APPENDIX I

Revised Drainage & Sewerage Impact Assessment

Prepared for

New Season Global Limited

Prepared by

Ramboll Hong Kong Limited

SECTION 16 PLANNING APPLICATION FOR THE PRESERVATION AND REVITALISATION OF MARYKNOLL HOUSE, STANLEY, HONG KONG

DRAINAGE & SEWERAGE IMPACT ASSESSMENT

Date	**October 2024**
Prepared by	**Miko Wan** **Environmental Consultant**
Signed	
Approved by	**Billy Fan** **Principal Environmental Consultant**
Signed	
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Ramboll Hong Kong Limited
21/F, BEA Harbour View Centre
56 Gloucester Road, Wan Chai, Hong Kong
Tel: (852) 3465 2888
Fax: (852) 3465 2899
Email: hkinfo@ramboll.com

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CHAPTERS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 Project Background

1.1.1 The Application Site falls within an area zoned "Other Specified Uses (Residential Development with Historic Building Preserved)" ("OU" zone) on the Approved Stanley Outline Zoning Plan No. S/H19/16.

1.1.2 This planning application proposes a residential development which preserves and revitalises the Maryknoll House. The Proposed Scheme envisions to preserve most of the architectural heritage and to maintain a similar use to the original function of the Maryknoll House as an accommodation building. At the same time, the Proposed Scheme seeks to revitalise the Maryknoll House through good planning and design measures for the adaptive reuse of the heritage building and its surrounding environment.

1.1.3 The Underground Utility Survey at Maryknoll House conducted on December 2020 is referenced in this Drainage & Sewerage Impact Assessment (DSIA) (see **Appendix 2.2**).

1.1.4 Ramboll Hong Kong Limited has been commissioned by New Season Global Limited (hereinafter referred as "Applicant") to conduct this Drainage and Sewerage Impact Assessment for the Proposed Scheme at the Application Site.

1.1.5 A Section 16 Planning Application (A/H19/82) was submitted in 2021 for proposed residential redevelopment at the Application Site. The application was approved by the Town Planning Board (TPB) in the meeting dated 24 December 2021.

1.1.6 Based on the recent update of the project, the layout plan has been changed and the plot ratio has been increased. As such, submission of Section 16 Planning Application is required. This DSIA is prepared with respect to the change of layout plan for supporting the Section 16 Planning Application.

1.2 Application Site and its Environs

1.2.1 The Application Site area is about 7646 m^2. The Application Site is located on a small ridge and to the north-western of Stanley Market. The Stanley Knoll development is located to the north and east of the Application Site, while the Carmel Hill development is to the south-eastern of the Application Site. To the south-west and south of the site is a retaining wall followed by a steep vegetated slope. The south-east and south-west boundaries of the site adjoin with the neighbouring area zoned as "Green Belt".

1.2.2 At present, the Application Site is accessible from Stanley Village Road of which is located to the north-eastern of the Application Site and via the internal access road of Stanley Knoll. Carmel Road connecting the Stanley Village Road is located to the south of the Application Site.

1.2.3 The location of the Application Site and its surrounding environs are shown in **Figure 1.1**.

1.3 Existing Development

1.3.1 The Application Site is occupied by the Maryknoll House while it is no longer operating.

1.4 Proposed Scheme

1.4.1 The development mainly consists of 23 residential units and other supporting ancillaries such as underground carpark, private and garden decks, common and private swimming pools.

1.4.2 **Appendix 1.1** shows the indicative Master Layout Plan of the Proposed Scheme.

2. DRAINAGE IMPACT ASSESSMENT

2.1 Scope of Work

2.1.1 The aim of this Drainage Impact Assessment (DIA) is to assess whether the capacity of the existing drainage network serving the Application Site is sufficient to cope with the stormwater runoff from the Proposed Scheme.

2.2 Assessment Criteria and Methodology

2.2.1 The assessment standard complies with Drainage Services Department (DSD) Stormwater Drainage Manual (SDM) (2018 Edition), Corrigendum No. 1/2022 and No. 1/2024. The Application Site is situated in an urban drainage branch system, therefore, a 1 in 50 year return storm has been adopted for the DIA.

2.2.2 The catchment runoff has been calculated using the "Rational Method", as outlined in the DSD SDM:

$$Q = 0.278\, C\, i\, A$$

Where Q = peak runoff in m^3/s
C = runoff coefficient (dimensionless)
i = rainfall intensity in mm/hr
A = catchment area in km

2.2.3 The existing Application Site is occupied by the Maryknoll House, runoff coefficients of 0.35 and 0.95 are adopted for the existing unpaved and paved area respectively.

2.2.4 The Proposed Scheme will be for residential use. Runoff coefficients of 0.15 and 0.95 are adopted for the future unpaved and paved area respectively.

2.2.5 The rainfall intensity parameter "i" is dependent on the return period, rainfall duration and the time of concentration of the catchment under consideration. For the future upstream catchment containing the Site, there is no significant change to the flow path and the same time of concentration has been adopted as for the existing scenario. Runoff calculations are included in **Appendix 2.1**.

2.3 Site Condition

2.3.1 Maryknoll House is located on a small ridge. There are no existing flooding blackspots or known drainage problems in the vicinity of the Application Site.

2.4 Existing Drainage System

2.4.1 There is an Ø1050 mm stormwater drain located on the south-west of the Site. The pipe eventually discharges to the west of Carmel Road. The existing drain is shown in **Figure 2.1**. According to the Underground Utility Survey, there are existing drains within the Site that collect Site surface runoff. The surface runoff is then conveyed down the hill towards the existing Ø1050 mm pipe (**Appendix 2.2**).

2.5 Existing Catchment

2.5.1 About of the existing Site catchment is paved. **Figure 2.2** shows the paved and unpaved area within the existing Site. The surface runoff to the existing drains before development is summarized in **Table 2.1** below.

Table 2.1 Summary of Surface Runoff under Existing Conditions

Catchment	Area (m^2)	Paved Area (m^2)	Unpaved Area (m^2)	Runoff (m^3/s) under 1 in 50 years scenario
S	7,646	2,814	4,832	0.27

2.5.2 The calculated runoff from the above catchment to the existing drainage system for storm period of 50 years is shown in **Appendix 2.1**.

2.6 Proposed Scheme

2.6.1 The proposed hard paved landscape decks are located in the east and southwestern area of the Application Site. The decks are apparently at a lower elevation level than the existing building/structure. Based on the APP-152, not less than 20% of greenery will be provided at the Application Site. The minimum 20% greenery area is adopted for the conservative scenario. The increase in paved area will be about 3,303 m^2 after development.

2.6.2 Stormwater flow from the Application Site will be conveyed to a proposed terminal manhole and then connect to the existing pipe by a new Ø675 mm pipeline and 675 mm width stepped channel as shown in **Figure 2.1**.

2.6.3 The surface runoff of the Project Site after development is summarized in **Table 2.2**.

Table 2.2 Summary of Surface Runoff under Proposed Conditions

Catchment	Area (m^2)	Paved Area (m^2)	Unpaved Area (m^2)	Runoff (m^3/s) under 1 in 50 years scenario
S	7,646	6,117	1,529	0.37

2.7 Discussion

2.7.1 Due to change of surface type, the 1 in 50-year runoff from the Project Site is expected to slightly increase by 0.10 m^3/s, from 0.27 m^3/s to 0.37 m^3/s (Table 1 of **Appendix 2.1**).

2.7.2 In detailed calculation, the capacity of individual segments and estimated surface runoff discharge are estimated and compared with each other. Based on the assessment, the drainage system would have adequate capacity to cater for the Proposed Scheme and existing catchments (Table 4 of **Appendix 2.1**).

2.7.3 Peripheral channels within the Application Site are proposed and will be connected to the terminal manhole within the site. The terminal manhole, 4 new manholes and 3 new catchpits will be connected by a new Ø675 mm drain and Ø675 mm width stepped channel. It will then be linked to the existing stormwater drains (manhole ref. no. SMH7043921 (D1)) as shown in **Figure 2.1**. The new manholes, catchpit and drains will be constructed to allow gravity flow. The invert levels of the new drains presented in **Figure 2.1** are preliminary and indicative only. Where necessary, further survey will be conducted and details of the alignment of the drains will be provided. The drainage proposal and the exact location of peripheral channels will be confirmed in the detailed design stage.

3. SEWERAGE IMPACT ASSESSMENT

3.1 Scope of Work

3.1.1 The aim of this SIA is to assess whether the capacity of the existing sewerage network serving the Application Site is sufficient to cope with the sewage flow from the proposed development. Drainage Record Plans from Drainage Services Department (DSD) were obtained for the purposes of this SIA.

3.2 Existing Sewerage System

3.2.1 According to the Drainage Record obtained from the DSD, there are existing Ø150 mm sewers running along hillside of Carmel Hill and Carmel Road, it then expands to Ø200 mm and further to Ø225 mm (manhole reference no. FMH7036589 to FMH7037671). After manhole FMH7037671, the sewer downsized to Ø150 mm along Carmel Road.

3.2.2 The existing sewers serving the Application Site are shown in **Figure 3.1**.

3.2.3 The upstream catchment includes Stanley Knoll (Catchment A). The downstream catchment includes 18&20 Carmel Road (Catchment B).

3.2.4 The related catchment areas are shown in **Figure 3.2**.

3.3 Assessment Criteria and Methodology

3.3.1 Environmental Protection Department's (EPD's) Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning, Version 1 (GESF) has been referred to for the purposes of estimating the quantity of the sewage generated from the proposed development and the existing catchment area. Sewage flow parameters and peaking factors in this document have been adopted for this SIA.

3.3.2 Based on the building types in the area, the following unit flow factors are used in the SIA calculation:

- Residents: 0.37 m^3/person/day (R3)
- Common facilities employees: 0.28 m^3/day (J11 - Community, Social & Personal Services)

3.3.3 Catchment Inflow Factor (P_{CIF}) of Stanley (1.00) has been applied in the assessment.

3.4 Assessment of Sewerage Impact

3.4.1 The wastewater generated by the Proposed Scheme will be contributed by the residential and common facilities flow. The development is designed to provide 23 nos. of flats with common facilities.

3.4.2 Sewage generated from the Application Site will be discharged to the existing manhole FMH7037669 (S1) as shown in **Figure 3.1**.

3.4.3 **Appendix 3.1** shows the detailed calculation on the estimated hydraulic capacity of the existing sewer sections and the calculation of the amount of sewage entering each segment of the said sewer network.

3.4.4 Calculation for the Proposed Scheme is given in **Table 3.1**.

Table 3.1 Estimated Peak Flow of the Proposed Scheme

Calculation for Sewage Generation Rate of the Proposed Scheme			
1. Residential Development			
1a. Total number of residential units	=	23	units
1b. Total number of residents	=	74	people -- (2021 Population Census: Average Household size of 3.2 - Stanley & Shek O District Council Constituency Area)
1c. Design flow	=	0.34	m^3/person/day -- (Private Permanent Housing R3)
1d. Sewage Generation rate	=	**25.0**	m^3/day
2. Clubhouse			
2a. Assumed Area	=	344	m^2
2b. Assumed floor area per employee	=	30.3	m^2 per worker -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
2c. Total number of employees	=	11	employees
2d. Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J11)
2e. Sewage Generation rate	=	**3.2**	m^3/day
3. Swimming Pools (Common)			
Area	=	187	m^2
Flow Rate	=	6.6	litre/sec
4. Swimming Pools (Private)			
Area	=	39	m^2
Flow Rate	=	0.7	litre/sec
5. Swimming Pools (Private)			
Area	=	40	m^2
Flow Rate	=	0.7	litre/sec
6. Swimming Pools (Private)			
Area	=	44	m^2
Flow Rate	=	0.8	litre/sec
7. Swimming Pools (Private)			
Area	=	47	m^2
Flow Rate	=	0.8	litre/sec
8. Swimming Pools (Private)			
Area	=	16	m^2
Flow Rate	=	0.3	litre/sec
9. Swimming Pools (Private)			
Area	=	16	m^2
Flow Rate	=	0.3	litre/sec

Calculation for Sewage Generation Rate of the Proposed Scheme			
10. Swimming Pools (Private)			
Area	=	24	m^2
Flow Rate	=	0.4	litre/sec
11. Swimming Pools (Private)			
Area	=	19	m^2
Flow Rate	=	0.3	litre/sec
12. Swimming Pools (Private)			
Area	=	19	m^2
Flow Rate	=	0.3	litre/sec
13. Swimming Pools (Private)			
Area	=	10	m^2
Flow Rate	=	0.2	litre/sec
14. Swimming Pools (Private)			
Area	=	44	m^2
Flow Rate	=	0.8	litre/sec
Total Flow from Proposed Scheme			
Total Flow	=	28.2	m^3/day
Contributing Population	=	104	people
Peaking factor	=	6	Refer to Table T-5 of GESF for population <1,000 incl. stormwater allowance
Peak Flow	=	**1.96**	litre/sec
Peak Flow incl. pool	=	**10.7**	litre/sec

3.5 Discussion

3.5.1 The potential sewerage impact due to the Proposed Scheme has been quantitatively addressed as shown in **Appendix 3.1**.

3.5.2 The average and peak flow rates from the Proposed Scheme area about 28.2 m^3/day and 10.7 litre/sec (including backwash from swimming pools) respectively.

3.5.3 The estimated sewage flow from the Proposed Scheme and surrounding catchment areas has been compared with the capacity of the existing sewerage system. There is adequate capacity to accommodate the flow from the proposed connection. Therefore, no adverse sewerage impact is anticipated.

3.5.4 According to DSD Advice Note No. 1 outlines the DSD's assessment procedures for the drainage impact of private sector project, the project proponent shall be responsible for incorporating the study findings, including the agreed drainage impact mitigation measures into the design of the project to ensure that the expected drainage performance of the project is achieved. The project proponent shall also be responsible for in the agreed drainage impact mitigation measures and undertaking the monitoring programme during the construction stage to ensure compliance with the conditions of drainage requirements, flood mitigation measures and performance monitoring requirements.

4. OVERALL CONCLUSION

4.1 Conclusion

4.1.1 The potential drainage and sewerage impacts have been quantitatively addressed for the Proposed Scheme.

Drainage

4.1.2 Based on the drainage impact assessment results, a new Ø675mm drain and Ø675 mm width stepped channel are proposed to connect and convey flow from the Application Site to Carmel Road. The existing and proposed drainage system will have adequate capacity to cater additional flow from the Application Site after development. The DIA confirms the feasibility of the Proposed Scheme in terms of impacts to the public drainage system.

4.1.3 Detail Building Drainage Plan will be submitted in the detail design stage of the project and relevant details will be submitted to DSD's comment and approval.

Sewerage

4.1.4 Based on the sewerage impact assessment results, it is found that the capacity of the existing sewerage system (sewer pipes) serving the area is sufficient to cater for the sewage generation from the Proposed Scheme. Therefore, no adverse sewerage impact is anticipated.

Figures

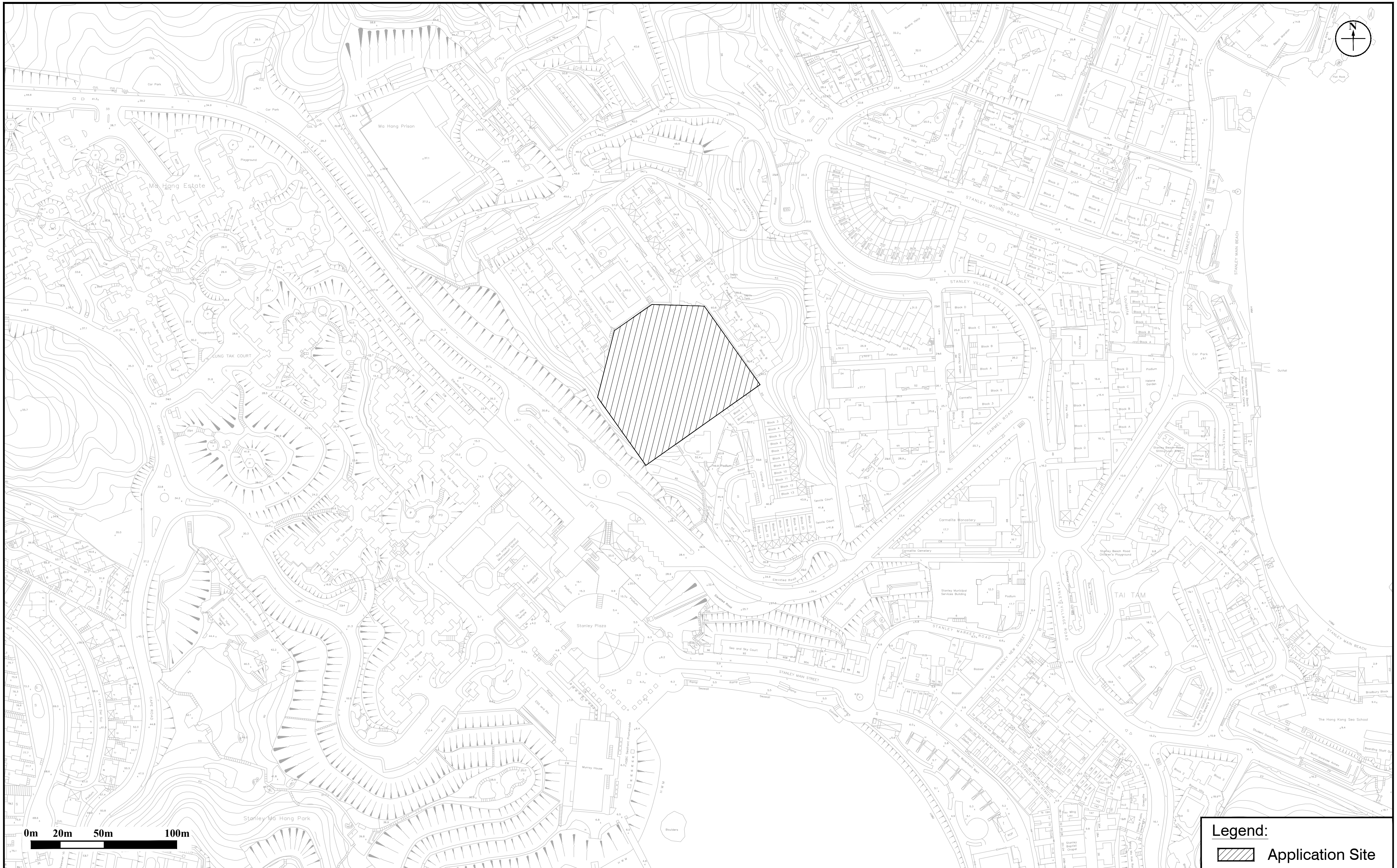

Figure: 1.1	RAMBØLL
Title: Location of the Application Site and its Environ	Drawn by: LC
	Checked by: BF
Project: Section 16 Planning Application for the Preservation and Revitilisation of Maryknoll House, Stanley, Hong Kong	Rev.: 1.0
	Date: Jun 2021

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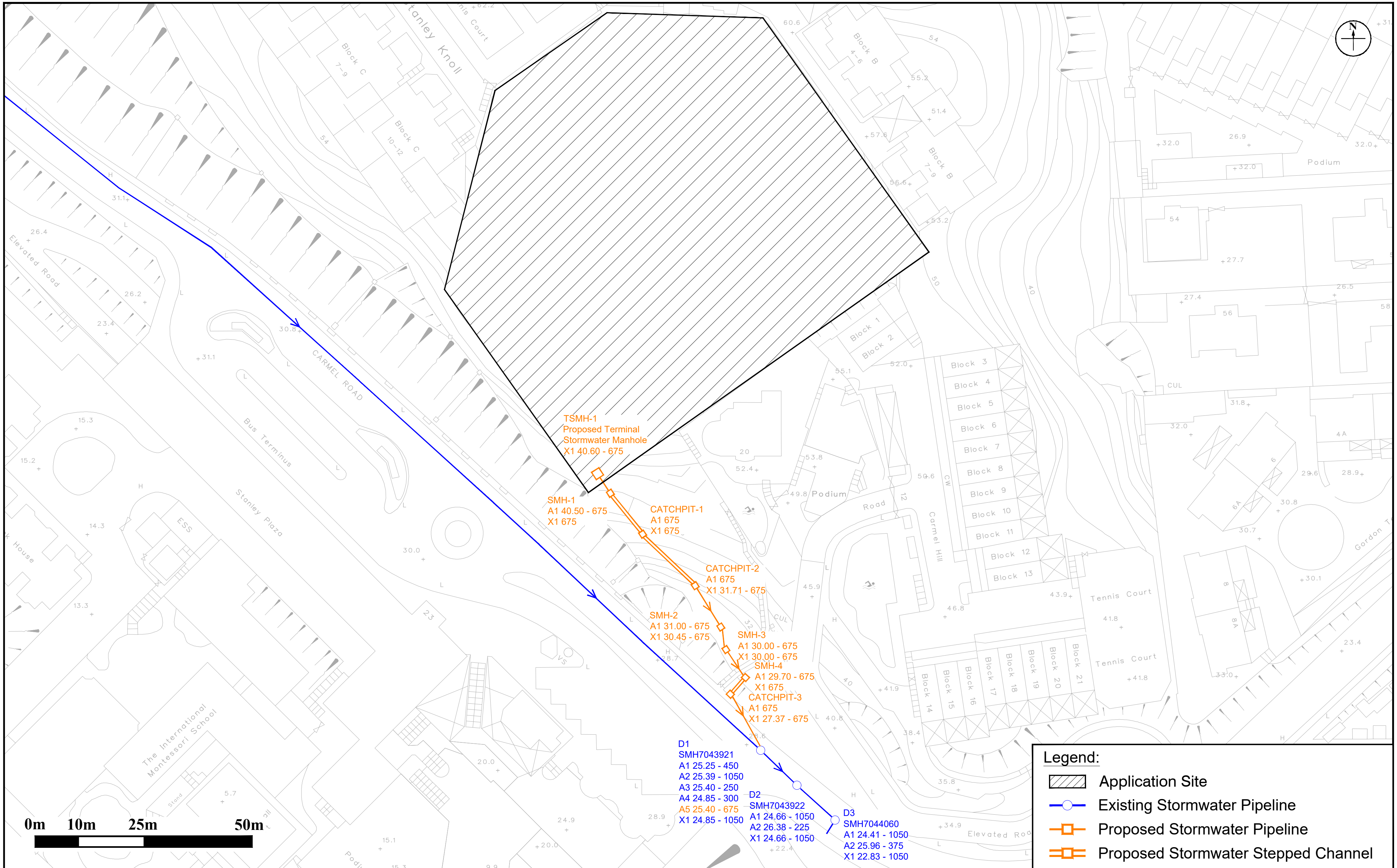

Figure: 2.1

Title: Existing Drainage System and Proposed Drain Connection

Project: Section 16 Planning Application for the Preservation and Revitalisation of Maryknoll House, Stanley, Hong Kong

RAMBOLL

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Checked by:	BF
Rev.:	1.0
Date:	Jun 2021

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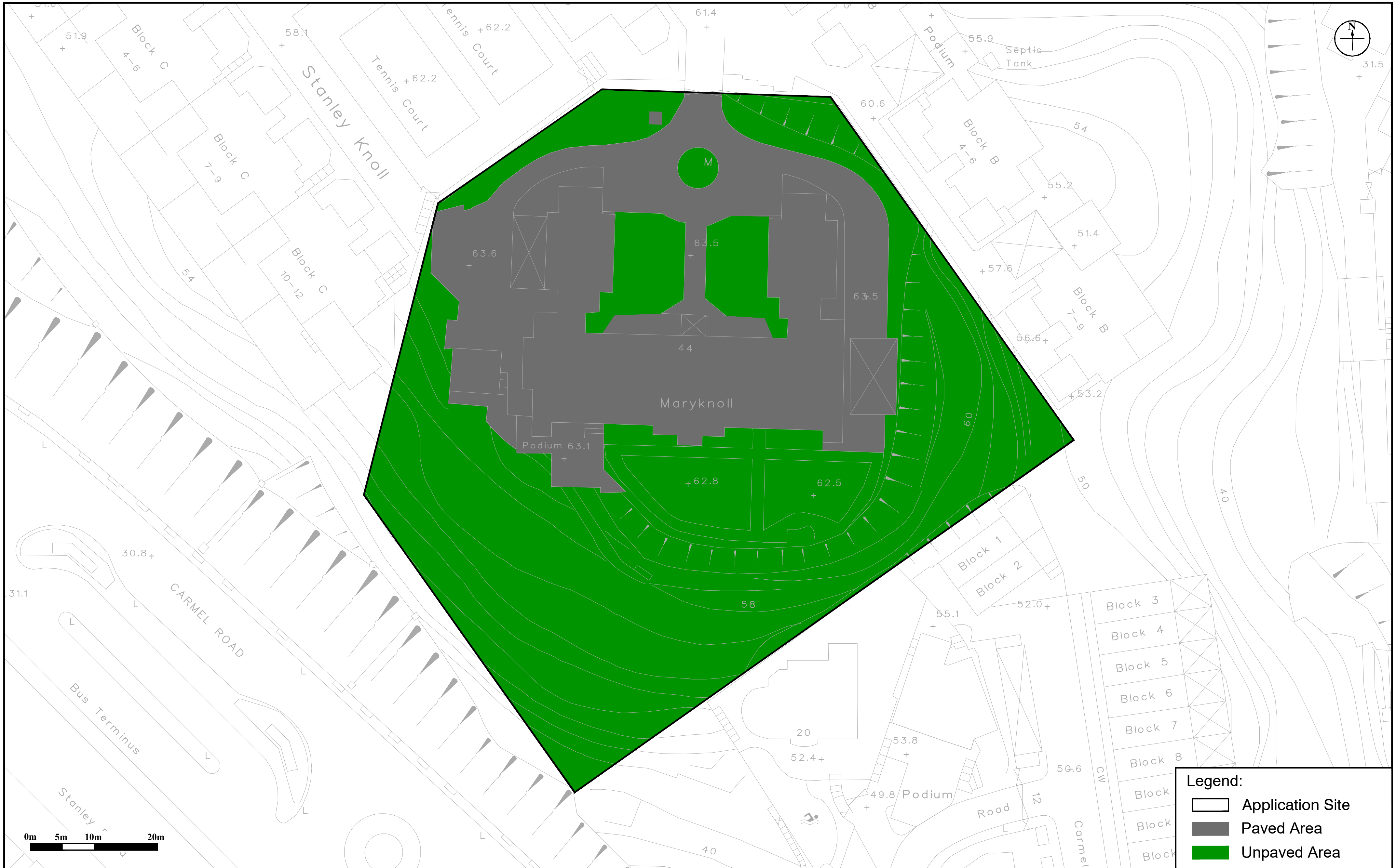

Figure:	2.2
Title:	Paved and Unpaved Area within the Application Site (Existing Condition)
Project:	Section 16 Planning Application for the Preservation and Revitalisation of Maryknoll House, Stanley, Hong Kong

Drawn by: LC
Checked by: BF
Rev.: 1.0
Date: Jun 2021

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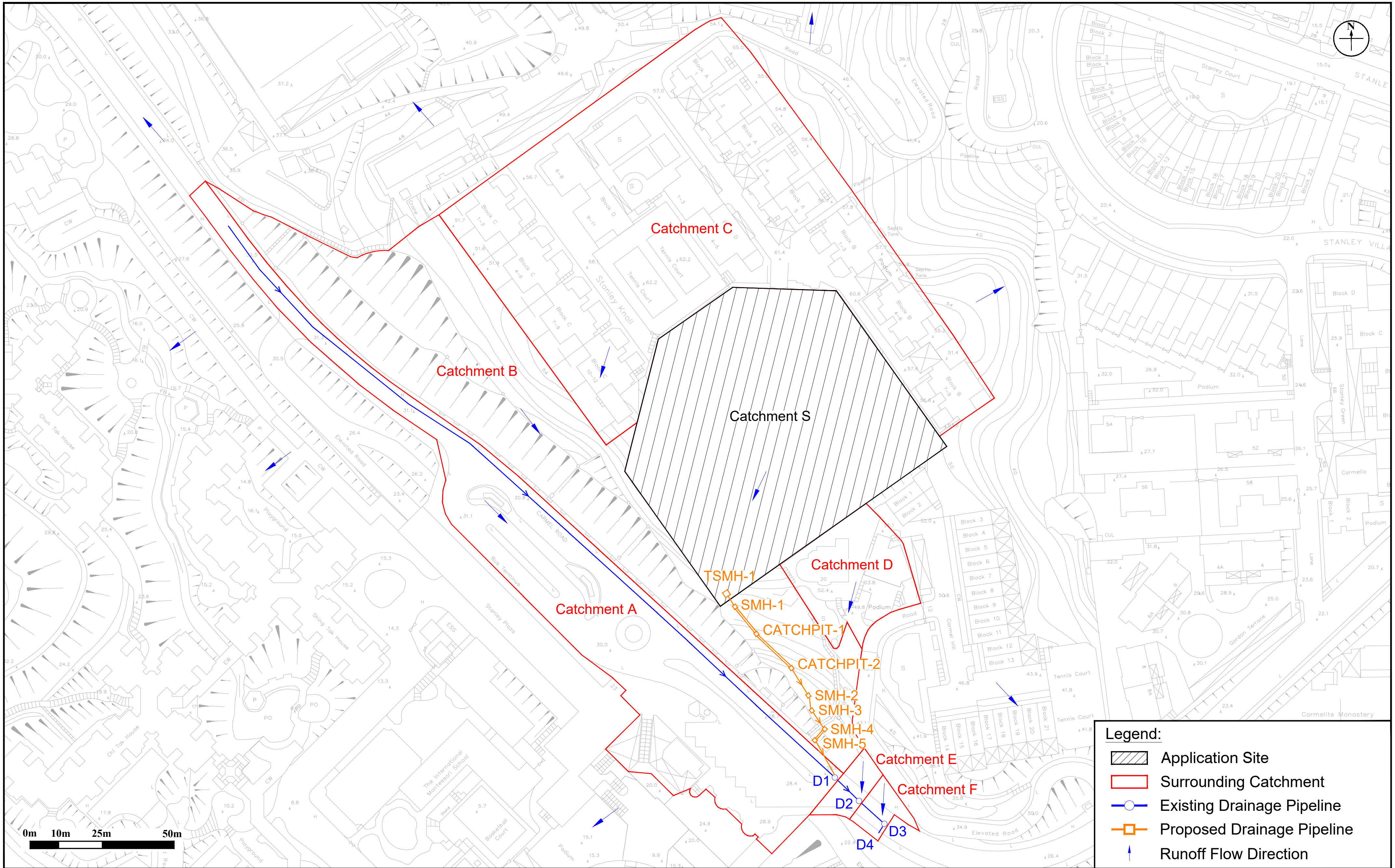

Figure: 2.3

Title: Drainage System and Catchment Areas in the Vicinity of the Application Site

Project: Section 16 Planning Application for the Preservation and Revitilisation of Maryknoll House, Stanley, Hong Kong

RAMBOLL

Drawn by: LC
Checked by: BF
Rev.: 1.0
Date: Jun 2021

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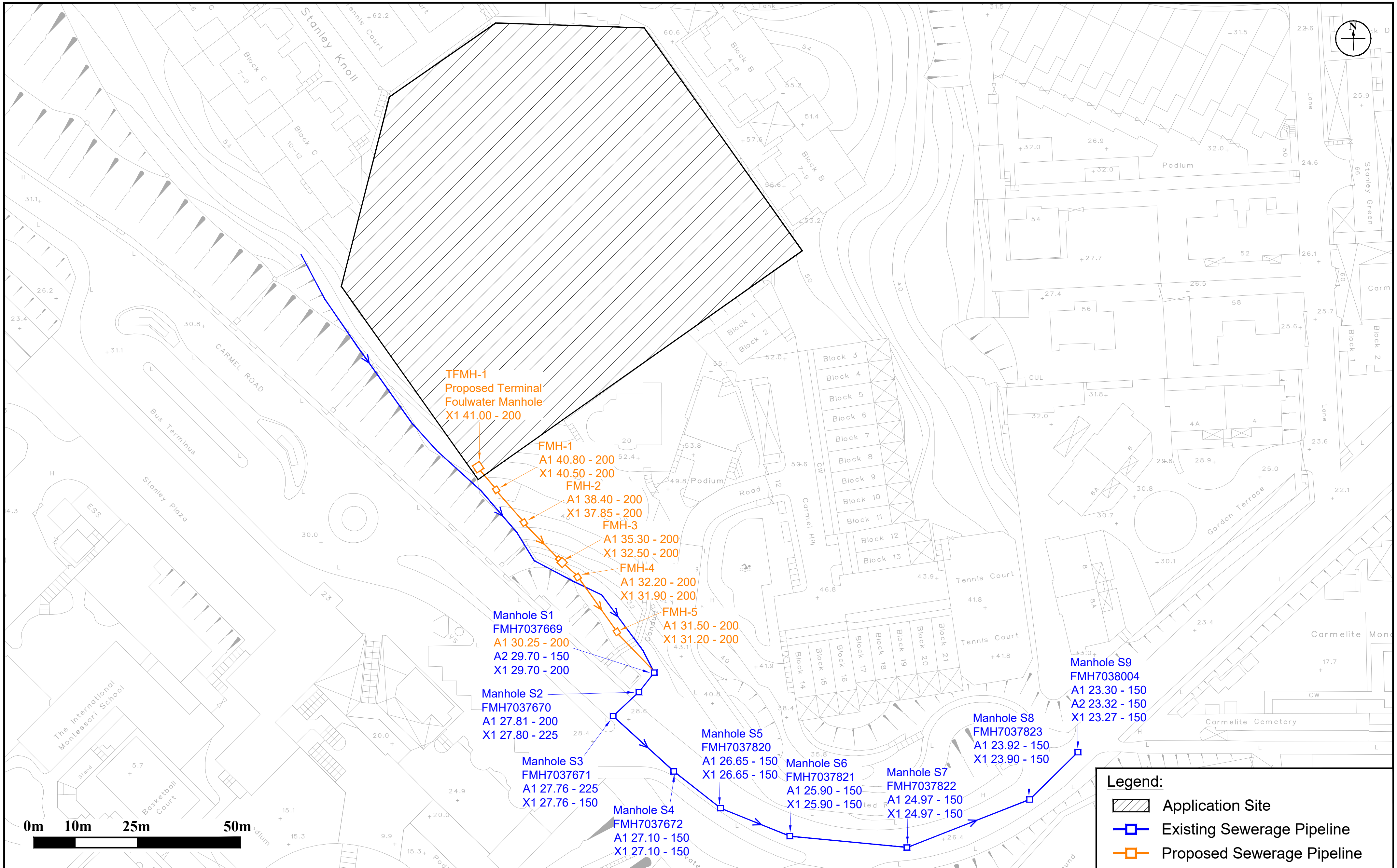

Figure: 3.1

Title: Existing Sewerage System and Proposed Sewer Connection

Project: Section 16 Planning Application for the Preservation and Revitilisation of Maryknoll House, Stanley, Hong Kong

RAMBOLL

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Checked by:	BF
Rev.:	1.0
Date:	Jul 2024

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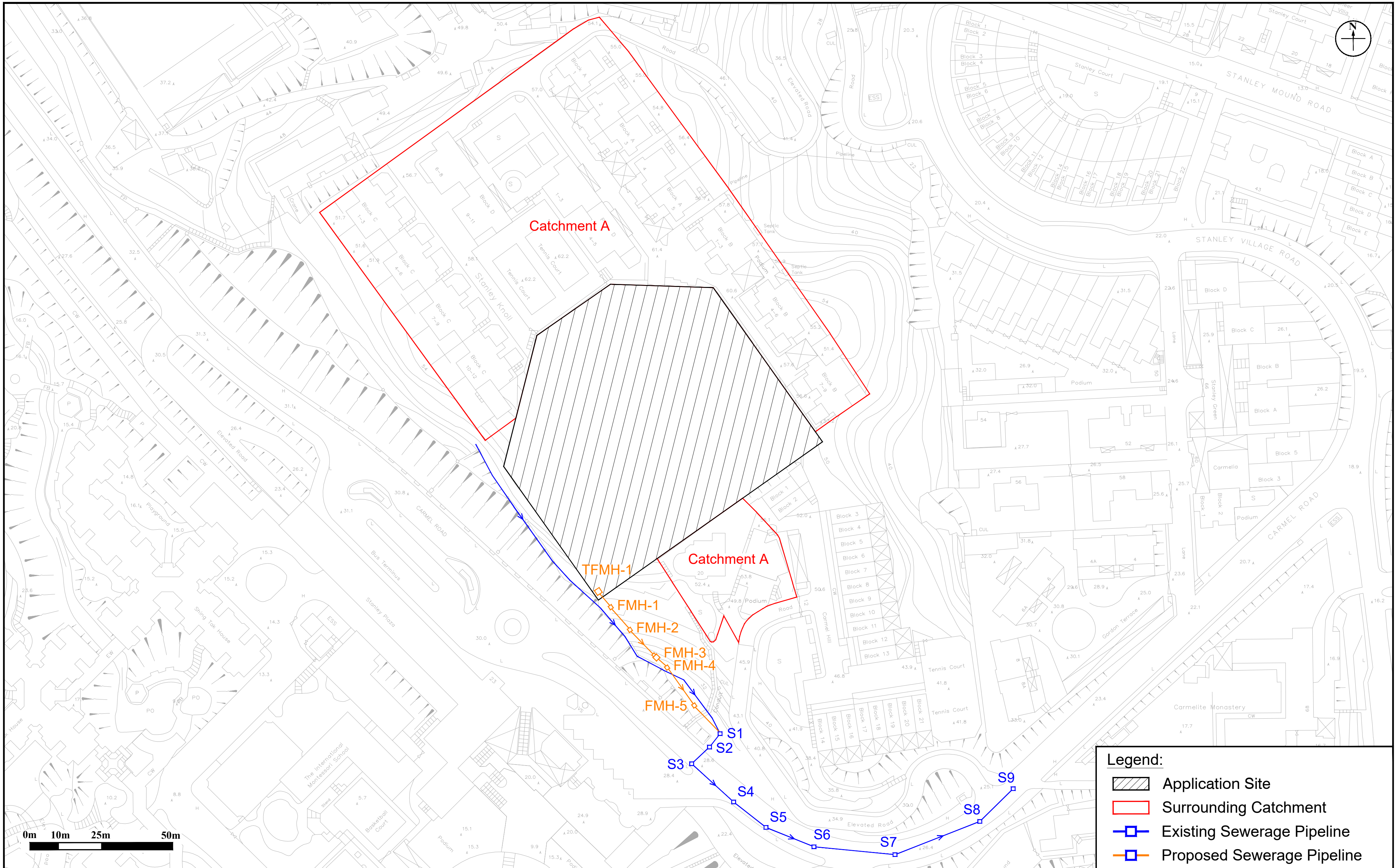

Figure: 3.2

Title: Sewerage System and Catchment Areas in the Vicinity of the Application Site

Project: Section 16 Planning Application for the Preservation and Revitilisation of Maryknoll House, Stanley, Hong Kong

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Rev.: 1.0
Date: Jun 2021

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Appendix 1.1 Indicative MLP of the Proposed Scheme

MARYKNOLL BUILDING, STANLEY
MASTER LAYOUT PLAN

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MARYKNOLL BUILDING, STANLEY
UPPER DECK G/F LAYOUT PLAN

15 AUG 2024

LEGEND

- BUILDING HEIGHT RESTRICTION BAND FROM OZP
- VEHICULAR INGRESS & EGRESS
- PEDESTRIAN ACCESS
- NEW EXTENSION TO THE EXISTING BUILDING
- AREA WITH FACADE CHANGES
- PROPOSED LOCATION OF 1 NOS. NEW FIRE ESCAPE STAIRCASE
- PROPOSED RELOCATION OF HERITAGE STAIRCASE
- COMMON SWIMMING POOL
- PRIVATE SWIMMING POOL

REMARKS: SUBJECT TO DETAILED DESIGN STAGE AND DISCUSSION WITH RELEVANT GOVERNMENT DEPARTMENTS

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MARYKNOLL BUILDING, STANLEY
LOWER DECK G/F LAYOUT PLAN

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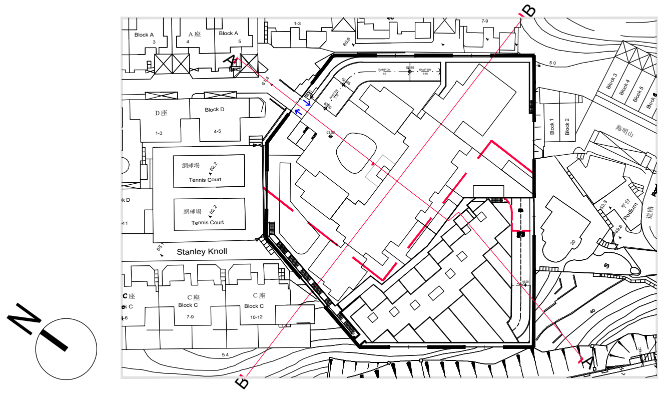
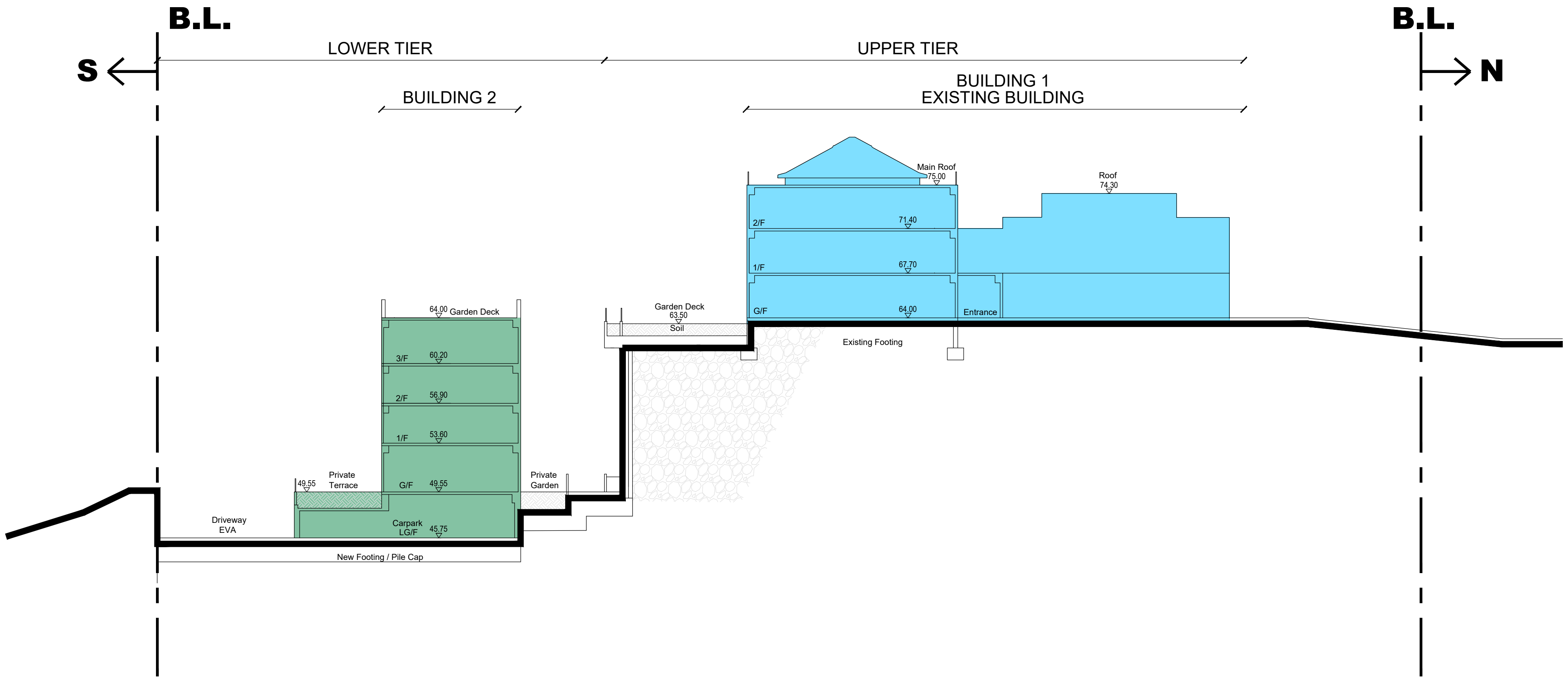
MARYKNOLL BUILDING, STANLEY
SECTION A

15 AUG 2024





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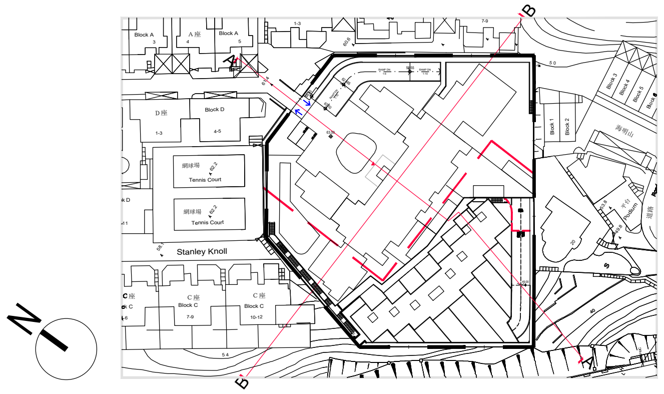
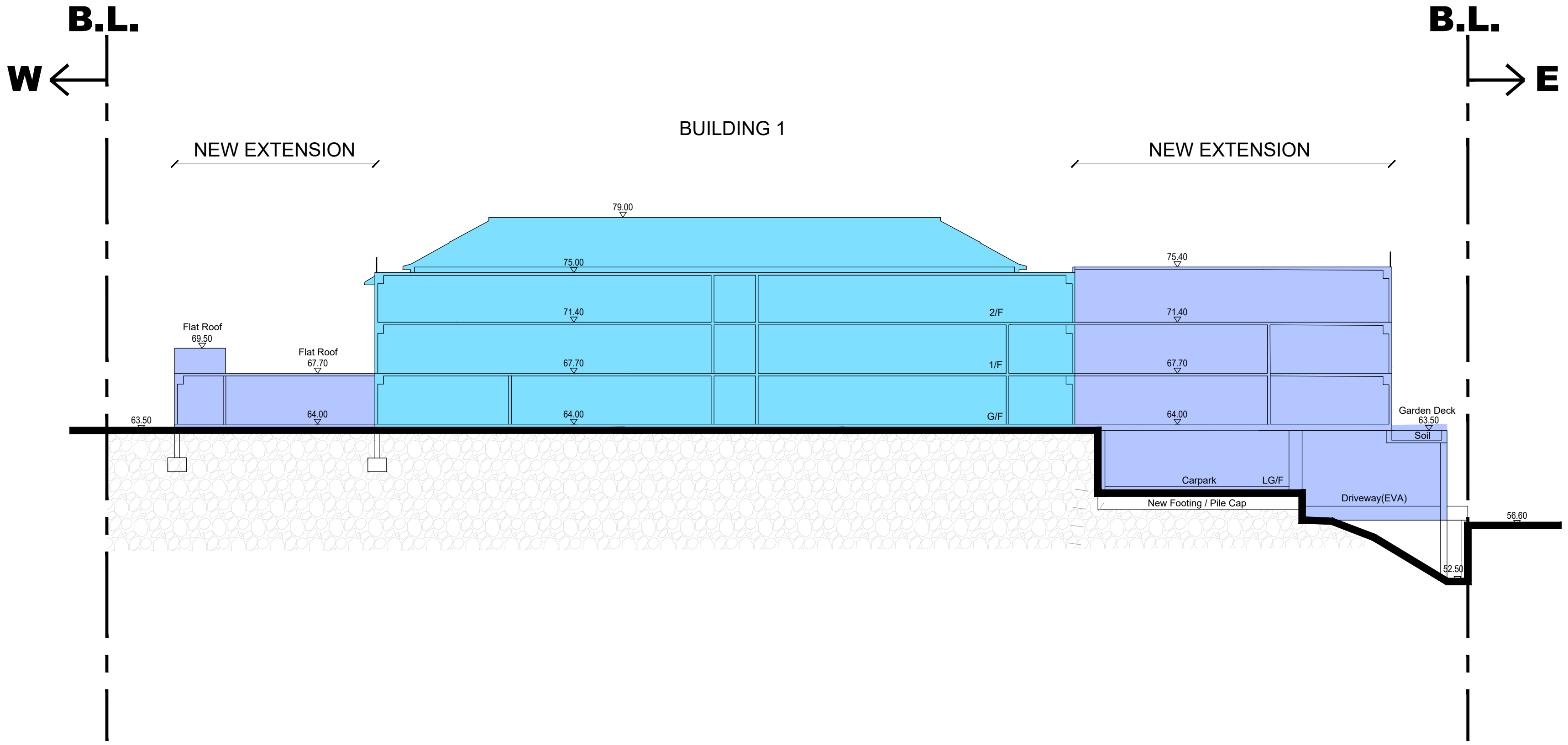
MARYKNOLL BUILDING, STANLEY
SECTION B

15 AUG 2024





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Appendix 2.1 Detailed Drainage Impact Assessment Calculations

Section 16 Planning Application for the Preservation and Revitalisation of Maryknoll House, Stanley, Hong Kong
Table 1 - Proposed Catchment Areas and Run-off (1 in 50 year)

Notes:
Site Area: 7,646 m^2

Proposed Scheme will include Paved Areas, C = 1, with Soft Landscaping, C = 0.15
Catchments are small, so Rational Method is appropriate

$$Q_p = 0.278\ C\ i\ A$$

where
Q_p = peak runoff in m^3/s
C = runoff coefficient (dimensionless)
i = rainfall intensity in mm/hr
A = catchment area in km^2

Surface Characteristics	*Runoff coefficient, C**
Asphalt	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Grassland (heavy soil**)	
Flat	0.13 - 0.25
Steep	0.25 - 0.35
Grassland (sandy soil)	
Flat	0.05 - 0.15
Steep	0.15 - 0.20

1 in 50 year (according to Table 3 of DSD Manual)
a= 505.5
b= 3.29
c= 0.355

Catchment		Area	Levels (mPD)		Fall	Overland, L	Fall, H	Overland t_c	t_0	Total t_f[1]	Total t_c[2]	Intensity	Weighted Runoff Coefficient	Run-off
		(m^2)	Upstream	Downstream	(m)	(m)	(m/100m)	(min)	(min)	(min)	(min)	(mm/h)		(m^3/s)
Existing	Catchment A (D1) Paved (~100%)													
	at D1	6,907	32.5	28.6	3.9	302	1.3	17.2	17.2	0.0	17.2	173	0.95	0.32
	at D2									0.1	17.3	173	0.95	0.32
	at D3									0.1	17.4	172	0.95	0.31
	Catchment B (D1) Paved (~5%) Unpaved (~95%)													
	at D1	8,728	54.0	28.6	25.4	302	8.4	11.5	11.5	0.0	11.5	194	0.38	0.14
	at D2									0.1	11.6	194	0.38	0.14
	at D3									0.1	11.8	193	0.38	0.14
	Catchment C (D1) Paved (~90%) Unpaved (~10%)													
	at D1	12,506								12.8	12.8	189	0.87	0.57
	at D2									0.1	12.9	188	0.87	0.57
	at D3									0.1	13.1	187	0.87	0.57
	Catchment D (D1) Paved (~85%) Unpaved (~15%)													
	at D1	1,375								2.8	2.8	267	0.83	0.08
	at D2									0.1	2.9	265	0.83	0.08
	at D3									0.1	3.0	263	0.83	0.08
	Catchment E (D2) Paved (~60%) Unpaved (~40%)													
	at D2	272	40.8	28.4	12.4	18.5	67.1	0.7	0.7	0.0	0.7	310	0.71	0.02
	at D3									0.1	0.8	307	0.71	0.02
	Catchment F (D2) Paved (~55%) Unpaved (~45%)													
	at D2	237	40.8	28.2	12.6	17.1	73.8	0.6	0.6	0.0	0.6	312	0.68	0.01
	at D3									0.1	0.7	308	0.68	0.01
	Catchment S (D1) Paved (~37%) Unpaved (~63%)													
	at D1	7,646								0.0	7.0	221	0.57	0.27
	at D2									0.1	7.1	220	0.57	0.27
	at D3									0.1	7.3	219	0.57	0.27
	Overall	**37,671**												**1.41**
Future	**Unchanged Catchments**													
	Catchment A	6,907												0.32
	Catchment B	8,728												0.14
	Catchment C	12,506												0.57
	Catchment D	1,375												0.08
	Catchment E	272												0.02
	Catchment F	237												0.01
	Sub-total	**30,025**												**1.14**
	Proposed Catchments for the Proposed Development													
	Catchment S (D1) Paved (~80%) Unpaved (~20%)													
	TSMH-1	7,646								7.0	7.0	221	0.79	0.37
	SMH-1									0.0	7.0	221	0.79	0.37
	CATCHPIT-1									0.1	7.2	220	0.79	0.37
	CATCHPIT-2									0.2	7.3	218	0.79	0.37
	SMH-2									0.1	7.4	218	0.79	0.37
	SMH-3									0.0	7.4	218	0.79	0.37
	SMH-4									0.1	7.5	217	0.79	0.36
	CATCHPIT-3									0.0	7.6	217	0.79	0.36
	at D1									0.0	7.6	217	0.79	0.36
	at D2									0.1	7.7	216	0.79	0.36
	at D3									0.1	7.9	215	0.79	0.36
	Overall	**37,671**												**1.51**

Remarks:
1. Assumed Time of Concentration through stream flow
2. Assumed Time of Concentration

Table 2a - 1 in 50 year Runoff of Existing Catchments (m^3/s)

Runoff	Catchment A	Catchment B	Catchment C	Catchment D	Catchment E	Catchment F	Catchment S	Total
at D1	0.32	0.14	0.57	0.08			0.27	**1.38**
at D2	0.32	0.14	0.57	0.08	0.02	0.01	0.27	**1.41**
at D3	0.31	0.14	0.57	0.08	0.02	0.01	0.27	**1.40**

Table 2b - 1 in 50 year Runoff of Future Catchments (m^3/s)

Runoff	Catchment A	Catchment B	Catchment C	Catchment D	Catchment E	Catchment F	Catchment S	Total
TSMH-1							0.37	**0.37**
SMH-1							0.37	**0.37**
CATCHPIT-1							0.37	**0.37**
CATCHPIT-2							0.37	**0.37**
SMH-2							0.37	**0.37**
SMH-3							0.37	**0.37**
SMH-4							0.36	**0.36**
CATCHPIT-3							0.36	**0.36**
at D1	0.32	0.14	0.57	0.08			0.36	**1.48**
at D2	0.32	0.14	0.57	0.08	0.02	0.01	0.36	**1.50**
at D3	0.31	0.14	0.57	0.08	0.02	0.01	0.36	**1.50**

Table 3a - Hydraulic Capacities for Existing Drainage System

Segment	Manhole Reference	Manhole Reference	Type of Channel	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	Gradient	v	V	Area[2]	Q	Q_{silt}[1]
				mm	m	mPD	mPD	m/s^2	m		1 in	m^2/s	m/s	m^2	m^3/s	m^3/s
D1-D2	SMH7043921	SMH7043922	Circular	1050	11.7	24.85	24.66	9.81	0.0030	0.016	61	0.000001	3.60	0.87	3.12	2.81
D2-D3	SMH7043922	SMH7044060	Circular	1050	11.9	24.66	24.41	9.81	0.0030	0.021	48	0.000001	4.09	0.87	3.54	3.19
D3-D4	SMH7044060	-	Circular	1050	3.7	22.83	22.70	9.81	0.0030	0.035	29	0.000001	5.28	0.87	4.57	4.12

Table 3b - Hydraulic Capacities for Proposed Drainage System (Circular Pipe)

Segment	Manhole Reference	Manhole Reference	Type of Channel	Pipe Dia.	Pipe Length	Invert Level 1	Invert Level 2	g	k_s	s	Gradient	v	V	Area[2]	Q	Q_{silt}[1]
				mm	m	mPD	mPD	m/s^2	m		1 in	m^2/s	m/s	m^2	m^3/s	m^3/s
TSMH-1 - SMH-1	TSMH-1	SMH-1	Circular	675	3.7	40.60	40.50	9.81	0.0030	0.027	37	0.000001	3.49	0.36	1.25	1.12
CATCHPIT-2 - SMH-2	CATCHPIT-2	SMH-2	Circular	675	6.4	31.71	31.00	9.81	0.0030	0.111	9	0.000001	7.08	0.36	2.53	2.41
SMH-2 - SMH-3	SMH-2	SMH-3	Circular	675	4.0	30.45	30.00	9.81	0.0030	0.113	9	0.000001	7.13	0.36	2.55	2.42
SMH-3 - SMH-4	SMH-3	SMH-4	Circular	675	6.5	30.00	29.70	9.81	0.0030	0.046	22	0.000001	4.56	0.36	1.63	1.55
CATCHPIT-3 - D1	CATCHPIT-3	SMH70423921	Circular	675	12.5	27.37	25.40	9.81	0.0030	0.158	6	0.000001	8.44	0.36	3.02	2.87

Table 3c - Hydraulic Capacities for Proposed Drainage System (Stepped Channel)

Segment	Manhole Reference	Manhole Reference	Type of Channel	Gradient	Length	Depth	Width	Step Height	Step Length	C_e	x	f_e	Y_{90}	d_o	D_H	V_o	Q
				α°	m	mm	mm	mm	mm				m	m	m	m/s	m^3/s
SMH-1 - CATCHPIT-1	SMH-1	CATCHPIT-1	Stepped Channel	20.6	10.6	740	675	300	800	0.32	0.56	0.76	0.69	0.47	0.78849	10.73	3.43
CATCHPIT-1 - CATCHPIT-2	CATCHPIT-1	CATCHPIT-2	Stepped Channel	20.6	15.6	740	675	300	800	0.32	0.56	0.76	0.69	0.47	0.78849	10.73	3.43
SMH-4 - CATCHPIT-3	SMH-4	CATCHPIT-3	Stepped Channel	31.0	3.9	740	675	300	500	0.46	0.12	0.56	0.63	0.34	0.67821	14.00	3.22

Section 16 Planning Application for the Preservation and Revitalisation of Maryknoll House, Stanley, Hong Kong
Hydraulic Calculations of Existing and Proposed Drainage System

Table 4a - Comparison of Runoff from Existing Catchments and Hydraulic Capcities of Existing Drainage System

Segment	Manhole Reference	Manhole Reference	Pipe Dia. (mm)	Q_{silt}[1] (m^3/s)	Catchment Involved	Runoff (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [2] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [3] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [4] (m^3/s)	Occupancy	Sufficient Capacity?
D1-D2	SMH7043921	SMH7043922	1050	2.81	A-D, S	1.38	49.2%	YES	1.53	54.7%	YES	1.60	57.1%	YES	1.77	63.0%	YES
D2-D3	SMH7043922	SMH7044060	1050	3.19	A-F, S	1.41	44.1%	YES	1.56	49.0%	YES	1.63	51.2%	YES	1.80	56.5%	YES
D3-D4	SMH7044060	-	1050	4.12	A-F, S	1.40	34.1%	YES	1.56	37.8%	YES	1.63	39.5%	YES	1.80	43.6%	YES

Table 4b - Comparison of Runoff from Proposed Catchments and Hydraulic Capcities of Existing Drainage System

Segment	Manhole Reference	Manhole Reference	Pipe Dia. (mm)	Q_{silt}[1] (m^3/s)	Catchment Involved	Runoff (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [2] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [3] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [4] (m^3/s)	Occupancy	Sufficient Capacity?
D1-D2	SMH7043921	SMH7043922	1050	2.81	A-D, S	1.48	52.6%	YES	1.64	58.4%	YES	1.71	61.0%	YES	1.89	67.4%	YES
D2-D3	SMH7043922	SMH7044060	1050	3.19	A-F, S	1.50	47.1%	YES	1.67	52.3%	YES	1.74	54.6%	YES	1.92	60.3%	YES
D3-D4	SMH7044060	-	1050	4.12	A-F, S	1.50	36.4%	YES	1.66	40.4%	YES	1.74	42.2%	YES	1.92	46.6%	YES

Table 4c - Comparison of Runoff from Proposed Catchments and Hydraulic Capcities of Proposed Drainage System (Circular Pipe)

Segment	Manhole Reference	Manhole Reference	Pipe Dia. (mm)	Q_{silt}[1] (m^3/s)	Catchment Involved	Runoff (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [2] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [3] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [4] (m^3/s)	Occupancy	Sufficient Capacity?
TSMH-1 - SMH-1	TSMH-1	SMH-1	675	1.12	S	0.37	33.0%	YES	0.41	36.7%	YES	0.43	38.3%	YES	0.48	42.3%	YES
CATCHPIT-2 - SMH-2	CATCHPIT-2	SMH-2	675	2.41	S	0.37	15.2%	YES	0.41	16.9%	YES	0.43	17.7%	YES	0.47	19.5%	YES
SMH-2 - SMH-3	SMH-2	SMH-3	675	2.42	S	0.37	15.1%	YES	0.41	16.8%	YES	0.42	17.5%	YES	0.47	19.4%	YES
SMH-3 - SMH-4	SMH-3	SMH-4	675	1.55	S	0.37	23.6%	YES	0.41	26.2%	YES	0.42	27.3%	YES	0.47	30.2%	YES
CATCHPIT-3 - D1	CATCHPIT-3	SMH70423921	675	2.87	S	0.36	12.7%	YES	0.40	14.1%	YES	0.42	14.7%	YES	0.47	16.3%	YES

Table 4d - Comparison of Runoff from Proposed Catchments and Hydraulic Capcities of Proposed Drainage System (Stepped Channel)

Segment	Manhole Reference	Manhole Reference	Pipe Dia. (mm)	Q (m^3/s)	Catchment Involved	Runoff (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [2] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [3] (m^3/s)	Occupancy	Sufficient Capacity?	Runoff [4] (m^3/s)	Occupancy	Sufficient Capacity?
SMH-1 - CATCHPIT-1	SMH-1	CATCHPIT-1	675	3.43	S	0.37	10.8%	YES	0.41	12.0%	YES	0.43	12.5%	YES	0.47	13.8%	YES
CATCHPIT-1 - CATCHPIT-2	CATCHPIT-1	CATCHPIT-2	675	3.43	S	0.37	10.8%	YES	0.41	11.9%	YES	0.43	12.5%	YES	0.47	13.8%	YES
SMH-4 - CATCHPIT-3	SMH-4	CATCHPIT-3	675	3.22	S	0.36	11.3%	YES	0.41	12.6%	YES	0.42	13.1%	YES	0.47	14.5%	YES

Remarks:

1. Qsilt: 10% reduction in flow for gradient is not greater than 1 in 25, 5% reduction in flow for gradient greater than 1 in 25.
2. Cross Section Area of Circular Pipe: $D^2 \times PI / 4$
3. Perimeter of Circular Pipe: $(D \times 2 \times PI) / 2$
4. Table 3c: calculation of capacity of stepped channel refers to GEO TGN 27 - Annex A2

Runoff [2] represents the situation in Mid 21st Century with additional runoff of 11.1%
Runoff [3] represents the situation in Late 21st Century with additional runoff of 16.0%
Runoff [4] represents the situation in Late 21st Century - due to climate change (16.0%) and design allowance (12.1%)

Appendix 2.2 Underground Utility Survey at Maryknoll House

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WDE/SPJ-080/20

Underground Utility for Proposed Residential Development at Maryknoll Housed 44 Stanley Village Road

Underground Utility Survey

Date: **December 2020**

Revision 0

Underground Utility Survey Report

Prepared by:
Waterland Detection Engineering Ltd.
Rm 902, 9/F Sun Fung Centre,
88 Kwok Shui Road, Kwai Chung, NT
T: 2636 6900
F: 2636 6907
E: enquiry@waterland.com.hk

FOREWORD

This report presents the Underground Utility Survey for captioned project. This report was written and checked by Waterland Detection Engineering Ltd. to ensure all data and records in order and accurate.

Prepared by:

Mr. Astro yung
Assistant Engineer

Surveyed by:

Mr. Rong Gangcai (CP00964)
Team Leader

Approved by:

Mr. K.K. Yan
Project Director

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Background

Waterland Detection Engineering Limited was appointed by New Season Global Limited as specialist contractor for u Underground Utility for Proposed Residential Development at Maryknoll Housed 44 Stanley Village Road.

1.2 Scope of Survey

- Provision of specialist and equipment to carry out underground utilities survey by means of electromagnetic induction method for mapping the alignment and depth of all existing underground detectable utilities including fresh water pipe, salt water pipe, electric cables, gas pipe, telecom cables, drainage as shown in Appendix D.
- Provision of specialist and equipment to carry out the level survey of manholes as shown in Appendix D.

2. DETAILS OF INVESTIGATION

Project Director:	Mr. K.K. Yan
General Manager:	Mr. Jacky So
Survey Team Leader:	Mr. Rong Gangcai (CP00964)
Date of Survey:	19 & 30 Nov, 2 & 3 December 2020
Equipment Used:	Radiodetection RD8000
	Sokkia CX-105
Surveyed Area:	6393m^2
	Storm Water Manhole 14nos
	Foul Water Manhole 10 nos.

3. FIELD PROCEDURES

1) Team leader evaluates the ground condition and the traffic condition before the commencement of work. Temporary traffic arrangement will be considered if necessary.
2) When it is possible, manholes / valves / vaults / chambers are opened in order to map their locations sizes and depths. Underground pipes are marked with their flow direction, sizes and depths. In addition, the first manhole / valves / vaults /

chambers immediate outside the site boundary are also opened in order to locate the alignment of the pipes.

3) All surface features related to underground utilities such as manholes, draw pits, inspection chambers, gullies lamp posts, illuminated road signs and telephone booths etc. are also recorded.
4) All known and recordable underground services within the site are surveyed. Pipe and cable locator is employed to locate metallic buried pipes and live cables; while drains check needs manhole covers to be opened so that the alignment of drains can be traced.
5) When using the cable locator, direct connection method has no damage to the existing utilities. All electrical utilities (lamp post, traffic light, low / medium / high voltage electric cables and telecom cables) are located by induction method or by using a clamp-on device to induce current.
6) Sonde will be used to locate non-metallic lines. Sonde is a small self-generator of signal which is used to generate signal in non-metallic ducts or drains so that the alignment can be traced with a receiver.
7) Depth of metallic lines located by pipe and cable locator is referenced to the centre of the field or centre of pipes / cables. Depth of non-metallic ducts located using sonde is referenced to the bottom of the duct.
8) For the topographic survey, the marked positions of utility alignments are mapped by the surveyor. All data will be recorded automatically by using data logger.
9) Depth of utilities is plotted on the drawing with a cross and its depth shown as:

10) When cable / duct band were identified, the number of cables / ducts and the configurations are recorded. As for bundle of cables, a carpet of cables is marked on the drawing with the outer cables shown on each side of the bundle.
11) Before the completion of site work, team leader will carry out a checklist procedure to make sure that all site work has been completed and all the field data are recorded properly.
12) The devices to be used were enclosed in Appendix B.

4. SURVEY RESULTS

4.1 Detected Utilities

The results of utility survey were drawn and attached in Appendix D.

Table 4.1.1 – Sections of pipes & cables

Total numbers of Sections of pipes & cables	Drawing no.
154	SPJ080-20-D01

4.2 Survey Difficulties

Please refer to the appendix E for the site plan, which indicated the location of the site photos. The following table summarized the problems encountered during the site work:

Table 4.2.1 – Pipe / Cable Line

Utility	Line Ref.	Problem	Reason /Remarks
Storm Water Pipe	15-	Unreliable	- Utility could not be determined on site because the manhole S168 was unable to survey (UTS).
	36	Unreliable	Utility could not be determined on site because the manhole S142 was unable to survey (UTS).
	98	Unreliable	Utility could not be determined on site because the manhole S137 was unable to survey (UTS).
	99	Unreliable	Utility could not be determined on site because the manhole S137 was unable to survey (UTS).
	129	Unreliable	Utility could not be determined on site because the manhole F10 was unable to survey (UTS).
	152	Unreliable	Utility could not be determined on site because the manhole S137 was unable to survey (UTS).
	154	Unreliable	Utility could not be determined on site because the manhole S132 was unable to survey (UTS).
Foul Water Pipe	140	Unreliable	Utility could not be determined on site because the manhole F26 was unable to get access (UTGA).

Table 4.2.2 – Manhole/Pit

Utility	Manhole / Pit Ref.	Problem	Reason /Remarks
HKT PIT	T15	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
HKT PIT	T20	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Storm Water Manhole	S73	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Storm Water Manhole	S75	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Storm Water Manhole	S132	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Storm Water Manhole	S137	UTR	The manhole cover could not be lifted up for investigation.
Storm Water Manhole	S142	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Storm Water Manhole	S168	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Storm Water Manhole	S318	UTR	The manhole cover could not be lifted up for investigation.
Storm Water Manhole	S319	UTR	The manhole cover could not be lifted up for investigation.
Foul Water Manhole	F10	UTS	Its chamber was filled with debris and silt. The internal condition could not be visualized for investigation.
Foul Water Manhole	F26	UTGA	The Manhole Unable To Get Access for investigation.

Abbr.:
UTS – Unable To Survey
UTR – Unable To Raise
UTGA – Unable To Get Access
UTL – Unable To Locate

4.3 Remarks

1) Methodology is stated in Appendix C of this report.
2) Bending of pipe / cable which sheering off obstruction (such as manhole, gullies, valve, etc.) is too small to be determined. Alignment and depth of pipe / cable in such case might be deviated.

3) A bundle of pipes or cables buried in the same level or very close to each others (say an inch or even in contact) is not possible to be identified. The pipe of a larger diameter should be reported in the drawing.
4) In case of pipes / cables buried in the same vertical level, only the upper pipe/cable will be reported in the drawing.
5) All electricity cables were determined by passive mode (unless specified). Details (include depth, alignment, and number of cables) of electricity cables shown on the drawing are for reference only. The number of cable was determined by counting the peak of detected signal.
6) The pipe material is referred to the record drawings from utilities companies which shall be confirmed during construction stage. For those utility record drawings without specific pipe material stated, the materials are estimated only.

5. RECOMMENDATIONS

1) Excavation by trial pit is recommended:
   - according to The Code of Practice on Working near Electricity Supply Lines (Year 2000 edition) Part II B1.3; & The Code of Practice on Avoiding danger from gas pipes (Year 1997 edition) item 42; and
   - to verify and identify the unreliable pipe / cable line.
2) The Competent Person only conducted the PASSIVE DETECTION on date mentioned in *Section 2 – Site Description* for sole purpose of recommending the location(s) of trial hole(s) as shown in the drawing refer to *Section 4.1 – Detected Utilities*.
3) The Contractor shall use hand tools to dig the TRIAL HOLE to expose the underground electricity cables and then MUST request the Competent Person again to conduct ACTIVE DETECTION to locate the unexposed cables.
4) Extra care must be taken during excavation to avoid damages of existing buried utilities.
5) Cables with unknown voltage, if any, should be treated as carrying high voltage.
6) In accordance with Electricity Supply Lines (Protection) Regulation under the Electricity Ordinance (Cap. 406H), this report in respect of underground electricity cable is in purpose of recommending trial pit location only and cannot be served as a completed cable detection report for excavation.
7) Trial pit(s) is recommended to expose the bundles of cables/unknown object.

REFERENCES

Code of Practice on Avoiding danger from gas pipes (Year 1997 edition)

Code of Practice on Working near Electricity Supply Lines (Year 2000 edition)

RD8000 Series User Manual, Radiodetection Inc.

Relevant layout plan / record provided from Utility Undertaker(s):

Utility Undertaker	Date of Relevant
The Hongkong Electric Co., Ltd.	6/8/2020
CLP Power Hong Kong Ltd.	(N/A)
Chief Engineer/Lighting, Highways Department	
PCCW-HKT Telephone Limited	05/08/2020
The Hong Kong & China Gas Co. Ltd.	
Hutchison Global Communications Ltd.	7/10/2020
New World Telecommunications Ltd.	
Wharf T & T Ltd.	
Hong Kong Cable Television Ltd.	
Water Supplies Department	
Drainage Services Department	
Transport Department	
Hong Kong Broadband Network Limited	
Towngas Telecommunication Fixed Network Limited	
SmarTone Communications Limited	
TraxComm Limited	
HKC Network Limited	
Hongkong Tramways Ltd	(N/A)

Appendix A – Site Photographs

Figure 1 General View

Figure 2 General View

Figure 3 General View

Figure 4 General View

Figure 5 S73 UTR

Figure 6 S75 UTS

Figure 7 S137 UTR

Figure 8 S318 UTR

Figure 9 S319 UTR

Appendix B – Equipment Used

B.1 CABLE / PIPE LOCATOR (RADIODETECTION RD8000)

An electromagnetic Cable / Pipe Locator was used to identify the pipe alignment. The equipment contains two parts – a transmitter and a receiver. The transmitter generates a low-frequency signal to the targeted object. The receiver can detect the same frequency signal with an aerial antenna. The pipe alignment and depth can be marked on site immediately for record. Calibration and maintenance check would be performed every year.

B.2 ELECTRONIC TOTAL STATION (SOKKIA CX-105)

An electronic total station was used to record all survey details marked on site for plan preparation. All co-ordinates and heights are referenced to the Hong Kong 1980 Grid and the Hong Kong Principal Datum respectively.

Appendix C – Methodology

C.1 PLANNING AND SETTING UP

Systematic planning is fundamental for the conduction of a contract. A preliminary schedule will be arranged in accordance with the agreement signed by Waterland and the client.

Available utility maps will be searched in order to get an understanding of the potential layout of subsurface utilities. Clients shall provide those records as part of their obligation and to minimize the time spent on the issue.

The preparation kit includes utility drawings; all necessary permits for field works and safety precaution procedures will be issued to the survey team before the commencement of field works.

C.2 BOUNDARY DEFINITION AND VISUAL INSPECTIONS

The site boundary will be marked with spray paint for site work reference after the confirmation of client's representative. It is facilitated based on a Total Station and multiple control points. Where possible manholes / valves / vaults / chambers will be opened for measuring their extents and depths. Sewers also need to be marked with the flow directions of drain tunnels, diameters and depths of tunnels. Manhole covers and valves outside the immediate site boundary will be opened, marked and traced too if they contain services which enter the boundary area.

C.3 ELECTROMAGNETIC LOCATING SURVEY

Electromagnetic location instruments (Cable/Pipe Locator) will be used to locate metallic pipes, tracer wires for non-metallic pipes, and drains.

All surface features of underground utilities will be recorded, including manholes, draw pits, inspection chambers, gullies, and street furniture’s connected to pipes and cables, such as lamp posts, illuminated road signs and bollards, telephone kiosks etc. All underground services within the site shall be surveyed. The known information shall be checked too. The conditions of services however, will not be surveyed.

Underground utilities will be positioned in three dimensions at reasonable interval for each surface feature. Where bands of cables/ducts are identified, the upper and lower outer cables/ducts will be traced in order to provide a cross section of the cable/duct band.

All electrical utilities (lampposts, traffic lights, low / medium / high voltage electric cables and telecom cables) will be located by either inductive methods or where necessary the use of a signal clamp which makes no contact with any conducting material. For gas and water valves, locator will directly connect with the utilities without damage. Sewer manholes will be examined by use of torches so that confined space entry is needed greatly reducing the chance of injury from harmful gases, rats, snakes, etc. While drains or sewers must be surveyed by lifting covers, the path of the drain is usually traced and located using an electromagnetic sonde.

The position of utilities will be marked for the surveyor to record the findings by undertaking a topographical survey and eventually forming a drawing in DWG/DGN format.

C.4 TOPOGRAPHIC SURVEY

After the utility alignments are marked on site, all data are then collected via onboard data logging facility controlled by a programme.

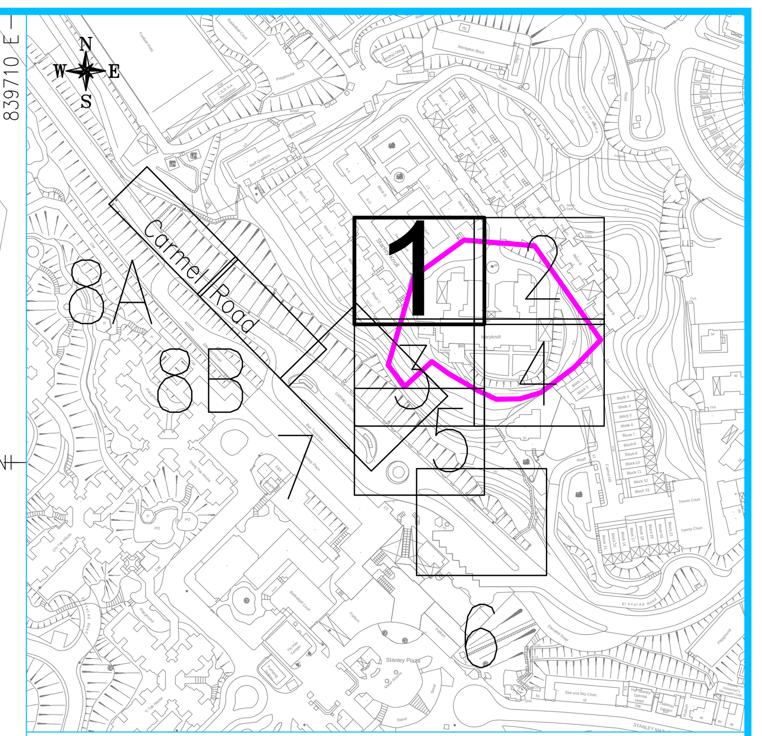
The utility information is transferred to digital format and presented in a utility drawing scale of 1:100 or 1:200 in DWG/DGN format. Cover levels and invert levels are related to the arbitrary control point and datum.

Cable depth here refers to the cable centre, with symbol "- 0.68d –". Any significant change in depth will be annotated for each surface feature.

All cable/duct band identified will be marked with the cable number contained in the band. When a bundle of cables are found, a carpet of cables will be marked on the drawing with the outer cables show on each side of the bundle.

Appendix D – Utility Survey Drawing

Drawing No.:
SPJ080-20-D01



Location Map

Rev.	Date	Description
00	12/20	First Issue
01		
02		

NOTE :

1. Depth to utility is indicated as #d(m). The depth for drains and sewers are from cover levels (C.L.) to invert levels (I.L.). The depth of other services are from ground levels (G.L.) to centre of services.
2. All co-ordinates are in accordance with the Hong Kong 1980 Grid System.
3. All levels are in meters as reference to the principal datum unless otherwise stated.
4. All dimensions are in millimeters as unit unless otherwise stated.
5. All the sizes of the services indicated on the plan are not to scale. The alignments show the central axis of the utility.
6. For those utilities cannot be accurately surveyed due to various factors will be classified as 'unreliable'. Trial pit is highly recommended for verification of the true alignment.
7. The utilities are found on the utilities record drawings but cannot be located during the survey. These utilities will be classified as 'record'.
8. Due to the electric cable cannot be surveyed by active mode method, trial pits were recommended. After the trial pit was excavated, Competent Person will be requested for carrying out the active detection works.

LEGEND :

- Water Point
- Water Meter
- Fire Hydrant
- Water Valve
- Water Pit
- Gas Valve
- Gas Pit
- CATV Pit
- HKCWN Pit
- HGC Pit
- HKBN Pit
- HKT Pit
- NWT Pit
- TGT Pit
- TraxComm Pit
- WTT Pit
- Traffic Light
- Traffic Bollard
- Lamppost
- Electric Pole
- ATC (E&M) Pit
- Lighting Pit
- Electric Pit
- Control Box
- Telecom Pole
- Down Pipe
- Inlet
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- Other / Unclassified Utility
- F WAT — Fresh Water Pipe
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- GAS — Gas Pipe
- ATC — ATC (E&M) Cable
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- CATV — CATV Cable
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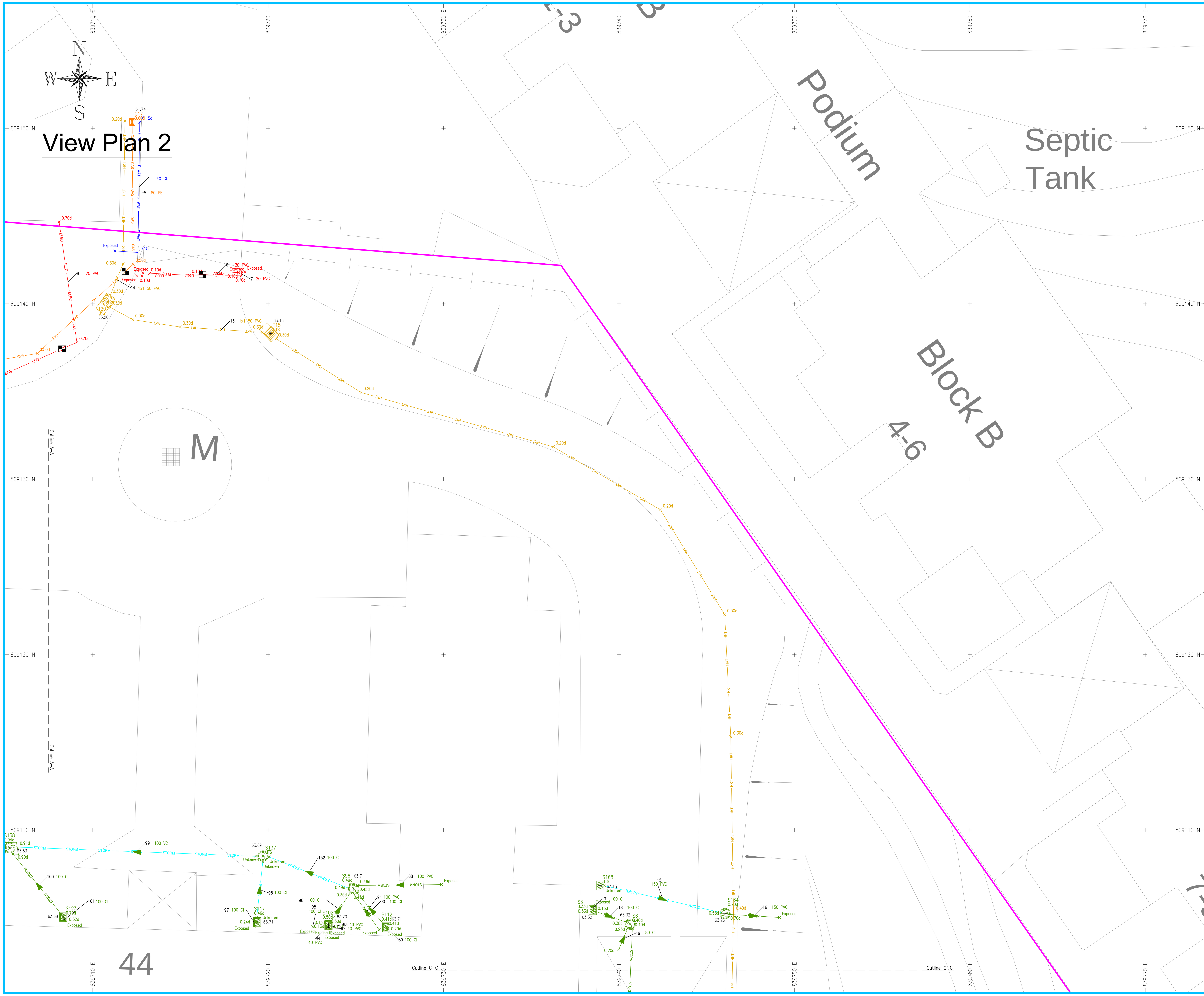
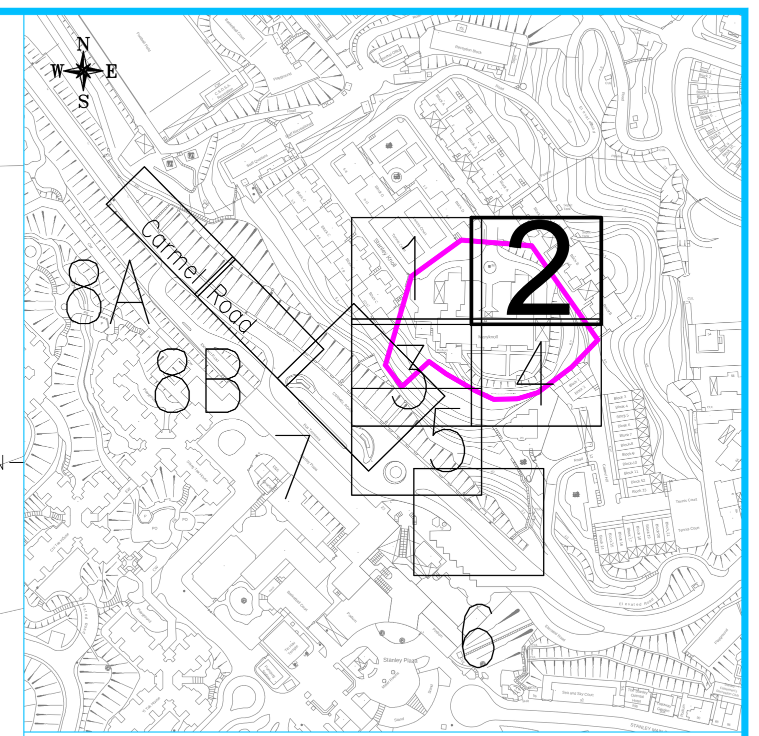
DRAWING TITLE : Utility Layout Plan

A1 Size	Scale 1:100	Survey Date:	DEC 2020

Surveyed By:	Approved By:
Mr. Rong Guangcai (CP00964)	Mr. K.K. Yan

Project No.	WDE/SPJ-080/20	
Drawing No.	SPJ080-20-D01	Page 1 of 9





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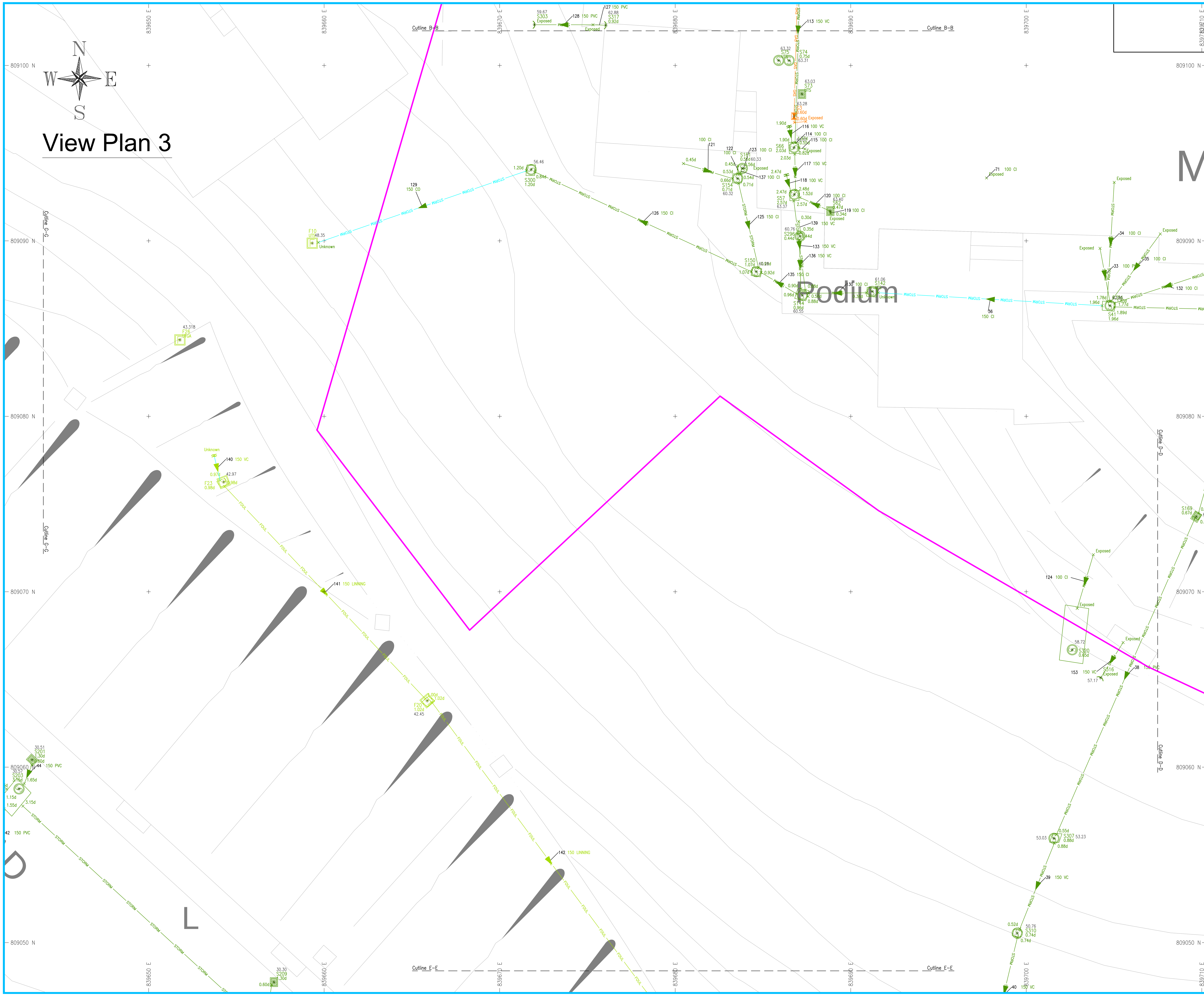

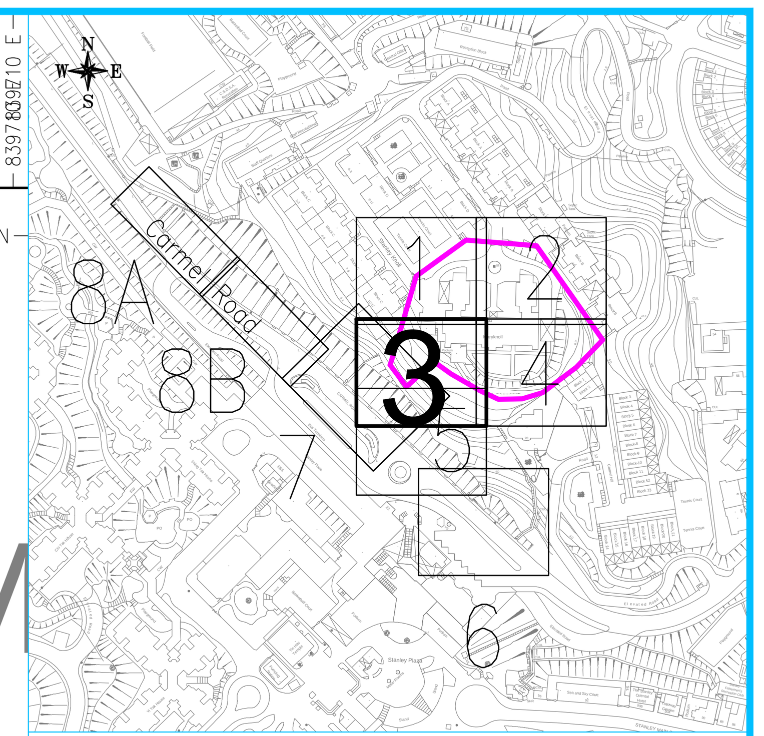

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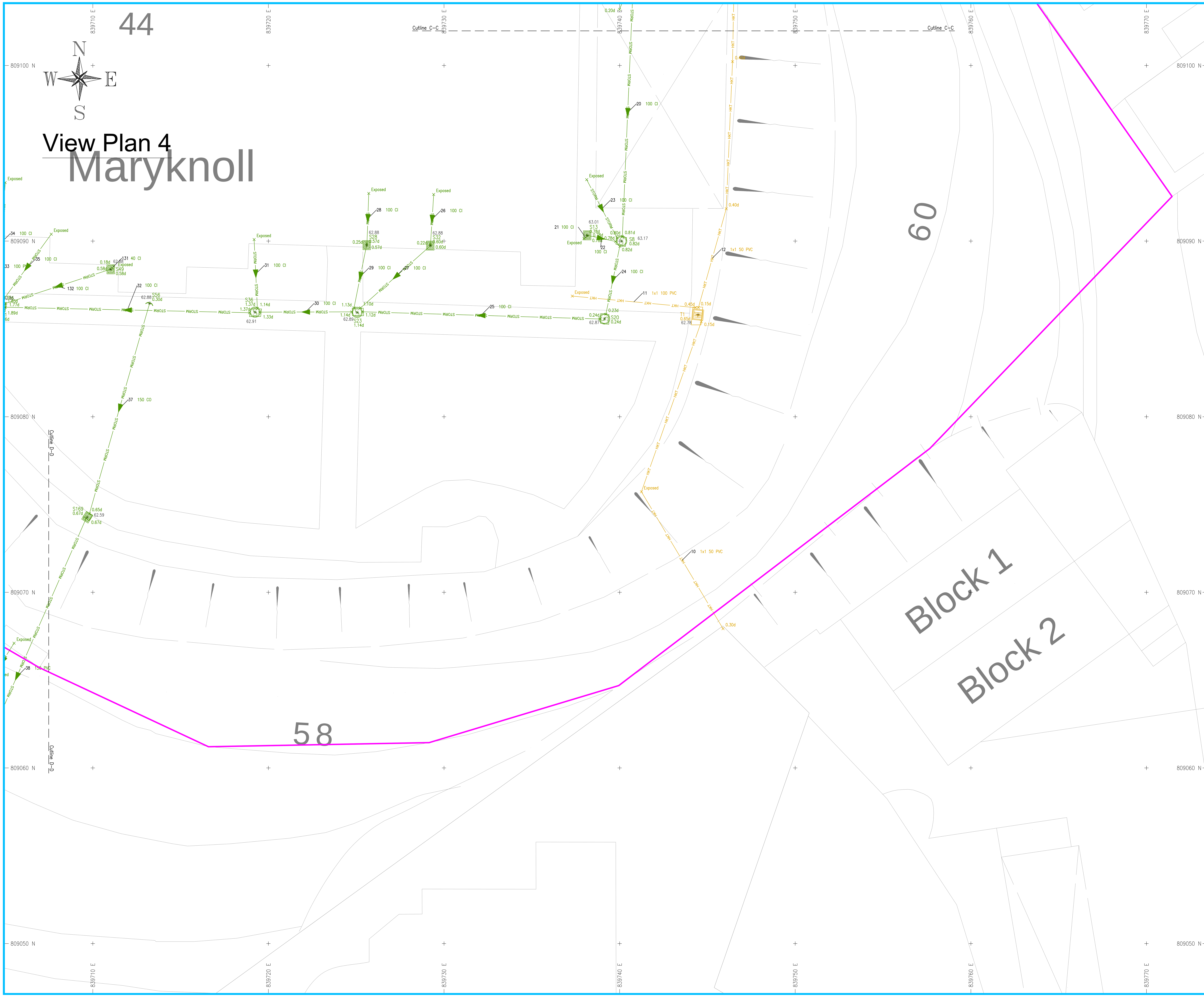

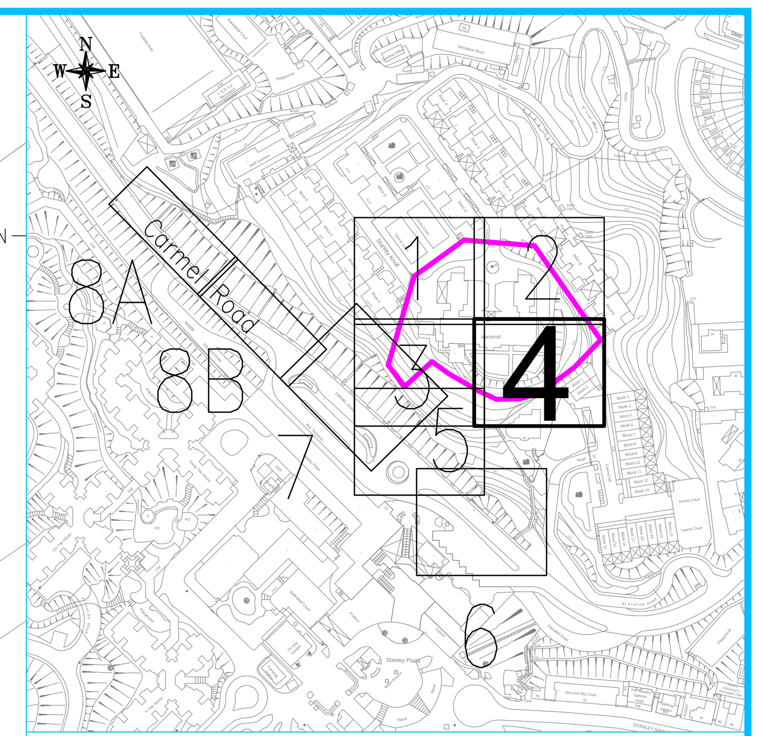

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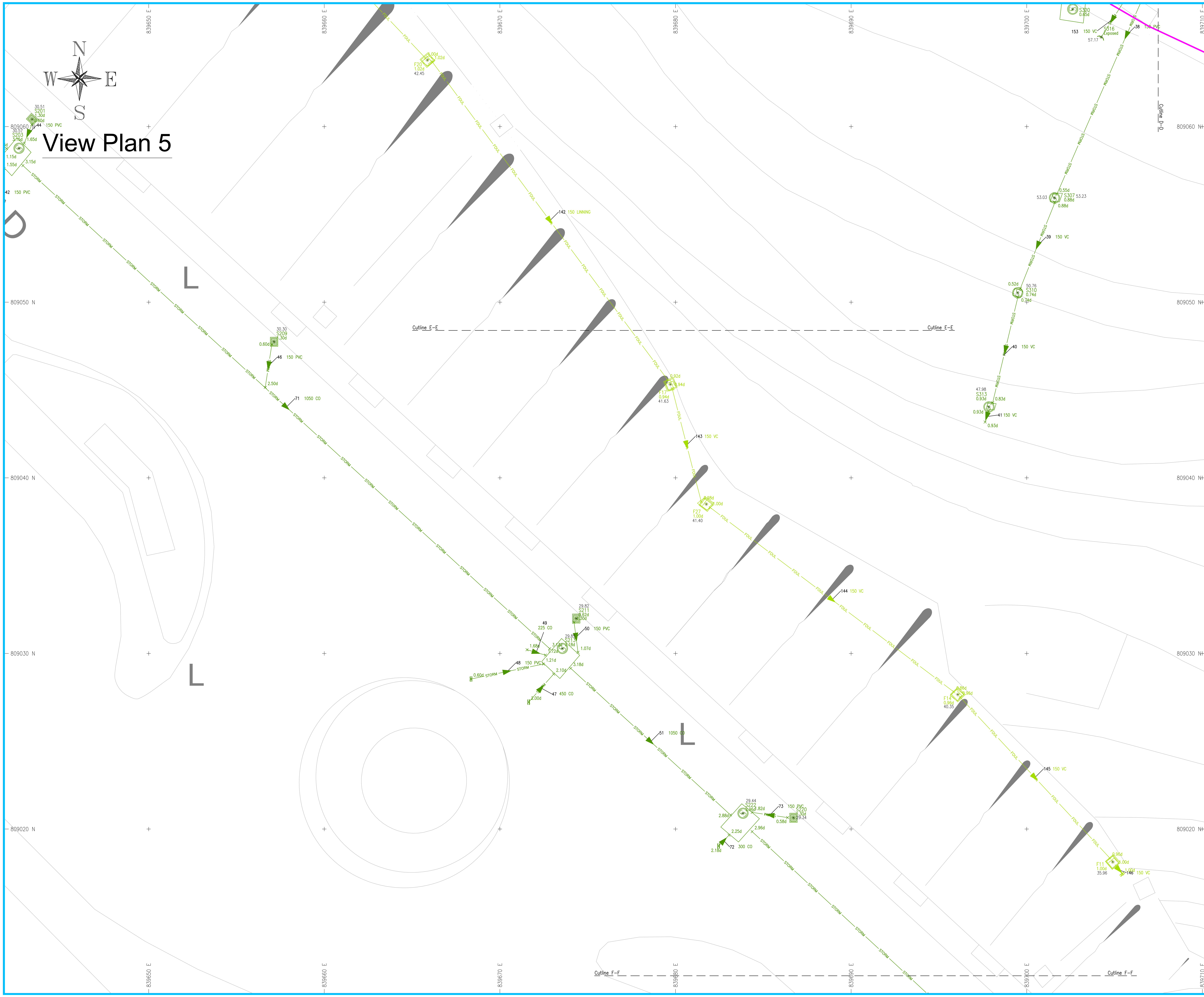

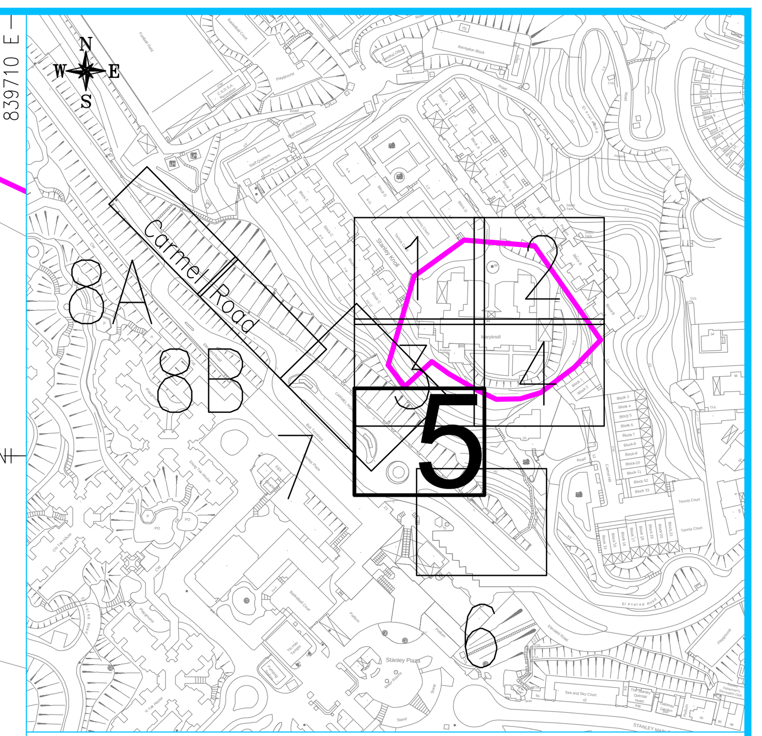

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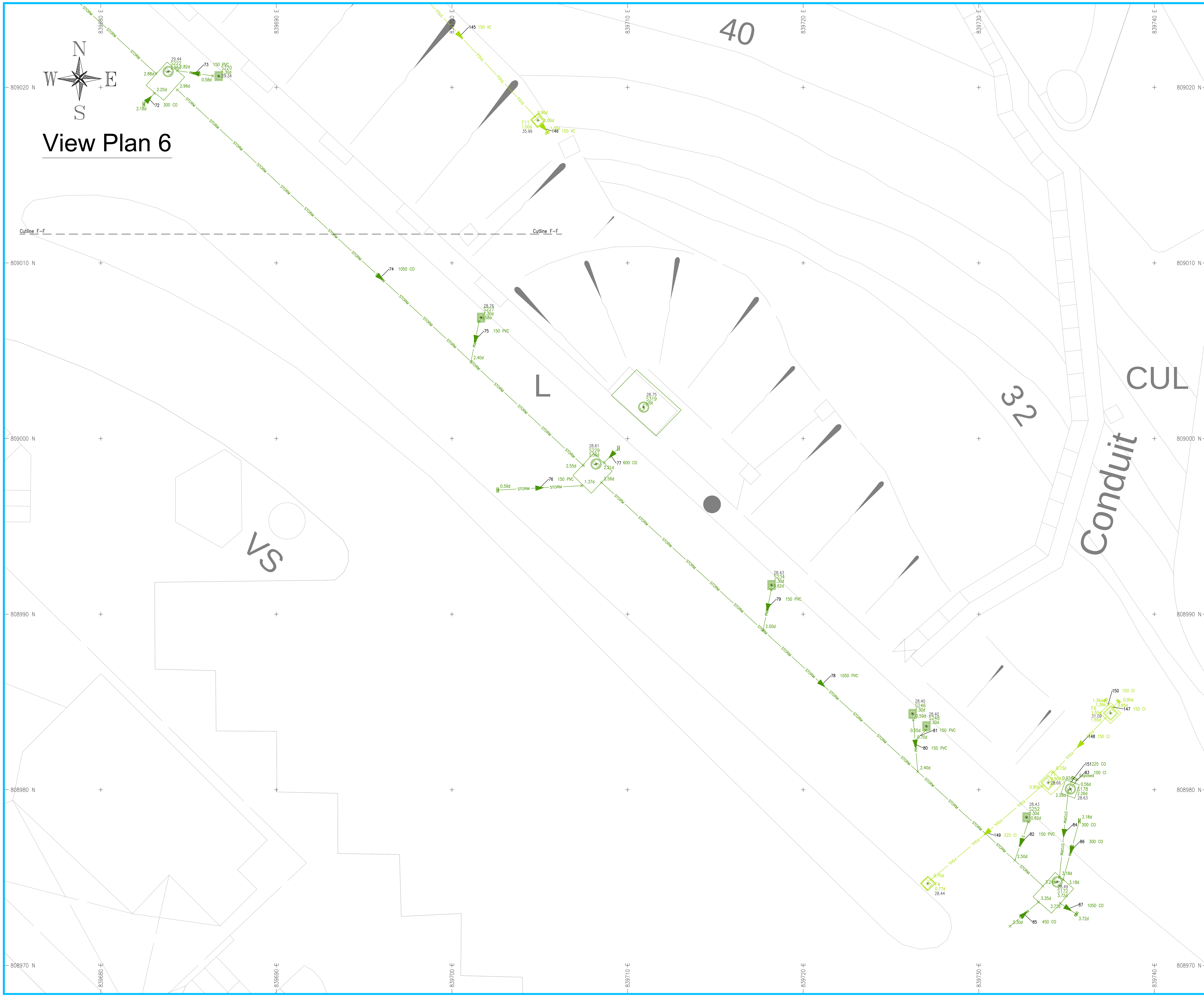

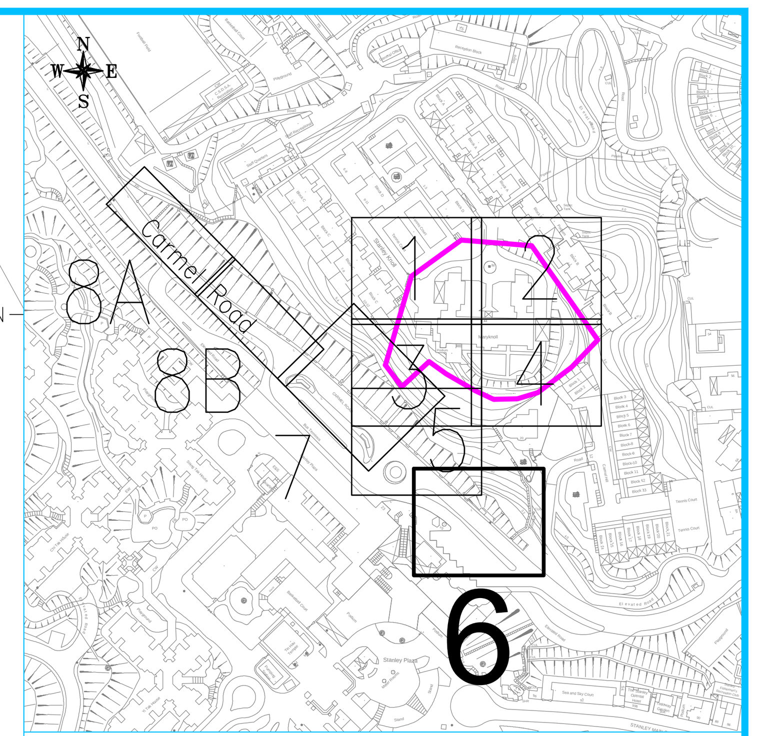

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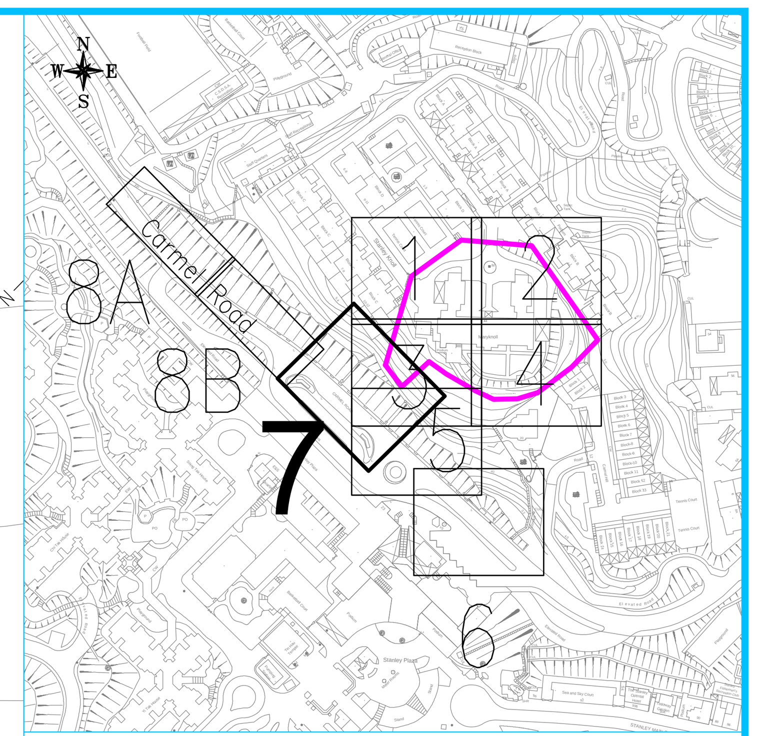

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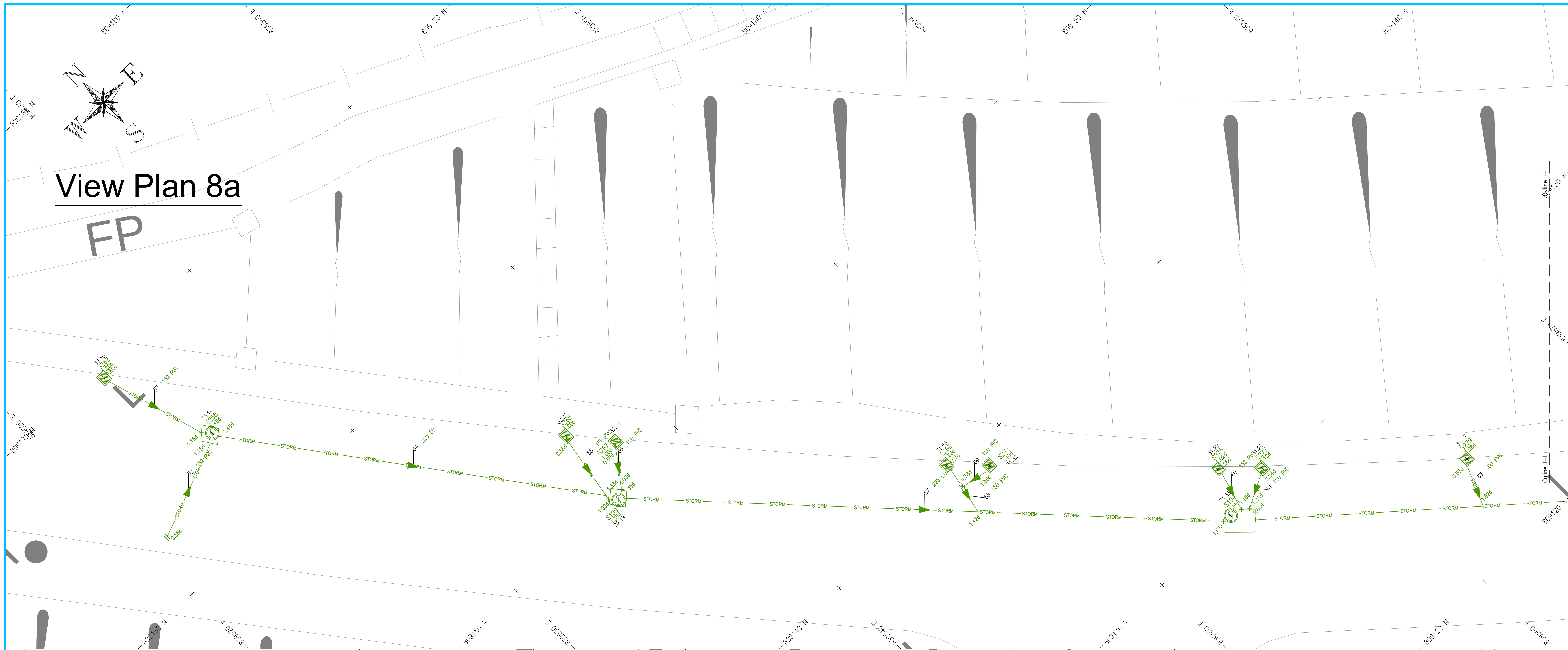

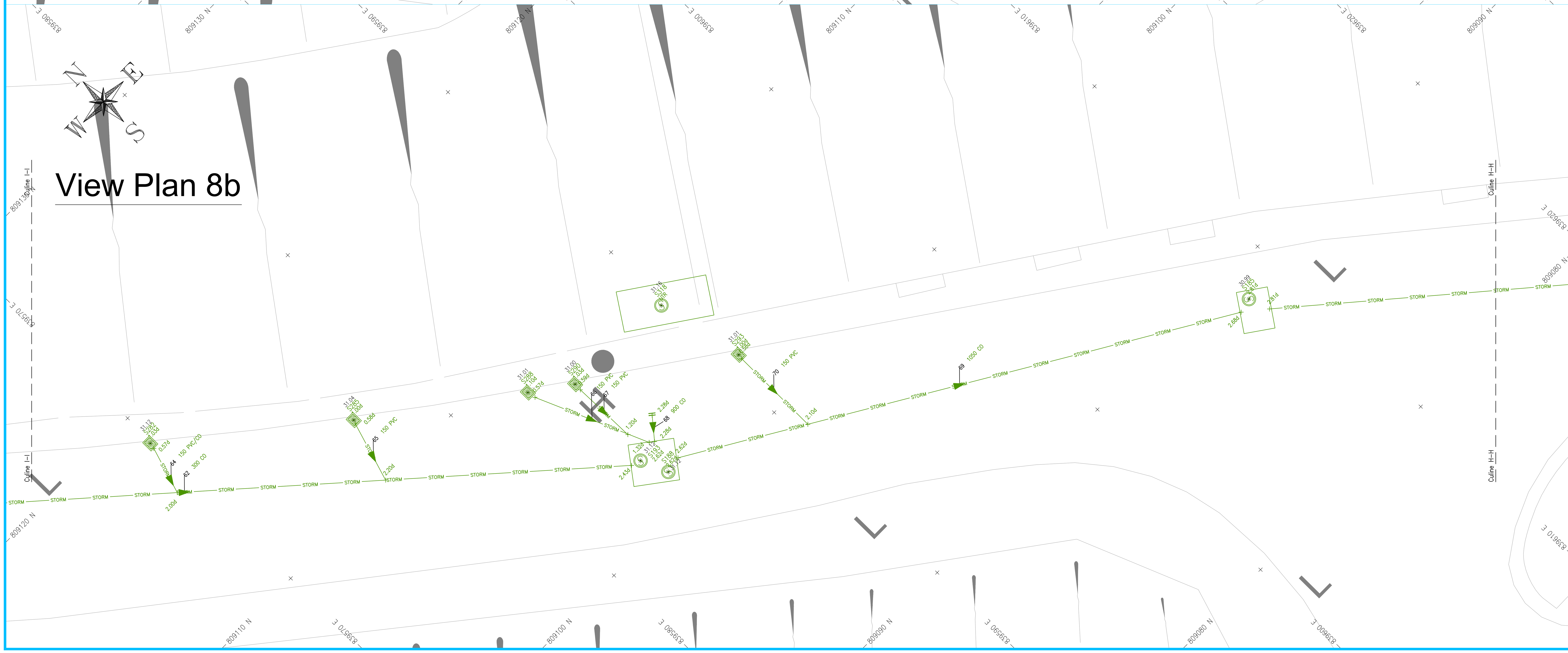

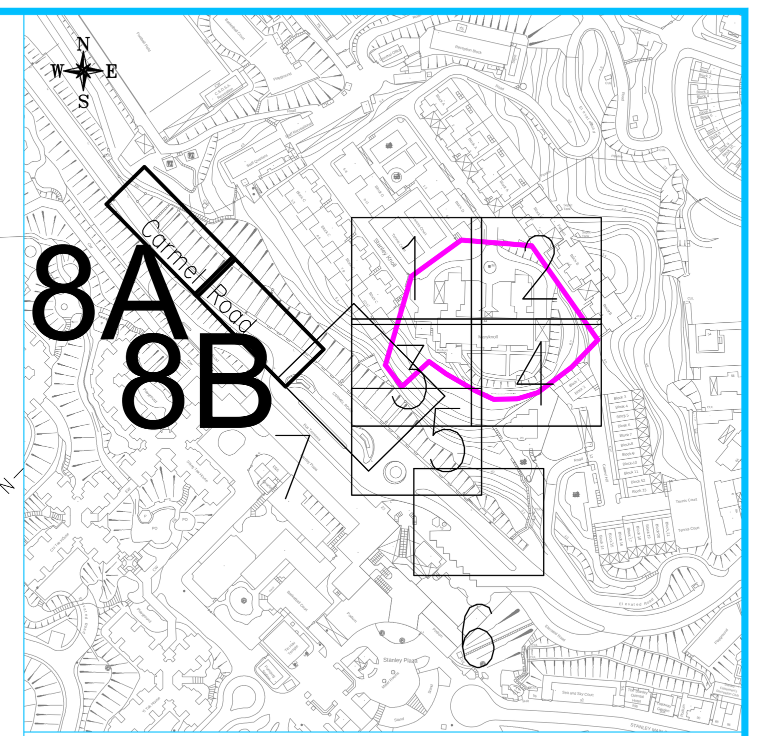

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1. Depth to utility is indicated as #d(m). The depth for drains and sewers are from cover levels (C.L.) to invert levels (I.L.). The depth of other services are from ground levels (G.L.) to centre of services.
2. All co-ordinates are in accordance with the Hong Kong 1980 Grid System.
3. All levels are in meters as reference to the principal datum unless otherwise stated.
4. All dimensions are in millimeters as unit unless otherwise stated.
5. All the sizes of the services indicated on the plan are not to scale. The alignments show the central axis of the utility.
6. For those utilities cannot be accurately surveyed due to various factors will be classified as 'unreliable'. Trial pit is highly recommended for verification of the true alignment.
7. The utilities are found on the utilities record drawings but cannot be located during the survey. These utilities will be classified as 'record'.
8. Due to the electric cable cannot be surveyed by active mode method, trial pits were recommended. After the trial pit was excavated, Competent Person will be requested for carrying out the active detection works.

LEGEND :

- Water Point
- Water Meter
- Fire Hydrant
- Water Valve
- Water Pit
- Gas Valve
- Gas Pit
- CATV Pit
- HKCWN Pit
- HGC Pit
- HKBN Pit
- HKT Pit
- NWT Pit
- TGT Pit
- TraxComm Pit
- WTT Pit
- Traffic Light
- Traffic Bollard
- Lamppost
- Electric Pole
- ATC (E&M) Pit
- Lighting Pit
- Electric Pit
- Control Box
- Telecom Pole
- Down Pipe
- Inlet
- Outlet
- Gully
- Catch-Pit
- Storm Water Manhole
- Foul Water Manhole
- Other / Unclassified Utility
- F WAT — Fresh Water Pipe
- S WAT — Salt Water Pipe
- GAS — Gas Pipe
- ATC — ATC (E&M) Cable
- PL — Public Lighting Cable
- ELEC — Electric Cable
- CATV — CATV Cable
- HKCWN — HKCWN Cable
- HGC — HGC Cable
- HKBN — HKBN Cable
- HKT — HKT Cable
- NWT — NWT Cable
- TGT — TGT Cable
- TRAX — TraxComm Cable
- WTT — WTT Cable
- STORM — Storm Water Pipe
- FOUL — Foul Water Pipe
- UN — Other / Unclassified Utility
- GPR Transverse
- End of Detected Signal
- Unreliable
- Record
- Proposed Trial Pit Location
- Survey Boundary

For any works in the vicinity of electricity supply lines and / or gas pipes, excavation by hand dig trial pit(s) is highly recommended in according to

- Code of Practice on Working near Electricity Supply Lines (provisions of the Electricity Supply Lines (Protection) Regulation made under the Electricity Ordinance Cap.406);
- Code of Practice on Avoiding danger from gas pipes (provisions of the Gas Safety Ordinance Cap. 51).

For details, please refer to text report.

CLIENT :

New Season Global Limited

SPECIALIST CONTRACTOR :

益 捷 探 測 工 程 有 限 公 司
Waterland Detection Engineering Ltd.
Unit 02, 9/F, Sun Fung Centre,
88 Kwok Shui Road, Kwai Chung, N.T., H.K.
Tel: 2636 6900 Fax: 2636 6907
Web Site : http://www.waterland.com.hk

PROJECT TITLE :

Underground Utility for Proposed Residential Development at Maryknoll House 44 Stanley Village Road, Stanley, Hong Kong

DRAWING TITLE : Utility Layout Plan

A1 Size	Scale 1:100	Survey Date:	DEC 2020

Surveyed By:	Approved By:
Mr. Rong Guangcai (CP00964)	Mr. K.K. Yan

Project No.	WDE/SPJ-080/20	
Drawing No.	SPJ080-20-D01	Page 8 of 9

Summary Table for Pipe / Cable

Line Ref.	Utility	Depth (m)	Pipe Size (mm) & Material	Remark
1	Fresh Water Pipe	0.15d-Exposed	40 CU	
2	Fresh Water Pipe	0.10d-Exposed	40 CU	
3	Fresh Water Pipe	Exposed	40 CU	
4	Salt Water Pipe	0.10d-Exposed	30 PVC	
5	Gas Pipe	0.50d-Exposed	80 PE	UP
6	Electric Cable	0.10d-Exposed	20 PVC	LV
7	Electric Cable	0.10d-Exposed	20 PVC	LV
8	Electric Cable	0.30d-Exposed	20 PVC	LV
9	Electric Cable	0.10d-0.10d	20 PVC	LV
10	HKT Cable	0.15d-Exposed	1x1 50 PVC	●
11	HKT Cable	0.45d-Exposed	1x1 100 PVC	●
12	HKT Cable	0.15d-0.40d	1x1 50 PVC	●
13	HKT Cable	0.30d-0.30d	1x1 50 PVC	
14	HKT Cable	0.20d-0.30d	1x1 50 PVC	
15	Storm Water Pipe	0.58d-0.58d	150 PVC	Unreliable
16	Storm Water Pipe	0.70d-Exposed	150 PVC	
17	Storm Water Pipe	0.15d-Exposed	100 CI	
18	Storm Water Pipe	0.33d-0.38d	100 CI	
19	Storm Water Pipe	0.20d-0.23d	80 CI	Connecting to building
20	Storm Water Pipe	0.40d-0.81d	100 CI	
21	Storm Water Pipe	0.78d-Exposed	100 CI	
22	Storm Water Pipe	0.78d-0.78d	100 CI	
23	Storm Water Pipe	0.80d-Exposed	100 CI	
24	Storm Water Pipe	0.23d-0.82d	100 CI	
25	Storm Water Pipe	0.24d-1.12d	100 CI	
26	Storm Water Pipe	0.22d-Exposed	100 CI	
27	Storm Water Pipe	0.60d-1.10d	100 CI	
28	Storm Water Pipe	0.25d-Exposed	100 CI	
29	Storm Water Pipe	0.57d-1.13d	100 CI	
30	Storm Water Pipe	1.14d-1.33d	100 CI	
31	Storm Water Pipe	1.14d-Exposed	100 CI	
32	Storm Water Pipe	1.37d-1.89d	100 CI	
33	Storm Water Pipe	0.35d-Exposed	100 PVC	
34	Storm Water Pipe	1.78d-Exposed	100 CI	
35	Storm Water Pipe	1.85d-Exposed	100 CI	
36	Storm Water Pipe	1.96d-1.96d	150 CI	Unreliable
37	Storm Water Pipe	0.30d-0.65d	150 CO	
38	Storm Water Pipe	0.55d-0.67d	150 PVC	
39	Storm Water Pipe	0.52d-0.88d	150 VC	
40	Storm Water Pipe	0.74d-0.83d	150 VC	
41	Storm Water Pipe	0.93d-0.93d	150 VC	
42	Storm Water Pipe	0.58d-1.55d	150 PVC	
43	Storm Water Pipe	2.63d-2.63d	1050 CO	
44	Storm Water Pipe	0.60d-1.65d	150 PVC	
45	Storm Water Pipe	3.13d-3.15d	1050 CO	
46	Storm Water Pipe	0.60d-2.50d	150 PVC	
47	Storm Water Pipe	2.00d-2.10d	450 CO	
48	Storm Water Pipe	0.60d-1.21d	150 PVC	
49	Storm Water Pipe	1.68d-1.72d	225 CO	
50	Storm Water Pipe	1.07d-1.30d	150 PVC	
51	Storm Water Pipe	2.88d-3.18d	1050 CO	
52	Storm Water Pipe	0.58d-1.15d	150 PVC	
53	Storm Water Pipe	0.60d-1.16d	150 PVC	
54	Storm Water Pipe	1.33d-1.48d	225 CO	
55	Storm Water Pipe	0.58d-1.00d	150 PVC	
56	Storm Water Pipe	0.55d-1.00d	150 PVC	
57	Storm Water Pipe	1.35d-1.63d	225 CO	
58	Storm Water Pipe	0.57d-1.42d	150 PVC	
59	Storm Water Pipe	0.78d-1.56d	150 PVC	
60	Storm Water Pipe	0.56d-1.16d	150 PVC	
61	Storm Water Pipe	0.54d-1.16d	150 PVC	
62	Storm Water Pipe	1.66d-2.43d	300 CO	
63	Storm Water Pipe	0.57d-1.82d	150 PVC	
64	Storm Water Pipe	0.57d-2.00d	150 PVC/CO	
65	Storm Water Pipe	0.58d-2.20d	150 PVC	
66	Storm Water Pipe	0.57d-1.32d	150 PVC	
67	Storm Water Pipe	0.59d-1.20d	150 PVC	
68	Storm Water Pipe	2.28d-2.28d	900 CO	
69	Storm Water Pipe	2.62d-2.68d	1050 CO	
70	Storm Water Pipe	0.58d-2.10d	150 PVC	
71	Storm Water Pipe	Exposed	100 CI	
72	Storm Water Pipe	2.18d-2.25d	300 CO	
73	Storm Water Pipe	0.58d-1.82d	150 PVC	
74	Storm Water Pipe	2.55d-2.96d	1050 CO	
75	Storm Water Pipe	0.58d-2.40d	150 PVC	
76	Storm Water Pipe	0.59d-1.37d	150 PVC	
77	Storm Water Pipe	2.21d-2.21d	600 CO	
78	Storm Water Pipe	2.56d-3.21d	1050 PVC	
79	Storm Water Pipe	0.62d-2.00d	150 PVC	
80	Storm Water Pipe	0.59d-2.40d	150 PVC	
81	Storm Water Pipe	0.55d-0.70d	150 PVC	
82	Storm Water Pipe	0.62d-2.50d	150 PVC	
83	Storm Water Pipe	0.56d-Exposed	100 CI	
84	Storm Water Pipe	2.26d-3.18d	300 CO	
85	Storm Water Pipe	3.30d-3.35d	450 CO	
86	Storm Water Pipe	3.18d-3.18d	300 CO	
87	Storm Water Pipe	3.72d-3.72d	1050 CO	
88	Storm Water Pipe	0.46d-Exposed	100 PVC	
89	Storm Water Pipe	0.29d-Exposed	100 CI	
90	Storm Water Pipe	0.41d-0.45d	100 CI	
91	Storm Water Pipe	0.45d-Exposed	100 PVC	
92	Storm Water Pipe	0.13d-Exposed	40 PVC	
93	Storm Water Pipe	0.13d-Exposed	40 PVC	
94	Storm Water Pipe	0.13d-Exposed	40 PVC	
95	Storm Water Pipe	Exposed	100 CI	
96	Storm Water Pipe	0.35d-0.50d	100 CI	
97	Storm Water Pipe	0.24d-Exposed	100 CI	
98	Storm Water Pipe	0.46d-0.46d	100 CI	Unreliable
99	Storm Water Pipe	0.91d-0.91d	100 VC	Unreliable
100	Storm Water Pipe	0.70d-0.90d	100 CI	
101	Storm Water Pipe	0.32d-Exposed	100 CI	
102	Storm Water Pipe	0.94d-1.02d	100 VC	
103	Storm Water Pipe	0.32d-Exposed	100 CI	
104	Storm Water Pipe	0.59d-0.96d	100 CI	
105	Storm Water Pipe	0.95d-Exposed	225 VC	
106	Storm Water Pipe	0.45d-Exposed	50 PVC	
107	Storm Water Pipe	1.13d-1.47d	150 VC	
108	Storm Water Pipe	0.85d-0.85d	150 VC	
109	Storm Water Pipe	1.32d-1.51d	150 VC	
110	Storm Water Pipe	1.28d-Exposed	100 CI	
111	Storm Water Pipe	0.39d-Exposed	100 CI	
112	Storm Water Pipe	0.58d-1.27d	100 CI	
113	Storm Water Pipe	1.42d-1.97d	150 VC	
114	Storm Water Pipe	0.55d-0.55d	100 CI	
115	Storm Water Pipe	0.82d-Exposed	100 CI	
116	Storm Water Pipe	1.90d-1.90d	100 VC	
117	Storm Water Pipe	2.03d-2.48d	150 VC	
118	Storm Water Pipe	2.47d-2.47d	100 VC	
119	Storm Water Pipe	0.34d-Exposed	100 CI	
120	Storm Water Pipe	0.47d-1.52d	100 CI	
121	Storm Water Pipe	0.45d-0.66d	100 CI	Connecting to building
122	Storm Water Pipe	0.45d-0.53d	100 CI	Connecting to building
123	Storm Water Pipe	0.56d-Exposed	100 CI	Connecting to building
124	Storm Water Pipe	0.45d-0.53d	100 CI	
125	Storm Water Pipe	0.71d-0.91d	150 CI	
126	Storm Water Pipe	0.84d-1.07d	150 CI	
127	Storm Water Pipe	0.92d-Exposed	150 PVC	
128	Storm Water Pipe	Exposed	150 PVC	
129	Storm Water Pipe	1.20d-1.20d	150 CO	Unreliable
130	Storm Water Pipe	0.38d-0.58d	100 CI	
131	Storm Water Pipe	0.18d-Exposed	40 CI	
132	Storm Water Pipe	0.58d-1.77d	100 CI	
133	Storm Water Pipe	0.88d-2.57d	150 VC	
134	Storm Water Pipe	1.03d-1.40d	100 CI	
135	Storm Water Pipe	0.92d-0.96d	150 CI	
136	Storm Water Pipe	0.44d-0.90d	150 VC	
137	Storm Water Pipe	0.54d-0.54d	100 CI	
138	Storm Water Pipe	0.58d-1.15d	150 PVC	
139	Storm Water Pipe	0.30d-0.35d	150 VC	
140	Foul Water Pipe	0.97d-Unknown	150 VC	Unreliable
141	Foul Water Pipe	0.98d-1.00d	150 LINNING	
142	Foul Water Pipe	0.92d-1.02d	150 LINNING	
143	Foul Water Pipe	0.94d-0.98d	150 VC	
144	Foul Water Pipe	0.86d-1.00d	150 VC	
145	Foul Water Pipe	0.96d-0.96d	150 VC	
146	Foul Water Pipe	1.00d-1.00d	150 VC	
147	Foul Water Pipe	0.95d-0.95d	150 CI	
148	Foul Water Pipe	0.73d-1.55d	150 CI	
149	Foul Water Pipe	0.75d-0.90d	225 CI	
150	Foul Water Pipe	1.36d-1.36d	150 CI	
151	Storm Water Pipe	0.92d-0.92d	225 CO	
152	Storm Water Pipe	0.49d-0.49d	100 CI	Unreliable
153	Storm Water Pipe	Exposed	150 VC	
154	Storm Water Pipe	Unknown-Exposed	225 VC	Unreliable
155	Storm Water Pipe	Exposed	150 CO	U-channel

A - Fresh Water, B - Salt Water, G - Gas, P - Electric, L - Public Lighting, M - Traffic Control, C - CATV, H - HGC, D - HKCNW, K - HKBN, T - HKT, W - NWT, J - SmarTone, E - TGT, X - TraxComm, N - WTT, S - Storm, F - Foul, U - Unknown / Unclassified Utility

AC - Asbestos Cement
CI - Cast Iron
CO - Concrete
CU - Copper
DI - Ductile Iron
GI - Galvanized Iron
GRP - Glass Fibre Reinforced Plastic
MS - Mild Steel
PE - Polyethylene
PVC - Polyvinyl Chloride
S - Steel
UPVC - Unplasticized Polyvinyl Chloride
VC - Vitrified Clay

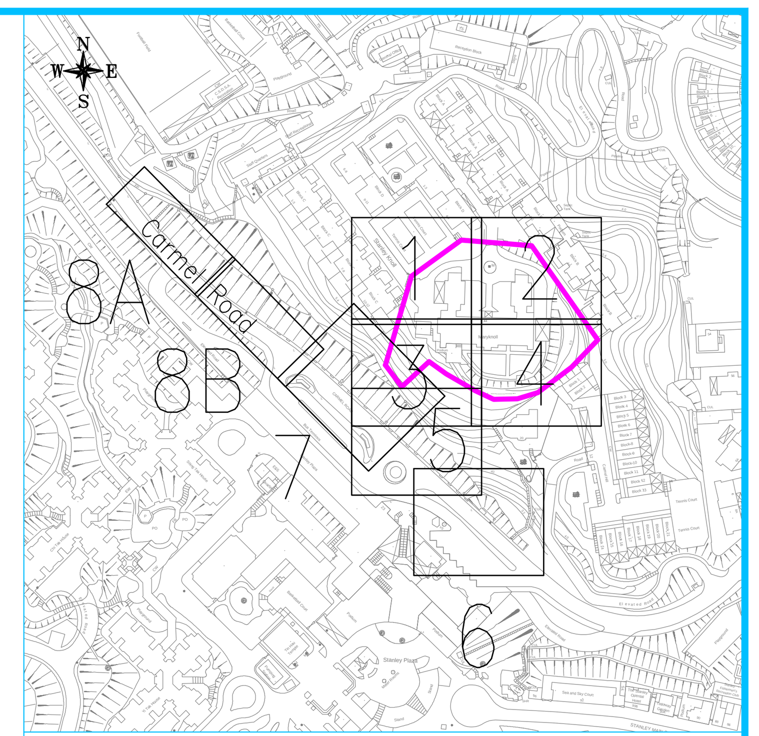
UTL - Unable To Locate
UTGA - Unable To Gain Access
UTR - Unable To Raise
UTS - Unable To Survey

Electric Cable Voltage Classification:
LV: below 11kV
MV: 11kV-22kV
HV: above 22kV
UV: Unknown Voltage

Gas Pipe Pressure Classification:
LP: below 7.5kPa
MP: 7.5kPa-240kPa
IP: 240kPa-700kPa
HP: above 700kPa
RP: Reserved Pipe
UP: Unknown Pressure

Classification of Voltage / Pressure is referred to record plan. Further clarification is required for unknown voltage / pressure.

Cable Matrix for Telecom Cables:
Column x Row Diameter:
3x2 100 ●●●/●●●
Occupied Duct ●
Empty Duct ○



Location Map

Rev.	Date	Description
00	12/20	First Issue
01		
02		

NOTE :
1. Depth to utility is indicated as #d(m). The depth for drains and sewers are from cover levels (C.L.) to invert levels (I.L.). The depth of other services are from ground levels (G.L.) to centre of services.
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LEGEND :

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Fire Hydrant
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Water Pit
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CATV Pit
HKCWN Pit
HGC Pit
HKBN Pit
HKT Pit
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WTT Pit
Traffic Light
Traffic Bollard
Lamppost
Electric Pole
ATC (E&M) Pit
Lighting Pit
Electric Pit
Control Box
Telecom Pole
Down Pipe
Inlet
Outlet
Gully
Catch-Pit
Storm Water Manhole
Foul Water Manhole
Other / Unclassified Utility
F WAT — Fresh Water Pipe
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GAS — Gas Pipe
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HKT — HKT Cable
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TRAX — TraxComm Cable
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FOUL — Foul Water Pipe
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End of Detected Signal
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Proposed Trial Pit Location
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For any works in the vicinity of electricity supply lines and / or gas pipes, excavation by hand dig trial pit(s) is highly recommended in according to
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For details, please refer to text report.

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SPECIALIST CONTRACTOR :

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88 Kwok Shui Road, Kwai Chung, N.T., H.K.
Tel: 2636 6900 Fax: 2636 6907
Web Site : http://www.waterland.com.hk

PROJECT TITLE :

Underground Utility for Proposed Residential Development at Maryknoll House 44 Stanley Village Road, Stanley, Hong Kong

DRAWING TITLE : Utility Layout Plan

A1 Size	Scale 1:100	Survey Date:	DEC 2020
Surveyed By: Mr. Rong Guangcai (CP00964)		Approved By: Mr. K.K. Yan	
Project No.	WDE/SPJ-080/20		
Drawing No.	SPJ080-20-D01	Page 9 of 9	

Appendix 3.1 Detailed Sewerage Impact Assessment Calculation

Table 1 Calculation for Sewage Generation Rate of the Proposed Scheme at the Application Site

1. Residential Tower

1a. Total number of residential units	=	23	units
1b. Total number of residents	=	74	people -- (2021 Population Census: Average Household size of 3.2 - Stanley & Shek O District Council Constituency Area)
1c. Design flow	=	0.34	m^3/person/day -- (refer to Table T-1 of GESF - Private R3)
1d. Sewage Generation rate	=	**25.0**	m^3/day

2. Clubhouse

2a. Assumed Area	=	344	m^2
2b. Assumed floor area per employee	=	30.3	m^2 per worker -- (refer to Table 8 of CIFSUS - Community, Social & Personal Services)
2c. Total number of employees	=	11	employees
2d. Design flow for commercial activities	=	0.28	m^3/employee/day -- (refer to Table T-2 of GESF - J11)
2e. Sewage Generation rate	=	**3.2**	m^3/day

3. Common Pool for Upper Deck

a. Assumed Area of Swimming Pool	=	187	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	234	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.8	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	1.2	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**6.5**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**3.2**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

4. Private Pool for Unit B (Upper Deck)

Assumed Area of Swimming Pool	=	39	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	49	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.2	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.2	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**1.3**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.7**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

Table 1 Calculation for Sewage Generation Rate of the Proposed Scheme at the Application Site

5. Private Pool for Unit C (Upper Deck)

Assumed Area of Swimming Pool	=	44	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	55	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.2	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.3	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**1.5**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.8**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

6. Private Pool for Unit D (Upper Deck)

Assumed Area of Swimming Pool	=	40	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	50	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.2	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.3	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**1.4**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.7**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

7. Private Pool for Unit E (Upper Deck)

Assumed Area of Swimming Pool	=	47	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	59	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.2	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.3	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**1.6**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.8**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

Table 1 Calculation for Sewage Generation Rate of the Proposed Scheme at the Application Site

8. Private Pool for Unit C (Lower Deck)

Assumed Area of Swimming Pool	=	16	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	20	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.1	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**0.6**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.3**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

9. Private Pool for Unit E (Lower Deck)

Assumed Area of Swimming Pool	=	16	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	19.7875	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.1	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**0.5**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.3**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

10. Private Pool for Unit F (Lower Deck)

Assumed Area of Swimming Pool	=	24	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	29	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.1	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**0.8**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.4**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

Table 1 Calculation for Sewage Generation Rate of the Proposed Scheme at the Application Site

11. Private Pool for Unit G (Lower Deck)

Assumed Area of Swimming Pool	=	19	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	24	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.1	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**0.7**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.3**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

12. Private Pool for Unit H (Lower Deck)

Assumed Area of Swimming Pool	=	19	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	24	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.1	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**0.7**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.3**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

13. Private Pool for Unit I (Lower Deck)

Assumed Area of Swimming Pool	=	10	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	13	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.0	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**0.4**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.2**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

14. Private Pool for Unit E (Upper Deck)

Assumed Area of Swimming Pool	=	44	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	55	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	$m^3/m^2/hr$ (based on min. 2 identical filters)
f. Filter Area required	=	0.2	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	$m^3/m^2/hr$ (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.3	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**1.5**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**0.8**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

Total Flow from Proposed Scheme

Flow Rate	=	28.2	m^3/day
Contributing Population	=	104	people
Peaking factor	=	6	Refer to Table T-5 of GESF for population < 1,000 excl. stormwater allowance
Peak Flow	=	**1.96**	litre/sec
Peak Flow with backwash from swimming pool	=	**10.7**	litre/sec

Table 2a Hydraulic Capacity of Existing Sewers at Carmel Road, Stanley

Segment	**Manhole**	**Manhole**	**Pipe Dia.**	**Pipe Length**	**Invert Level 1**	**Invert Level 2**	**g**	**k_s**	**s**	**v**	**V**	**Area**	**Q**	**Estimated Capacity**
	Reference	**Reference**	**mm**	**m**	**mPD**	**mPD**	**m/s^2**	**m**		**m^2/s**	**m/s**	**m^2**	**m^3/s**	**L/s**
S1-S2	FMH7037669	FMH7037670	200	6.0	29.70	27.81	9.81	0.00060	0.315	0.000001	6.86	0.03	0.22	215
S2-S3	FMH7037670	FMH7037671	225	8.6	27.80	27.76	9.81	0.00300	0.005	0.000001	0.70	0.04	0.03	28
S3-S4	FMH7037671	FMH7037672	150	19.9	27.76	27.10	9.81	0.00060	0.033	0.000001	1.84	0.02	0.03	32
S4-S5	FMH7037672	FMH7037820	150	14.5	27.10	26.65	9.81	0.00060	0.031	0.000001	1.78	0.02	0.03	31
S5-S6	FMH7037820	FMH7037821	150	18.1	26.65	25.90	9.81	0.00060	0.041	0.000001	2.06	0.02	0.04	36
S6-S7	FMH7037821	FMH7037822	150	28.6	25.90	24.97	9.81	0.00060	0.033	0.000001	1.82	0.02	0.03	32
S7-S8	FMH7037822	FMH7037823	150	32.0	24.97	23.92	9.81	0.00060	0.033	0.000001	1.83	0.02	0.03	32
S8-S9	FMH7037823	FMH7038004	150	16.4	23.90	23.30	9.81	0.00060	0.037	0.000001	1.93	0.02	0.03	34

Table 2b Hydraulic Capacity of Proposed Sewers from the Terminal Manhole of the Proposed Scheme for Sewage generated from the Proposed Scheme

Segment	**Manhole**	**Manhole**	**Pipe Dia.**	**Pipe Length**	**Invert Level 1**	**Invert Level 2**	**g**	**k_s**	**s**	**v**	**V**	**Area**	**Q**	**Estimated Capacity**
	Reference	**Reference**	**mm**	**m**	**mPD**	**mPD**	**m/s^2**	**m**		**m^2/s**	**m/s**	**m^2**	**m^3/s**	**L/s**
TFMH-1 - FMH-1	TFMH-1	FMH-1	200	5.3	41.00	40.80	9.81	0.00030	0.038	0.000001	2.58	0.03	0.08	81
FMH-1 - FMH-2	FMH-1	FMH-2	200	9.0	40.50	38.40	9.81	0.00030	0.233	0.000001	6.47	0.03	0.20	203
FMH-2 - FMH-3	FMH-2	FMH-3	200	11.0	37.85	35.30	9.81	0.00030	0.232	0.000001	6.44	0.03	0.20	202
FMH-3 - FMH-4	FMH-3	FMH-4	200	3.6	32.50	32.20	9.81	0.00030	0.083	0.000001	3.85	0.03	0.12	121
FMH-4 - FMH-5	FMH-4	FMH-5	200	15.0	31.90	31.50	9.81	0.00030	0.027	0.000001	2.17	0.03	0.07	68
FMH-5 - S1	FMH-5	FMH7037669	200	12.8	31.20	30.25	9.81	0.00030	0.0742	0.000001	3.64	0.03	0.11	114

Notes: (1) TFMH-1 and FMH-1 to FMH-5 are the proposed manholes as shown in Figure 3.1 of the SIA report. The exact invert levels of the proposed manholes are subject to change during detailed design stage.

Remarks:
(1) g=gravitational acceleration; k_s=equivalent sand roughness; s=gradient; v=kinematic viscosity of water; V=mean velocity
(2) Table 2a: The value of k_s = 0.6-3.0mm is used for the calculation of slimed clayware sewer, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
(3) Table 2b: The value of k_s = 0.3-1.5mm is used for the calculation of slimed polyethelyene for the proposed sewers, poor condition (based on Table 5: Recommended roughness values in Sewerage Manual)
(4) The value of velocity (V) is referred to the Tables for the hydraulic design of pipes, sewers and channels (8th edition)
(5) Equation used: $V = -\sqrt{(8gDs)}\log(\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{(2gDs)}})$

Table 3 Calculation for Sewage Generation Rate of the Existing Surrounding Building

Catchment A
1. Stanley Knoll

1a. Total number of residential units	=	37	units
1b. Total number of residents	=	185	people -- (Nominal Assumption of Household size of 5)
1c. Design flow	=	0.34	m^3/person/day -- (refer to Table T-1 of GESF - Private R3)
1d. Sewage Generation rate	=	**62.9**	m^3/day

Swimming Pools (Outdoor)

a. Assumed Area of Swimming Pool	=	182	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	226.96	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.8	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	1.1	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**6.3**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**3.2**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

2. 18 Carmel Road

2a. Total number of residential units	=	1	units
2b. Total number of residents	=	5	people -- (Nominal Assumption of Household size of 5)
2c. Design flow	=	0.34	m^3/person/day -- (refer to Table T-1 of GESF - Private R3)
2d. Sewage Generation rate	=	**1.7**	m^3/day

3. 20 Carmel Road

3a. Total number of residential units	=	1	units
3b. Total number of residents	=	5	people -- (Nominal Assumption of Household size of 5)
3c. Design flow	=	0.34	m^3/person/day -- (refer to Table T-1 of GESF - Private R3)
3d. Sewage Generation rate	=	**1.7**	m^3/day

Swimming Pools (Outdoor)

a. Assumed Area of Swimming Pool	=	123	m^2
b. Average Depth of Water	=	1.25	m (ordinary assumption)
c. Volume of Swimming Pool (Ordinary Assumption)	=	153.839	m^3
d. Turnover Rate	=	6	hr
e. Required Surface Loading Rate of Filter	=	50	m^3/m^2/hr (based on min. 2 identical filters)
f. Filter Area required	=	0.5	m^2
g. Backwash Duration	=	3	min/d
h. Backwash flow rate	=	30	m^3/m^2/hr (based on min. 2 identical filters)
i. Design flow for Swimming Pool Backwashing	=	0.8	m^3/day (based on min. 2 identical filters)
j. Design flow for Swimming Pool Backwashing	=	**4.3**	litre/sec (based on min. 2 identical filters)
k.Design Flowrate for Each Filter	=	**2.1**	litre/sec (assuming 2 identical filters to be used and operated sequentially)

<u>Sub-total with Catchment Inflow Factors = 1.0 (Stanley)</u>

Total Flow at S1 (including Proposed Scheme, Catchment A)	=	**94.5**	m^3/day

Table 3a Comparision of the Hydraulic Capacity of Existing Sewers for Sewerage generated from the Proposed Scheme and Surrounding Catchment Areas

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	ADWF (m^3/day)	Contributing Population	Peaking Factor	Swimming Pool/Public Toilet (L/s)	Peak Flow from the Proposed Scheme and Catchment Areas (L/s)	Contribution from the Proposed Scheme and the Surrounding Catchment Areas (%)	Status
S1-S2	200	6.0	0.315	215	94.5	350	8	14.1	22.8	10.6%	OK
S2-S3	225	8.6	0.005	28	94.5	350	8	14.1	22.8	82.1%	OK
S3-S4	150	19.9	0.033	32	94.5	350	8	14.1	22.8	70.2%	OK
S4-S5	150	14.5	0.031	31	94.5	350	8	14.1	22.8	72.4%	OK
S5-S6	150	18.1	0.041	36	94.5	350	8	14.1	22.8	62.8%	OK
S6-S7	150	28.6	0.033	32	94.5	350	8	14.1	22.8	70.8%	OK
S7-S8	150	32.0	0.033	32	94.5	350	8	14.1	22.8	70.5%	OK
S8-S9	150	16.4	0.037	34	94.5	350	8	14.1	22.8	66.8%	OK

Remarks: (1) The value of peaking factor = 8 is used for population <1,000 incl. stormwater allowance (refers to Table T-5 of GESF)

Table 3b Comparision of the Hydraulic Capacity of Proposed Sewers from the Terminal Manhole of the Proposed Scheme for Sewage generated from the Proposed Scheme

Segment	Pipe Dia. (mm)	Pipe Length (m)	Gradient	Estimated Capacity (L/s)	ADWF (m^3/day)	Contributing Population	Peaking Factor	Swimming Pool/Public Toilet (L/s)	Peak Flow from the Proposed Scheme and Catchment Areas (L/s)	Contribution from the Proposed Scheme and the Surrounding Catchment Areas (%)	Status
TFMH-1 - FMH-1	200	5.3	0.038	81	28.2	104	6	8.8	10.7	13.2%	OK
FMH-1 - FMH-2	200	9.0	0.233	203	28.2	104	6	8.8	10.7	5.3%	OK
FMH-2 - FMH-3	200	11.0	0.232	202	28.2	104	6	8.8	10.7	5.3%	OK
FMH-3 - FMH-4	200	3.6	0.083	121	28.2	104	6	8.8	10.7	8.9%	OK
FMH-4 - FMH-5	200	15.0	0.027	68	28.2	104	6	8.8	10.7	15.7%	OK
FMH-5 - S1	200	12.8	0.074	114	28.2	104	6	8.8	10.7	9.4%	OK

Remarks: (1) The value of peaking factor = 6 is used for population <1,000 excl. stormwater allowance (refers to Table T-5 of GESF)