Appendix 10

Drainage Impact Assessment

MOTT MACDONALD

Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories

Drainage Impact Assessment (Rev. A2)

September 2025

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Drainage Impact Assessment (Rev. A2)

September 2025

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1 Introduction

1.1 General

1.1.1 Mott MacDonald Hong Kong Limited (hereinafter as "MMHK") was commissioned by the Applicant to prepare a Drainage Impact Assessment (DIA) for supporting the proposed development at Fung Yuen, Tai Po (the Development). The location of the proposed development is shown in **Appendix A1**.

1.1.2 This S.12A application is to seek the Town Planning Board's approval for the proposed amendments to the Draft Tai Po Outline Zoning Plan No. S/TP/31 ("the OZP") for the proposed development at various lots and adjoining Government land at Fung Yuen, Tai Po, New Territories ("the Development Site"). The proposed development will include residential development(s) with supporting retail and public vehicle park facilities in Area (A); and a social welfare complex comprising a Residential Care Home for the Elderly ("RCHE") and a Day Care Unit ("DCU") for the Elderly in Area (B).

1.1.3 The Applicant submitted an s.12A Planning Application (No. Y/TP/38) to TPB in 2022 to rezone the current western portion of the "CDA(1)" zone to "R(B)13" zone to enable a proposed residential development with retail facilities and public vehicle park, and amending maximum building height restriction of the "G/IC" zone from 2 storeys to 8 storeys to the south of the "CDA(1)" zone for a proposed 8-storey Social Welfare Complex. While tremendous effort has been put to address and resolve the comments from Planning Department and relevant Government departments during circulation of the application, it is noted that majority of the Government departments have no further adverse comment on the technical assessments attached to Application No. Y/TP/38 since almost 3 years efforts being put by the Applicant & consultancy team.

1.1.4 Taking into account comments received from relevant Government departments and in order to achieve a wholistic planning scheme for the entire "CDA(1)" zone, the Applicant has put forward to include the CDA(1) Future Phase proposed in Application No. Y/TP/38 into the Development Site of this Application. The Proposed Development Proposal in this Application is largely the same as that under Application No. Y/TP/38. The Development Site of this Application is solely formed by the previous development sites, i.e. Area (A), Area(B) and the "CDA(1)" Future Phase. The total GFA, PR, building height, no. of units and estimated population of the Development Proposal is almost exactly the same as that under Application No. Y/TP/38.

1.1.5 This Drainage Impact Assessment (DIA) is prepared to support the planning application for the proposed development at various lots in D.D.11 and adjoining Government land in Fung Yuen, Tai Po under Section 12A of the Town Planning Ordinance for the proposed amendments to the OZP. This report forms part of the application document and will demonstrate that the proposed Development at the Development Site is feasible in terms of its impact on the drainage system.

1.1.6 The proposed Development will include the proposed phase I residential development with supporting retail and public vehicle park facilities in Area (A) Phase I; the proposed phase II residential development in Area (A) Phase II ; and the proposed Social Welfare Complex (SWC) consisting of a 150-place Residential Care Home for the Elderly

("RCHE") and a 30-place Day Care Unit ("DCU") for the Elderly in Area (B) as shown in layout plan of **Appendix A2**.

1.2 Objectives of the Assessment

1.2.1 The DIA focuses on the potential drainage impacts due to the implementation of the residential development in Area (A) Phase I, residential development in Area (A) Phase II, and the SWC in Area (B). The objective of the DIA is to identify, assess and mitigate potential adverse drainage impacts which may arise from the Development.

1.3 Structure of the Report

1.3.1 This DIA Report contains the following sections in addition to this introduction (Section 1):-

Section 2 – Methodology and Design Parameters for Drainage Impact Assessment

Discuss the methodology adopted and the design parameters used in the drainage impact assessment.

Section 3 – Existing Drainage System

Describe the drainage conditions and catchment characteristics of the existing drainage system.

Section 4 – Drainage Impact Assessment and Proposed Drainage System

Briefly discuss the catchment characteristics of the proposed Development and neighbouring area, assess the potential drainage impacts arising from the proposed Development, and propose the necessary drainage mitigation works as necessary.

Section 5 – Conclusion

Summarise the findings and conclude the drainage impact arising from the Development.

2 Methodology and Design Parameters for Drainage Impact Assessment

2.1 General Approach

2.1.1 The DIA is conducted by comparing the existing drainage condition (Baseline Condition) against the drainage condition after the implementation of the proposed Development (Proposed Condition) to identify potential drainage impacts to the existing drainage system near the Development Site. Appropriate mitigation measures will be proposed to reduce potential drainage impacts, if necessary.

2.1.2 Potential drainage impacts are identified by comparing the baseline drainage condition against the proposed drainage condition after the implementation of the proposed Development in respect of the water levels.

2.2 Assessment Methodology

Assessment Method

2.2.1 As discussed in the above section, potential drainage impacts are identified by comparing the baseline drainage condition against the proposed drainage condition. The existing drainage systems and its catchments likely to be affected by the proposed Development are presented in **Appendix B1** and **Appendix C1** respectively.

2.2.2 The following approach and methodology will be adopted in the drainage impact assessment:-

- Carry out desktop study to collect the relevant information for the assessment, relevant information collected included drainage record plans and hydraulic model for scenario of existing networks and existing land use developed in "CE 43/2012(DS) Review of Drainage Master Plan in Tai Po – Feasibility Study" (DMP Review in Tai Po) from Drainage Services Department (DSD) and river cross section survey for the stream within the Development Site received from the Applicant in **Appendix D**.
- Based on desktop information, identify the existing drainage systems in the vicinity of the Development Site;
- Estimate the change in runoff generated from the proposed Development; and
- Assess the drainage impacts arising from the proposed Development.

2.2.3 Due to the implementation of the proposed Development, the catchment characteristic within the Development Site will be changed to partly paved areas and partly landscaped areas. It is anticipated that the surface runoff shall be varied after the implementation of the proposed Development. For analysing the implications of the proposed condition, hydraulic model software "InfoWorks ICM" was adopted in the assessment.

2.2.4 To perform the drainage impact assessment, hydraulic model developed in DMP Review in Tai Po for scenario of Existing Networks and Existing Land Use (the Master Model) will form a basis for developing localised model (Baseline model, the extent of model refers to **Appendix F**) for existing drainage condition under this assessment. The localised model was updated with the supplement on river cross section survey

information. The baseline model of the existing drainage system is then used to establish hydraulic model for proposed Development under proposed condition.

2.3 Assessment Criteria, Design Parameters and Assumptions

Assessment Criteria

2.3.1 The assessment criteria are based on the recommendations set out in the Stormwater Drainage Manual (SDM) – 5th Edition, Corrigendum No.1/2022 and Corrigendum No.1/2024 issued by DSD. Flood event of 1 in 10 years return period, 1 in 50 years return period and 1 in 200 years return period for village drainage, branch and trunk drains respectively as recommended in Table 10 of SDM has been adopted in the design and assessment of drainage system for the Development. This DIA has also taken the Corrigendum No. 2/2024 of SDM into account for the formulation of proposed drainage mitigation measures.

2.3.2 The flood combinations in accordance with Section 6.4 and Table 11 of the SDM and repeated in **Table 2.1** are adopted to assess the existing and proposed drainage systems.

Table 2.1: Flood combinations

Flood Level Return Period (Years)	Rainfall Return Period (Years)	Sea Level Return Period (Years)	Flood Return Event Case
10	10	2	a
	2	10	b
50	50	10	a
	10	50	b
200	200	10	a
	10	200	b

Design Parameters and Assumptions for modelling

Modelling Approach

2.3.3 As mentioned above, the hydraulic performance of the drainage system near the Development Site has been assessed using InfoWorks ICM software. The assumptions and various parameters used in the modelling are presented in this section.

Baseline Model Scenario

2.3.4 Since the Master Model received from DSD was used for strategic drainage planning, to perform the DIA, a localised baseline model, consisting of the existing drainage system near the Development, has been developed based on the Master Model for existing network and existing land use under DMP Review in Tai Po. The localised model will adopt the same modelling elements of the existing drainage system such as conduits and catchment characteristics as Master Model provided by DSD while 2D grid extent has been re-meshed for the model extent in this report. The results of localised model will use for comparing flood level and extent under existing and proposed

conditions. Latest design rainfall and boundary condition at outfall for the localised model are updated to align with the latest Stormwater Drainage Manual.

2.3.5 The localised baseline model has also been refined to incorporate the following:-

- catchment delineation and discharge points for catchments adjacent to the Development Site have been reviewed according to topographic data shown in basemap;
- segment of the stream course within and near the Development Site has been surveyed and cross sections along the segment have been incorporated in the model according to the survey data; and
- some existing bridges found in site survey and site inspections were omitted from Master Model and they have been incorporated in the localised model.

2.3.6 SCS-Curve Number (CN) method and fixed runoff method, which were used in Master Model for runoff estimation, have been used to calculate the runoff from the assessed upland and urban catchments respectively. In order to identify the flooding condition for areas in the vicinity of the Development Site, a two-dimensional (2D) surface ground model covering the concerned area has been used in assessing the flood extent. Drainage system including the conduits, river reaches and channels are modelled through the 1D network.

2.3.7 The reviewed existing catchment plan and discharge points can be referred to **Appendix C1**. Detailed survey data of the cross sections along existing stream course segment and existing bridges within and near the Development Stie can be referred to **Appendix D**.

<u>Proposed Model Scenario</u>

2.3.8 Based on the localised model under baseline condition, a localised model under proposed condition was established. The changes incorporated in the model under proposed condition with reference to the latest layout plan in **Appendix A2** are:

- The change of CN for the Development Site due to the proposed residential development with supporting retail, public vehicle park and Social Welfare Complex (SWC);
- An existing river crossing will be reconstructed as vehicular bridge which has been modified for proposed condition in the model;
- Abandoned cross river facilities within the Development Site and abandoned cross river facility connecting to the Development near to Control Point 4a will be removed;
- The development area is set to its formation level of +7.5mPD to +12mPD;
- The proposed drainage works as discussed in Section 4; and
- A constant flow of about 0.1m^3/s has been allowed for the discharge of treated effluent from proposed sewage treatment plant.

2.3.9 The extent of the proposed model will be same as the baseline model and can be referred to **Appendix F**. A set of hydraulic models including baseline and proposed models used in this assessment is included in **Appendix H**.

Design Rainfall

2.3.10 A 4-hour duration rainfall profile has been used in model simulation and the rainfall profile is determined based on the equation as mentioned in Clause 4.3.5 of SDM where storm constants for different return period of HKO Headquarters (a, b, c) are given in Table 3a of SDM corrigendum No. 1/2024 and repeated in **Table 2.2.**

$$F(t) = \begin{cases} \dfrac{a[b+2(1-c)t]}{(2t+b)^{c+1}} & , \quad 0 \le t \le \dfrac{t_d}{2} \\ F(-t) & , \quad -\dfrac{t_d}{2} \le t \le 0 \end{cases}$$

where

F(t) = rate of rainfall or instantaneous intensity in mm/hr at time t (in minutes)

t_d = rainstorm duration (in minutes) (t_d <= 240)

a, b, c = storm constants given in Table 3a of SDM corrigendum No. 1/2024 and repeated in the following table.

Table 2.2: Storm constants for different return periods

Return Period T (years)	2	10	50	200
a	446.1	485.0	505.5	508.8
b	3.38	3.11	3.29	3.46
c	0.463	0.397	0.355	0.322

2.3.11 Rainfall duration of 240 minutes has been adopted for the assessment.

Design Modification due to Climate Change

2.3.12 According to SDM, climate change effect will be considered in this assessment. As a conservative estimation, the rainfall increase percentage and mean sea level rise projected to end 21st Century (2081 – 2100) as recommended in SDM Corrigendum No.1/2022 presented in **Table 2.3** have been adopted in this assessment. Besides, storm surge increase due to climate change at Tai Po Kau as recommended in SDM Corrigendum No.1/2022 presented in **Table 2.4** is also adopted in this assessment.

2.3.13 Considering the uncertainties in the range of possible future climate change development and global actions among nations on reducing carbon emissions, design allowance as recommended in SDM Corrigendum No.1/2022 presented in **Table 2.5** have been adopted in this assessment.

Table 2.3: Percentage of rainfall increase and sea level rise due to climate change

	Rainfall Increase	Mean sea Level Rise (m)
End 21st Century (2081 – 2100)	16.0%	0.47

Table 2.4: Storm surge increase due to climate change in end 21st Century

Return Period (Years)	Storm Surge Increase (m)
2	0.09
10	0.17
50	0.25
200	0.34

Table 2.5: Design allowance in end 21st Century

Return Period (Years)	Extreme Sea Level Rise (m)	Rainfall Increase
2	0.22	12.1%
10	0.25	
50	0.29	
200	0.34	

Design Water Level for Downstream Boundary

2.3.14 In order to assess the hydraulic performance of the existing drainage system, the downstream boundary condition at the sea outfall of the model follows the extreme design sea level at Tai Po Kau as recommended in Table 8 of SDM Corrigendum No.1/2022. The design sea level for the corresponding flood return period is summarised in **Table 2.6**.

Table 2.6: Design sea levels for different return periods

Return Period T (years)	Sea Level (mPD)	Sea Level with Climate Change (mPD)
2	2.97	3.75
10	3.54	4.43
50	4.41	5.42
200	5.59	6.74

Runoff Estimation

2.3.15 The estimation of runoff from the design rainfall events is calculated with two methods in InfoWorks ICM which are following the rural and urban approach adopted in DMP Review in Tai Po.

- Rural Catchments

The Soil Conservation Services (SCS) Curve Number method of InfoWorks ICM rainfall runoff module has been used to compute the runoff hydrograph. The SCS “Curve Number” CN is a characteristic of the soil type, land use and the initial degree of saturation. In this assessment, weighed average SCS curve numbers extracted from DMP Review in Tai Po have been adopted for existing condition. Other data for the catchments such as the catchment area, flow path length and slope have also been based on the Master Model from DMP Review in Tai Po.

For proposed development, CN value of 90 has been assumed for the developed areas of the Development Site under the proposed condition.

- Urban Catchments

The following runoff coefficient (C), based on DMP Review in Tai Po, has been adopted for urban catchments in this assessment:-

0.90 for paved area; and
0.30 for unpaved area.

Roughness

2.3.16 There are two approaches available in the ICM which can be used in modelling hydraulic roughness of the drainage system, i.e. Colebrook-White equation (ks) for underground drains or the Manning formula (n) for open channel or river.

2.3.17 For existing drainage system, the following roughness values have been adopted in accordance with DMP Review in Tai Po:-

- Colebrook-White ks value of 3mm has been adopted for pipelines and box culverts; and
- Manning's n value of 0.020 – 0.040 has been adopted for existing stream course.

2.3.18 For proposed drainage system, Colebrook-White ks value of 3mm has been adopted for the proposed new pipes and box culvert.

Sediment

2.3.19 For existing drainage system, siltation for the existing urban pipeline system follows the assumption used in Master Model from DMP Review in Tai Po.

2.3.20 For proposed drainage system, siltation follows the recommendation given in SDM, which suggests allowing for 5% reduction in flow area if the gradient is greater than 1 in 25 or 10% reduction in flow area in other cases.

3 Existing Drainage System

3.1 Site Condition

3.1.1 The Development Site (the Site) is located in an urban fringe environment, that covers site areas of about 31,854 square metres for Area (A) (comprising Phase I and Phase II) and about 3,347 square meters for Area (B), and situated next to Fung Yuen Road. The Site is found to be composed mostly trees and grass based on desktop study and site inspections. Topography of the Site is slightly oblique and with levels of around +2.1 mPD to 12.2 mPD. Villages and temporary structures are scattered in the surrounding area of the Site. The location of the Site is shown in **Appendix A1**. An existing stream course bounds the east side of the development in Area (A) Phase I and five existing river crossings connecting the west and east side of the stream are identified. The five existing river crossing structures have been located by carrying out site inspections and photos as well as cross-sections are given in **Appendix D** and **Appendix D1**.

3.2 Existing Drainage System and Catchment

3.2.1 The surface runoff from the existing catchments of the Site is currently discharged to a stream course passing through the Site that runs from the natural hillside area at the north of the Site up to the urbanized area at the south. Location of the stream course refers to **Appendix B1**.

3.2.2 Based on drainage record plan, the stream course that runs from the upstream hillside collects and conveys runoff from upstream and the Site. The stream is then connected to existing box culverts at Ting Kok Road next to Tin Sam Sewage Pumping Station. The existing box culverts laid along Dai Wah Street, size ranging from 3 cells of 3.8m x 2.1m to 5 cells of 4m x 2.7m, convey the runoff from upstream hillside and rural catchments as well as urban catchments and discharge to Tolo Harbour.

3.2.3 According to the topography, the runoff from the nearby villages, including Lau Hang (at about 11mPD to 15mPD) and Fung Mei Wai (at about 7mPD or above except some areas at South of Fung Mei Wai where the ground levels are ranged from a range of about 6mPD to 10mPD), is currently discharged to the existing stream course by overland flow. Under the existing condition, the Site currently serves as a flow path for collecting runoff from nearby villages, as well as a flow path for the flood water from the upstream of stream that will overland through the Site to downstream of the stream.

3.2.4 The existing drainage system in vicinity of the proposed Development is shown in **Appendix B1**.

3.3 Existing Land Use Surface Characteristics

3.3.1 The existing drainage system currently conveys runoff from several catchments. Based on hydraulic model under DMP Review in Tai Po, the delineation of local catchments discharging into the stream has been reviewed according to topography data in basemap. The reviewed local catchments, and catchment properties of the existing rural

sub-catchments which are based on DMP Review in Tai Po, have been summarised in **Table 3.1**. The existing catchment plan is shown in **Appendix C1**.

3.3.2 The CN values for the corresponding land uses are summarised in **Table 3.1** and are used to calculate the weighted CN for the following sub-catchments.

Table 3.1: Catchment properties of existing catchments

Model ID	Area (ha)	Weighted CN
SMH1049110_1	0.706	71.18
SMH1049111_1	0.302	70.33
Catchment_899	74.841	71.46
SGJ1003040_8	4.259	72.3
Catchment_900	56.098	71.36
Catchment_931	8.189	70.27
Catchment_929A_P02	10.852	69.68
Catchment_929A_P0	1.516	73.80
Catchment_901_1	10.607	71.10
Catchment_901_2	2.895	70.01
Catchment_901_4	6.280	75.08
Catchment_931_1	5.443	69.26
Catchment_901_5	4.104	68.02
Catchment_929A_P01 A	10.287	74.48
Catchment_929A_P01 B1	10.451	74.48
Catchment_901_3	6.507	74.13

3.3.3 Under this assessment, existing catchment (Model ID: Catchment_929A_P01) with weighted CN of 74.48 under DMP Review in Tai Po has been refined based on existing topography. By observing the crest of the hills within existing catchment (Model ID: Catchment_929A_P01), it can be sub-divided into two sub-catchments, namely Catchment_929A_P01 A and Catchment_929A_P01 B1 for the Site with discharge points as shown in **Appendix C1**. The corresponding CN values for the two sub-divided catchments, which are same as the Master Model, are summarised in the **Table 3.1**.

3.3.4 For other rural sub-catchments, weighted average CN values ranging from about 68 to 75, same as Master Model from DMP Review in Tai Po have been adopted.

3.3.5 For urban sub-catchments serviced by the assessed drainage, the existing surface characteristic are based on the runoff parameter currently adopted in Master Model from DMP Review in Tai Po.

3.4 Hydraulic Performance of Existing Drainage System

3.4.1 The hydraulic performance of the existing drainage system has been assessed by the model with the network containing the conduits, river reaches and channels in the existing drainage system including the stream course passing through the Site. Result showed that the existing stream course passing through the Site, in general, will flood even under 10 years flood return period for nearby village zone, Development Site and

Government , Institution or Community (G/IC) zone. Details of hydraulic model results can be referred to the hydraulic model included in **Appendix H**.

4 Drainage Impact Assessment and Proposed Drainage System

4.1 The Development

4.1.1 The proposed Development will include a residential development with supporting retail and public vehicle park in Area (A) Phase I; residential development in Area (A) Phase II; and a SWC with Residential Care Home for the Elderly ("RCHE") and a Day Care Unit ("DCU") for the Elderly in Area (B). The proposed Development will include paved condition and some landscaping area. Existing river crossing facilities (i.e. River Crossing Structures (B) to (E) in **Appendix D1**) will be removed to enhance the hydraulic performance of the existing stream course. A new vehicular bridge will be constructed as the main access to the Site. The proposed residential development in Area (A) Phase I and Area (A) Phase II will have a site formation level of +7.5mPD to 12mPD and +7.5mPD to 8mPD respectively (refer to **Appendix A2**) . The proposed social welfare complex will have a site formation slightly higher than the nearby road level (around 4.85mPD) with floodwalls having the crest at 7.5mPD surrounding the Site. For the commercial & public vehicle park, the site formation level will be about 11mPD which is similar to the existing ground profile. Permeable fencing will be provided at the development boundaries, subject to detailed design at the next stage. Besides, blue-green drainage infrastructure, such as green roof, landscaping areas and permeable pavement for open space, would also be considered in future design stage. The layout of the proposed development is shown in **Appendix A2**.

4.1.2 To mitigate the flood condition at the localised area near the Site, the following drainage mitigation measures as shown in **Appendix B2** have been proposed and the layout of the proposed developments with the proposed drainage mitigation measures is also provided in **Appendix A3**:-

- The existing stream course will be maintained as it is and a 3m buffer area from building area has been reserved in the developments in Area (A) Phase I, Area (A) Phase II and Area (B). No buildings will be proposed at the buffer area;
- A single-cell box culvert with a size ranged from 4000mm x 3000mm to 4000mm x 3500mm will be provided in the development in Area (A) Phase I to convey most of the stormwater from the existing 3600mm x 2500mm box culvert at Fung Yuen Road and runoff from development in Area (A) Phase I to the downstream of the stream at Control Point 4a in **Appendix E** under extreme flood events;
- A 1050mm diameter pipe will be provided in the development in Area (A) Phase I to maintain partial stormwater flow from the existing 3600mm x 2500mm box culvert at Fung Yuen Road to midstream of the existing stream course;
- A 1650mm diameter pipe will be provided in the development in Area (A) Phase I to intercept and convey the stream water at Control Point 1 in **Appendix E** to the proposed box culvert;
- Subject to detailed design in next General Building Plan submission stage, boundary drains with covers and associated pipes will be provided in the development in Area (A) Phase I to intercept runoff from nearby villages to the existing stream course and/or the proposed box culvert as shown in **Appendix B2**.
- Flap valve will be provided at the downstream of Pipes 3.1.3, 3.2.2, 3.3.1 in the development in Area (A) Phase I and Pipe B1 in the development in Area (B); and

- Floodwalls surrounding the proposed social welfare complex in Area (B) with a crest of 7.5mPD will be provided.

4.1.3 On-site inspection will be carried out in the future detailed design and construction stage to verify all existing drainage pipes/ channels and ensure all existing drainage pipes/ channels are to be reconnected to the proposed/existing drainage system, as well as the existing flow paths will not be obstructed by the proposed works under the development. The existing runoff toward the existing drainage system on the site will be intercepted and redirected to the proposed/existing drainage system.

4.1.4 Based on hydraulic assessment of existing drainage system in **Section 3**, the existing stream course will be flooded even under a flood return period of 10 years. To prevent flooding in the upstream and mid-stream section of the existing stream course under extreme flood events, most of the flow from the existing 3.6m x 2.5m box culvert will be intercepted by the proposed box culvert under extreme conditions. A lower flow will be continuously discharged to existing stream course via the 1050mm diameter pipe under extreme flood events without causing flooding for the section of existing stream course within the Site while the steam course habitat can be maintained.

4.1.5 In view of that the proposed box culvert will be interfaced with the existing stream course, the existing stream course will be disconnected locally at the location of interface (i.e. immediate downstream of Control point 2 in **Appendix E**) so that the existing stream course will be divided into an upper section and a lower section as shown in **Appendix B2**. Under the proposed condition, the upper section of the existing stream course will be connected to the proposed box culvert via a proposed 1650mm diameter pipe; whilst the lower section of the existing stream course connecting to the downstream box culvert at Ting Kok Road will receive the partial stormwater flow from the existing 3600mm x 2500mm box culvert at Fung Yuen Road via the proposed 1050mm drain and flow from an existing 1800mm drain connecting from the storm storage pond on the east of Fung Yuen Road.

4.1.6 To properly collect the runoff from the nearby catchments including Lau Hang and Fung Mei Wai, boundary drains consisting of channels and associated pipes are proposed to intercept the runoff to the existing stream course and the proposed box culvert. A continuous boundary channel, Channel 3.1a to Channel 3.4, will be constructed at the west side of the Development to intercept the runoff from nearby catchments. Associated pipes connecting the continuous boundary channel and the proposed box culvert will be provided as by-pass pipes. The alignment of the proposed boundary channels and associated pipes is shown in **Appendix B2** and the hydraulic calculation of the proposed boundary channels and associated pipes is enclosed in **Appendix J**. In light of that the adjacent villages have a higher ground profile than the development and boundary drains have been proposed to intercept the runoff from the adjacent villages, adverse drainage impact to the adjacent villages is not anticipated.

4.1.7 The stormwater inside the developments of Area (A) Phase I will be collected by the internal drainage and is proposed to be discharged to the proposed box culvert; while Area (A) Phase II and Area (B) will be collected by the internal drainage and is proposed to be discharged to the existing stream course. Sectional views of the proposed

Development with the proposed drainage mitigation measures are shown in **Appendix K.**

4.2 Changes in Catchment and Existing Drainage Network due to the Proposed Development

4.2.1 As discussed in **Section 3**, the runoffs generated from the Site are discharged to the existing stream course along Fung Yuen Road. For the proposed Development, the runoff generated from Area (A) Phase I will be discharged to the proposed box culvert; while Area (A) Phase II and Area (B) will be discharged to the existing stream course via an internal drainage system.

4.2.2 Three existing catchments (Model ID: Catchment_929A_P0, Catchment_901_4 and Catchment_929A_P01 B1) are further refined to delineate the catchments of the proposed Development and its surrounding areas. The existing catchments (Model ID: Catchment_929A_P0, Catchment_901_4 and Catchment_929A_P01 B1) are divided into thirteen sub-catchments as shown in **Table 4.1**. The catchments of Site (Model ID: Catchment_Development_1, Catchment_Development_2, Catchment_Development_T6, Catchment_Development_T5, Catchment_Gov and Catchment_SWC) are delineated based on the footprint of the proposed Development. The surrounding areas of the Site are divided into another seven sub-catchments (Model ID: Catchment_929A_P01 B -1, 1, 2, 3, Catchment_929A_P0, Catchment_901_4 and BridA_DS) The discharge points of the divided eleven sub-catchments are reviewed and five of them has been refined based on existing topography as shown in **Appendix C2**.

4.2.3 There will be at least 20% landscape area in residential area under the developments in Area (A) Phase I and SWC in Area (B). The weighted CN value of 90 will be assigned to the catchments of residential area under the developments in Area (A) Phase I and SWC in Area (B) (i.e. Catchment_Development_1 and Catchment_SWC). Apart from the commercial & public vehicle park, the catchment properties for area in northern portion of the development in Area (A) Phase I will be kept unchanged, thus, the weighted CN value of 75.56 has been assigned for this catchment (Model ID: Catchment_Development_2).

4.2.4 For the development in Area (A) Phase II, the residential development will be located on the east side of the existing stream course and the western portion will be soft landscaping area. The weighted CN value of 80.95 has been assigned for this catchment (Model ID: Catchment_Gov). The CN values assigned for the Site after implementation of the Development and details are given in **Table 4.1**. The Catchment plan under proposed condition can be referred to **Appendix C2**.

4.2.5 For the remaining seven sub-divided catchment (Model ID: Catchment_929A_P01 B -1, 1, 2, 3, Catchment_929A_P0, Catchment_901_4 and BridA_DS), as there will be no change to these areas, CN value same as existing condition has been assigned.

Table 4.1: Catchment properties of proposed catchments

Model ID	Area (ha)	Weighted CN
Catchment_Development_1	1.111	90.00
Catchment_Development_T5	0.314	90.00
Catchment_Development_T6	0.438	90.00
Catchment_Development_2	0.789	75.56

Model ID	Area (ha)	Weighted CN
Catchment_SWC	0.112	90.00
Catchment_929A_P01 B -1	0.817	74.48
1	1.990	74.48
2	3.158	74.48
3	0.949	74.48
Catchment_Gov	0.528	80.95
Catchment_929A_P0	0.818	73.80
Catchment_901_4	6.252	75.08
BridA_DS	0.970	74.48
Remark: 1. Catchment_Gov is catchment for the development in Area (A) Phase II, the CN under sensitivity analysis for only development in Area (A) Phase I and Area (B) will be 75.20 which reflects the existing condition.		

4.2.6 As there is no change to other catchments served by the assessed drainage system, and thus the catchment properties for other catchments in **Table 3.1** are also applicable to the proposed condition.

4.2.7 As mentioned in **Section 2**, the localised model under proposed condition has incorporated several changes due to the proposed Development in addition to the change in CN value arising from additional paved condition and they are listed below:-

- An existing river crossing will be reconstructed as vehicular bridge which has been modified for proposed condition in the model;
- Abandoned cross river facilities within the Development and abandoned cross river facility connecting to the Development near Control Point 4a will be removed;
- The Development area is set to its formation level of +7.5mPD to +12mPD;
- The proposed drainage improvement works as mentioned above; and
- A constant flow of about 0.1m^3/s has been allowed for the discharged of treated effluent from proposed sewage treatment plant.

4.3 Drainage Impact Assessment for the Entire Development

4.3.1 The drainage impact to the existing drainage system due to the Development consisting of the developments in Area (A) Phase I and Phase II, and Area (B) has been assessed with hydraulic model. The assessed drainage system includes the proposed box culvert, proposed 1050mm diameter pipe, proposed 1650mm diameter pipe, existing stream course, 3 cells of 3.8m x 2.1m box culverts across Ting Kok Road, 4 cells of 4m x 2.7m box culverts along Dai Wah Road and various pipeline and box culverts that discharge to box culvert along Dai Wah Road. Existing river crossings found on site and survey have been incorporated in the localised model for existing model, as well as the proposed model. Model extent can be referred to **Appendix F**.

4.3.2 Control points have been placed to observe changes in predicted water level between existing and proposed conditions for concerned drainage system. Location of control points can be found in **Appendix E**. The predicated water levels under the 10 years, 50

years and 200 years flood return period under the existing and proposed conditions are presented in **Table 4.2**.

4.3.3 The result of the hydraulic model also shows that the proposed 4m x 3m to 4m x 3.5m box culvert will have at least 300mm freeboard under 200-year flood event. The hydraulic profile of the proposed box culvert under 200-year flood event is shown in **Appendix L**.

Table 4.2: Predicted peak water levels and freeboard of stream near the Site under 10, 50 and 200 years flood events for the entire Development

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition- Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
10A	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.649	-1.029	-1.940	9.000	12.000	6.536	2.464	5.464	-2.113
	2	Section 7-7-Section 8-8	7.100	7.138	8.576	-1.476	-1.438	9.000	9.000	7.075	1.925	1.925	-1.501
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.968	-1.038	-0.378	8.00	7.590	6.446	1.554	1.144	-1.522
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.568	-0.848	-0.168	8.00	7.500	6.294	1.706	1.206	-1.274
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	6.851	-0.627	-0.470	7.200	7.500	5.523	1.677	1.977	-1.328
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	4.895	-0.305	0.727	7.500	5.622	4.662	2.838	0.960	-0.233
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	4.695	-0.230	-0.669	4.465	4.026	4.668	-0.203	-0.642	-0.027
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	4.656	-0.907	-1.231	3.749	3.425	4.690	-0.941	-1.265	0.034
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	4.682	-1.042	-1.682	3.640	3.000	4.728	-1.088	-1.728	0.046
10B	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.296	-0.676	-1.587	9.000	12.000	5.687	3.313	6.313	-2.609
	2	Section 7-7-Section 8-8	7.100	7.138	8.289	-1.189	-1.151	9.000	9.000	6.988	2.012	2.012	-1.301
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.712	-0.782	-0.122	8.00	7.590	6.358	1.642	1.232	-1.354
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.337	-0.617	0.063	8.00	7.500	6.225	1.775	1.275	-1.112
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	6.605	-0.381	-0.224	7.200	7.500	5.473	1.727	2.027	-1.132
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	4.906	-0.316	0.716	7.500	5.622	4.814	2.686	0.808	-0.092
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-	4.465	4.026	4.819	-0.354	-0.793	4.465	4.026	4.827	-0.362	-0.801	0.008

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
		FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH											
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	4.818	-1.069	-1.393	3.749	3.425	4.844	-1.095	-1.419	0.026
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	4.849	-1.209	-1.849	3.640	3.000	4.861	-1.221	-1.861	0.012
50A	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.885	-1.265	-2.176	9.000	12.000	7.503	1.497	4.497	-1.382
	2	Section 7-7-Section 8-8	7.100	7.138	8.717	-1.617	-1.579	9.000	9.000	7.229	1.771	1.771	-1.488
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	8.106	-1.176	-0.516	8.00	7.590	6.544	1.456	1.046	-1.562
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.698	-0.978	-0.298	8.00	7.500	6.372	1.628	1.128	-1.326
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	7.006	-0.782	-0.625	7.200	7.500	5.619	1.581	1.881	-1.387
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	5.640	-1.050	-0.018	7.500	5.622	5.526	1.974	0.096	-0.114
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	5.568	-1.103	-1.542	4.465	4.026	5.540	-1.075	-1.514	-0.028
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	5.559	-1.810	-2.134	3.749	3.425	5.543	-1.794	-2.118	-0.016
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	5.561	-1.921	-2.561	3.640	3.000	5.572	-1.932	-2.572	0.011
50B	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.649	-1.029	-1.940	9.000	12.000	7.281	1.719	4.719	-1.368
	2	Section 7-7-Section 8-8	7.100	7.138	8.576	-1.476	-1.438	9.000	9.000	7.117	1.883	1.883	-1.459
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.969	-1.039	-0.379	8.00	7.590	6.474	1.526	1.116	-1.495
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.568	-0.848	-0.168	8.00	7.500	6.308	1.692	1.192	-1.260
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	6.869	-0.645	-0.488	7.200	7.500	5.916	1.284	1.584	-0.953

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	5.956	-1.366	-0.334	7.500	5.622	5.904	1.596	-0.282	-0.052
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	5.920	-1.455	-1.894	4.465	4.026	5.910	-1.445	-1.884	-0.010
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	5.920	-2.171	-2.495	3.749	3.425	5.901	-2.152	-2.476	-0.019
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	5.921	-2.281	-2.921	3.640	3.000	5.924	-2.284	-2.924	0.003
200A	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.917	-1.297	-2.208	9.000	12.000	7.911	1.089	4.089	-1.006
	2	Section 7-7-Section 8-8	7.100	7.138	8.737	-1.637	-1.599	9.000	9.000	7.288	1.712	1.712	-1.449
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	8.132	-1.202	-0.542	8.00	7.590	6.602	1.398	0.988	-1.530
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.724	-1.004	-0.324	8.00	7.500	6.419	1.581	1.081	-1.305
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	7.033	-0.809	-0.652	7.200	7.500	5.747	1.453	1.753	-1.286
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	5.827	-1.237	-0.205	7.500	5.622	5.719	1.781	-0.097	-0.108
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	5.765	-1.300	-1.739	4.465	4.026	5.729	-1.264	-1.703	-0.036
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	5.756	-2.007	-2.331	3.749	3.425	5.717	-1.968	-2.292	-0.039
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	5.754	-2.114	-2.754	3.640	3.000	5.750	-2.110	-2.750	-0.004
200B	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.649	-1.029	-1.940	9.000	12.000	8.097	0.903	3.903	-0.552
	2	Section 7-7-Section 8-8	7.100	7.138	8.576	-1.476	-1.438	9.000	9.000	7.289	1.711	1.711	-1.287
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.981	-1.051	-0.391	8.00	7.590	6.850	1.150	0.740	-1.131

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.586	-0.866	-0.186	8.00	7.500	6.791	1.209	0.709	-0.795
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	7.089	-0.865	-0.708	7.200	7.500	6.788	0.412	0.712	-0.301
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	6.808	-2.218	-1.186	7.500	5.622	6.790	0.710	-1.168	-0.018
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	6.802	-2.337	-2.776	4.465	4.026	6.810	-2.345	-2.784	0.008
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	6.815	-3.066	-3.390	3.749	3.425	6.852	-3.103	-3.427	0.037
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	6.826	-3.186	-3.826	3.640	3.000	6.824	-3.184	-3.824	-0.002

Remarks:-

1. Location of control points refers to **Appendix E**.
2. +ve value of freeboard indicates predicted water level is lower than the river bank level.
3. -ve value of freeboard indicates predicted water level is higher than the river bank level.
4. Under proposed condition, river banks within Site boundaries are adjusted due to the increase of site formation.

* Due to the backwater effect under high tide condition, water level at control points 5a, 5b and 6 is relatively high. However, the downstream drainage network has sufficient capacity under low tide condition.

4.3.4 With reference to results in **Table 4.2**, the water levels at the upstream and mid-stream section of the existing stream course are significantly reduced under 1 in 10 years, 1 in 50 years and 1 in 200 years flood event compared with the existing condition. For the upstream section of the existing stream course (i.e. Control points 1 and 2), the water level is reduced up to 2.6m, 1.5m and 1.4m under 1 in 10 years, 1 in 50 years and 1 in 200 years flood event compared with the existing condition. A significant drop of in water levels (up to -1.5m) is also anticipated at the mid-stream section of the existing stream course (i.e. Control points 3a, 3b and 3c) under 1 in 200 years flood event. With the provision of the proposed box culvert, the drainage condition at upstream and mid-stream of the stream course are greatly improved.

4.3.5 In view of that the removal of existing abandoned cross river facilities and provision of a proper drainage system i.e. the proposed box culvert, which collects stormwater including flooded water and part of stream course water under existing drainage condition back to the downstream section of the existing stream course at Control point 4a, under the proposed condition, there will be a slight decrease in the water level at Control point 4a under 1 in 200 years storm event compared with the existing condition.

4.3.6 At the downstream section of the existing stream course (Control Points 5a, 5b and 6) which located at a village zone, the predicated water level is similar to existing condition and flooding only localised at area near to the banks of existing stream course. With reference to the flood extent map in **Appendix G**, there is no major change in flooding extent under the 1 in 10 years flood event. Also, flood wall with crest level of +7.5mPD (with 0.3m freeboard under the 200 years flood event) has been proposed at the proposed SWC to mitigate the potential flood risk. Under daily operation, internal drainage system will collect and discharge the local runoff to the proposed box culvert for the development in Area (A) Phase I and to the existing stream course for development in Area (A) Phase II and Area (B). A flap valve will be provided to prevent backwater effect to the internal drainage system under extreme weather condition. To tackle the backwater effect under extreme weather event, local emergency pumping, if necessary, will be used for discharging the runoff from the SWC to the existing stream course to deal with the backwater effect. The local emergency pump should be equipped with a maximum pumping rate of 0.1m^3/s, which is equal to the maximum discharge from SWC under the 200 years rainfall, to handle the peak local runoff from the proposed SWC. The local emergency pumping, consisting of a duty pump and a standby pump, will be deployed at the lowest point of the SWC and maintained by the future operator of the SWC. Thus, it is considered that there is no significant drainage impacts to the existing drainage system due to the proposed Development.

4.3.7 Under the existing condition, the Site currently serves as a flow path and the flood water from the upstream of stream will overland through the Site to downstream of the stream. The predicted maximum flood depth for flooding areas near to Control points 1 to 4a under existing condition is about 1.94m, 2.18m and 2.22m under 10 years, 50 years, and 200 years storm respectively. With reference to **Appendix G**, the flooding is no longer observed at the area near to Control point 1 to 4a under the proposed condition with both developments in Area (A) Phase I and Phase II due to the provision of proper drainage system. Thus, the flooding condition for area near Controls Points 1 to 4a has been significantly improved.

4.3.8 With reference to the flood extent map in **Appendix G**, local flooding is anticipated at the downstream section of the existing stream course (near to Control points 5a to 6) under 1 in 10 years, 1 in 50 years and 1 in 200 years flood events for both existing

condition and proposed conditions. The flood extent at the area is similar under both the existing and proposed conditions.

4.3.9 Under the extremely high sea level condition such as 1 in 50 years and 1 in 200 years design sea level, the design sea level of those extreme condition (i.e. 5.42mPD for 50 years and 6.74mPD for 200 years respectively) is higher than the existing ground levels for most of Tai Po area which are between 5mPD and 6mPD, for examples, the village areas, currently vegetation area, near Control Points 4 to 6 (i.e. ground levels from 4.4mPD to 4.6mPD). Sea water is anticipated to be flooded into those areas which have ground levels lower than the design sea level under 1 in 50 years and 1 in 200 years flood events in both existing and proposed conditions. Based on the hydraulic model results, the flooding for these areas is mainly arising from extreme high design sea level and low existing topography of the areas. In view of the flooding is causing by high design sea level, thus, it is considered that no significant adverse impacts will be arising from the proposed Development with the proposed drainage.

4.3.10 As the flood extent of the proposed condition are in generally reduced when compared to the existing condition. Thus, there will be no significant adverse impacts arising from the proposed Development upon the provision of proposed mitigation measures.

4.4 Drainage Impact Assessment for only Development in Area (A) Phase I and Area (B)

4.4.1 In view of the development in Area (A) Phase II will be implemented later than other parts of the Development, a hydraulic sensitivity analysis for only the development in Area (A) Phase I and Area (B) in place has also been carried out. Under this scenario, all proposed drainage system as mentioned in **Section 4.1** will be provided under the development in Area (A) Phase I and Area (B) except the site condition for the Area (A) Phase II will be maintained as existing condition and its runoff will be discharged to the existing stream course.

4.4.2 Same as scenario of the entire Development in **Section 4.3**, control points, as given in **Appendix E**, have been placed to observe changes in predicted water level between existing and proposed conditions for concerned drainage system under this sensitivity analysis. The predicated water levels under the 10 years, 50 years and 200 years flood return period under the existing and proposed conditions for only the development in Area (A) Phase I and Area (B) are presented in **Table 4.2**.

4.4.3 The result of the hydraulic model also shows that the proposed 4m x 3m to 4m x 3.5m box culvert will have at least 300mm freeboard under 200-year flood event.

Table 4.3: Predicted peak water levels and freeboard of stream near the Site under 10, 50 and 200 years flood events for only the Development in Area (A) Phase I and Area (B)

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
10A	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.649	-1.029	-1.940	9.000	12.000	6.535	2.465	5.465	-2.114
	2	Section 7-7-Section 8-8	7.100	7.138	8.576	-1.476	-1.438	9.000	9.000	7.075	1.925	1.925	-1.501
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.968	-1.038	-0.378	6.930	7.590	6.446	0.484	1.144	-1.522
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.568	-0.848	-0.168	6.720	7.400	6.294	0.426	1.106	-1.274
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	6.851	-0.627	-0.470	7.200	6.381	5.522	1.678	0.859	-1.329
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	4.895	-0.305	0.727	7.500	5.622	4.661	2.839	0.961	-0.234
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	4.695	-0.230	-0.669	4.465	4.026	4.666	-0.201	-0.640	-0.029
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	4.656	-0.907	-1.231	3.749	3.425	4.688	-0.939	-1.263	0.032
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	4.682	-1.042	-1.682	3.640	3.000	4.729	-1.089	-1.729	0.047
10B	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.296	-0.676	-1.587	9.000	12.000	5.687	3.313	6.313	-2.609
	2	Section 7-7-Section 8-8	7.100	7.138	8.289	-1.189	-1.151	9.000	9.000	6.988	2.012	2.012	-1.301
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.712	-0.782	-0.122	6.930	7.590	6.356	0.574	1.234	-1.356
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.337	-0.617	0.063	6.720	7.400	6.222	0.498	1.178	-1.115
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	6.605	-0.381	-0.224	7.200	6.381	5.471	1.729	0.910	-1.134
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	4.906	-0.316	0.716	7.500	5.622	4.813	2.687	0.809	-0.093

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	4.819	-0.354	-0.793	4.465	4.026	4.827	-0.362	-0.801	0.008
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	4.818	-1.069	-1.393	3.749	3.425	4.841	-1.092	-1.416	0.023
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	4.849	-1.209	-1.849	3.640	3.000	4.861	-1.221	-1.861	0.012
50A	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.885	-1.265	-2.176	9.000	12.000	7.503	1.497	4.497	-1.382
	2	Section 7-7-Section 8-8	7.100	7.138	8.717	-1.617	-1.579	9.000	9.000	7.229	1.771	1.771	-1.488
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	8.106	-1.176	-0.516	6.930	7.590	6.543	0.387	1.047	-1.563
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.698	-0.978	-0.298	6.720	7.400	6.372	0.348	1.028	-1.326
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	7.006	-0.782	-0.625	7.200	6.381	5.618	1.582	0.763	-1.388
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	5.640	-1.050	-0.018	7.500	5.622	5.529	1.971	0.093	-0.111
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	5.568	-1.103	-1.542	4.465	4.026	5.541	-1.076	-1.515	-0.027
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	5.559	-1.810	-2.134	3.749	3.425	5.542	-1.793	-2.117	-0.017
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	5.561	-1.921	-2.561	3.640	3.000	5.577	-1.937	-2.577	0.016
50B	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.649	-1.029	-1.940	9.000	12.000	7.285	1.715	4.715	-1.364
	2	Section 7-7-Section 8-8	7.100	7.138	8.576	-1.476	-1.438	9.000	9.000	7.117	1.883	1.883	-1.459
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.969	-1.039	-0.379	6.930	7.590	6.473	0.457	1.117	-1.496
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.568	-0.848	-0.168	6.720	7.400	6.308	0.412	1.092	-1.260

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	6.869	-0.645	-0.488	7.200	6.381	5.920	1.280	0.461	-0.949
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	5.956	-1.366	-0.334	7.500	5.622	5.908	1.592	-0.286	-0.048
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	5.920	-1.455	-1.894	4.465	4.026	5.914	-1.449	-1.888	-0.006
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	5.920	-2.171	-2.495	3.749	3.425	5.904	-2.155	-2.479	-0.016
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	5.921	-2.281	-2.921	3.640	3.000	5.927	-2.287	-2.927	0.006
200A	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.917	-1.297	-2.208	9.000	12.000	7.913	1.087	4.087	-1.004
	2	Section 7-7-Section 8-8	7.100	7.138	8.737	-1.637	-1.599	9.000	9.000	7.288	1.712	1.712	-1.449
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	8.132	-1.202	-0.542	6.930	7.590	6.603	0.327	0.987	-1.529
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.724	-1.004	-0.324	6.720	7.400	6.420	0.300	0.980	-1.304
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	7.033	-0.809	-0.652	7.200	6.381	5.751	1.449	0.630	-1.282
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	5.827	-1.237	-0.205	7.500	5.622	5.724	1.776	-0.102	-0.103
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	5.765	-1.300	-1.739	4.465	4.026	5.735	-1.270	-1.709	-0.030
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	5.756	-2.007	-2.331	3.749	3.425	5.723	-1.974	-2.298	-0.033
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	5.754	-2.114	-2.754	3.640	3.000	5.756	-2.116	-2.756	0.002
200B	1	Section 5-5-Section 5-5-Section 6-6	7.620	6.709	8.649	-1.029	-1.940	9.000	12.000	8.105	0.895	3.895	-0.544
	2	Section 7-7-Section 8-8	7.100	7.138	8.576	-1.476	-1.438	9.000	9.000	7.296	1.704	1.704	-1.280

Case	Control Points	Cross Section line ID	Existing Condition					Proposed Condition (with mitigation)					Change in Water Level (m) (i.e. Proposed Condition-Existing Condition)
			West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	West Bank Level (mPD)	East Bank Level (mPD)	Water Level (mPD)	West Bank Freeboard (m)	East Bank Freeboard (m)	
	3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	6.930	7.590	7.981	-1.051	-0.391	6.930	7.590	7.048	-0.118	0.542	-0.933
	3b	FUNG_YUEN_W_CH1160	6.720	7.400	7.586	-0.866	-0.186	6.720	7.400	7.037	-0.317	0.363	-0.549
	3c	FUNG_YUEN_W_CH1200-HF279-1	6.224	6.381	7.089	-0.865	-0.708	7.200	6.381	6.865	0.335	-0.484	-0.224
	4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	4.590	5.622	6.808	-2.218	-1.186	7.500	5.622	6.800	0.700	-1.178	-0.008
	5a*	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH	4.465	4.026	6.802	-2.337	-2.776	4.465	4.026	6.840	-2.375	-2.814	0.038
	5b*	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450	3.749	3.425	6.815	-3.066	-3.390	3.749	3.425	6.864	-3.115	-3.439	0.049
	6*	FUNG_YUEN_W_CH1450	3.640	3.000	6.826	-3.186	-3.826	3.640	3.000	6.837	-3.197	-3.837	0.011

Remarks:-

1. Location of control points refers to **Appendix E**.
2. +ve value of freeboard indicates predicted water level is lower than the river bank level.
3. -ve value of freeboard indicates predicted water level is higher than the river bank level.
4. Under proposed condition, river banks within Site boundaries are adjusted due to the increase of site formation.

* Due to the backwater effect under high tide condition, water level at control points 5a, 5b and 6 is relatively high. However, the downstream drainage network has sufficient capacity under low tide condition.

4.4.4 Same as the entire Development scenario, with reference to results in **Table 4.2**, the water levels at the upstream and mid-stream section of the existing stream course are significantly reduced under 1 in 10 years, 1 in 50 years and 1 in 200 years flood event compared with the existing condition. For the upstream section of the existing stream course (i.e. Control points 1 and 2), the water level is reduced up to 2.6m, 1.5m and 1.4m under 1 in 10 years, 1 in 50 years and 1 in 200 years flood event compared with the existing condition. A significant drop of in water levels (up to -1.5m) is also anticipated at the mid-stream section of the existing stream course (i.e. Control points 3a, 3b and 3c) under 1 in 200 years flood event. With the provision of the proposed box culvert, the drainage condition at upstream and mid-stream of the stream course are greatly improved. Although the drainage condition at mid-stream of stream course between Control point 3a and 3b is significant improved, due to relatively low existing ground levels in Area (A) Phase II, the section of stream course falling within this area will marginally have a 300mm freeboard under the 200 years storm event upon the runoff from the development in Area (A) Phase I has been discharged to the proposed box culvert.

4.4.5 Similar to scenario of entire Development, at Control point 4a, under the proposed condition, there will be a slight decrease in the water level at Control point 4a under 1 in 200 years storm event compared with the existing condition.

4.4.6 At the downstream section of the existing stream course (Control Points 5a, 5b and 6) which located at a village zone, the predicated water level is similar to existing condition and flooding only localised at area near to the banks of existing stream course. With reference to the flood extent map in **Appendix G**, there is also no major change in flooding extent under the 1 in 10 years flood event under the hydraulic sensitivity analysis. Also, flood wall with crest level of +7.5mPD (with 0.3m freeboard under the 200 years flood event) at the proposed SWC in Area (B) is also provided to mitigate the potential flood risk.

4.4.7 Under daily operation, internal drainage system will be provided to collect and discharge the local runoff to the proposed box culvert for the development in Area (A) Phase I and to the existing stream course for Area (B). Same as scenario of entire Development, flap valve and local emergency pumping (with a maximum pumping rate of $0.1m^3/s$ that capable to 200 years storm peak runoff from the proposed SWC) will be provided for the SWC in Area (B) to prevent backwater effect to the internal drainage system under extreme weather condition. Thus, it is considered that there is no significant drainage impacts to the existing drainage system due to the proposed development in Area (A) Phase I and Area (B).

4.4.8 With reference to **Appendix G**, the flooding condition for area near Controls Points 1 to 4a has been significantly improved under the proposed condition with only development in Area (A) Phase I and Area (B) due to the provision of proper drainage system. Local flooding is anticipated at the downstream section of the existing stream course (near to Control points 5a to 6) under 1 in 10 years, 1 in 50 years and 1 in 200 years flood events for both existing condition and proposed conditions. The flood extent at the area is similar under both the existing and proposed conditions under this scenario.

4.4.9 Same as the entire Development as discussed in **Section 4.3.9**, under the extremely high sea level condition such as 1 in 50 years and 1 in 200 years design sea level (i.e. 5.42mPD for 50 years and 6.74mPD for 200 years respectively), low-lying areas, for examples, the local area on the east of the site adjacent to Tower 4 (i.e. ground level is about 6mPD) and village areas, currently vegetation area, near Control Points 4 to 6

(i.e. ground levels from 4.4mPD to 4.6mPD) is anticipated to be flooded by sea water under 1 in 50 years and 1 in 200 years flood events under both existing and proposed conditions. Based on the hydraulic model results, the flooding for these areas is mainly arising from extreme high design sea level and low existing topography of the areas. In view of the flooding is causing by high design sea level, thus, it is considered that no significant adverse impacts will be arising from the proposed Development with the proposed drainage.

4.4.10 As the flood extent of the proposed condition are in generally reduced when compared to the existing condition. Thus, there will be no significant adverse impacts arising from the proposed Development upon the provision of proposed mitigation measures.

4.5 Maintenance Responsibility

4.5.1 **Appendix I** shows the drainage features within and near the Development Site and **Table 4.4** summarises the proposed maintenance parties for the drainage features associated with the proposed development.

4.5.2 In light of that part of the existing stream course falling within the development in Area (A) Phase I and Area (A) Phase II, the owners of the development in Area (A) Phase I and Phase II will be responsible for the maintenance of that part of the existing stream course on government land and private land while HAD will be the maintenance party for the existing stream course located on unleased and unallocated government land. For other existing and proposed drainage features within the development in Area (A) Phase I , the owners of the development in Area (A) Phase I will be responsible for the maintenance of those proposed drainage features including proposed box culvert, 1650mm diameter pipe and 1050mm diameter on both government land and private lands.

4.5.3 The SWC will be managed by the future owner/ operator, the proposed flood wall with a crest level of 7.5 mPD for the SWC and drainage facilities, including flap valve for Pipe B1, will be maintained by the future owner/ operator.

4.5.4 The owners of the development in Area (A) Phase I will be responsible for the maintenance works of the proposed box culvert, the proposed boundary channels and associated pipes, the existing stream course on government land and private lands within the development in Area (A) Phase I and the existing stormwater drainage facilities at the northern part of the development in Area (A) Phase I near Fung Yuen Road, as well as structural maintenance of drainage within the development in Area (A) Phase I . The maintenance works will include routine inspection and desilting works for the proposed box culvert, the proposed boundary channels and associated pipes and the works will be carried out before wet season, after wet season and after storms.

4.5.5 The owners of the development in Area (A) Phase II will be responsible for the maintenance works of the existing stream course on government land and private lands within the development in Area (A) Phase II . The maintenance works will include routine

inspection and desilting works for the existing stream course and the works will be carried out before wet season, after wet season and after storms.

Table 4.4: Maintenance matrix

Drainage Features	Maintenance Party
Existing stream course within Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Existing stream course within Area (A) Phase II of the Development Site Boundary	Owners of the development in Area (A) Phase II
Existing stream course outside Area (A) Phase I and Area (A) Phase II of the Development Site Boundary on unleased and unallocated Government land	HAD
Existing box culvert with a size ranged from 3.6m x 2.5m along Fung Yuen Road on Government land	DSD
Existing box culvert with a size ranged from 3.6m x 2.5m within the Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Existing pipe with diameter of 600mm connecting from the lake in Butterfly Valley[1] to the existing stream course	The drainage works of the proposed development will not affect this existing pipe, maintenance responsibility will remain unchanged from the current arrangement.
Existing stormwater drainage facilities at the northern part of the Area (A) Phase I near Fung Yuen Road within the Development Site	Owners of the development in Area (A) Phase I
Proposed box culvert within the Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Proposed pipe with diameter of 1650mm within the Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Proposed pipe with diameter of 1050mm within the Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Proposed boundary channels with covers and associated pipes and the proposed flap valve for Pipes 3.1.3, 3.2.2 and 3.3.1 within the Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Proposed internal drainage within the Area (A) Phase I of the Development Site Boundary	Owners of the development in Area (A) Phase I
Proposed internal drainage within the Area (A) Phase II of the Development Site Boundary	Owners of the development in Area (A) Phase II
Proposed flood wall of the social welfare complex (SWC) and drainage facilities in Area (B) including the proposed flap valve for Pipe B1	Owner/ operator of the SWC

[1] Previously known as Le Jardin

Drainage Features	Maintenance Party
Proposed internal drainage, flap valve and emergency pump of SWC	Owner/ operator of the SWC

4.6 Conceptual Interim Drainage Arrangement for Construction Phases

4.6.1 To minimise flood risk in association with the construction phase of the proposed Development, conceptual interim drainage arrangement for construction stage including site formation stage and phasing of works for the proposed Development has been proposed in **Appendix M**. All the information in **Appendix M**, including but not limited to phasing of works and time of works, is tentative and subject to further update, if necessary, based on the future detailed design and Contractor actual construction arrangement for the final development layout.

4.6.2 Based on the construction sequence presented in **Appendix M**, the construction period for the proposed Development is a few years, to maintain the flow path of nearby areas mainly for villages and agriculture use near the Site, surface drainage channels as per permanent boundary channels for the development in Area (A) Phase I and interim drainage with discharge capacity for 10 years rainfall for the developments in Area (A) Phase II and Area (B) will be constructed at the beginning of construction stage and will be provided throughout the construction stage. The construction of permanent boundary drainage channels in Area (A) Phase I should be completed in construction stage before commencement of development works in the site. The site runoff will be properly collected and discharged into existing stream course via local temporary site drainage with desilting facilities. Also, the construction activities that will affect / in close vicinity of the existing stream course are all carefully scheduled and will be constructed in dry seasons. Thus, it is considered that there will be no insurmountable drainage impacts during construction stage and the flow path of neighbouring areas can be maintained.

5 Conclusion

5.1 Proposed Drainage System for Development and Drainage Impact

5.1.1 The surface runoff running from the Development Site will be discharged into existing stream course near to Fung Yuen Road. To mitigate the flood condition at the localised area near the Site, some drainage mitigation measures have been proposed:-

- The existing stream course will be maintained as it is and a 3m buffer area from building area has been reserved in the development in Area (A) Phase I, Area (A) Phase II and Area (B). No buildings will be proposed at the buffer area;
- A single-cell box culvert with a size ranged from 4000mm x 3000mm to 4000mm x 3500mm will be provided in the development in Area (A) Phase I to convey most of the stormwater from the existing 3600mm x 2500mm box culvert at Fung Yuen Road and runoff from development in Area (A) Phase I to the downstream of the stream (Control Point 4a) under extreme weather events;
- A 1050mm diameter pipe will be provided in the development in Area (A) Phase I to divert partially of the stormwater from the existing 3600mm x 2500mm box culvert at Fung Yuen Road to midstream of the existing stream course;
- A 1650mm diameter pipe will be provided in the development in Area (A) Phase I to intercept and convey the stream water at Control Point 1 to the proposed box culvert;
- Abandoned cross river facilities within the site in the development in Area (A) Phase I and abandoned cross river facility connecting to the Development near Control Point 4a will be removed;
- Subject to detailed design at the next General Building Plan submission stage, boundary channels with covers and associated pipes will be provided to intercept runoff from nearby villages to the existing stream course and/or the proposed box culvert as shown in **Appendix B2**. Construction of permanent boundary drainage channels in the development in Area (A) Phase I should be completed in construction stage - Stage 1 before commencement of development works in the Development Site.
- Flap valve will be provided at the downstream of Pipes 3.1.3, 3.2.2, 3.3.1 in the development in Area (A) Phase I and Pipe B1 in the development in Area (B); and
- Floodwalls surrounding the proposed social welfare complex in Area (B) with a crest of 7.5mPD will be provided.

5.1.2 In order to prevent flooding in the upstream and mid-stream section of the existing stream course under extreme flood events, most of the flow from the existing 3.6m x 2.5m box culvert will be intercept by the proposed box culvert under extreme condition. In view of that the proposed box culvert will be interfaced with the existing stream course, the existing stream course will be disconnected locally at the location of interface (i.e. immediate downstream of Control point 2) so that the existing stream course will be

divided into an upper section and a lower section. Under the proposed condition, the upper section of the existing stream course will be connected to the proposed box culvert via a proposed 1650mm diameter pipe whilst the lower section of the existing stream course will serve to receive part of flow from the existing culvert, flow from the existing 1800 drain and runoff from the Site so that the stream habitat can be maintained but the flooding condition at the Site can be improved.

5.1.3 Based on the model results, the water levels at the upstream and mid-stream section of the existing stream course are significantly reduced under 1 in 10 years, 1 in 50 years and 1 in 200 years flood event compared with the existing condition. For the upstream section of the existing stream course (i.e. Control points 1 and 2), the water levels are reduced up to 2.6m, 1.5m and 1.4m under 1 in 10 years, 1 in 50 years and 1 in 200 years flood event compared with the existing condition. A significant drop of in water levels (up to -1.5m) is also anticipated at the mid-stream section of the existing stream course (i.e. Control points 3a, 3b and 3c) under 1 in 200 years flood event. With the provision of the proposed box culvert, the drainage condition at upstream and mid-stream of the stream course are greatly improved.

5.1.4 In view of that the removal of existing abandoned cross river facilities and provision of a proper drainage system i.e. the proposed box culvert, which collects stormwater including flooded water and part of stream course water under existing drainage condition back to the downstream section of the existing stream course at Control point 4a, under the proposed condition, there will be a slight decrease in the water levels at Control point 4a under 1 in 200 years storm event compared with the existing condition.

5.1.5 At the downstream section of the existing stream course (Control Points 5a, 5b and 6) which located at a village zone, the predicated water level is similar to existing condition and flooding only localised at area near to the banks of existing stream course. Since there is no major change in flooding extent under the 1 in 10 years flood event and flood wall with crest level of +7.5mPD (with 0.3m freeboard under the 200 years flood event) has been proposed at the proposed SWC to mitigate the potential flood risk, it is considered that there is no significant drainage impacts to the existing drainage system due to the proposed Development.

5.1.6 As the flood extent of the proposed condition are in generally reduced when compared to the existing condition. Besides, the result of the hydraulic model also shows that the proposed box culvert will have at least 300mm freeboard under the 200-year flood event. Thus, there will be no significant adverse impacts arising from the proposed Development upon the provision of proposed mitigation measures.

5.1.7 In view of the development in Area (A) Phase II will be implemented later than other parts of the Development, a hydraulic sensitivity analysis for only the development in Area (A) Phase I and Area (B) in place has also been carried out. Under this scenario, all proposed drainage system as mentioned in **Section 4.1** will be provided under the development in Area (A) Phase I and Area (B) except the site condition for the Area (A) Phase II will be maintained as existing condition and its runoff will be discharged to the existing stream course.

5.1.8 The hydraulic results for the sensitivity analysis for condition only the development in Area (A) Phase I and Area (B) is very similar to the results of entire Development except that the section of existing stream course falling within the site of the development in Area (A) Phase II will marginally have a 300mm freeboard under the 200 years storm event upon the runoff from the development in Area (A) Phase I has been discharged to

the proposed box culvert due the low ground levels in this local area. In view that the flood extent of the proposed condition under sensitivity analysis are in generally reduced when compared to the existing condition. Besides, the result of the hydraulic model also shows that the proposed box culvert will have at least 300mm freeboard under the 200-year flood event. Thus, there will also be no significant adverse impacts arising from the proposed Development under condition of only Area (A) Phase I and Area (B) in place upon the provision of proposed mitigation measures

5.1.9 In light of that part of the existing stream course falling within the development in Area (A) Phase I and Area (A) Phase II, the owners of the development in Area (A) Phase I and Phase II will be responsible for the maintenance of that part of the existing stream course on government land and private lands within the development site while HAD will be the maintenance party for the existing stream course located on unleased and unallocated government land. For other existing and proposed drainage features within the development in Area (A) Phase I , the owners of the development in Area (A) Phase I will be responsible for the maintenance of those proposed drainage features including proposed box culvert, 1650mm diameter pipe and 1050mm diameter on both government land and private lands.

5.2 Conceptual Interim Drainage Arrangement for Construction Phases

5.2.1 To minimise flood risk in association with the construction phase of the proposed Development, conceptual interim drainage arrangement for construction stage including site formation stage and phasing of works for the proposed Development has been proposed. The conceptual interim drainage arrangement, including but not limit to phasing of works and time of works, is tentative and subject to further update, if necessary, based on the future detailed design and Contractor actual construction arrangement for the final development layout.

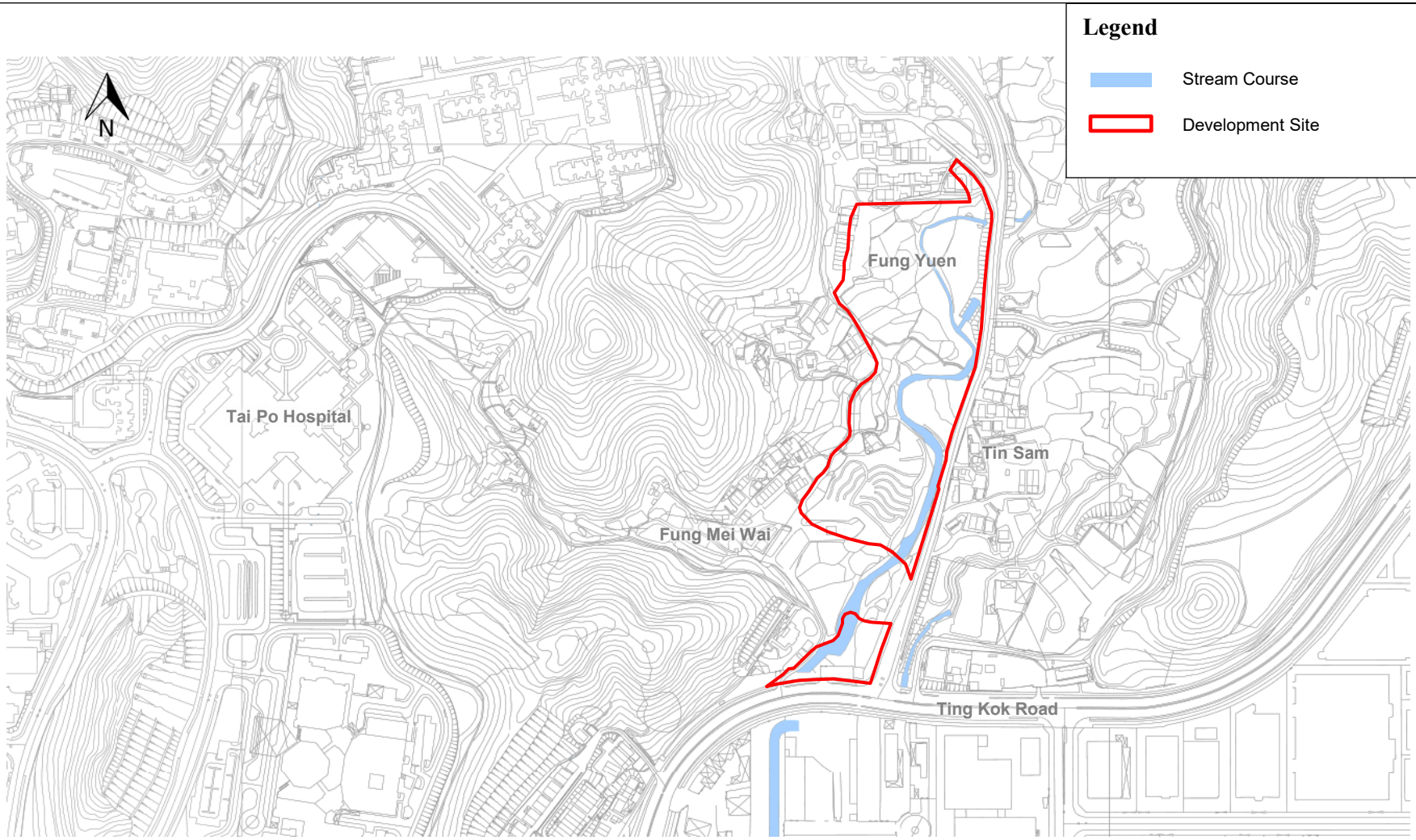
5.2.2 The construction of the proposed Development will take a few years, to maintain the flow path of nearby areas mainly for villages and agriculture use near the Site, surface drainage channels as per permanent boundary channels for the development in Area (A) Phase I and interim drainage with discharge capacity for 10 years rainfall for the developments in Area (A) Phase II and Area (B) will be constructed at the beginning of construction stage and will be provided throughout the construction stage. The site runoff will be properly collected and discharged into existing stream course via local temporary site drainage with desilting facilities. Also, the construction activities that will affect / in close vicinity of the existing stream course are all carefully scheduled and will be constructed in dry seasons. Thus, it is considered that there will be no insurmountable drainage impacts during construction stage and the flow path of neighbouring areas can be maintained.

6 Appendices

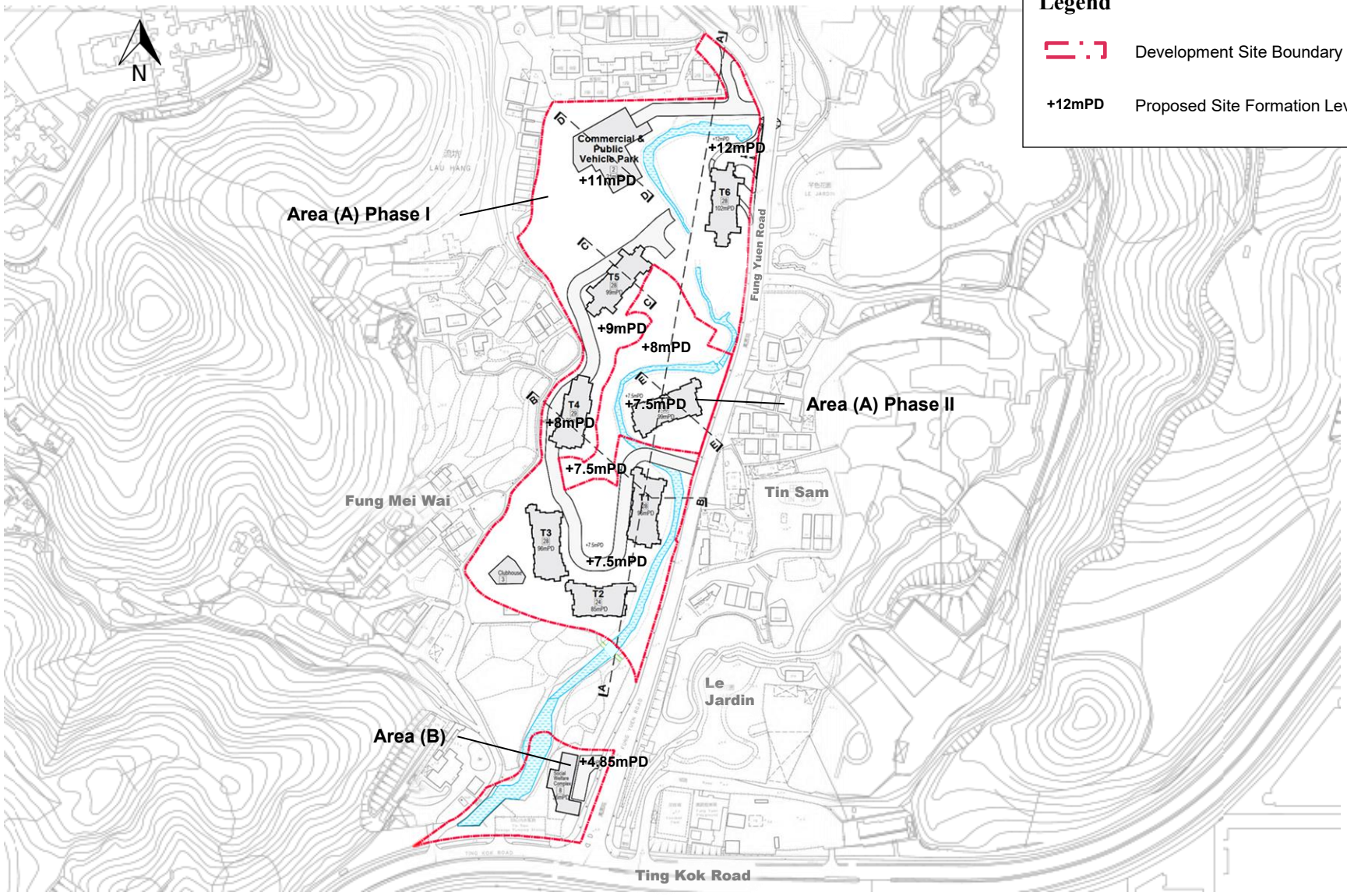
Appendix A	Location Plan and Layout Plan
Appendix B1	Existing Drainage System
Appendix B2	Proposed Drainage System
Appendix C1	Existing Catchment Plan
Appendix C2	Proposed Catchment Plan
Appendix D	Photograph of the Site and Survey Information
Appendix D1	Sectional Views for 5 River Crossing Structures included in Hydraulic Model
Appendix E	Location Plan for Model Results Control Points
Appendix F	Model Extent
Appendix G	Flood Map
Appendix H	InfoWorks ICM Hydraulic Model
Appendix I	Drainage Features Near the Development Site
Appendix J	Calculation for Boundary drains
Appendix K	Sectional Views of Proposed Mitigation Measures
Appendix L	Hydraulic Profile of the Proposed Box Culvert at 200-year Flood Event
Appendix L1	Hydraulic Calculation for Area (B) Proposed Drainage System
Appendix M	Conceptual Interim Drainage Arrangement for Construction Phases

Appendix A

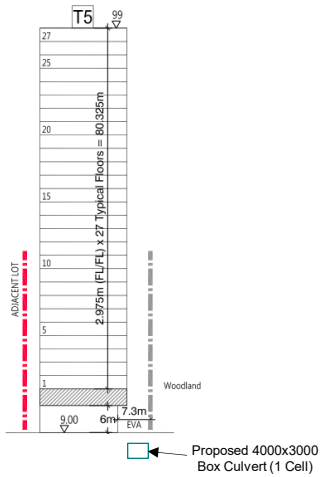
Location Plan and Layout Plan



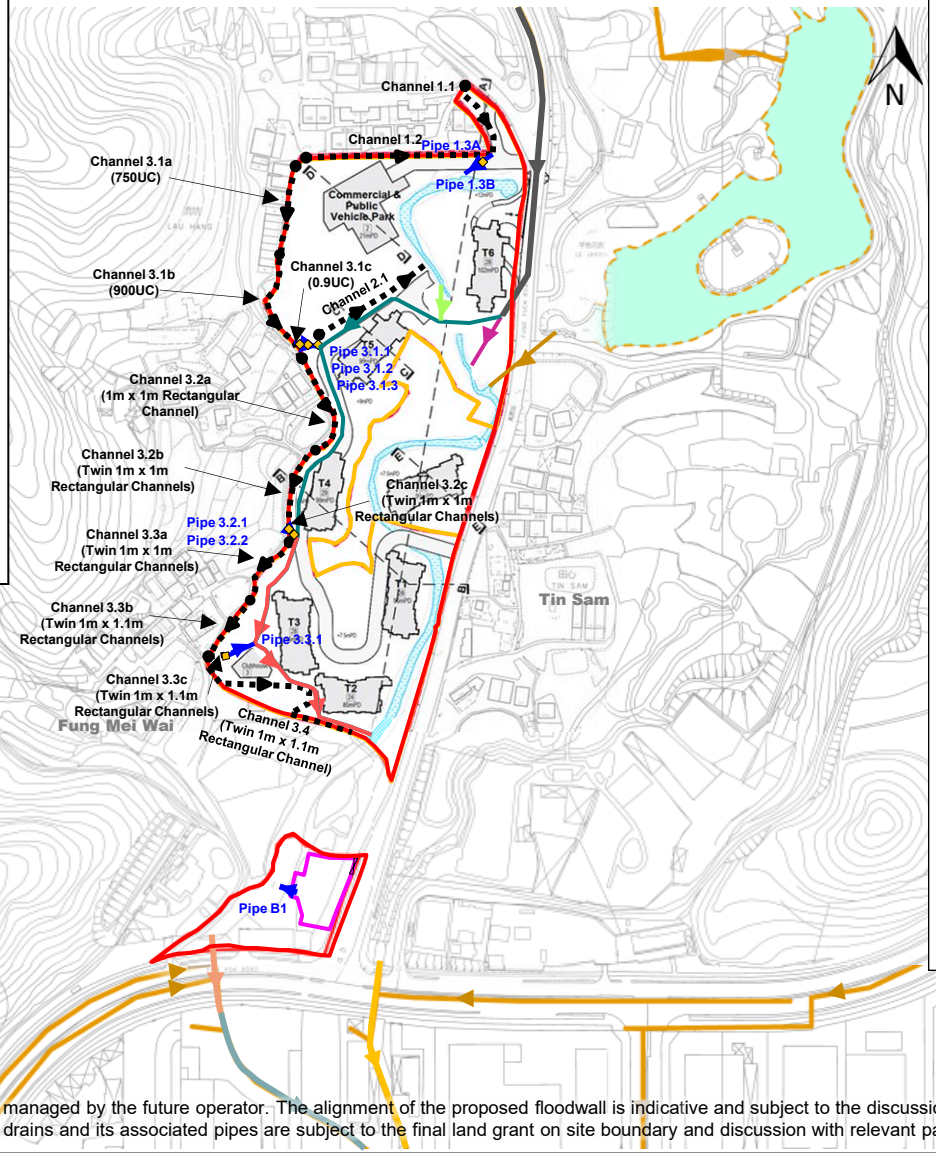
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Location Plan**	**Appendix A1**
Date Sep 2025	**Scale** N.T.S.	**File**



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Layout Plan**	**Appendix A2**
Date Sep 2025	**Scale** N.T.S.	**File**



Section C-C

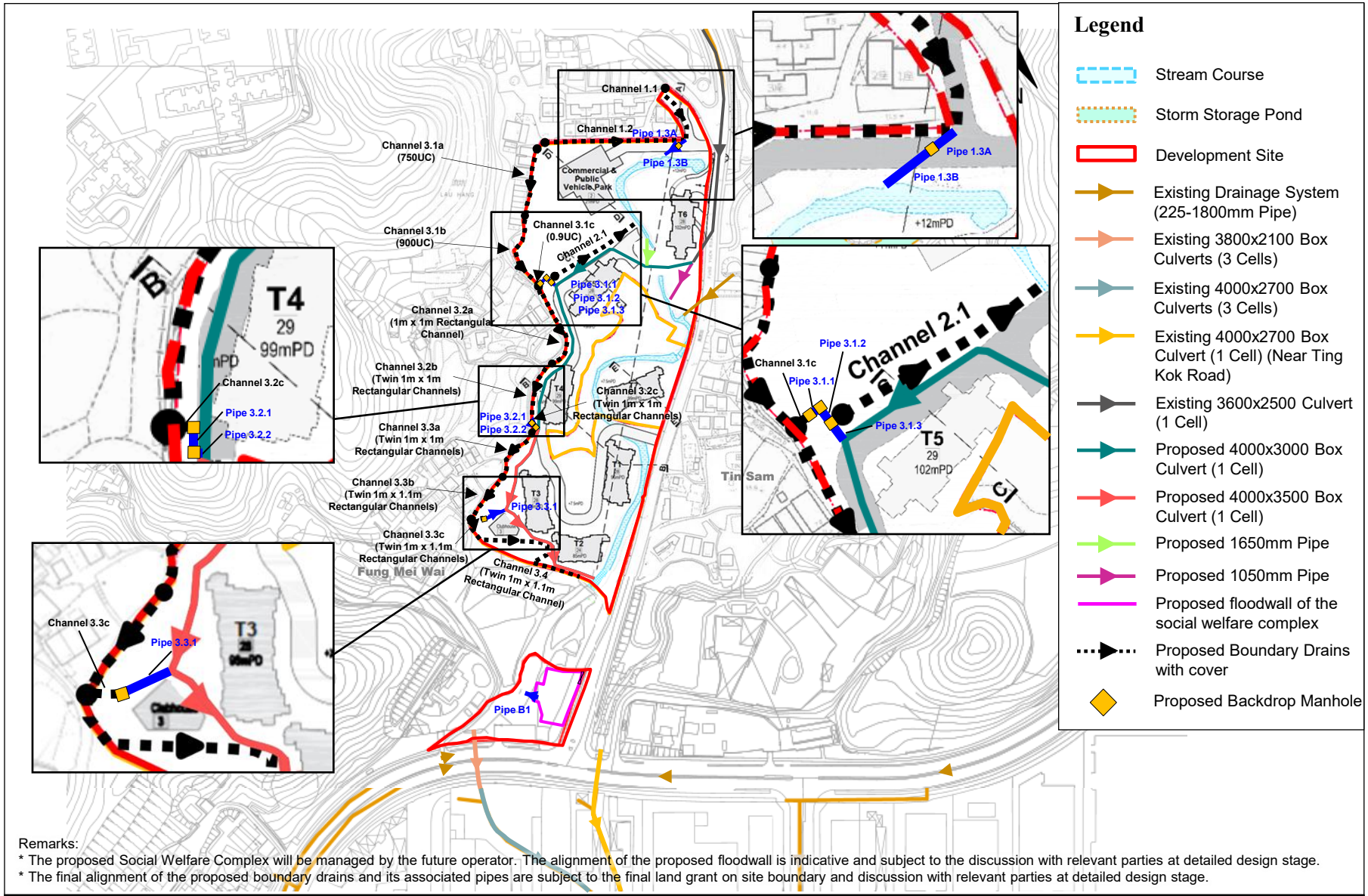


Legend

- Stream Course
- Storm Storage Pond
- Development Site Boundary
- Development Phase Boundary
- Existing Drainage System (225-1800mm Pipe)
- Existing 3800x2100 Box Culverts (3 Cells)
- Existing 4000x2700 Box Culverts (3 Cells)
- Existing 4000x2700 Box Culvert (1 Cell) (Near Ting Kok Road)
- Existing 3600x2500 Culvert (1 Cell)
- Proposed 4000x3000 Box Culvert (1 Cell)
- Proposed 4000x3500 Box Culvert (1 Cell)
- Proposed 1650mm Pipe
- Proposed 1050mm Pipe
- Proposed floodwall of the social welfare complex
- Proposed Boundary Drains with cover
- Proposed Backdrop Manhole

Remarks:
* The proposed Social Welfare Complex will be managed by the future operator. The alignment of the proposed floodwall is indicative and subject to the discussion with relevant parties at detailed design stage.
* The final alignment of the proposed boundary drains and its associated pipes are subject to the final land grant on site boundary and discussion with relevant parties at detailed design stage.

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Proposed Drainage System**	**Appendix A3**
Date Sep 2025	**Scale** N.T.S.	**File**



Remarks:
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* The final alignment of the proposed boundary drains and its associated pipes are subject to the final land grant on site boundary and discussion with relevant parties at detailed design stage.

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Proposed Drainage System**

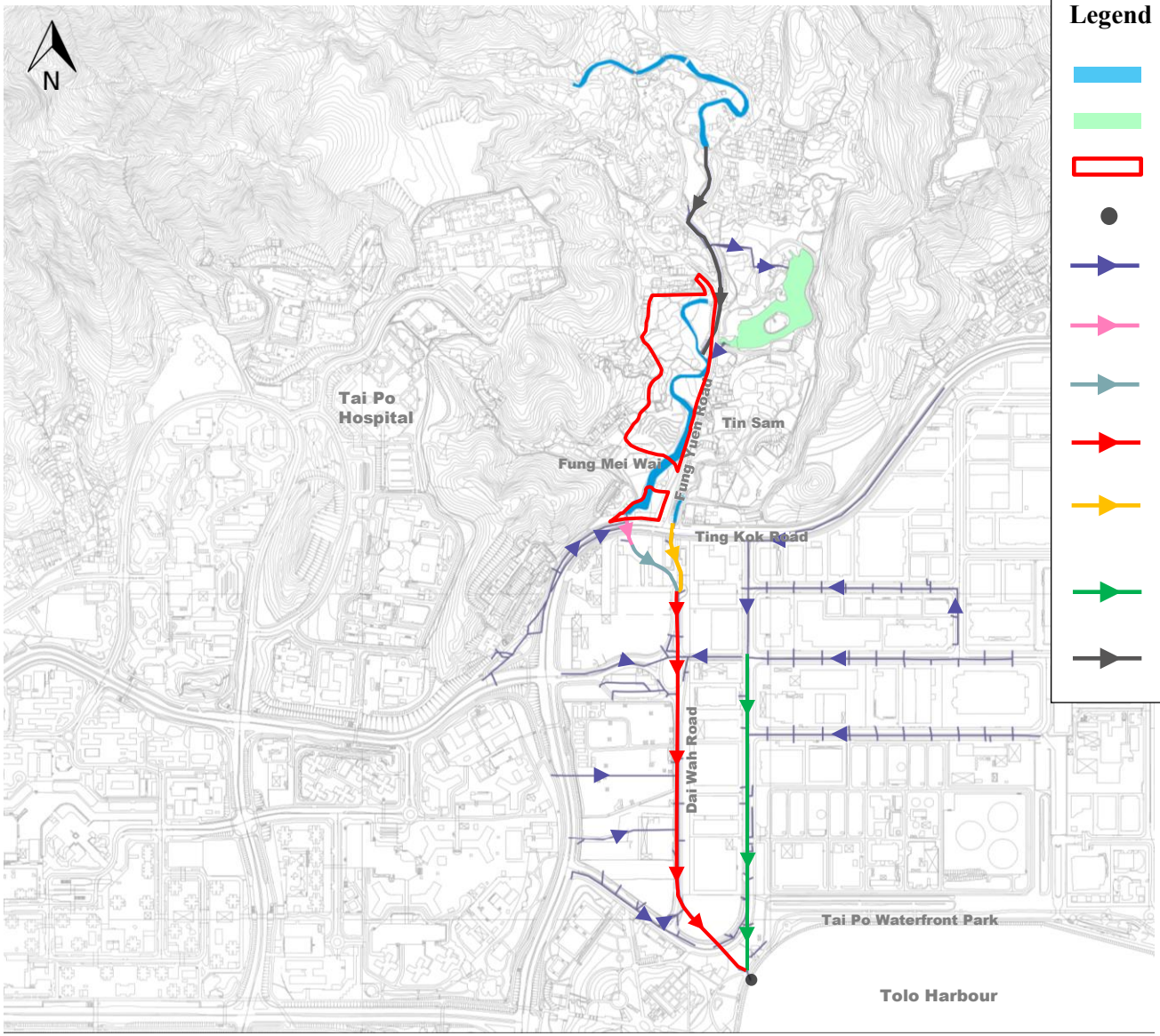
Date	Scale	File
Sep 2025	N.T.S.	

MOTT MACDONALD

Appendix A3

Appendix B1

Existing Drainage System



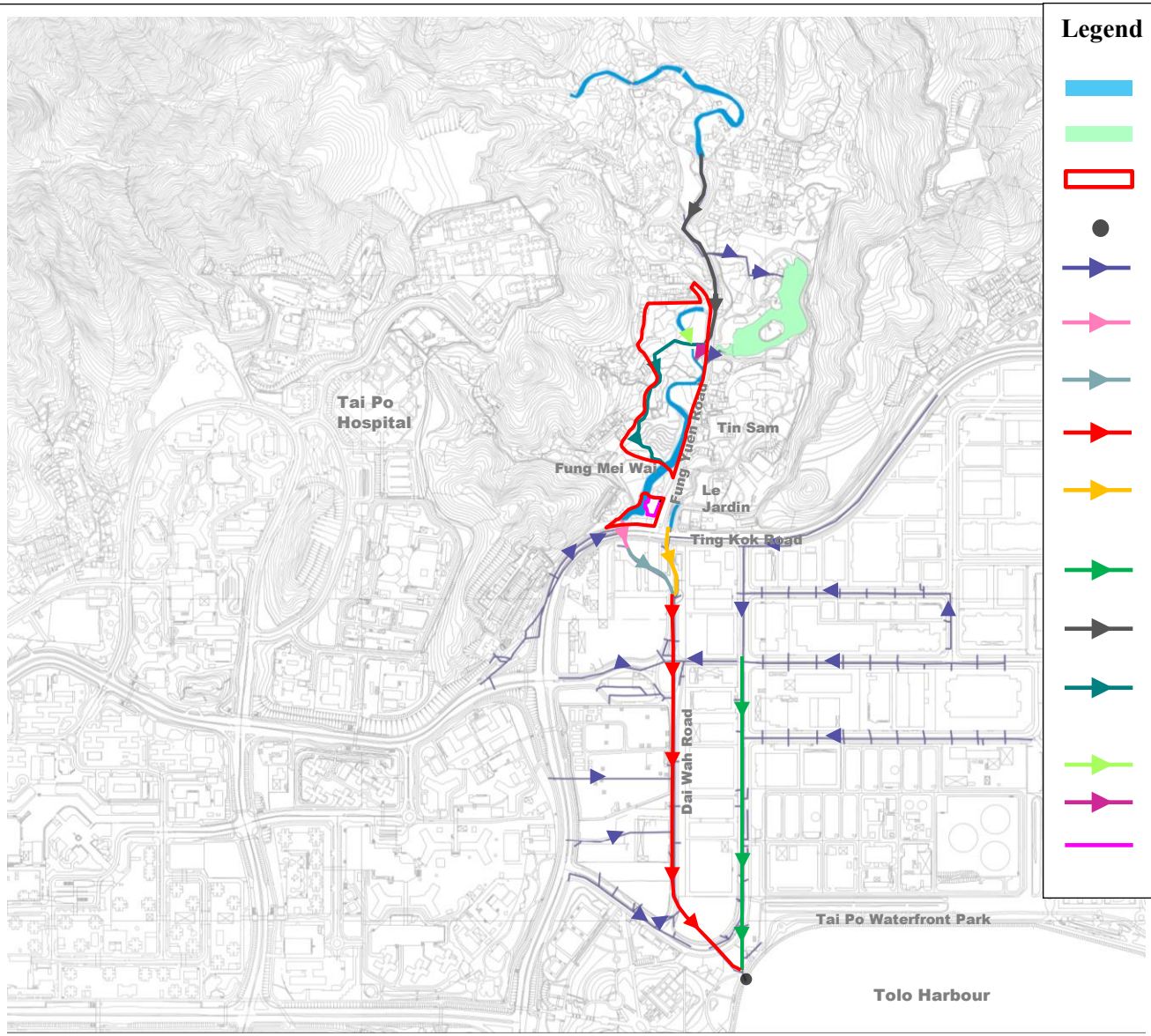
Legend

- Stream Course
- Storm Storage Pond
- Development Site
- Outfall
- Existing Drainage System (225-1800mm Pipe)
- Existing 3800x2100 Box Culverts (3 Cells)
- Existing 4000x2700 Box Culverts (3 Cells)
- Existing 4000x2700 Box Culverts (4 Cells) (To Outfall)
- Existing 4000x2700 Box Culvert (1 Cell) (Near Ting Kok Road)
- Existing 4000x2700 Box Culvert (1 Cell) (To Outfall)
- Existing 3600x2500 Box Culvert (1 Cell)

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Existing Drainage System**	**Appendix B1**
Date Sep 2025	Scale N.T.S.	File

Appendix B2

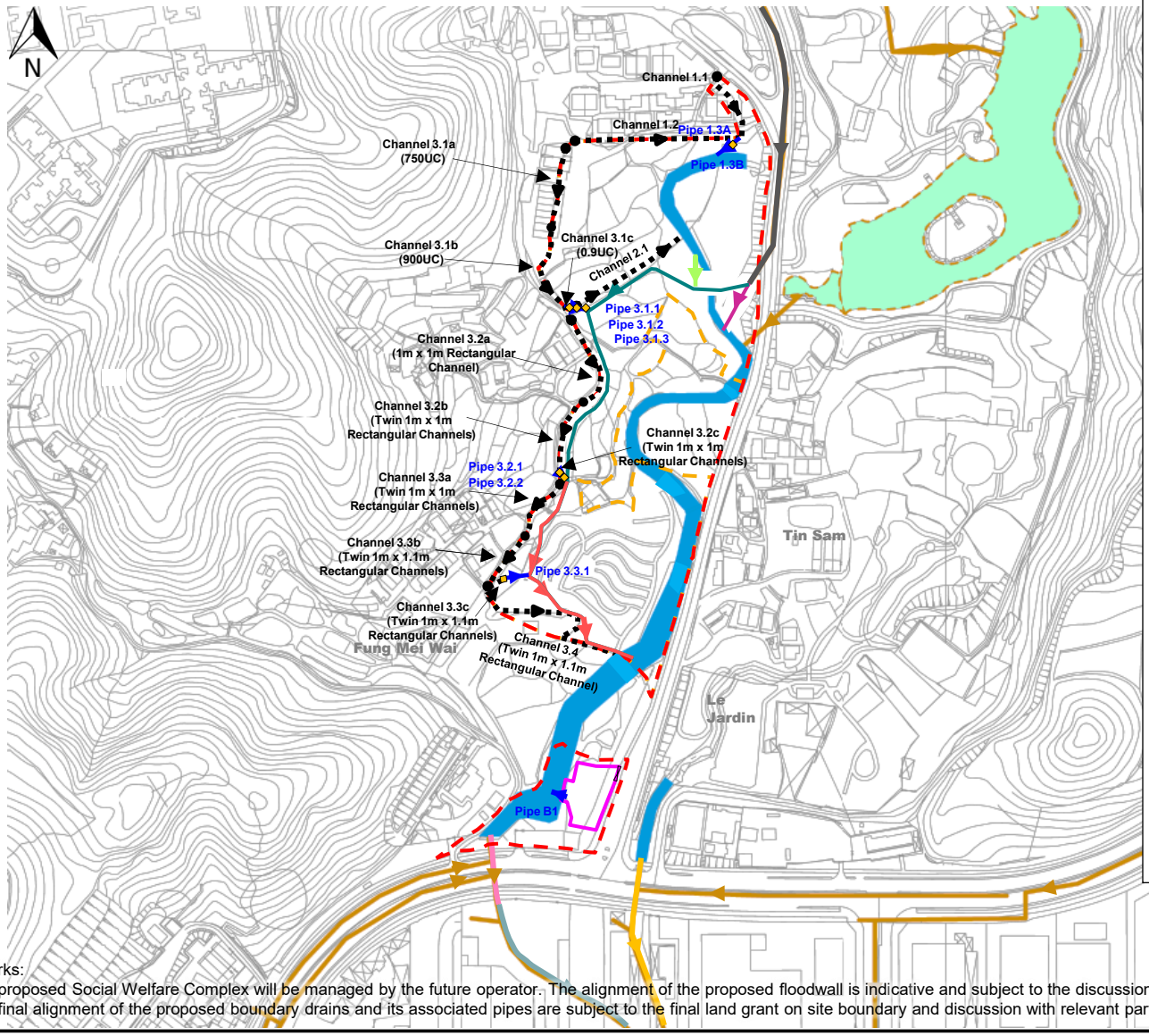
Proposed Drainage System



Legend

- Stream Course
- Storm Storage Pond
- Development Site
- Outfall
- Existing Drainage System (225-1800mm Pipe)
- Existing 3800x2100 Box Culverts (3 Cells)
- Existing 4000x2700 Box Culverts (3 Cells)
- Existing 4000x2700 Box Culverts (4 Cells) (To Outfall)
- Existing 4000x2700 Box Culvert (1 Cell) (Near Ting Kok Road)
- Existing 4000x2700 Box Culvert (1 Cell) (To Outfall)
- Existing 3600x2500 Box Culvert (1 Cell)
- Proposed 4000x3000 to 4000x3500 Box Culvert (1 Cell)
- Proposed 1650mm Pipe
- Proposed 1050mm Pipe
- Proposed floodwall of the social welfare complex

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Proposed Drainage System**	**Appendix B2**
Date Sep 2025	**Scale** N.T.S.	**File**



Legend

- Stream Course
- Storm Storage Pond
- Development Site Boundary
- Development Phase Boundary
- Existing Drainage System (225-1800mm Pipe)
- Existing 3800x2100 Box Culverts (3 Cells)
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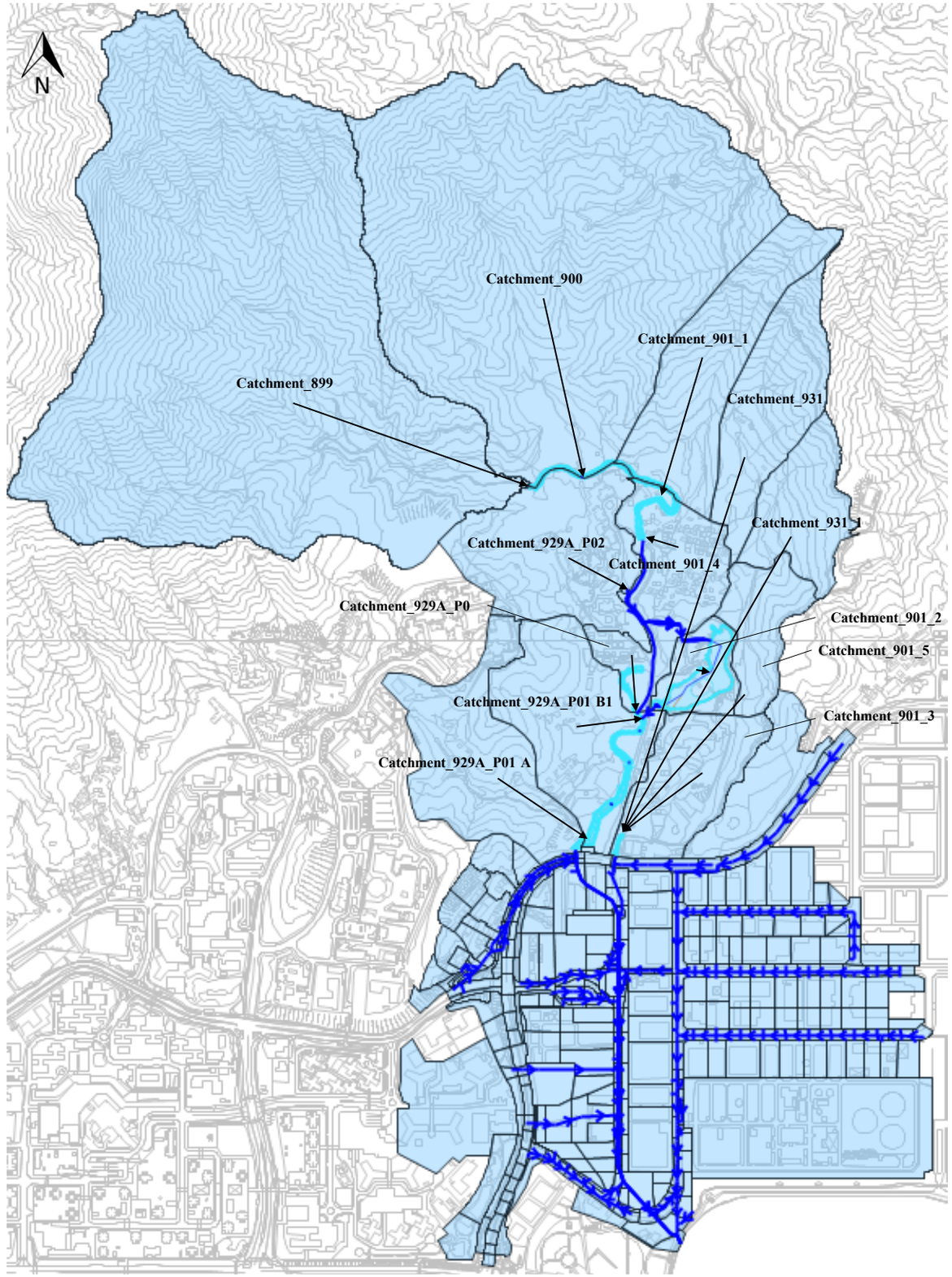
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Proposed Drainage System**	**Appendix B2**
Date Sep 2025	Scale N.T.S.	File

Appendix C1

Existing Catchment Plan



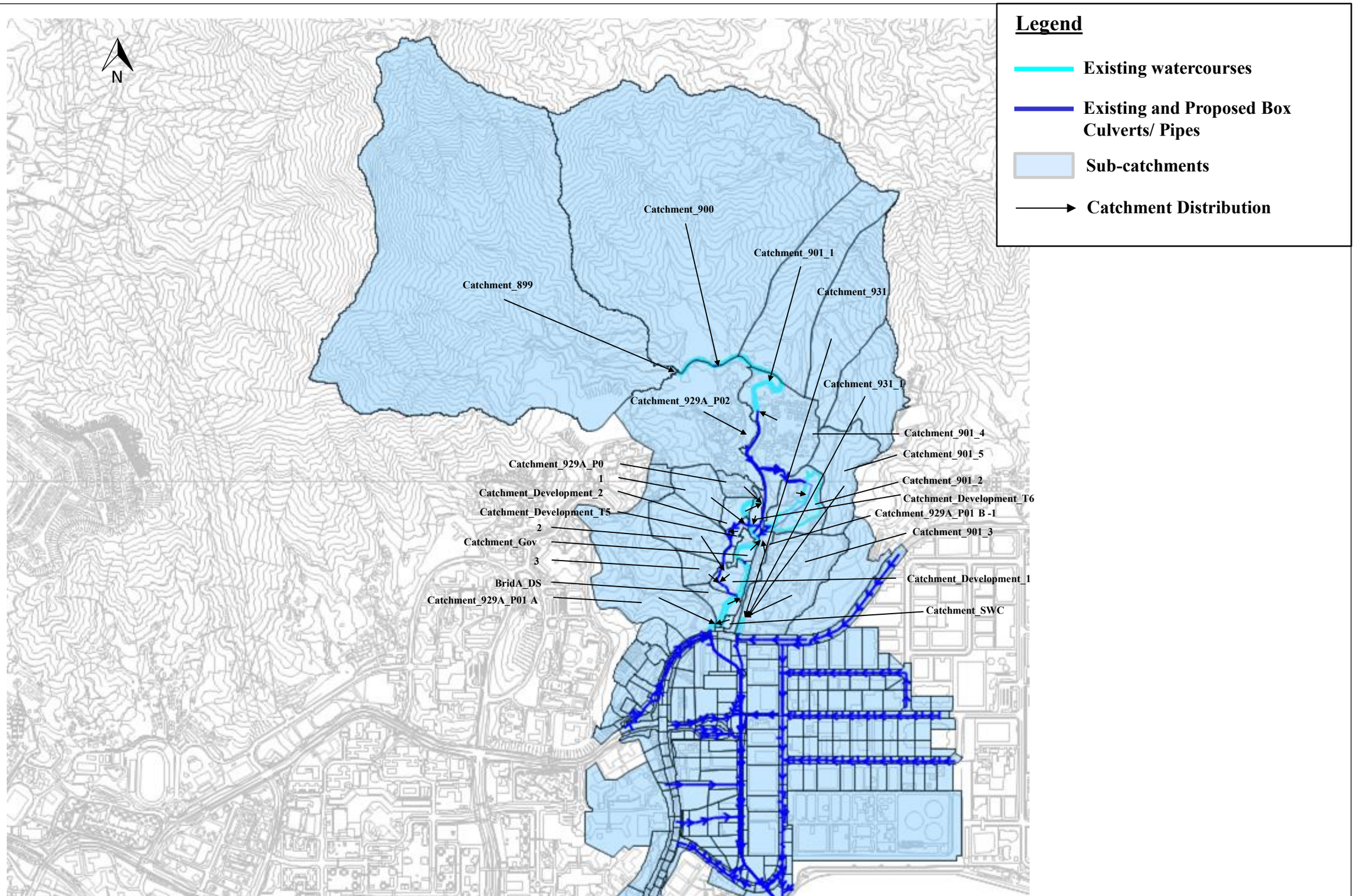
Legend

- Existing watercourses
- Existing Box Culverts/ Pipes
- Sub-catchments
- Catchment Distribution

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Existing Catchment Plan**	**Appendix C1**
Date Sep 2025	Scale N.T.S.	File

Appendix C2

Proposed Catchment Plan

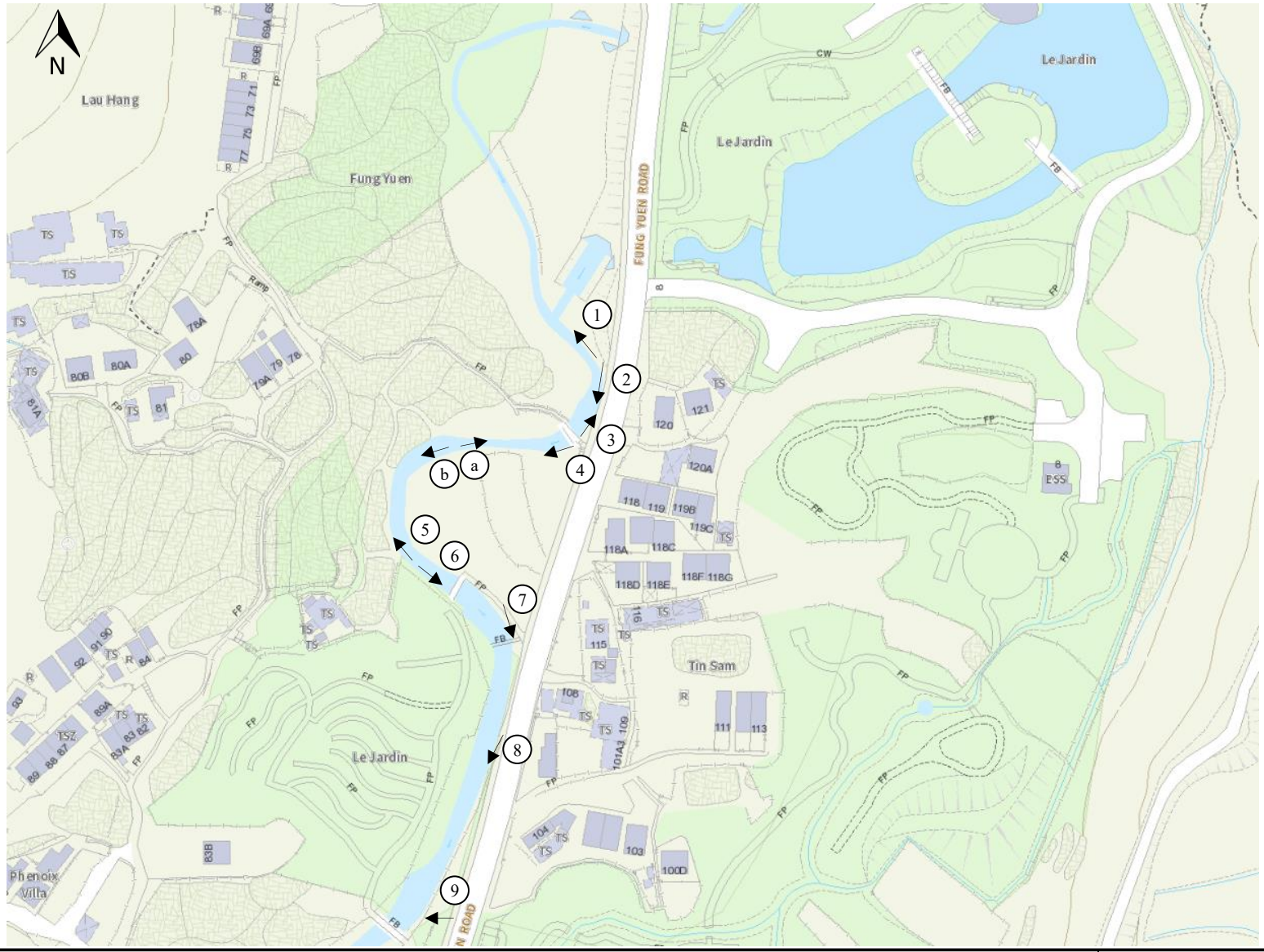


*** Catchment_Gov is catchment for the development in Area (A) Phase II, the CN under sensitivity analysis for only development in Area (A) Phase I and Area (B) will be 75.20 which reflects the existing condition.**

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Proposed Catchment Plan**	**Appendix C2**
Date **Sep 2025**	Scale **N.T.S.**	File

Appendix D

Photograph of the Site and Survey Information



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Location Plan for Site Photographs**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Photo 1

Photo 2

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Site Photographs**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Photo 3

Photo 4

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Site Photographs**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Photo a

Photo b

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Site Photographs**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Photo 5

Photo 6

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Site Photographs**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Photo 7

Photo 8

Photo 9

Existing Footbridge covered with vegetation

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Site Photographs**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Survey Cross Section ID	Model Cross Section Line ID	Survey Cross Section ID	Model Cross Section Line ID	Survey Cross Section ID	Model Cross Section Line ID
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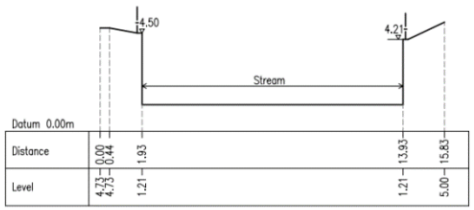
2A	FUNG_YUEN_W_CH1463	16	FUNG_YUEN_W_CH1160	Section 8-8	Section 8-8
2B	FUNG_YUEN_W_CH1460	17	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160	Section 9-9	Section 9-9
2C	FUNG_YUEN_W_CH1450	17A	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160		
4	FUNG_YUEN_W_CH1400	18	FUNG_YUEN_W_CH1130		
6	FUNG_YUEN_W_CH1300-FUNG_YUEN_W	19	FUNG_YUEN_W_CH1100		
7	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400	19A	FUNG_YUEN_W_CH1000-FUNG_YUEN_W_CH1100-FUNG_YUEN_W_CH1100		
8	FUNG_YUEN_W_CH1300				
9	FUNG_YUEN_W_BRIDN_DS	Section 1-1	Section 1-1		
9A	FUNG_YUEN_W_BRIDN_US	Section 2-2	Section 2-2		
10	HF279-2-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300	Section 3-3	Section 3-3		
11	HF279-2-FUNG_YUEN_W_CH1300	Section 4-4	Section 4-4		
12	HF279-2	Section 5-5	Section 5-5		
13	HF279-1	Section 6-6	Section 6-6		

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Survey Cross Sections**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Section 0



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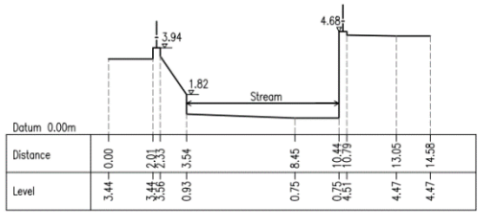

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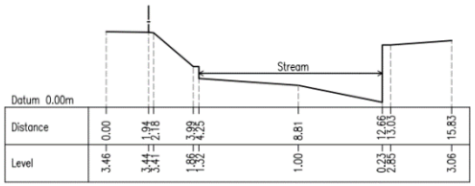

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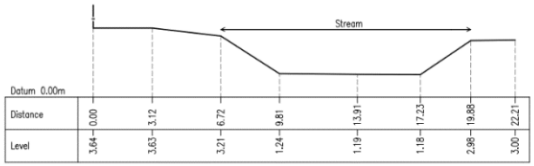

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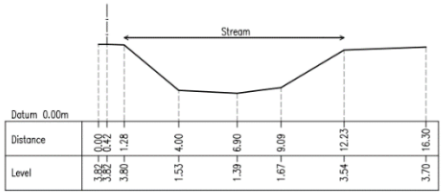

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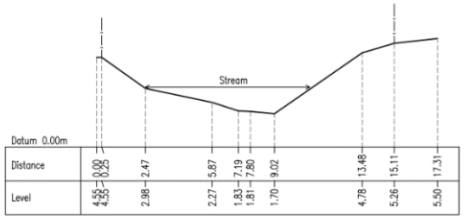
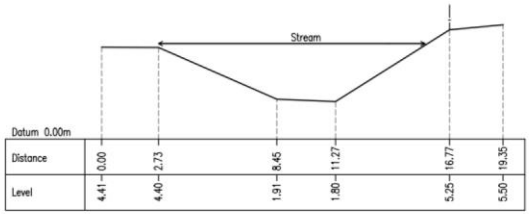


Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Survey Cross Sections**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Section 7



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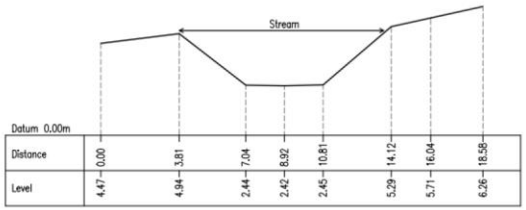
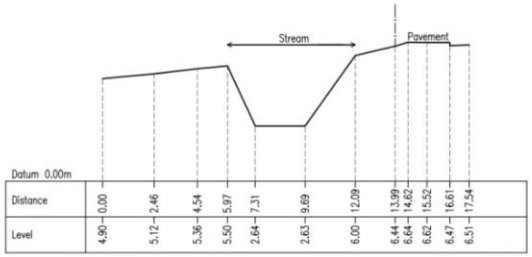
Level	4.41	4.40	1.91	1.80	5.25	5.50

Section 8



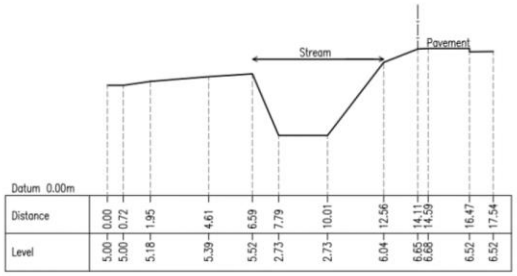
Distance	0.00	3.81	7.04	8.92	10.81	14.12	16.04	18.58
Level	4.47	4.94	2.44	2.42	2.45	5.29	5.71	6.26

Section 9



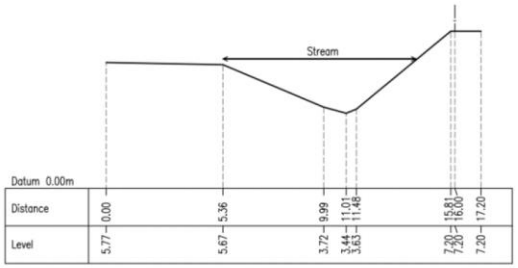
Distance	0.00	2.46	4.54	5.97	7.31	9.69	12.09	13.99	14.62	15.52	16.61	17.54
Level	4.90	5.12	5.36	5.50	2.64	2.63	6.00	6.44	6.64	6.62	6.47	6.51

Section 9A



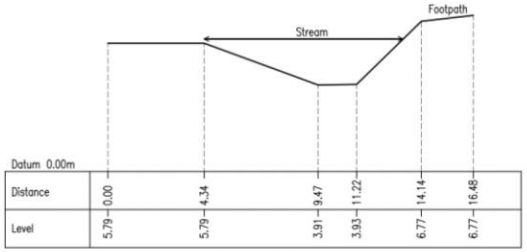
Distance	0.00	0.72	1.95	4.61	6.59	7.79	10.01	12.56	14.11	14.59	16.47	17.54
Level	5.00	5.00	5.18	5.39	5.52	2.73	2.73	6.04	6.65	6.68	6.52	6.52

Section 10



Distance	0.00	5.36	9.99	11.01	11.48	15.81	16.00	17.20
Level	5.77	5.67	3.72	3.44	3.63	7.20	7.20	7.20

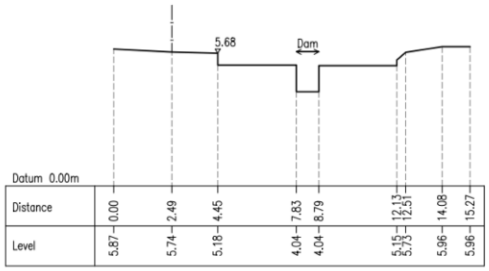
Section 11



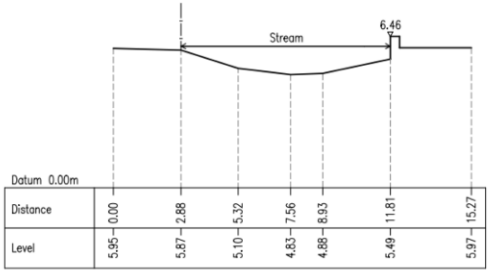
Distance	0.00	4.34	9.47	11.22	14.14	16.48
Level	5.79	5.79	3.91	3.93	6.77	6.77

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Survey Cross Sections**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

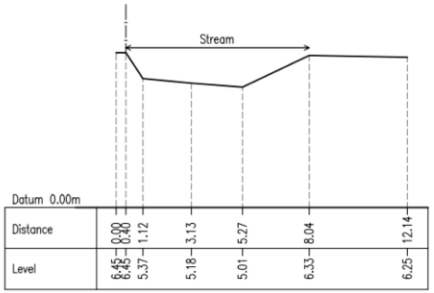
Section 12



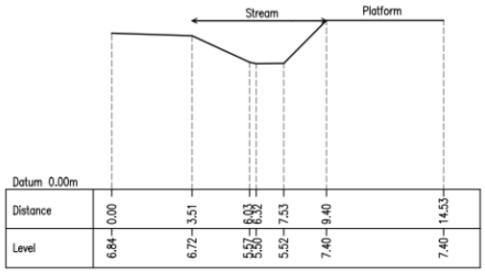
Section 13



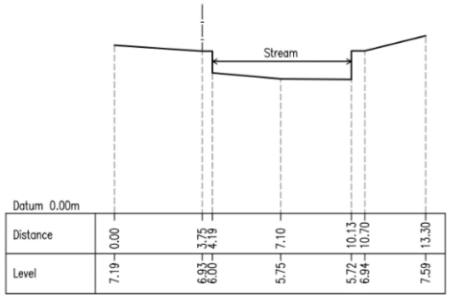
Section 13A



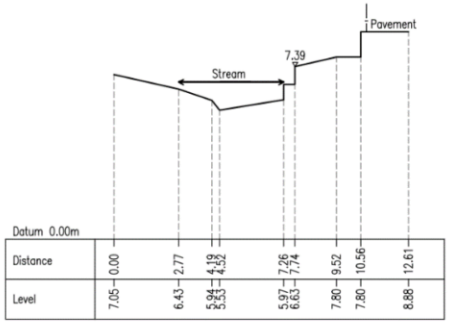
Section 16



Section 17

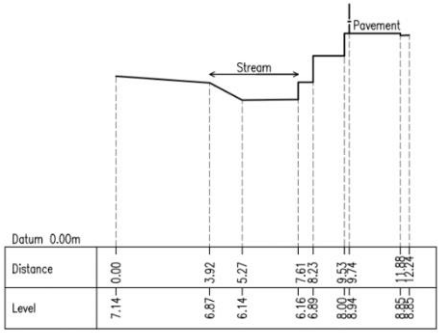


Section 17A

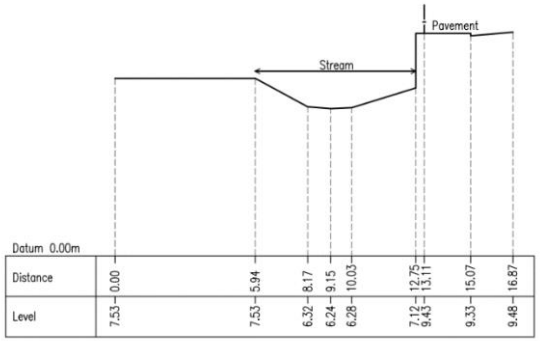


Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Survey Cross Sections**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

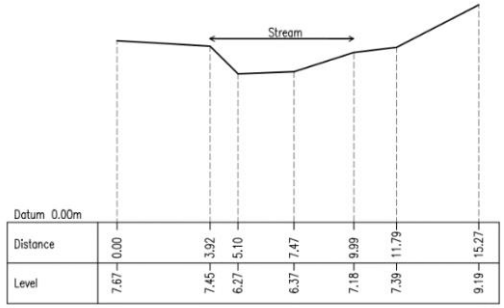
Section 18

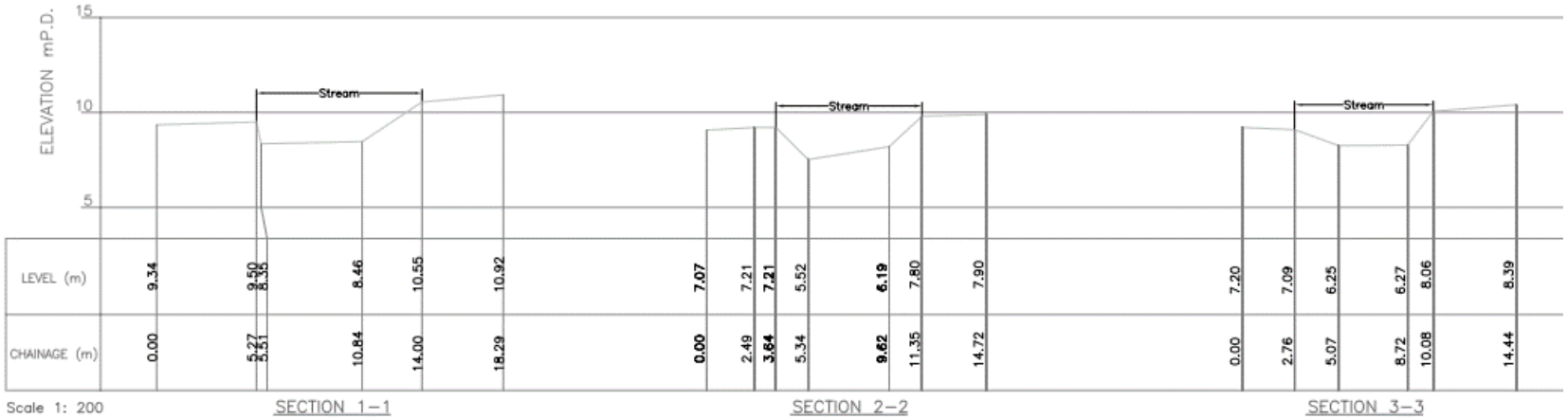


Section 19

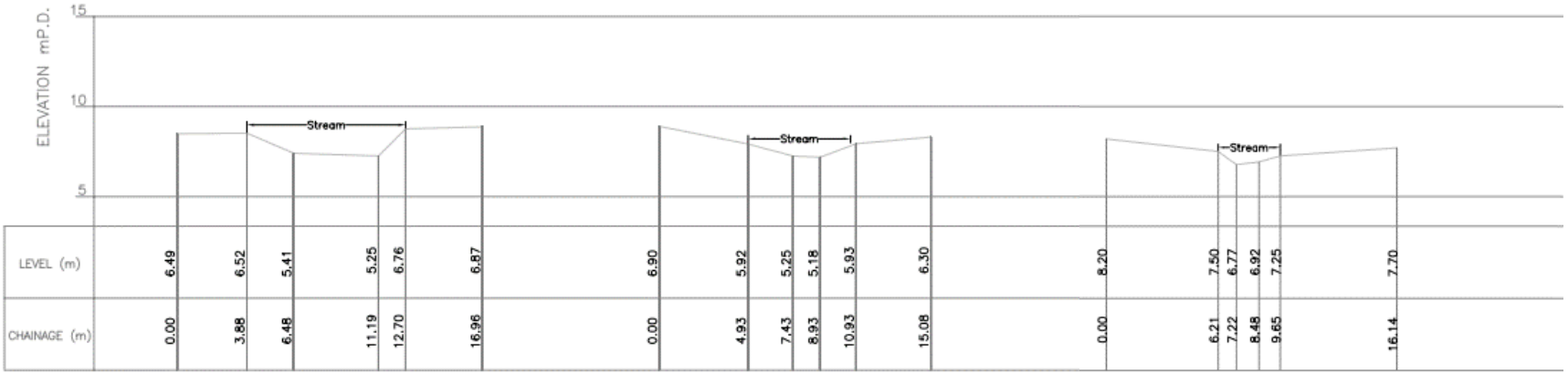


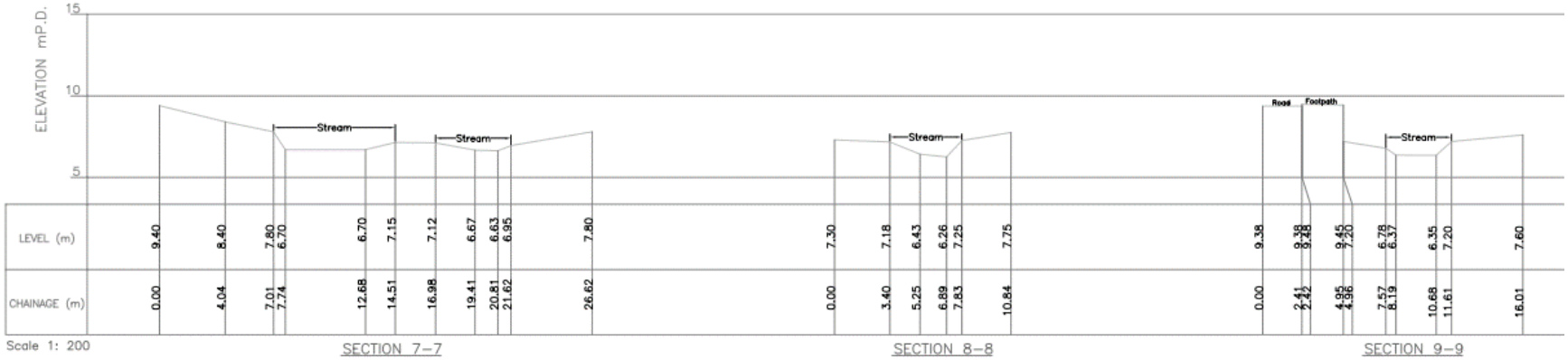
Section 19A





Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Survey Cross Sections**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

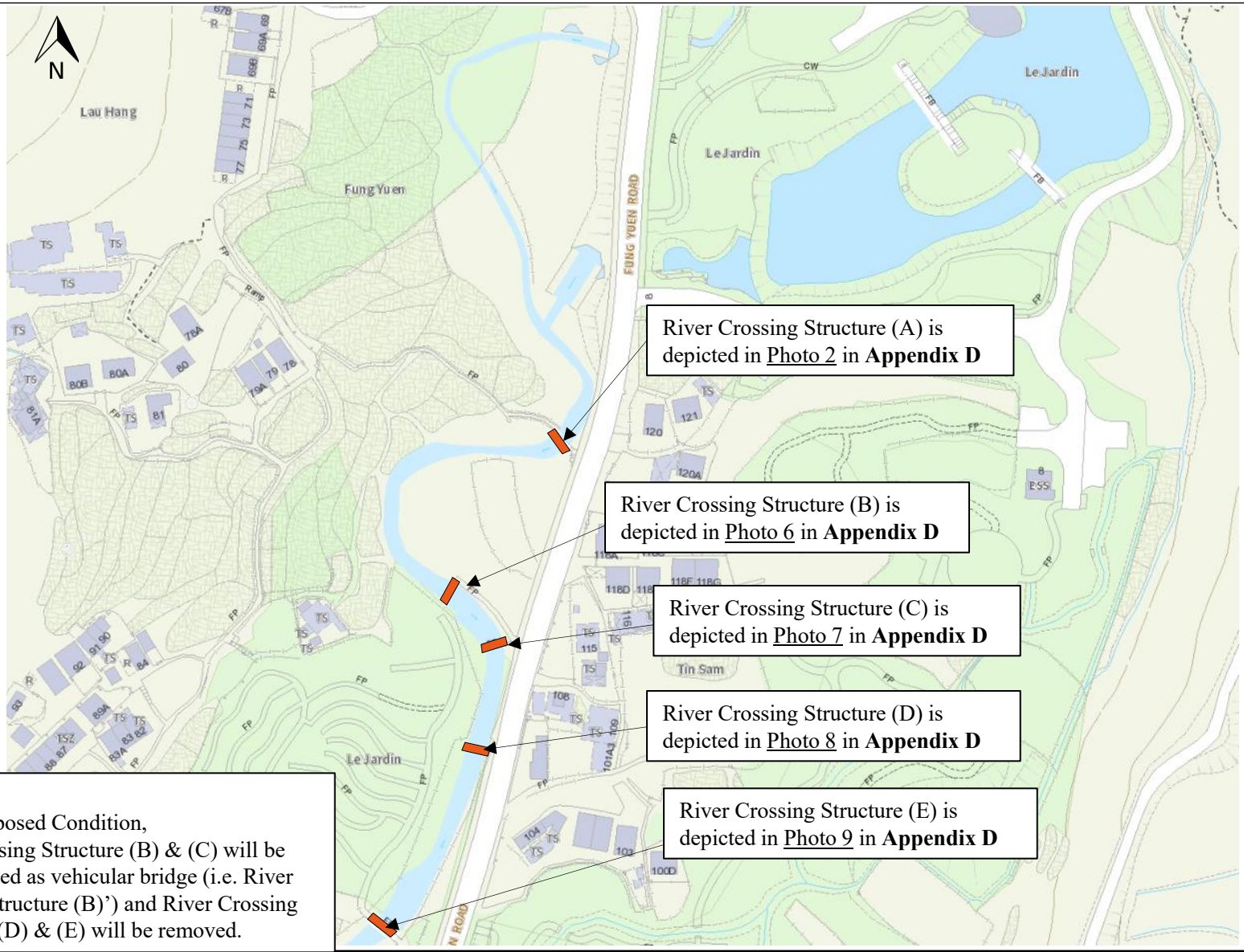




Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Survey Cross Sections**	**Appendix D**
Date Sep 2025	**Scale** N.T.S.	**File**

Appendix D1

Sectional Views for 5 River Crossing Structures included in Hydraulic Model



Remark:
Under Proposed Condition,
River Crossing Structure (B) & (C) will be reconstructed as vehicular bridge (i.e. River Crossing Structure (B)') and River Crossing Structures (D) & (E) will be removed.

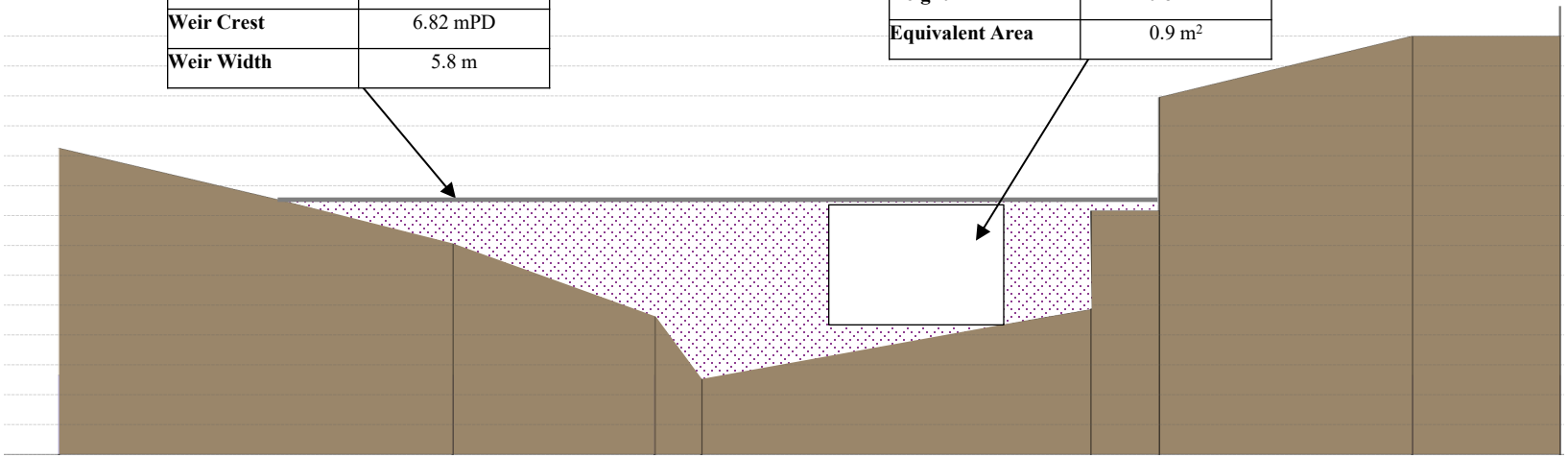
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Location Plan for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

Site Photo

River Structure (A)

Object ID	BridD_US.1
Model Component	Weir Object
Weir Crest	6.82 mPD
Weir Width	5.8 m

Object ID	BridD_US.2
Model Component	Conduit Object
Width	1.05 m
Height	0.82 m
Equivalent Area	0.9 m^2



Remark:

- The sectional view is extracted from Model Cross Section Line ID - FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160 which corresponds to Survey Section 17A.
- Left riverbank is to eastern direction, right riverbank is to western direction.

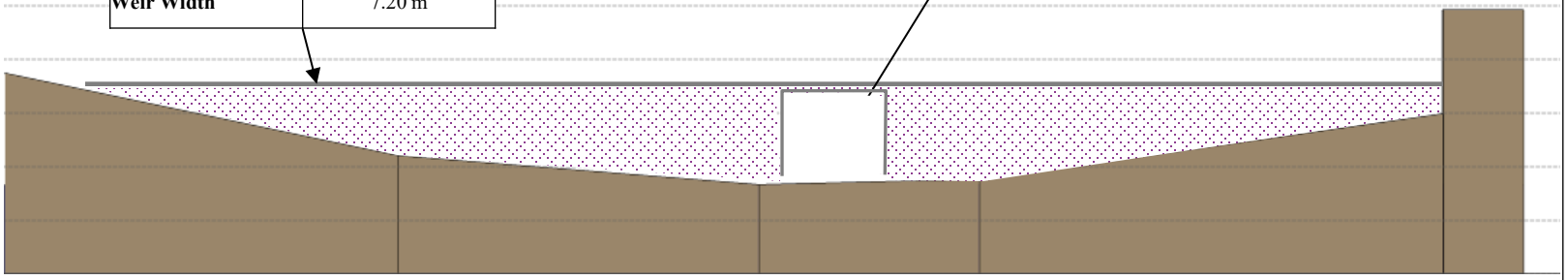
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

Site Photo

River Structure (B)

Object ID	HF279-1.1
Model Component	Conduit Object
Width	0.860 m
Height	0.840 m
Equivalent Area	0.7 m^2

Object ID	HF279-1.2
Model Component	Weir Object
Weir Crest	5.36 mPD
Weir Width	7.20 m



Remark:

- The sectional view is extracted from Model Cross Section Line ID - HF279-1 which corresponds to Survey Section 13.
- Left riverbank is to eastern direction, right riverbank is to western direction.

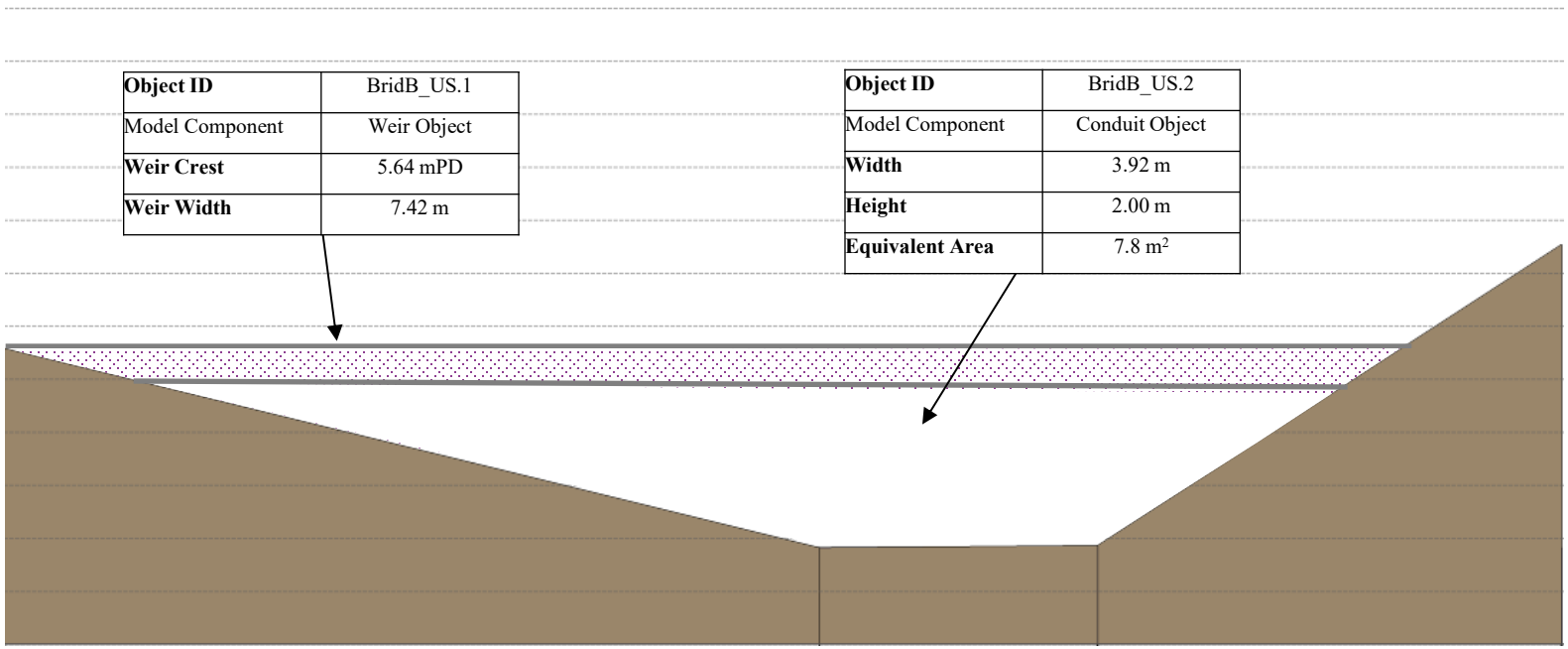
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

Site Photo

River Structure (C)

Object ID	BridB_US.1
Model Component	Weir Object
Weir Crest	5.64 mPD
Weir Width	7.42 m

Object ID	BridB_US.2
Model Component	Conduit Object
Width	3.92 m
Height	2.00 m
Equivalent Area	7.8 m^2



Remark:

- The sectional view is extracted from Model Cross Section Line ID - HF279-2-FUNG_YUEN_W_CH1300 which corresponds to Survey Section 11.
- Left riverbank is to eastern direction, right riverbank is to western direction.

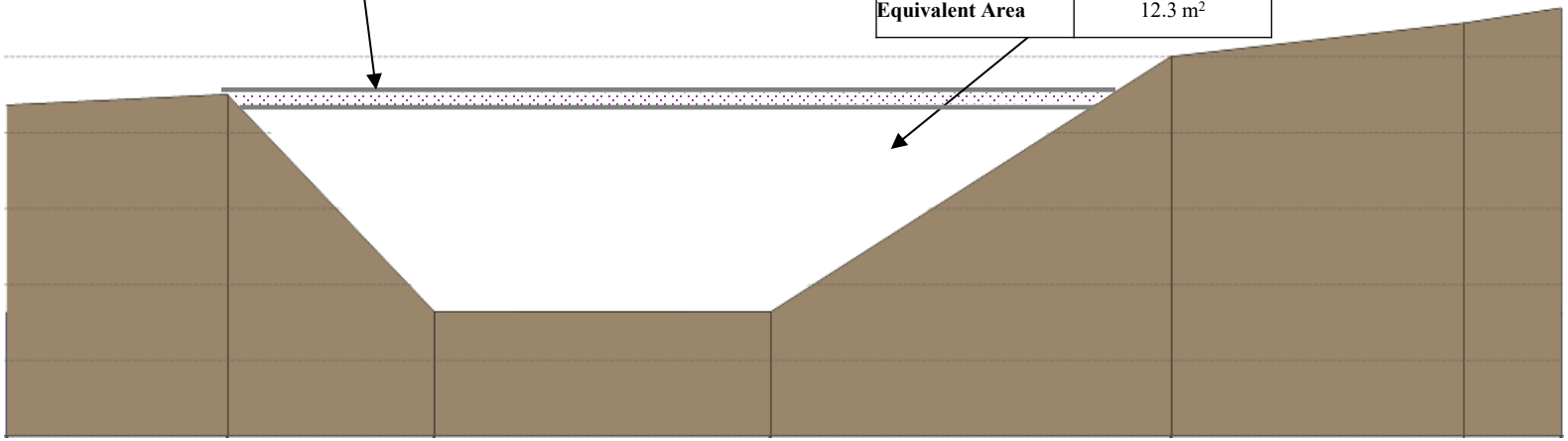
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

Site Photo

River Structure (D)

Object ID	BridN_US.1
Model Component	Weir Object
Weir Crest	5.74 mPD
Weir Width	5.70 m

Object ID	BridN_US.2
Model Component	Conduit Object
Width	4.10 m
Height	3.00 m
Equivalent Area	12.3 m^2



Remark:

- The sectional view is extracted from Model Cross Section Line ID - FUNG_YUEN_W_BRIDN_DS which corresponds to Survey Section 9.
- Left riverbank is to eastern direction, right riverbank is to western direction.

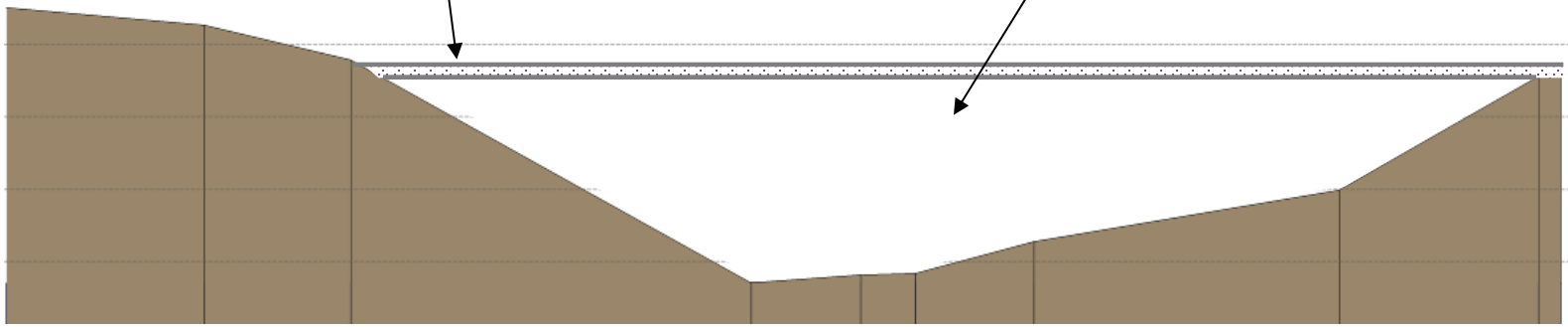
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

Site Photo

River Structure (E)

Object ID	BridA_US.1
Model Component	Weir Object
Weir Crest	4.87 mPD
Weir Width	14.8 m

Object ID	BridA_US.2
Model Component	Conduit Object
Width	7.90 m
Height	3.00 m
Equivalent Area	23.7 m^2

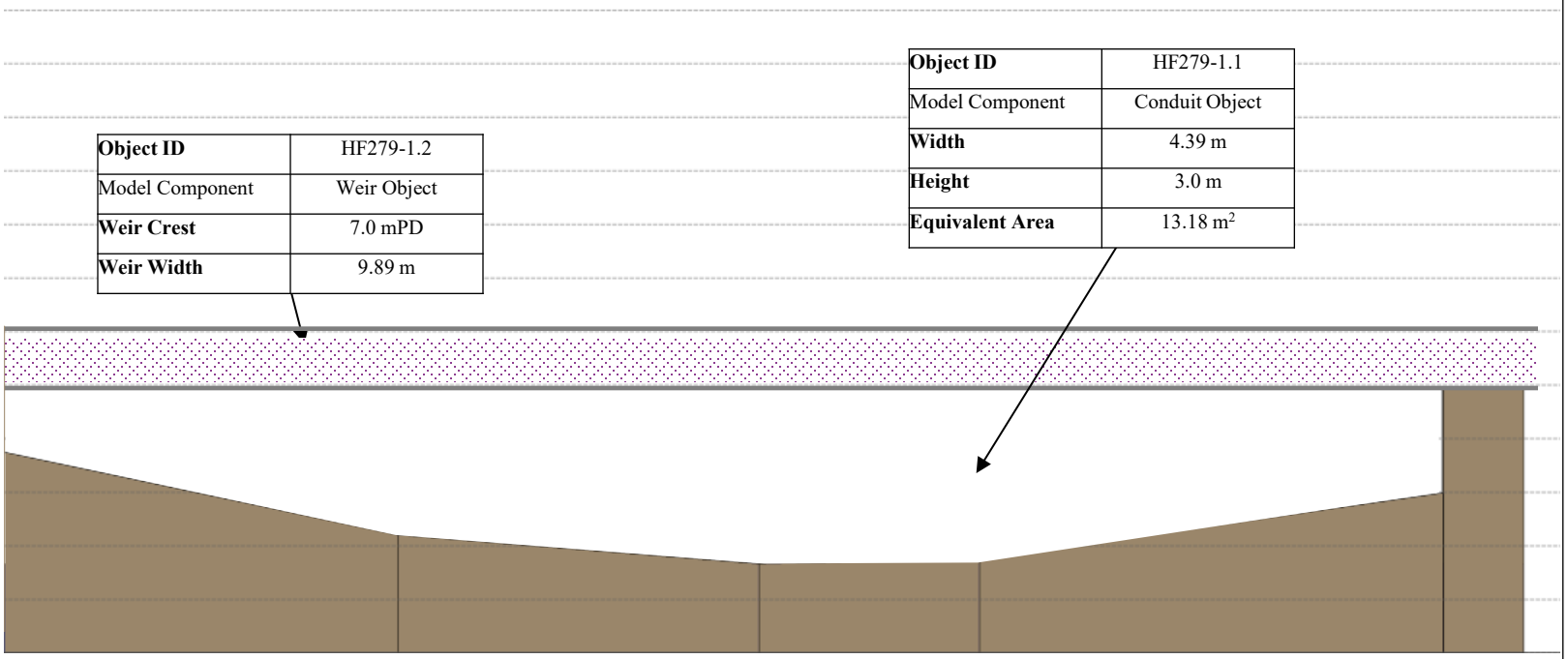


Remark:

- The sectional view is extracted from Model Cross Section Line ID - FUNG_YUEN_W_CH1300-FUNG_YUEN_W which corresponds to Survey Section 6.
- Left riverbank is to eastern direction, right riverbank is to western direction.

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

River Structure (B)'



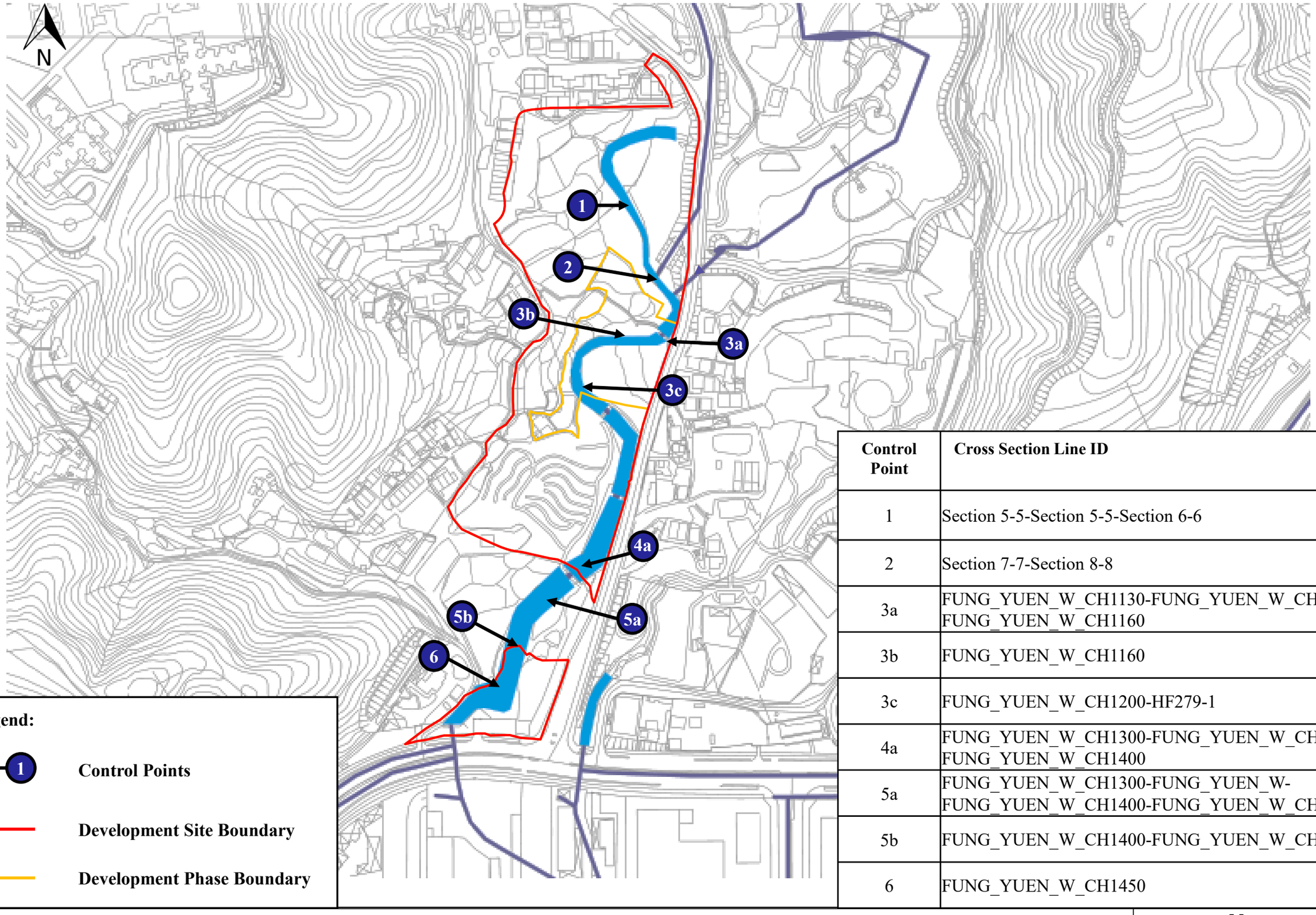
Remark:

- The sectional view is extracted from Model Cross Section Line ID - HF279-1 which corresponds to Survey Section 13.
- Left riverbank is to eastern direction, right riverbank is to western direction.

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views for 5 River Crossing Structures included in Hydraulic Model**	**Appendix D1**
Date Sep 2025	**Scale** N.T.S.	**File**

Appendix E

Location Plan for Model Results Control Points

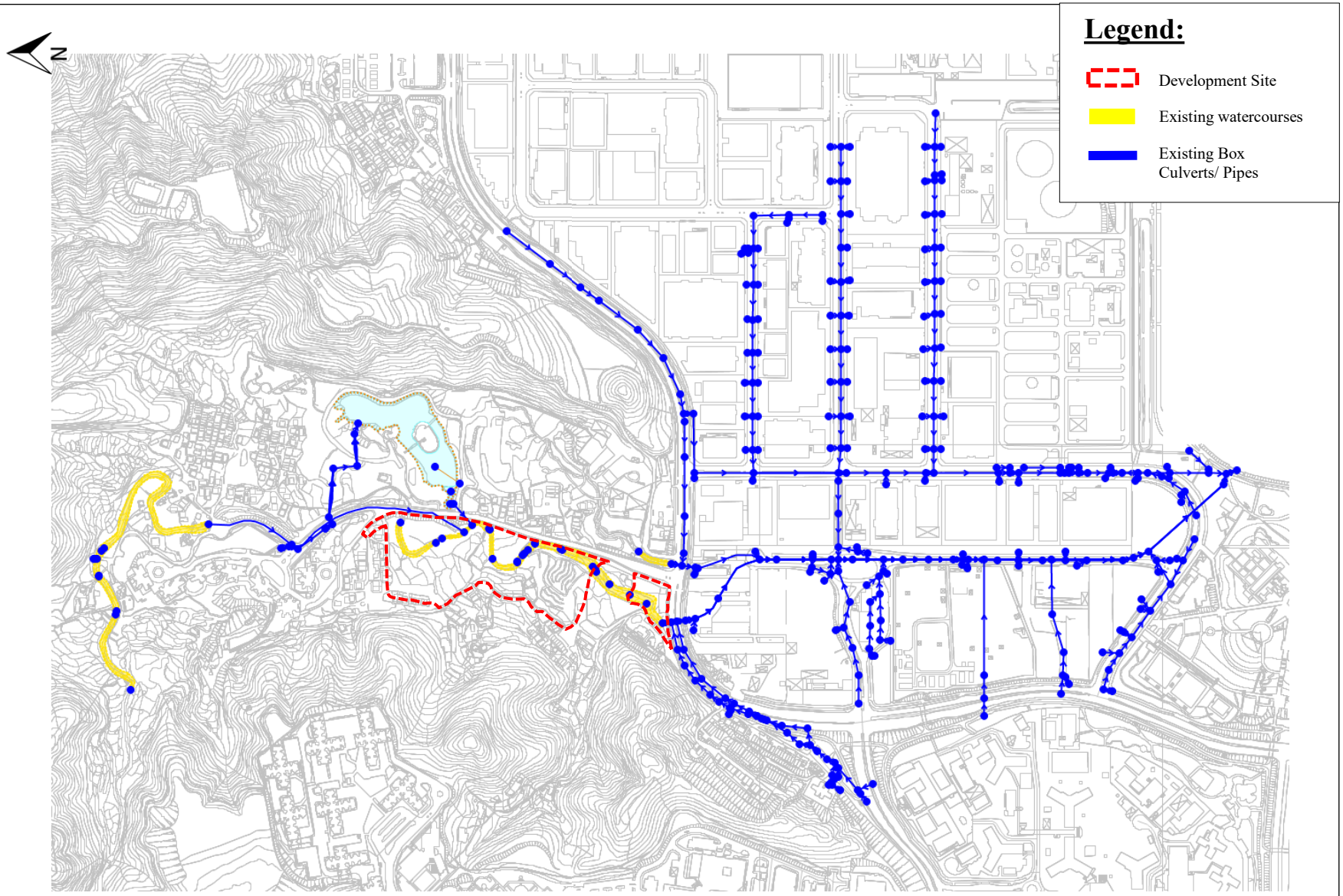


Control Point	Cross Section Line ID
1	Section 5-5-Section 5-5-Section 6-6
2	Section 7-7-Section 8-8
3a	FUNG_YUEN_W_CH1130-FUNG_YUEN_W_CH1160-FUNG_YUEN_W_CH1160
3b	FUNG_YUEN_W_CH1160
3c	FUNG_YUEN_W_CH1200-HF279-1
4a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1300-FUNG_YUEN_W_CH1400
5a	FUNG_YUEN_W_CH1300-FUNG_YUEN_W-FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH
5b	FUNG_YUEN_W_CH1400-FUNG_YUEN_W_CH1450
6	FUNG_YUEN_W_CH1450

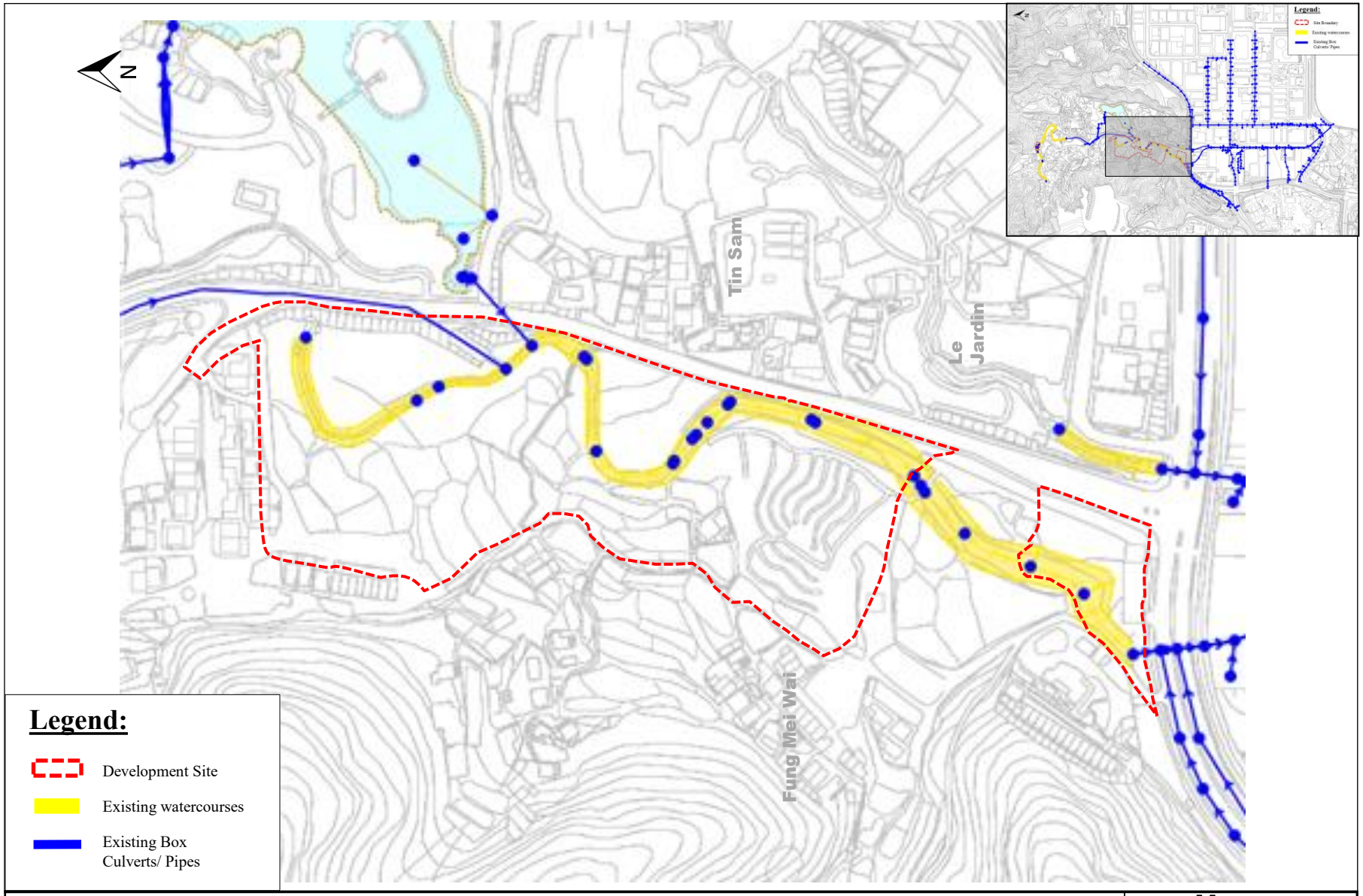
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Location Plan for Model Results Control Points**	**Appendix E**
Date Sep 2025	Scale N.T.S.	File

Appendix F

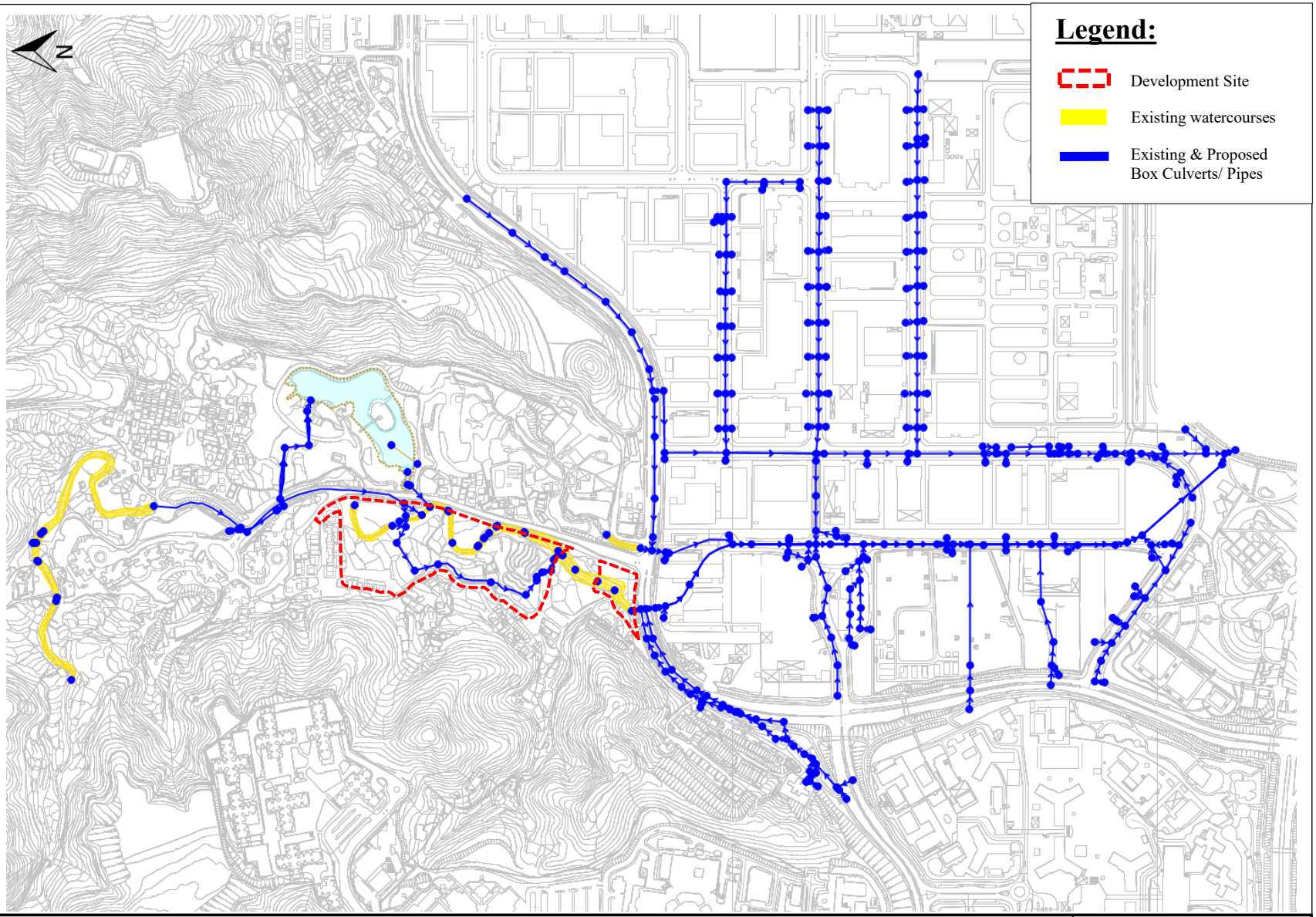
Model Extent



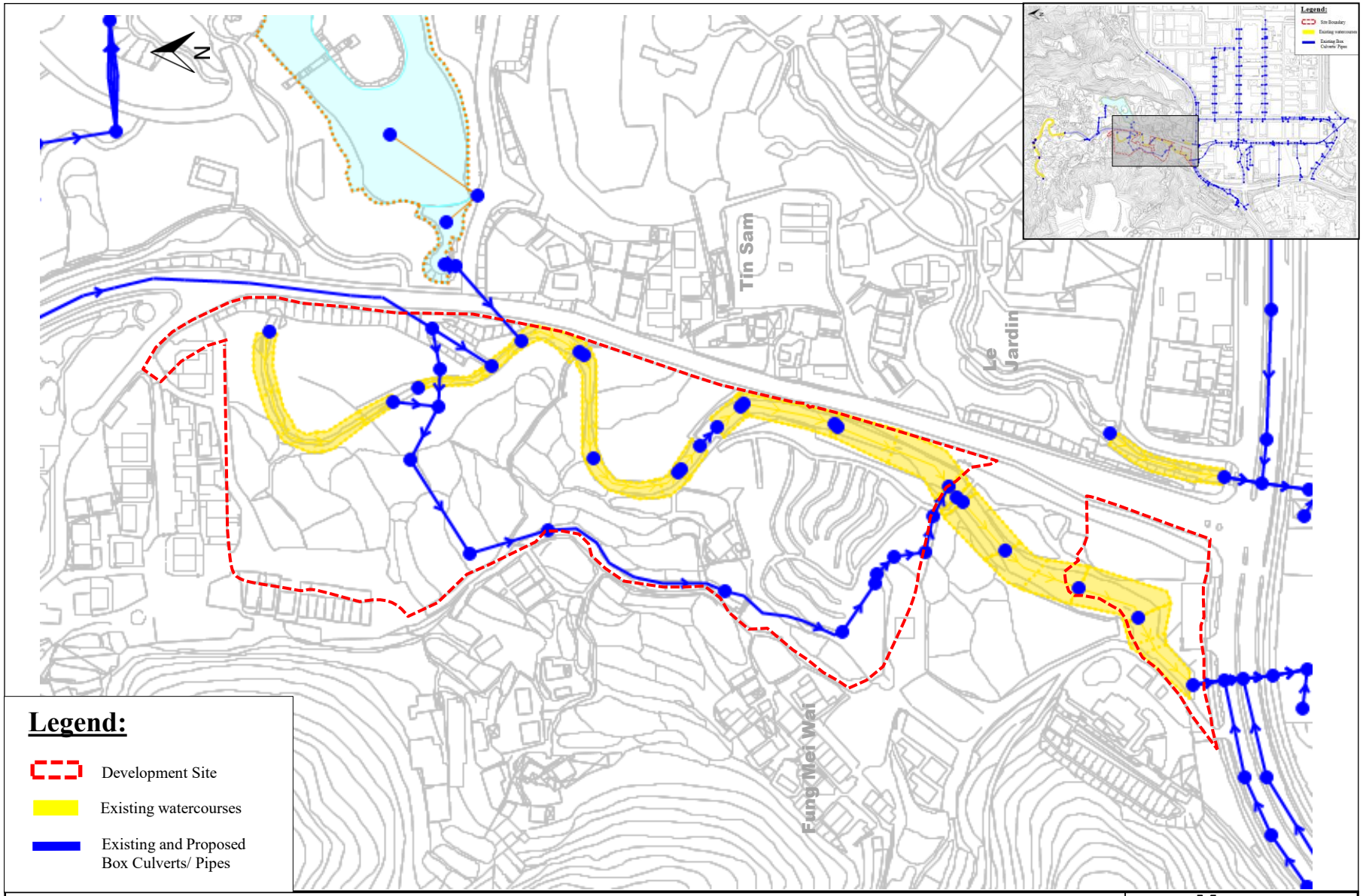
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Existing Model Extent (Overview)**	**Appendix F**
Date Sep 2025	**Scale** N.T.S.	**File**



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Existing Model Extent (Enlarged Plan for Stream near the Site)**	**Appendix F**
Date Sep 2025	**Scale** N.T.S.	**File**



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Proposed Model Extent (Overview)**	**Appendix F**
Date Sep 2025	**Scale** N.T.S.	**File**



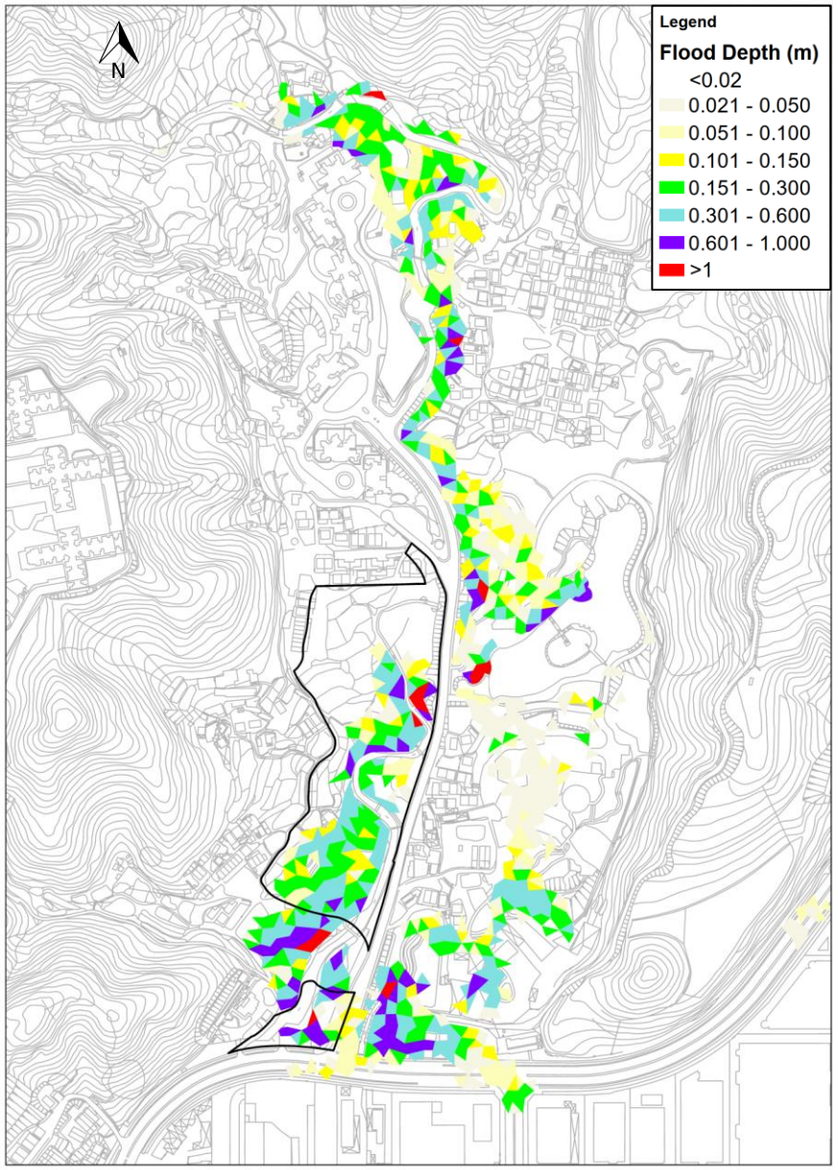
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Proposed Model Extent (Enlarged Plan for Stream near the Site)**	**Appendix F**
Date Sep 2025	**Scale** N.T.S.	**File**

Appendix G

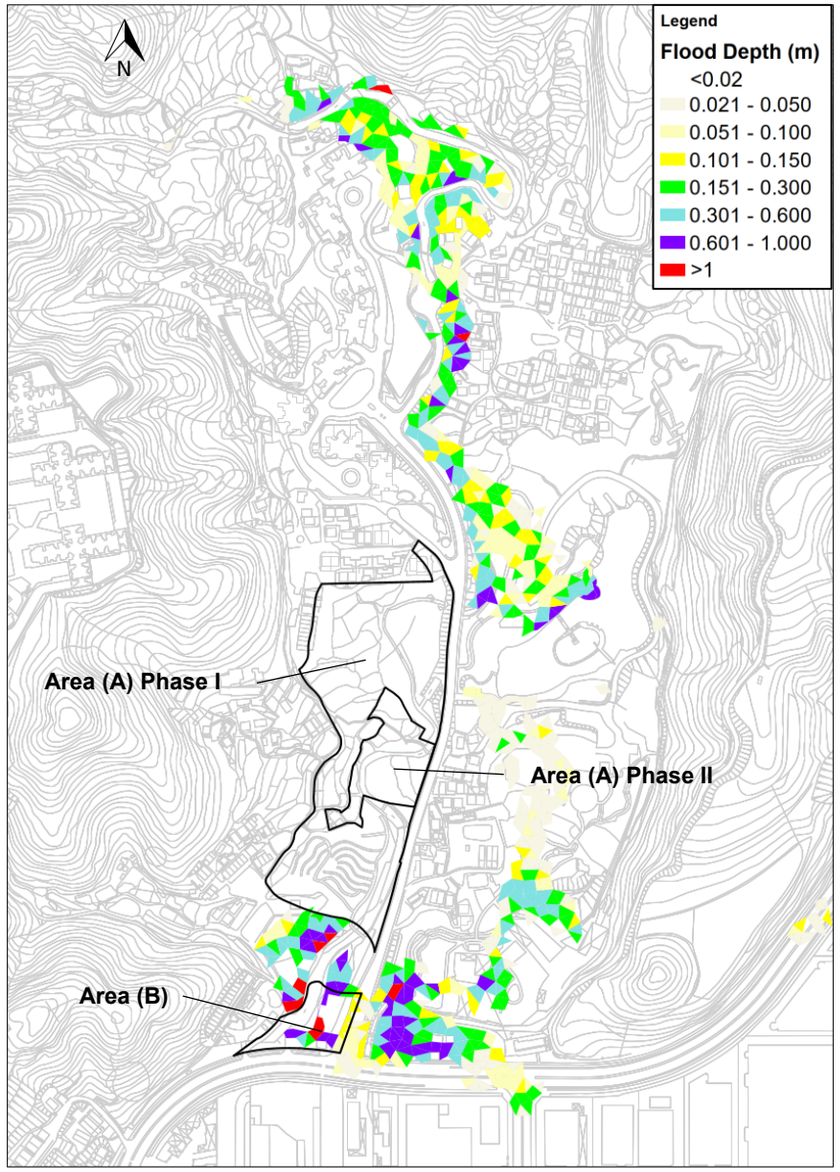
Flood Map

Comparison of Enlarged Flood Map near the Site under 10A Flood Event

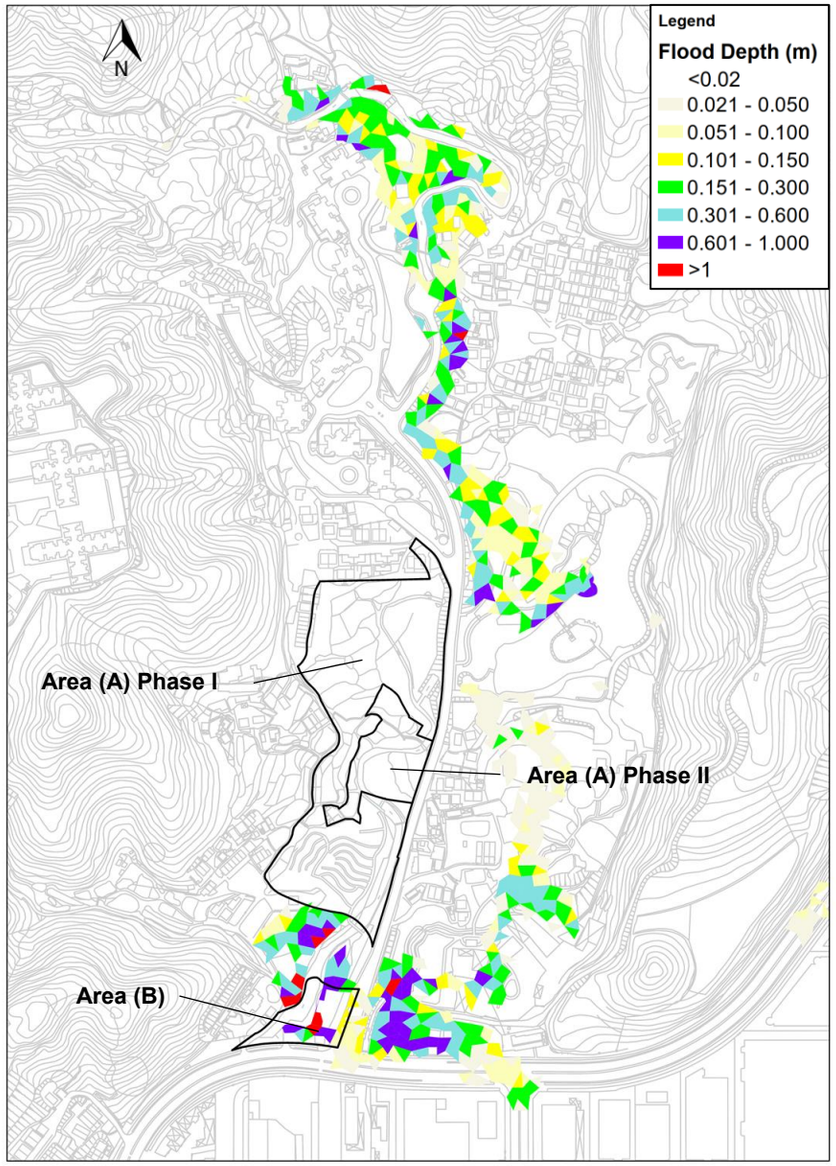
Existing Condition



Proposed Condition with only Development in Area (A) Phase I and Area (B)

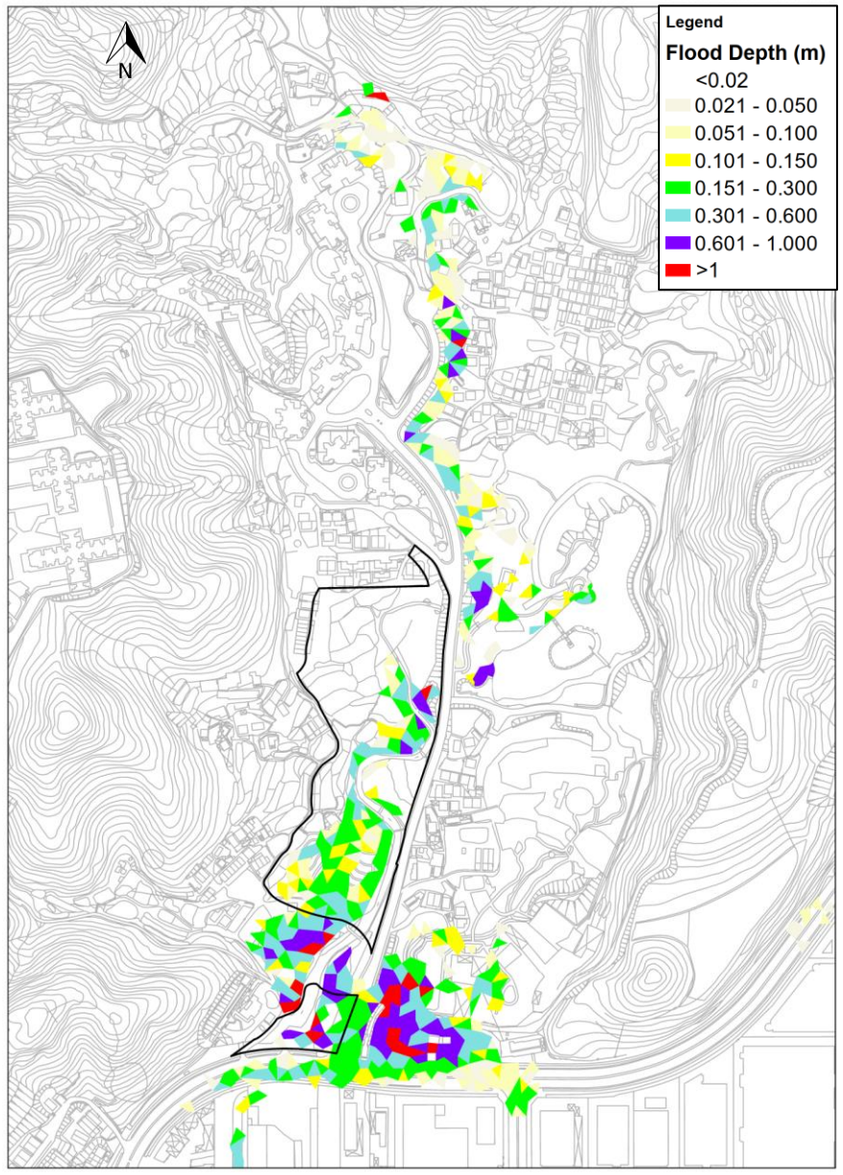


Proposed Condition with entire Development

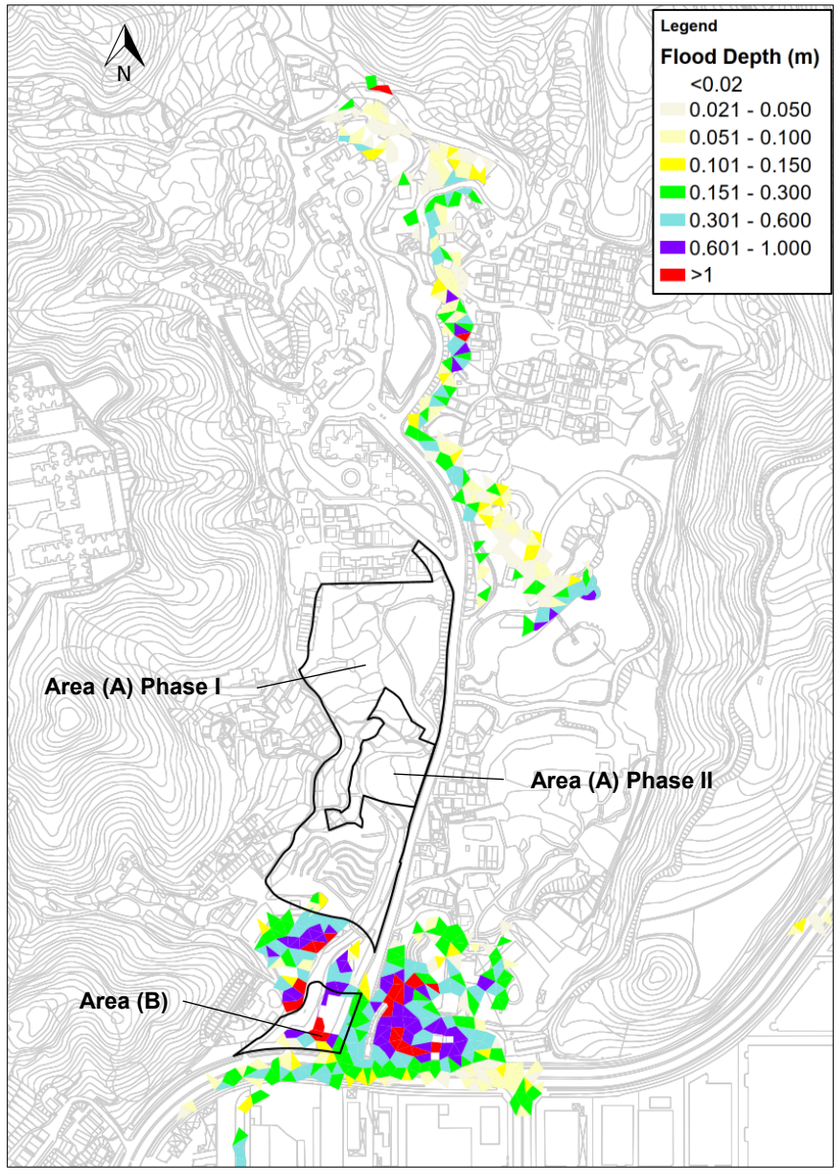


Comparison of Enlarged Flood Map near the Site under 10B Flood Event

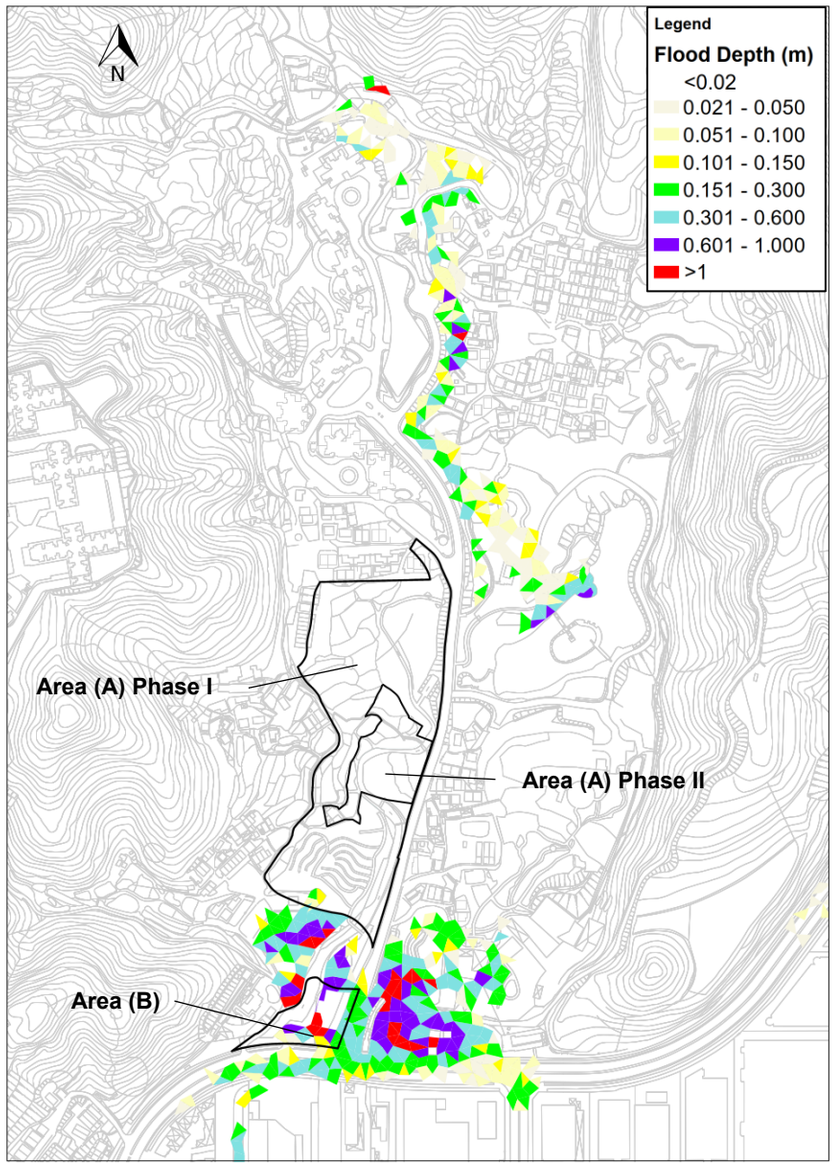
Existing Condition



Proposed Condition with only Development in Area (A) Phase I and Area (B)

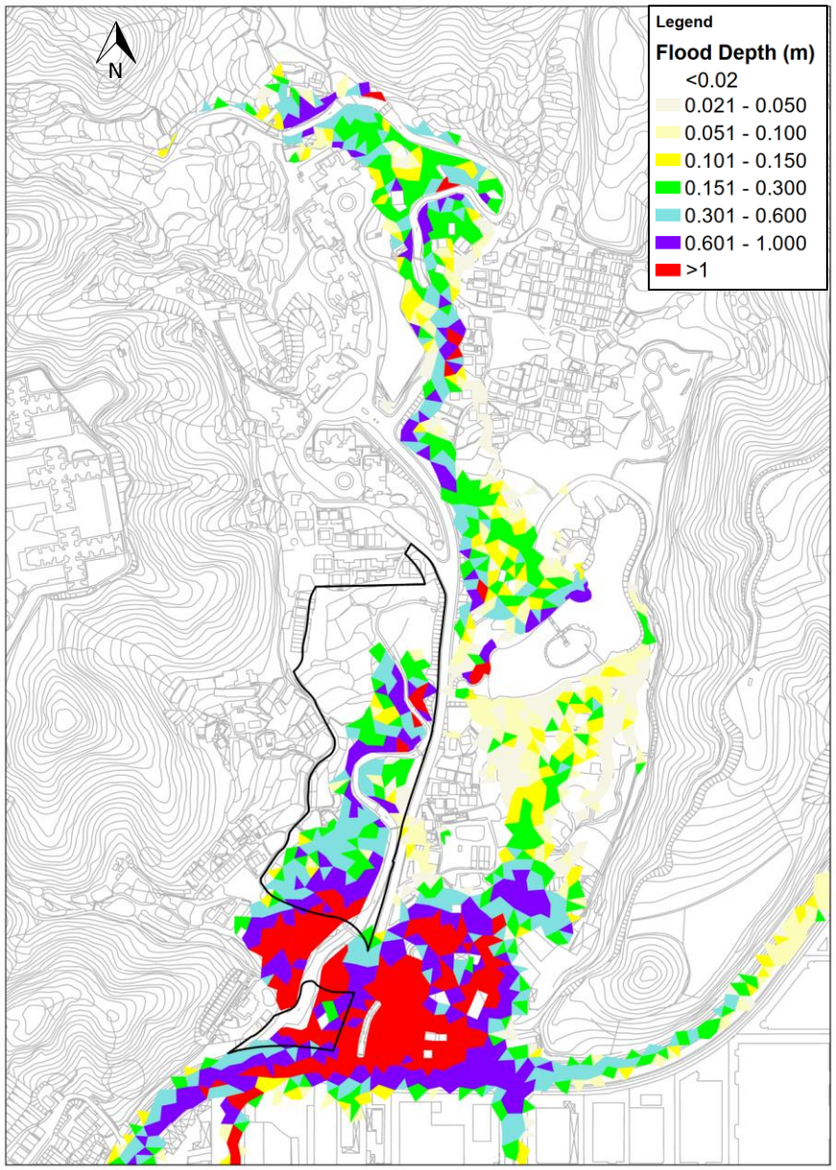


Proposed Condition with entire Development

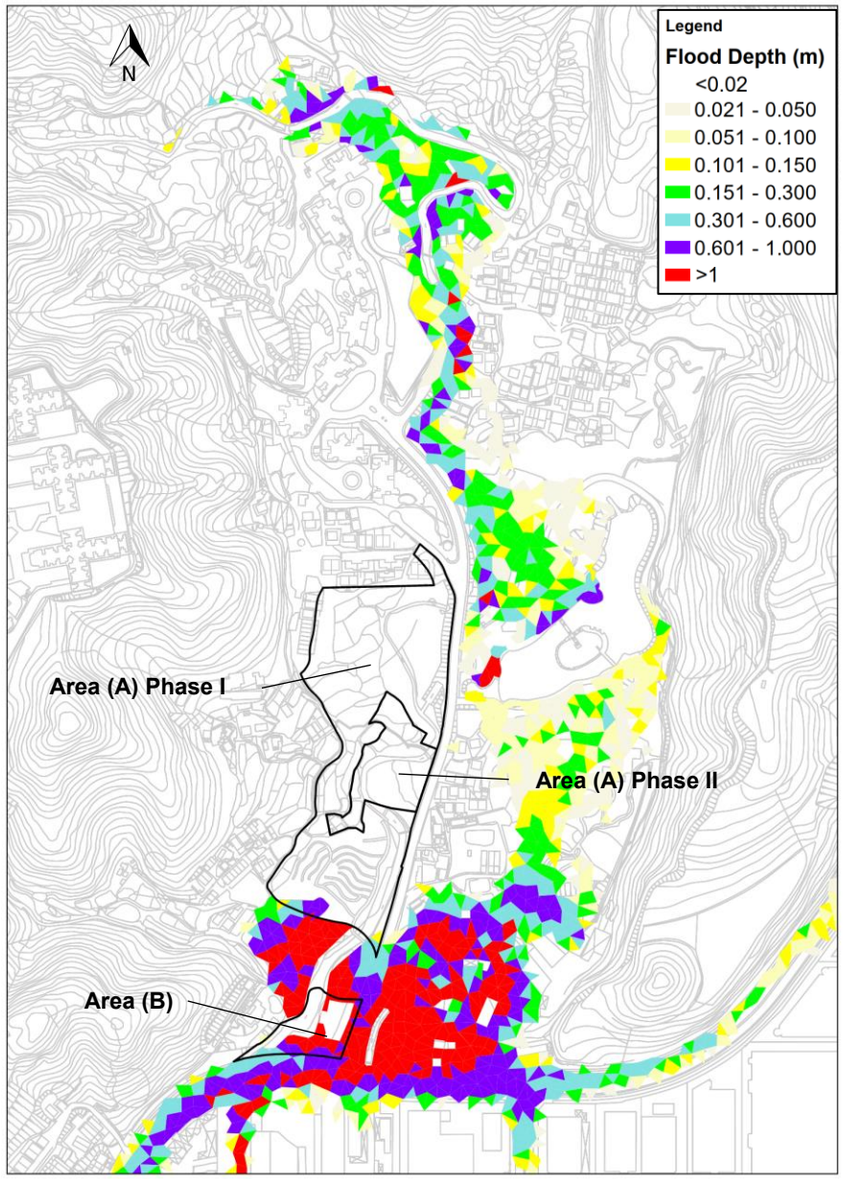


Comparison of Enlarged Flood Map near the Site under 50A Flood Event

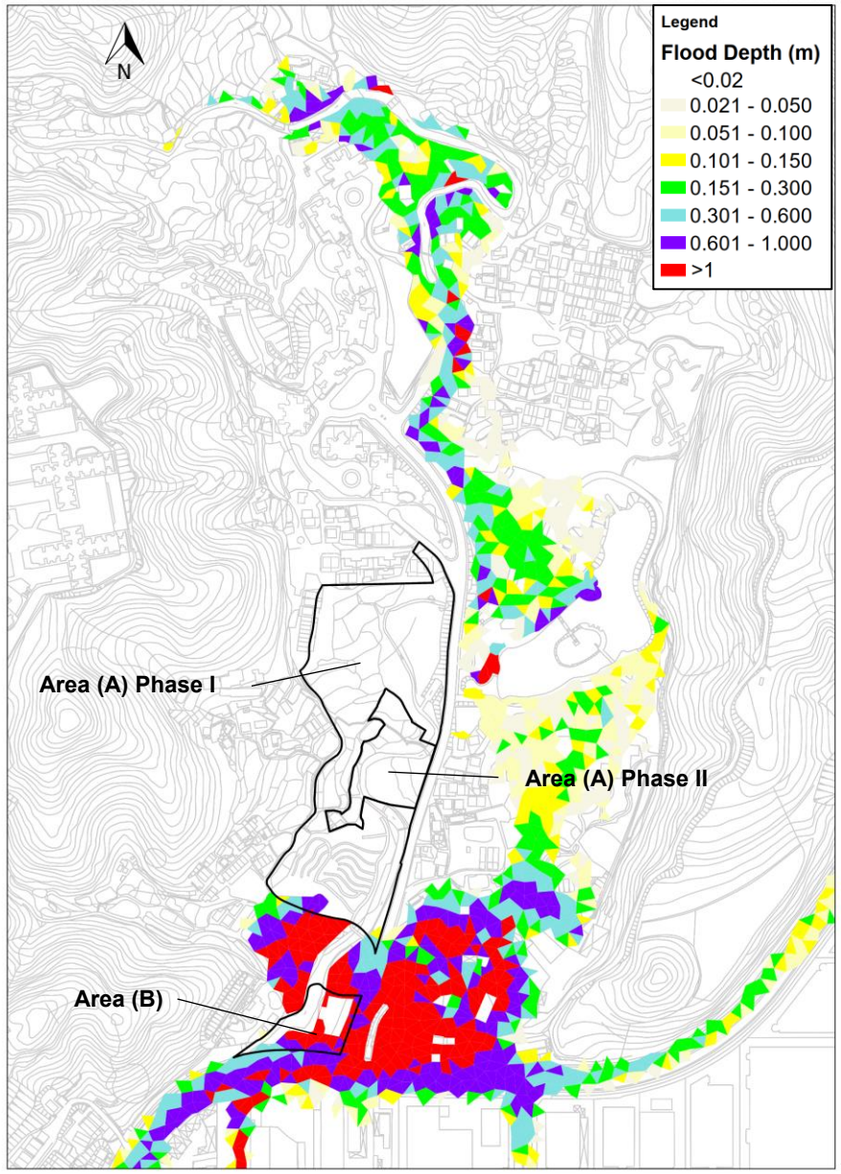
Existing Condition



Proposed Condition with only Development in Area (A) Phase I and Area (B)

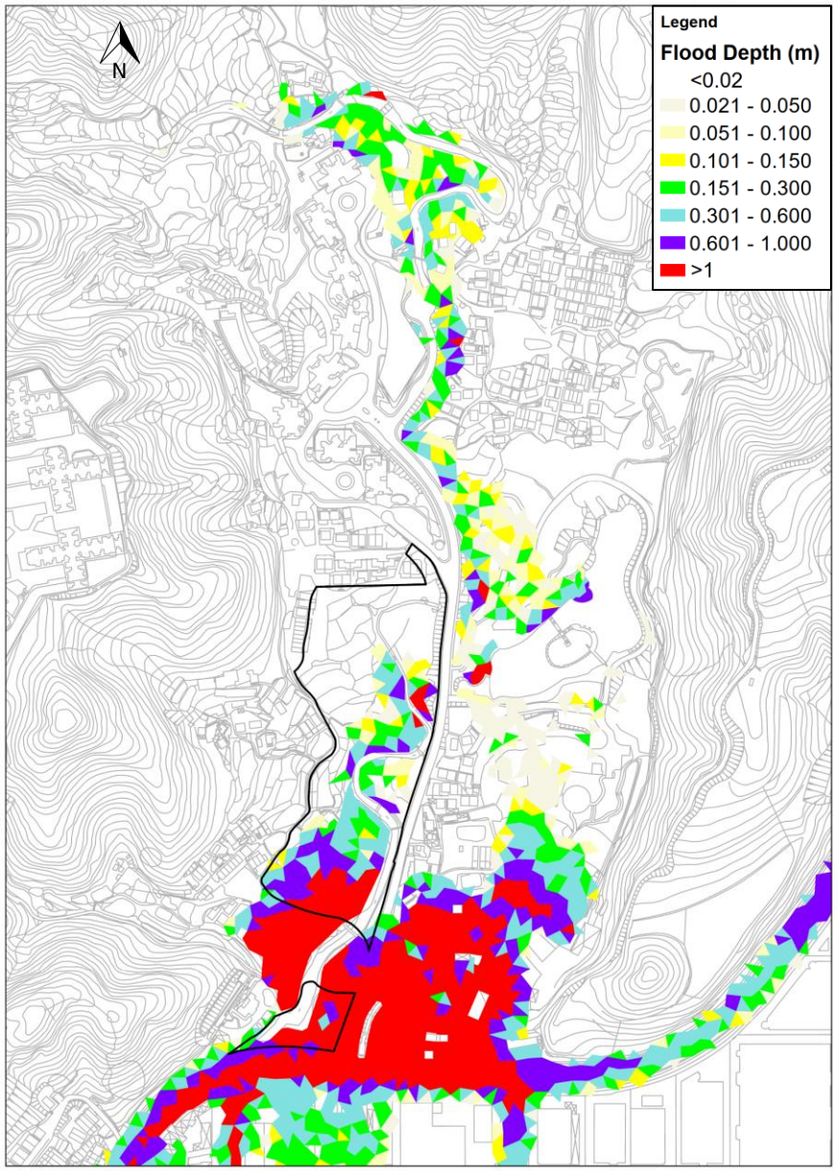


Proposed Condition with entire Development

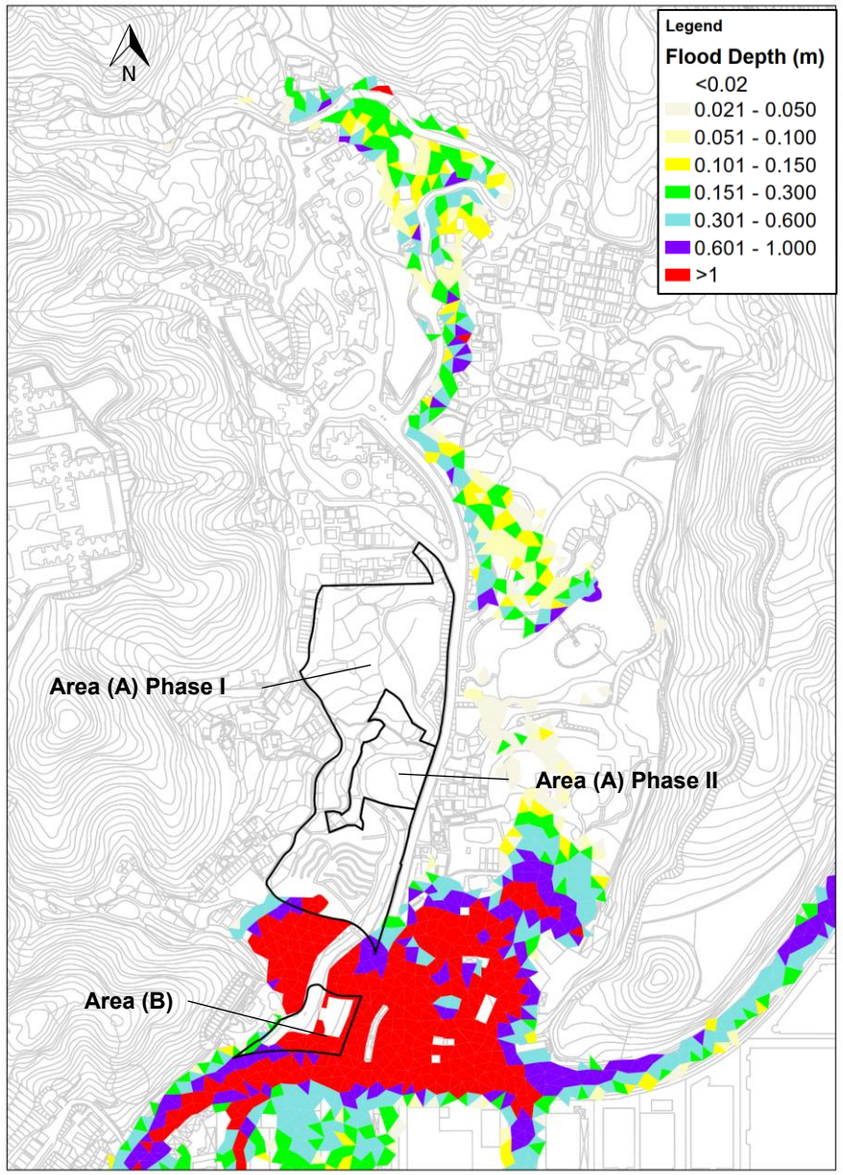


Comparison of Enlarged Flood Map near the Site under 50B Flood Event

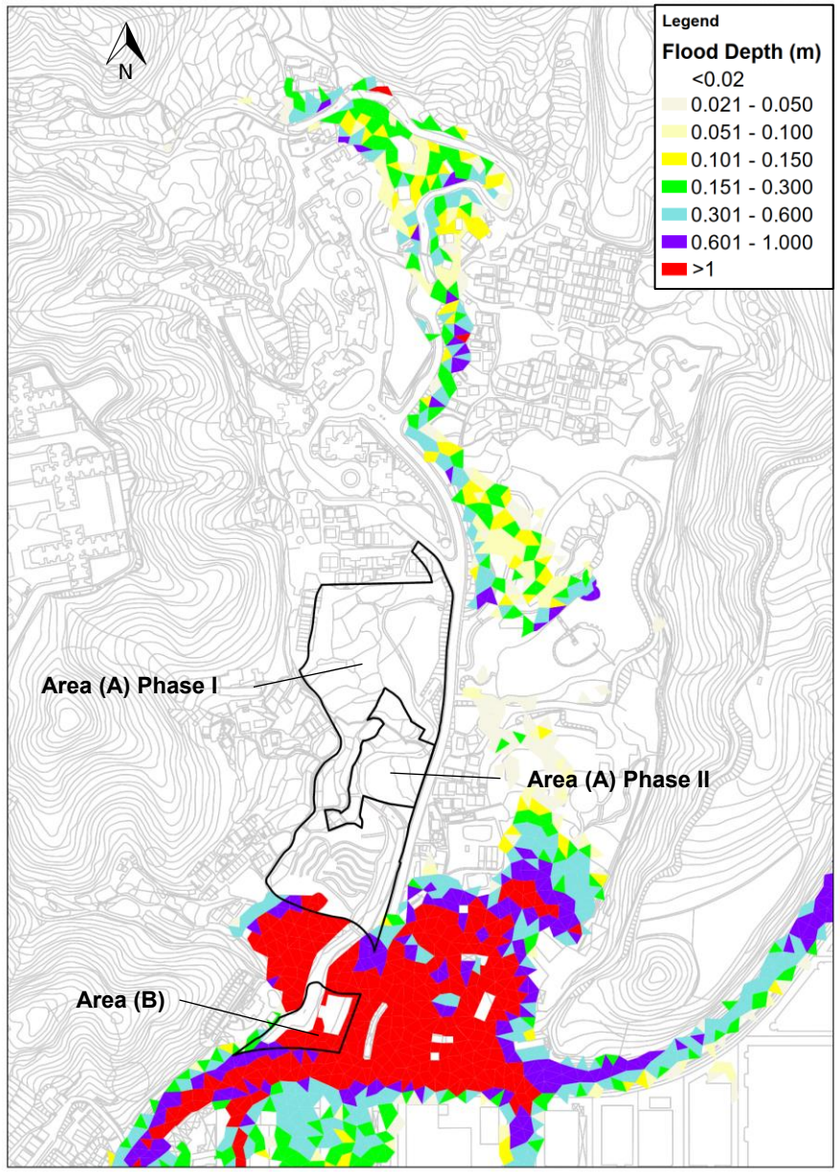
Existing Condition



Proposed Condition with only Development in Area (A) Phase I and Area (B)

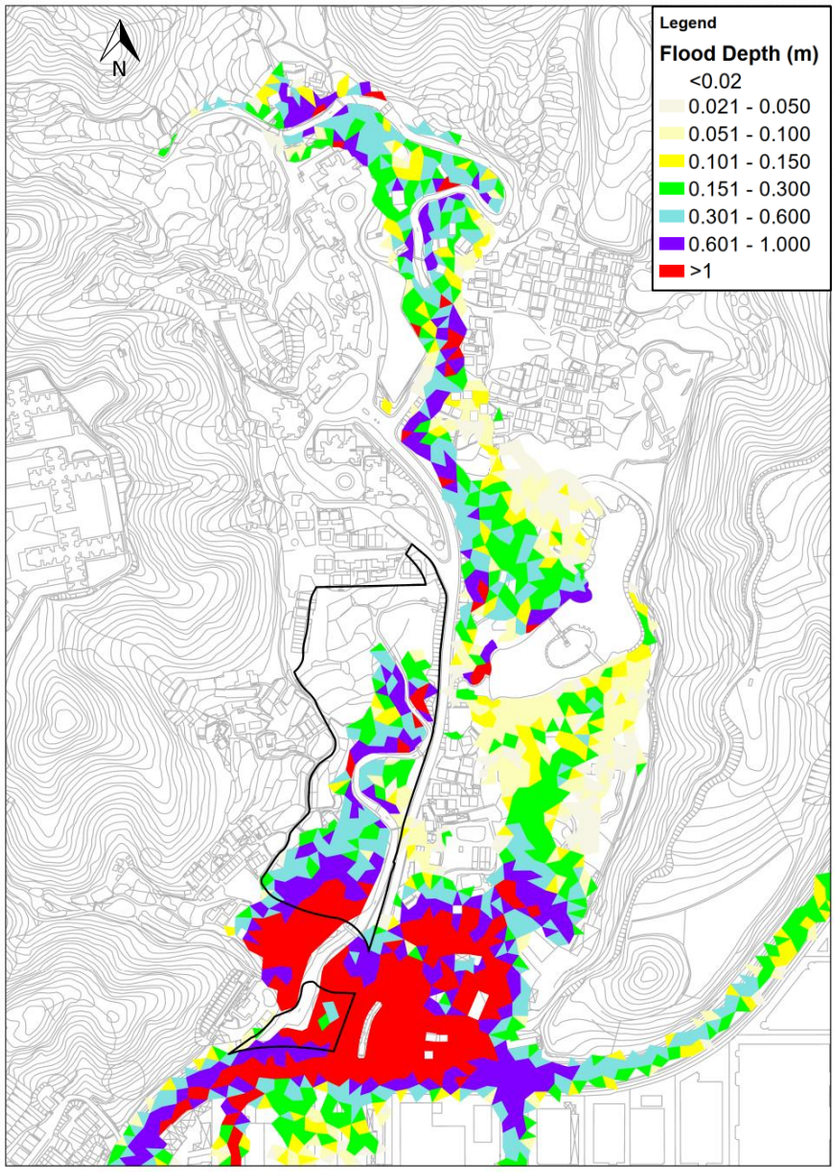


Proposed Condition with entire Development

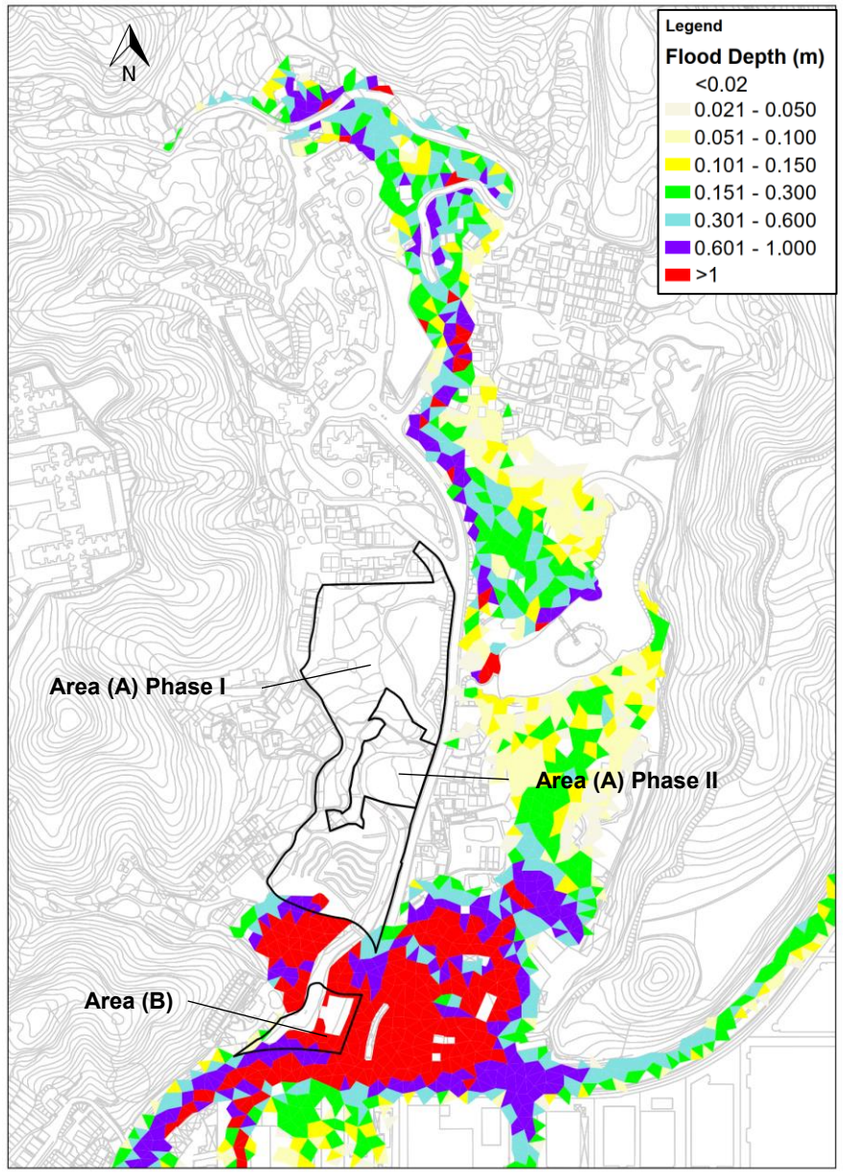


Comparison of Enlarged Flood Map near the Site under 200A Flood Event

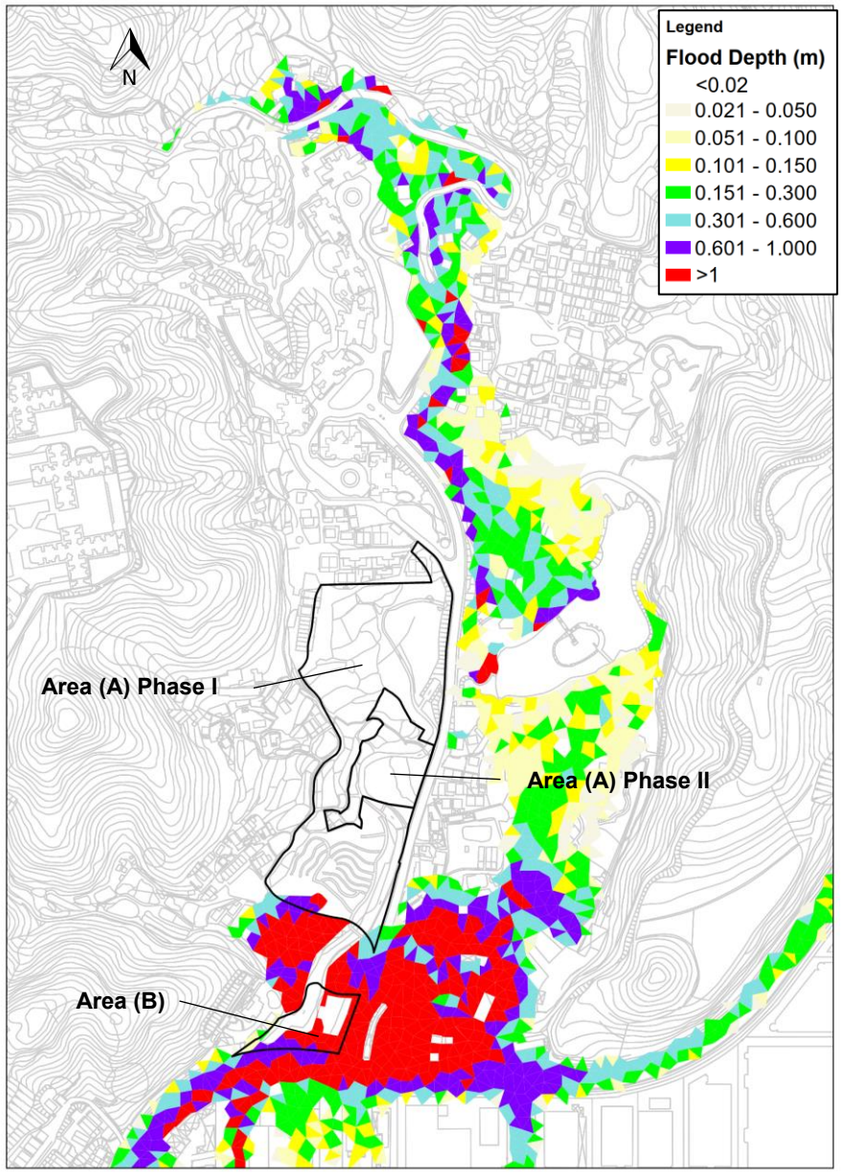
Existing Condition



Proposed Condition with only Development in Area (A) Phase I and Area (B)

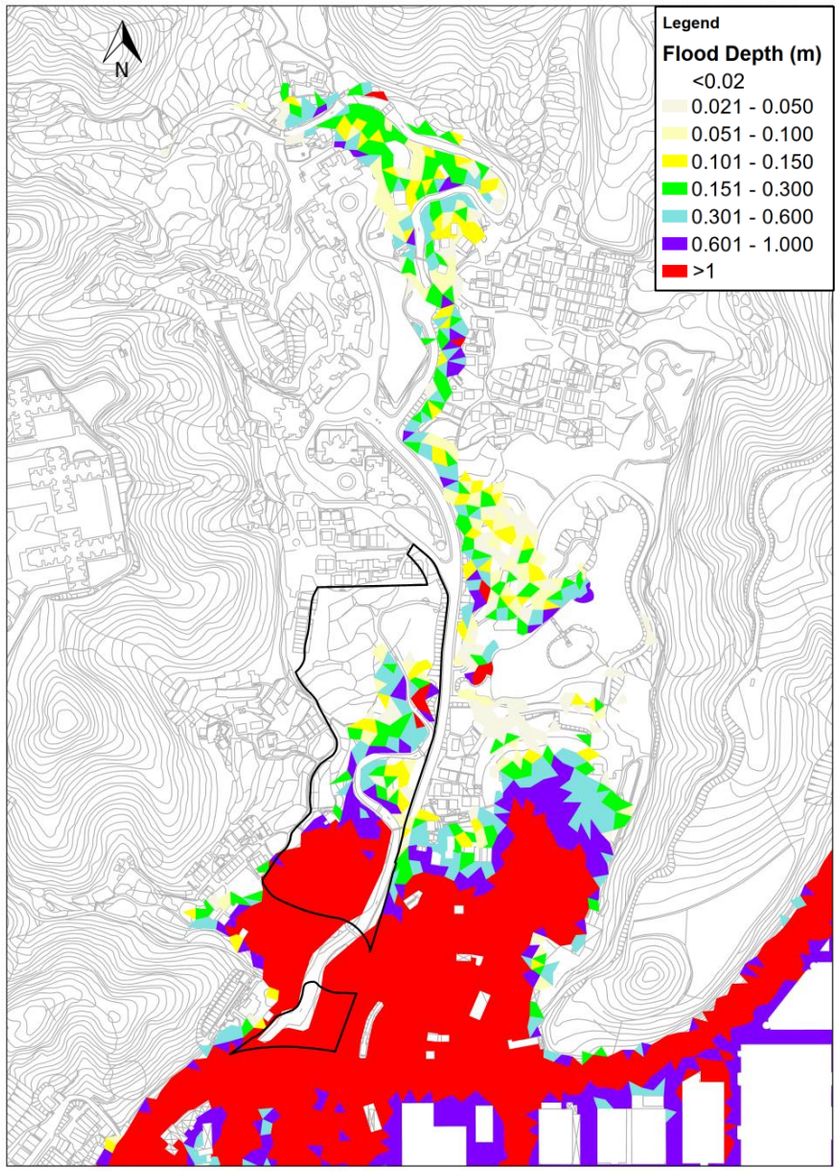


Proposed Condition with entire Development

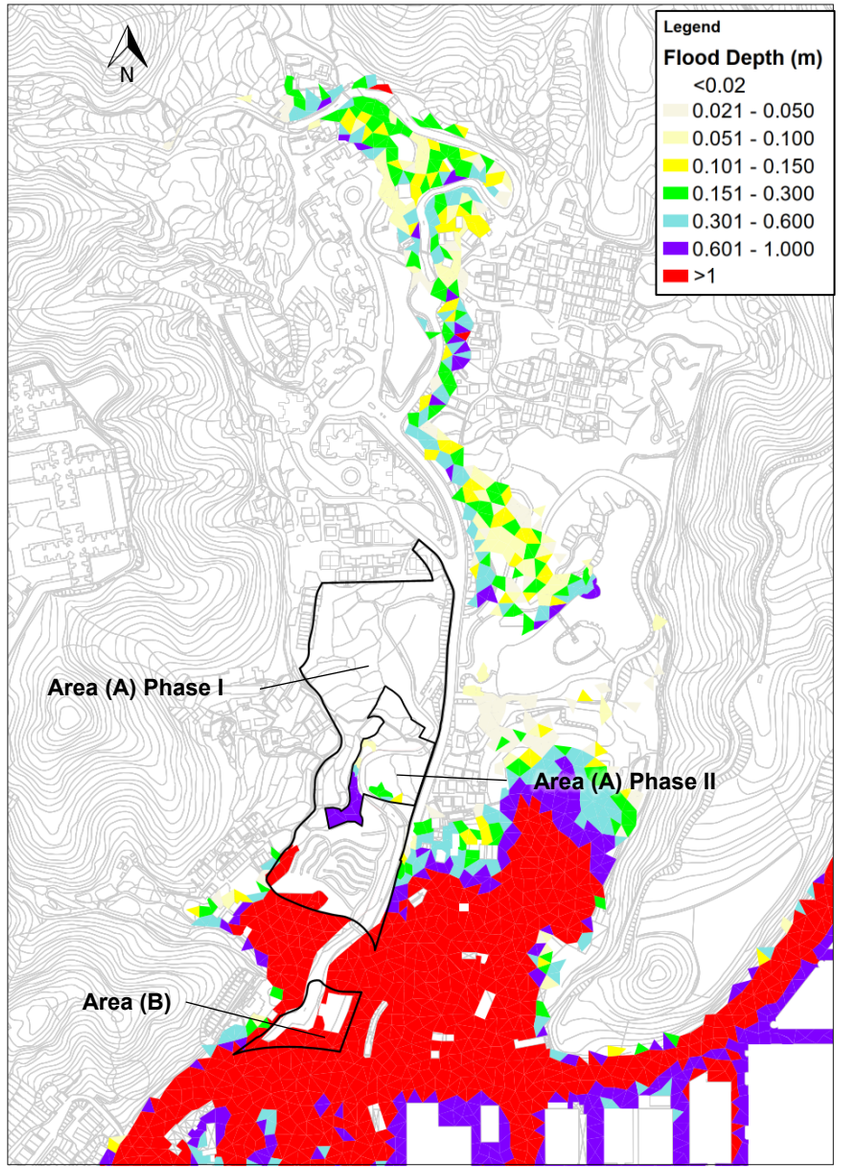


Comparison of Enlarged Flood Map near the Site under 200B Flood Event

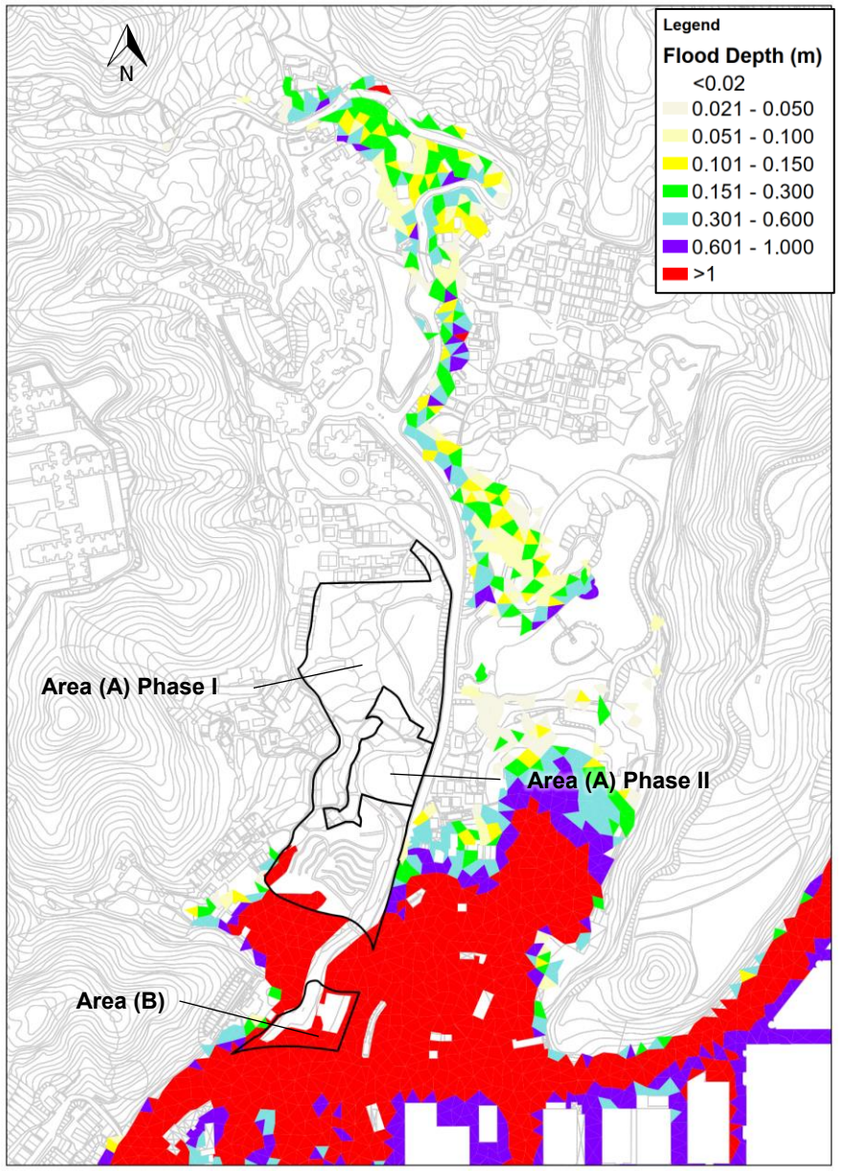
Existing Condition



Proposed Condition with only Development in Area (A) Phase I and Area (B)



Proposed Condition with entire Development

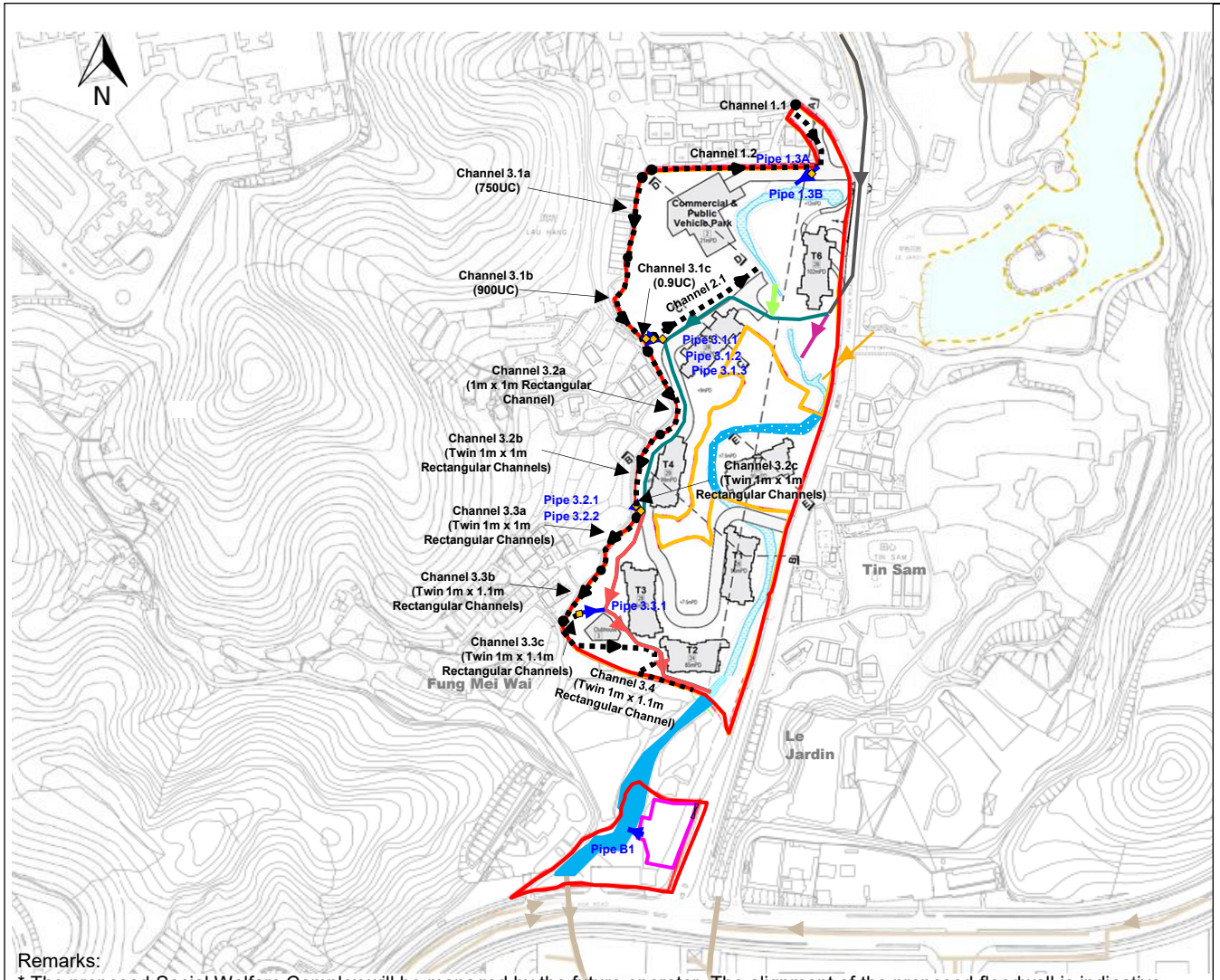


Appendix H

InfoWorks ICM Hydraulic Model

Appendix I

Drainage Features Near the Development Site



Legend

- Development Site Boundary
- Development Phase Boundary
- Existing stream course within Area (A) Phase I of the Development Site Boundary
- Existing stream course within Area (A) Phase II of the Development Site Boundary
- Existing stream course outside development area
- Existing box culvert with a size ranged from 3.6m x 2.5m along Fung Yuen Road
- Existing pipe with diameter of 600mm connecting from the lake in Le Jardin to the existing stream course
- Proposed 4000x3000 Box Culvert (1 Cell)
- Proposed 4000x3500 Box Culvert (1 Cell)
- Proposed 1650mm Pipe
- Proposed 1050mm Pipe
- Proposed floodwall of the social welfare complex
- Other existing drainage features
- Proposed Boundary Drains with cover
- Proposed Backdrop Manhole

Remarks:
* The proposed Social Welfare Complex will be managed by the future operator. The alignment of the proposed floodwall is indicative and subject to the discussion with relevant parties at detailed design stage.
* The final alignment of the proposed boundary drain is subject to the final land grant on site boundary and discussion with relevant parties at detailed design stage.

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Drainage Features Near The Development Site**	**Appendix I**
Date Sep 2025	**Scale** N.T.S.	**File**

Appendix J

Calculation for Boundary drains

Appendix J - Hydraulic Calculation of Proposed Drainage System

Part I

Ref.	Calculation

Objective Determine the runoff of the adjacent areas that will be collected by the proposed boundary drains.

Methodology

1. Determine the runoff from subcatchments by extracting from the results of hydraulic model
2. Use Manning Equation to determine the capacity of the proposed open channel and check against the design flow
3. Use the Colebrook-White Equation to determine the drainage capacity and check against the design flow
4. According to the Stormwater Drainage Manual (SDM), the design return period of drainage system for village zone is 10-year. The proposed boundary channels and associated pipes is designed for 10-year rainfall event to meet the SDM standard.
5. To prevent flooding in the nearby village area, this hydraulic check will also be checked for 50-year and 200-year rainfall events. In view of regular routine maintenance and emergency maintenance will be carried out by the owners of the development to prevent silt accumulation, as well as sufficient flow velocity under 50 and 200 years rainfall return period for self-cleansing, siltation is excluded in the hydrualic check calculations for 50 and 200 years rainfall return period.

1. Runoff from Nearby Catchments Extracted from the Hydraulic Model

Refer to Appendix C2 for the catchment plan for proposed condition.
Runoff is extracted from hydraulic model as attached in Appendix H of this DIA Report.

Sub Catchment ID	Total Catchment Areas(m^2)	Runoff from rainfall event (m^3/s) 2-year	10-year	50-year	200-year	Collected By Proposed Drainage System
Catchment_929A_P0	8,181	0.2619	0.3921	0.5008	0.5596	20% of runoff to Channel 1.1, 66% of runoff to Channel 1.2, and 14% of runoff to Existing Stream Course according to topography
Catchment_Development_2	7,894	0.3308	0.4758	0.5858	0.6408	100% of runoff to Channel 2.1 according to topography
1	19,900	0.6650	0.9868	1.2522	1.3943	64% of runoff to Channel 3.1a, 100% of runoff to Channel 3.1b according to topography. Channel 3.1b will be connected to Channel 3.2a.
2	31,583	1.0554	1.5661	1.9873	2.2129	45%% of runoff to Channel 3.2a and 100% of runoff to Channel 3.2b according to topography .Channel 3.2b will be connected to Channel 3.3a.
3	9,492	0.3172	0.4707	0.5972	0.6650	57% of runoff to Channel 3.3a and 100% of runoff to Channel 3.3b according to topography. Channel 3.3b will be connected to Channel 3.4a.
BridA_DS	9,696	0.3240	0.4808	0.6101	0.6794	28% of runoff to Channel 3.4a, Channel 3.4b and Channel 3.4c. The remaining 72% of runoff to Existing Stream Course

4. Determine the size of proposed open channel

Using Manning equation for calculate the channel Free Flow Full Bore Capacity

SDM Table 12

$$\bar{v} = \frac{R^{1/6}}{n}\sqrt{RS_f}$$

where

	=	Velocity (m/s)
R	=	Hydraulic Radius (m)
S_f	=	Slope (m/m)
n	=	Manning's Coefficient of Roughness (Dimensionless)

Assumptions:

1 Surface roughness coefficient (n) = 0.016 (assume poor concrete surface)
2 Siltation = 10% of Area

Proposed open channel

For Rainfall Return Period 10 years

Channel Name	No. of Channel	Channel Size m	Area m^2	Wet Perimeter m	Channel Length m	Hydraulic Radius m	Upstream Ground Level mPD	Downstream Ground Level mPD	Upstream Invert mPD	Downstream Invert mPD	Min. slope of the channel bed (So) 1 in	Flow from Catchment m^3/s	Free Flow Full-bore Capacity m^3/s	Full-bore Velocity m/s	Utilization %	Flow Capacity Check
Proposed Channel 1.1	1	0.45	0.18	1.16	43.2	0.16	12.2	11.4	11.76	10.75	43	0.078	0.500	2.77	15.69	OK
Proposed Channel 1.2	1	0.675	0.41	1.74	97.5	0.23	11.2	11.4	10.52	10.17	279	0.259	0.579	1.42	44.70	OK
Proposed Channel 2.1	1	0.675	0.41	1.74	81.6	0.23	9.7	9.6	8.99	8.44	150	0.476	0.789	1.94	60.30	OK
Proposed Channel 3.1a	1	0.75	0.50	1.93	56.7	0.26	11.8	11.6	10.95	10.48	120	0.632	1.168	2.33	54.05	OK
Proposed Channel 3.1b	1	0.9	0.72	2.31	56.7	0.31	11.6	11.4	10.48	10.00	120	0.987	1.900	2.63	51.94	OK
Proposed Channel 3.1c	1	0.9	0.72	2.31	1.0	0.31	11.4	11.4	9.90	9.89	100	0.987	2.083	2.88	47.37	OK
Proposed Channel 3.2a	1	1 x 1	1.00	3.00	54.1	0.33	11.4	10.5	9.80	9.31	110	1.692	2.865	2.86	59.04	OK
Proposed Channel 3.2b	2	1 x 1	1.00	3.00	54.1	0.33	10.5	9.7	8.91	8.55	148	2.553	4.940	2.47	51.68	OK
Proposed Channel 3.2c	2	1 x 1	1.00	3.00	1.0	0.33	9.7	9.7	8.15	8.14	148	2.553	4.940	2.47	51.68	OK
Proposed Channel 3.3a-1	2	1 x 1	1.00	3.00	19.4	0.33	9.7	8.9	7.95	7.83	161	2.821	4.736	2.37	59.57	OK
Proposed Channel 3.3a-2	2	1 x 1	1.00	3.00	19.4	0.33	8.9	8.2	7.23	7.11	161	2.821	4.736	2.37	59.57	OK
Proposed Channel 3.3b-1	2	1 x 1.1	1.10	3.20	19.4	0.34	8.2	7.5	6.51	6.39	173	3.024	5.130	2.33	58.94	OK
Proposed Channel 3.3b-2	2	1 x 1.1	1.10	3.20	19.4	0.34	7.5	6.8	5.79	5.68	173	3.024	5.130	2.33	58.94	OK
Proposed Channel 3.3c	2	1 x 1.1	1.10	3.20	1.0	0.34	6.8	6.8	5.28	5.27	150	3.024	5.509	2.50	54.88	OK
Proposed Channel 3.4a	2	1 x 1.1	1.10	3.20	41.0	0.34	6.8	6.0	5.08	4.84	173	3.158	5.130	2.33	61.56	OK
Proposed Channel 3.4b	2	1 x 1.1	1.10	3.20	41.0	0.34	6.0	5.2	4.24	4.01	173	3.158	5.130	2.33	61.56	OK
Proposed Channel 3.4c	2	1 x 1.1	1.10	3.20	41.0	0.34	5.2	4.4	3.51	3.27	173	3.158	5.130	2.33	61.56	OK

Ref.	Calculation

For Rainfall Return Period 50 years

Channel Name	No. of Channel	Channel Size m	Area m^2	Wet Perimeter m	Channel Length m	Hydraulic Radius m	Upstream Ground Level mPD	Downstream Ground Level mPD	Upstream Invert mPD	Downstream Invert mPD	Min. slope of the channel bed (So) 1 in	Flow from Catchment m^3/s	Free Flow Full-bore Capacity m^3/s	Full-bore Velocity m/s	Utilization %	Flow Capacity Check
Proposed Channel 1.1	1	0.45	0.18	1.16	43.2	0.16	12.2	11.4	11.76	10.75	43	0.100	0.500	2.77	20.04	OK
Proposed Channel 1.2	1	0.675	0.41	1.74	97.5	0.23	11.2	11.4	10.52	10.17	279	0.331	0.579	1.42	57.10	OK
Proposed Channel 2.1	1	0.675	0.41	1.74	81.6	0.23	9.7	9.6	8.99	8.44	150	0.586	0.789	1.94	74.24	OK
Proposed Channel 3.1a	1	0.75	0.50	1.93	56.7	0.26	11.8	11.6	10.95	10.48	120	0.801	1.168	2.33	68.59	OK
Proposed Channel 3.1b	1	0.9	0.72	2.31	56.7	0.31	11.6	11.4	10.48	10.00	120	1.252	1.900	2.63	65.91	OK
Proposed Channel 3.1c	1	0.9	0.72	2.31	1.0	0.31	11.4	11.4	9.90	9.89	100	1.252	2.083	2.88	60.11	OK
Proposed Channel 3.2a	1	1 x 1	1.00	3.00	54.1	0.33	11.4	10.5	9.80	9.31	110	2.146	2.865	2.86	74.92	OK
Proposed Channel 3.2b	2	1 x 1	1.00	3.00	54.1	0.33	10.5	9.7	8.91	8.55	148	3.239	4.940	2.47	65.58	OK
Proposed Channel 3.2c	2	1 x 1	1.00	3.00	1.0	0.33	9.7	9.7	8.15	8.14	148	3.239	4.940	2.47	65.58	OK
Proposed Channel 3.3a-1	2	1 x 1	1.00	3.00	19.4	0.33	9.7	8.9	7.95	7.83	161	3.580	4.736	2.37	75.59	OK
Proposed Channel 3.3a-2	2	1 x 1	1.00	3.00	19.4	0.33	8.9	8.2	7.23	7.11	161	3.580	4.736	2.37	75.59	OK
Proposed Channel 3.3b-1	2	1 x 1.1	1.10	3.20	19.4	0.34	8.2	7.5	6.51	6.39	173	3.837	5.130	2.33	74.79	OK
Proposed Channel 3.3b-2	2	1 x 1.1	1.10	3.20	19.4	0.34	7.5	6.8	5.79	5.68	173	3.837	5.130	2.33	74.79	OK
Proposed Channel 3.3c	2	1 x 1.1	1.10	3.20	1.0	0.34	6.8	6.8	5.28	5.27	150	3.837	5.509	2.50	69.64	OK
Proposed Channel 3.4a	2	1 x 1.1	1.10	3.20	41.0	0.34	6.8	6.0	5.08	4.84	173	4.007	5.130	2.33	78.12	OK
Proposed Channel 3.4b	2	1 x 1.1	1.10	3.20	41.0	0.34	6.0	5.2	4.24	4.01	173	4.007	5.130	2.33	78.12	OK
Proposed Channel 3.4c	2	1 x 1.1	1.10	3.20	41.0	0.34	5.2	4.4	3.51	3.27	173	4.007	5.130	2.33	78.12	OK

For Rainfall Return Period 200 years

Channel Name	No. of Channel	Channel Size m	Area m^2	Wet Perimeter m	Channel Length m	Hydraulic Radius m	Upstream Ground Level mPD	Downstream Ground Level mPD	Upstream Invert mPD	Downstream Invert mPD	Min. slope of the channel bed (So) 1 in	Flow from Catchment m^3/s	Free Flow Full-bore Capacity m^3/s	Full-bore Velocity m/s	Utilization %	Flow Capacity Check
Proposed Channel 1.1	1	0.45	0.18	1.16	43.2	0.16	12.2	11.4	11.76	10.75	43	0.112	0.500	2.77	22.39	OK
Proposed Channel 1.2	1	0.675	0.41	1.74	97.5	0.23	11.2	11.4	10.52	10.17	279	0.369	0.579	1.42	63.79	OK
Proposed Channel 2.1	1	0.675	0.41	1.74	81.6	0.23	9.7	9.6	8.99	8.44	150	0.641	0.789	1.94	81.21	OK
Proposed Channel 3.1a	1	0.75	0.50	1.93	56.7	0.26	11.8	11.6	10.95	10.48	120	0.892	1.168	2.33	76.38	OK
Proposed Channel 3.1b	1	0.9	0.72	2.31	56.7	0.31	11.6	11.4	10.48	10.00	120	1.394	1.900	2.63	73.39	OK
Proposed Channel 3.1c	1	0.9	0.72	2.31	1.0	0.31	11.4	11.4	9.90	9.89	100	1.394	2.083	2.88	66.93	OK
Proposed Channel 3.2a	1	1 x 1	1.00	3.00	54.1	0.33	11.4	10.5	9.80	9.31	110	2.390	2.865	2.86	83.43	OK
Proposed Channel 3.2b	2	1 x 1	1.00	3.00	54.1	0.33	10.5	9.7	8.91	8.55	148	3.607	4.940	2.47	73.03	OK
Proposed Channel 3.2c	2	1 x 1	1.00	3.00	1.0	0.33	9.7	9.7	8.15	8.14	148	3.607	4.940	2.47	73.03	OK
Proposed Channel 3.3a-1	2	1 x 1	1.00	3.00	19.4	0.33	9.7	8.9	7.95	7.83	161	3.986	4.736	2.37	84.17	OK
Proposed Channel 3.3a-2	2	1 x 1	1.00	3.00	19.4	0.33	8.9	8.2	7.23	7.11	161	3.986	4.736	2.37	84.17	OK
Proposed Channel 3.3b-1	2	1 x 1.1	1.10	3.20	19.4	0.34	8.2	7.5	6.51	6.39	173	4.272	5.130	2.33	83.28	OK
Proposed Channel 3.3b-2	2	1 x 1.1	1.10	3.20	19.4	0.34	7.5	6.8	5.79	5.68	173	4.272	5.130	2.33	83.28	OK
Proposed Channel 3.3c	2	1 x 1.1	1.10	3.20	1.0	0.34	6.8	6.8	5.28	5.27	150	4.272	5.509	2.50	77.55	OK
Proposed Channel 3.4a	2	1 x 1.1	1.10	3.20	41.0	0.34	6.8	6.0	5.08	4.84	173	4.462	5.130	2.33	86.99	OK
Proposed Channel 3.4b	2	1 x 1.1	1.10	3.20	41.0	0.34	6.0	5.2	4.24	4.01	173	4.462	5.130	2.33	86.99	OK
Proposed Channel 3.4c	2	1 x 1.1	1.10	3.20	41.0	0.34	5.2	4.4	3.51	3.27	173	4.462	5.130	2.33	86.99	OK

Ref.	Calculation

5.0. Determine the Size of the Proposed Pipes

5.1. Determine the Size of the Proposed Pipe Connecting the peripheral drain to the Existing Drainage Network

New proposed pipes will be proposed to divert the surface runoff collected from the development to the existing drainage network.

$$V = -\sqrt{32gRSf}\log\left[\frac{ks}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRSf}}\right]$$

Use the Colebrook-White Equation to Determine the Drainage Capacity

Assumptions:
1. Pipe Roughness is 3.00 mm
2. Transitional flow and water at 15 degree Celsius, i.e. kinematic viscosity is 1.14 x 10-6 m2/s.

Full-bore capacity for Proposed Pipe 1.3A:

Pipe Diameter	900	mm
Pipe Roughness	3	mm
Length of Pipe	3.2	m
Upstream Invert	10.17	mPD
Downstream Invert	10.15	mPD
Hydraulic Gradient, Sf	0.006	
Gradient 1 in	166.667	
Full-bore capacity	1.26	m^3/s and velocity of 1.98 m/s

The future flow of 0.34 m^3/s is 26.8% of the full-bore capacity of 1.26 m^3/s **OK!**

The proposed Pipe 1.3A is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 0.43 m^3/s is 34.2% of the full-bore capacity of 1.26 m^3/s **OK!**

The proposed Pipe 1.3A is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 0.48 m^3/s is 38.2% of the full-bore capacity of 1.26 m^3/s **OK!**

The proposed Pipe 1.3A is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Full-bore capacity for Proposed Pipe 1.3B:

Pipe Diameter	900	mm
Pipe Roughness	3	mm
Length of Pipe	15	m
Upstream Invert	8.64	mPD
Downstream Invert	8.55	mPD
Hydraulic Gradient, Sf	0.006	
Gradient 1 in	166.667	
Full-bore capacity	1.26	m^3/s and velocity of 1.98 m/s

The future flow of 0.34 m^3/s is 26.8% of the full-bore capacity of 1.26 m^3/s **OK!**

The proposed Pipe 1.3B is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 0.43 m^3/s is 34.2% of the full-bore capacity of 1.26 m^3/s **OK!**

The proposed Pipe 1.3B is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 0.48 m^3/s is 38.2% of the full-bore capacity of 1.26 m^3/s **OK!**

The proposed Pipe 1.3B is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Full-bore capacity for Proposed Pipe 3.1.1 (Proposed Pipe 3.1.1 will be connected to Channel 3.1c with a backdrop manhole type 1):

Pipe Diameter	1350	mm
Pipe Roughness	3	mm
Length of Pipe	1.00	m
Upstream Invert	8.58	mPD
Downstream Invert	8.57	mPD
Hydraulic Gradient, Sf	0.008	
Gradient 1 in	130.000	
Full-bore capacity	4.16	m^3/s and velocity of 2.91 m/s

The future flow of 0.99 m^3/s is 23.7% of the full-bore capacity of 4.16 m^3/s **OK!**

The Proposed Pipe 3.1.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 1.25 m^3/s is 30.1% of the full-bore capacity of 4.16 m^3/s **OK!**

The Proposed Pipe 3.1.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 1.39 m^3/s is 33.5% of the full-bore capacity of 4.16 m^3/s **OK!**

The Proposed Pipe 3.1.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Full-bore capacity for Proposed Pipe 3.1.2 (Proposed Pipe 3.1.2 will be connected to Pipe 3.1.1 with a backdrop manhole type 2):

Pipe Diameter	1350	mm
Pipe Roughness	3	mm
Length of Pipe	5.70	m
Upstream Invert	6.77	mPD
Downstream Invert	6.72	mPD
Hydraulic Gradient, Sf	0.008	
Gradient 1 in	130.000	
Full-bore capacity	4.16	m^3/s and velocity of 2.91 m/s

The future flow of 0.99 m^3/s is 23.7% of the full-bore capacity of 4.16 m^3/s **OK!**

The proposed Pipe 3.1.2 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 1.25 m^3/s is 30.1% of the full-bore capacity of 4.16 m^3/s **OK!**

The proposed Pipe 3.1.2 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 1.39 m^3/s is 33.5% of the full-bore capacity of 4.16 m^3/s **OK!**

The proposed Pipe 3.1.2 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Full-bore capacity for Proposed Pipe 3.1.3 (Proposed Pipe 3.1.3 will be connected to Pipe 3.1.2 with a backdrop manhole type 2):

Pipe Diameter	1350	mm
Pipe Roughness	3	mm
Length of Pipe	5.70	m
Upstream Invert	4.83	mPD
Downstream Invert	4.79	mPD
Hydraulic Gradient, Sf	0.007	
Gradient 1 in	142.500	
Full-bore capacity	3.97	m^3/s and velocity of 2.77 m/s

The future flow of 0.99 m^3/s is 24.8% of the full-bore capacity of 3.97 m^3/s **OK!**

The proposed Pipe 3.1.3 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 1.25 m^3/s is 31.5% of the full-bore capacity of 3.97 m^3/s **OK!**

The proposed Pipe 3.1.3 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 1.39 m^3/s is 35.1% of the full-bore capacity of 3.97 m^3/s **OK!**

The proposed Pipe 3.1.3 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Ref.	Calculation

Full-bore capacity for Proposed Pipe 3.2.1 (Proposed Pipe 3.2.1 will be connected to Channel 3.2c with a backdrop manhole type 1):

Pipe Diameter	1350	mm
Pipe Roughness	3	mm
Length of Pipe	3.58	m
Upstream Invert	7.13	mPD
Downstream Invert	7.10	mPD
Hydraulic Gradient, Sf	0.008	
Gradient 1 in	123.000	
Full-bore capacity	4.28	m^3/s and velocity of 2.99 m/s

The future flow of 2.55 m^3/s is 59.7% of the full-bore capacity of 4.28 m^3/s **OK!**

The proposed Pipe 3.2.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 3.24 m^3/s is 75.8% of the full-bore capacity of 4.28 m^3/s **OK!**

The proposed Pipe 3.2.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 3.61 m^3/s is 84.4% of the full-bore capacity of 4.28 m^3/s **OK!**

The proposed Pipe 3.2.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Full-bore capacity for Proposed Pipe 3.2.2 (Proposed Pipe 3.2.2 will be connected to Pipe 3.2.1 with a backdrop manhole type 2):

Pipe Diameter	1350	mm
Pipe Roughness	3	mm
Length of Pipe	8.22	m
Upstream Invert	5.01	mPD
Downstream Invert	4.95	mPD
Hydraulic Gradient, Sf	0.007	
Gradient 1 in	149.455	
Full-bore capacity	3.88	m^3/s and velocity of 2.71 m/s

The future flow of 2.55 m^3/s is 65.8% of the full-bore capacity of 3.88 m^3/s **OK!**

The proposed Pipe 3.2.2 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 3.24 m^3/s is 83.5% of the full-bore capacity of 3.88 m^3/s **OK!**

The proposed Pipe 3.2.2 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 3.61 m^3/s is 93.0% of the full-bore capacity of 3.88 m^3/s **NOT OK!**

The proposed Pipe 3.2.2 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

Full-bore capacity for Proposed Pipe 3.3.1 (Proposed Pipe 3.3.1 will be connected to Channel 3.3c with a backdrop manhole type 1):

Pipe Diameter	1500	mm
Pipe Roughness	3	mm
Length of Pipe	7.64	m
Upstream Invert	4.57	mPD
Downstream Invert	4.52	mPD
Hydraulic Gradient, Sf	0.007	
Gradient 1 in	152.800	
Full-bore capacity	5.06	m^3/s and velocity of 2.86 m/s

The future flow of 3.02 m^3/s is 59.7% of the full-bore capacity of 5.06 m^3/s **OK!**

The proposed Pipe 3.3.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 3.84 m^3/s is 75.8% of the full-bore capacity of 5.06 m^3/s **OK!**

The proposed Pipe 3.3.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 4.27 m^3/s is 84.4% of the full-bore capacity of 5.06 m^3/s **OK!**

The proposed Pipe 3.3.1 is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

5. Conclusion

(1) The proposed open channels have sufficient capacity to collect the peak flow from catchments.
(2) The proposed pipes have sufficient capacity to collect the peak flow from proposed open channels to the proposed box culvert/ the existing stream course.

Appendix J - Backwater Effect on Proposed Associated Pipes

Part II

Aim: To calculate the backwater level from proposed box culvert to check whether the proposed Pipes are affected by back water effect

Manning Coefficient of the Concrete Pipe
0.016 SDM, Table 13

Refer to DIA Report for the catchment area of the concerned drainage system

$$Sf = \left(\frac{\bar{V}n}{R^{2/3}}\right)^2$$

Only pipes 3.1.3, 3.2.2 and 3.3.1 will likely be submerged under high flood return period. Thus, backwater effect is only provided for the identified pipes likely have backwater effect.
*Downstream water levels are the maximium water level extracted from the hydraulic model in Appendix H of this DIA Report or the normal flow depth of the pipe.

Water Level of Proposed Associated Pipes under 10A

Pipe	Flow Area (m^2)	Wetted Perimeter (m)	Length of Pipe (m)	Manning Coef.	Hydraulic Gradient	Water Depth (m)	Q (m^3/s)	Angle (˚)	Velocity (m/s)	US I.L. (mPD)	DS I.L. (mPD)	**US Water Level (mPD)**	**DS Water Level (mPD)**	Gradient of Pipe	Pipe Size (m)	**US Ground Level (mPD)**	**DS Ground Level (mPD)**	**US Freeboard (m)**	**DS Freeboard (m)**
Pipe 3.1.3	1.43	4.24	5.70	0.016	0.0005	1.36	0.99	360.00	0.7	4.83	4.79	**6.15**	**6.15**	0.0070	1.35	**11.39**	**9.00**	**5.24**	**2.86**
Pipe 3.2.2	0.92	2.42	8.22	0.016	0.0072	0.83	2.55	205.79	2.8	5.01	4.95	**5.84**	**5.78**	0.0073	1.35	**9.66**	**8.00**	**3.82**	**2.22**
Pipe 3.3.1	1.07	2.61	7.64	0.016	0.0066	0.88	3.02	199.58	2.8	4.57	4.52	**5.45**	**5.40**	0.0065	1.50	**7.50**	**7.50**	**2.05**	**2.10**

Water Level of Proposed Associated Pipes under 10B

Pipe	Flow Area (m^2)	Wetted Perimeter (m)	Length of Pipe (m)	Manning Coef.	Hydraulic Gradient	Water Depth (m)	Q (m^3/s)	Angle (˚)	Velocity (m/s)	US I.L. (mPD)	DS I.L. (mPD)	**US Water Level (mPD)**	**DS Water Level (mPD)**	Gradient of Pipe	Pipe Size (m)	**US Ground Level (mPD)**	**DS Ground Level (mPD)**	**US Freeboard (m)**	**DS Freeboard (m)**
Pipe 3.1.3	0.75	2.16	5.70	0.016	0.0008	0.70	0.66	183.74	0.9	4.83	4.79	**5.49**	**5.49**	0.0070	1.35	**11.39**	**9.00**	**5.90**	**3.51**
Pipe 3.2.2	0.68	2.06	8.22	0.016	0.0074	0.65	1.72	174.91	2.5	5.01	4.95	**5.66**	**5.60**	0.0073	1.35	**9.66**	**8.00**	**4.00**	**2.40**
Pipe 3.3.1	0.80	2.24	7.64	0.016	0.0066	0.69	2.04	171.47	2.5	4.57	4.52	**5.26**	**5.21**	0.0065	1.50	**7.50**	**7.50**	**2.24**	**2.29**

Water Level of Proposed Associated Pipes under 50A

Pipe	Flow Area (m^2)	Wetted Perimeter (m)	Length of Pipe (m)	Manning Coef.	Hydraulic Gradient	Water Depth (m)	Q (m^3/s)	Angle (˚)	Velocity (m/s)	US I.L. (mPD)	DS I.L. (mPD)	**US Water Level (mPD)**	**DS Water Level (mPD)**	Gradient of Pipe	Pipe Size (m)	**US Ground Level (mPD)**	**DS Ground Level (mPD)**	**US Freeboard (m)**	**DS Freeboard (m)**
Pipe 3.1.3	1.43	4.24	5.70	0.016	0.0008	2.18	1.25	360.00	0.9	4.83	4.79	**6.97**	**6.97**	0.0070	1.35	**11.39**	**9.00**	**4.42**	**2.03**
Pipe 3.2.2	1.28	3.13	8.22	0.016	0.0054	1.13	3.24	265.46	2.5	5.01	4.95	**6.13**	**6.08**	0.0073	1.35	**9.66**	**8.00**	**3.53**	**1.92**
Pipe 3.3.1	1.66	3.70	7.64	0.016	0.0040	1.34	3.84	282.77	2.3	4.57	4.52	**5.89**	**5.86**	0.0065	1.50	**7.50**	**7.50**	**1.61**	**1.64**

Water Level of Proposed Associated Pipes under 50B

Pipe	Flow Area (m^2)	Wetted Perimeter (m)	Length of Pipe (m)	Manning Coef.	Hydraulic Gradient	Water Depth (m)	Q (m^3/s)	Angle (˚)	Velocity (m/s)	US I.L. (mPD)	DS I.L. (mPD)	**US Water Level (mPD)**	**DS Water Level (mPD)**	Gradient of Pipe	Pipe Size (m)	**US Ground Level (mPD)**	**DS Ground Level (mPD)**	**US Freeboard (m)**	**DS Freeboard (m)**
Pipe 3.1.3	1.43	4.24	5.70	0.016	0.0005	2.14	0.99	360.00	0.7	4.83	4.79	**6.93**	**6.93**	0.0070	1.35	**11.39**	**9.00**	**4.46**	**2.07**
Pipe 3.2.2	1.43	4.24	8.22	0.016	0.0035	1.41	2.55	360.00	1.8	5.01	4.95	**6.39**	**6.36**	0.0073	1.35	**9.66**	**8.00**	**3.27**	**1.64**
Pipe 3.3.1	1.77	4.71	7.64	0.016	0.0028	1.66	3.02	360.00	1.7	4.57	4.52	**6.20**	**6.18**	0.0065	1.50	**7.50**	**7.50**	**1.30**	**1.32**

Water Level of Proposed Associated Pipes under 200A

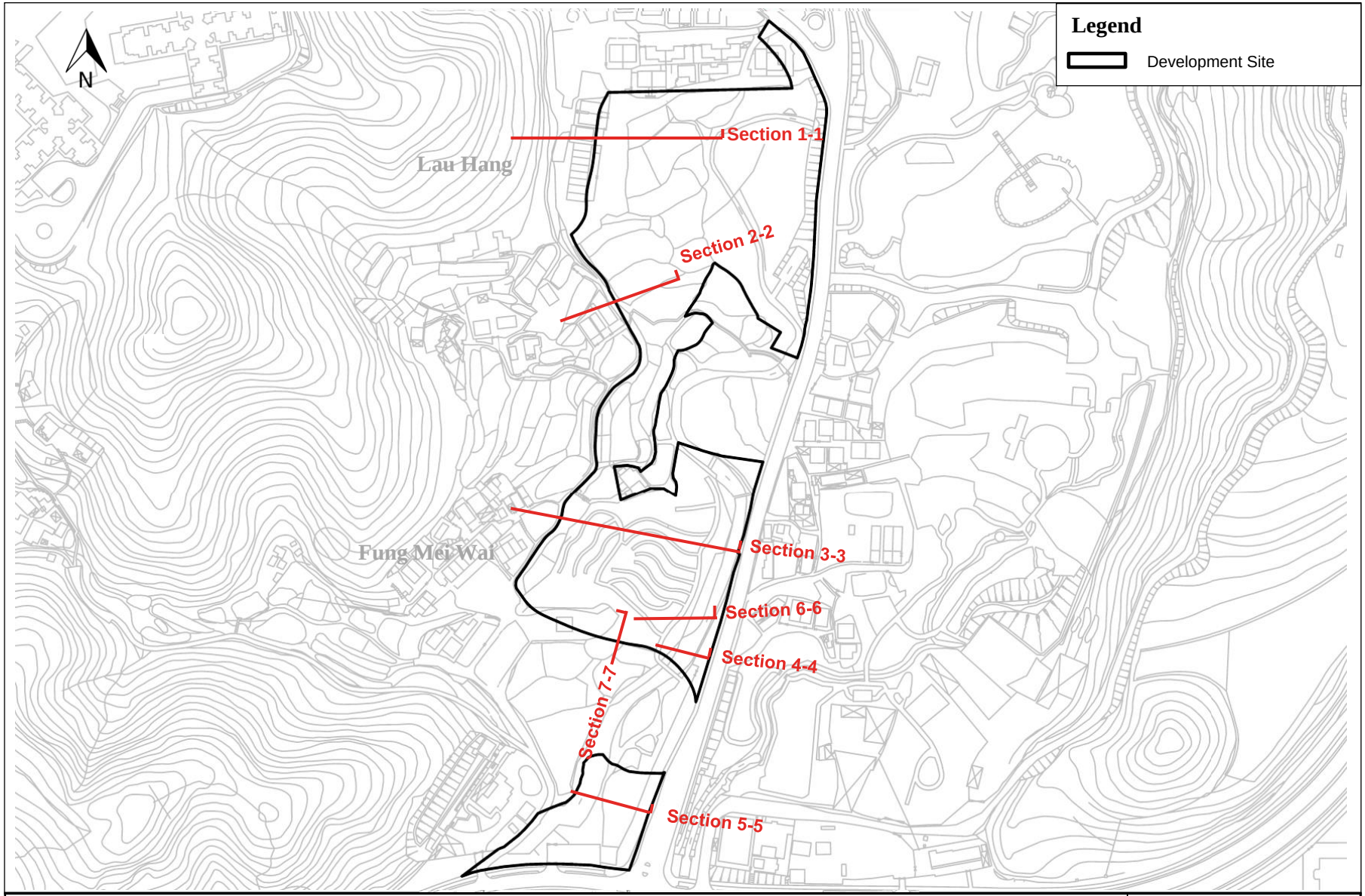
Pipe	Flow Area (m^2)	Wetted Perimeter (m)	Length of Pipe (m)	Manning Coef.	Hydraulic Gradient	Water Depth (m)	Q (m^3/s)	Angle (˚)	Velocity (m/s)	US I.L. (mPD)	DS I.L. (mPD)	**US Water Level (mPD)**	**DS Water Level (mPD)**	Gradient of Pipe	Pipe Size (m)	**US Ground Level (mPD)**	**DS Ground Level (mPD)**	**US Freeboard (m)**	**DS Freeboard (m)**
Pipe 3.1.3	1.43	4.24	5.70	0.016	0.0010	2.57	1.39	360.00	1.0	4.83	4.79	**7.37**	**7.36**	0.0070	1.35	**11.39**	**9.00**	**4.02**	**1.64**
Pipe 3.2.2	1.43	4.24	8.22	0.016	0.0069	1.51	3.61	360.00	2.5	5.01	4.95	**6.52**	**6.46**	0.0073	1.35	**9.66**	**8.00**	**3.14**	**1.54**
Pipe 3.3.1	1.77	4.71	7.64	0.016	0.0055	1.60	4.27	360.00	2.4	4.57	4.52	**6.21**	**6.17**	0.0065	1.50	**7.50**	**7.50**	**1.29**	**1.33**

Water Level of Proposed Associated Pipes under 200B

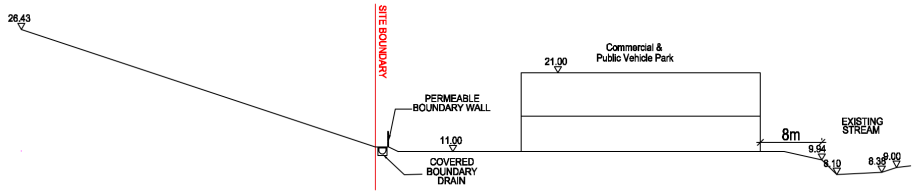
Pipe	Flow Area (m^2)	Wetted Perimeter (m)	Length of Pipe (m)	Manning Coef.	Hydraulic Gradient	Water Depth (m)	Q (m^3/s)	Angle (˚)	Velocity (m/s)	US I.L. (mPD)	DS I.L. (mPD)	**US Water Level (mPD)**	**DS Water Level (mPD)**	Gradient of Pipe	Pipe Size (m)	**US Ground Level (mPD)**	**DS Ground Level (mPD)**	**US Freeboard (m)**	**DS Freeboard (m)**
Pipe 3.1.3	1.43	4.24	5.70	0.016	0.0005	2.98	0.99	360.00	0.7	4.83	4.79	**7.77**	**7.77**	0.0070	1.35	**11.39**	**9.00**	**3.62**	**1.24**
Pipe 3.2.2	1.43	4.24	8.22	0.016	0.0035	2.27	2.55	360.00	1.8	5.01	4.95	**7.25**	**7.22**	0.0073	1.35	**9.66**	**8.00**	**2.41**	**0.78**
Pipe 3.3.1	1.77	4.71	7.64	0.016	0.0028	2.53	3.02	360.00	1.7	4.57	4.52	**7.07**	**7.05**	0.0065	1.50	**7.50**	**7.50**	**0.43**	**0.45**

Appendix K

Sectional Views of Proposed Mitigation Measures



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views of Proposed Mitigation Measures**	**Appendix K**
Date Sep 2025	**Scale** N.T.S.	**File**



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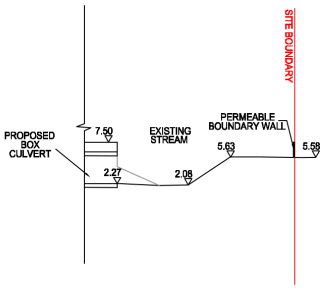
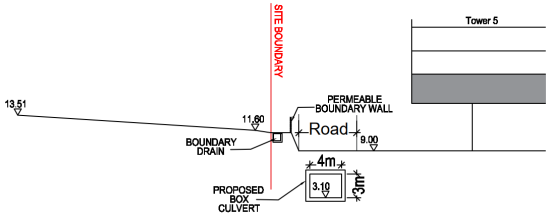


SECTION 4 - 4



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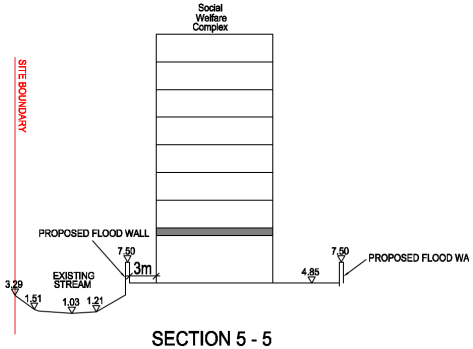

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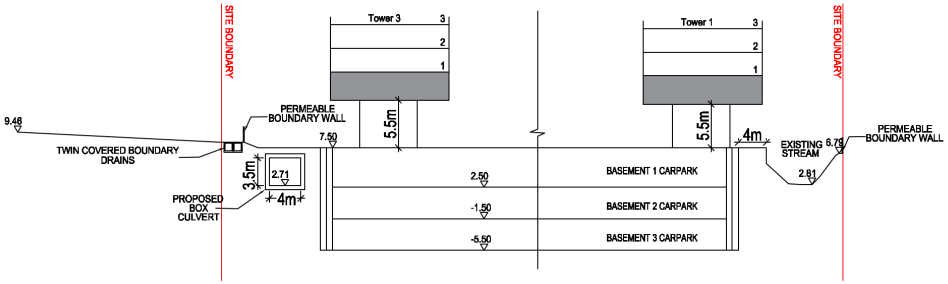

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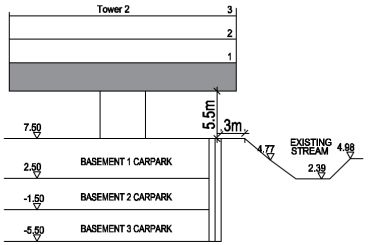
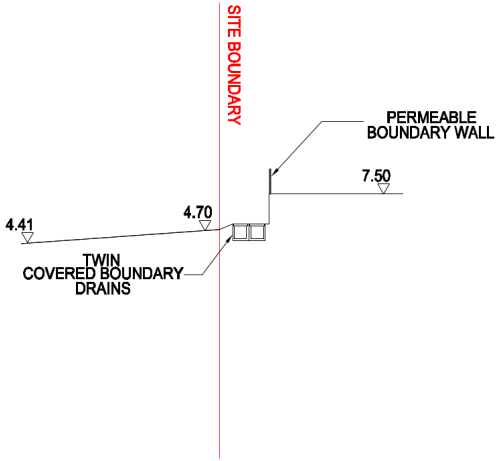


SCETION 6 - 6

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views of Proposed Mitigation Measures**	**Appendix K**
Date Sep 2025	**Scale** N.T.S.	**File**



SECTION 7 - 7

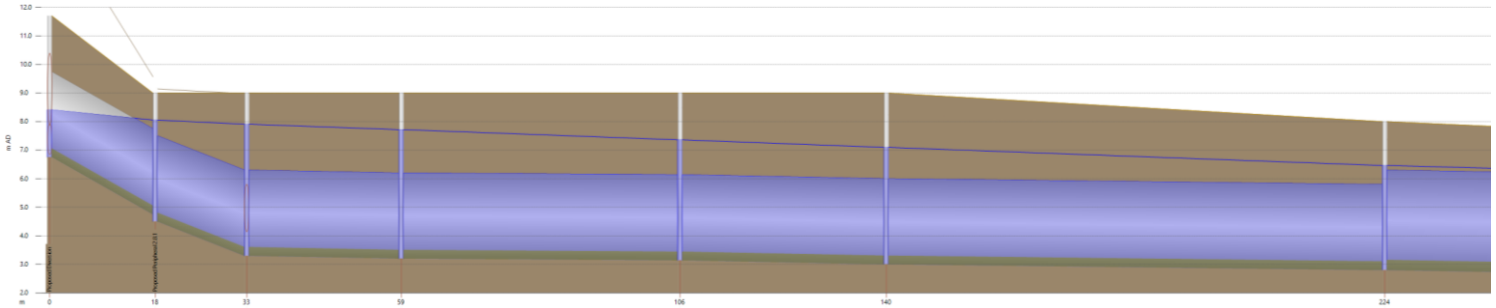
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Sectional Views of Proposed Mitigation Measures**	**Appendix K**
Date Sep 2025	**Scale** N.T.S.	**File**

Appendix L

Hydraulic Profile of the Proposed Box Culvert at 200-year Flood Event

200A

Proposed Box Culvert

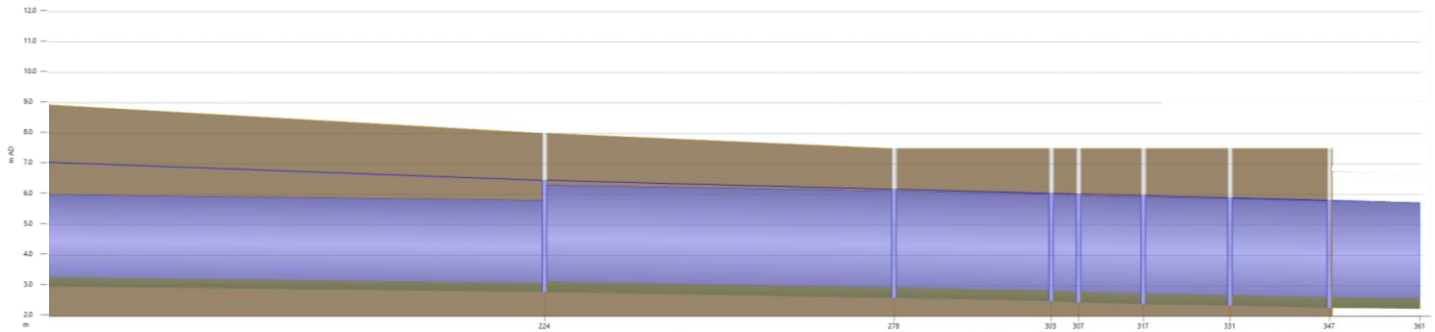


Link	Proposed Diversion2	Proposed Peripheral 2.8.1.2	Proposed box culvert2	Proposed B.C. 2.1	Proposed B.C. 3.1	Proposed B.C. 4.1
Shape ID	RECT	RECT	RECT	RECT	RECT	RECT
width (mm)	4000	4000	4000	4000	4000	4000
height (mm)	3000	3000	3000	3000	3000	3000
us inv (m AD)	6.750	4.500	3.300	3.200	3.140	3.000
ds inv (m AD)	4.750	3.300	3.200	3.140	3.000	2.800
US flow (m3/s)	51.99915	52.19127	52.78783	53.64322	53.78545	53.78214
US velocity (m/s)	12.024	6.143	4.647	4.726	4.750	4.754
DS flow (m3/s)	51.99390	52.19112	52.78764	53.64170	53.78465	53.78112
DS velocity (m/s)	5.816	4.594	4.650	4.737	4.755	4.771

Node	Proposed Diversion	Proposed Peripheral 2.8.1	Proposed box culvert	Proposed B.C. 2	Proposed B.C. 3	Proposed B.C. 4	Proposed Peripheral 2.1
ground (m AD)	11.700	9.000	9.000	9.000	9.000	9.000	8.000
level (m AD)	8.411	8.054	7.909	7.717	7.361	7.097	6.462
flood dep (m)	-3.289	-0.946	-1.091	-1.283	-1.639	-1.903	-1.538

Proposed Box Culvert

Existing Stream Course



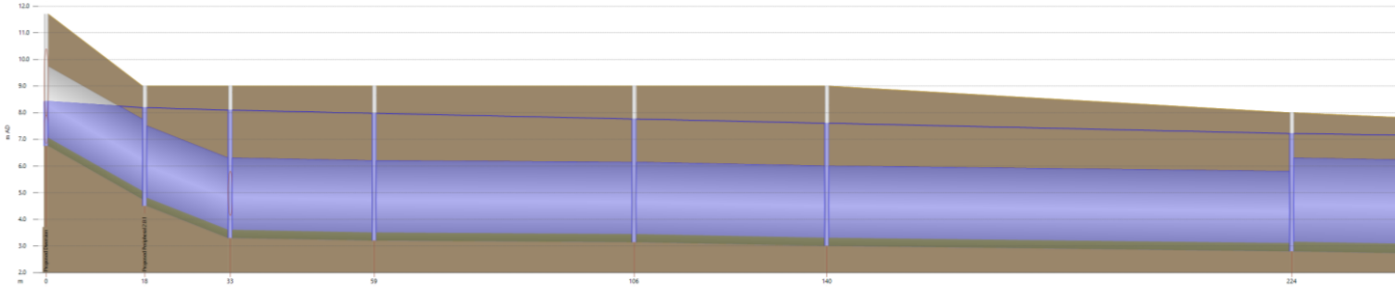
Link	Proposed B.C. 4.1	Proposed Peripheral 2.1.2	Proposed Peripheral 1.6.1	-	-	Proposed Peripheral 1.3.1	Proposed Peripheral 1.4.1	Proposed Peripheral 1.5.1
Shape ID	RECT	RECT	RECT	RECT	RECT	RECT	RECT	RECT
width (mm)	4000	4000	4000	4000	4000	4000	4000	4000
height (mm)	3000	3500	3500	3500	3500	3500	3500	3500
us inv (m AD)	3.000	2.600	2.600	2.500	2.500	2.400	2.350	2.280
ds inv (m AD)	2.800	2.600	2.500	2.450	2.400	2.350	2.280	2.250
US flow (m3/s)	53.78214	55.54281	56.79896	-	56.74767	56.72872	56.70670	56.68317
US velocity (m/s)	4.754	4.680	4.871	4.893	4.846	4.839	4.860	4.861
DS flow (m3/s)	53.78112	55.45110	56.76567	-	56.73458	56.71214	56.68844	56.66690
DS velocity (m/s)	4.771	4.749	4.894	4.546	4.839	4.861	4.862	4.927

Node	Proposed Peripheral 2.1	Proposed Peripheral 1.6	Proposed Peripheral 1.2	Proposed Peripheral 1.7	Proposed Peripheral 1.3	Proposed Peripheral 1.4	Proposed Peripheral 1.5	Newbreak6
ground (m AD)	8.000	7.500	7.500	7.500	7.500	7.500	7.500	
level (m AD)	6.462	6.171	6.041	6.015	5.962	5.889	5.807	5.719
flood dep (m)	-1.538	-1.329	-1.459	-1.485	-1.538	-1.611	-1.693	5.719

Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Hydraulic Profile of the Proposed Box Culvert at 200-year Flood Event**	**Appendix L**
Date Sep 2025	**Scale** N.T.S.	**File**

200B

Proposed Box Culvert

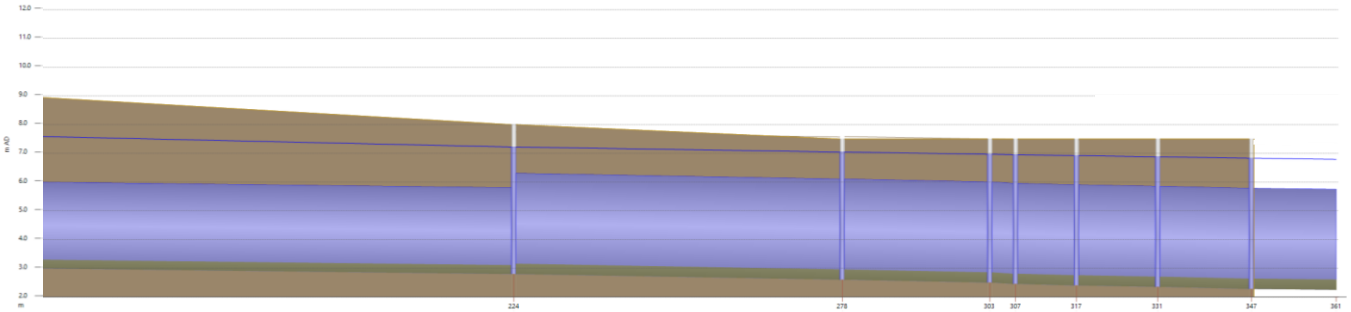


Link	Proposed Diversion.2	Proposed Peripheral 2.8.1.2	Proposed box culvert.2	Proposed B.C. 2.1	Proposed B.C. 3.1	Proposed B.C. 4.1
Shape ID	RECT	RECT	RECT	RECT	RECT	RECT
width (mm)	4000	4000	4000	4000	4000	4000
height (mm)	3000	3000	3000	3000	3000	3000
us inv (m AD)	6.750	4.500	3.300	3.200	3.140	3.000
ds inv (m AD)	4.750	3.300	3.200	3.140	3.000	2.800
US flow (m3/s)	40.44573	40.57369	41.05381	41.54808	41.63580	41.64717
US velocity (m/s)	8.340	3.597	3.608	3.652	3.664	3.666
DS flow (m3/s)	40.44756	40.57379	41.05451	41.54832	41.63656	41.64723
DS velocity (m/s)	3.593	3.596	3.609	3.657	3.665	3.672

Node	Proposed Diversion	Proposed Peripheral 2.8.1	Proposed box culvert	Proposed B.C. 2	Proposed B.C. 3	Proposed B.C. 4	Proposed Peripheral 2.1
ground (m AD)	11.700	9.000	9.000	9.000	9.000	9.000	8.000
level (m AD)	5.421	8.191	8.096	7.979	7.765	7.606	7.220
flood dep (m)	-3.279	-0.809	-0.904	-1.021	-1.235	-1.394	-0.780

Proposed Box Culvert

Existing Stream Course



Link	Proposed B.C. 4.1	Proposed Peripheral 2.1.2	Proposed Peripheral 1.6.1	-	-	Proposed Peripheral 1.3.1	Proposed Peripheral 1.4.1	Proposed Peripheral 1.5.1
Shape ID	RECT	RECT	RECT	RECT	RECT	RECT	RECT	RECT
width (mm)	4000	4000	4000	4000	4000	4000	4000	4000
height (mm)	3000	3500	3500	3500	3500	3500	3500	3500
us inv (m AD)	3.000	2.800	2.600	2.500	2.450	2.400	2.350	2.280
ds inv (m AD)	2.800	2.600	2.500	2.450	2.400	2.350	2.280	2.250
US flow (m3/s)	41.64717	42.44046	43.01584	-	43.09551	43.13798	43.19688	43.26062
US velocity (m/s)	3.666	3.223	3.266	3.269	3.271	3.274	3.278	3.282
DS flow (m3/s)	41.64723	42.44762	43.01936	-	43.09753	43.14123	43.20135	43.26699
DS velocity (m/s)	3.672	3.223	3.266	3.268	3.271	3.274	3.278	3.284

Node	Proposed Peripheral 2.1	Proposed Peripheral 1.6	Proposed Peripheral 1.2	Proposed Peripheral 1.7	Proposed Peripheral 1.3	Proposed Peripheral 1.4	Proposed Peripheral 1.5	Newbreak6
ground (m AD)	8.000	7.500	7.500	7.500	7.500	7.500	7.500	
level (m AD)	7.220	7.046	6.968	6.952	6.920	6.878	6.833	6.790
flood dep (m)	-0.780	-0.454	-0.532	-0.548	-0.580	-0.622	-0.667	6.790

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Date Sep 2025	**Scale** N.T.S.	**File**

Appendix L1

Hydraulic Calculation for Area (B) Proposed Drainage System

Appendix L1 - Hydraulic Calculation for Area (B) Proposed Drainage System

Ref.	Calculation

Objective Determine the runoff of Area (B) that will be collected by the internal drain.

Methodology
1. Determine the runoff from subcatchments by extracting from the results of hydraulic model
2. Use the Colebrook-White Equation to determine the drainage capacity and check against the design flow

3. According to the Stormwater Drainage Manual (SDM), the design return period of drainage system for village zone is 10-year. To prevent flooding in the nearby village area, this hydraulic check will also be checked for the design return periods of 50-year and 200-year.

1. Runoff from Nearby Catchments Extracted from the Hydraulic Model

Refer to Appendix C2 for the catchment plan for proposed condition.
Runoff is extracted from hydraulic model as attached in Appendix H of this DIA Report.

		Runoff from rainfall event (m^3/s)				
Sub Catchment ID	**Total Catchment Areas(m^2)**	**2-year**	**10-year**	**50-year**	**200-year**	**Collected By Proposed Drainage System**
Catchment_SWC	1,122	0.060	0.078	0.091	0.098	100% runoff will be collected by internal drain, thus discharged to the existing stream course.

2. Determine the Size of the Proposed Pipes

Newly proposed pipes will be proposed to discharge the surface runoff collected from Area (B) to the existing stream course.

$$V = -\sqrt{32gRSf}\log\left[\frac{ks}{14.8R} + \frac{1.255\nu}{R\sqrt{32gRSf}}\right]$$

Use the Colebrook-White Equation to Determine the Drainage Capacity

Assumptions:
1. Pipe Roughness is 3.00 mm
2. Transitional flow and water at 15 degree Celsius, i.e. kinematic viscosity is 1.14 x 10-6 m2/s.

Full-bore capacity for Proposed Pipe:

Pipe Diameter	450	mm
Pipe Roughness	3	mm
Length of Pipe	10	m
Upstream Invert	2.69	mPD
Downstream Invert	2.65	mPD
Hydraulic Gradient, Sf	0.004	
Gradient 1 in	250	
Full-bore capacity	0.16	m^3/s and velocity of 1.03 m/s

The future flow of 0.078 m^3/s is 47.6% of the full-bore capacity of 0.16 m^3/s **OK!**

The proposed Pipe is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 10 years storm event.

The future flow of 0.091 m^3/s is 55.7% of the full-bore capacity of 0.16 m^3/s **OK!**

The proposed Pipe is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 50 years storm event.

The future flow of 0.098 m^3/s is 59.7% of the full-bore capacity of 0.16 m^3/s **OK!**

The proposed Pipe is capable of conveying the future flow while maintaining 10% flow capacity allowance for siltation under 1 in 200 years storm event.

3. Conclusion
(1) The proposed pipe has sufficient capacity to collect the peak flow from Area (B) to the existing stream course.

Appendix M

Conceptual Interim Drainage Arrangement for Construction Phases

1 Background

1.1.1 To minimise flood risk in association with the construction phase of the proposed Development, a conceptual interim drainage arrangement for construction stage including site formation stage and phasing of works for the proposed development and to support the S12A Planning Application stage has been formulated. All the information in this appendix, including but not limit to phasing of works and time of works, is tentative and subject to further update, if necessary, based on the future detailed design and Contractor actual construction arrangement for the final development layout.

1.1.2 The proposed Development will include the residential development with retail and public vehicle park facilities in Area (A) Phase I; residential development in Area (A) Phase II; and a Social Welfare Complex (SWC) consisting of a 150-place Residential Care Home for the Elderly ("RCHE") and a 30-place Day Care Unit ("DCU") for the Elderly in Area (B).

1.1.3 This appendix will demonstrate that the flow path of the neighbouring areas to the existing stream course has been properly maintained, with the provision of the proposed interim drainage system, during construction stage.

2 Construction Sequence and Design Criteria and Parameters for Interim Drainage

2.1 Approach

2.1.1 As discussed above, there are three main areas of the proposed development, including the residential development with retail and public vehicle park facilities in Area (A) Phase I, residential development in Area (A) Phase II and a Social Welfare Complex (SWC) in Area (B). In view of that the existing stream course is passing through the developments of Area (A) Phase I and Area (A) Phase II, the phasing of construction of the proposed development are thoughtfully considered to avoid causing any adverse impacts to the existing stream course and the nearby villages. For Area (B), the works of SWC does not touch on the existing stream course, therefore, no diversion works for Area (B) development are required and no adverse impacts on flow path to nearby area are anticipated with provision of proper site drainage during construction.

2.1.2 This appendix will discuss the interim drainage arrangement for maintaining the flow path of the neighbouring areas to the existing stream course during construction. Since the developments of Area (A) Phase I and Area (A) Phase II will be developed separately with a time lag of about 1 year. In order to maintain the flow path of nearby areas and minimise the impact to existing stream course, before major construction activities to be carried out on site, for the development of Area (A) Phase I that will be implemented earlier, surface channels as proposed under the DIA as shown in **Annex 2** will be provided along the west site boundary for collecting runoff of the neighbouring areas back to the existing stream course. This set of surface channels will be used for both construction stage and subsequent implementation stage. For the development of Area (A) Phase II that will be implemented later, a set of interim drainage in form of two surface channels will be provided during construction. For Area (B), an interim drainage in form of a surface channel as shown in **Annex 2** will be provided for collecting surroundings runoff to the existing stream course during the construction stage. Also, the construction activities that will affect/ in close vicinity of the existing stream course are carefully scheduled and will be constructed in dry seasons. The detailed construction sequences are discussed in **Table 2.1** below and illustrated in **Annex 1**.

2.1.3 Since the DIA has demonstrated that the permanent boundary channels for the development of Area (A) Phase I have sufficient capacity for serving the surrounding areas, hydraulic check for the surface channels is not required for this appendix. To demonstrate that sufficient capacity of interim drainage for the developments of Area (A) Phase II and Area (B) will be provided during construction, hydraulic calculation will be provided on the proposed interim drainages along the site boundary of the developments of Area (A) Phase II and Area (B) during construction. The assessment criteria and design parameters for the interim drainages are discussed in **Section 2.3** below.

2.2 Construction Sequence

2.2.1 A tentative construction sequence for the proposed works in the developments of Area (A) Phase I, Area (A) Phase II and Area (B) is summarised in **Table 2.1**. The works in

the developments of Area (A) Phase I and Area (B) are anticipated to be completed by the mid of 2029 while the works in the development of Area (A) Phase II are anticipated to commence 1 year later and will be completed in late 2030. An overview of the drainage facilities in the development of Area (A) Phase I, Area (A) Phase II and Area (B) upon the completion of works are presented in Figure 5 of **Annex 1**.

Table 2.1: Tentative construction sequence of proposed works in the developments of Area (A) Phase I, Area (A) Phase II and Area (B)

Phase	Tentative Construction Period	Major Construction Works	Remark(s)
Stage 1 **(Figure 1 of Annex 1)**	Q4 2026 to Q1 2027 (Wet season & Dry season)	**Area (A) Phase I and Area (B):-** • Site preparation; • Site investigation works; • Site clearance and set up; • Construction of vehicular bridge access to the site in Area (A) Phase I (carried within dry season, i.e. Dec 2026 to Mar 2027); • Construction of surface drainage channels along site boundary in Area (A) Phase I; • Construction of interim drainage along site boundary in Area (B); and • Demolition of unused footbridges in Area (A) Phase I (Structures B, C, D and E) at east and south of site (carried out within dry season, i.e. Dec 2026 to Mar 2027).	• Prefabricated single span bridge will be used to decked over the existing stream course; and lifting and erection of the bridge will be carried out during dry season; • Surface drainage channels along site boundary in Area (A) Phase I and interim drainage in Area (B) in form of concrete channels will be constructed from downstream to upstream for early usage of completed section of surface drainage channels / interim channels; • Overland flow from the nearby area/ flow from the works area will be pumped to the existing stream course; • Site runoff will be collected by site drainage which will be designed in accordance with DSD Technical Circular No. 1/2017 and ProPECC PN 1/94 “Environmental Protection Department Practice Note for Profession Persons”, desilting facilities such as silt trap will be provided to remove sand/silt particles from runoff prior to discharge according to ProPECC PN 1/94, and the discharge location(s) will be agreed by the relevant departments such as EPD and HAD; and • The existing stream course will be maintained as prefabricated bridge has been used for the access and there the flow of existing stream course will be kept.
Stage 2 **(Figure 2 of Annex 1)**	Q2 2027 to Q1 2028 (Wet seasons & Dry seasons)	**Area (A) Phase I and Area (B):-** • Excavation; • Piling works; • Construction of basement; • Site formation works and general underground works; and • Construction of partial permanent box culvert in Area (A) Phase I. **Area (A) Phase II:-** • Site preparation; • Site investigation works; • Site clearance and set up; and • Construction of interim drainage along site boundary in Area (A) Phase II.	• Flow of the existing stream course will be kept as it is, except for the works of Stage 2A; • Overland flow from the nearby area will be intercepted by the surface drainage channels / interim drainage; • Runoff from works area will be pumped and discharged to the existing stream course; • Site runoff will be collected by site drainage which will be designed in accordance with DSD Technical Circular No. 1/2017 and ProPECC PN 1/94, desilting facilities such as silt trap will be provided to remove sand/silt particles from runoff prior to discharge according to ProPECC PN 1/94, and the discharge location(s) will be agreed by the relevant departments such as EPD and HAD.
Stage 2A **(Figure 2A of Annex 1)**	Nov 2027 to Mar 2028 (Dry season)	• Construction of permanent box culvert outlet for connecting to the existing stream course in Area (A) Phase I.	• Surface drainage channels / interim drainage will be same as Stage 2; and • Flow of the existing stream course will be kept as practicable as possible, local pumping will be deployed to pump the dry weather flow of the existing stream course at the box culvert outlet section to downstream, if required.
Stage 3 **(Figure 3 of Annex 1)**	Q2 2028 to Q2 2029 (Wet seasons & Dry seasons)	**Area (A) Phase I and Area (B):-** • Superstructure construction; • E&M installation; and • Interior fitting works. **Area (A) Phase II:-** • Excavation; • Piling works; and • Site formation works and general underground works.	• Flow of the existing stream course will be kept as it is, except for works under Stage 3A.2; • Overland flow from the nearby area will be intercepted by the surface drainage channels / interim drainage; • Runoff from works area will be pumped and discharged to the existing stream course; • Site runoff will be collected by site drainage which will be designed in accordance with DSD Technical Circular No. 1/2017 and ProPECC PN 1/94, desilting facilities such as silt trap will be provided to remove sand/silt particles from runoff prior to discharge according to ProPECC PN 1/94, and the discharge location(s) will be agreed by the relevant departments such as EPD and HAD.
Stage 3A **(Figure 3A.1 & 3A.2 of Annex 1)**	Nov 2028 to Mar 2029 (Dry season)	<u>Stage 3A.1</u> • Construction of the permanent 1650mm pipe which connect the upper section of the existing stream course to the permanent box culvert in Area (A) Phase I; and • Construction of the permanent flood wall in Area (B).	• Flow from the upper section of the existing stream course will be intercepted to the permanent box culvert after the construction of the permanent box culvert and permanent 1650mm pipe (See Figure 3A.1); • Pumping will be provided to divert the dry season flow from the existing 3.6m x 2.5m box culvert at Fung Yuen Road to the existing stream course; • Flow from existing 3.6m x 2.5m box culvert at Fung Yuen Road will be conveyed to the permanent box culvert and the permanent 1050mm pipe after the completion of works (See Figure 3A.2); • The lower section of the existing stream course will be maintained;

Phase	Tentative Construction Period	Major Construction Works	Remark(s)
		Stage 3A.2 • Construction of the section of permanent box culvert in Area (A) Phase I for connecting to the existing 3.6m x 2.5m box culvert at Fung Yuen Road; • Construction of the permanent 1050mm pipe in Area (A) Phase I for connecting the existing 3.6m x 2.5m box culvert to the existing stream course; • Construction of the permanent channel and associated pipes in Area (A) Phase I for connecting to permanent drainages; and • Construction of the permanent flood wall in Area (B)	• Overland flow from the nearby area will be intercepted by the surface drainage channels / interim drainage, if necessary, pumping will be used to discharge dry season runoff from nearby areas to downstream completed drainage; • Runoff from works area will be pumped and discharged to the existing stream course/ downstream completed box culvert; • Site runoff will be collected by site drainage which will be designed in accordance with DSD Technical Circular No. 1/2017 and ProPECC PN 1/94, desilting facilities such as silt trap will be provided to remove sand/silt particles from runoff prior to discharge according to ProPECC PN 1/94, and the discharge location(s) will be agreed by the relevant departments such as EPD and HAD.
Stage 4 **(Figure 4 of Annex 1)**	Q3 2029 to Q4 2030 (Dry seasons & Wet Seasons)	**Area (A) Phase I and Area (B):-** • Works completed **Area (A) Phase II:-** • Superstructure construction; • E&M installation; and • Interior fitting works.	• Proposed permanent drainage in Area (A) Phase I and Area (B) in use; • Interim drainage for Area (A) Phase II will be same as Stage 3; • Overland flow from the nearby area will be intercepted by the interim drainage; • Runoff from works area will be pumped and discharged to the existing stream course; • Site runoff will be collected by site drainage which will be designed in accordance with DSD Technical Circular No. 1/2017 and ProPECC PN 1/94, desilting facilities such as silt trap will be provided to remove sand/silt particles from runoff prior to discharge according to ProPECC PN 1/94, and the discharge location(s) will be agreed by the relevant departments such as EPD and HAD.

2.3 Assessment Criteria

2.3.1 As discussed above, as the DIA has demonstrated that the permanent boundary channels for the development of Area (A) Phase I will have sufficient capacity for serving the surrounding areas, hydraulic check for the surface channels during construction stage for Area (A) is not repeated. For interim drainage in the developments of Area (A) Phase II and Area (B), the assessment criteria are based on the recommendations set out in the Stormwater Drainage Manual (SDM) – 5th Edition issued by DSD and SDM Corrigenda No. 1 /2024 and 2/2024. Since the construction of proposed development is tentatively carried out by stages between 2026 and 2030, and the neighbouring areas are mainly villages and agricultural lands, a 1 in 10 years rainfall return period that is adequate for protecting village areas has been adopted in the design and assessment of interim drainage system during the construction stage of the proposed development.

Design Modification due to Climate Change

2.3.2 As the proposed interim drainage system will be used for a few years (from 2026 to 2030), design for climate change is considered not necessary.

Design Runoff from Catchments for Interim Drainage

2.3.3 The runoffs of neighbouring catchments used for hydraulic check for the interim drainage system are extracted from the hydraulic model as attached in **Appendix H** of the DIA. Since the effect of climate change in End of 21st Century (i.e. Rainfall Increase: +16% + Design Allowance: +12.1% = +28.1%) has been considered in the hydraulic model in **Appendix H**, the peak runoff results extracted from the hydraulic model will be adjusted to determine the runoff without considering climate change effect. The following equation will be used to calculate the peak runoffs from catchments without considering climate change effect: -

$$Q2 = Q1/(1 + 28.1\%)$$

Q2 = Peak Runoff from 10 years rainfall event without considering climate change effect
*Q1 = Peak Runoff from 10 years rainfall event with considering climate change effect extracted from hydraulic model in **Appendix H***

2.3.4 The peak runoffs from nearby catchment under 10 years rainfall event with and without climate change effect are tabulated in **Table 2.2** and can be referred to **Annex 3**.

Table 2.2: Peak Runoffs from nearby catchment under 10 years rainfall event with and without Climate Change effect

Sub Catchment ID	Peak Runoff from rainfall event (m^3/s)	
	Considering Climate Change (Extracted from Hydraulic Model in Appendix H)	Without considering Climate Change
Catchment_SWC	0.0779	0.0608
Catchment_929A_P01 B -1	0.4049	0.3161
Catchment_Gov	0.3400	0.2654

Roughness

2.3.5 For proposed interim drainage system, manning's coefficient of roughness of 0.016 has been adopted for the proposed interim open channel.

3 Existing Drainage System

3.1 Existing Drainage System

3.1.1 The surface runoff from the existing catchments of the Development Site is currently discharged to a stream course passing through the Site that runs from the natural hillside area at the north of the Site up to the urbanized area at the south. Location of the stream course refers to **Appendix B1** of the DIA.

3.1.2 According to the topography, the runoff from the neighbouring areas, including Lau Hang (at about 11mPD to 15mPD) and Fung Mei Wai (at about 7mPD or above except some areas at South of Fung Mei Wai where the ground levels are ranged from a range of about 6mPD to 10mPD), is currently discharged to the existing stream course by overland flow. Under the existing condition, the Site currently serves as a flow path for collecting runoff from nearby villages to downstream of the stream.

3.2 Hydraulic Performance of Existing Drainage System

3.2.1 In accordance with the findings of DIA, the hydraulic performance of the existing stream course passing through the Site, in general, will flood even under 10 years flood return period.

4 Proposed Interim Drainage Arrangement During Construction

4.1 Proposed Interim Drainage Arrangement

4.1.1 During construction, the site runoff will be collected by site drainage which will be designed in accordance with DSD Technical Circular no. 1/2017 and ProPECC PN 1/94 "Environmental Protection Department Practice Note for Profession Persons" and will be pumped to the existing stream course for discharge. Desilting facilities such as sand traps, as per ProPECC PN 1/94 will be provided to remove the debris and sediment prior to discharging to stream course.

4.1.2 As discussed in **Section 2** and **Table 2.1**, the construction period for the proposed development is a few years, to maintain the flow path of nearby areas mainly for villages and agriculture use near the Site, surface drainage channels, as per permanent boundary drains of the proposed Development, will be provided for the development of Area (A) Phase I and interim drainage with discharge capacity for 10 years rainfall will be constructed for the developments of Area (A) Phase II and Area (B) at the beginning of construction stage for each area and will be provided throughout the construction stage. The construction of permanent boundary drainage channels in Area (A) Phase 1 should be completed in construction stage (Stage 1) before commencement of development works in the site. The proposed drainage for construction stage is shown in **Annex 2**.

4.1.3 On-site inspection will be carried out in the future detailed design and construction stage to verify all existing drainage pipes/ channels and ensure all existing drainage pipes/ channels are to be reconnected to the proposed/existing drainage system, as well as the existing flow paths will not be obstructed by the proposed works under the development. The existing runoff toward the existing drainage system on the site will be intercepted and redirected to the proposed/existing drainage system.

4.1.4 Also, to minimise impacts to the existing stream course, the following construction activities that will affect the existing stream course will be scheduled to be carried out in dry seasons only, these activities, with details given in **Section 4.3**, include: -

- Stage 1 – demolition of existing unused footbridges and construction of vehicular bridge access by prefabricated techniques;
- Stage 2A - construction of permanent box culvert outlet for connecting to stream course; and
- Stage 3A - construction of permanent 1650mm pipe for collecting the upstream stream course to the proposed box culvert, and the construction of new box culvert connection and permanent 1050mm pipe to the existing box culvert as well as construction of permanent channel and associated pipes for connecting to new box culvert.

4.2 Drainage Impact During Construction

4.2.1 According to **Section 3**, the Development Site is currently acting as a flow path for collecting runoff from nearby villages to the existing stream course via overland flow. In order to ensure the runoff from the nearby villages and agriculture lands are properly

conveyed to the existing stream course during the construction, surface drainage channels and interim drainage shown in **Annex 2** will be provided on the site boundary of the developments of Area (A) Phase I, Area (A) Phase II and Area (B) respectively to intercept the runoff from the nearby catchments.

4.2.2 Since the surface drainage channels for the development of Area (A) Phase I during construction stage will have arrangement same as the permanent boundary channels of the proposed Development, the surface channels will have adequate capacity to serve the surrounding areas. For the developments of Area (A) Phase II and Area (B), as the construction of the proposed development is anticipated to be about few years, the interim drainage designed for collecting the runoff from nearby villages and agriculture lands will be designed to have a discharge capacity for 1 in 10 years rainfall event that meet the requirement for village drainage under DSD Stormwater Drainage Manual.

4.2.3 During construction stage, there will be three sets of surface drainage channels for the development of Area (A) Phase I and two sets of interim drainage for the developments of Area (A) Phase II and Area (B) to collect the runoff from nearby villages and agriculture lands. Surface drainage channels in the development of Area (A) Phase I include channel 1.1, channel 1.2, and channels 3.1a to 3.4. The interim drainage covers Channel A.1 and A.2 for the development of Area (A) Phase II and channel B.1 for the development in Area (B). The proposed drainage for construction stage is shown in **Annex 2**. Channel 1.1, Channel 1.2 and Channels 3.1a to 3.4 follow the design of permanent boundary drains and will be kept after construction stage as permanent boundary drains. For Channels A.1, A.2 and B.1, they are interim drainage for construction stage.

4.2.4 Based on hydraulic calculation in **Annex 3**, the utilization of the interim drainage for the developments of Area (A) Phase II and Area (B) are less than 75% under 1 in 10 years storm, thus, it is considered that there will be no insurmountable drainage impacts during construction stage and the flow path of neighbouring areas can be maintained.

4.3 Construction Activities in Dry Seasons

4.3.1 As mentioned in **Section 4.1,** the following construction activities that will / may affect stream course will be scheduled to be carried out in dry seasons.

<u>Stage 1 - Demolition of Existing Unused Footbridges and Construction of Vehicular Bridge Access by Prefabricated Techniques (Nov 2026 to Mar 2027)</u>

4.3.2 To facilitate the future construction activities in the Site, the vehicular bridge access will be constructed in the first dry season, tentatively November 2026 to March 2027. To expedite the construction of vehicular bridge access and avoid hydraulic impact to the existing stream course, prefabricated single span bridge will be used to decked over the existing stream course to avoid obstruction of stream course. In case of necessary, pumping will be adopted to convey the dry weather flow of stream course to downstream side of the existing stream course. To further enhance the drainage conditions of the existing stream course, the existing river-crossing structures (B) to (E) that are currently obstructed the stream flow will be removed.

<u>Stage 2A - Construction of Permanent Box Culvert Outlet for Connecting to Stream Course (Nov 2027 to Mar 2028)</u>

4.3.3 While the proposed box culvert will be constructed from Q2 2027 to Q1 2028, the proposed box culvert outlet for connecting to stream course will be constructed in dry

season, tentatively in November 2027 to March 2028. During the construction in dry season, local pumping will be deployed to pump the dry weather flow of the existing stream course at the upstream of the works section to the downstream of the existing stream course, if needed.

Stage 3A.1 - Construction of Permanent 1650mm Pipe During Dry Season for Collecting the Upstream Stream Course to the Proposed Box Culvert (Nov 2028)

4.3.4 The majority of the proposed box culvert and its downstream outlet to the existing stream course will be completed in Stage 2, tentatively in Mar 2028, and can be used for discharging runoff from the Site, as well as ready for collecting diverted flow from existing upstream drainage systems. The proposed 1650mm for collecting runoff from upstream portion stream course will be constructed and connected to the proposed box culvert during dry season, tentative November 2028. Upon completion of construction of the proposed 1650mm pipe, the flow of the existing stream from the upper section of the existing stream course will be intercepted to the proposed box culvert for discharging back to downstream stream course. The proposed flood wall in Area (B) will be constructed during Stage 3A.

Stage 3A.2 - Construction of new Box Culvert Connection and Permanent 1050mm Pipe to the existing box culvert as well as construction of permanent boundary channels and associated pipes for connecting to new box culvert (Dec 2028 to Mar 2029)

4.3.5 With connection of the existing upstream stream course to the proposed box culvert, a localised section of the existing stream course at the immediately downstream of new 1650mm pipe will be removed for the construction of the remaining upstream portion of proposed box culvert and the 1050mm pipe for connecting to the existing box culvert. The construction of remaining portion of box culvert and 1050mm pipe will be scheduled in dry season, tentative December 2028 to March 2029. Local pumping will be deployed for diverting the dry weather flow from the existing 3.6m x 2.5m box culvert at Fung Yuen Road to the downstream of existing stream course, if necessary. The proposed flood wall in Area (B) will be constructed during Stage 3A.

4.3.6 The construction of by-pass pipes between permanent boundary channels and new box culvert will also be carried in this dry season.

4.4 Completion of New Drainage System for the Proposed Development

4.4.1 With reference to construction sequence discussed in **Section 2**, it is expected that the drainage system for the proposed development in Area (A) Phase I and Area (B) will be tentatively ready for use in mid-2029 as the construction works of the developments in Area (A) Phase I and Area (B) will be completed at that time for population intake while the entire Development including Area (A) Phase II will be completed in late 2030 as the remaining construction works for Area (A) Phase II will be completed in 2030.

5 Monitoring Requirements

5.1.1 With reference to the preliminary drainage arrangement during the construction phase in **Annex 1**, to maintain flow path of the existing stream course, interim drainage in form of channels will be provided to collect surface runoff from neighbouring areas for discharging to downstream of stream course and local temporary site drainage, with desilting facilities, provided within site for proper discharging of site runoff. Thus, it is expected that there will be no insurmountable drainage impacts to the surrounding areas and existing drainage system during the construction stage. Although, adverse impact is not expected from the site during construction with the provision of interim drainage system, the following monitoring system will be provided:-

Water level Monitoring for the Existing Stream course

5.1.2 During construction, the existing stream course might pose risk to the workers and plants of the construction site, monitoring of the water level is recommended to protect the workers and plants.

5.1.3 Water level at the upstream and downstream of the stream course will be monitored during the construction stage. Water level monitoring shall be based on the "Alert, Alarm and Action" (AAA) Trigger Level mechanism. The corresponding actions shall be based on the local water level monitoring and rainstorm signal issued by HKO together. The corresponding actions shall be based on action for water level reached Action Level descripted in **Table 5.1**.

Table 5.1: Action when AAA Trigger Level reach

Rainstorm Warning Signal from HKO	Water Level Monitoring	Actions
Amber/Red/Black Rainstorm Warning Signal Issued OR Announcement on Localized Heavy Rain	Alert Level (3.54mPD – 10 years tide level)	○ Close monitoring on water level
	Alarm Level (500mm below stream course bank level)	○ Close monitoring on water level ○ Check if there is overflow and start pumping water inside excavation areas if necessary
	Action Level (Overflow from Existing Stream course)	○ Suspend all the works adjacent the Existing Stream course ○ Commence the emergency plan to evacuate the workers and plants

Sediment Monitoring for the Existing Stream Course

5.1.4 Monitoring of sedimentation and erosion for the existing stream course by visual inspections shall take place once per week throughout the entire construction phases of the works. Additional monitoring shall take place immediately after any significant storm event.

6 Conclusion

6.1.1 This appendix shows the conceptual interim drainage arrangement for construction stage. All the information in this appendix, including but not limit to phasing of works and time of works, is tentative and subject to further update, if necessary, based on the future detailed design and Contractor actual construction arrangement for the final development layout.

6.1.2 Based on the construction sequence presented in **Section 2**, the construction period for the proposed development is a few years, to maintain the flow path of nearby areas mainly for villages and agriculture use near the Site, surface drainage channels as per permanent boundary channels for the development of Area (A) Phase I and interim drainage with discharge capacity for 10 years rainfall for the developments of Area (A) Phase II and Area (B) will be constructed at the beginning of construction stage and will be provided throughout the construction stage. The drainage during construction stage will be in form of three sets of surface drainage channels which will also be used as permanent boundary channels for the development of Area (A) Phase I and three sets of interim channels for the developments of Area (A) Phase II and Area (B). The drainage will be provided along the site boundary for collecting runoff of the neighbouring areas back to the existing stream course. The site runoff will be properly collected and discharged into existing stream course via local temporary site drainage with desilting facilities. Also, the construction activities that will affect / in close vicinity of the existing stream course are all carefully scheduled and will be constructed in dry seasons.

6.1.3 Since the surface drainage channels for the development of Area (A) Phase I during construction stage will have arrangement same as the permanent boundary channels of the proposed development, the surface channels will have adequate capacity to serve the surrounding areas. For the developments of Area (A) Phase II and Area (B), based on hydraulic calculation results, the utilizations of interim drainage are less than 75% under 1 in 10 years storm which is capable to serve the nearby villages and agriculture areas. Thus, it is considered that there will be no insurmountable drainage impacts during construction stage and the flow path of neighbouring areas can be maintained.

6.1.4 Insurmountable drainage impact is not expected from the Site during construction with the provision of interim drainage system. Carefully planning of construction activities, water level and sediment monitoring will be provided to protect the workers and plants, as well as minimising potential sediment issue at existing stream course.

Annex

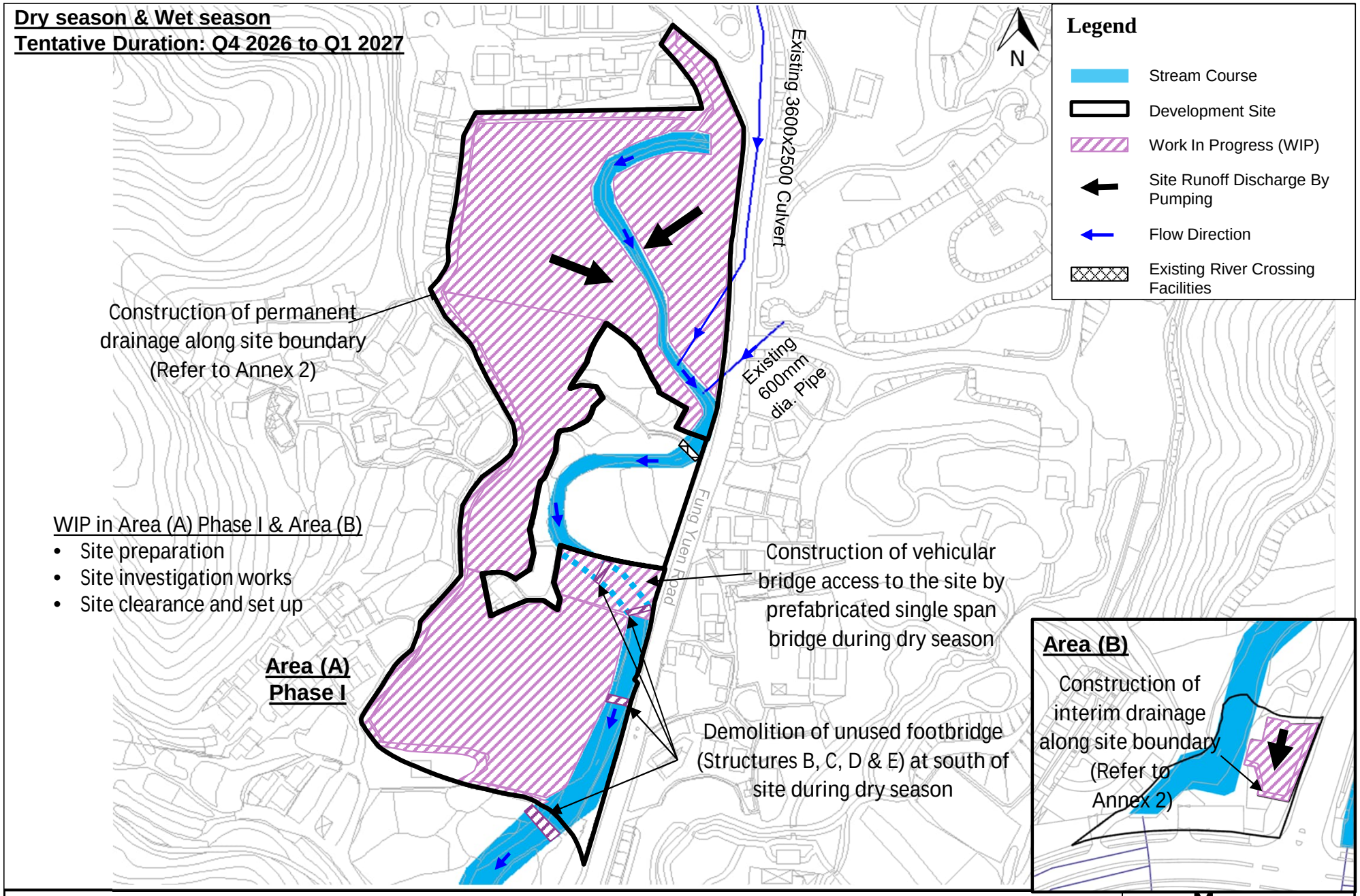
Annex 1 Conceptual Construction Sequence

Annex 2 Drainage System for Construction Stage

Annex 3 Hydraulic Calculation for Interim Drainage System

Annex 1

Conceptual Construction Sequence



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Construction Sequence – Stage 1**
Date Sep 2025	**Scale** N.T.S. **File**

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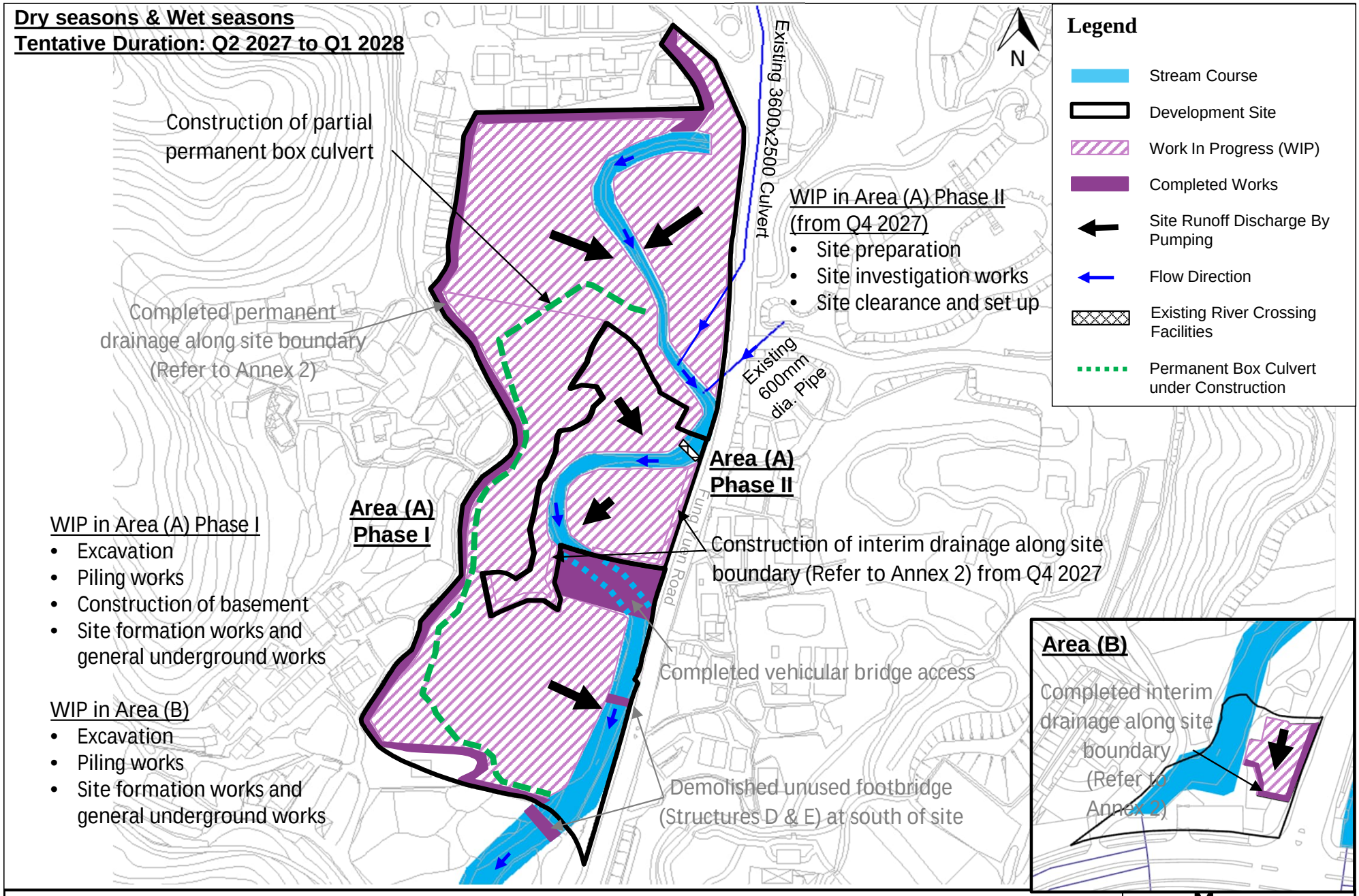
Figure 1

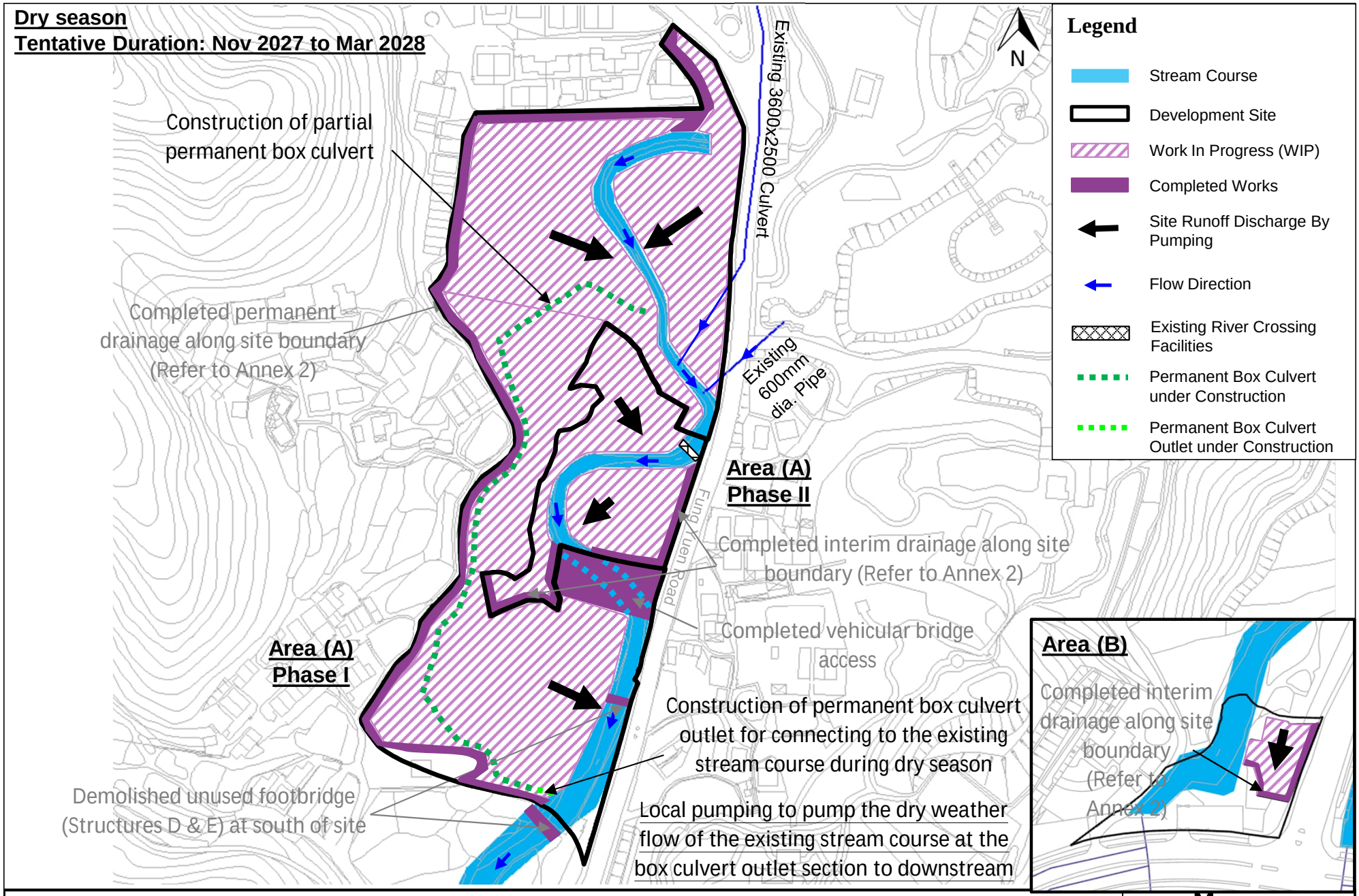


Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Construction Sequence – Stage 2**

Date	Scale	File
Sep 2025	N.T.S.	

MOTT MACDONALD

Figure 2

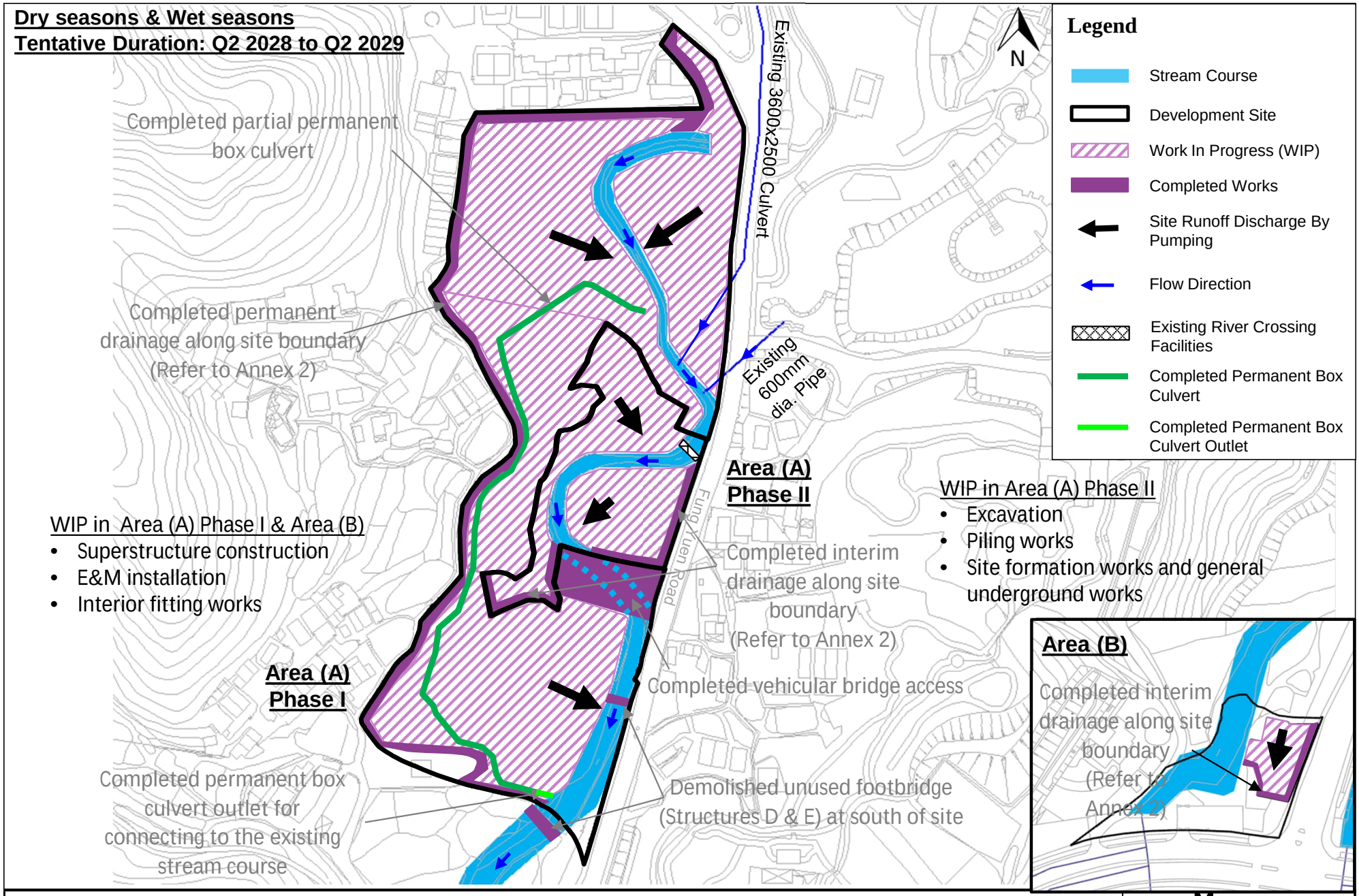


Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Construction Sequence – Stage 2A**

Date	Scale	File
Sep 2025	N.T.S.	

MOTT MACDONALD

Figure 2A



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Construction Sequence – Stage 3**
Date Sep 2025	**Scale** N.T.S. **File**

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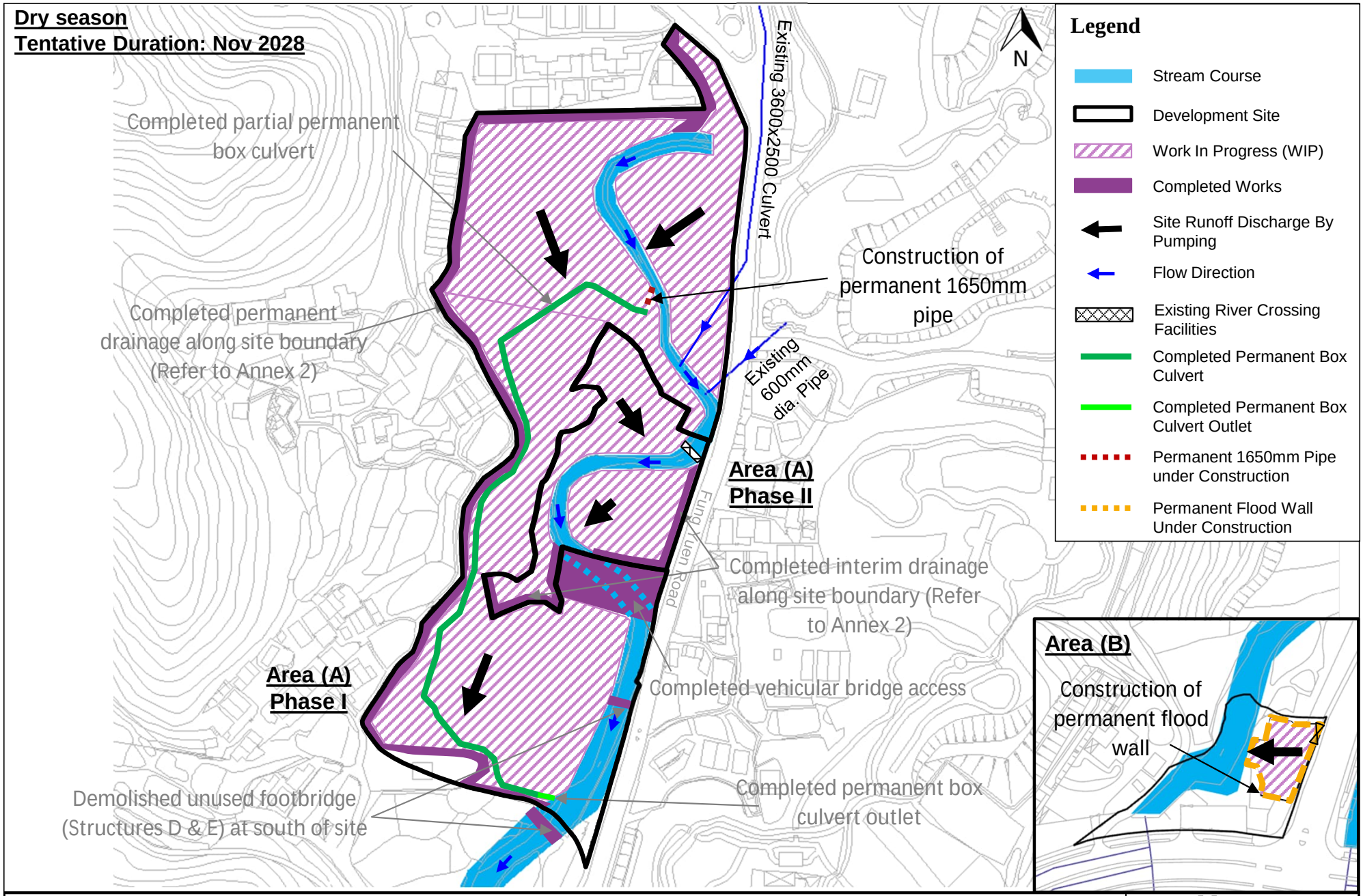
Figure 3

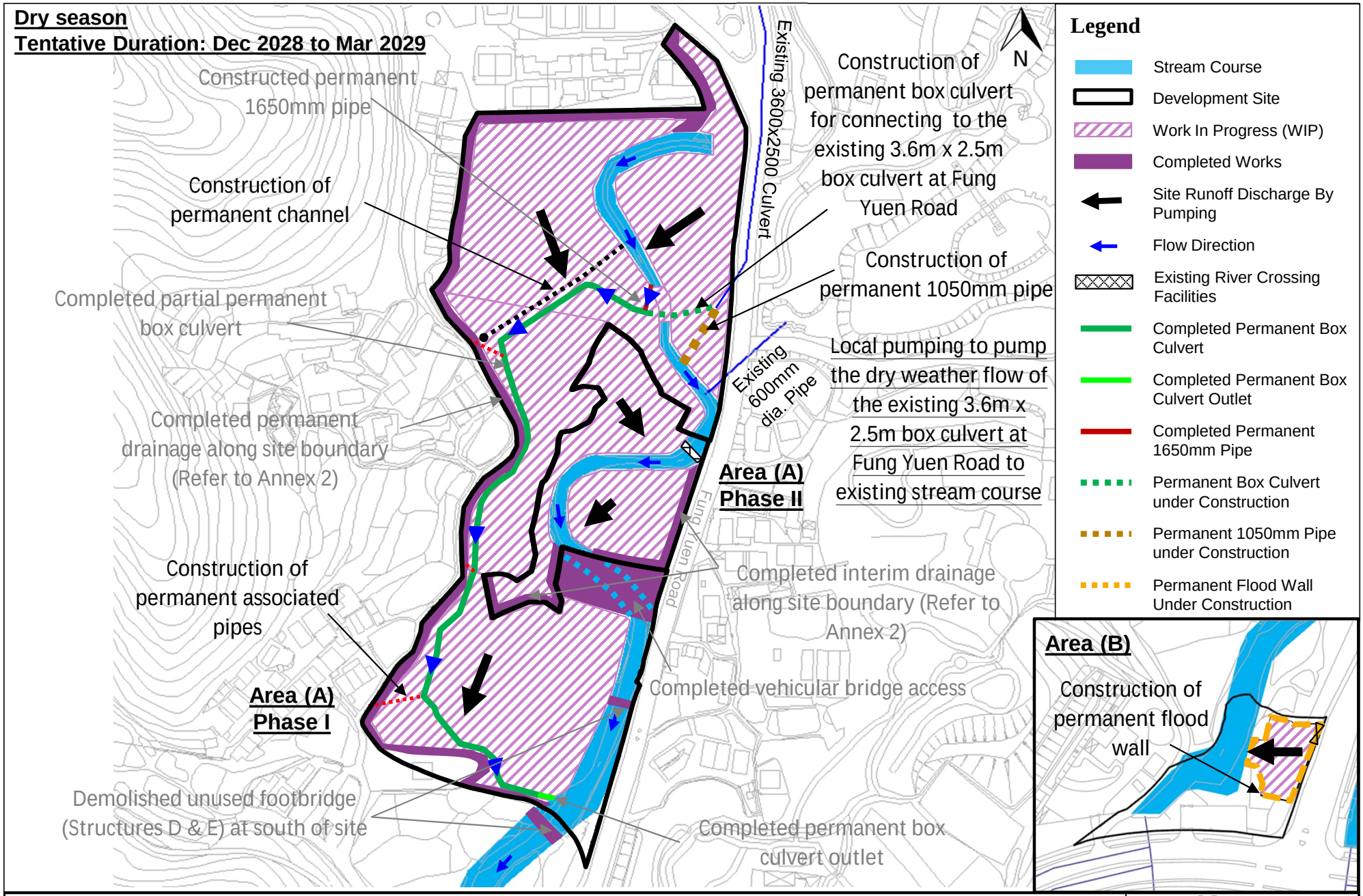


Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Construction Sequence – Stage 3A.1**

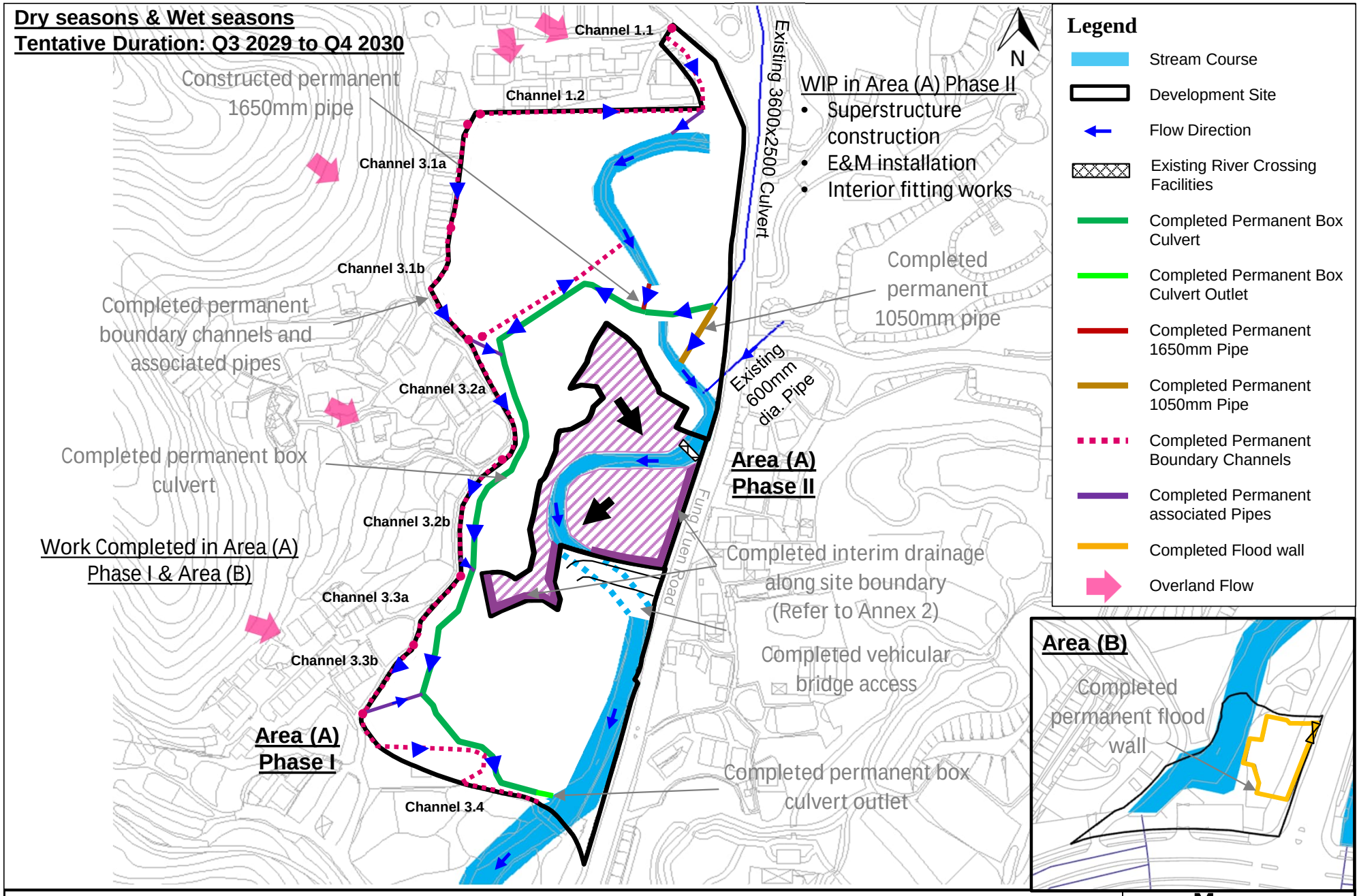
Date	Scale	File
Sep 2025	N.T.S.	

MOTT MACDONALD

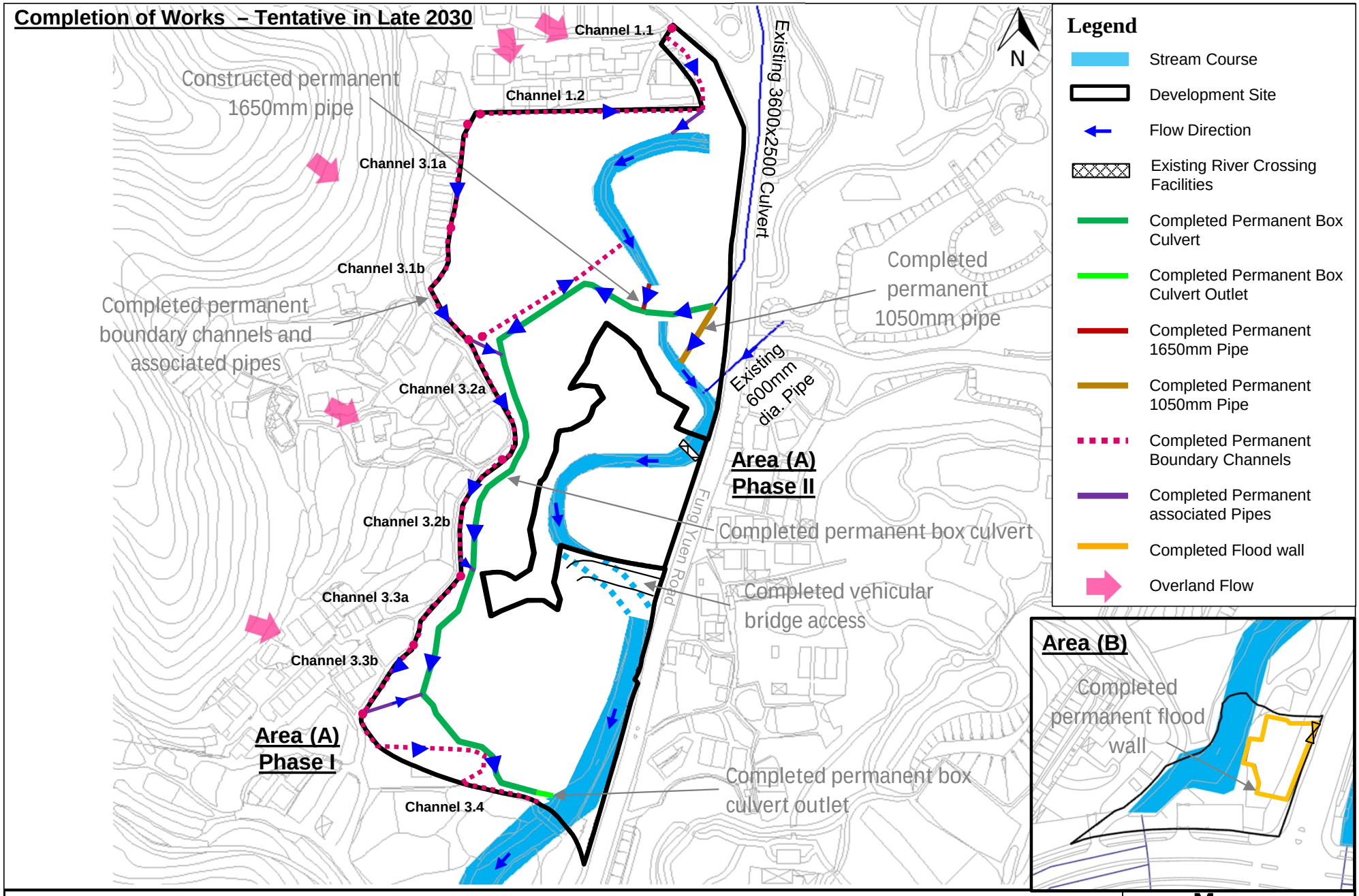
Figure 3A.1



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Construction Sequence – Stage 3A.2**	**Figure 3A.2**
Date Sep 2025	**Scale** N.T.S.	**File**



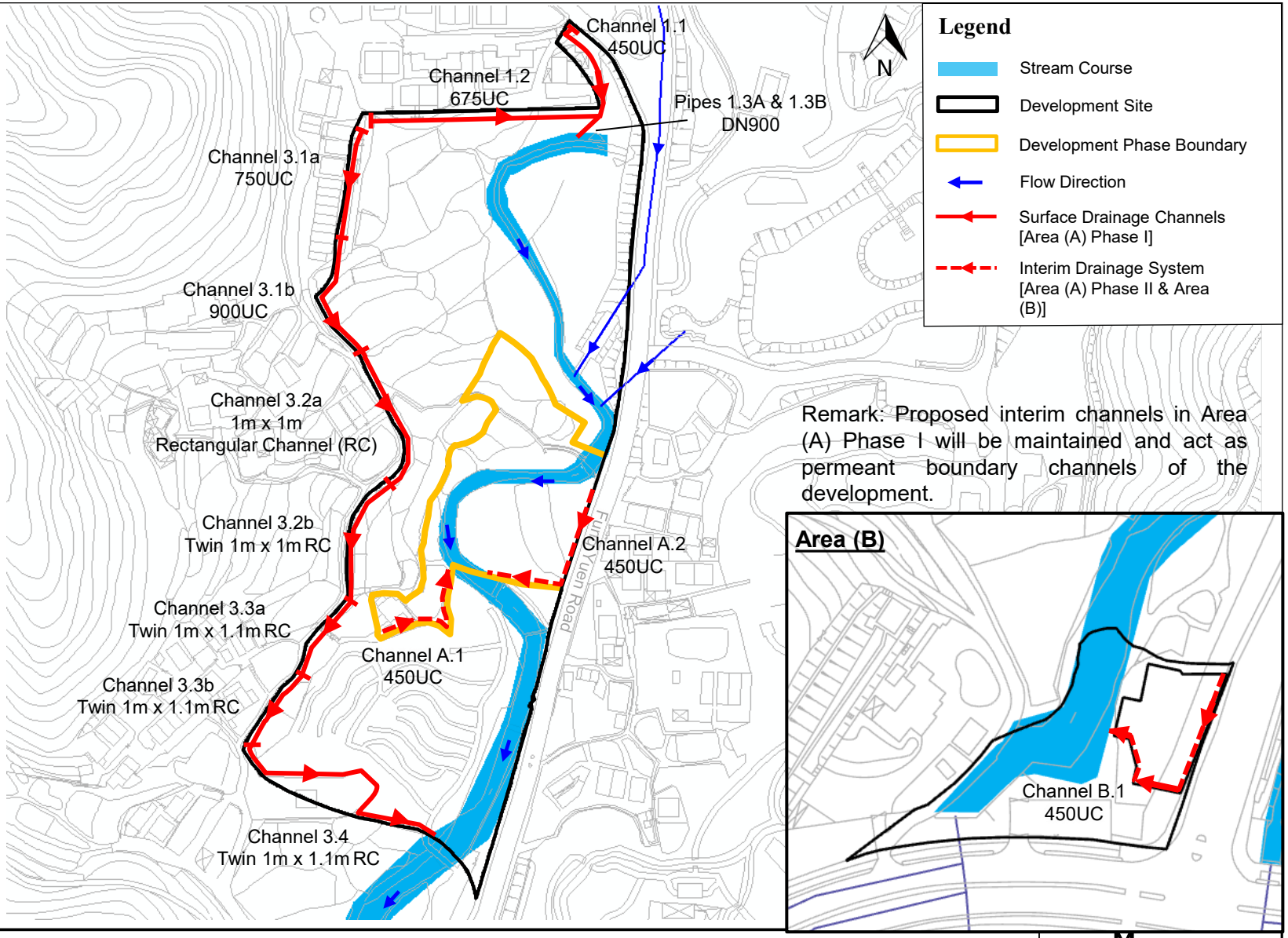
Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Construction Sequence – Stage 4**	**Figure 4**
Date Sep 2025	**Scale** N.T.S.	**File**



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Construction Sequence – Completion of Works**	**Figure 5**
Date Sep 2025	**Scale** N.T.S.	**File**

Annex 2

Drainage System for Construction Stage

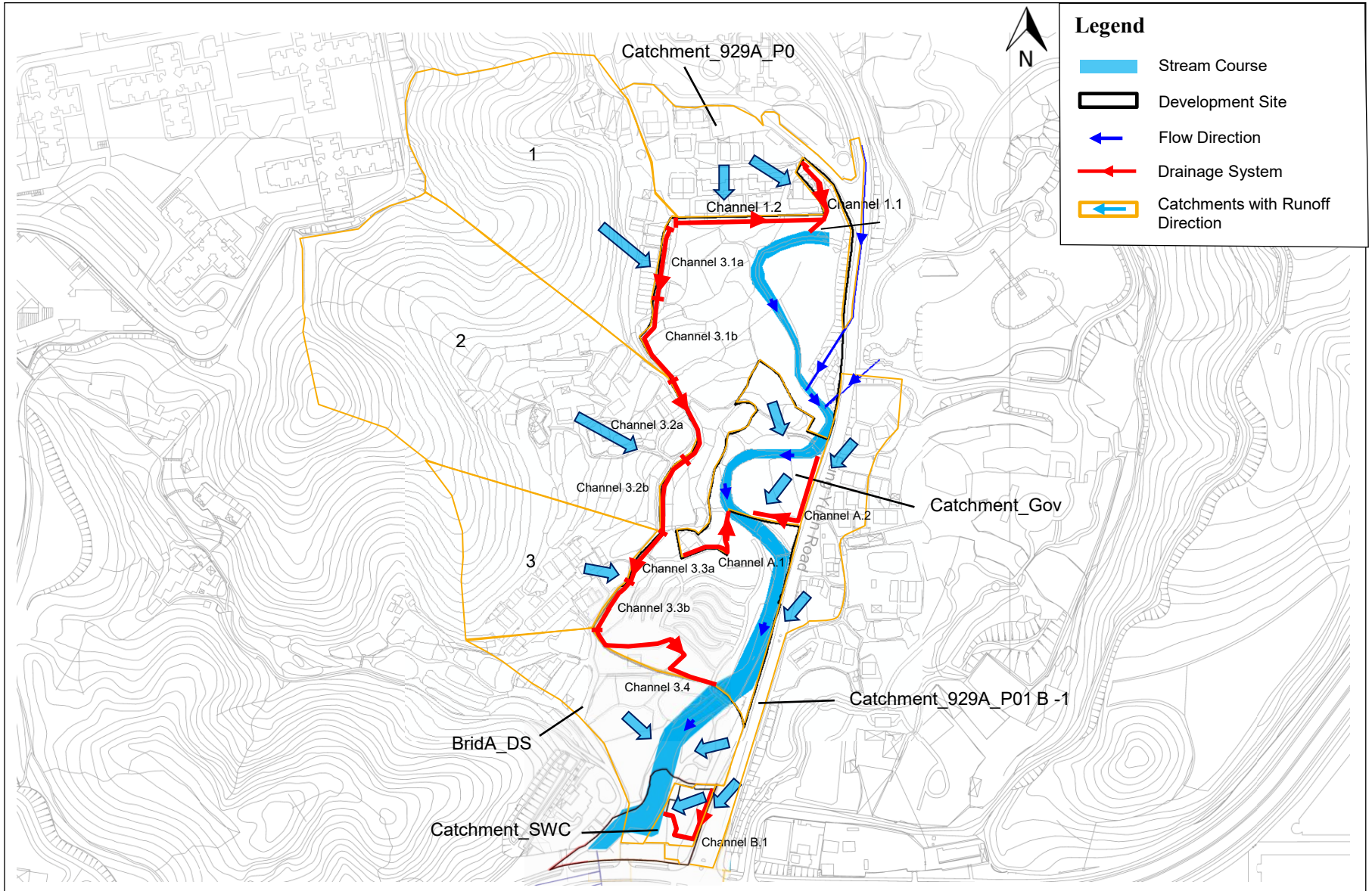


Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**
Title	**Proposed Drainage System for Construction Stage**

Date	Scale	File
Aug 2025	N.T.S.	

MOTT MACDONALD

Annex 2



Project	**Proposed Residential Development(s) with Retail, Public Vehicle Park and Social Welfare Facilities at Various Lots and Adjoining Government Land at Fung Yuen, Tai Po, New Territories**	MOTT MACDONALD
Title	**Catchment Plan for Proposed Drainage System during Construction Stage**	**Annex 2**
Date Aug 2025	**Scale** N.T.S.	**File**

Annex 3

Hydraulic Calculation for Interim Drainage System

Annex 3 - Hydraulic Calculation for Interim Drainage System

Ref.	Calculation

Objective Hydraulic design of interim drainage system at construction stage.

Methodology
1. Determine the runoff from subcatchments without consideration of climate change.
2. Use Manning Equation to determine the capacity of the proposed interim channels and check against the design flow.
3. Construction works are proposed to be completed within a few years. Thus, the interim drainage will be designed to cater for a 10-year return period of rainfall.
4. As the interim drainage will only be used during the construction stage for a few years, climate change effect is considered not necessary to be considered in the design.
5. Regular clearance and maintenance for the interim drainage system will be implemented during the construction stage. No siltation is considered in the design.

1. Runoff from Nearby Catchments to be Served by Interim Channels

Refer to Annex 2 for the catchment plan.
Runoff with consideration of climate change is extracted from hydraulic model as attached in Appendix H.
Since the interim drainage system is temporary for construction stage of a few years, climate change effect is considered not required to be considered, thus, the runoff with end of climate change effect will be adjusted to obtain the runoff without climate change effect with details given in remarks.

		Runoff from rainfall event (m^3/s) (Considering Climate Change)[1]	Runoff from rainfall event (m^3/s) (Without considering Climate Change)[2]	
Sub Catchment ID	**Total Catchment Areas(m^2)**	**10-year, Q1**	**10-year, Q2**	**Collected By Proposed Drainage System**
Catchment_SWC	1,122	0.0779	0.0608	100% of runoff to Channel B.1 according to topography
Catchment_929A_P01 B -1	8,166	0.4049	0.3161	20% of runoff to Channel B.1, 50% of runoff to Channel A.2 and 30% of runoff to the existing watercourse according to topography
Catchment_Gov	5,285	0.3400	0.2654	55% of runoff to Channel A.1 and 45% of runoff to Channel A.2 according to topography

Remarks:
1. Rainfall intensity extracting from the hydraulic model has considered climate change effects up to End of 21st Century (Rainfall Increase: +16% + Design Allowance: +12.1% = +28.1%).
2. For interim drainage system, climate change effect is negligible. To calculate runoff without considering climate change effect, it can be back-calculated by the following equation.

$$Q2 = Q1/(1 + 28.1\%)$$

2. Determine the size of proposed open channels

Using Manning equation for calculate the channel Free Flow Full Bore Capacity

SDM Table 12

$$\bar{V} = \frac{R^{1/6}}{n}\sqrt{RS_f}$$

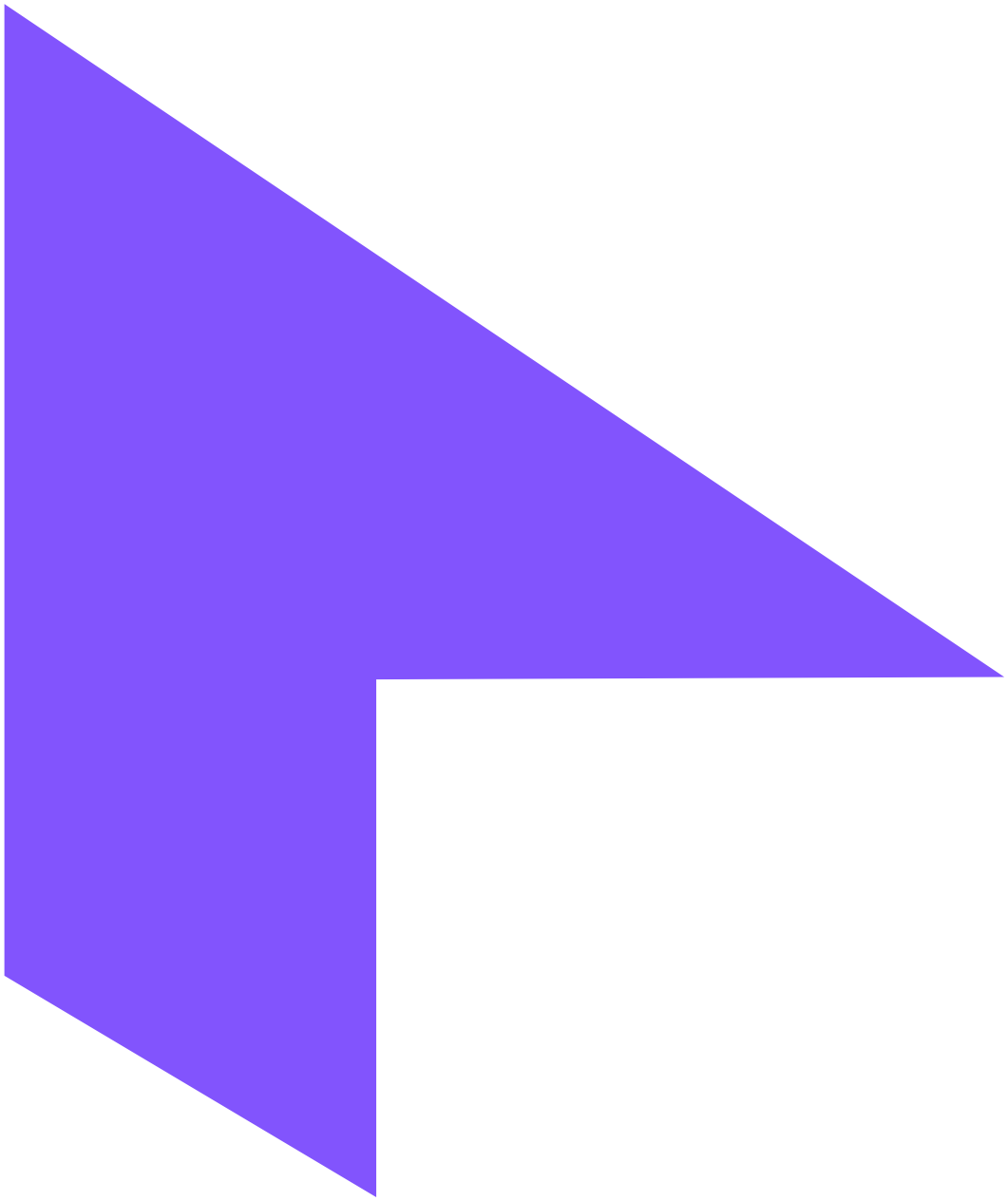
where

$\bar{V}$	=	Velocity (m/s)
R	=	Hydraulic Radius (m)
S_f	=	Slope (m/m)
n	=	Manning's Coefficient of Roughness (Dimensionless)

Assumptions:
1 Surface roughness coefficient (n) = 0.016 (refer to Concrete-lined Channel under Fair condition in Stormwater Drainage Manual Part 1 - Table 13)

Proposed open channels

For Rainfall Return Period 10 years

Channel Name	U-Channel / Rectangular Channel Size m	Area m^2	Wet Perimeter m	Channel Length m	Hydraulic Radius m	Upstream Ground Level mPD	Downstream Ground Level mPD	Upstream Invert mPD	Downstream Invert mPD	Min. slope of the channel bed (So)	Flow from Catchment m^3/s	Free Flow Full-bore Capacity m^3/s	Full-bore Velocity m/s	Utilization %	Flow Capacity Check
Channel B.1	0.45	0.18	1.16	73.0	0.16	4.5	4.4	4.01	3.78	318	0.124	0.184	1.02	67.4	OK
Channel A.1	0.45	0.18	1.16	59.0	0.16	5.9	5.9	5.37	5.11	227	0.146	0.218	1.20	67.1	OK
Channel A.2	0.45	0.18	1.16	75.5	0.16	7.3	6.3	6.79	5.77	74	0.277	0.381	2.11	72.8	OK

5. Conclusion
(1) The proposed interim channels have sufficient capacity to collect the 10 years design storm from concerned subcatchments during the construction stage.