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IMPACT. ENGINEERED.

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Our Ref: 503048/22.6/MB/gc

03 March 2022

Power Construction (Pty) Ltd.
PO Box 129
Blackheath
7580

Attention : Mr Steven Levey

Dear Sir

CONSTRUCTION OF INTERNAL CIVIL ENGINEERING SERVICES FOR ERVEN 20128 - 20129: THE VILLAGE RIDGE: STORMWATER MANAGEMENT PLAN

Below please find the Stormwater Management Plan for The Village Ridge, based on the latest preliminary town planning layout as received from Formaplan CC Town Planners, refer to enclosed Drawing no. Village R 1.5, dated February 2022.

1. INTRODUCTION

1.1 Background to Report

The George Municipal area has seen a period of rapid growth in recent years which has had the effect that the demand for affordable housing has dramatically increased.

Power Construction, part of the Power Group of companies, initially proposed the development of an affordable housing scheme in the central George Municipal area which consisted of 189 serviced units. Due to a directive from the Department of Environmental Affairs and Development Planning, the developers were accused of the destruction of wetlands areas when construction commenced.

Since then, a new layout has been proposed where the development will be outside of the demarcated wetland boundaries. The amended layout consists of 158 serviced units, including 155 residential and 3 business zoned sites. Zutari will look at the road design and civil services for the proposed development which includes the necessary infrastructure to collect and control stormwater runoff where required.

1.2 General and Development Location

The proposed development is situated at the King George Park, South East of Kingswood Golf Estate and West from the George CBD, refer to Figure 1 as well as the enclosed Drawing no. 503048-0000-DRG-CC-0001 indicating the extent of the works (Annexure A). The climate is moderate, with rainfall occurring throughout the year and the mean annual precipitation being in the order of 662mm. The average midday temperature ranges from 18.2°C in July to 27.6°C in February.

Figure 1 : Locality Map

2. OBJECTIVE OF REPORT

The objective of this statement is to :

- Analyze the local catchment area in order to :
  - Determine the 1:5 year (minor system) flow rates at points of interest; and
  - Determine sizes for stormwater drainage pipes, culverts and / or channels within the proposed development.
- Make recommendations with respect to the discharge of runoff.
- Prepare drawings showing the outlet structure components and possible mitigating measures for stormwater drainage and erosion control i.e. energy dissipation and attenuation.

3. DESIGN CRITERIA AND STANDARDS

3.1 Design criteria

The following document serves as the basis for the detail design criteria and standards:

Guidelines for Human Settlement Planning and Design ("Red Book").

3.2 Construction specifications

All materials and workmanship shall comply with the specifications as set out in the South African National Standards for Civil Engineering (SANS).

3.3 Stormwater

The stormwater system forms an integral part of the road and urban planning layout. The system rests on three legs, the minor system, the major system and an emergency system. Minor storms are catered for in the pipe system while major storms are routed through a linked system of roads and public open spaces using attenuation techniques. The emergency system recognizes failure of the minor and major system by storms greater than provided for in the major system or in the event of malfunction of the minor system by providing continuous overland flow routes to minimize flooding of residential areas.

3.3.1 Minimum design criteria for stormwater system

The criteria to be used for the design of the system are the following:

- Minor system : 5 year return period conveyed in an underground pipe system. Preferably the overland flow shall not exceed a depth of 200mm;
- Major system : 50 year return period. The difference between the 5 year and 50 year to be conveyed in the road prism with a flow depth not exceeding 150mm within the road reserve width;
- The minimum gradients for pipelines will be designed to give a minimum velocity of 0.7m per second with the pipes flowing full;
- The maximum flow velocity shall be 3.5m per second;
- Major Stormwater overflows are to be provided to convey the excess storm water from the streets into designated public open spaces;
- Stormwater flow velocities in road ways will be kept as low as possible and related to the surface finish to prevent scour and erosion; and
- Roads will be graded to ensure free and continuous flow to the main Stormwater system and to prevent localized ponding at intersections.

3.3.2 Pipelines

- Stormwater pipes will generally be class 50D, 75D or 100D as required by the loading and installation conditions;
- Pipes will be laid on Class C bedding;
- The minimum cover on pipes will be 0.80m; and
- The minimum pipe diameter will be 450mm for longitudinal runs and catch pit connections.

3.4 Roads

The road system forms an integral part of the local area plan.

3.4.1 Design Criteria

The design criteria for roads are the following:

- Road reserve widths are 10m and 8m;
- Design life of the roads is 20 years;
- Subgrade CBR: 15 to 20;
- Subbase CBR: 45 minimum (processed crushed stone);
- Base course CBR: 80 minimum (processed crushed stone);
- Surfacing: Asphalt, paving;

- Minimum road longitudinal grade: 0.475%; and
- Minimum road cross fall: 2% depending on final road surfacing type.

3.5 Standard of Engineering Services to be Provided

Level of services regarding roads and stormwater are as follows:

3.5.1 Roads and stormwater

- Road widths will be 4.5m in 8m and 10m reserves
- Subgrade, Subbase and Base materials will be imported;
- Subsurface drainage will not be required;
- The underground piped stormwater drainage system will have a minimum of 450mm diameter;
- Where roads are surfaced, paving or asphalt surface will be provided.
- Combination kerbs, CK5 will be provided on the low side of all roads and BK2 and Channel, C1 at intersections or road crossings to drain stormwater towards catch pits.
- Barrier kerbs will be installed around bell mouths. Bellmouth radiuses will be a minimum of 6m.
- All stormwater drains will be provided with a sand trap of at least 500mm deep.

4. EXISTING STORMWATER NETWORK

Currently, stormwater exists within the boundaries of the proposed development, however, it will have to be abandoned/removed due to the existing road in the area which will be re-routed. The Camphersdrift River exists to the immediate east of the proposed development. This is the current catchment source point of the area. It flows towards the southwest where it merges with the Gwaing river, which in turn drains out into the ocean between Oubaai and Le Grand Golf estates.

The internal stormwater will be designed in such a manner that it follows the natural topography of the site, and the outflow will be dispersed via an energy dissipating outlet towards the southeast corner of the site and an attenuation pond situated at the northeast corner of the site where the overflow will disperse towards the existing wetland (Camfersdrift River).

If required, indigenous vegetation will be established to the specifications of stormwater wetlands plant material contained in various publications to assist in reducing the risk of erosion and the re-establishment of the wetland for the purpose of further stormwater attenuation. All ponds will be cordoned off for security and safety and necessary signage erected indicating the purpose of the ponds to raise awareness amongst the residents and public of the importance of stormwater control and treatment.

5. RUNOFF CALCULATION

The calculated stormwater runoff is as follows:

Description	The Village Ridge	
MAP (mm)	662mm	
Area	4.521 ha	
Design Period	1:5 years	
	Pre Development	Post Development
Runoff Q (l/s)	125.6	655.5
Dispersal areas	Camphersdrift River	Camphersdrift River

From the above it can be seen that there will be a moderate increase in volume of stormwater as a result of the proposed development.

6. PROPOSED DESIGN

The proposed layout of the development is still in draft format pending the finalization of a Water Use Licence (WULA) and Town Planning application. The final stormwater layout and detail design will be done as soon as the layout has been approved. Annexure A shows the proposed extent of the development as well as proposed coverage.

A conventional stormwater network consisting of stormwater catch pits, manholes and headwalls will convey the stormwater generated in the area towards the proposed energy dissipation outlets and attenuation pond. This will reduce the peak runoff towards the existing wetland (Camphersdrift River). Recently, a Wetland was identified within the development footprint area which will become a conservation area. A green corridor will also be running from the wetland all the way down to the Camphersdrift River allowing for access to animals such as frogs. Where the road crosses this corridor, access will be maintained by means of suitably sized precast culverts. Annexure C shows typical examples of energy dissipation and silt retention structures.

A site specific and detailed stormwater design including mitigating measures as described in this report will be done within this framework following the approval of the layout and may vary slightly from what is presented in this plan.

7. FLOODLINES

This proposed development project is not directly affected by any floodline.

8. SPATIAL PLANNING CONSIDERATIONS

It is proposed that the SDP take cognisance of the required stormwater management. This includes:

- Provision of stormwater escape routes between erven to direct minor and major flows towards the existing watercourse area;
- Roads linking the proposed site with the existing/proposed access road should not restrict stormwater run-off;

- No erven should be constructed too close to the existing watercourse to impede overland flows or be infringing on the National Water Act (1998) Section 144; and
- Incorporation of the existing watercourse and detention ponds in the final SDP, if applicable.

9. STORMWATER MANAGEMENT TECHNIQUES: DURING CONSTRUCTION

The stormwater surface run-off water will be managed carefully during construction. The following management techniques will be implemented:

- Temporary cut-off channels and berms;
- Routing of run-off towards the existing watercourse and current drainage routes;
- Erosion protection by means of gabions, Reno mattresses, Geofabric and/or any combination thereof;
- Compliance with a site specific Environmental Management Plan;
- Provision for dealing with water, in accordance with SABS 1200, will be stipulated in the Project Specification and Contract Documents. Of specific importance will be the following clauses:

    i. Clause 5.5 in SABS 1200 A;
    ii. Clause 5.3 in SABS 1200 AA;
    iii. Clause 5.1.3 in SABS 1200 D; and
    iv. Clause 5.1.2 in SABS 1200 DB.

10. STORMWATER MANAGEMENT TECHNIQUES: POST-CONSTRUCTION

The factors to consider in Stormwater Management falls broadly into two main categories, namely those related to quantity and those related to quality.

Any development brings about changes to the natural environment of a site, which in turn has an effect or disrupts the natural hydrological cycle. Changes include, among other:

- Increase in impermeable surfaces (roads, roofs etc.) resulting in lower infiltration, higher run-off volumes and velocities;
- Changes to natural flow routes through earthworks, infrastructure and shaping of terrain; and
- Changes to local water course environment and ecology.

The management of the increased run-off volumes and velocities is important as it can be detrimental to the receiving drainage system and communities downstream of the site, as it could cause severe erosion, property damage and even loss of life.
By restricting peak flows to pre-development levels, the *status quo* of the catchment is maintained. This could be achieved through the implementation of the following recommended practices, as described in paragraphs 10.1 and 10.2 below.

10.1 Infiltration and dissipation

By dispersing the run-off to various outfalls spread across the site, the recharge of the underground water table is promoted and the risk of erosion reduced.

Energy dissipating structures combined with Reno mattresses to prevent scouring and erosion will be utilised creating a high friction factor and thereby reduce the velocity of stormwater. Refer to Appendix C for further information regarding energy dissipation.

The installation of Reno mattresses and gabion boxes at outlets acts as energy dissipaters and stilling basins. These structures are also used as silt traps to prevent the loss of silt to the natural water courses. Silt that gets trapped on the Reno mattresses acts as a growing medium for vegetation which thereby accelerates the re-establishment of natural vegetation. This rehabilitated vegetation also acts as a dissipation medium, resulting in attenuated run-off.

10.2 Attenuation

Attenuation functions by the principle of allowing large flows of water to enter a facility, but limiting the outflow by having a small opening at the low point in the facility. The difference between in- and outflows is temporarily stored in an allocated space within which safe storage/detention can occur.

Attenuation in the form of a pond will be implemented at the northeast corner of the site. Rainwater within the proposed development will be accumulated inside the road prism and then flow into inlet works/catch-pits. The water will then proceed to the lowest point flowing out to the headwall at the attenuation pond. A "morning glory" pipe will be installed inside the pond which will allow for overflow into the existing stormwater pipe and will disperse at the existing headwall. The aim is to ensure the maximum percentage of rainwater flows to the catchment source point near the proposed development area.

11. CONCLUSION AND RECOMMENDATIONS

The planning of stormwater design elements must always be seen as a holistic process which incorporates much more than the infrastructural elements required in adequately dealing with stormwater. It affects a range of environmental goals and management principles and aims not only to mitigate negative impacts, but actively promote positive modifications in its application.

The design approach to be adopted for the proposed development and as discussed above, can be summarised as follows:

- Promotion of on-site infiltration;
- Minimise concentration of stormwater;
- Maintain pre-development run-off levels as far as possible;
- Enforcement of management principles;
- Identify escape routes for major floods;
- Responsible discharge of stormwater into downstream systems; and
- Allowing for the necessary attenuation where possible.

Certain aspects will require further consideration during the detail design stage, they are:

- Stormwater needs to be responsibly conveyed to the existing watercourse;
- Stormwater collected along the watercourse needs to be able to reach the existing drainage infrastructure downstream;
- The site development plan needs to adequately provide for servitudes to accommodate major flows;
- Maximisation of attenuation of the rainwater that most water can be catched.

As indicated in this report, the proposed site's stormwater will be managed in a responsible manner and be safely discharged into the surrounding drainage system, without any detrimental impacts to the environment or communities.

The application of this Plan on this particular project will lead to:

- Minimisation of the impacts of stormwater from new developments on receiving waters such as watercourses, wetlands, coastal waters, etc; and
- Prevention of further degradation of receiving waters by stormwater draining from existing developments, as well as in the long term the reversal of current undesirable stormwater impacts.

We trust that we have provided sufficient information for your purposes and look forward to hearing from you shortly. Please do not hesitate to contact us should you require any further information.

Yours faithfully

M BOTHA Pr Tech Eng
Technical Specialist
pp. Zutari

AC KEYSER Pr Tech Eng
Office Manager
pp. Zutari

Encl: Annexure A: Drawing No. 503048-0000-DRG-CC-0001, General Services Layout
Annexure B: Site Development Plan
Annexure C: Drawing No. 503048-0000-DRG-CC-0014, Energy Dissipation Details

ANNEXURE A

GENERAL SERVICES LAYOUT

BENCHMARK				
POINT	Y-Coord	X-Coord	HEIGHT	DESCRIPTION
RIDGE1	51351.964	3759351.907	225.399	HIC NXT TO MHR
RIDGE2	51268.109	3759412.360	225.136	12MM NEXT ROAD
RIDGE3	51310.863	3759391.330	225.366	12MM

PROPOSED STORMWATER DETENTION POND

NEW MANHOLE TO BE CONSTRUCTED ON EXISTING SEWER LINE

EXISTING STORMWATER HEADWALL

UPGRADED SEWER LINE TO BE CONNECTED TO EXISTING MANHOLE POSITION AND LEVEL TO BE CONFIRMED ON SITE

EXISTING 110mm Ø SEWER LINE TO BE UPGRADED TO 160mm Ø

PROPOSED STORMWATER OVERFLOW FROM DETENTION POND TO BE CONNECTED TO EXISTING STORMWATER PIPE

EXISTING 350mm Ø STORMWATER LINE TO BE UPGRADED TO 450mm Ø

CONSTRUCT NEW MANHOLE ON EXISTING STORMWATER LINE

NEW MANHOLE TO BE CONSTRUCTED ON EXISTING STORMWATER LINE

EXISTING STORMWATER LINE TO BE REROUTED

NEW MANHOLES TO BE CONSTRUCTED ON EXISTING SEWER LINE

DALMARY ST

MILTON ST

LOCH KATRINE STREET

RUSKIE ST

GREEN CORRIDOR

GLEN MASSAN STREET

MILTON STREET

GLEN BRANTER STREET

GARTMORE STREET

LOCH LOMONDY AVENUE

KING GEORGE DRIVE

Rem. Erf 20958

9356

21020

21026

21027

21014

21025

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GENERAL NOTES:

1. ALL CONSTRUCTION MUST BE DONE IN ACCORDANCE WITH SANS 1200.
2. FOR SEWER LAYOUT SEE DRG NO. 503048-0000-DRG-CC-0002.
3. FOR WATER LAYOUT SEE DRG NO. 503048-0000-DRG-CC-0003.
4. FOR ROADS AND STORMWATER LAYOUT SEE DRG NO. 503048-0000-DRG-CC-0004.
5. FOR ROADS DETAILS SEE DRG NO. 503048-0000-DRG-CC-0012 & 0013.
6. FOR STORMWATER DETAILS SEE DRG NO. 503048-0000-DRG-CC-0014 & 0015.
7. FOR SEWER DETAIL PLAN SEE DRG. 503048-0000-DRG-CC-0008 & 009.

LEGEND:

PROPOSED	EXISTING
SEWER PIPE LINE	BENCHMARK
SEWER MANHOLE	SEWER PIPE LINE
SEWER ERF CONNECTION	SEWER MANHOLE
WATER PIPE LINE	WATER PIPE LINE
FIRE HYDRANT	FIRE HYDRANT
VALVE	VALVE
WATER ERF CONNECTIONS	WATER ERF CONNECTIONS
STORMWATER PIPE	FENCE
CATCHPIT	50 YEAR FLOOD LINE
STORMWATER MANHOLE	100 YEAR FLOOD LINE
STORMWATER PIPE TO DETENTION POND	
SILT RETENTION AND ENERGY DISSIPATER HEADWALL	
"STOP" - ROAD SIGN	
BARRIER KERB & CHANNEL	
MOUNTABLE KERB (MK10)	
COMBINATION KERB (CK 5)	

POND BUFFERING	
	DELINEATED WETLANDS
	19m BUFFERS

RESPONSIBLE PERSONS			
	NAME	SIGNATURE	DATE
DRAWN			
DESIGNED			
CHECKED			

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CLIENT

POWER GROUP

REV	DATE	REVISION DETAILS	APPROVED
A	15/10/2020	FOR APPROVAL	AC KEYSER
0	05/5/2021	FOR CONSTRUCTION	AC KEYSER
1	25/5/2021	REVISED ERF CONNECTIONS	AC KEYSER
A	26/8/2021	NEW CADASTRAL AND SERVICES ADDED	AC KEYSER
B	6/9/2021	NEW CADASTRAL AND SERVICES ADDED	AC KEYSER
C	29/11/2021	PREFERED LAYOUT AND AS-BUILT SERVICES	AC KEYSER
D	31/1/2022	REVISED LAYOUT WITH NEW DESIGN	AC KEYSER
E	22/2/2022	REVISED LAYOUT AND STORMWATER	AC KEYSER

SCALE	SIZE	
1:500	A1	FOR DISCUSSION NOT FOR CONSTRUCTION

DRAWN	APPROVED
M RICHARDS	DATE
DESIGNED: G COETZEE	
REVIEWED: M BOTHA	AC KEYSER ECSA-200670108

PROJECT

THE VILLAGE RIDGE

TITLE

GENERAL SERVICES LAYOUT

DRAWING NUMBER

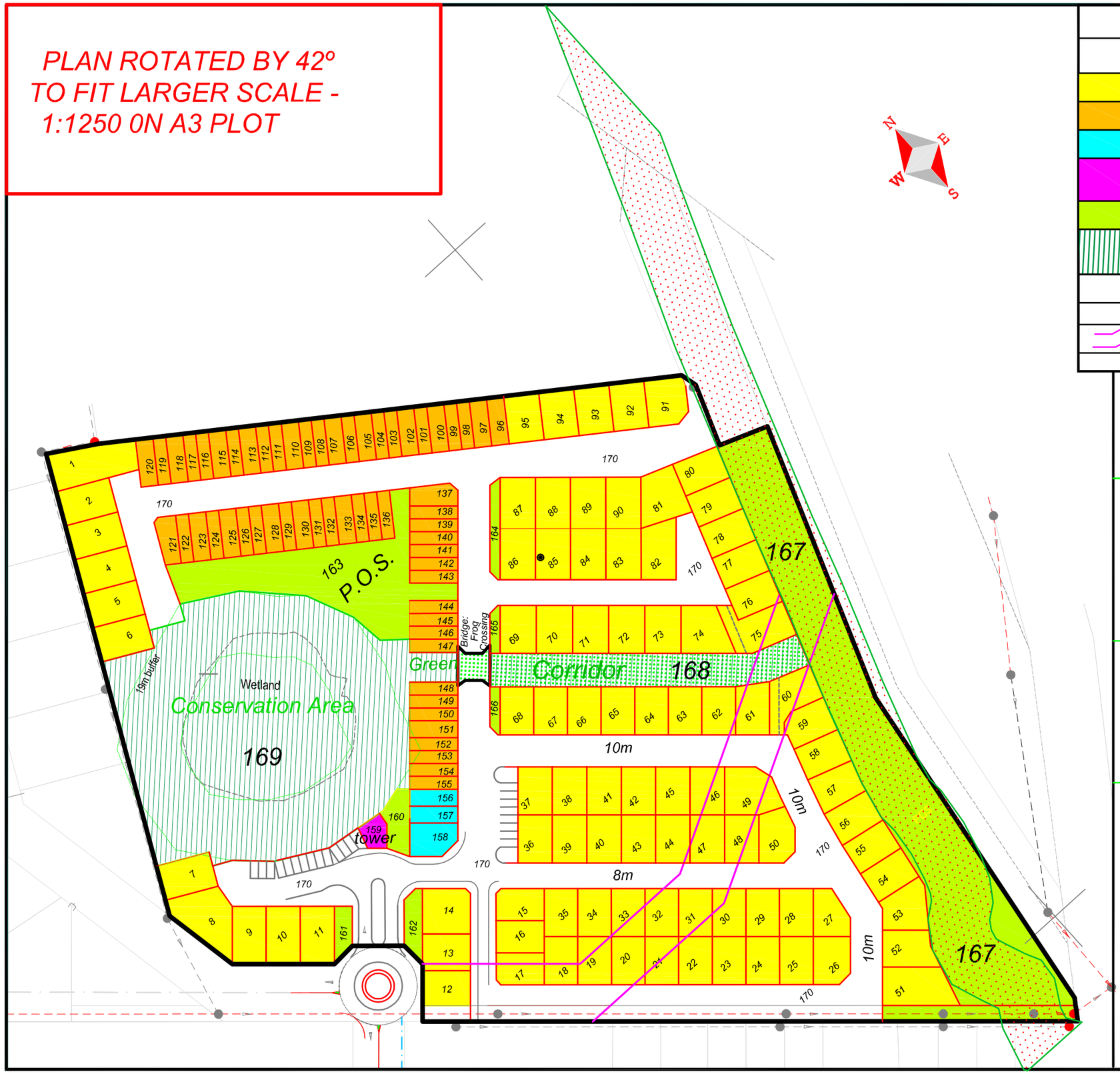
PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
503048	0000	DRG	CC	0001	E

Plot Date: 3/3/2022 12:31:27 pm Office: ZAGRJ Filename: P:\PROJECTS\503048 VILLAGE RIDGE ESTATES DEL DES\03 CAD\DRAWINGS\FOR DISCUSSION\2022-02-21\503048-0000-DRG-CC-0001REVE.DWG

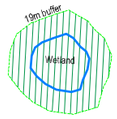
ANNEXURE B

SITE DEVELOPMENT PLAN

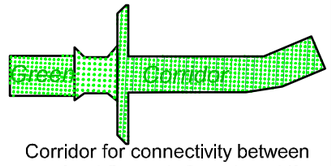
PLAN ROTATED BY 42º
TO FIT LARGER SCALE -
1:1250 0N A3 PLOT



Legend					
Zoning		ERF Nos	No. erven	Area m²	%
	Single Residential Zone I	AS INDICATED ON PLAN	95	16 513	36.53
	General Residential Zone III		60	4 035	8.93
	Business Zone III		3	304	0.67
	Utility Zone (Cell PhoneTower)		1	69	0.15
	Open Space Zone I		8	6 175	13.66
	Open Space Zone III (conservation area-froggs)		2	7 598	16.80
	Transport Zone II		1	10 517	23.26
TOTAL				45 210	100
The portion of Loch Lomond Closed by Municipality					
SEE ATTACHED SCHEDULE FOR ERF SIZES.					



Wetland flat area with 19m Buffer Area: Scale reduced



Corridor for connectivity between wetland flat and Camphersdrift wetland
Scale reduced

19m Buffer Area from river wetland: Scale reduced

PHASING OF DEVELOPMENT

STILL TO BE DETERMINED

NOTE:
All measurements on this plan are approximate and must be verified by a landsurveyor.

Client: Klient:

VILLAGE
RIDGE ESTATE

FORMAPLAN cc
STADS- & STREEKSBEPLANNERS
TOWN- & REGIONAL PLANNERS
P.O. Box 9824, George 6530 / 8 St John St
Tel: (044) 873-4395 Faks: (044) 874-5632

Project: Projek:
Village Ridge Estate
Residential Development

Title: Titel:
Proposed Rezoning, Subdivision Plan - Amendment of Approval.

Property: Eiendom:
Erven 21028 & 21029, Now Erf 28930, GEORGE.

Scale: Skaal: 1 : 1250 on A3 Plot

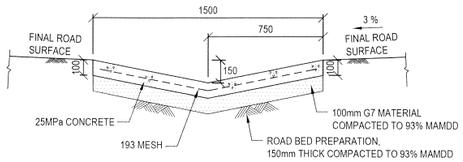
Drawing Number: Tekening Nommer:
Village R 1.5

Date: Datum:
February 2022

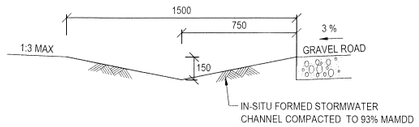
ANNEXURE C

ENERGY DISSIPATION DETAILS

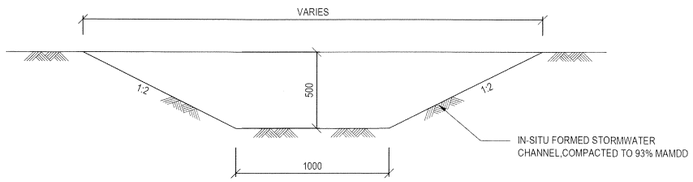
NOTE :
1. CAST CHANNEL IN ALTERNATIVE PANELS OF 3m EACH.
2. LAYER WORKS SHOULD BE 2% CEMENT STABILIZED, 500mm WIDE ON BOTH SIDES OF CHANNEL



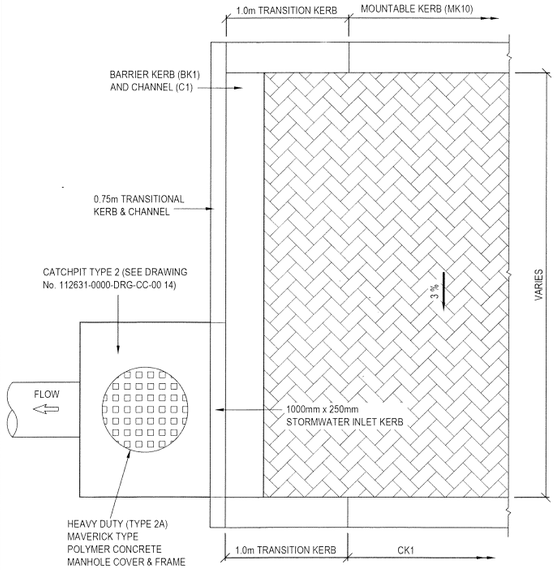
DETAIL C
DETAIL OF CONCRETE STORMWATER CHANNEL IN SERVITUDE
SCALE 1:20



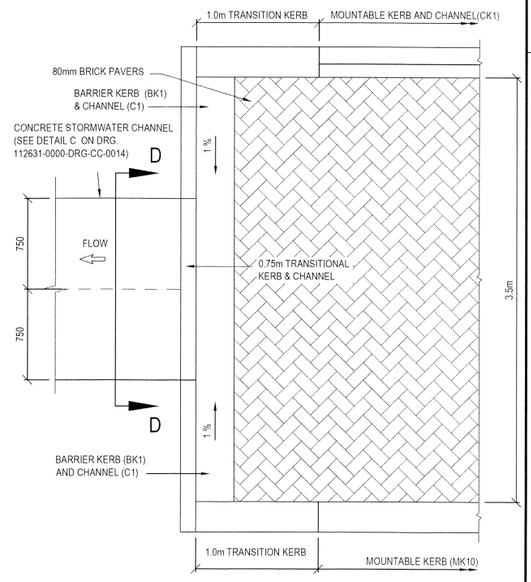
IN-SITU STORMWATER CHANNEL : TYPE 1
SCALE 1:20



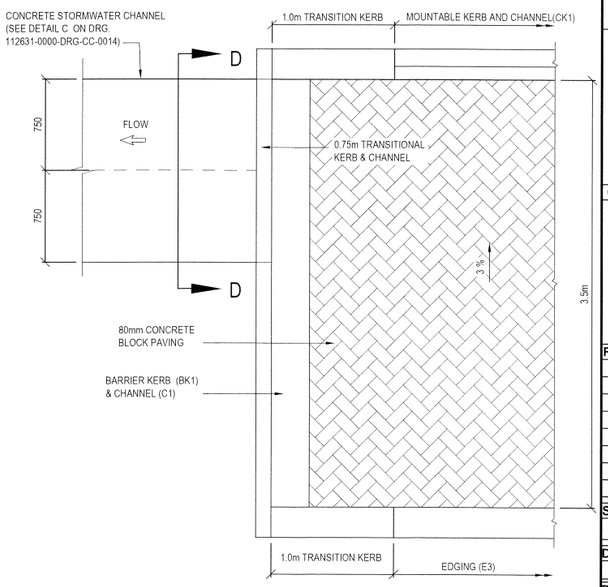
TYPICAL DETAIL OF BULK IN-SITU STORM WATER CHANNEL : TYPE 2
SCALE 1:20



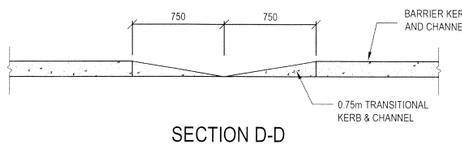
DETAIL D
TYPICAL TYPE 2 CATCHPIT AT ROAD ENDS
SCALE 1:25



DETAIL E
SCALE 1:25

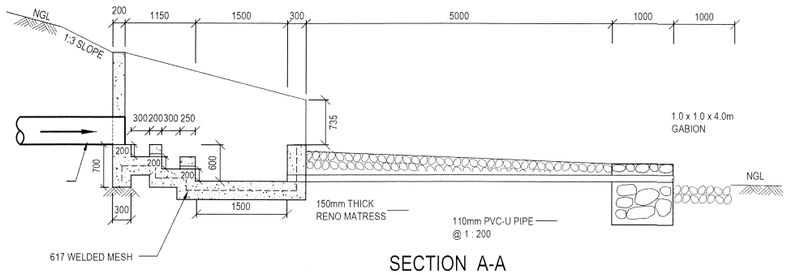


DETAIL F
SCALE 1:25

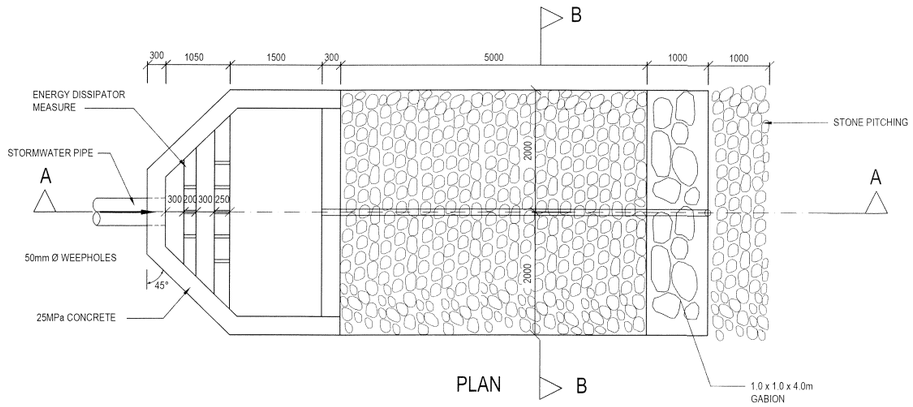


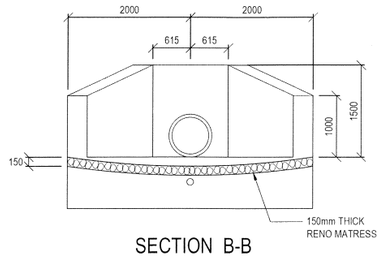
SECTION D-D
SCALE 1:25

TYPICAL DETAIL OF BARRIER KERBS TO CONCRETE STORMWATER CHANNEL



SECTION A-A





SECTION B-B

DETAIL A
SILT RETENTION AND ENERGY DISSIPATER HEADWALL
SCALE 1:50

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GENERAL NOTES:

1. ALL CONSTRUCTION DONE IN ACCORDANCE WITH SANS 1200.
2. FOR ROADS LAYOUT SEE DRAWING No. 503048-0000-DRG-CC-004.

RESPONSIBLE PERSONS			
	NAME	SIGNATURE	DATE
DRAWN	E Wilbers		7/5/21
DESIGNED	G. Coetzee		7/5/21
CHECKED	M. Botha		7/5/21

ZUTARI
IMPACT. ENGINEERED.

CLIENT

POWER GROUP

REV	DATE	REVISION DETAILS	APPROVED
A	5/10/2020	FOR APPROVAL	AC KEYSER
0	05/5/2021	FOR CONSTRUCTION	AC KEYSER

SCALE	SIZE	
1:500	A1	FOR CONSTRUCTION

DRAWN: A VAN WYK
DESIGNED: G COETZEE
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APPROVED: AC KEYSER ECSA-200670108 DATE 10/5/21

PROJECT

THE VILLAGE RIDGE

TITLE

STORMWATER DETAILS

DRAWING NUMBER

PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
503048	0000	DRG	CC	0014	0

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