVED OF RESILIENT SEAL TYPE, BE CLOCKWISE OPENING / ANTI-CLOCKWISE CLOSING, HEAVY DUTY CLASS 16 WITH NON-RISING SPINDLES
10. WATERMAIN LINES SHALL NOT BE PRESSURE TESTED AGAINST ISOLATING VALVES, TEMPORARY BLANK FLANGES OR END CAPS TO BE INSTALLED FOR TESTING.
11. ALL PIPES TO BE INSTALLED WITH A CLASS C BEDDING
12. FOR INTERFACE AT BUILDINGS, REFER TO ARCHITECT's DRAWINGS (PLUMBING).
13. CIVIL CONTRACTOR TO LIAISE WITH PLUMBER REGARDING INTERFACE AT BUILDINGS FOR ALL WATER AND SEWER CONNECTIONS.
14. MINIMUM COVER OF WATER PIPES TO BE 800mm.
15. SEWER BUILDING CONNECTIONS TO BE AT 1:60 SLOPE.
16. MEDIUM DUTY COVER & FRAMES IN WALKWAYS / LANDSCAPING AREAS AND HEAVY DUTY COVER & FRAMES IN ROADWAYS (AND WHERE ADDITIONALLY INDICATED)
17. WHERE CONNECTION TO AN EXISTING SEWER MANHOLE IS TO BE MADE, FLEXIBLE uPVC COUPLING SHALL BE BUILT INTO EXISTING MANHOLE (SEALED AND EPOXY), THE MANHOLE BENCHING MODIFIED ACCORDINGLY, EXISTING SEWAGE FLOW HANDLED / MAINTAINED AND FOREIGN MATERIAL PREVENTED FROM ENTERING THE SEWAGE SYSTEM AT ALL TIMES.
18. ROADWAYS AND WALKWAYS TO BE RE-INSTATED TO MATCH EXISTING LAYERWORKS & FINISH WHERE APPLICABLE.
19. ALL SUBLINKS TO HYDRANTS TO HAVE A VALVE AFTER TEE (NOT SHOWN ON SHORT LENGHTS)
20. WHERE DOMESTIC AND FIRE LINES RUN PARALLEL, PIPES ARE TO BE INSTALLED IN THE SAME TRENCH @ 400mm C/C
21. ALL FIRE HYDRANT CONNECTIONS TO BE 75Ø T-OFF FROM FIRE LINE (UNLESS OTHERWISE SHOWN)
22. ALL FIRE HYDRANTS TO BE PEDESTAL TYPE (REFER TO TYPICAL DETAIL DRAWING)
23. REFER ARCHITECTS DRAWING FOR SECONDARY SEWER CONNECTIONS FROM BUILDING
24. SLEEVES TO BE 110Ø CLASS 34 uPVC OR OTHERWISE SHOWN (REFER TO ELECTRICAL ENGINEER AND ARCHITECT DRAWINGS).
25. MIN COVER ON SLEEVES TO BE 600mm IN WALKWAYS AND LANDSCAPING AREAS AND 800mm IN ROADWAYS
26. SPECIAL CARE TO BE TAKEN TO AVOID THE TRAPPING OF RAIN WATER, BY PLANNING THE WORKS PROPERLY, AND BY INSTALLING TEMPORARY CUT-OFF DRAINS IF REQUIRED, ETC.
27. PROPOSED WALKWAY PAVING / LANDSCAPING TO BE IN ACCORDANCE WITH ARCHITECT'S LAYOUT AND DETAILS.
28. REFER TO ARCHITECT / STRUCTURAL ENGINEER'S DRAWINGS FOR FINAL FLOOR LEVELS / TOC LEVELS
29. REFER A4 BOOKLET FOR TYPICAL DETAILS



A	FOR INFORMATION	29/10/2025	N. W.
No. Nr.	REVISION / WYSIGING	DATE DATUM	AUTHOR OUTEUR

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ERF 10301, WELLS ESTATE SOUTH, GQEBERHA
PROPOSED INDUSTRIAL PARK

COMBINED SERVICES LAYOUT - GENERAL

DRAWN GETEKEN	N. WOLTER	CHECKED NAGESIEN	N. WOLTER
DATE DATUM	2025-10-15		
SCALE SKAAL	1:750 (A0)		
DRG. No. TEK. Nr.	25067/200	REVISION No. WYSIGING Nr.	A

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APPENDIX D

Operation and Maintenance Schedule

PROJECT NO: 25067
ERF 10301, WELLS ESTATE, GQEBERHA
STORMWATER INFRASTRUCTURE: OPERATION AND MAINTENANCE SCHEDULES

kls CONSULTING ENGINEERS
progress delivered

INSPECTION DONE BY: _____

DATE OF INSPECTION: _____

DATE OF PREVIOUS INSPECTION: _____

ROUTINE STORMWATER INFRASTRUCTURE MAINTENANCE CHECKLIST		ACCEPTABLE	MAINTENANCE REQUIRED	ENGINEERING INPUT REQUIRED	SCHEDULE	COMMENTS: *Note location, descriptions and relevant information*
DOWNPIPES AND GULLIES	Downpipes are in tact					
	Gullies are free from debris and blockages					
	Structure is in good condition					
MANHOLES & INLETS	Structures in good condition, without cracks or visible damage					
	Structure free of rubbish, debris and sand					
	Cover and frame secure					
	No sign of pollution or spills					
	Sand traps are clean (where applicable)					
STORMWATER PIPES	No visible damage to pipes					
	Pipes are free flowing and clear of blockages					
	No visible signs of scour, pollution, etc.					
OPEN CHANNELS/ SWALES	No potential obstructions or blockages in channel					
	All embangments/structures are in tact					
	Vegetation is kept					

STORMWATER DETENTION POND OPERATION AND MAINTENANCE SCHEDULE		YES/NO	CLEAN	REPAIR	REBUILD	SCHEDULE	COMMENTS: *Note location, descriptions and relevant information*
	ACTIVITY	CHECK	REMEDIAL ACTION				
SEDIMENT/ CONTAMINANT CONTROL	Monitor Sediment accumulation in the detention facility and forebays						
	Remove debris, litter and excess leaves from pond						
	Ensure in- and outlet structures are free of blockages						
	Remove sediment build up from all in- and outlet structures as well as pond invert						
	Inspect for signs of pollutants						
STRUCTURAL	Inspect for structural damage to all in- and outlet structures						
	Ensure all covers to structures are intact						
	Inspect for signs of seepage/leakages						
	Perform structural repairs to inlet and outlet structures, spillways and structural erosion control*						
EROSION CONTROL	Inspect for erosion of banks and invert of pond						
	Repair undercut eroded areas*						
	Reinstate undercut or eroded areas						
VEGETATION	Seed or sod to restore damaged vegetation						
	Mow grassed side slopes and surfaces						
	Inspect and clear vegetation overgrowth obstructing flow						
	Manually remove invasive plant species and weed growth						

**Temporary measures to be implemented after significant storm events, if permanent measures are not feasible at the time*

OPERATION AND MAINTENANCE SCHEDULE	
Routine	*Scheduled inspections, in line with development's facilities management*
Following Significant Storms	*Additional inspection to be done after significant storm events*
Annualy	*Annual inspection,to be scheduled prior to rainfall season*
As required, based on inspections	*Remedial action to be taken based on inspections*

RECOMMENDATIONS AND NOTES:

Signed (Inspector)

Disclaimer:
The operation and maintenance schedule is to be implemented by the owner/facilities manager. It is provided as a general guideline only, intended to assist in the optimal functioning of the pond as per intended design. It is important to note that each facility is unique, and maintenance needs may vary based on factors such as size, climate and region. The maintenance schedule does not guarantee the prevention of potential issues. It is advised that the maintenance scehdule is to be reviewed and adjusted regularly, as required. For complex issues, seek advice from a qualified proffesional. The creators of this maintenance scehdule are not liable for any damage or loss resulting in the implementation thereof. The property owner assume all responsibility for care and maintenance of their pond/s, and should excercise caution in performing maintenance tasks. Operational and maintenance tasks are to be performed in accordance with all provisions of the Occupational Health and Safety Act (Act 85 of 1993).