Report

ERF 3997, STILL BAY WEST

STORMWATER MANAGEMENT PLAN

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ERF 3997, STILL BAY WEST
STORMWATER MANAGEMENT PLAN

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ERF 3997, STILL BAY WEST: STORMWATER MANAGEMENT PLAN

1. INTRODUCTION

Erf 3997 is located in a private development, Muishondbaai located in Still Bay West. It is proposed to subdivide and rezone erf 3997 as shown in Figure 1. The layout is to be comprised of 7 residential erven of which 2 have existing houses, access roads and open space. The locality of the site is shown in Figure 1.

FIGURE 1: LOCALITY

TABLE 1: PROPOSED ERF SIZES AND LAND USE

ERF	AREA (m2)	ZONING
1	2147	Road
2	1624	Single residential (existing)
3	609	Single residential
4	613	Single residential
5	616	Single residential
6	651	Single residential
7	668	Single residential
8	1140	Single residential (existing)
9	10210	Private open space
Total	18278	

2. DATA ACQUISITION

2.1 SITE INSPECTION

Site inspections were carried on 2021-11-.. and 2022-01-07.

The soil is sandy throughout with lenses of horizontally deposited calcrete, which are visible at certain places on the surface as well as on the slopes down to the beach.

The site is well covered with vegetation. There are no visible watercourses across the site and no run-on will occur from the adjacent properties.

2.2 TOPOGRAPHICAL SURVEY AND CADASTRAL BOUNDARY

A topographical survey with 0,5m contours was provided by Sharples Environmental and the proposed cadastral boundaries were traced from drawing 2102-TPa dated 2021-05-19 from Design Centre and Associates.

The above information was used in preparing the stormwater management plan.

3. STORMWATER MANAGEMENT

3.1 EARTHWORKS

It is proposed to lower the ground for erven 3-7 by approximately 1,5m. This is to ensure that the views of existing homes to the north of the development will not be obscured.
The contours after these earthworks have been carried out is shown conceptually in Figure 2. The ground surface on these erven will slope uniformly from west to east to provide for the 1,5m lowering of that portion of the site.

It is important that the ground be stabilised post-earthworks.. The ground levels on proposed erven 3-7 is to be lowered by 1,5m. I have interpreted this as follows: each erf will have a fall of 0,2m towards the sea boundary. Where there is a level difference between erven a retaining wall not higher than 1,0m will be required along the boundaries between erven.

It will be noted that erven 5-7 have existing levels on portions of the erven which are below the proposed levels. In such cases those areas may be filled so as to create level erven. This infilling will assist in balancing out the volume of material to be cut.

The infilling could also be done once the houses are constructed if founding conditions are a concern.

TABLE 2: EARTHWORKS TO BE DONE ON ERVEN 3-7

ERF NO.	3	4	5	6	7
EXISTING GL HIGH POINT (m)	31,0	31,0	30,0	29,0	28,5
PROPOSED GL AFTER EARTHWORKS (m)	29,5	29,5	28,5	27,5	27,0
Note: Refer also to drawings MC379-C401, C420, C421 and C422					

3.2 STORM DATA

The storm data used for this stormwater management plan is from SA Weather Bureau station 00107242 W STILL BAAI (BOS) which is located 4 km from the site (Table 1).

TABLE 3: DESIGN RAINFALL STATION

SAWB NO.	NAME		LOCATION		MAP (mm)	ALTITUDE	YEARS
00107242 W	STILL BAAI (BOS)		34°22' S	21°25' E	425	2	31
1 DAY STORM							
RI (years)	0,5	2	5	10	20	50	100
DEPTH (mm)	6,2	39	57	71	86	108	126

Using the SA Type 2 storm distribution, the storm depths for various durations were derived (Table 4).

TABLE 4: STORM DEPTH FOR VARIOUS DURATIONS AND RECURRENCE INTERVALS

RI (years)	2	5	10	20	50	100
STORM DURATION (min)	STORM DEPTH (mm)					
1	1,48	2,16	2,69	3,25	4,09	4,77
5	5,26	7,68	9,57	11,59	14,56	16,98
10	7,94	11,60	14,45	17,51	21,98	25,65
15	9,71	14,19	17,68	21,41	26,89	31,37
30	12,96	18,95	23,60	28,59	35,90	41,88
60	16,46	24,05	29,96	36,29	45,57	53,16
90	18,64	27,24	33,93	41,10	51,61	60,21
120	20,26	29,62	36,89	44,69	56,12	65,47
180	22,70	33,17	41,32	50,05	62,85	73,33
360	27,32	39,93	49,74	60,25	75,66	88,27
720	32,69	47,78	59,52	72,09	90,53	105,62
780	33,37	48,77	60,75	73,58	92,41	107,81
1440	39,00	57,00	71,00	86,00	108,00	126,00

For the purpose of this stormwater management plan it is assumed that up to the 1:50 year storm runoff must be attenuated to pre-development peaks and that the 1:100 year runoff must be safely managed.

3.3 PROPOSED STORMWATER MANAGEMENT METHODOLOGY

It is not proposed to have any conduits extending down from the development to the beach area. Rather the runoff is to be treated and attenuated on each erf.

Along the sea boundary of each erf, a 1m x 1m gabion wrapped in geofabric will be placed. This gabion will collect surface runoff and seepage and will spread the water across the width of the erf to enable full infiltration to take place.

The runoff which will increase as a result of the roofs and paving, will be attenuated on each erf in a tank or tanks. These tanks will be positioned so as to receive roof runoff. Runoff from other hardened and impervious surfaces is unlikely to be able to drain to the tank which will be elevated to a level higher than the gabion..

These tanks will each have an open outlet so as to ensure that there is always storage volume available for attenuation to existing conditions. The open outlets will be piped to the underground gabion placed along the seaside edge of the property.

The runoff collected in the gabion will infiltrate into the surrounding sandy area. It is not anticipated that there will be any groundwater build-up due to the location near the slope towards the sea.

Furthermore the effect of the 20m long gabion will be to spread the runoff infiltration over a large area.

3.4 RUNOFF ATTENUATION

Attenuation of post-development runoff peaks to pre-development levels will be achieved through the use of tanks into which the roof runoff will be directed, and released to the gabion.

The tanks have been sized by setting up a SWMM model to simulate conditions for a 1:50 year storm. The 24 hour 1:50 year design storm was compiled from the data in Table 4. In the model, it was assumed that 100% of the roof runoff would enter the tank and be released to the gabion via a pipe outlet.

The results of the analyses are listed in Annexure A. These show that for a typical roof area of 165m^2, a storage volume of 3575 litres and located higher than the top of the gabion is to be provided. The tank will have a 40mm diameter orifice to achieve the required attenuation.

If there is a portion of the hardened surface that is too low to drain into the elevated tank, and instead drains directly to the gabion, then the tank storage would need to be increased in order to compensate. For example, should there be 50m^2 of paving which drains directly to the gabion then the required tank storage for a roof area of 165m^2, would be 4700 litres.

Should the paving not be impervious, e.g. permeable paving blocks, or decking with gaps between the slats then those areas may be regarded as unhardened, and would not require the tank storage to be increased.

TABLE A1: SWMM ANALYSIS SUMMARY

TANK OUTLET ORIFICE DIA (mm)	HARDENED SURFACE AREA WHICH DISCHARGES TO		RECURRENCE INTERVAL 1:5 (years)		RECURRENCE INTERVAL 1:20 (years)		RECURRENCE INTERVAL 1:50 (years)	
	TANK (m^2)	GABION (m^2)	ERF PEAK OUTFLOW (l/s)	ERF PEAK STORAGE (litres)	ERF PEAK OUTFLOW (l/s)	ERF PEAK STORAGE (litres)	ERF PEAK OUTFLOW (l/s)	ERF PEAK STORAGE (litres)
25	165	0	0,11	2470	1,19	4030	3,00	5330
35	165	0	0,11	1820	1,52	3055	3,00	4030
45	165	0	0,11	1560	2,02	2665	4,30	3575
50	165	0	0,11	1170	2,27	1170	5,15	2730
65	165	0	0,11	780	2,35	1300	6,88	1820
80	165	0	0,11	585	2,15	910	7,47	1235
110	165	0	0,11	455	2,17	585	8,92	585
25	165	50					3,56	5330
29	165	50					4,66	4700
30	165	50					4,9	4615
35	165	50					6,54	4030

4. CONCLUSIONS

Erf 3997 is to be developed to provide 5 residential erven (erven 3-7), in addition to the 2 existing houses (erven2 and 8).

Earthworks will be carried out to lower the ground level on erven 3-7 by 1,5m. This will create a series of building platforms at a level low enough not to obstruct views of higher lying erven.

The works are to be stabilised against erosion through the use of straw, vegetating or other environmentally acceptable means.

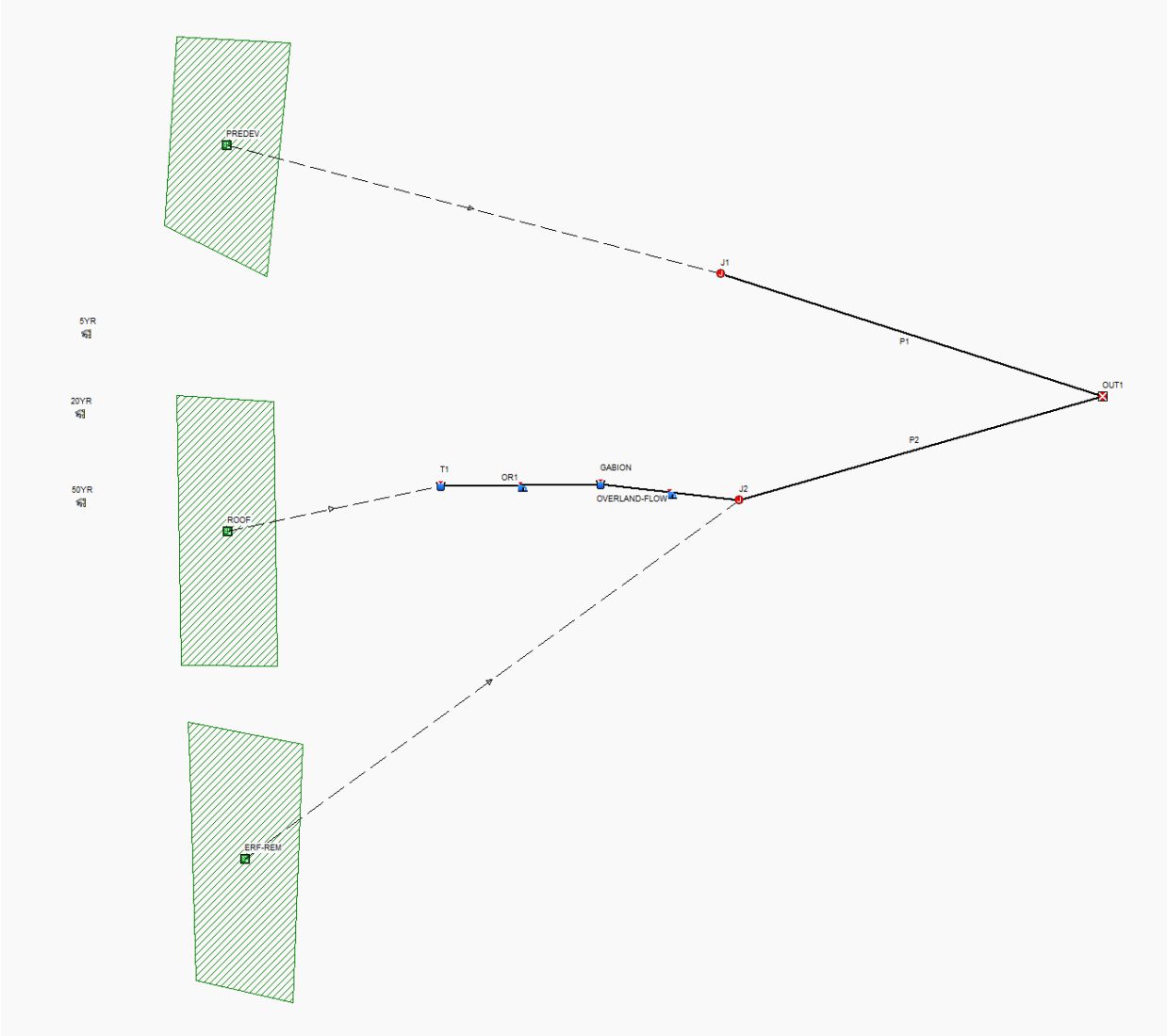
The stormwater management will be on-site. This will be done by attenuating the runoff from hardened surfaces by means of attenuation tanks which will slowly release water to a 20m long gabion basket on the seaside edge of each erf. There the water will be spread and allowed to infiltrate into the surrounding sandy soil.

Once vegetation has re-established there should be no negative impact on the surrounding area.

On-going maintenance of the systems is essential and should be made a requirement for the property owners.

ANNEXURE A1: SWMM RESULTS

MODEL SUB-CATCHMENT LAYOUT



SWMM RESULTS

1:50 YEAR RI

- ROOF 165 m^2 DISCHARGES TO TANK

- TANK OUTLET ORIFICE DIA 45mm

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

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Subbasin Runoff Summary

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Subbasin ID	Total Rainfall mm	Total Runon mm	Total Evap. mm	Total Infil. mm	Total Runoff mm	Peak Runoff LPS	Runoff Coefficient	Time of Concentration days	Time of Concentration hh:mm:ss
ERF-REM	108.00	0.00	0.00	80.08	26.79	3.02	0.248	0	00:30:56
PREDEV	108.00	0.00	0.00	80.03	26.81	4.69	0.248	0	00:30:19
ROOF	108.00	0.00	0.00	2.54	100.66	6.04	0.932	0	00:05:55

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Node Depth Summary

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Node ID	Average Depth Attained m	Maximum Depth Attained m	Maximum HGL Attained m	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume ha-mm	Total Flooded Time minutes	Retention Time hh:mm:ss
J1	0.00	0.02	28.02	0	12:10	0	0	0:00:00
J2	0.00	0.02	28.02	0	12:22	0	0	0:00:00

OUT1	0.00	0.02	26.52	0	12:10	0	0	0:00:00
GABION	0.30	1.00	29.30	0	12:22	0	0	0:00:00
T1	0.01	0.48	29.78	0	12:13	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow LPS	Peak Inflow LPS	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow LPS	Time of Peak Flooding Occurrence days	hh:mm
J1	JUNCTION	4.69	4.69	0	12:10	0.00		
J2	JUNCTION	3.02	4.37	0	12:22	0.00		
OUT1	OUTFALL	0.00	7.66	0	12:10	0.00		
GABION	STORAGE	0.00	2.92	0	12:13	0.00		
T1	STORAGE	6.04	6.04	0	12:10	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 m³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	hh:mm	Average Ponded Volume 1000 m³	Average Ponded Volume (%)	Maximum Storage Node Outflow LPS	Maximum Exfiltration Rate cmm	Total Exfiltrated Volume 1000 m³
GABION	0.006	100	0	12:23	0.002	30	2.61	0.00	0.011
T1	0.003	32	0	12:13	0.000	1	2.92	0.00	0.000

****

Outfall Loading Summary

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Outfall Node ID	Flow Frequency (%)	Average Flow LPS	Peak Inflow LPS
OUT1	17.68	0.72	7.66
System	17.68	0.72	7.66

****

Link Flow Summary

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Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained m/sec	Length Factor	Peak Flow during Analysis LPS	Design Flow Capacity LPS	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
P1	CONDUIT	0 12:10	1.86	1.00	4.66	704.71	0.01	0.06	0	Calculated
P2	CONDUIT	0 12:23	1.84	1.00	4.30	704.71	0.01	0.06	0	Calculated
OR1	ORIFICE	0 12:13			2.92			0.00		
OVERLAND-FLOW	WEIR	0 12:22			2.61			0.00		

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Highest Flow Instability Indexes

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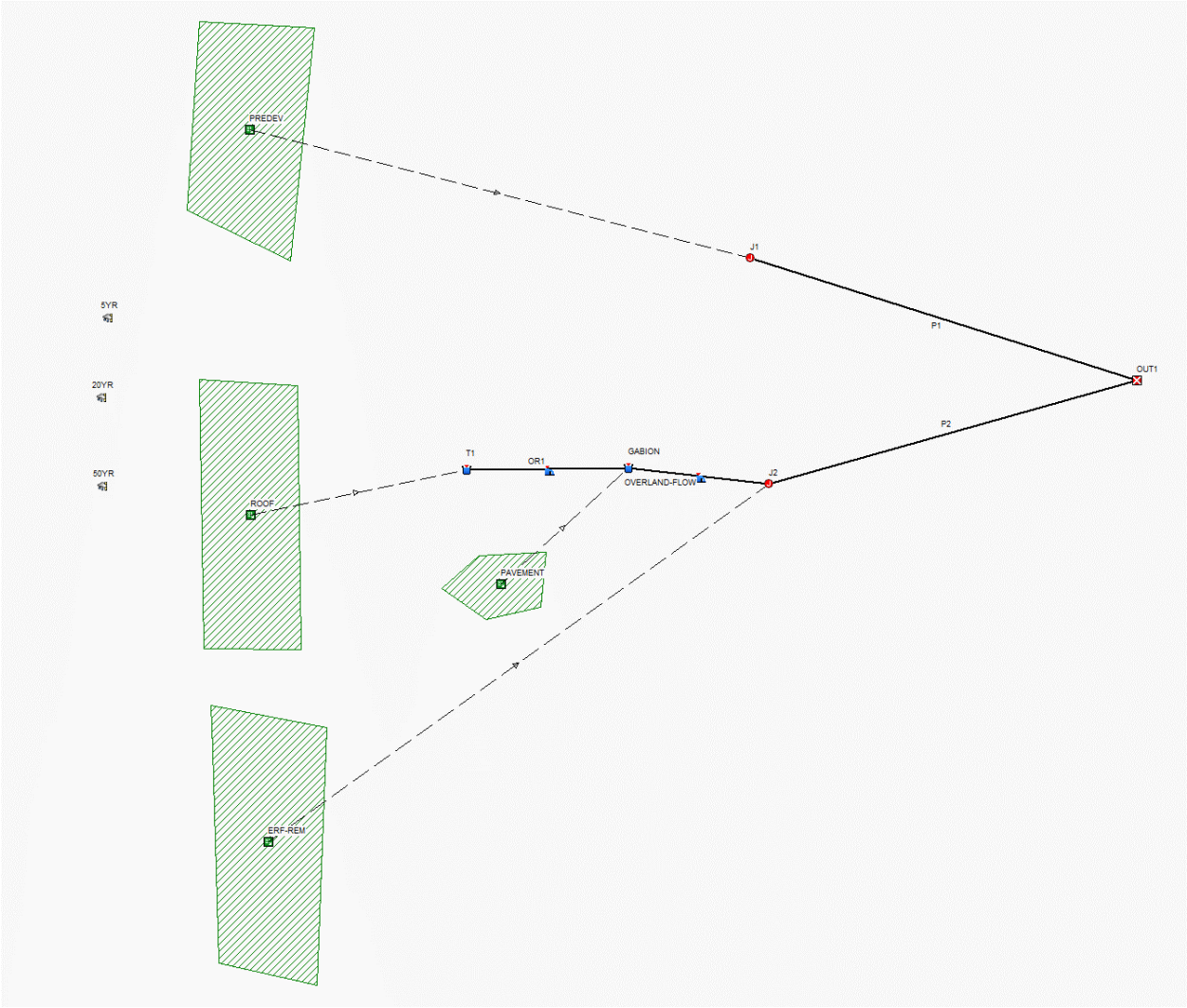
All links are stable.

ANNEXURE A1: SWMM RESULTS INCLUDING 50m² PAVEMENT

MODEL SUB-CATCHMENT LAYOUT



1:50 YEAR RI

- ROOF 165 m^2 DISCHARGES TO TANK

- WITH ADDITIONAL 50m^2 OF PAVEMENT DISCHARGING TO GABION

- TANK OUTLET ORIFICE DIA 25mm

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

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Subbasin Runoff Summary

****

Subbasin ID	Total Rainfall mm	Total Runon mm	Total Evap. mm	Total Infil. mm	Total Runoff mm	Peak Runoff LPS	Runoff Coefficient	Time of Concentration days	Time of Concentration hh:mm:ss
ERF-REM	108.00	0.00	0.00	80.08	26.79	3.02	0.248	0	00:30:56
PAVEMENT	108.00	0.00	0.00	5.06	98.27	1.82	0.910	0	00:07:00
PREDEV	108.00	0.00	0.00	80.03	26.81	4.69	0.248	0	00:30:19
ROOF	108.00	0.00	0.00	2.54	100.66	6.04	0.932	0	00:05:55

****

Node Depth Summary

****

Node ID	Average Depth Attained	Maximum Depth Attained	Maximum HGL Attained	Time of Max Occurrence	Total Flooded Volume	Total Time Flooded	Retention Time

	m	m	m	days	hh:mm	ha-mm	minutes	hh:mm:ss
J1	0.00	0.02	28.02	0	12:10	0	0	0:00:00
J2	0.00	0.02	28.02	0	12:19	0	0	0:00:00
OUT1	0.00	0.02	26.52	0	12:10	0	0	0:00:00
GABION	0.32	0.99	29.29	0	12:19	0	0	0:00:00
T1	0.03	0.82	30.12	0	12:22	0	0	0:00:00

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Node Flow Summary

****

Node ID	Element Type	Maximum Lateral Inflow LPS	Peak Inflow LPS	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow LPS	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
J1	JUNCTION	4.69	4.69	0	12:10	0.00		
J2	JUNCTION	3.02	3.59	0	12:19	0.00		
OUT1	OUTFALL	0.00	7.66	0	12:10	0.00		
GABION	STORAGE	1.82	2.92	0	12:10	0.00		
T1	STORAGE	6.04	6.04	0	12:10	0.00		

****

Storage Node Summary

****

Storage Node ID	Maximum Ponded Volume 1000 m³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	Time of Max Ponded Volume hh:mm	Average Ponded Volume 1000 m³	Average Ponded Volume (%)	Maximum Storage Node Outflow LPS	Maximum Exfiltration Rate cmm	Total Exfiltrated Volume 1000 m³
GABION	0.006	99	0	12:19	0.002	32	1.60	0.00	0.012
T1	0.005	55	0	12:22	0.000	2	1.20	0.00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow LPS	Peak Inflow LPS
OUT1	17.68	0.82	7.66
System	17.68	0.82	7.66

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days	hh:mm	Maximum Velocity Attained m/sec	Length Factor	Peak Flow during Analysis LPS	Design Flow Capacity LPS	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
P1	CONDUIT	0	12:10	1.86	1.00	4.66	704.71	0.01	0.06	0	Calculated
P2	CONDUIT	0	12:19	1.70	1.00	3.56	704.71	0.01	0.05	0	Calculated
OR1	ORIFICE	0	12:22			1.20			0.00		
OVERLAND-FLOW	WEIR	0	12:19			1.60			0.00		

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Highest Flow Instability Indexes
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All links are stable.

REVISION:

No.	DATE	DESCRIPTION

NOTES:

1. LOCAL GRID CO-ORDINATE SYSTEM USED.
2. THE TOPOGRAPHICAL SURVEY WITH 0.5m WAS PROVIDED BY SHARPLES ENVIRONMENTAL.

LEGEND:

- DEVELOPMENT BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR

PROJECT:

ERF 3997, STILL BAY WEST STORMWATER MANAGEMENT PLAN

DRAWING TITLE

EXISTING CONDITIONS

CLIENT

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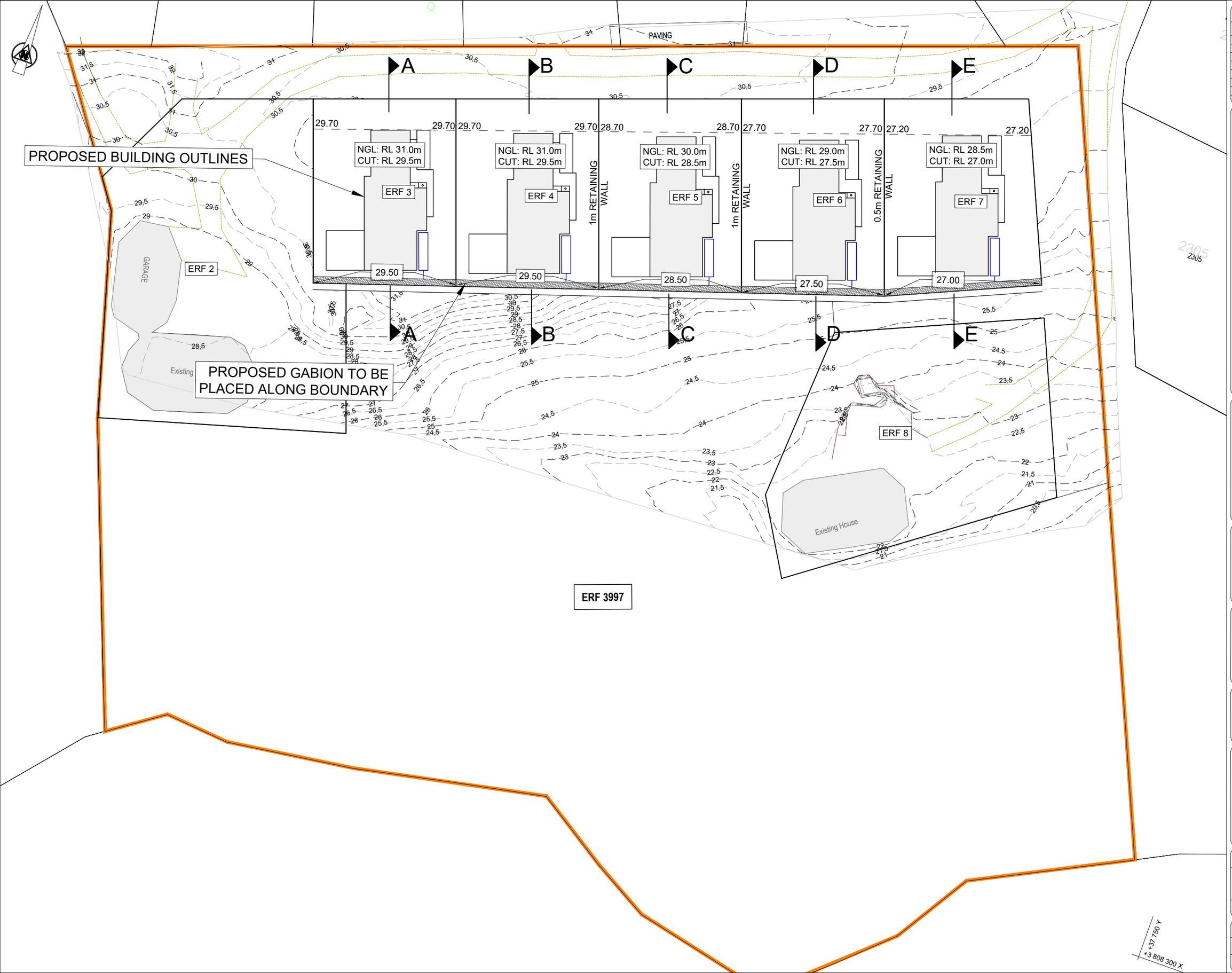
DRAWN BY	DESIGNED BY
JA CIBANGWA	GR McGILL Pr Eng No. 780269
DATE	2022-02-22
SCALE	1:1000 (A3)
DRAWING NO	MC379-C400
REVISION	A



REVISION:

No.	DATE	DESCRIPTION

NOTES:

1. LOCAL GRID CO-ORDINATE SYSTEM USED.
2. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE STORMWATER MANAGEMENT PLAN.

LEGEND:

- DEVELOPMENT BOUNDARY
- CADASTRAL BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR
- PROPOSED ERVEN BOUNDARY

PROJECT:

ERF 3997, STILL BAY WEST
STORMWATER MANAGEMENT PLAN

DRAWING TITLE

PROPOSED DEVELOPMENT LAYOUT

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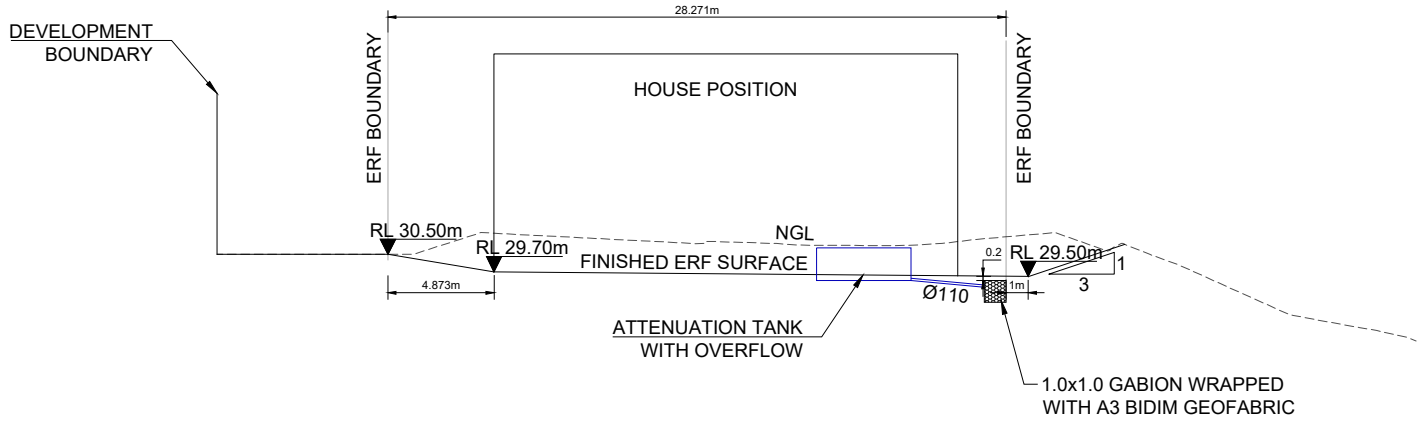
DRAWN BY	DESIGNED BY
DL FEBRUARY	GA McGILL Pr Eng No. 780269
DATE	2022-02-22
SCALE	1:500 (A3)
DRAWING NO	MC379-C401
REVISION	A



ERF 3: SECTION A-A

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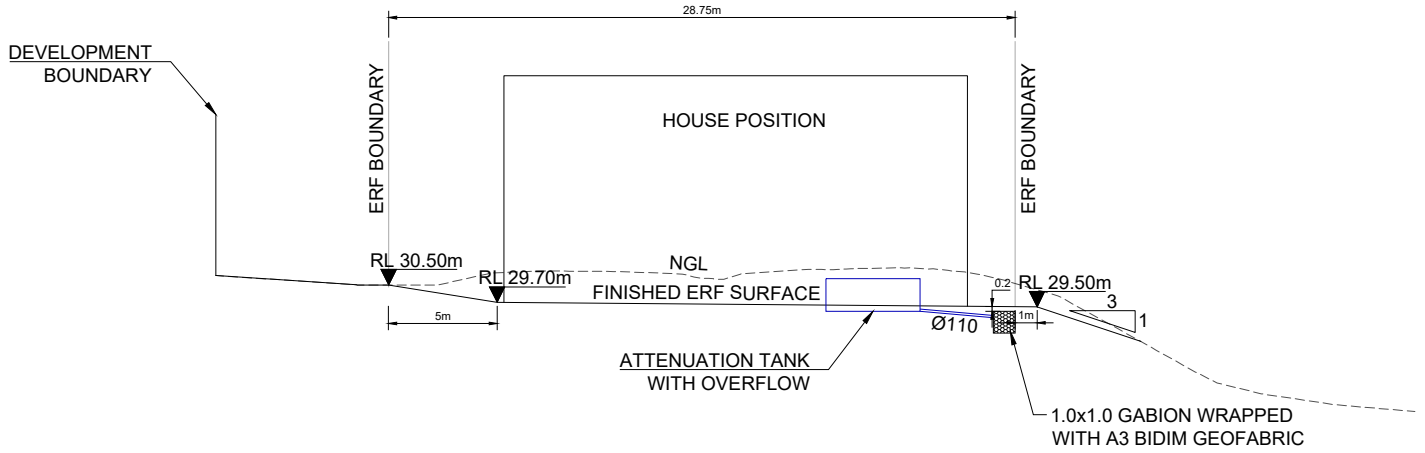

ERF 4: SECTION B-B

SCALE 1:75

REVISION:

No.	DATE	DESCRIPTION

PROJECT:
ERF 3997, STILL BAY WEST
STORMWATER MANAGEMENT PLAN

DRAWING TITLE
ERVEN 3 & 4
CROSS SECTIONS

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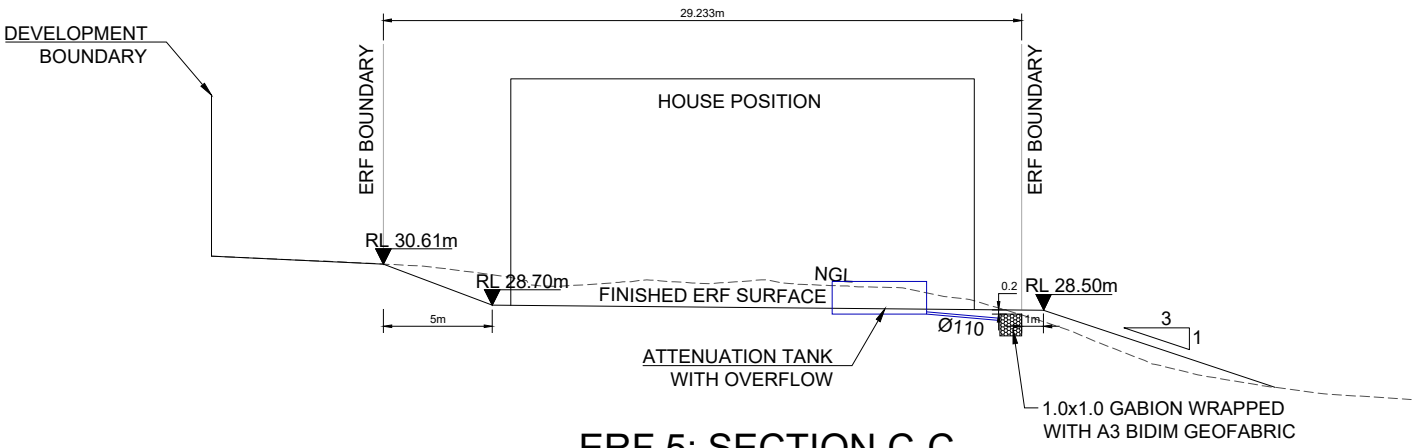
DRAWN BY	DESIGNED BY
JA CIBANGWA	GA McGILL Pr Eng No. 780269
DATE	2022-02-22
SCALE	AS SHOWN (A4)
DRAWING NO	MC379-C420
REVISION	A



ERF 5: SECTION C-C

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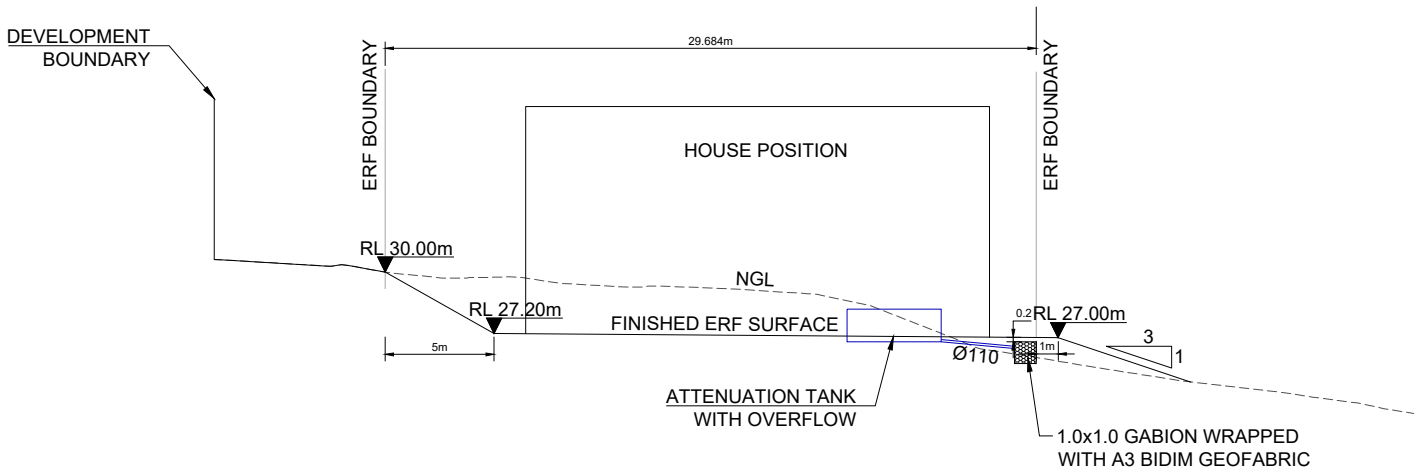

ERF 6: SECTION D-D

SCALE 1:75

REVISION:

No.	DATE	DESCRIPTION

PROJECT:
ERF 3997, STILL BAY WEST STORMWATER MANAGEMENT PLAN

DRAWING TITLE
ERVEN 5 & 6 CROSS SECTIONS

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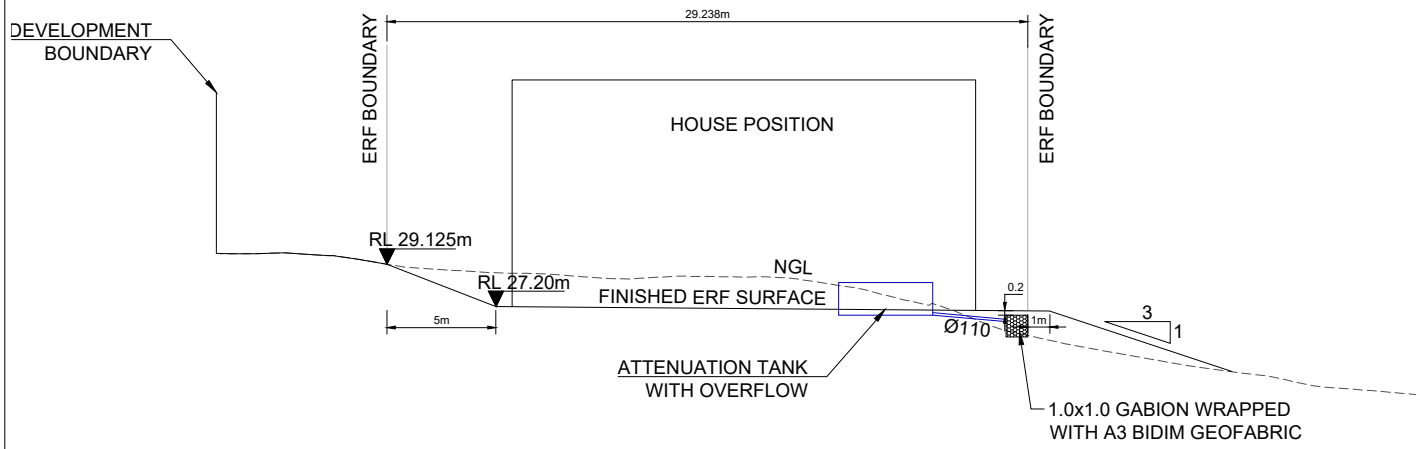
JA CIBANGWA	GMcGILL Pr Eng No. 780269
DATE	2022-02-22
SCALE	AS SHOWN (A1)
DRAWING NO	MC379-C421
REVISION	A



ERF 7: SECTION E-E

SCALE 1:75

REVISION:

No.	DATE	DESCRIPTION

PROJECT:
ERF 3997, STILL BAY WEST
STORMWATER MANAGEMENT PLAN

DRAWING TITLE
ERF 7 CROSS SECTION

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