

Appendix 7: Water Supply Impact Assessment



WATER SUPPLY IMPACT ASSESSMENT

To Amend the Notes of the “Comprehensive Development to include Wetland Restoration Area” Zone for a Proposed Comprehensive Development at Wo Shang Wai, Yuen Long, Lots 77 and 50 S.A in DD101

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1 INTRODUCTION

1.1 BACKGROUND

- 1.1.1 WSP (Asia) Limited was commissioned by Profit Point Enterprises Ltd to conduct a Water Supply Impact Assessment (WSIA) for a Comprehensive Development to include Wetland Restoration Area at Wo Shang Wai, Yuen Long, Lots 77 and 50 S.A in DD101 (thereafter referred to as “the Application Site”) by assessing the impact of the water demand due to the proposed comprehensive residential development.
- 1.1.2 This application is made under section 12A of the Town Planning Ordinance, to rezone the Application Site on the approved Mai Po and Fairview Park Outline Zoning Plan (“OZP”) No. S/YL-MP/8. The rezoning application aims to increase the plot ratio (“PR”) from 0.4 (i.e. maximum permissible PR on the OZP) to 1.3, with a maximum building height (“BH”) adjusted to not more than 10-storeys and not exceeding +42mPD by amending the Notes of the current “Other Specified Uses (Comprehensive Development to include Wetland Restoration Area)” (“OU(CDWRA)”) zone.
- 1.1.3 The Applicant, Profit Point Enterprises Limited, proposes to increase the development intensity, and revise the layout and form of the housing developments in the Application Site, in response to the drastic changes in the development site context and planning circumstances of the area.
- 1.1.4 The Application Site is located at Wo Shang Wai, Yuen Long. It is generally bounded by Castle Peak Road – Mai Po and San Tin Highway to the east, fishponds to the north, residential developments, namely Royal Palms and Palm Springs to the south, and Wo Shang Wai Village to the southeast, as shown in Figure 1.

1.2 DESCRIPTION OF PROPOSED DEVELOPMENT

- 1.2.1 The proposed development consists of a mix of 3 stories detached and semi-detached house and 6, 8 and 10 storey residential tower. 48716 m² of land are reserved as open greenery area.
- 1.2.2 The proposed development consists of 3571 housing unit in total with a plot ratio of 1.28 and an average unit gross floor area of 74.45 m².
- 1.2.3 The master layout plan is attached in **Appendix A**.
- 1.2.4 The application site includes a residential care home for elderly (RCHE). The RCHE would consist of 100 beds and 15 staff. For assessment in this report, the land use is considered hospital, and the staff are assumed to be non-residential.

1.3 OBJECTIVES

1.3.1 The objective for this study is set out to be as follows:

- (1) Estimating water demand arising from proposed development
- (2) Estimating water intakes to the existing/planned development
- (3) Evaluating water supply impacts to other existing development
- (4) Proposing water supply main layout to mitigate negative impacts to existing developments

1.4 DESIGN GUIDELINE

1.4.1 To conduct this study, we have obtained and adopted the following information:

- Existing water main records provided by WSD
- Capacity, Top water level, and Invert water level of Ngau Tam Mei Fresh Water Preliminary Service Reservoir
- Master Layout Plan of the proposed development
- WSD's Departmental Instruction 1309 (D.I. 1309)
- Manual of Mainlaying Practice
- 2021 Population Census

1.4.2 The following approach were adopted in carrying out this WSIA

- (1) Evaluate existing and planned works within the study area
- (2) Assess water demand from proposed development
- (3) Assess water demand from existing and planned development
- (4) Evaluate impact on existing water main
- (5) Recommend and propose water supply scheme with a hydraulic analysis
- (6) Examine the short- and long-term impacts on existing water mains and interfacing projects

1.5 INTERFACING PROJECTS

1.5.1 Notable interfacing project includes:

- CE 15/2023 (CE) First Phase Development of the New Territories North – San Tin/Lok Ma Chau Development Node – Package 1 – Design and Construction

2 EXISTING AND PLANNED WORK

2.1 EXISTING WATER WORKS AND SERVICE RESERVOIRS

- 2.1.1 Ngau Tam Mei area surrounding the application site is served by Ngau Tam Mei Water Treatment Works. The treated water from Ngau Tam Mei is stored in Ngau Tam Mei Primary Service Reservoir.
- 2.1.2 **Table 2.1** summarise the capacity, top water level and invert level of the Ngau Tam Mei Primary Service Reservoir.

Table 2.1 Parameter of Ngau Tam Mei Primary Service Reservoir

Reservoir	Capacity (m ³)	Top Water Level (APD)	Invert Level (APD)
Ngau Tam Mei Primary Service Reservoir	40750	104.1	94.15

- 2.1.3 There is no saltwater supply nor reclaimed water supply to the area, therefore, fresh water is used for flushing.

2.2 EXISTING WATER MAINS

- 2.2.1 With reference to Main Record Plans (MRPs) from WSD, the application site is served by a DN150 and a DN200 pipe. Both pipes are a tee-off from a DN200 ductile iron pipe running along Castle-Peak Road-Mai Po section.
- 2.2.2 A DN600 pipe runs along San Tam Road on the other side of San Tin Highway opposite to the application site. The DN600 pipe gets fresh water from a DN700 pipe along Castle Peak Road – Tam Mi section.
- 2.2.3 The DN700 pipe gets water from DN1400 which runs from east to west along Ching Yau Road, starting from Ngau Tam Mei Primary Service Reservoir and ending at San Tin Highway.

2.3 EXISTING DEVELOPMENT

- 2.3.1 After evaluating aerial photo and water main records of the application site, the list of developments identified is shown in **Table 2.2**.

Table 2.2 List of Building Group Identified and Parameters

Building Group	Number of units	Population (person)
Mai Po San Tsuen	338	
Green Crest	81	
Wai Tsai Tsuen	127	
The Vineyard phase 2	30	
Yau Tam Mei San Tsuen	31	
Wah On Villa	119	
Ian Court	105	
Faye Villa	39	
Kadoorie Villas	75	
San Wai Tsuen	30	
YL 0172 (Palm Springs)		4677
YL 0162 (Casa Paradizo + Royal Camelia)		3836

2.3.2 Number of units were obtained by counting houses on aerial photo and data from real estate database. Populations were found from population census 2021.

2.3.3 The population of building group YL 0172 and YL 0162 is extracted from the population census in 2021. Building group YL 0173 is not included as it covered settlements that are not served by the same existing water mains as application site.

2.4 PLANNED WATER WORK AND WATER MAIN

2.4.1 North to application site, CEDD have commissioned CE 15/2023 (CE) First Phase Development of the New Territories North – San Tin/Lok Ma Chau Development Node – Package 1 – Design and Construction. The project will involve re-routing water main in the area and constructing a new water treatment work and service reservoir.

2.4.2 The drafted preliminary diversion plan of CE 15/2023 was obtained from the project consultant. It shows that the application site itself does not fall into the project scope, but there would be potential interface if proposed water main extends to the section of San Tam Road under San Tin Highway. The DN600 pipe on San Tam Road, north of application site will be proposed for rerouting as part of the development plan in CE 15/2023.

3 WATER SUPPLY IMPACT ASSESSMENT

3.1 WATER DEMAND FROM PROPOSED DEVELOPMENT

- 3.1.1 As quoted in section 1, the proposed development would be R3 type residential development with 3571 units, estimated to house 9999 people assuming an average of 2.8 people occupying each unit. The total landscaping area is 48716 m² and includes a residential care home for elderly with 100 beds.
- 3.1.2 With reference to D.I. 1309, the freshwater demand is assumed to be 0.390 m³ per person per day, with a service trade allowance of 0.045 m³ per person per day. The flushing water demand is 0.070 m³ per person per day. Irrigation water demand is assumed to be 0.01 m³ per m² per day based on the approved EIA report of the project “Sludge Treatment Facilities” (EIA-155/2008).
- 3.1.3 Overall, the freshwater demand from the application site is estimated to be 4882.2 m³ per day and the mean flushing demand is 729.4 m³ per day.

3.2 WATER DEMAND FROM EXISTING DEVELOPMENTS

- 3.2.1 As quoted in section 3.3, the existing developments can be divided into 11 building groups. Based on **Table 2.2**, the population can be estimated from number of units using the average occupier per unit from population census 2021. For Yuen Long district the factor is 2.8 person per household. The irrigation area is taken to be 48716 m² and the water demand per area is 0.010 m³ per m².
- 3.2.2 Some settlements, such as Mai Po San Tsuen and San Wai Tsuen, around application site are recognised as modern villages. For such site, the freshwater demand is assumed to be 0.230 m³ per person per day, with a service trade allowance of 0.045 m³ per person per day. The flushing water demand is 0.070 m³ per person per day.
- 3.2.3 Overall, the freshwater demand from the existing developments is estimated to be 4622.5 m³ per day and the mean flushing demand is 780.4 m³ per day.
- 3.2.4 The calculations and table summarising the demand arising from different demand type can be found in **Table 3.1**.

Table 3.1 Table of Water Demands Taken from D.I. 1309 and EIA-155/2008

Demand Type	Water Type	Unit Demand	Unit
Residential (R3)	Fresh	0.390	m ³ per person per day
	Flushing	0.070	m ³ per person per day
Villages (Modern)	Fresh	0.230	m ³ per person per day
	Flushing	0.070	m ³ per person per day
Hospital	Fresh	0.455	m ³ per person per day
	Flushing	0.295	m ³ per person per day

Service Trade	Fresh	0.045	m ³ per person per day
Irrigation	Fresh	0.010	m ³ per m ² per day

3.3 IMPACT ON EXISTING WATER WORK

- 3.3.1 The freshwater peak demand factor is assumed to be 3 and the flushing water peak demand factor were assumed to be 2. According to the Manual of Mainlaying Practice, the maximum advisable flow velocity in water mains is 3 m/s. Therefore, the maximum peak flowrate was found assuming flow velocity to be 3 m/s.
- 3.3.2 Based on the calculation shown in **Appendix B**, The proposed development have a mean daily water demand of 5611.6 m³/day and a peak water demand of 14448.6 m³/day. The maximum allowable flowrate for the DN150 and DN200 pipe leading to the site is 7271.9 m³/day and 3876.9 m³/day respectively. The existing pipes are not sufficient to meet the peak water demand of the application site.

4 PROPOSED WATER MAIN SCHEME

4.1 OVERVIEW

- 4.1.1 As mentioned in **Section 2.2**, there is a DN600 pipe running along San Tam Road on the other side of San Tin Highway. The calculation table in Appendix B shows that the DN600 pipe would have the flow velocity 0.67 m/s and flowrate of 0.18 m³/s supplying to only existing development. The flow velocity in the DN600 pipe increase to 1.36 m/s with a flowrate of 0.37 m³/s when the proposed development is considered.
- 4.1.2 It is therefore proposed to construct a new tee-off from the DN600 pipe, named 600DI89 on MRP. Two options are presented and evaluated in this WSIA. The drawings of the proposed pipe layout can be found in **Appendix C**.
- 4.1.3 Only elevation heads and frictional head are considered in the hydraulic calculations. Elevation head is considered as the sole driving force from primary reservoir and the main head loss is due to friction. Velocity and angled head loss are considered minor compared to frictional head loss. Minor losses are estimated as 10% of the frictional head loss.
- 4.1.4 Hazen-William's equation is used to calculate frictional head loss, and Hazen-Willams Coefficient is taken as 120 for pipe with diameter larger than 600mm, and 110 for pipe with diameter smaller than 600mm. Pipes where water demand cannot be estimated are assumed to have a flow velocity of 3 m/s for a conservative approach.

4.2 PREFERRED OPTION – CONSTRUCTION AT EXISTING SUBWAY AT SAN TAM ROAD

- 4.2.1 The preferred option would be to tee-off from the DN600 pipe further north at existing San Tam Road Subway under San Tin Highway. This option would avoid construction work under San Tin Highway and mitigate all potential structural and safety issues associate with the works at San Tin Highway.
- 4.2.2 Proposed tee-off pipe will be 350 mm at minimum in nominal diameter based on the calculation in **Appendix B**, and the length were estimated to be 573 meters. For conservative estimation, it is assumed to have the elevation of 6.2 mPD, which is the elevation of ground level recorded near the application site. It is expected that the pipe will be underground and therefore have an even lower elevation.
- 4.2.3 Calculation have shown that with a head loss of 46.1 meter from existing water mains and 10.4 meter head loss from proposed water main, the residual head in the pipe will be 46.8 meter at the boundary of the application site.

- 4.2.4 Based on WSD's circular letter No. 1/2007, the minimum acceptable residual pressure in water mains is 20m . This option meets the minimum requirements and are therefore hydraulically feasible.
- 4.2.5 However, the proposed connection point is located on a proposed pipe under CE15/2023 managed by AECOM-Halcrow Joint Venture. The joint venture should be consulted on construction schedule and feasibility of the connection may varies with time. In the case that the proposed tee-off is not feasible, the backup option should be considered.

4.3 BACKUP OPTION – CONSTRUCTION UNDER SAN TIN HIGHWAY

- 4.3.1 The backup option would be to directly tee-off from the DN600 pipe across San Tin Highway. Construction would preferably be through micro-tunnelling to avoid interrupting traffic on San Tin Highway.
- 4.3.2 Proposed tee-off pipe will be 300 mm at minimum in nominal diameter, and the length were estimated to be 166 meters. For conservative estimation, it is assumed to have the elevation of 6.2 mPD, which is the elevation of ground level recorded near the application site. It is expected that the pipe will be underground and therefore have a lower elevation.
- 4.3.3 Calculation have shown that with a head loss of 41.9 meter from existing water mains and 6.8-meter head loss from proposed water main, the residual head in the pipe will be 51.1 meter at the boundary of the application site.
- 4.3.4 Digging underneath the San Tin Highway will requires an excavation permit from Highway department. If the option is to be adapted, the applicant shall register on XPMS as soon as possible and liaison with Highway department for permission.

5 CONCLUSION AND WAY FORWARD

- 5.1.1 It could be concluded that the existing water supply mains around the proposed development is not sufficient for the water demand, and hence a new water main scheme is needed.
- 5.1.2 It would be feasible to tee-off from the existing DN600 pipe (600DI89) which runs along San Tam Road on the other side of San Tin Highway opposite to the application site. The preferred scheme would be to tee-off further north on San Tam Road to prevent construction work under the highway. The residual head would be 46.8 meter, which meets the minimum residual pressure requirement from WSD.
- 5.1.3 Another feasible scheme is to tee-off directly across San Tin Highway, this is not preferred as construction work on San Tin highway may be uncertain. The residual head is estimated to be 51.1 meter, which would also meet the minimum residual pressure requirement from WSD.
- 5.1.4 The applicant will discuss the preferred option with AECOM for interface with CE 15/2023 and adopt the backup option if the preferred option becomes unavailable.

Appendices

Appendix A

MLP of Proposed Development

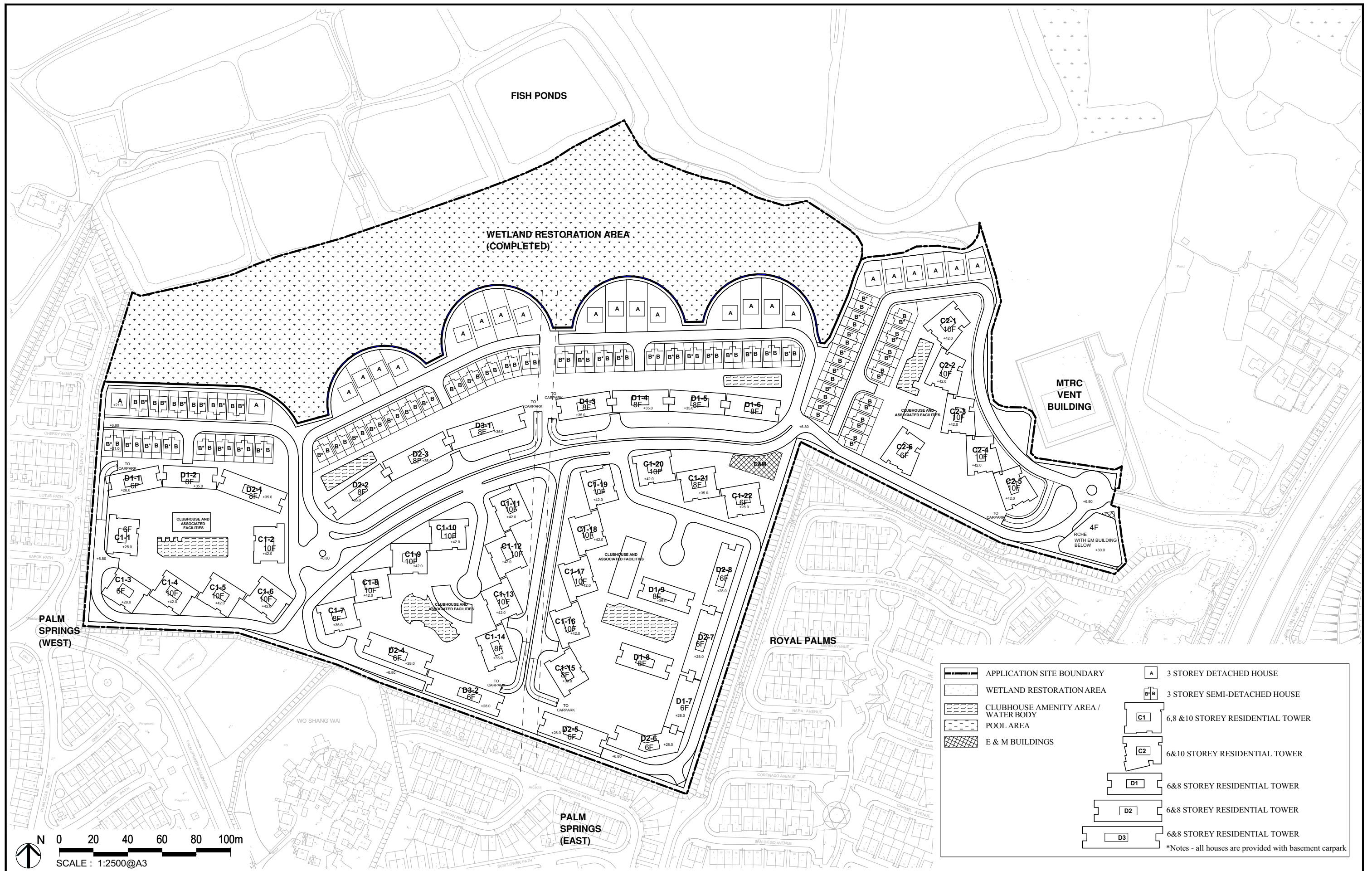


Figure 3: Revised Master Layout Plan in this Amendment Application

Appendix B

Table of Calculation

						Fresh		Flushing		
	Building Group	Landuse	Area (m2)	Number of units	Population (person)	Unit Demand Factor (m3/head/day)	Unit Demand Factor (m3/m2/day)	Mean Water Demand (m3/day)	Unit Demand Factor (m3/head/day)	Mean Flushing demand (m3/day)
Exisiting Developments	Mai Po San Tsuen	Villages (Modern)		338	913	0.275		251.075	0.07	63.91
	Green Crest	Residential (R3)		81	219	0.435		95.265	0.07	15.33
	Wai Tsai Tsuen	Villages (Modern)		127	343	0.275		94.325	0.07	24.01
	The Vineyard phase 2	Residential (R3)		30	81	0.435		35.235	0.07	5.67
	Yau Tam Mei San Tsuen	Villages (Modern)		31	84	0.275		23.1	0.07	5.88
	Wah On Villa	Residential (R3)		119	322	0.435		140.07	0.07	22.54
	Ian Court	Residential (R3)		105	284	0.435		123.54	0.07	19.88
	Faye Villa	Residential (R3)		39	106	0.435		46.11	0.07	7.42
	Kadoorie Villas	Residential (R3)		75	203	0.435		88.305	0.07	14.21
	San Wai Tsuen	Villages (Modern)		30	81	0.275		22.275	0.07	5.67
	YL 0172 (Palm Springs)	Residential (R3)		980	4677	0.435		2034.495	0.07	327.39
YL 0162 (Casa Paradizo + Royal Camelii	Residential (R3)			3836	0.435		1668.66	0.07	268.52	
Total	4622.455							780.43		
Proposed Development		Residental		3571	9642	0.435		4194.27	0.07	674.94
		RCHE			100	0.455		45.5	0.295	29.5
		Landscaping	50504				0.01	505.04		
Total	9642							4239.77		704.44

Remark:

Unit demand factor from DI 1309, where parameter not provide, similar estimation were used

Unit demand = Fresh water demand + Flushing water demand + Service trades

Records for populations taken from 2021 population census

Census found from: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.census2021.gov.hk%2Fdoc%2FHMA_BG_21C.xlsx&wdOrigin=BROWSELINK

Population data for village type settlement are estimated by counting house seen in aerial photo and assuming 2.7 person per house

2.7 per house is assumed based on the data for Yuen Long District in the 2021 population census

Portion	Nominal Diameter (mm)	Internal Diameter (mm)	Length (m)	Material	Hazen-Williams Coefficient	Total Fresh water demand	Total Flushing water demand	Fresh water peak factor	Flushing water peak factor	Peak Demand Flow(m3/day)	Peak flowrate(m3/s)	Area (m2)	Velocity (m/s)	Head loss per length	Head Loss (m)	Minor Head Loss (m)	Total Head Loss (m)	Note
1400S01	1400	1379	2255.3	S	120							1.5	3.00	0.005	11.4	1.1	12.5	Assumed velocity of 3 m/s for conservative estimation
1400S98	1400	1379	53.8	S	120							1.5	3.00	0.005	0.3	0.0	0.3	Assumed velocity of 3 m/s for conservative estimation
1200S98	1200	1182	11.3	S	120							1.1	3.00	0.006	0.1	0.0	0.1	Assumed velocity of 3 m/s for conservative estimation
700S00	700	682	29.4	S	120							0.4	3.00	0.011	0.3	0.0	0.4	Assumed velocity of 3 m/s for conservative estimation
700S91	700	682	155.3	S	120							0.4	3.00	0.011	1.8	0.2	2.0	Assumed velocity of 3 m/s for conservative estimation
700S88	700	682	311.4	S	120							0.4	3.00	0.011	3.6	0.4	3.9	Assumed velocity of 3 m/s for conservative estimation
600S90	600	586	207.8	S	110							0.3	3.00	0.016	3.3	0.3	3.7	Assumed velocity of 3 m/s for conservative estimation
600S89	600	586	341.7	S	110							0.3	3.00	0.016	5.5	0.6	6.1	Assumed velocity of 3 m/s for conservative estimation
600DI90	600	586	1493.0	DI	110	8862.2	1484.9	3	2	29556.4	0.3	0.3	1.27	0.003	4.9	0.5	5.4	Considering all existing and planned development
200DI17	200	200			110	4194.3	674.9	3	2	13932.7	0.2	0.03	5.13	0.15	0	0.0	0.0	
									Option 1			0						
DN300	300	282	166.0	DI	110	4239.8	704.4	3	2	14128.2	0.2	0.1	2.62	0.029	4.9	0.5	5.4	Supply to only proposed development
									Option 2									
600DI90	600	586	173.6	DI	110	8862.2	1484.9	3	2	29556.4	0.3	0.27	1.27	0.00	0.57	0.1	0.6	
DN350	350	334	573.0	DI	110	4239.8	704.4	3	2	14128.2	0.2	0.1	1.87	0.013	7.4	0.7	8.1	Supply to only proposed development

Notes:

Hazen-Williams Coefficient taken as 110 when diameter < 600, 120 when diameter > 600
According to main laying practice, the maximim velocity allowed is 3 m/s
Velocity head loss, angled headloss and headloss at connections are considered minor
Minor headloss accounted by a 1.1 factor on frictional headloss

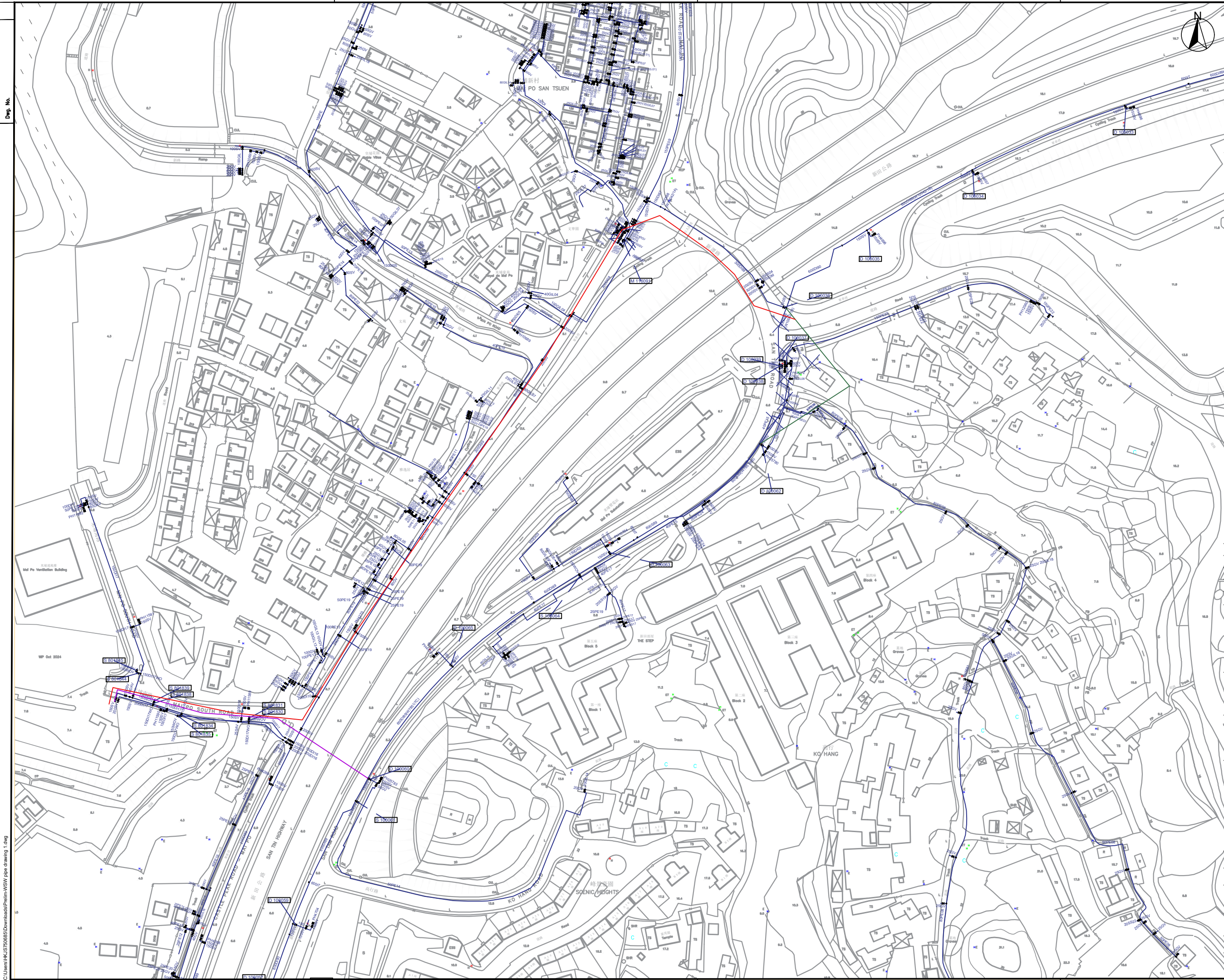
Estimate Residual Head			
Head to Ngau Tam Mei Fresh Water Preliminary Service Reservoir	=	99.1	mPD
Ground Level at extremity of proposed system	=	6.2	mPD
Friction Head Loss from Existing and Proposed Main Option 1	=	39.7	m
Residual Head at Extremity	=	53.3	m
Friction Head Loss from Existing and Proposed Main Option 2	=	43.0	m
Residual Head at Extremity	=	49.9	m

Appendix C

Proposed Water Supply Scheme

Dep. No.

C:\Users\HKUST50685\Downloads\Prim-WSW pipe drawing 1.dwg



- LEGEND
- Option 1
 - Option 2
 - Water Main to be diverted in CE15
 - Water Main to be abolished in CE15

- NOTES:
- Use written dimensions or grid lines. Measurements to existing work to be checked on site.
 - This drawing is to be read in conjunction with the Specification & Conditions of Contract.
 - This drawing & design are copyright and no portion may be reproduced without the written permission of WSP(Asia)Ltd. Consulting Engineers.
 - All Pipe Sizes refers to inner diameter in millimeters.

CLIENT
Profit Point Enterprise Ltd

DESIGN CONSULTANT
wsp

PROJECT
PROPOSED DEVELOPMENT AT
WO SHANG WAI
HONG KONG
LOTS 77 AND 50 S.A in DD101

DESIGNED BY	DATE	CHECKED BY	DATE
JS	JAN 2025	CC	JAN 2025
DRAWN BY	DATE	APPROVED BY	DATE
JS	JAN 2025		

DRAWING TITLE
PROPOSED WATER SUPPLY SCHEME
(Sheet 1)

SCALE	1:2000	STATUS	FILE NAME
DRAWING NO.			REV.