

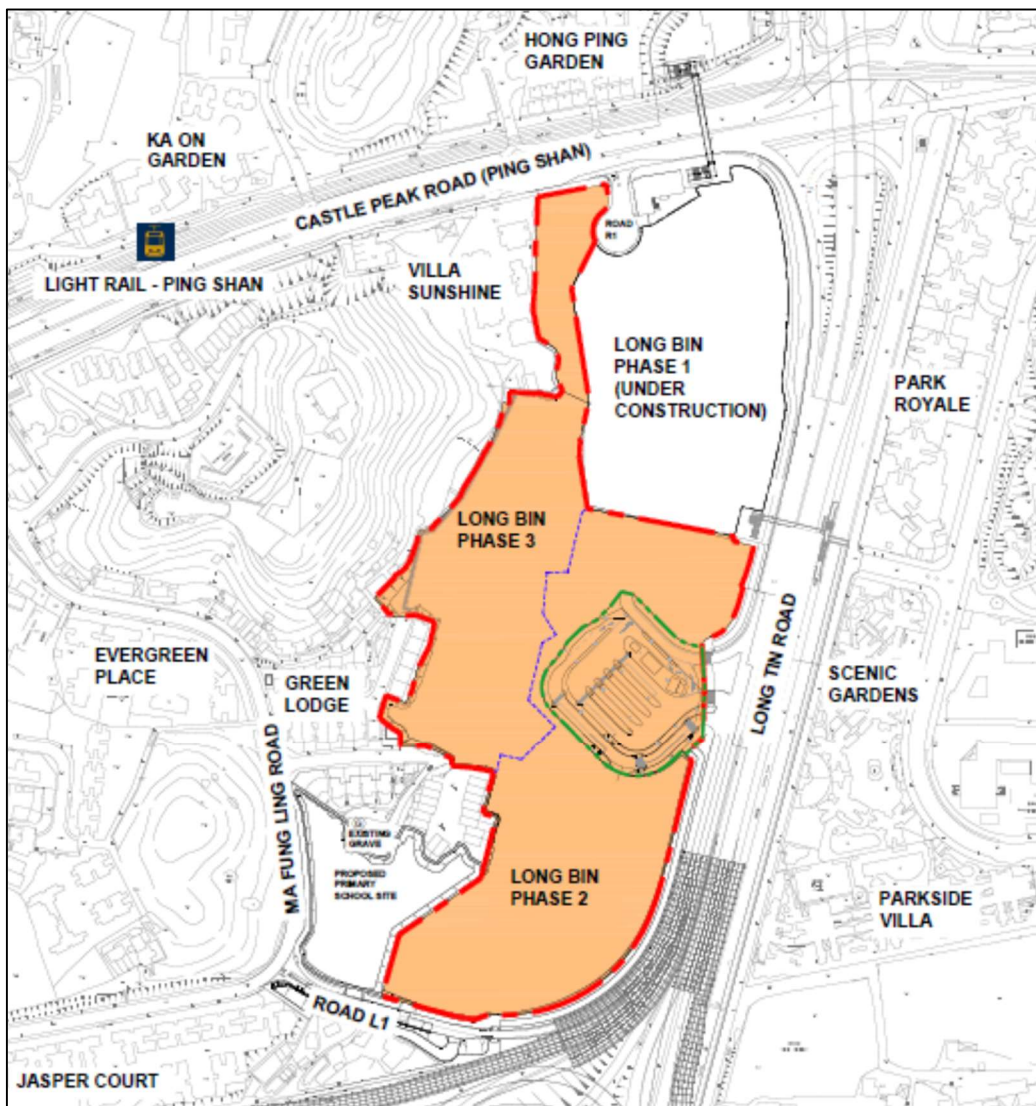
Appendix 7

Review of Drainage Impact Assessment

1 BACKGROUND

- 1.1 The Government identified the site at Long Bin, Yuen Long, for the development of public housing, school, public transport interchange and associated infrastructures (the Development site). The Development site is located at the west of Long Tin Road and north of Tong Yan San Tsuen Interchange in Yuen Long.
- 1.2 Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by Civil Engineering and Development Department (CEDD) to carry out the investigation, design and construction supervision for site formation and provision of essential infrastructures to support the housing development at the Development site, under Agreement No. CE 75/2017 (CE) Site Formation and Infrastructure Works for Public Housing Developments at Long Bin, Yuen Long – Investigation, Design and Construction.
- 1.3 A Drainage Impact Assessment (DIA) was carried out by CEDD / Arup and finalized for departmental retention in December 2020 under their submission of Revised Final DIA (ref. REP-012-05).
- 1.4 The latest site layout plan for the proposed housing development is shown in **Figure 1**.

Figure 1 – Location of the Site



- 1.5 Under the current Section 16 planning application, the development parameters of non-domestic facilities

for Phase 2 & 3 sites are mainly updated with an increase of non-domestic plot ratio from 0.5 to 0.8, for which the GFA involved covers the following:

- 1.5.1 A covered PTI of about 6,500 sq.m (note: this PTI was previously not covered in previous Section 16 planning application but now it is covered back and considered as non-domestic GFA in the current Section 16 planning application);
 - 1.5.2 Four additional welfare facilities at 2/F and 3/F, about 4,200 sq.m;
 - 1.5.3 Management offices at 6/F, about 1,444 sq.m; and
 - 1.5.4 Other miscellaneous uses (e.g. covered walkway, staircase, lift shaft, etc.) at various floors, about 4,500 sq.m.
- 1.6 Based on the above updated development parameters, a review of DIA based on the approved Revised Final DIA (ref. REP-012-05) is carried out.

2 DIA REVIEW

- 2.1 Based on the Revised Final DIA (ref. REP-012-05), a flood protection level of design return period of 1 in 50 years, 30% of greening ratio and the climate change scenario of mid-21st century have been adopted to assess the drainage impacts to the Yuen Long West Nullah due to the Long Bin development.
- 2.2 The catchment area and proposed drainage plan are extracted and shown in **Annex 1**. The proposed drainage connections are mainly 2 nos. of D1200 drainage connections for Phase 2 & 3 sites and a D900 drainage connection for the PTI, which will be connected to D1200 to D1350 drainage pipes constructed along Long Tin Road and to be discharged to Yuen Long West Nullah.
- 2.3 With these proposed drainage mitigation measures, it is concluded that there is no adverse drainage impact due to the Long Bin development.
- 2.4 By referencing to the above increase of non-domestic ratio (Cl. 1.5.1), the PTI was previously not covered in previous Section 16 planning application but now it is included back and considered as non-domestic GFA in the current Section 16 planning application. Since the PTI area has been considered in CEDD's Revised Final DIA (**Annex 1**), including back the PTI area in the current Section 16 planning application will not incur any additional drainage impact on DIA point of view.
- 2.5 Regarding the GFA in Cl. 1.5.2 to 1.5.4, the originally paved area at various floors will be utilized for various purposes (e.g. welfare facilities, management office, etc.). With the on-going detailed design in progress, ample greenings (e.g. planter, podium and roof plantings, vertical green walls, etc.) will be provided and the design principle of 30% greening for Phase 2 & 3 sites will still be followed. The catchment area plan and proposed drainage connections (i.e. pipe sizes, pipe connection locations, invert levels) for Phase 2 & 3 sites will still be followed and close liaison with CEDD will be maintained during construction period. Hence, there will be no change to the hydraulic model and no additional drainage impact to be incurred.
- 2.6 A preliminary assessment reviewing the impacts under the requirements of Corrigendum No. 1/2022 is added in **Annex 2**. Considering the requirements of Corrigendum No. 1/2022, the findings confirmed conclusion stated in the Revised Final DIA remain valid that, with proper implementation of drainage mitigation measures, there is no adverse drainage impact due to the project.

ANNEX 1

Catchment area and proposed drainage plan

(Extracted from Revised Final DIA Report (ref, REP-012-05))

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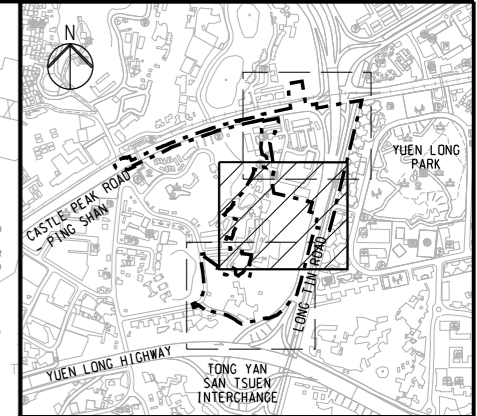
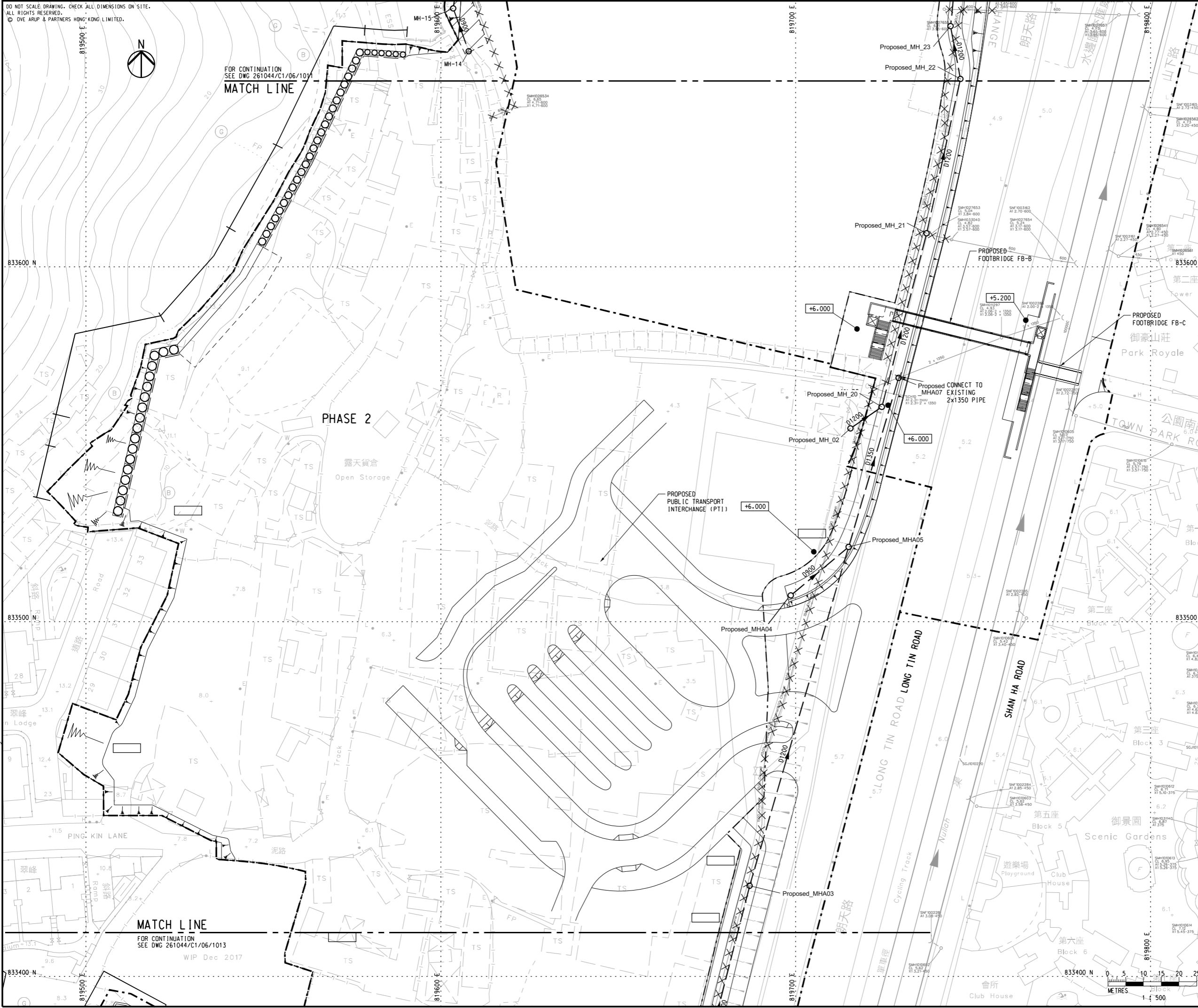
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KEY PLAN

NOTES

1. FOR NOTES AND LEGEND, REFER TO DRAWING NO. 261044/C1/06/1011.

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Project title
Agreement No. CE 75/2017 (CE)
Site Formation and Infrastructure Works for Public Housing Development at Long Bin, Yuen Long - Investigation, Design and Construction

Drawing title
PROPOSED DRAINAGE PLAN
(SHEET 2 OF 3)

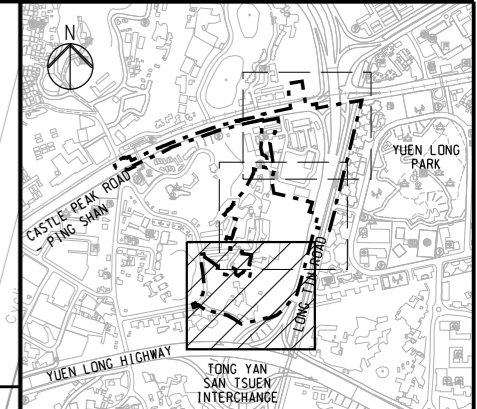
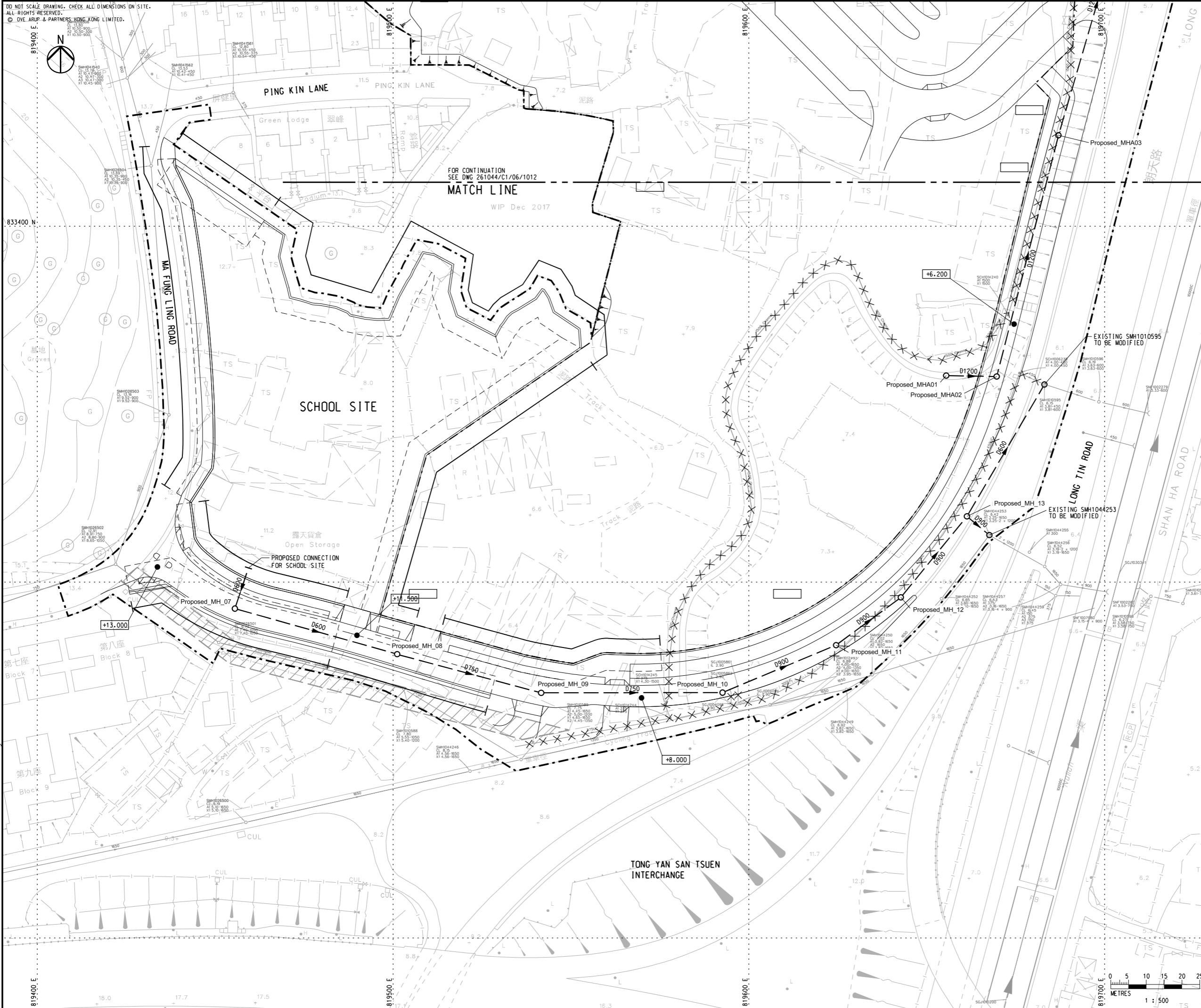
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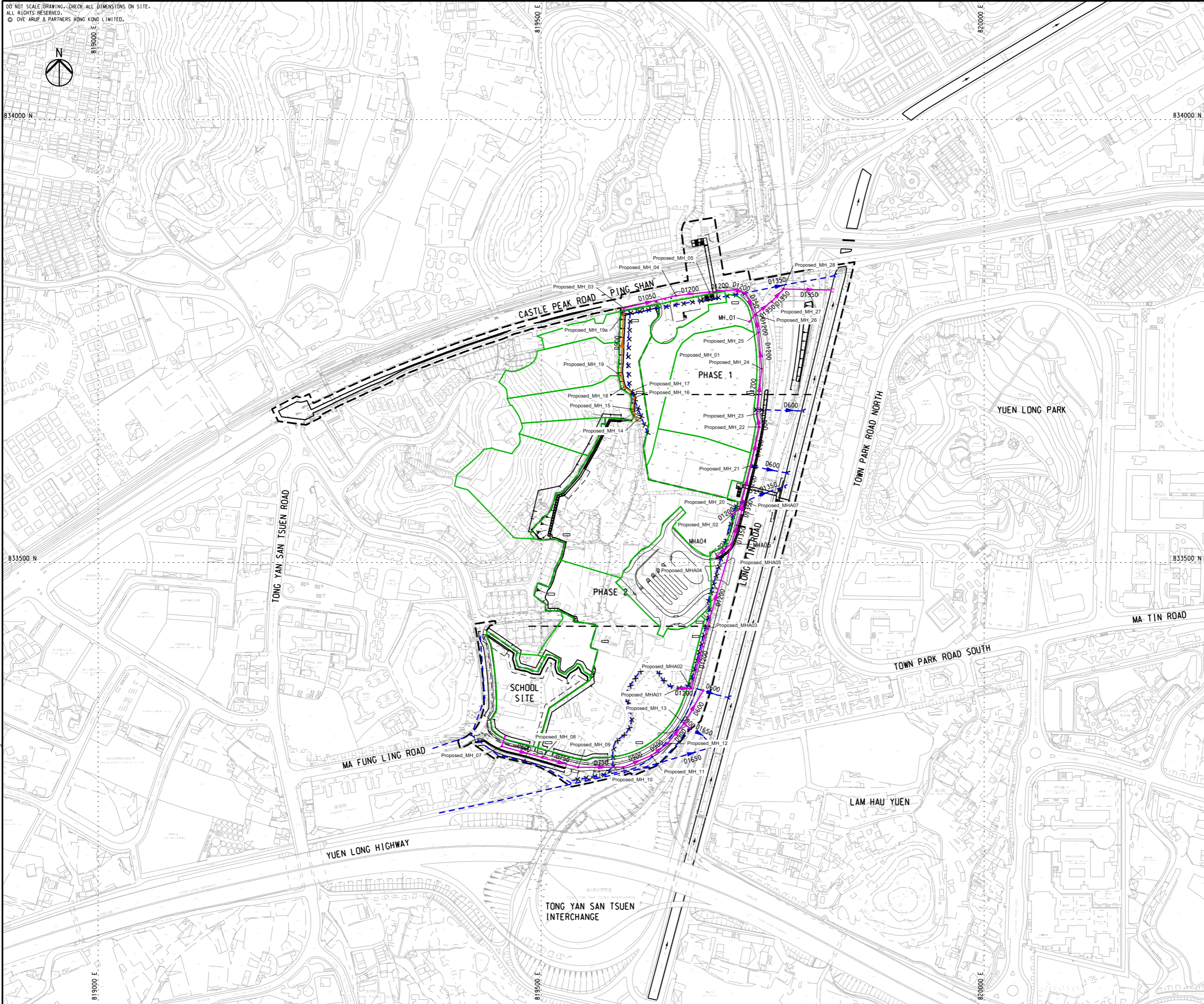
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Manhole Name	Ground Level (mPD)	Incoming Pipe			Outgoing Pipe		
		No.	Size (mm)	Invert Level (mPD)	Size (mm)	Invert Level (mPD)	to Manhole
Proposed_MH_01	6.0	-	-	-	1350 Pipe	2.80	Proposed_MH_26
Proposed_MH_02	6.0	-	-	-	1200 Pipe	2.31	Proposed_MH_20
Proposed_MH_03	8.9	A1	1050 Pipe	4.47	1050 Pipe	4.47	Proposed_MH_04
Proposed_MH_04	7.6	A1	1050 Pipe	4.33	1200 Pipe	4.33	Proposed_MH_05
Proposed_MH_05	6.7	A1	1200 Pipe	3.50	1200 Pipe	3.50	Proposed_MH_06
Proposed_MH_06	5.8	A1	1200 Pipe	3.02	1200 Pipe	3.02	SMH1026544 (Existing Manhole)
Proposed_MH_07	9.7				600 Pipe	8.14	Proposed_MH_08
Proposed_MH_08	7.8	A1	600 Pipe	6.20	750 Pipe	6.05	Proposed_MH_09
Proposed_MH_09	7.8	A1	750 Pipe	5.52	750 Pipe	5.52	Proposed_MH_10
Proposed_MH_10	6.9	A1	750 Pipe	4.52	900 Pipe	4.52	Proposed_MH_11
Proposed_MH_11	7.0	A1	900 Pipe	4.14	900 Pipe	4.14	Proposed_MH_12
Proposed_MH_12	6.7	A1	900 Pipe	3.79	900 Pipe	3.79	Proposed_MH_13
Proposed_MH_13	6.4	A1	900 Pipe	3.33	600 Pipe	4.10	SMH1010595 (Existing Manhole)
					900 Pipe	3.33	SMH1044253 (Existing Manhole)
Proposed_MH_14	7.1	-	-	-	900 Pipe	4.76	Proposed_MH_15
Proposed_MH_15	7.7	A1	900 Pipe	4.73	900 Pipe	4.73	Proposed_MH_16
Proposed_MH_16	8.7	A1	900 Pipe	4.70	900 Pipe	4.70	Proposed_MH_17
Proposed_MH_17	8.9	A1	900 Pipe	4.69	900 Pipe	4.69	Proposed_MH_18
Proposed_MH_18	9.2	A1	900 Pipe	4.67	900 Pipe	4.67	Proposed_MH_19
Proposed_MH_19	9.2	A1	900 Pipe	4.63	900 Pipe	4.63	Proposed_MH_19a
Proposed_MH_19a	9.3	A1	900 Pipe	4.48	1050 Pipe	4.48	Proposed_MH_03
Proposed_MH_20	6.0	A1	1200 Pipe	2.28	1200 Pipe	2.26	Proposed_MH_21
Proposed_MH_21	6.0	A1	1200 Pipe	2.16	1200 Pipe	2.16	Proposed_MH_22
Proposed_MH_22	6.0	A1	1200 Pipe	2.02	1200 Pipe	2.02	Proposed_MH_23
Proposed_MH_23	6.0	A1	1200 Pipe	2.00	1200 Pipe	2.00	Proposed_MH_24
Proposed_MH_24	6.0	A1	1200 Pipe	1.88	1200 Pipe	1.88	Proposed_MH_25
Proposed_MH_25	6.0	A1	1200 Pipe	1.77	1200 Pipe	1.77	Proposed_MH_26
Proposed_MH_26	6.0	A1	1350 Pipe	2.76	1950 Pipe	1.68	Proposed_MH_27
		A2	1200 Pipe	1.73			
		A3	750 Pipe	2.93			
Proposed_MH_27	5.6	A1	1950 Pipe	1.61	1950 Pipe	1.61	Proposed_MH_28
Proposed_MH_28	5.3	A1	1950 Pipe	1.56	1950 Pipe	1.56	Yuen Long West Nullah
Proposed_MHA01	6.0	-	-	-	1200 Pipe	3.02	Proposed_MHA02
Proposed_MHA02	6.0	A1	1200 Pipe	2.98	1200 Pipe	2.98	Proposed_MHA03
Proposed_MHA03	6.0	A1	1200 Pipe	2.76	1200 Pipe	2.76	Proposed_MHA05
Proposed_MHA04	6.0	-	-	-	900 Pipe	2.53	Proposed_MHA05
Proposed_MHA05	6.0	A1	900 Pipe	2.49	1350 Pipe	2.43	Proposed_MHA07
		A2	1200 Pipe	2.43			
Proposed_MHA07	6.0	A1	1350 Pipe	2.26	2x 1350 Pipe (Existing Pipe)	2.26	SMH1011297 (Existing Manhole)

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LEGEND

- WORKS LIMIT
- EXISTING NULLAH
- EXISTING DRAINAGE SYSTEM
- EXISTING STORM DRAIN TO BE ABANDONED
- PROPOSED DRAINAGE PIPE
- REPROVISION OF EXISTING DRAINAGE PIPE
- CATCHMENT BOUNDARY
- +7.0 PROPOSED SITE FORMATION LEVEL

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Drawing title
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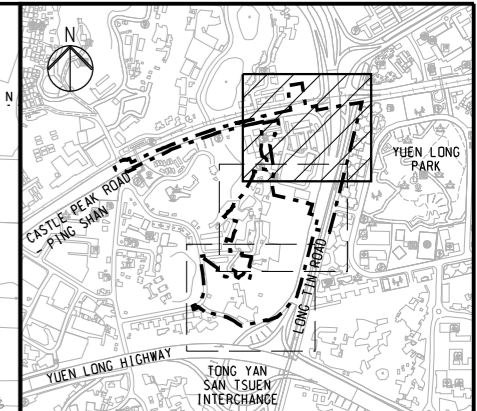
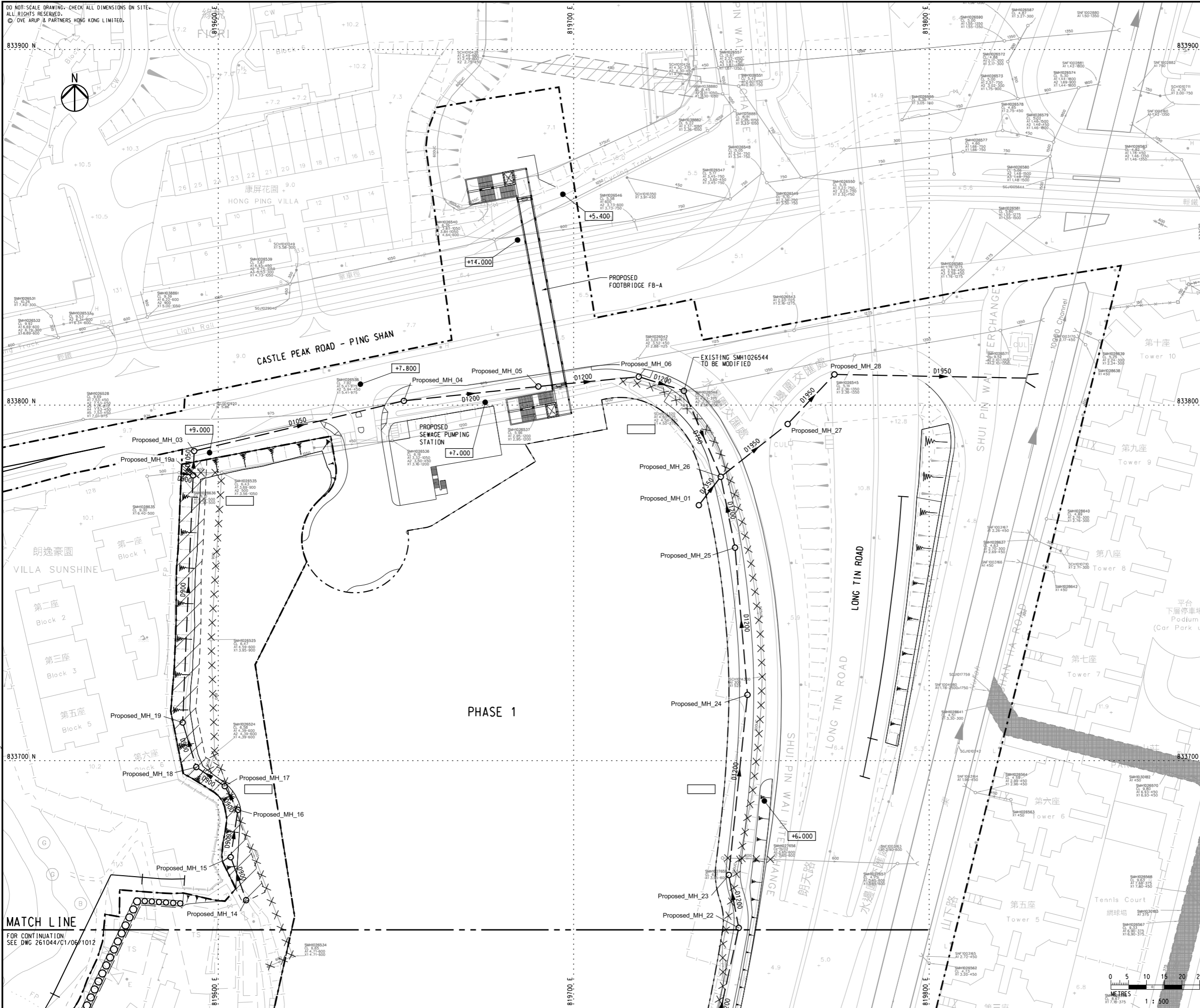
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LEGEND

- BOUNDARIES OF THE SITE
- HOUSING SITE BOUNDARY
- EXISTING NULLAH
- EXISTING DRAINAGE SYSTEM
- XX EXISTING STORM DRAIN TO BE ABANDONED
- EXISTING DRAINAGE RESERVE
- PROPOSED DRAINAGE RESERVE
- PROPOSED DRAINAGE PIPE
- +6.500 SPOT LEVEL

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PROPOSED DRAINAGE PLAN
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ANNEX 2

**Preliminary assessment of water levels and freeboards with
Corrigendum No. 1/2022**

also conflict with the Phase 1 Development and will be diverted north outside Phase 1 boundary on Ping Shan Section of Castle Peak Road.

3.9.18 Various sustainable drainage system (SuDS) measures to reduce peak surface runoff, improve surface runoff quality, minimize impact to existing drainage system, and improve aesthetics and living environment could be applied in the proposed development. The benefit of providing sustainable drainage system and increasing the greening area of the Long Bin development on the local drainage system and the proposed connecting pipes to the Yuen Long West Nullah will be further studied in the detailed design stage.

3.9.19 It is proposed to provide new D600 to D900 drainage pipes to convey the runoff from the school site to the Yuen Long West Nullah along future road at south of Site. The proposed drainage pipes are recommended to connect to the existing manholes SMH1044253 and SMH1010595 and utilize the existing drainage pipes crossing Long Tin Road to convey the flow to Yuen Long West Nullah.

3.9.20 The simulation results of the proposed drainage pipe is summarized in the **Table 3.9.2** below:-

Table 3.9.2 – Change of Predicted Maximum Water Level of Proposed Drainage Pipes

Location	Node ID of Hydraulic Model (Size of Downstream Pipe)	Ground Level (mPD)	Maximum Water Level of 50-year (mPD)*	
			Only Phase 1 Developed **	Both Phase 1 and Phase 2 Developed **
Phase 1	Proposed_MH_01 (D1350)	6.00	4.91 [1.09m]	4.99 [1.01m]
	Proposed_MH_26 (D1950)	6.00	4.89 [1.11m]	4.97 [1.03m]
	Proposed_MH_27 (D1950)	5.56	4.88 [0.68m]	4.94 [0.62m]
	Proposed_MH_28 (D1950)	5.32	4.87 [0.45m]	4.91 [0.41m]
Phase 2	Proposed_MHA01 (D1200)	6.00	-	5.52 [0.48m]
	Proposed_MHA02 (D1200)	6.00	-	5.49 [0.51m]
	Proposed_MHA03 (D1200)	6.00	-	5.31 [0.69m]
	Proposed_MHA04 (D900)	6.00	-	5.17 [0.83m]
	Proposed_MHA05 (D1350)	6.00	-	5.13 [0.87m]

Location	Node ID of Hydraulic Model (Size of Downstream Pipe)	Ground Level (mPD)	Maximum Water Level of 50-year (mPD)*	
			Only Phase 1 Developed **	Both Phase 1 and Phase 2 Developed **
	Proposed_MHA07 (Existing 2xD1350)	6.00	-	5.02 [0.98m]
	Proposed_MH_02 (D1200)	6.00	-	5.31 [0.69m]
	Proposed_MH_20 (D1200)	6.00	-	5.29 [0.71m]
	Proposed_MH_21 (D1200)	6.00	-	5.23 [0.77m]
	Proposed_MH_22 (D1200)	6.00	-	5.17 [0.83m]
	Proposed_MH_23 (D1200)	6.00	-	5.14 [0.86m]
	Proposed_MH_24 (D1200)	6.00	-	5.07 [0.93m]
	Proposed_MH_25 (D1200)	6.00	-	5.01 [0.99m]
Drainage Diversion of Phase 1	Proposed_MH_03 (D1050)	8.93	5.37 [3.56m]	5.71 [3.22m]
	Proposed_MH_04 (D1200)	7.55	5.16 [2.39m]	5.33 [2.22m]
	Proposed_MH_05 (D1200)	6.66	5.09 [1.57m]	5.24 [1.42m]
	Proposed_MH_06 (D1200)	5.81	5.03 [0.78m]	5.14 [0.67m]
School Site	Proposed_MH_07 (D600)	9.74	-	8.50 [1.24m]
	Proposed_MH_08 (D750)	7.80	-	6.54 [1.26m]
	Proposed_MH_09 (D750)	7.75	-	6.13 [1.62m]
	Proposed_MH_10 (D900)	6.89	-	5.93 [0.96m]
	Proposed_MH_11 (D900)	7.02	-	5.85 [1.17m]
	Proposed_MH_12 (D900)	6.65	-	5.79 [0.86m]
	Proposed_MH_13	6.42	-	5.74

Location	Node ID of Hydraulic Model (Size of Downstream Pipe)	Ground Level (mPD)	Maximum Water Level of 50-year (mPD)*	
			Only Phase 1 Developed **	Both Phase 1 and Phase 2 Developed **
	(D900, D600)			[0.68m]
Reprovision of Drainage Pipe at West of Phase 1	Proposed_MH_14 (D900)	7.10	5.88 [1.22m]	6.72 [0.38m]
	Proposed_MH_15 (D900)	7.67	5.87 [1.80m]	6.69 [0.98m]
	Proposed_MH_16 (D900)	8.71	5.85 [2.86m]	6.63 [2.08m]
	Proposed_MH_17 (D900)	8.88	5.83 [3.05m]	6.58 [2.30m]
	Proposed_MH_18 (D900)	9.22	5.82 [3.40m]	6.53 [2.69m]
	Proposed_MH_19 (D900)	9.15	5.80 [3.35m]	6.47 [2.68m]
	Proposed_MH_19a (D1050)	9.30	5.40 [3.90m]	5.80 [3.50m]

Notes:-

* the Design Water Level is the maximum water level comparing (i) 50-year events [case 1 & 2 in SDM]

** the value in bracket represent the freeboard, positive value is shown if ground level is higher than water level.

The simulation results showed that it has sufficient freeboard of the proposed drainage pipes. The location of the proposed manholes is shown in **Drawing Nos. 261044/C1/06/1011-1013** in **Appendix C**.

3.9.21 All the proposed drainage mitigation measure/drainage works mentioned above are shown in **Drawing No. 261044/C1/06/1011-1013** in **Appendix C**.

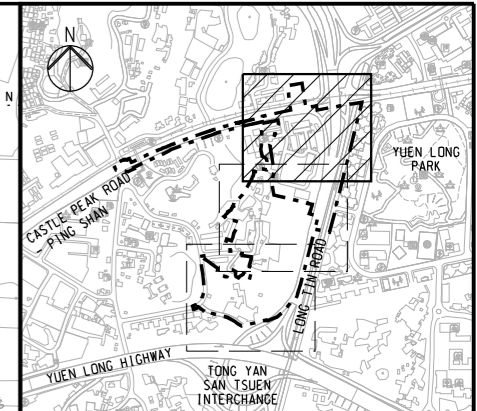
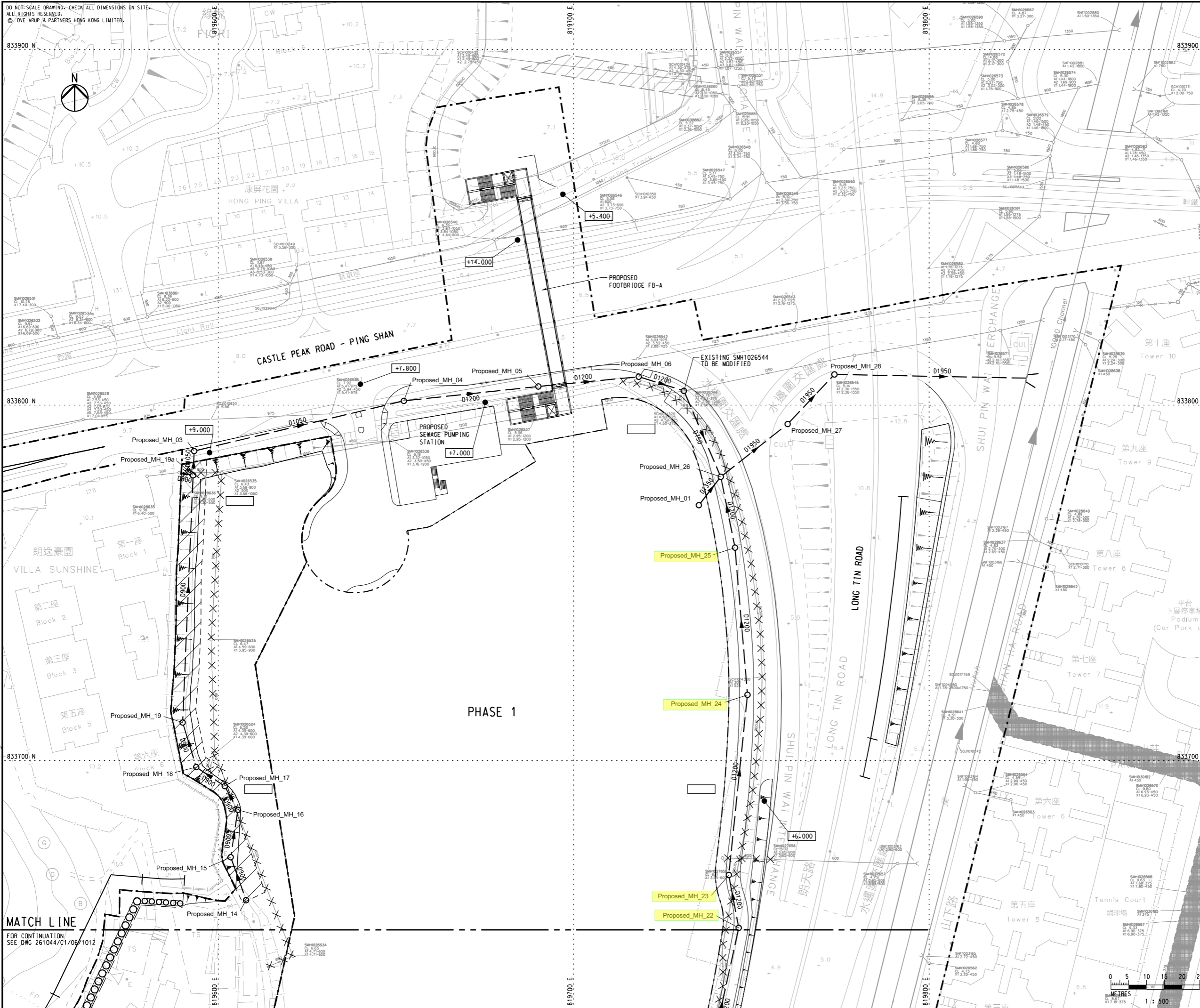
4 CONCLUSIONS

- 4.1.1** The drainage impact associated with the development site and infrastructure work area has been properly assessed in this report.
- 4.1.2** The development site are currently served by some existing drainage systems which involved existing channel, underground drainage pipe underneath Long Tin Road discharging to the Yuen Long West Nullah.
- 4.1.3** A comparison of the planned land use scenario under DMP Review completed in 2012 and the drainage condition of the site after development has been considered in this report.
- 4.1.4** The climate change scenario of Mid 21st Century has been considered in this DIA.
- 4.1.5** It is noted that the planned landuse of the DMP Review has already considered the development at Long Bin therefore all proposed drainage improvement works under the DMP Review has catered the drainage impact by Long Bin development. The hydraulic analysis under this project found that the changing of the landuse due to the Long Bin development will increase the water level of Yuen Long West Nullah by maximum 4mm at the location of the DMP Review proposed floodwall, the water level increase will not cause overbank flow from the nullah with the DMP Review proposed floodwall. Therefore, the drainage impact to this regional drainage system is considered minimal and the resultant drainage condition after development is considered satisfactory.
- 4.1.6** Providing more greening area within the Long Bin Development will generate less runoff to the Yuen Long West Nullah. In the view of minimizing the impact to the existing drainage system and the planned drainage improvement works under the DMP Review, it is recommended that 30% of greening ratio stated in the Table 1 of the TC (Works) No.3/2012 "Site Coverage of Greenery for Government Building Projects" should be provided within the Long Bin Development.
- 4.1.7** The existing drainage pipe under Long Tin Road discharging to Yuen Long West Nullah has been assessed. Apart from retaining the existing drainage pipes underneath Long Tin Road, additional drainage pipes of sizes D900 to D1950 are proposed in order to accommodate the flow from the sites of Phase 1, Phase 2 and PTI. Moreover, D1050 to D1200 pipes are proposed at northern side of the Phase 1 to divert the existing drain which conflict with proposed development.
- 4.1.8** D600 to D900 drainage pipes are proposed to convey the runoff from the school site to the Yuen Long West Nullah along future road at south of Site (to be widened). The proposed drainage pipes are recommended to connect to the existing manholes SMH1044253 and SMH1010595

and utilize the existing drainage pipes crossing Long Tin Road to convey the flow to Yuen Long West Nullah.

4.1.9 With proper implementation of drainage mitigation measures, it is concluded that there is no adverse drainage impact due to this Project.

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LEGEND

- BOUNDARIES OF THE SITE
- HOUSING SITE BOUNDARY
- EXISTING NULLAH
- EXISTING DRAINAGE SYSTEM
- EXISTING STORM DRAIN TO BE ABANDONED
- EXISTING DRAINAGE RESERVE
- PROPOSED DRAINAGE RESERVE
- PROPOSED DRAINAGE PIPE
- SPOT LEVEL

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PROPOSED DRAINAGE PLAN
(SHEET 1 OF 3)

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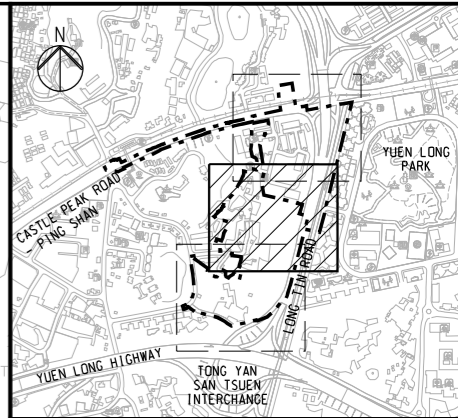
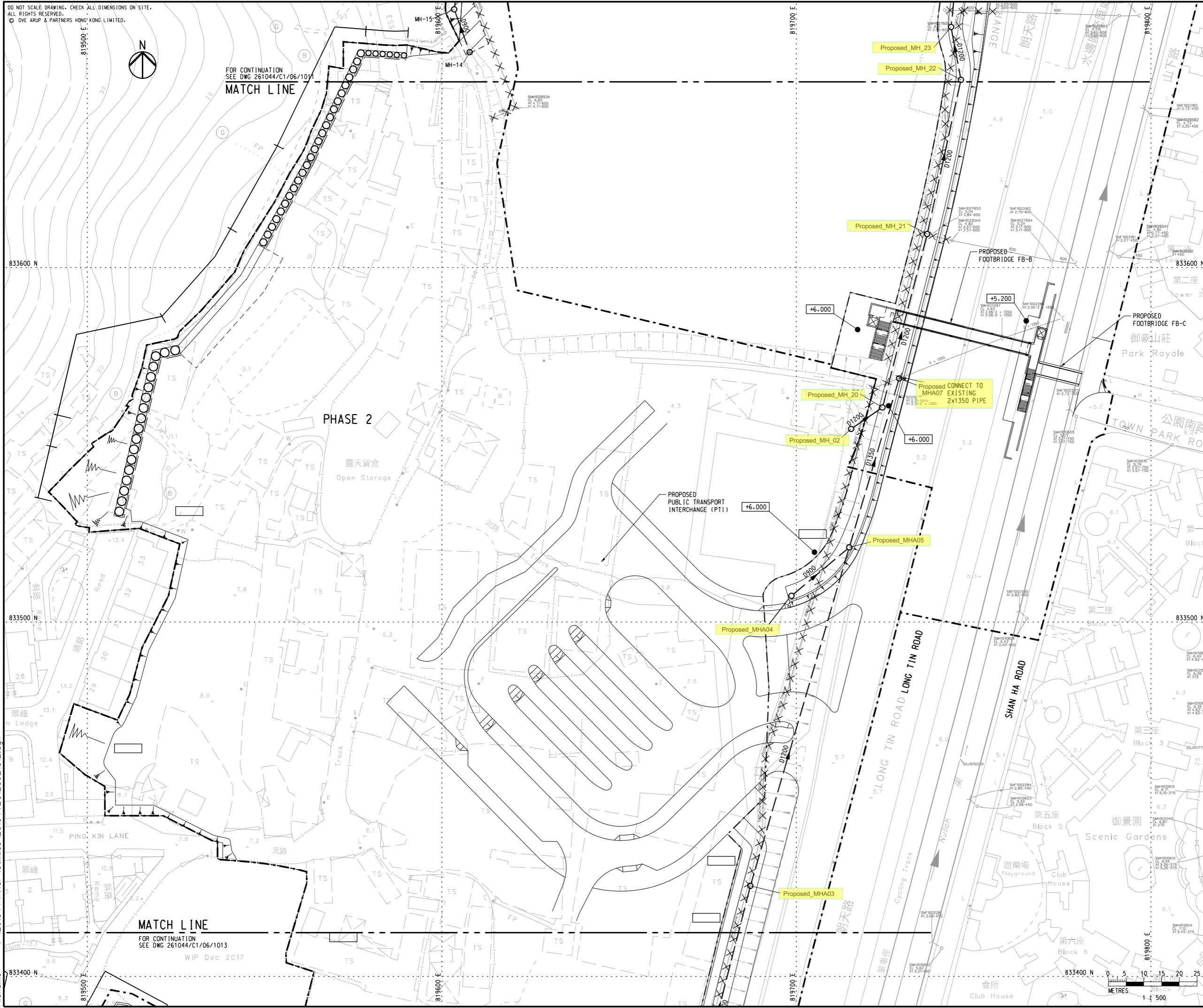


FOR CONTINUATION
SEE DWG 261044/C1/06/1011
MATCH LINE

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KEY PLAN

NOTES

1. FOR NOTES AND LEGEND, REFER TO DRAWING NO. 261044/C1/06/1011.

Extracted page from Revised Final DIA report (ref. REP-012-05)

Rev	Description	By	Date
A	FIRST ISSUE	JW	10/20
Consultant			
ARUP			

Project title
Agreement No. CE 75/2017 (CE)
Site Formation and Infrastructure Works for Public Housing Development at Long Bin, Yuen Long - Investigation, Design and Construction

Drawing title
PROPOSED DRAINAGE PLAN
(SHEET 2 OF 3)

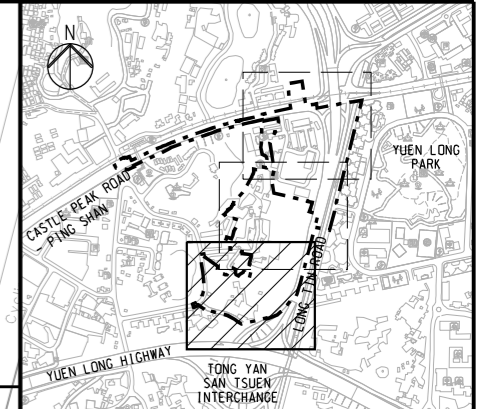
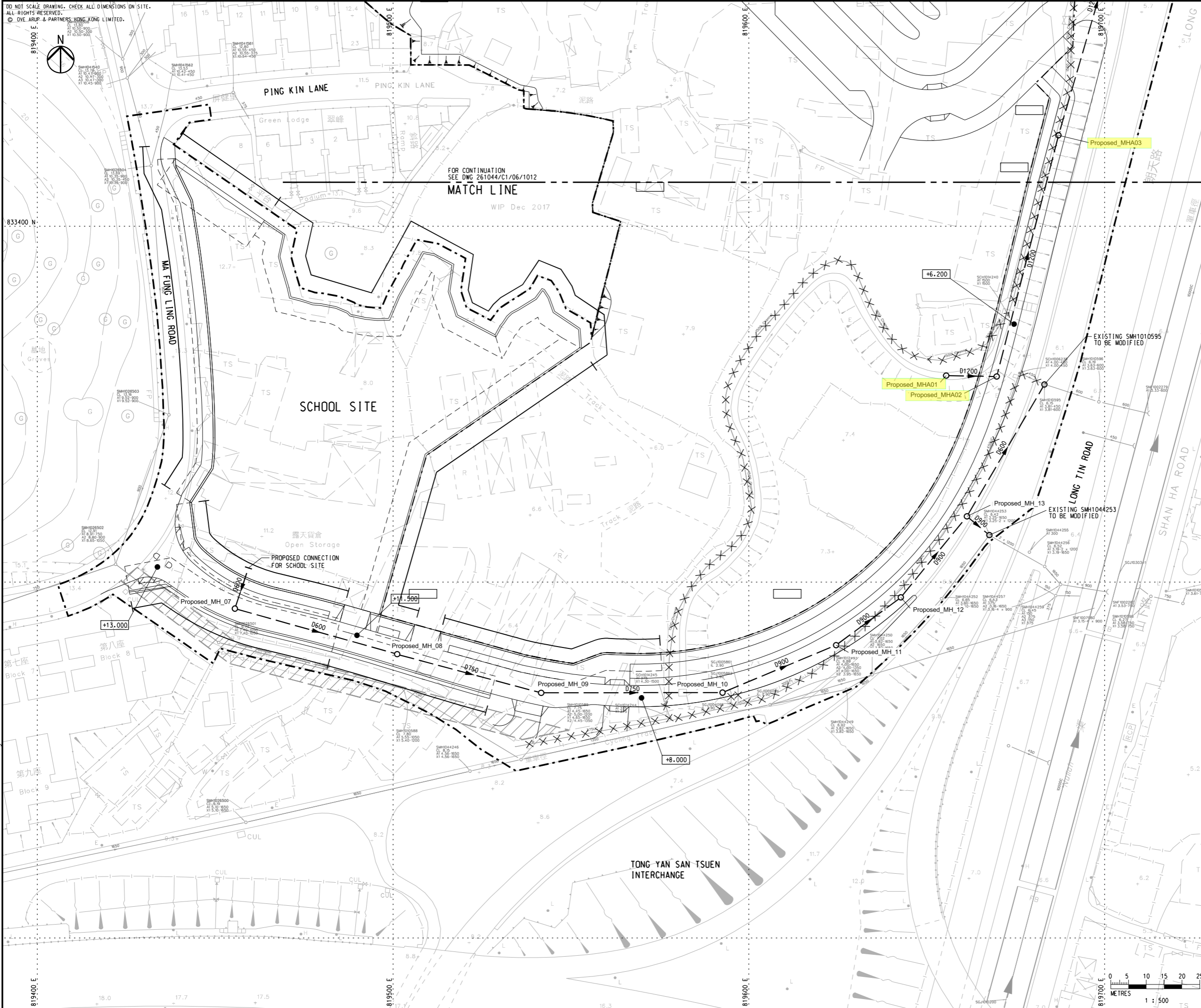
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NOTES
 1. FOR NOTES AND LEGEND, REFER TO DRAWING NO. 261044/C1/06/1011.

Extracted page from Revised Final DIA report (ref. REP-012-05)

Rev	Description	By	Date
A	FIRST ISSUE	JW	10/20
Consultant			
ARUP			

Project title
 Agreement No. CE 75/2017 (CE)
 Site Formation and Infrastructure Works for Public Housing Development at Long Bin, Yuen Long - Investigation, Design and Construction

Drawing title
PROPOSED DRAINAGE PLAN
 (SHEET 3 OF 3)

Drawing no.		Rev.	
261044/C1/06/1013		A	
Drawn	Date	Checked	Approved
RY	10/20	EH	KKC
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 12/17/2020

Preliminary Assessment of Water Level and Freeboard with Corrigendum No. 1/2022.

Location	Ground Level (mPD)	SDM		Corrigendum No. 1/2022		Reduction in freeboard (Corrigendum-SDM) (m)
		Max. water level of 50-year (mPD) ¹	Freeboard (m) ²	Max. water level of 50-year (mPD) ³	Freeboard (m) ²	
Proposed_MHA01 (D1200)	6.00	5.52	0.48	5.56	0.45	-0.03
Proposed_MHA02 (D1200)	6.00	5.49	0.51	5.52	0.48	-0.03
Proposed_MHA03 (D1200)	6.00	5.31	0.69	5.34	0.66	-0.03
Proposed_MHA04 (D900)	6.00	5.17	0.83	5.20	0.80	-0.03
Proposed_MHA05 (D1350)	6.00	5.13	0.87	5.16	0.84	-0.03
Proposed_MHA07 (Existing 2xD1350)	6.00	5.02	0.98	5.05	0.95	-0.03
Proposed_MH_02 (D1200)	6.00	5.31	0.69	5.34	0.66	-0.03
Proposed_MH_20 (D1200)	6.00	5.29	0.71	5.32	0.68	-0.03
Proposed_MH_21 (D1200)	6.00	5.23	0.77	5.26	0.74	-0.03
Proposed_MH_22 (D1200)	6.00	5.17	0.83	5.20	0.80	-0.03
Proposed_MH_23 (D1200)	6.00	5.14	0.86	5.17	0.83	-0.03
Proposed_MH_24 (D1200)	6.00	5.07	0.93	5.10	0.90	-0.03
Proposed_MH_25 (D1200)	6.00	5.01	0.99	5.04	0.96	-0.03

Note:

1. Max. water levels of 50-year are extracted from the Revised Final DIA report (ref. REP-012-05).
2. Positive value is shown if ground level is higher than water level.
3. Updated factor of rainfall increase due to climate change in Corrigendum No. 1/2022 is applied to update the water level calculation.

Rainfall increase due to Climate Change:

Mid Century: 10.4% (SDM) & 11.1% (Corrigendum)

Example: Max. water level of Proposed_MHA01 = $5.52 / (1+10.4\%) * (1+11.1\%) = 5.56$ mPD

Minimum freeboard occurs at Proposed_MHA01 = 0.45m.
All manholes could still maintain sufficient freeboard not less than 300mm.