S.16 Planning Application for Proposed Religious Institution (the Supreme Kwan Ti Temple) and Improvements to the Tai Tong Kwan Ti Square and the Associated Existing Access Road at Tai Tong, Yuen Long

Water Supply Proposal

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Chapter 1 Introduction and Objectives

1.1 Introduction

1.1.1 This Section 16 application Site will fall mainly within an area zoned "Recreation" ("REC") and "Green Belt" ("GB") on the Approved Tai Tong Outline Zoning Plan (OZP) No. S/YL-TT/20.

1.1.2 The application site has a total area of about 31,068 m2, which comprises the following three parts:

a. The development area (the Supreme Kwan Ti Temple site. It is the main Temple site which includes the standalone religious institution and ancillary facilities, and is made up of about 17,393 m2 area with about total 22,775 m2 GFA.

b. The Tai Tong Kwan Ti Square area. It is an existing area for the celebration of Kwan Ti with cultural events.

c. The access road improvement area. This area covers the associated existing access road to the Supreme Kwan Ti Temple site and the proposed road improvement portion.

1.2 Objectives

Upon WSD's request, we are commissioned to assess the availability of the government water supply mains in the vicinity of the development site and propose the feasible water supply scheme.

Chapter 2 Design Criteria and Parameters

2.1 Design Criteria

2.1.1 Reference is made to the relevant unit water demand in WSD's DI No. 1309.

2.2 Design Parameters

2.2.1 Water Velocity and Pressure Loss

2.2.1.1 Hydraulic equation – Hazen-Williams ($V = 0.85\ C\ R^{0.63}\ S^{0.54}$) will be used to calculate the water velocity in the proposed pipe.

Where V = water velocity (m/s) in a pipe
C = Roughness coefficient
R = Hydraulic radius

S = Frictional hydraulic gradient

2.2.1.2 Roughness coefficient C will be assumed as follows:

(1) For DI with internal cement lined pipe and external epoxy coating
Fresh water pipe (<600mm diameter) 120
Salt water pipe 90
(2) For PE pipe 155

2.2.1.3 The total pressure loss of the whole length of water supply mains alignment will include the pressure loss of longitudinal pipe length plus the minor head losses due to the bends, tees and valves. The minor head loss is assumed to be 50% of that of longitudinal pipe length.

The pipe diameter will be designed on basis of maximum flow velocities of 1.5 m/s for DN200 – DN300 fresh water pipe and < DN450 salt water pipe. The flow velocity will not be less than 0.9 m/s preferably to avoid stagnant water problem.

The pipe mains will be designed and installed at a minimum gradient of 1:400, and will be laid at a minimum distance of 300mm away from the existing utilities and underground structures

2.2.1.4 The water mains will be designed and installed with adequate brackets, thrust blocks and maintenance and access provisions as would be required by WSD.

The materials of the water mains, bends, and valves will be selected in compliance with WSD's requirements.

2.2.2 Residual Pressure Heads

The fresh water supply system for the Development Area will be designed to provide at least 20m head at the extremity of the system for both visitors/staff use and fire fighting systems.

2.2.3 Fire Services Water Demand

Fresh water will be used for the sprinkler system and fire hydrant/hose reel system. As the proposed water supply main will be connected to the one feed (single source) WSD water main, full capacity sprinkler water tank will be installed, which shall need to be refilled from empty situation to full capacity within not more than 36 hours.

2.2.4 Irrigation Demand

The daily water consumption for the landscape irrigation system will be 5 litres/m2/day.

2.3 Calculation of Water Users

The development site will be operated as a religious institution open to public visitors. The maximum number of visitors during peak festival days will be as follows:

1. Within four hours in the morning session, there will be 2000 visitors and 150 staff.
2. Within six hours in the afternoon, it is estimated 2000 people will visit the Supreme Kwan Ti Temple and 150 staff will work there.

Chapter 3 Proposal of the Water Supply System

3.1 Existing Condition and Available Government Water Mains

3.1.1 As revealed by the "Fresh Water Mains Record Plan" dated 2nd July, 2024 and issued by Water Supplies Department, there is currently no government fresh water mains in the vicinity of the Development Site. It is hence presumed that there is currently no salt water (for flushing) mains near the Development Site.

3.1.2 In reply to the Pre-submission of s.16 Planning Application dated 18th April, 2024, Water Supplies Department gave its comment, "Due to the remoteness of the site, the applicant may need to make use of his private sump and pump system to effect adequate wate supply to the development".

In reply to the Formal Pre-submission dated 26th July, 2014, Water Supplies Department requested for a Water Supply Proposal.

3.2 Estimated Future Water flow

3.2.1 In accordance with Sub-section 4.3 – Operation of the Temple in the Planning Statement submitted with the Planning Application, during each the festival days, there will be150 staffs employed to serve 2000 worshippers from 8:00am to 12:00pm and another 2000 visitors who will join the non-worshipping activities between 12:00pm and 6:00pm.

According to Table 4.2 – Breakdown of GFA Calculation in the Planning Statement, there will be one staff canteen, office for security, office for Religious Facilities, and security room.

3.2.2 On basis of these architectural design parameters, the total water consumption flow rate, including those for the fresh water and flush water and that for fire services are estimated to be 3.94 Litres/sec and 1.43 Litre/sec respectively as tabulated in Table 1.

3.3 Schematic Design of Water Supply Pipeline to the Development

3.3.1 Existing Condition and Available Government Water Mains

The Fresh Water Mains Record Plans (WSD drawing nos. W67880_06-SW-04B and W67880_06-NW-24D) reveal that there is currently not any government fresh water main nor salt water main in the vicinity of the Development Site and that there is an existing 150mm PE fresh water main up north at 1000 metres away from the Development Site, as shown on Figure 1 and 2.

It is noted that the existing 150mm fresh water main is buried under the road surface at about 37.0 mPD.

3.3.2 If a water pipe of 100 mm diameter is considered, the velocity and water head loss incurred by the 3.94 Litres/s water flow will be 0.5 m/s and 0.003 metre/metre.

As the sump tank and pump room shall be located at 26.0 mPD, the water pressure of the fresh water main connection point at 37.0 mPD will be ample to cater for the pipe pressure loss to deliver the total water consumption flow rate, 3.94 Litres/s through the 100 mm diameter pipe of more than 1000 metres length.

3.3.3 It is proposed that the applicant shall be responsible to construct a 100mm diameter fresh water pipe from the connection of the existing 150mm diam. fresh water main to the sump tank and pump room in the Development Site. The schematic design of the pipe and sump and pump system is displayed in Figure 3.

Pumps with associated pneumatic tanks for the inside plumbing services, and fire services pumps will be installed to deliver water to the respective systems.

Table 1 Calculation of Total Water Consumption Flow Rate

Potable and Flush Water Consumption					
Total number of staff and the temporary volunteers			=	150	persons
Water Usage Factor (70% for potable water use and 30% flushing water)			=	280	Litres/day
Total Water Usage per day (70% for potable water use and 30% flushing water)	=	280 x 150	=	42000	Litres/day
Peak flow rate (peak flow factor = 3)	=	42000 x3 / (10 x 3600)	=	3.5	Litres/sec
Cleansing Water Usage					
There will be about 6 cleansing water taps, each using 0.15 Litres/s for minutes per day.					
Daily cleansing water consumption	=	6 x 0.15 x 1800	=	1620	Litres/day
Peak flow rate (peak flow factor = 3)	=	1620 x 3 / (12 x 3600)	=	0.113	Litres/sec
Irrigation Water Usage					
There will be about 1200 m2 landscape, requiring 5 Litres/m2 per day					
Daily irrigation water consumption	=	1200 x 5	=	6000	Litres/day
Peak flow rate (peak flow factor = 3)	=	6000 x 3 / (12 x 3600)	=	0.417	Litres/sec
Total water consumption for the whole Development Site (including potable water, non-potable water and flush water consumption) (which will occur from 8:00am to 6:00pm)	=	42000 + 1620 +6000	=	49620	Litres/day
Calculation of Maximum Water Flow Rate (Potable, Flushing, and non-potable)					
Maximum water flow rate	=	3.5 + 0.113 + 0.417	=	4.03	Litres/s
Sprinkler System					
Sprinkler tank full capacity (OH 3)	=	185 m3			
Water flow rate (refilling in 36 hours)	=	185/(36 x 3600)	=	1.43	Litres/s

As the maximum water flow rate, 4.03 Litres/s (potable, flushing, and non-potable) is more than sprinkler water tank refilling flow rate, the proposed water supply pipe will be based on the former.

Table 2 Calculation of Residual Head of the Proposed Water Supply System

Calculation of water pressure loss from the connection to the existing government water mains to the proposed Development by using Hazen-Williams Equation,

$$V = 0.85\ C\ R^{0.63}\ S^{0.54}$$

Where V = water velocity (m/s) in a pipe

C = Roughness coefficient

R = Hydraulic radius

S = Frictional hydraulic gradient

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Parameters of Calculation	Unit	Existing WSD Water Mains	Calculated Parameter of Proposed Supply Main	Remark
		DN150	DN100	
Design peak flow (mean daily demand plus sprinkler/fire hydrant system)	Lit/sec		4.03	Note 1
Hydraulic radius, R	m		0.025	
Coefficient, C			110	
Frictional hydraulic gradient, S			0.011	
Velocity under design peak flow	m/s		0.803	Note 2
Estimated head (pressure) loss (Refer to Graph 4 - PE pipe of Chartered Institute of Plumbing and Heating Engineers)	m/m length		0.004	
Estimated water main length	m		1500	
Estimated pipe length head loss	m		6	
Minor head loss (50% of pipe length head loss)	m		3	

Total head loss	m	9	
Assume existing residual head at existing fire hydrant near government water main	m	30	
Level drop of head from existing government water main (at 37 mPD) to the water tank room in the Development Site (at 26 mPD)	m	11	
Residual head at the proposed water supply main in the Development	m	30 + 11 – 9 = 32	>20 m as required by WSD

Notes:

1. Design peak flow is 3 x mean daily demand as there is one existing fire hydrant near the Development.
2. Calculated velocity of proposed water mains is less than the desired maximum flow velocity, 1.5m/s.

Figure 1 Development Site – Fresh Water Supply Pipe Layout Plan

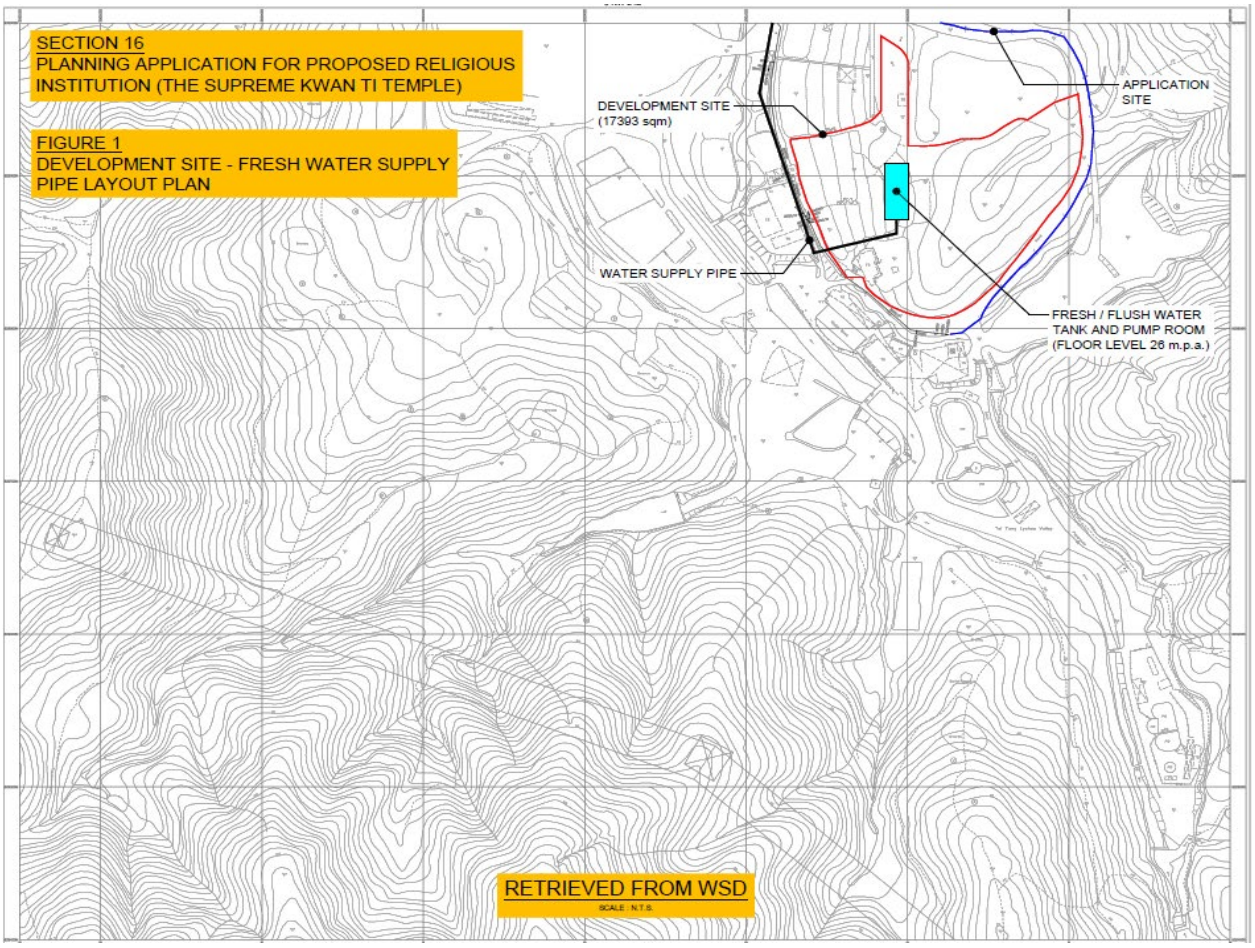

Figure 2 WSD Water Main Connection Point and Water Supply Pipe Layout Plan

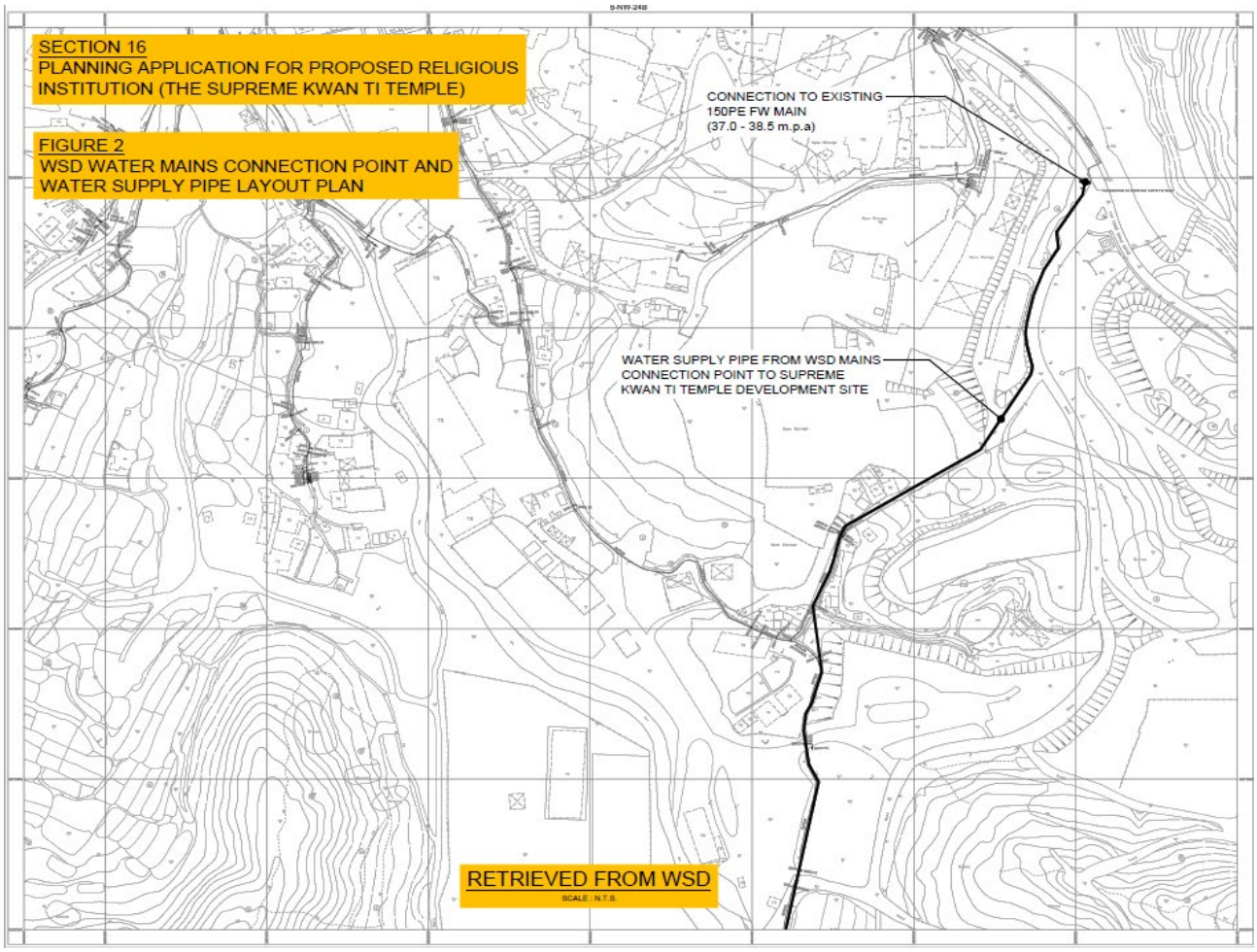

Figure 3 Water Supply Proposal - Schematic Diagram