

Appendix G

Water Supply Impact Assessment

Proposed Rezoning from “Residential (Group B)1” Zone to “Residential (Group B)4” Zone for Medium Density Housing Development to Include a Footpath for Public Use at Various Lots and Adjacent Government Land in

D.D.130, Lam Tei, Tuen Mun

Water Supply Impact Assessment Report
Report No.: EB002372

Wing Mau Tea House Limited

EB002372

November 2023

Executive Summary

Client:	Wing Mau Tea House Limited
Report:	Water Supply Impact Assessment
Project:	Proposed Rezoning from “Residential (Group B)1” Zone to “Residential (Group B)4” Zone for Medium Density Housing Development to Include a Footpath for Public Use at Various Lots and Adjacent Government Land in D.D.130, Lam Tei, Tuen Mun
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1. Introduction

1.1 Background

1.1.1 The project involves medium-density housing development and a footpath for public use in "Residential (Group B)" zone (hereinafter refer to as the "proposed development") located at D.D.130 in Lam Tei, Tuen Mun (hereinafter refer to as the "project site") as shown in Figure 1-1 below. The area of the project site is 8,896 m² with a proposed plot ratio of 5.00. The proposed site will comprise both private lots and government land. Population intake is expected in 2030.

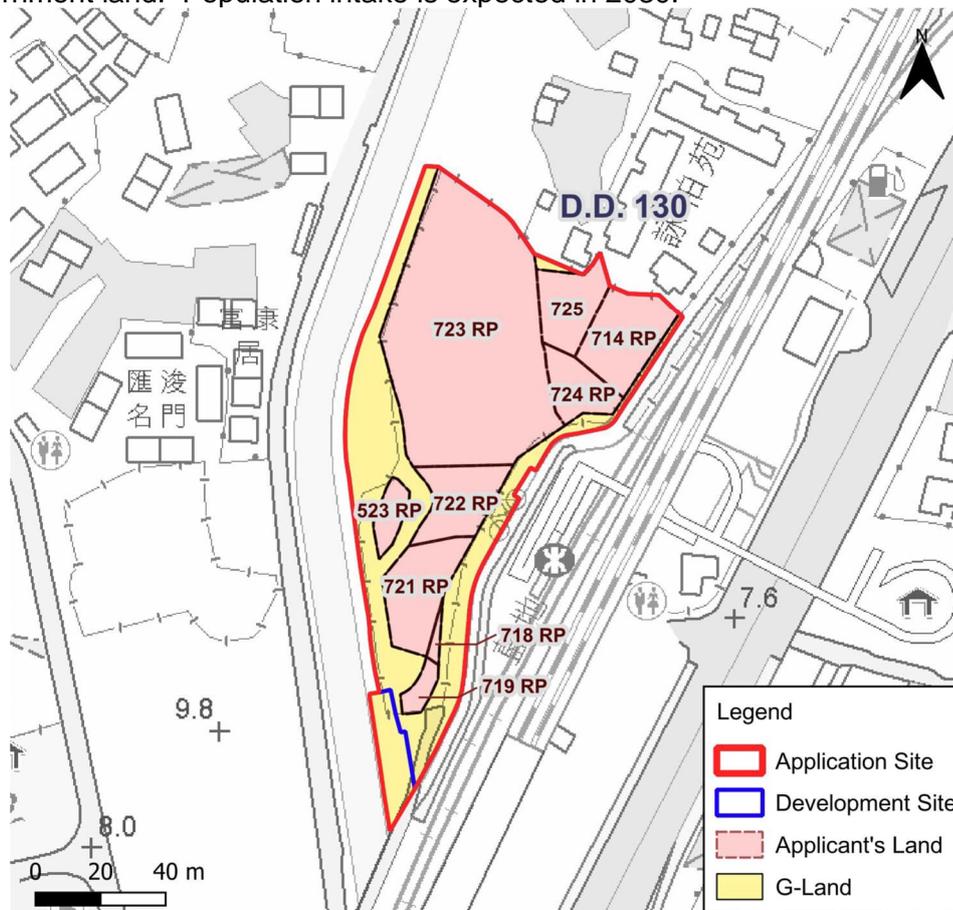


Figure 1-1 Site Location

1.1.2 As shown in [Figure 1-2](#) below, the subject site is currently vacant with scattered vegetation. No major erected structures were built at the subject site.



Figure 1-2 Photo of Existing Development Site

1.2 Proposed Development Scheme

1.2.1 The proposed development will comprise 5 nos. of 14 to 27-storey residential blocks, leading to 1385 nos. of flats in total. The estimated population is 3740 in total (assuming 2.7 persons per flat). A shared clubhouse will be provided (assumed 2.3 workers per 100m² GFA).

1.3 Objectives

1.3.1 The objectives of the WSIA are as follows:

- i. To assess the water demands for the proposed development.
- ii. To examine whether the demand can be met by the existing waterworks facilities; and
- iii. To recommend suitable mitigation measures and/or diversion schemes, if required.

1.4 Abbreviations

1.4.1 The following table lists out the abbreviations for expressions adopted in this Report:

Table 1. Abbreviations

Abbreviations	Full Expression
DI	Departmental Instruction
FSD	Fire Services Department
FWSR	Fresh Water Service Reservoir
MOD	Mean daily demand
MLD	Million litres per day
SFH	Street Fire Hydrant
SWPS	Salt Water Pumping Station
SWSR	Salt Water Service Reservoir
WSD	Water Supplies Department
WSIA	Water Supply Impact Assessment

2. Design Assumptions and Criteria

2.1 General

2.1.1 The proposed development scheme will generate significant demands for fresh and salt water. The expected impacts on the existing water supply systems and the requirement for any upgrading works to meet such demands are analysed in the assessment.

2.2 Codes of Practice and Design Manuals

2.2.1 The assessment has made reference to the relevant unit water demand in the WSD's DI No. 1309 "Design Criteria together with the Revised/ New Planning Standards following DI No. 1309".

2.3 Design Parameters

Hydraulic Design

2.3.1 Hazen-Williams ($V = 0.85 C_{hw} R^{0.63} S_f^{0.54}$) will be used to calculate the velocity of water in a pipe.

where

- V is velocity of water in a Pipe
- C is a Roughness Coefficient
- R is the Hydraulic Radius
- S is Frictional Hydraulic Gradient

1) Roughness coefficient, C of Hazen-Williams for the water pipes will be assumed as follows:

I. For DI/MS Cement Lined Pipe with epoxy coating

Fresh water pipe	>= 600mm diameter	120
	< 600mm diameter	110
Salt water pipe	All sizes	90

II. For PE Pipe

PE pipe		155
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2) Minor head losses are also calculated based on the estimated number of bends, tees and valves along the water mains alignment. The minor head loss is assumed to be 20% of the frictional loss.

3) The parameters of the desirable velocities for hydraulic checking are quoted in Table 2:

Table 2. Desirable Flow Velocity Limit

Fresh Water		Salt Water	
Pipe Diameter (mm)	Max. Flow Velocity (m/s)	Pipe Diameter (mm)	Max. Flow Velocity (m/s)
> DN700	3.0	>= DN1000	3.0
DN525 - DN700	2.5	DN800 - DN900	2.5
DN375 - DN450	2.0	DN525 - DN700	2.0
DN200 - DN300	1.5	<= DN450	1.5

- 4) The preferably minimum velocity of 0.9 m/s for both fresh water and salt water should be achieved, as far as practicable, to prevent stagnant water problems. In case of the minimum velocity cannot be achieved, it is required to seek WSD's advice in detail on case-by-case basis.
- 5) The pipelines shall have a minimum gradient of 1:400. Pipes shall be laid at a minimum separation of 300mm away from existing utilities and underground structures.
- 6) The water mains shall be capable of withstanding the maximum head induced and pipeline materials shall be selected so as to achieve maximum overall economic performance of the supply system and shall be corresponding with the operating conditions to be expected.
- 7) The design of exposed water mains includes the design of water mains supports, loading protection, maintenance and access requirement and shall address expose conditions. Adequate pipe brackets shall be provided.

Peaking Factors

2.3.2 According to WSD's DI No. 1309, the following peak demand factors will be adopted for the detailed design.

- 1) Peak flow rate in fresh water distribution mains = 3 x mean daily demand;
- 2) Peak flow rate in salt water distribution mains = 2 x mean daily demand;
- 3) Peak flow rate in fresh water trunk mains = 1.5 x mean daily demand (for a single service reservoir);
- 4) Peak flow rate in fresh water trunk mains = 1.3 x mean daily demand of all the reservoir supply zones + 0.2 x mean daily demand of the largest zone (for two or more service reservoirs);
- 5) Peak flow rate in salt water trunk mains = 1.2 x mean daily demand.

Fire-Fighting

2.3.3 According to the recommendations from FSD, fresh water will be used for fire-fighting. Fire-fighting requirements shall be based on the WSD's Departmental Instruction No. 1309.

- 1) Residential Zones: 6,000 m³/d
- 2) Industrial Zones: 11,000 m³/d

Residual Heads

2.3.4 According to WSD's DI No. 1309, the fresh water and salt water supply systems for the Potential Development Areas will be designed to provide minimum residual heads at the extremity of the system as follows:

- 1) Fresh water - Normal: 20m (for developments on or after 1 April 2008)
- 2) Fresh water - Normal: 30m (for developments before 1 April 2008)
- 3) Fresh water - Fire Fighting: 17m
- 4) Salt water: 15m

Irrigation Demand

2.3.5 According to Table 3-4 of WSD's Technical Specification on Grey Water Reuse and Rainwater Harvesting, the recommended daily water consumption in landscaping irrigation design is 7 litres/day/m² of irrigation area.

2.4 Population

2.4.1 Under the current design scheme, the proposed development will consist of 1385 residential units with a 660m² clubhouse. Please refer to Table 3 for summary estimation of population at the proposed development and detailed estimation of population respectively.

Table 3. Population of Proposed Development

Type of Population	No. of Flat / Gross Floor Area	Estimated Population	Data Source
<i>Proposed Development</i>			
Residential	1385 units		Average household size of 2.7 in Tuen Mun District is referenced to Summary Table 1 Domestic household characteristics in Population and Household Statistics Analysed by District Council District 2020, by Census and Statistics Department HKSAR
Total		3740 persons	
Service Trade	660m ²		2.3 Workers per GFA (in 100 square meter) in Private Commercial for Community - Social & Personal Services in Figure 16 of CIFSUS Report, by Planning Department HKSAR
Total		16 workers	

3. Water Supply Impact Assessment

3.1 Existing Fresh and Salt Water Supply

- 3.1.1 The subject site is located within the fresh water distribution zone of Tuen Mun North FWSR located in Por Lo Shan, Tuen Mun, New Territories, Hong Kong. According to WSD, the Tuen Mun North FWSR has capacity of 60,564m³ and is currently having an average consumption of 63 MLD. Existing salt water is supplied by Lok On Pai SWPS and Tan Kwai Tsuen SWSR.
- 3.1.2 According to WSD, there are existing fresh water and salt water mains identified near the vicinity of the Site, see Drawing No. 1. Existing fresh watermains are located along Ng Lau Road, San Hing Road, west bank of nullah and Castle Peak Road. Existing salt watermains are located along Ng Lau Road, San Hing Road and Castle Peak Road.
- 3.1.3 The WSD mains record plan in the vicinity of the proposed development and location for measured water pressure are shown in Appendix A.
- 3.1.4 Existing water pressures at two fire hydrants, PH10620 and PH2744, for both fresh water and saltwater, respectively, were obtained from WSD and summarized in Table 4.

Table 4. Existing Water Pressure Measured by WSD

Fire Hydrant	psi	Bar
PH10620	95	6.55
PH2744	75	5.17

3.2 Proposed Fresh / Salt Water Demand

- 3.2.1 With reference to Table 1 of DI No. 1309 and WSD's advice, the water demand for the proposed development is estimated in Table 5 below. It is expected that the proposed development will generate 1135m³/day and 389m³/day of MDD fresh and salt water.

Table 5. Estimated Daily Water Demand (m³/day) from the Proposed Development

(a1) Population (Person)	3740	Estimated population in the proposed development
(a2) Workers (Person)	16	Estimated workers in the clubhouse of proposed development
(b1) Domestic Fresh Water Unit Demand (m ³ /person/day)	0.30	Residential - R2 in Table 1 of DI No. 1309
(b2) Service Trade Unit Demand (m ³ /person/day)	0.035	New Town - Tuen Mun in Table 2 of DI No. 1309
(c) Planting Area (m ²)	1,660	
(d) Irrigation consumption (litres/d/m ²)	7	WSD Technical Specification on Grey Water Reuse and Rainwater Harvesting
(e) Fresh Water Mean Daily Demand (m ³ /day)	1135	(a1) × (b1) + (a2) × (b2) + (c) × (d)
(f) Salt Water Unit Demand (m ³ /person/day)	0.104	Advised by WSD
(g) Salt Water Mean Daily Demand (m ³ /day)	389	(a) × (f)

3.2.2 The total peak flow arising from the proposed development is 3405 m³/day and 778 m³/day for fresh water and salt water respectively as shown in Table 6.

Table 6. Estimated Peak Flow (m³/day) from the Proposed Development

Water	Peaking Factor	Peak Flow (m ³ /day)
Fresh water	3	3405
Salt water	2	778

3.3 Proposed Water Supply Scheme

3.3.1 Existing fresh and salt water supply systems are found next to the proposed development. As per discussion with WSD, proposed watermains shall be tee-off from existing fresh watermain and salt watermain for the water supply to the proposed development. Proposed watermain alignment is shown in Drawing No. 2. Location of proposed water meter room is attached in Appendix B.

3.3.2 Proposed watermains located at public road with free access will be government watermains and to be handed over to, operated and maintained by WSD. Proposed watermains located within site boundary will be maintained by the private developer.

3.3.3 The development ground levels are similar to the existing ground levels, thus the existing water supply systems shall be able to supply fresh and salt water to the proposed development with sufficient residual heads.

3.3.4 Residual head assessment for the proposed fresh and salt watermains are shown in Appendix C.

3.3.5 Fresh water demand from the development will be supplied by Tuen Mun North FWSR, while salt water demand will be supplied by Lok On Pai SWPS and Tan Kwai Tsuen SWSR.

Proposed Fresh Water Supply System

3.3.6 Proposed fresh watermain of DN200 is proposed to tee-off from existing DN450 fresh watermain at road junction of Ng Lau Road. It is proposed to run along proposed new road and along the utility trough of the proposed nullah crossing bridge and enter the proposed site area.

3.3.7 Existing fresh water street fire hydrants are observed near the proposed development area. The distribution main is considered designed with sufficient fire-fighting capacity for the proposed development.

3.3.8 In view of the existing vicinity, existing fresh water SFH are not able to provide service for the proposed development within 100m distance requirement, additional fresh water SFH are required. Two swan neck fresh water SFH are proposed for the development. Further discussion with FSD would be carried out.

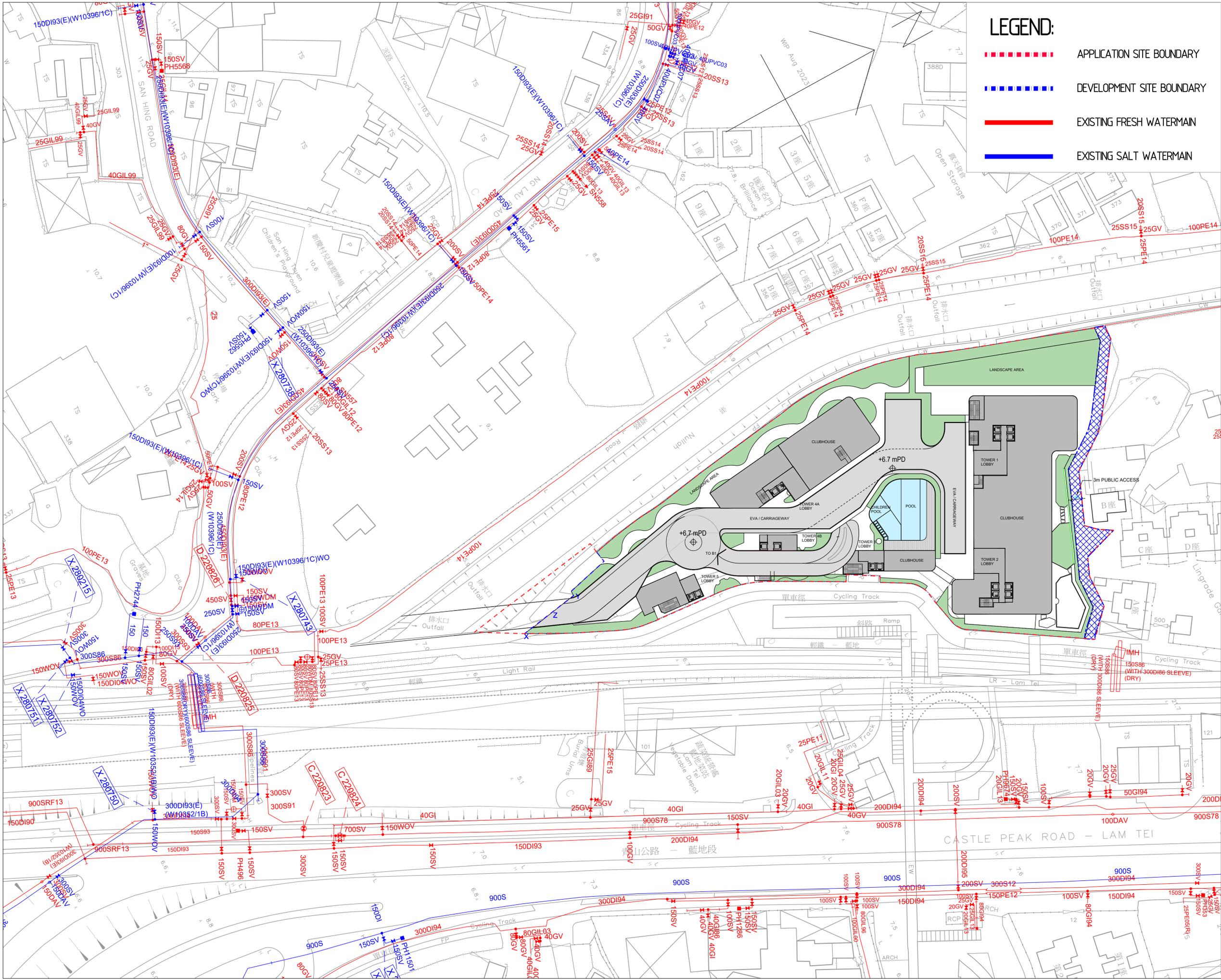
Proposed Salt Water Supply System

- 3.3.9 Proposed salt watermain of DN100 is proposed to tee-off from existing DN250 salt watermain at road junction of Ng Lau Road, at the similar location of the proposed tee-off location of proposed fresh watermain. Similar to proposed fresh watermain, proposed salt watermain is proposed to run along proposed new road and along the utility trough of the proposed nullah crossing bridge and enter the proposed site area.
- 3.3.10 Existing salt water street fire hydrants are identified near the proposed development, however, no new salt water fire hydrant is considered necessary in the proposed scheme.

4. Conclusions

- 4.1.1 A WSIA has been conducted to evaluate the possible impacts on the existing fresh water and salt water supply facilities as a result of the Proposed Medium-Density Housing Development to include a Footpath for Public Use at Various Lots and Adjacent Government Land in D.D.130 Lam Tei, Tuen Mun, New Territories.
- 4.1.2 Existing fresh water and salt water mains are identified near to the proposed development, thus proposed watermains would be connected from the existing watermains at Ng Lau Road junction. Proposed fresh water and salt water watermains are proposed to run parallel along the proposed road connection to the development and enter proposed water meter room. No existing watermain diversion is required.
- 4.1.3 SFHs are proposed within development site and further discussed and liaised with WSD in future maybe required.
- 4.1.4 Since the proposed development is located similar to existing ground level, no additional pumping is required for providing sufficient residual head. Upgrading of the existing water supply system is not required.
- 4.1.5 Existing residual heads for both fresh water and salt water supply systems are measured by WSD and considered sufficient for proposed connection in this water supply impact assessment.
- 4.1.6 There is no huge water consumption facilities within the proposed development. Fresh and salt watermains are proposed and analyzed in the water impact assessment.
- 4.1.7 With the proposed fresh water and salt water systems and proper maintenance in place, it is concluded that the proposed development will not have any unacceptable adverse water supply impacts to the surrounding.

Drawings



LEGEND:

- - - - - APPLICATION SITE BOUNDARY
- - - - - DEVELOPMENT SITE BOUNDARY
- EXISTING FRESH WATERMAIN
- EXISTING SALT WATERMAIN

Project Stage: **WSIA**
 Drawing Status: **FOR APPROVAL**

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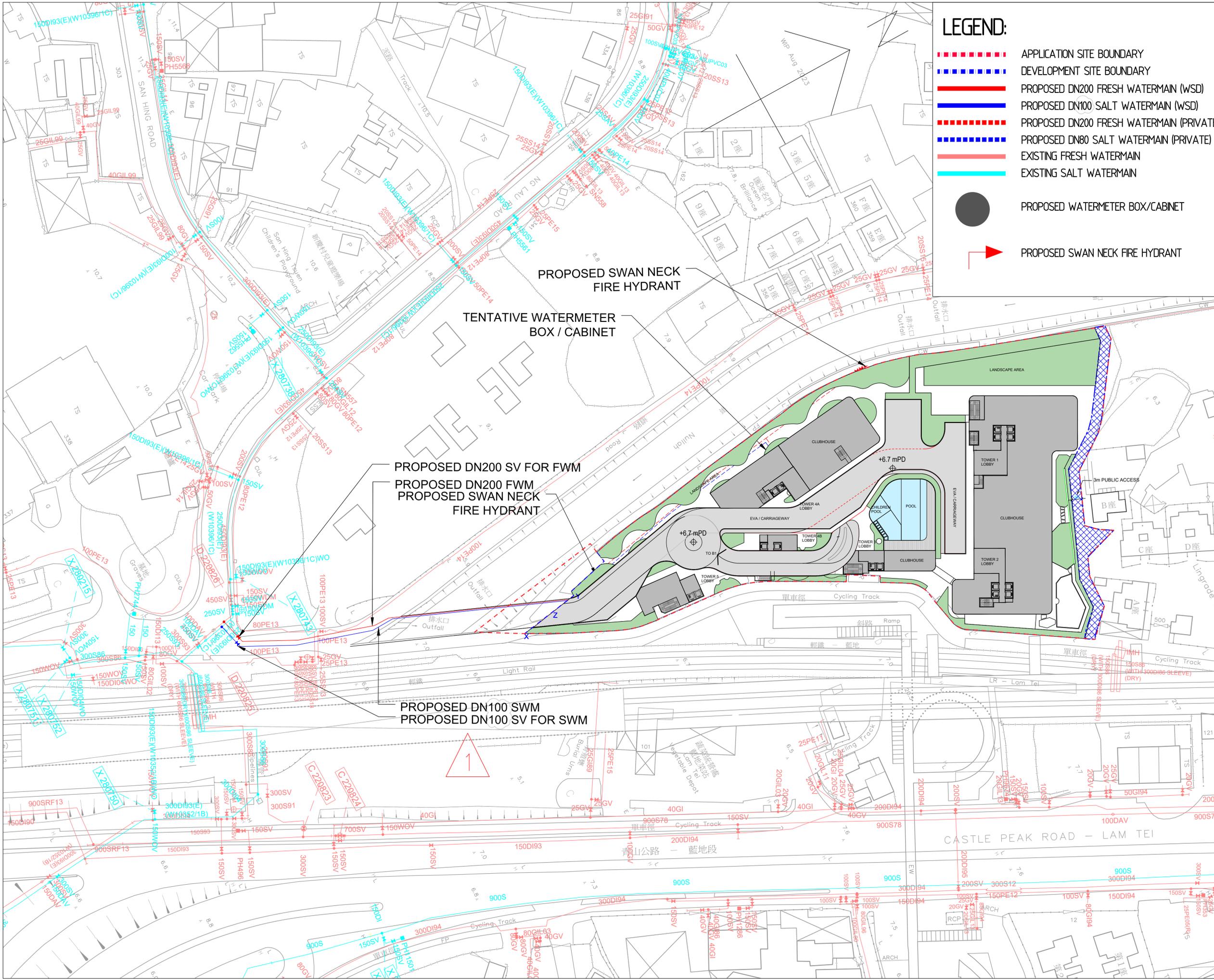
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Asia Infrastructure Solutions LTD

Project:
 PROPOSED REZONING FROM "RESIDENTIAL (GROUP B)1" ZONE TO "RESIDENTIAL (GROUP B)4" ZONE FOR MEDIUM-DENSITY HOUSING DEVELOPMENT TO INCLUDE A FOOTPATH FOR PUBLIC USE AT VARIOUS LOTS AND ADJACENT GOVERNMENT LAND IN DD130, LAM TEI, TUEN MUN

Drawing Title:
EXISTING WATER MAIN LAYOUT

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LEGEND:

- - - - - APPLICATION SITE BOUNDARY
- - - - - DEVELOPMENT SITE BOUNDARY
- PROPOSED DN200 FRESH WATERMAIN (WSD)
- PROPOSED DN100 SALT WATERMAIN (WSD)
- - - - - PROPOSED DN200 FRESH WATERMAIN (PRIVATE)
- - - - - PROPOSED DN80 SALT WATERMAIN (PRIVATE)
- EXISTING FRESH WATERMAIN
- EXISTING SALT WATERMAIN
- PROPOSED WATERMETER BOX/CABINET
- ▶ PROPOSED SWAN NECK FIRE HYDRANT

Project Stage: **WSIA**
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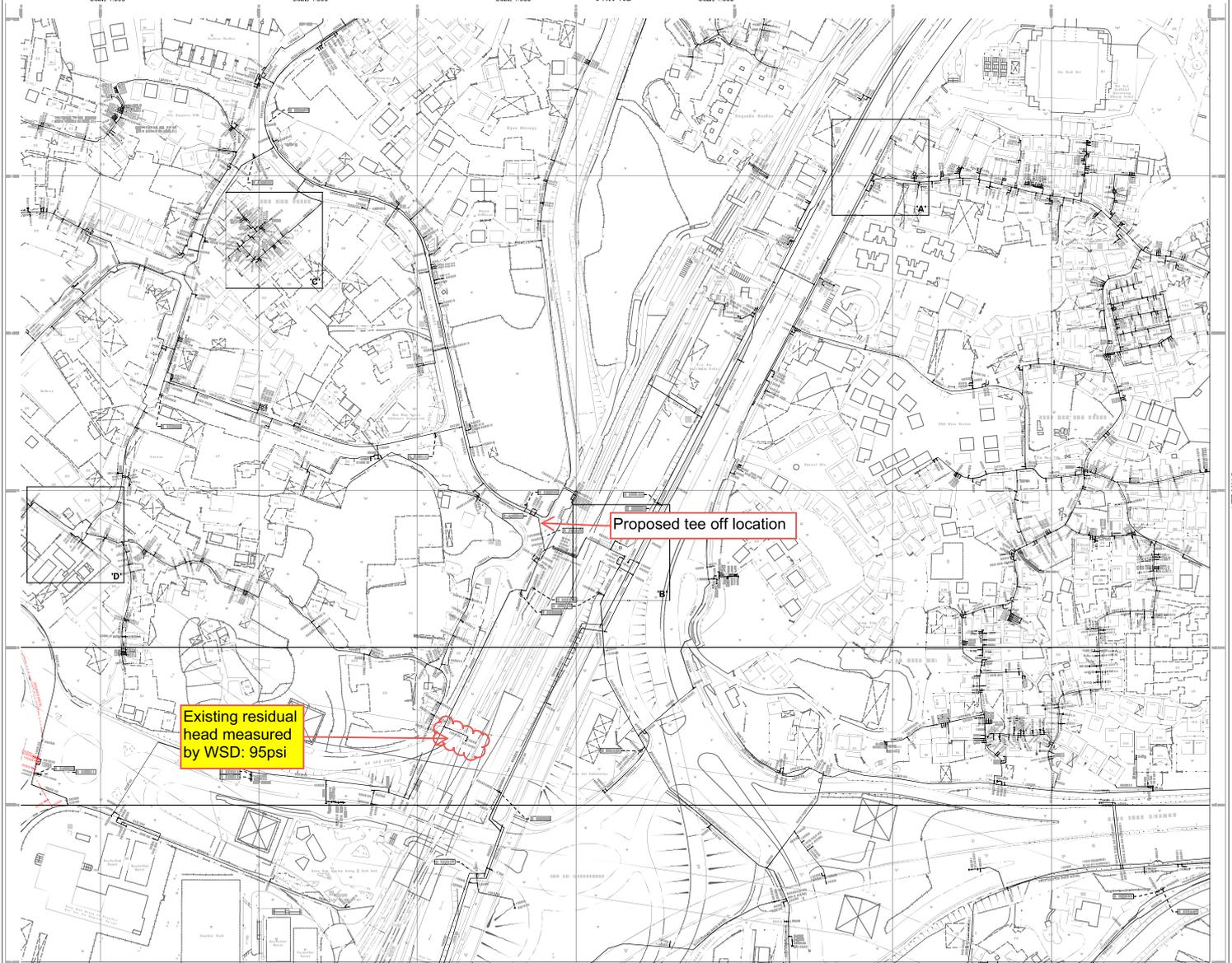
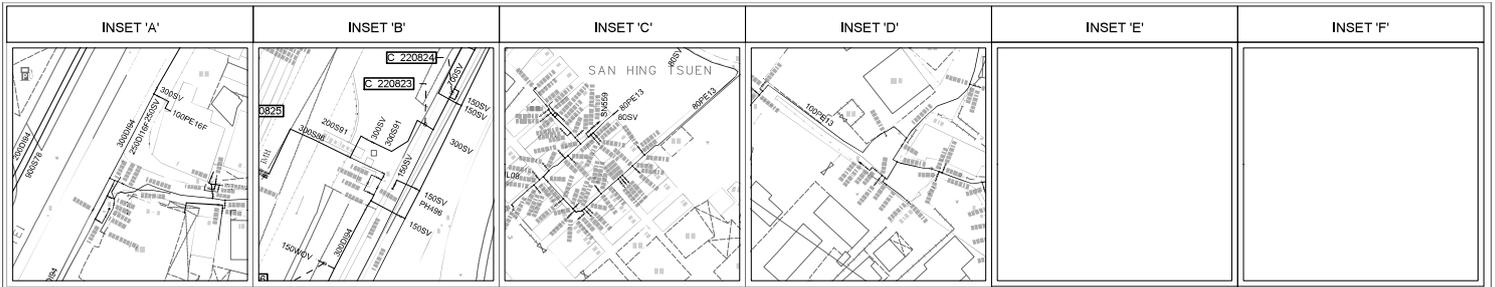
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PROPOSED WATER MAINS LAYOUT

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Appendix A

Existing Watermains Record Plan



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FRESH WATER MAINS RECORD PLAN

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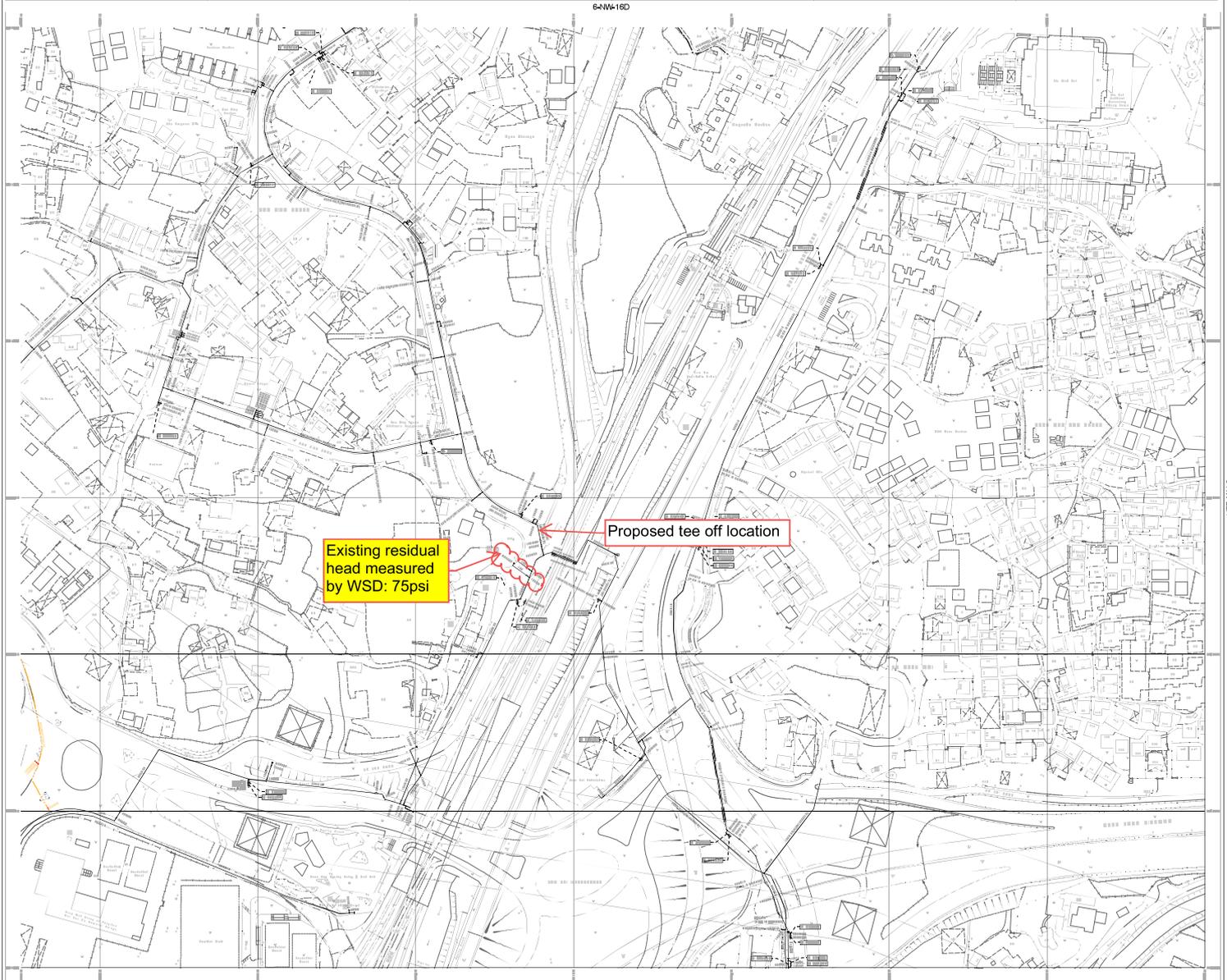
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SALT WATER MAINS RECORD PLAN

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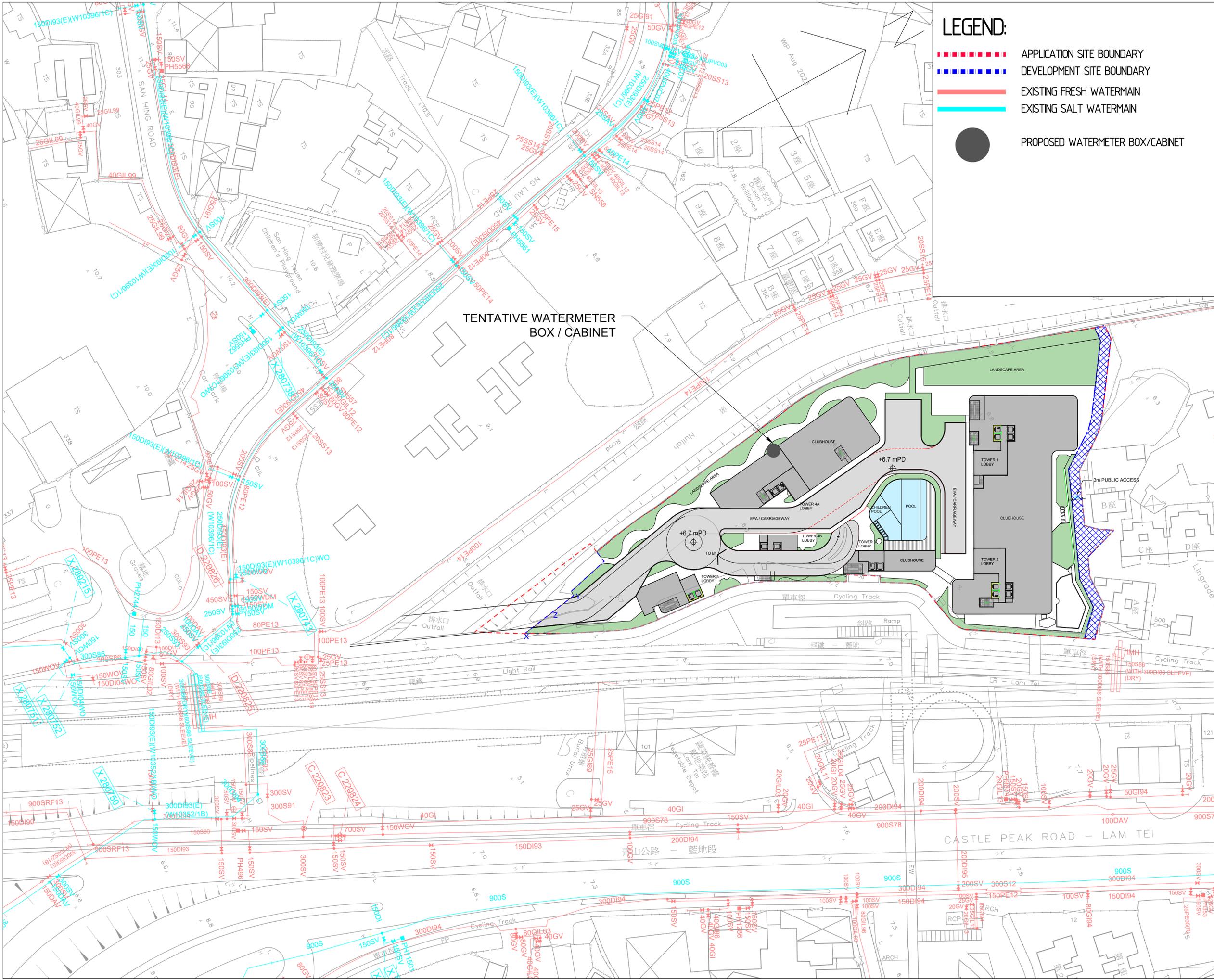
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Appendix B

Location Plan of Proposed Water Meter Room



LEGEND:

- - - - - APPLICATION SITE BOUNDARY
- - - - - DEVELOPMENT SITE BOUNDARY
- — — — — EXISTING FRESH WATERMAIN
- — — — — EXISTING SALT WATERMAIN
- PROPOSED WATERMETER BOX/CABINET

Project Stage: **WSIA**
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Drawing Title:
TENTATIVE WATERMETER BOX/CABINET

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Appendix C

Residual Head Calculation Assessment for Proposed Water Supply System

Estimation of Hydraulic Gradient and Headloss
by using Hazen-Williams Equation

$$V = 0.85 C_{hw} R^{0.63} S_f^{0.54}$$

Location: Fresh Water Supply from Existing Watermain to Proposed Development

Water Type: Fresh Water

Measurement of water pressure at fire hydrant	psi	bar	m
PH10620	95	6.55	66.81

From the Existing Watermains to the supply zone

Parameters	Unit	Existing Watermains			Proposed Watermains
		DN150	DN300	DN450	DN200
Total MDD/ fire fighting requirement for the proposed development	m ³ /d				1135
Assumed Actual Pipe Diameter, D	mm	138	282	424	200
Assumed Velocity Under Peak Flow Condition, V	m/s	1.5	1.5	2.0	
Design Peak Flow	L/s				39.41
Velocity Under Design Peak Flow	m/s				1.25
Design Pipe Capacity	L/s				39.41
Hydraulic Radius, R	m	0.035	0.071	0.106	0.050
Hazen-Williams Coefficient, C _{hw}		110	110	110	110
Hydraulic Gradient, Sf		0.024	0.011	0.011	0.011
or 1 in		41	95	90	89
Travel Distance	m	19	135	19	185.0
Estimated Headloss	m	0.5	1.4	0.2	2.1
Frictional Loss	m				4.2
Minor Loss*	m				0.8
Total Head loss	m				5.0
*Assumed as 20% of Frictional Loss					
Measured existing residual head at PH10620	m				66.8
Level of Proposed Fresh Water Mains	m				1.6
Residual Head at Existing and Proposed Water Mains	m				60.2

>20m, OK

Note:

1. Assume Velocity for Hydraulic Assessment (For proposed pipes, velocity is calculated by water demand)

Pipe Diameter (mm)	Max. Flow Velocity (m/s)
>DN700	3.0
DN525 - DN700	2.5
DN375 - DN450	2.0
<= DN300	1.5

2. Design peak flow is 3xMDD, since there are existing fire hydrants nearby the proposed development.

3. Measured existing residual head is advised by WSD.

Estimation of Hydraulic Gradient and Headloss
by using Hazen-Williams Equation

$$V = 0.85 C_{hw} R^{0.63} S_f^{0.54}$$

Location: Salt Water Supply from Existing Watermain to Proposed Development

Water Type: Salt Water

Measurement of water pressure at fire hydrant	psi	bar	m
PH2744	75	5.17	52.74

From the Existing Watermains to the supply zone

Parameters	Unit	Existing Watermains			Proposed Watermains
		DN150	DN300	DN250	DN80
Total MDD/ fire fighting requirement for the proposed development	m ³ /d				389
Assumed Actual Pipe Diameter, D	mm	138	282	236	100
Assumed Velocity Under Peak Flow Condition, V	m/s	1.5	1.5	1.5	
Design Peak Flow	l/s				9.00
Velocity Under Design Peak Flow	m/s				1.15
Design Pipe Capacity	l/s				9.00
Hydraulic Radius, R	m	0.035	0.071	0.059	0.025
Hazen-Williams Coefficient, C _{hw}		90	90	90	90
Hydraulic Gradient, Sf		0.035	0.015	0.019	0.031
or 1 in		29	66	53	32
Travel Distance	m	15	5	30	185.0
Estimated Headloss	m	0.5	0.1	0.6	5.7
Frictional Loss	m				6.9
Minor Loss*	m				1.4
Total Head loss	m				8.3
*Assumed as 20% of Frictional Loss					
Measured existing residual head at PH10620	m				52.7
Level of Proposed Fresh Water Mains	m				1.6
Residual Head at Existing and Proposed Water Mains	m				42.9

>15m, OK

Note:

1. Assume Velocity for Hydraulic Assessment (For proposed pipes, velocity is calculated by water demand)

Pipe Diameter (mm)	Max. Flow Velocity (m/s)
>=DN1000	3.0
DN800 - DN900	2.5
DN525 - DN700	2.0
<=DN450	1.5

2. Design peak flow is 3xMDD, since there are existing fire hydrants nearby the proposed development.

3. Measured existing residual head is advised by WSD.



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