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 And Fire Services Provisions

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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 Site 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 16,697 m2 area with 21864 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 Application 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.

2.2.1.2 Re-arranging Hazen-Williams Equation to express S in terms of V, C and R

$$Hf = S/L = 7.8828\ Q^{1.852}\ L\ /\ (k^{1.852}\ C^{1.852}\ d^{4.8704})$$

Where Hf = Total head loss over whole pipe length (in meter H_2O)
S = Head loss per unit pipe length (in meter H_2O / m)
L = Total pipe length (in meter)
Q = Water flow (in m3/s)
K = 0.85
d = Pipe diameter (in meter)
C = Roughness coefficient assumed as follows:

For DI with internal cement lined pipe and external epoxy coating	
Fresh water pipe (<600mm diameter)	110
Salt water pipe	90
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 30% of that of longitudinal pipe length.

The pipe diameter will be designed on basis of maximum flow velocities of less than 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 17m head for fire services installations and 20m head for other inside services for both visitors/staff use.

2.2.3 Fire Services Water Demand

Fresh water will be used for the street fire hydrants, 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 6 hours.

2.2.4 Irrigation Demand
The daily water consumption for the landscape irrigation system will be 7 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 five hours in the morning session, there will be 2000 visitors and 150 staff.
2. Within five 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 Site".

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

In reply to TOCO's letter of further information dated 24 March 2025 to Town Planning Board, WSD advised a limited flow rate of around 3,500 Litres/hour will be provided to the Development Site and a DN50 pipe connection can only be made to the inside services of the Application Site.

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 office for security, office for Religious Facilities, and security room.

3.2.2 On basis of these architectural design parameters, during each the festival event days the total water consumption demand and peak flow rate, including those for the fresh water and flush water and that for cleansing and irrigation is estimated to be 182 m3/day and 15.17 Litres/sec respectively as tabulated in Table 1.

3.2.3 While WSD advised a limited flow rate of around 3,500 Litres/hour (1 Litre/sec) can only be provided to the Application site, it will be much less than the peak flow rate demanded during each of the festival event days. It is proposed that a dual compartment water storage water of capacity 182 m3 will be provided within the Development Site to cater for the total water demand for one festival event day.

3.3 Calculation of Residual Head

3.3.1 If a water supply pipe of 50 mm diameter is considered, the pipe head loss and water velocity incurred by the 15.17 Litres/s water flow will be 23.2 mH2O and 0.51 m/s respectively as illustrated in Table 2.

3.4 Schematic Design of Water Supply Pipeline to the Application Site

3.4.1 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 approximately 1500 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, and according to WSD's comment relayed from Urban Design Unit of Planning Department, the residual head at PH9587 near the connection to the town main is 10m at day-time.

3.4.2 It is proposed a private underground water supply tank and pump room will be designed, constructed in the vicinity of the town main connection point by the applicant as shown in Fig 2.

Should the private underground water tank and pump room 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 of 1 Litre/s through the 50 mm diameter pipe of to the water tank, which is less than 100 m from the town main connection point.

As shown in Table 2, the required pump head will be 43.2 mH_2O.

In reference to Clause 6.2.5.1 of Technical-Requirements-for-Plumbing Works in Buildings 2019, the proportion of capacity of sump cistern to roof cistern is recommended to be in the order of 1:3, the capacity of the sump tank near the town main connection point will be ¼ of total storage capacity of fresh and flush water systems. It is proposed that the underground water tank of 20 m3 will be constructed near the connection to WSD town mains on the assumption that the total storage capacity for the fresh and flush water systems (calculated according to WSD Technical Requirements for Plumbing Works in Buildings) being 80 M3, and that two water supply pumps (one duty WSD and one standby with 15.17 Lit/s capacity and 43.2 m head will be installed by the applicant.

3.4.3 It is proposed that the applicant shall be responsible to construct a 50mm diameter fresh water pipe from the underground tank and pump room in the near vicinity of the town main connection to the Application Site. The schematic design of the pipeworks, tanks and pumps system is displayed in Figure 1 to Fig 4.

Chapter 4 Proposal of Fire Services Provision

4.1 Existing Condition of Street Hydrant

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 nor street fire hydrant in the vicinity of the Application Site.

4.2 Proposal of Fire Services Installations

Fresh water will be used for the street fire hydrants, sprinkler system and fire hydrant/hose reel system. Design of these fire services

installations will comply with Code of Practice for Minimum Fire Services Installations and Equipment 2022, Technical Guidance for Automatic Sprinkler Installations 2015, and BS EN 12845:2015 Automatic sprinkler systems.

Verbal advice from FSD/New Projects was sought on 26th June, 2025. As the proposed water supply main will be connected to the one feed (single source) WSD water main, one 84 m3 sprinkler tank which is equal to 2/3 of full capacity sprinkler water tank for OH2 hazard with height of the highest sprinkler above the lowest being less than 30 m will be constructed in the development site. Direct connection to Services Provider's Computerized Fire Alarm Transmission System will be provided. Two sprinkler pump (one duty and one standby) and one jockey pump will be installed in the Development site.

One 36 m3 FS water tank with two fire pumps (one duty and one standby) and one jockey pump will be installed in the Development site.

One street hydrant water tank of 245 m3 capacity with two supply pumps (one duty and one standby) will be provided in the Development site to supply water to the street fire hydrants to be installed on the access road around the Development site.

4.3 Schematic Design of Water Supply System for Fire Services

The water consumption for fire services installations is calculated as shown in Table 3.

According to CoP for Minimum Fire Services Installations and Equipment, the street fire hydrant water tank, sprinkler water tank and FS water tanks will have to be refilled to full capacities in six hours. While WSD advised a limited flow rate of around 3,500 Litres/hour (1 Litre/sec) can only be provided to the Application Site, an additional water storage of total capacity 343.4 m3 (245 m3 + 84 m3 + 36 m3 - 21.6 m3 (a litre/s x 6 hours x 3600 sec/hr)) will be provided to re-fill these three water tanks in six hours.

The schematic design of the water supply system for fire services installations is illustrated in Fig. 3 and Fig. 4.

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 for staff working day time (FW 50L/person, flush water 50L/person)			=	80	Litres/p/day	Refer to WSD's DI No. 1309
Total Water Usage per day for staff working day time	=	150 x 80	=	12000	Litres/day	
Total number of visitors in one of the festival days in a year			=	4000	persons	
Water Usage Factor for visitors (FW 20 L/person, flush water 20 L/person)			=	40	Litres/p/day	Refer to WSD's DI No. 1309
Total Water Usage per day for visitors	=	4000 x 40	=	160000	Litres/day	
Total Water Consumption per day for day time staff and visitors	=	12000 + 160000	=	172000	Litres/day	
Peak flow rate (peak flow factor = 3)	=	172000 x3 / (10 x 3600)	=	14.33	Litres/sec	
Cleansing Water Usage						
There will be about 6 cleansing water taps, each using 0.15 Litres/s for 30 minutes per day.						
Daily cleansing water consumption	=	6 x 0.15 x 1800	=	1620	Litres/day	
Peak flow rate (peak flow factor = 3, water used in 10 hrs per day)	=	1620 x 3 / (10 x 3600)	=	0.135	Litres/sec	
Irrigation Water Usage						
There will be about 1200 m2 landscape, requiring 7 Litres/m2 per day						
Daily irrigation water consumption	=	1200 x 7	=	8400	Litres/day	
Peak flow rate (peak flow factor = 3, water used in 10 hrs per day)	=	8400 x 3 / (10 x 3600)	=	0.7	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)	=	172000 + 1620 +8400	=	182020	Litres/day	

Calculation of Maximum Water Flow Rate (Potable, Flushing, and non-potable)					
Maximum water flow rate	=	14.33 + 0.135 + 0.7	=	15.17	Litres/s

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 (in metre)
S = Frictional hydraulic gradient

Re-arranging Hazen-Williams Equation to express S in terms of V, C and R

$$Hf = S*L = 7.8828\ Q^{1.852}\ L\ /\ (k^{1.852}\ C^{1.852}\ d^{4.8704})$$

Where Hf = Total head loss over whole pipe length (in meter H_2O)
S = Head loss per unit pipe length (in meter H_2O / m)
L = Total pipe length (in meter)
Q = Water flow (in m3/s)
K = 0.85
C = Roughness coefficient
d = Pipe diameter (in meter)

Parameters of Calculation		Calculated Parameter of Proposed Supply pipe			Remark
DN 50 pipe Connection to WSD existing DN150 mains					
Water flow, Q	=		0.001	m3/s	
Pipe length, L (plus 10% allowance)	=	1500 x 1.1	= 1650	m	
k	=		0.85		
Roughness coefficient, C	=		110		
Internal diameter of uPVC or PE lined GS pipe, d	=		0.049	m	
Head loss over whole pipe length, Hf	=		17.8	m	
Minor head loss (30% of pipe length head loss)	=		5.4	m	
Total head loss	=	17.8 + 5.4	= 23.2	m	
The proposed water supply pumps will be installed at 34 mPD inside the underground water pump chamber near the connection point to WSD's existing PE150 water main and the highest level of the water pipe installed along the proposed access road will be 40.5 mPD.					
Residual pressure (head) required for potable and flush water usage in the development	=		20 (17 m for street fire hydrant)	m	
Pump head required	=	23.2 + 20	= 43.2	m	

Velocity under design peak flow	=	0.001 x 4 / (3.1416) $(0.05)^2$	=	0.51 m/s

Table 3 Calculation of Water Consumption for Fire Services Installations

Street Fire Hydrants Water Consumption The total output of two 65 mm fire hydrant outlets shall be 66.7 Litres/s						
Street fire hydrants water tank capacity	=	66.7 x 3600	=	240120 , say 245000	Litres	
Water flow rate (refilling in 6 hours)	=	245000/ (6 x 3600)	=	11.35	Litres/s	
Sprinkler System Water Usage						
Sprinkler tank Full capacity (OH 2) with height of the highest sprinkler above the lowest being equal to or less than 30 m automatically by two pumps (one duty and one standby)	=	125 m3	=	125000	Litres	Table 9-Minimum water volume for pre-calculation LH and OH systems in BS EN 12845_2015 Auto Sprinkler Systems
With provision of direct connection to Service Provider's Computerized Fire Alaim Transmission System, Minimum tank capacity	=	125 x 2/3	=	84	M3	Technical Guidance for Sprinkler Installations incorp. BS EN 12845_2015
Water flow rate delivered by the sprinkler pumps	=	1000 Lit /min	=	16.67	Litres/s	OH2 hazard class is considered
Water flow rate (refilling in 6 hours	=	84000/ (6 x 3600)	=	3.89	Litre/s	
Fire Hydrant and Hose-reel System Water Usage						
Fire Services water tank capacity on roof of the highest building	=	36 m3	=	36000	Litres	
Water flow delivered by the fixed fire pumps for two hydrant outlets with running pressure at any hydrant outlet	=	7.5 x 2	=	15	Litres/s	
Water flow rate (refilling in 6 hours)		36000/ (6 x 3600)	=	1.67	Litres/s	
Total capacity of the three FSI water tanks		245 + 84 + 36	=	365	m3	
Water volume refilled by WSD's town mains in six hours	=	1 x 6 x 3600 / 1000	=	21.6	m3	

Additional water storage tanks for refilling the three FSI water tanks in six hours	=	365 -21.6	=	343.4	m3

Figure 1 Development Site – Fresh Water Supply Pipe Layout Plan

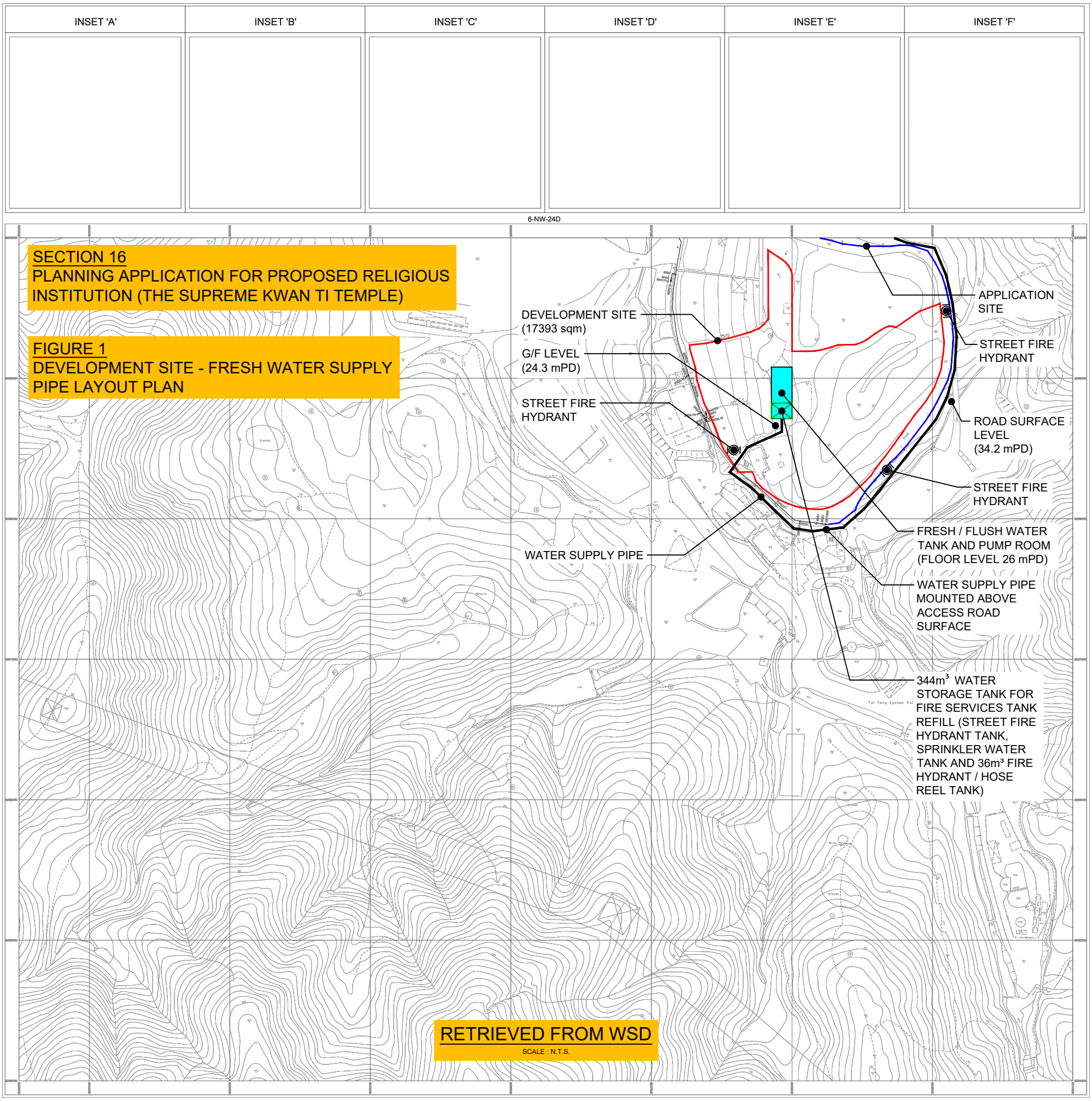

Figure 2 WSD Water Main Connection Point and Water Supply Pipe Layout Plan

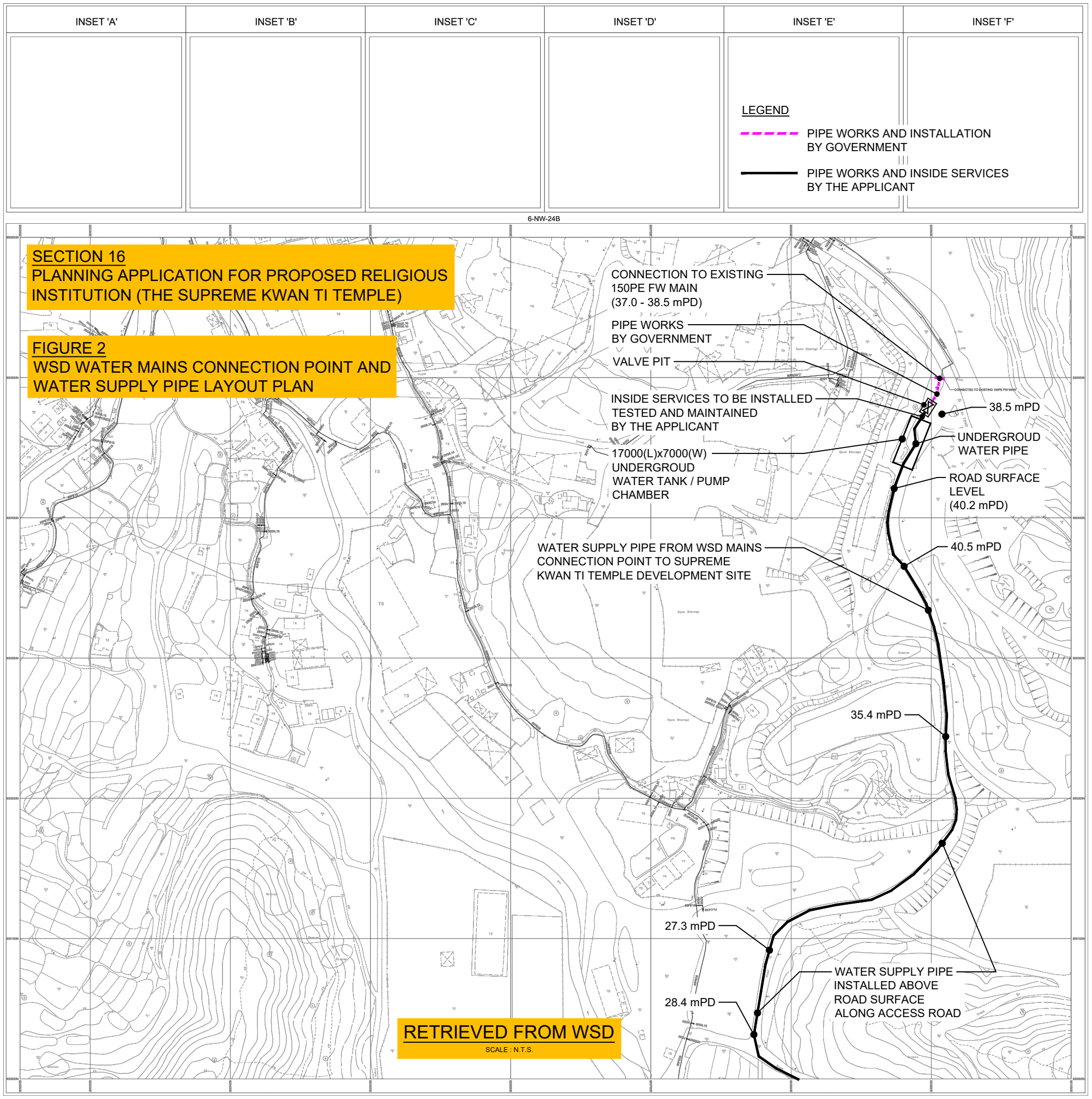

Figure 3 Water Supply Proposal – Schematic Diagram Sheet 1

SECTION 16
PLANNING APPLICATION FOR PROPOSED RELIGIOUS
INSTITUTION (THE SUPREME KWAN TI TEMPLE)

FIGURE 3
WATER SUPPLY PROPOSED - SCHEMATIC DIAGRAM (SHEET 1)

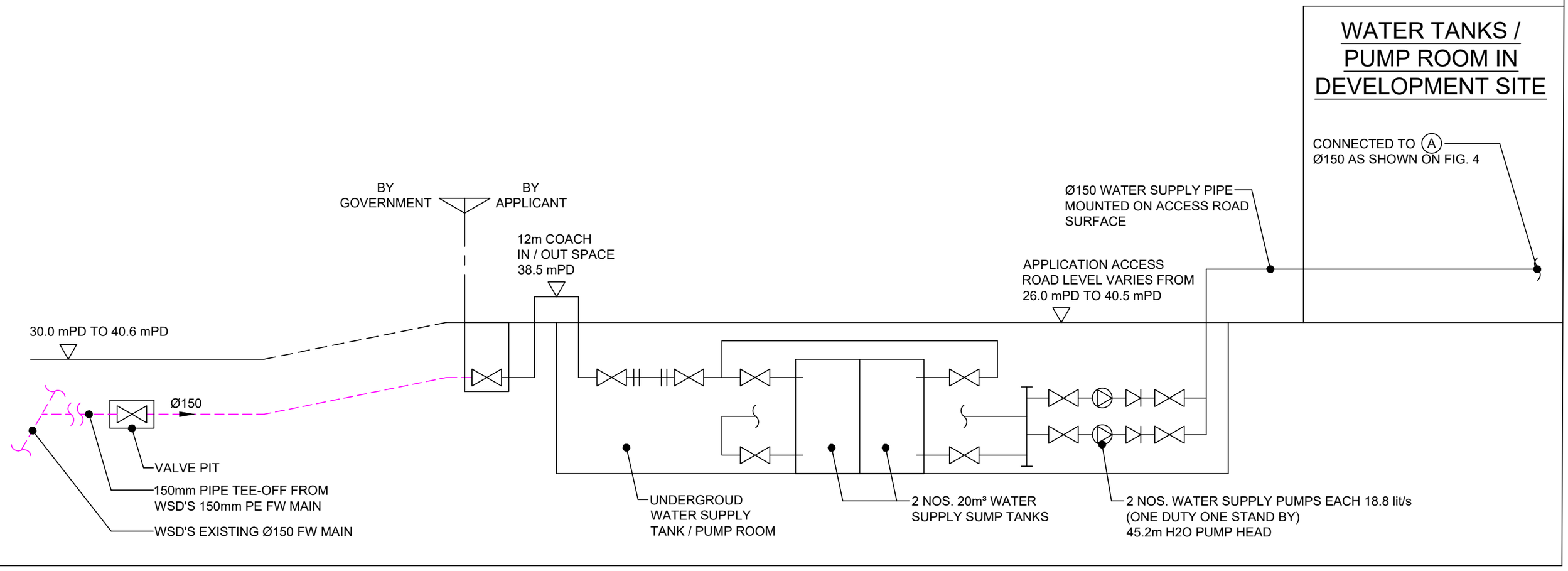

Figure 4 Water Supply Proposal – Schematic Diagram Sheet 2

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FIGURE 4
WATER SUPPLY PROPOSED - SCHEMATIC DIAGRAM (SHEET 2)