

# *Appendix 3*

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DRAINAGE IMPACT ASSESSMENT

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# **FINAL DRAINAGE IMPACT ASSESSMENT REPORT FOR PROPOSED TONG HANG FRESH WATER PUMPING STATION (ISSUE 1)**

December 2024

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**Agreement No. CE 47/2023 (WS)**

**Improvement of Water Supply to Northern New Territories  
– Investigation, Design and Construction**

WATER SUPPLIES DEPARTMENT

**REVISION HISTORY**

| Issue | Description of Revision | Date             |
|-------|-------------------------|------------------|
| 1     | Draft (Issue 1)         | 7 November 2024  |
| 2     | Draft (Issue 2)         | 21 November 2024 |
| 3     | Final (Issue 1)         | 23 December 2024 |
|       |                         |                  |

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**Reviewer** Morrie KWOK



**Approver** T. K. TING



**Date** 23 December 2024

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# 1 INTRODUCTION

## 1.1 Background

- 1.1.1 This Drainage Impact Assessment (DIA) is prepared in support of a Section 16 (S16) Planning Application for the Proposed Fresh Water Pumping Station (FWPS) in Government Land at Tai Wo Service Road East, Tong Hang, Fanling. The objective of the DIA is to introduce a structural and systematic approach to identifying, assessing and mitigating potential adverse drainage impacts which might arise from the proposed works of the Proposed FWPS.
- 1.1.2 The Proposed FWPS comprises of two (2) separate one-storey (excluding basement) buildings, namely a Pump Building in the east and an Electrical Building in the west. The Proposed FWPS will serve as a booster pumping station to take treated water from the Tai Po Tau Fresh Water Primary Service Reservoir (“FWPSR”) to other Fresh Water Service Reservoirs (FWSRs).





Figure 2.2 View A



Figure 2.3 View B



Figure 2.4 View C



## 3 DRAINAGE IMPACT ASSESSMENT

### 3.1 Proposed Drainage Works

- 3.1.1 As shown in **Drawing No. KEB002406-I-SD-20004**, some sections of the proposed works will conflict with the existing stormwater drains.
- 3.1.2 According to the hydraulic model provided by DSD, no catchment was allocated to the existing drains at the eastern end of the proposed site which comprise 225mm u-channel, Ø300 and Ø1500 pipes and the associated manhole structures (SCH1030403 and SBH1000320). These unused drains will be demolished for the construction of the proposed pump building.
- 3.1.3 The existing 300mm to 450mm u-channels will be realigned to match the proposed emergency vehicular access within site.
- 3.1.4 The Ø375 drainage pipe from the pier of Fanling Bypass and the associated manhole proposed by CEDD will be diverted for the construction of the proposed electrical building.
- 3.1.5 Approximately 150m of the realigned footpath and cycle track would encroach on the riverbed of Ma Wat River. The part of the structure would be overhung on top of the river in cantilever form, and the approximate maximum encroachment would be 4.5m. According to the hydraulic model provided by DSD, there would be approximately 2m-freeboard at the concerned area under 200-year return period. Therefore, it is considered that the structure would not affect the hydraulic performance of Ma Wat River.

### 3.2 Impact Assessment

- 3.2.1 As the change in land characteristics and the change in surface runoff would be minimal, it is anticipated that the drainage impact would be negligible.
- 3.2.2 Hydraulic assessment on the proposed drains has been conducted. The calculation is enclosed in **Appendix A** of the report. All proposed drains will be capable of handling a 50-year return period rainfall event.
- 3.2.3 To minimise the drainage impact and to mitigate flooding risk, the mitigation measures stated in Section 3.3 shall be implemented.





### 3.3 Proposed Mitigation Measures

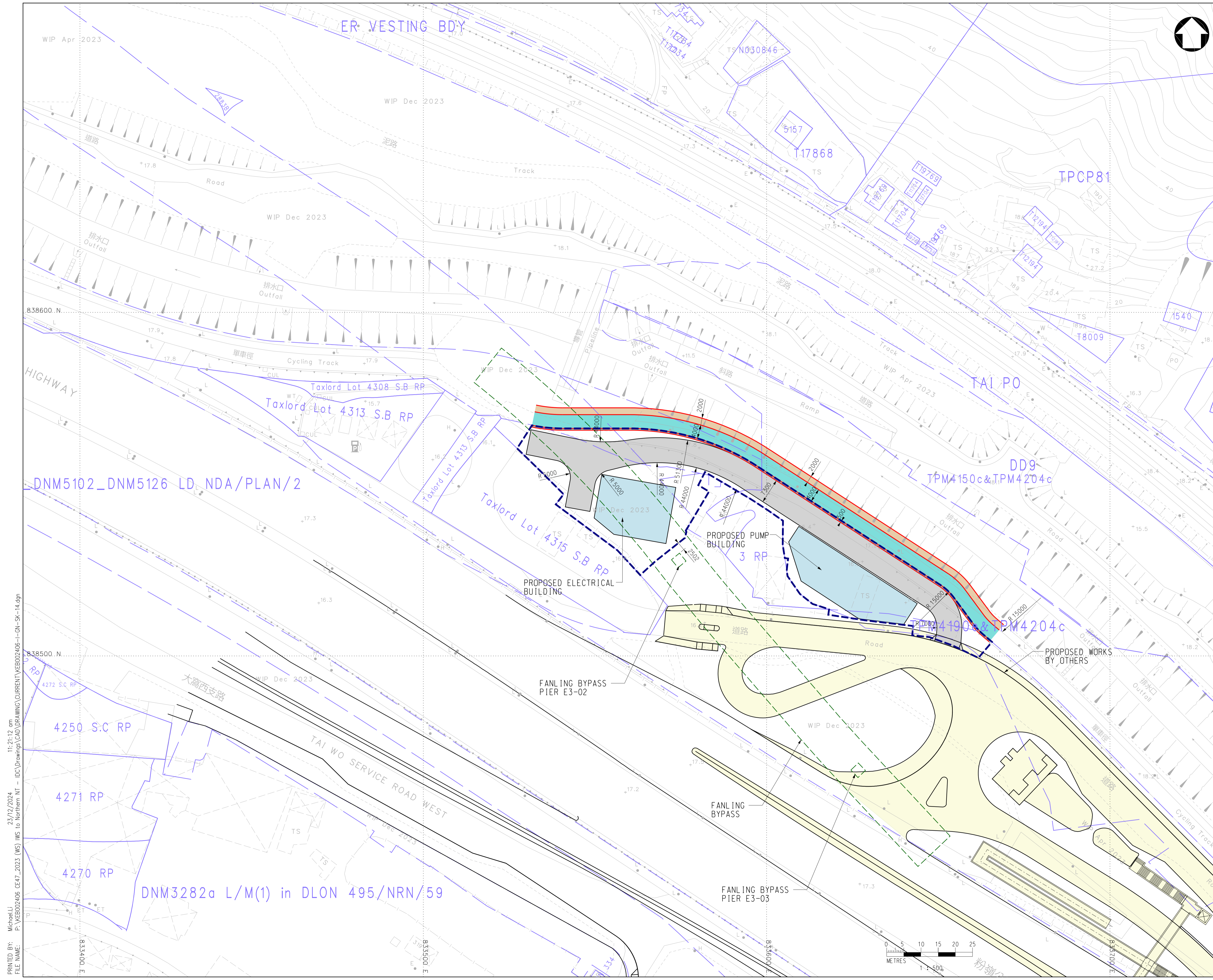
- 3.3.1 Temporary mitigation measures such as temporary supporting shall be adopted to protect the existing drains from damages during construction. Since the proposed works may require drainage diversion, some appropriate temporary measures implemented for avoiding drainage impacts are shown as below:
- (1) If temporary diversion is necessary, the details of the diversion shall be designed with reference to actual site situation and agreed with DSD. Temporary drainage diversion to convey the surface runoff from the construction site to the existing drainage system shall comply with the requirements as stipulated in DSD's Technical Circular No. 14/2000 "Temporary Flow Diversion and Temporary Works Affecting Capacity in Stormwater Drainage System".
  - (2) The programme of the proposed diversion, re-provisioning works and/or modifications of existing drains should be further agreed with DSD to facilitate the Project to be implemented as schedule.
  - (3) All construction works shall be carried out in accordance with EPD's Practice Note ProPECC PN 2/23 "Construction Site Drainage".
  - (4) Adequately designed desilting facilities such as sand traps, silt traps and sediment basins with proper maintenance shall be provided for the temporary drainage system where applicable.
  - (5) Temporary works should not encroach on the drainage path during wet seasons unless otherwise approved by DSD.
  - (6) The temporary drainage works shall be monitored in accordance with the monitoring and audit requirements. Regular inspection should be carried out during construction near major drainage structures and DSD Regional staff should be notified prior to the commencement of works.



## 4 CONCLUSION

- 4.1.1 The Proposed FWPS would be constructed on the existing cycle track, footpath, hard paved area. Also, part of the Proposed FWPS would be located under CEDD's proposed Fanling Bypass.
- 4.1.2 With the implementation of the proposed drainage system and landscaping features, the change in land characteristics and surface runoff would be minimal. Therefore, the drainage impact due to the proposed works is considered insignificant.
- 4.1.3 While no permanent drainage impact is expected, there are some temporary drainage impact mitigation measures to be implemented during the construction phase in order to avoid any drainage impacts to the existing watercourse. The construction works shall comply with the EPD's Practice Note ProPECC PN 2/23 in respect of handling and disposal of construction site discharges.

Drawings



- LEGENDS:**
- PROPOSED FWPS SITE
  - LOT BOUNDARY
  - FANLING BYPASS STRUCTURE BY OTHERS
  - PROPOSED WORKS BY OTHERS
  - PROPOSED EMERGENCY VEHICULAR ACCESS
  - PROPOSED REALIGNED CYCLE TRACK
  - PROPOSED REALIGNED FOOTPATH
  - PROPOSED FWPS BUILDINGS

| Rev. | Date | Drawn | Description | Checked | Approved |
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|      |      |       |             |         |          |

Employer



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Project

AGREEMENT NO. CE47/2023 (WS)  
IMPROVEMENT OF WATER SUPPLY TO  
NORTHERN NEW TERRITORIES  
- INVESTIGATION, DESIGN AND  
CONSTRUCTION

Title

PROPOSED TONG HANG FRESH WATER  
PUMPING STATION LAYOUT PLAN

Consultant



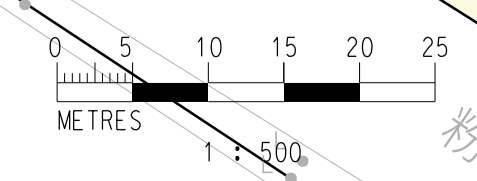
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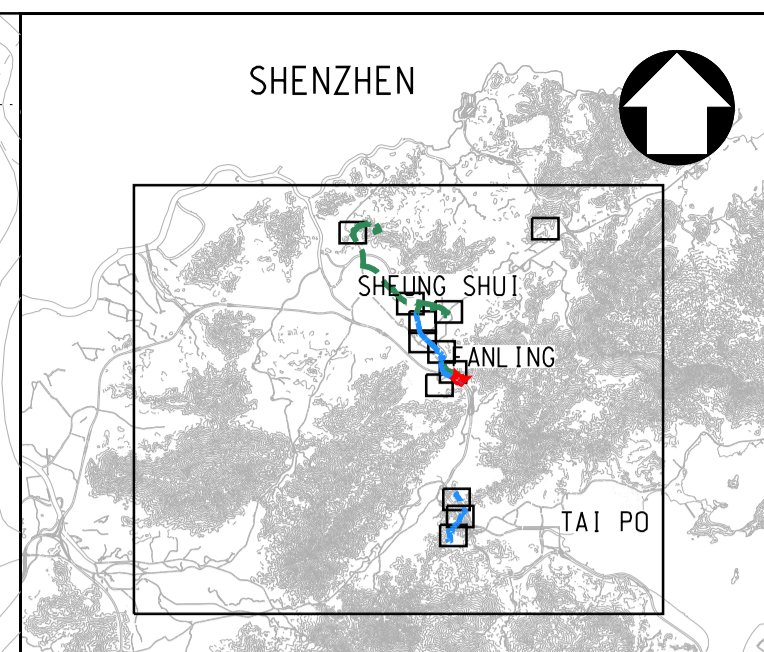
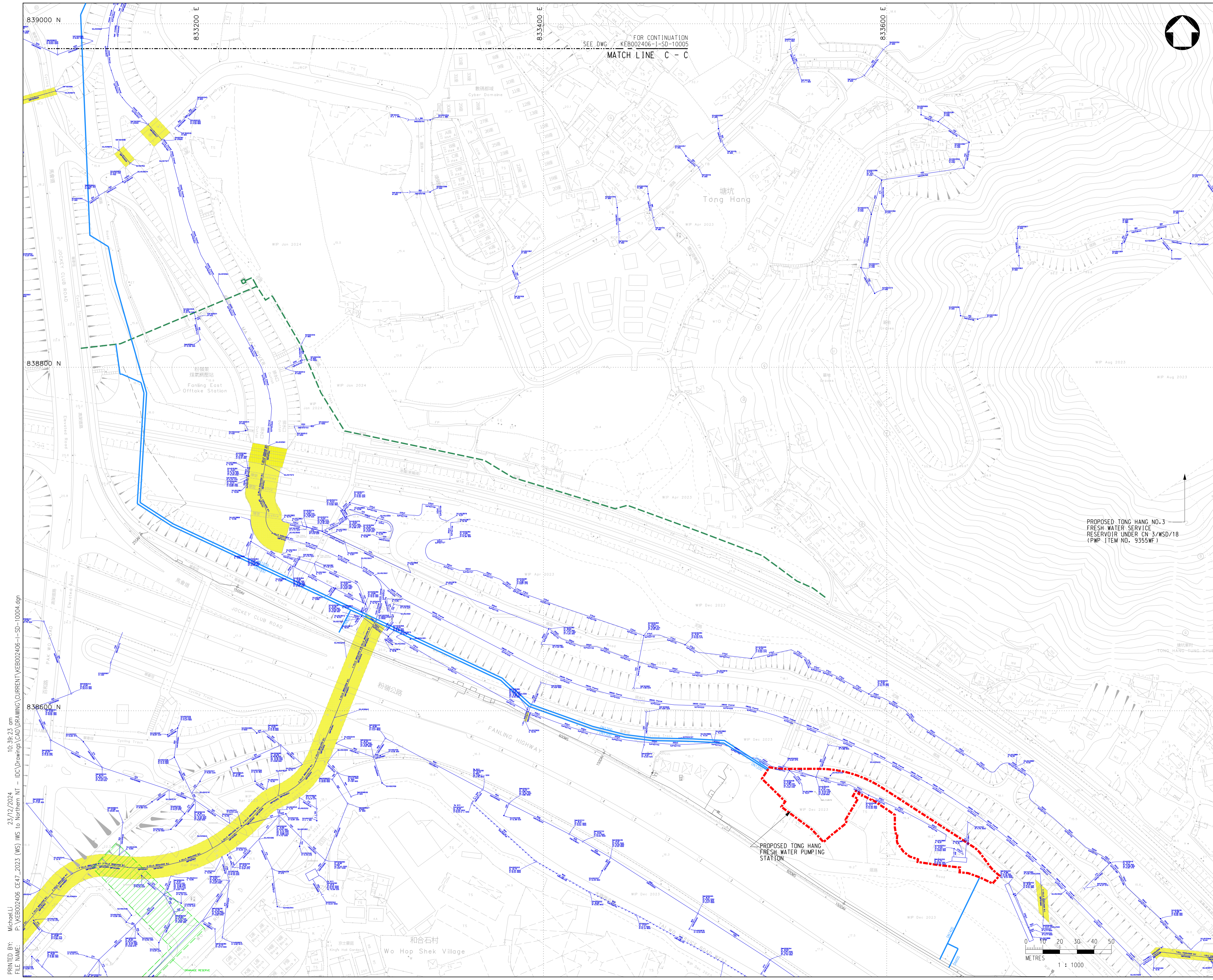
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DNM5102\_DNM5126 LD\_NDA/PLAN/2

DNM3282a L/M(1) in DLON 495/NRN/59



KEY PLAN  
SCALE 1:200,000

- LEGEND:
- PROPOSED WATERWORKS
  - - - WATERWORKS BY OTHERS
  - EXISTING FRESH WATER PIPE
  - - - PROPOSED FRESH WATER PUMPING STATION SITE BOUNDARY

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- INVESTIGATION, DESIGN AND  
CONSTRUCTION

Title  
EXISTING DRAINAGE PLAN  
(SHEET 4 OF 11)

Consultant



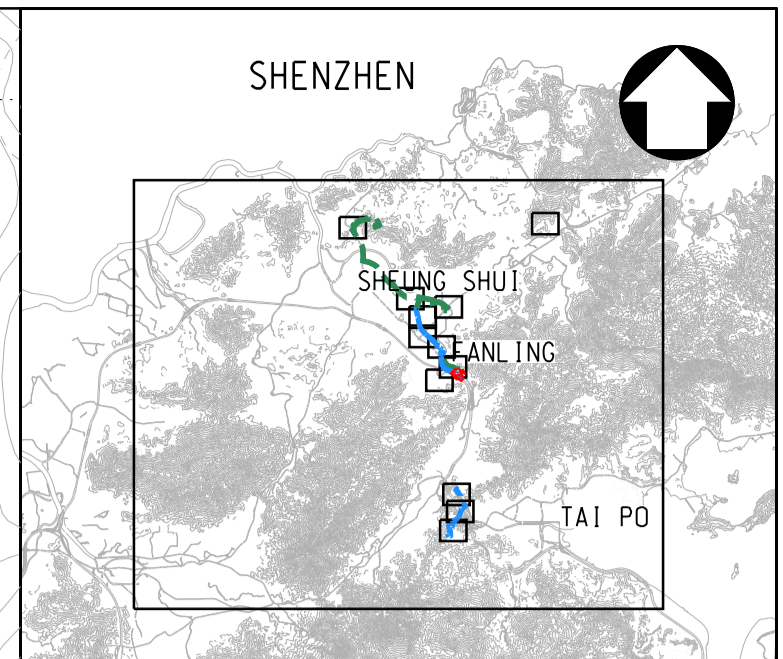
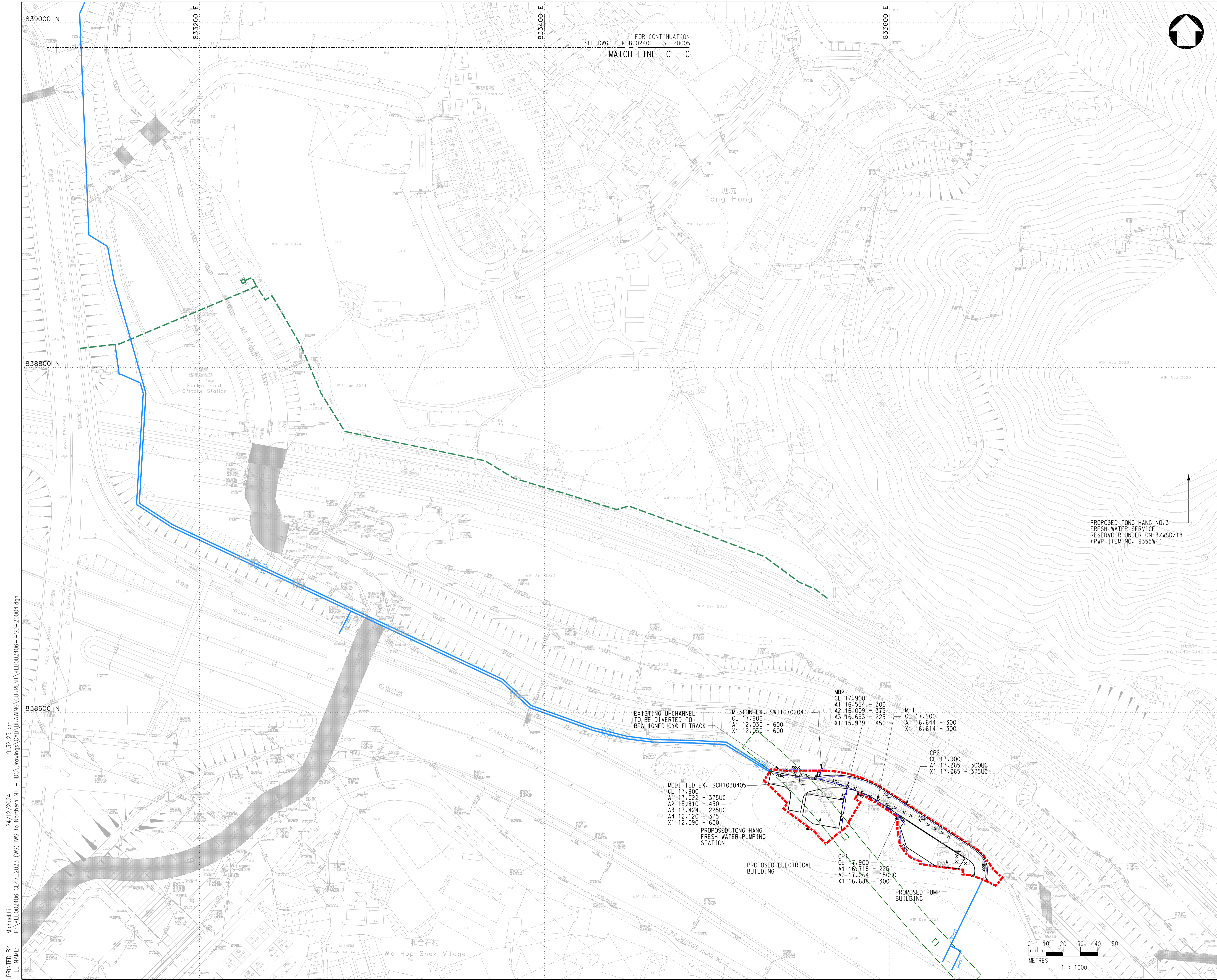
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**KEY PLAN**  
SCALE 1:200,000

- LEGEND:**
- PROPOSED WATERWORKS
  - - - WATERWORKS BY OTHERS
  - EXISTING STORM WATER PIPE
  - - - PROPOSED STORM WATER PIPE
  - - - PROPOSED STORM WATER U-CHANNEL
  - PROPOSED STORM WATER MANHOLE
  - PROPOSED STORM WATER CATCHPIT
  - ×-×-× EXISTING DRAIN TO BE DEMOLISHED
  - PROPOSED FRESH WATER PUMPING STATION SITE BOUNDARY

PROPOSED TONG HANG NO. 3  
FRESH WATER SERVICE  
RESERVOIR UNDER CN-3/WSD/18  
(PWP ITEM NO. 9355WF)

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IMPROVEMENT OF WATER SUPPLY TO  
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- INVESTIGATION, DESIGN AND  
CONSTRUCTION

Title  
PROPOSED DRAINAGE PLAN

(SHEET 4 OF 11)



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## Appendix A – Hydraulic Calculation

Agreement No. CE 47/2023 (WS) Improvement of Water Supply to Northern New Territories – Investigation, Design and Construction  
 Calculations for Proposed Stormwater Drainage System

Runoff Estimation by Rational Method

Technical Manual Stormwater Drainage Manual 2018, Corrigendum No. 1/2022, 1/2024 & 2/2024  
 Site Location North District  
 Return period 50  
 Storm Constants a 474.60 b 2.90 c 0.371  
 Rainfall Increase due to i) Climate Change Factor 1.160 for end of 21st Century ii) Design Allowance 1.121 for end of 21st Century  
 Viscosity 1.00E-06 m<sup>2</sup>/s

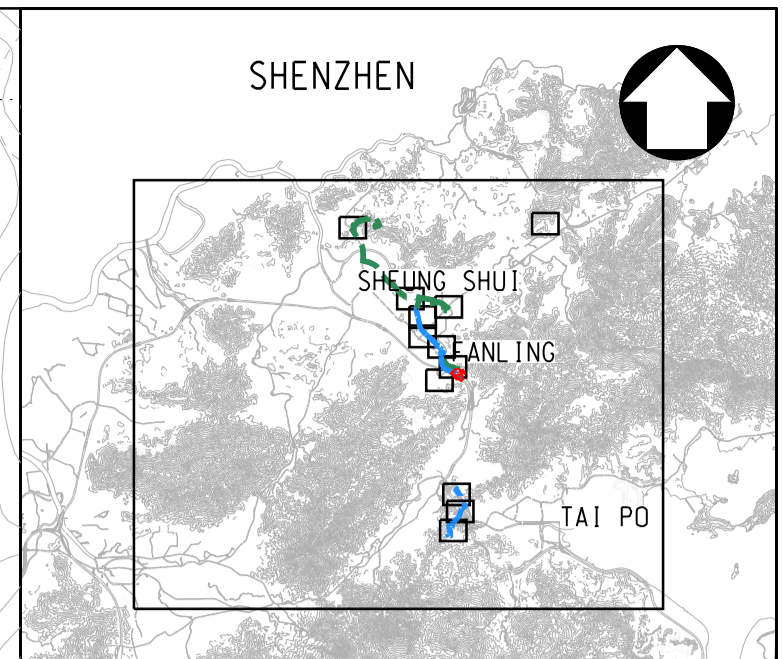
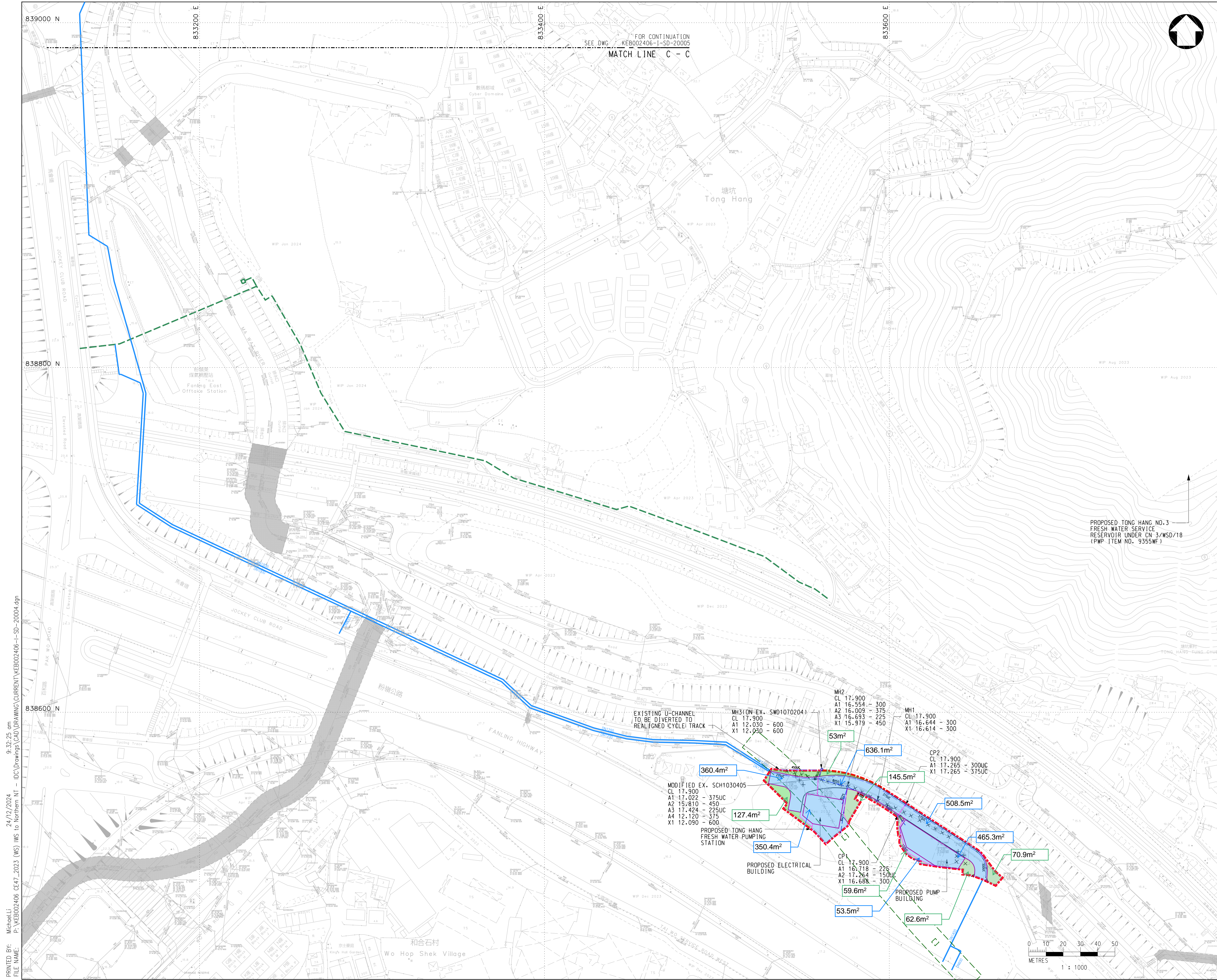
Pipe Capacity Check by Colebrook White Equation: 
$$\bar{V} = -\sqrt{32gRS_f} \log \left[ \frac{k_s}{14.8R} + \frac{1.255v}{R\sqrt{32gRS_f}} \right]$$

| Pipe ID           | US Node        | DS Node        | US GL<br>(mPD) | Cover<br>(m) | Length<br>(m) | Diameter<br>(mm) | US IL<br>(mPD) | DS IL<br>(mPD) | Gradient |       | Material | Roughness<br>ks<br>(m) | Sectional<br>Area A<br>(m <sup>2</sup> ) | Perimeter<br>P<br>(m) | R=A/P<br>(m) | Full Bore<br>Velocity<br>(m/sec) | Tf<br>(mins) | Tc<br>(mins) | Intensity<br>(mm/hr) | Paved<br>(m <sup>2</sup> ) | Unpaved<br>(m <sup>2</sup> ) | Cum.<br>Paved<br>(m <sup>2</sup> ) | Cum.<br>Unpaved<br>(m <sup>2</sup> ) | Total Drained<br>Area<br>(m <sup>2</sup> ) | Runoff<br>Coefficient |         | Weighted<br>Runoff<br>Coefficient | Flow<br>(l/sec) | Additional<br>Flow<br>(l/sec) | Flow<br>(l/sec) | Capacity<br>(l/sec) | Percent of<br>Flow to Pipe<br>Capacity |
|-------------------|----------------|----------------|----------------|--------------|---------------|------------------|----------------|----------------|----------|-------|----------|------------------------|--|-----------------------|--------------|----------------------------------|--------------|--------------|----------------------|----------------------------|------------------------------|------------------------------------|--------------------------------------|--|-----------------------|---------|-----------------------------------|-----------------|-------------------------------|-----------------|---------------------|--|
|                   |                |                |                |              |               |                  |                |                | (1 in x) | (m/m) |          |                        |  |                       |              |                                  |              |              |                      |                            |                              |                                    |                                      |  | Paved                 | Unpaved |                                   |                 |                               |                 |                     |  |
| P1                | Pump Building  | CP1            | 17.900         | 1.125        | 7.1           | 225              | 16.775         | 16.718         | 125      | 0.008 | Concrete | 0.0006                 | 0.040                                    | 0.707                 | 0.056        | 1.168                            | 0.101        | 3.101        | 317.440              | 465.3                      | 0                            | 465.3                              | 0                                    | 465  | 0.9                   | 0.2     | 0.900                             | 0.037           | 0.000                         | 0.037           | 0.046               | 79.6%                                  |
| P2                | Elec. Building | MH2            | 17.900         | 1.125        | 10.3          | 225              | 16.775         | 16.693         | 125      | 0.008 | Concrete | 0.0006                 | 0.040                                    | 0.707                 | 0.056        | 1.168                            | 0.147        | 3.147        | 316.549              | 350.4                      | 0                            | 350.4                              | 0                                    | 350  | 0.9                   | 0.2     | 0.900                             | 0.028           | 0.000                         | 0.028           | 0.046               | 59.8%                                  |
| P3                | BFL-8570-1     | MH2            | 17.900         | 1.275        | 27.7          | 375              | 16.625         | 16.009         | 45       | 0.022 | Concrete | 0.0006                 | 0.110                                    | 1.178                 | 0.094        | 2.707                            | 0.171        | 3.171        | 316.093              | 857                        | 0                            | 857.4                              | 0                                    | 857  | 0.9                   | 0.2     | 0.900                             | 0.068           | 0.000                         | 0.068           | 0.299               | 22.7%                                  |
| P4                | CP1            | MH1            | 17.900         | 1.212        | 13.4          | 300              | 16.688         | 16.644         | 300      | 0.003 | Concrete | 0.0006                 | 0.071                                    | 0.942                 | 0.075        | 0.903                            | 0.247        | 4.142        | 299.151              | 0                          | 0                            | 518.8                              | 59.6                                 | 578  | 0.9                   | 0.2     | 0.828                             | 0.040           | 0.000                         | 0.040           | 0.064               | 62.5%                                  |
| P5                | MH1            | MH2            | 17.900         | 1.286        | 18            | 300              | 16.614         | 16.554         | 300      | 0.003 | Concrete | 0.0006                 | 0.071                                    | 0.942                 | 0.075        | 0.903                            | 0.332        | 4.475        | 294.076              | 0                          | 0                            | 518.8                              | 59.6                                 | 578  | 0.9                   | 0.2     | 0.828                             | 0.039           | 0.000                         | 0.039           | 0.064               | 61.4%                                  |
| P6                | MH2            | Ex. SCH1030405 | 17.900         | 1.921        | 16.9          | 450              | 15.979         | 15.810         | 100      | 0.010 | Concrete | 0.0006                 | 0.159                                    | 1.413                 | 0.113        | 2.033                            | 0.139        | 4.613        | 292.052              | 0                          | 0                            | 1726.6                             | 59.6                                 | 1786                                       | 0.9                   | 0.2     | 0.877                             | 0.127           | 0.000                         | 0.127           | 0.323               | 39.3%                                  |
| Ex. SWD1070204 -1 | Ex. SCH1030405 | MH3            | 17.900         | 5.810        | 5.3           | 600              | 12.090         | 12.030         | 89       | 0.011 | Concrete | 0.0006                 | 0.283                                    | 1.884                 | 0.150        | 2.582                            | 0.034        | 5.413        | 281.297              | 0                          | 0                            | 3231.6                             | 519                                  | 3751                                       | 0.9                   | 0.2     | 0.803                             | 0.236           | 0.000                         | 0.236           | 0.730               | 32.3%                                  |
| Ex. SWD1070204 -2 | MH3            | Ex. SNF1010921 | 17.900         | 5.870        | 13.4          | 600              | 12.030         | 11.880         | 89       | 0.011 | Concrete | 0.0006                 | 0.283                                    | 1.884                 | 0.150        | 2.582                            | 0.087        | 5.499        | 280.218              | 0                          | 0                            | 3231.6                             | 519                                  | 3751                                       | 0.9                   | 0.2     | 0.803                             | 0.235           | 0.000                         | 0.235           | 0.730               | 32.2%                                  |

U-channel Capacity Check by Manning Equation: 
$$\bar{V} = \frac{R^{2/3}}{n} \sqrt{RS_f}$$

| UC ID | US Node | DS Node        | US GL<br>(mPD) | Cover<br>(m) | Length<br>(m) | Diameter<br>(mm) | US IL<br>(mPD) | DS IL<br>(mPD) | Gradient |       | Material | Roughness<br>n | Sectional<br>Area A<br>(m <sup>2</sup> ) | Perimeter<br>P<br>(m) | R=A/P<br>(m) | Vel.@ full bore<br>(m/sec) | Tf<br>(mins) | Tc<br>(mins) | Intensity<br>(mm/hr) | Paved<br>(m <sup>2</sup> ) | Unpaved<br>(m <sup>2</sup> ) | Cum.<br>Paved<br>(m <sup>2</sup> ) | Cum.<br>Unpaved<br>(m <sup>2</sup> ) | Total Drained<br>Area<br>(m <sup>2</sup> ) | Runoff<br>Coefficient |         | Weighted<br>Runoff<br>Coefficient | Flow<br>(l/sec) | Additional<br>Flow<br>(l/sec) | Flow<br>(l/sec) | Capacity<br>(l/sec) | Percent of<br>Flow to UC<br>Capacity |
|-------|---------|----------------|----------------|--------------|---------------|------------------|----------------|----------------|----------|-------|----------|----------------|--|-----------------------|--------------|----------------------------|--------------|--------------|----------------------|----------------------------|------------------------------|------------------------------------|--------------------------------------|--|-----------------------|---------|-----------------------------------|-----------------|-------------------------------|-----------------|---------------------|--------------------------------------|
|       |         |                |                |              |               |                  |                |                | (1 in x) | (m/m) |          |                |  |                       |              |                            |              |              |                      |                            |                              |                                    |                                      |  | Paved                 | Unpaved |                                   |                 |                               |                 |                     |                                      |
| UC1   | -       | CP1            | 17.900         | 0.070        | 41.6          | 150              | 17.680         | 17.264         | 100      | 0.010 | Concrete | 0.018          | 0.020                                    | 0.386                 | 0.052        | 0.775                      | 0.895        | 3.895        | 303.147              | 53.5                       | 59.6                         | 53.5                               | 59.6                                 | 113  | 0.9                   | 0.2     | 0.531                             | 0.005           | 0.000                         | 0.005           | 0.016               | 32.5%                                |
| UC2   | -       | CP2            | 17.900         | 0.070        | 66.3          | 300              | 17.530         | 17.265         | 250      | 0.004 | Concrete | 0.018          | 0.080                                    | 0.771                 | 0.104        | 0.778                      | 1.420        | 4.420        | 294.881              | 508.5                      | 133.5                        | 508.5                              | 133.5                                | 642  | 0.9                   | 0.2     | 0.754                             | 0.040           | 0.000                         | 0.040           | 0.062               | 63.5%                                |
| UC3   | CP2     | Ex. SCH1030405 | 17.900         | 0.070        | 54.7          | 375              | 17.265         | 17.022         | 225      | 0.004 | Concrete | 0.018          | 0.126                                    | 0.964                 | 0.130        | 0.952                      | 0.958        | 5.379        | 281.728              | 636.1                      | 198.5                        | 1144.6                             | 332                                  | 1477                                       | 0.9                   | 0.2     | 0.743                             | 0.086           | 0.000                         | 0.086           | 0.119               | 71.9%                                |
| UC4   | -       | Ex. SCH1030405 | 17.900         | 0.070        | 27.2          | 225              | 17.605         | 17.424         | 150      | 0.007 | Concrete | 0.018          | 0.045                                    | 0.578                 | 0.078        | 0.829                      | 0.547        | 3.547        | 309.118              | 360.4                      | 127.4                        | 360.4                              | 127.4                                | 488  | 0.9                   | 0.2     | 0.717                             | 0.030           | 0.000                         | 0.030           | 0.037               | 80.2%                                |





KEY PLAN  
SCALE 1:200,000

- LEGEND:**
- PROPOSED WATERWORKS
  - - - WATERWORKS BY OTHERS
  - EXISTING STORM WATER PIPE
  - - - PROPOSED STORM WATER PIPE
  - - - PROPOSED STORM WATER U-CHANNEL
  - o PROPOSED STORM WATER MANHOLE
  - PROPOSED STORM WATER CATCHPIT
  - x-x-x-x EXISTING DRAIN TO BE DEMOLISHED
  - PROPOSED FRESH WATER PUMPING STATION SITE BOUNDARY
  - UNPAVED AREA
  - PAVED AREA

| Rev. | Date     | Drawn | Description | Checked | Approved |
|------|----------|-------|-------------|---------|----------|
| -    | APR 2024 | CL    | FIRST ISSUE | MK      | TKT      |



Project  
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IMPROVEMENT OF WATER SUPPLY TO  
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- INVESTIGATION, DESIGN AND  
CONSTRUCTION

Title  
PROPOSED CATCHMENT PLAN  
  
(SHEET 4 OF 11)



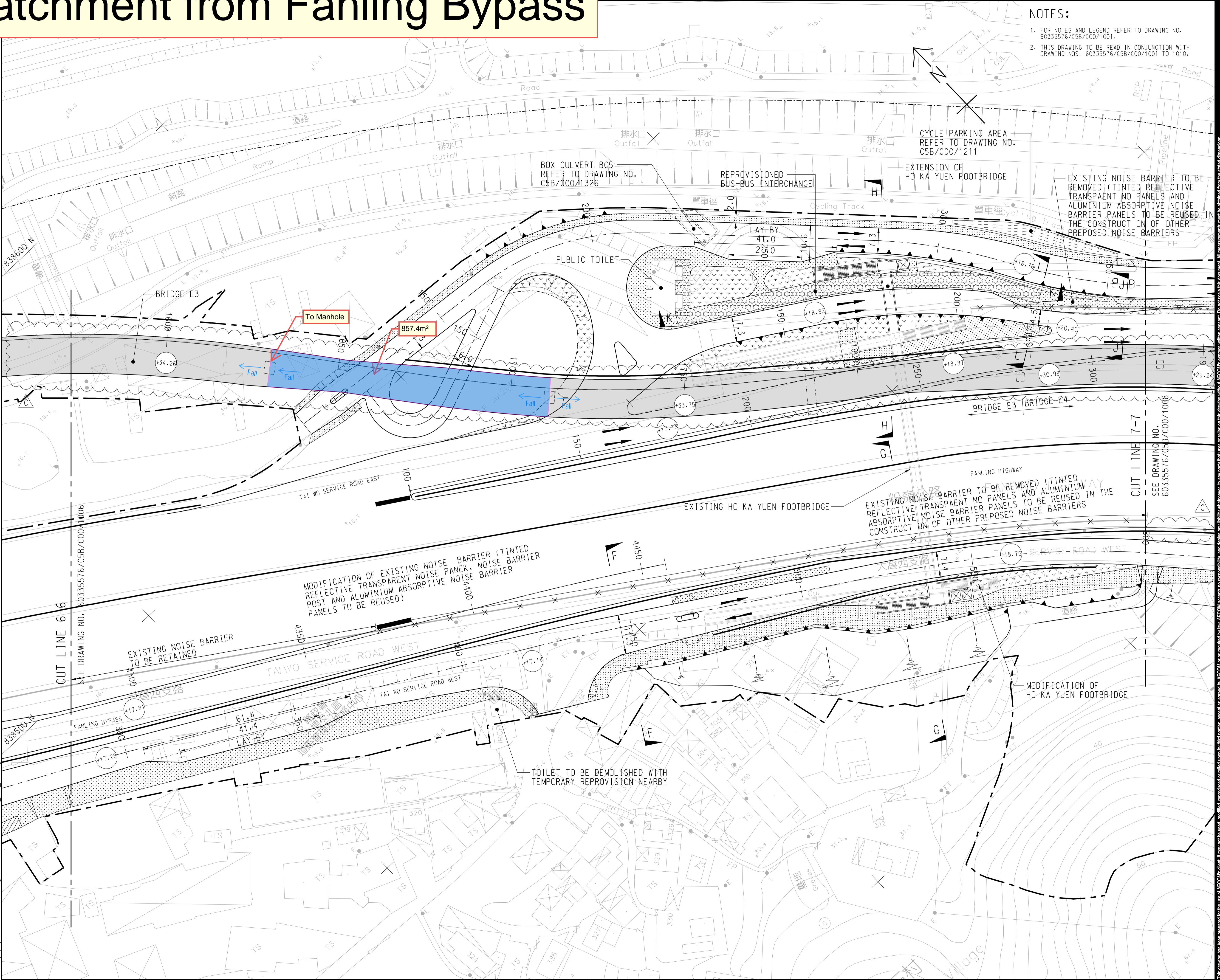
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# Catchment from Fanling Bypass

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 Checked: RPCM  
 Designer: WHWY  
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  - THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NOS. 60335576/C5B/C00/1001 TO 1010.



**PROJECT**  
 項目  
**DEVELOPMENT OF KWU TUNG NORTH AND FANLING NORTH NEW DEVELOPMENT AREAS, PHASE 1**

**CONTRACT TITLE:**  
 FANLING NORTH NEW DEVELOPMENT AREA, PHASE 1: FANLING BYPASS EASTERN SECTION (SHUNG HIM TONG TO KAU LING HANG)

**CLIENT**  
 業主  
 土木工程拓展署  
 Civil Engineering and Development Department

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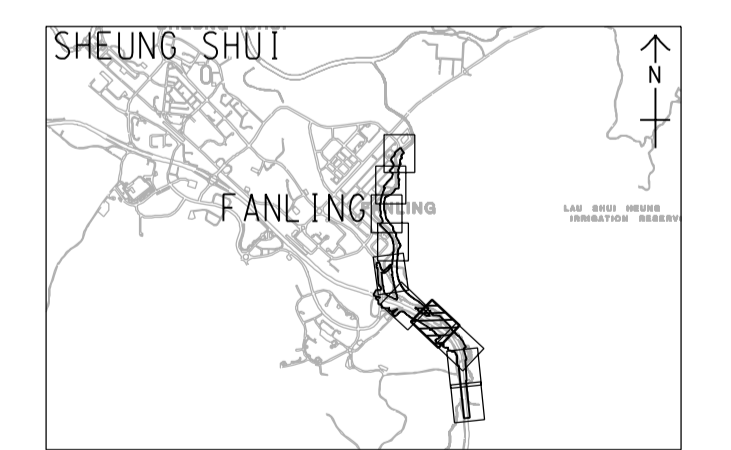
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 修訂

| I/R | DATE   | DESCRIPTION          | CHK. |
|-----|--------|----------------------|------|
| 修訂  | 日期     | 內容摘要                 | 核核   |
| C   | AUG-19 | TENDER ADDENDUM NO.4 | RPCM |
| B   | AUG-19 | TENDER ADDENDUM NO.3 | RPCM |
| A   | JUL-19 | TENDER ADDENDUM NO.2 | RPCM |
| -   | JUN-19 | TENDER DRAWING       | RPCM |

**STATUS**  
 階段

**SCALE**  
 比例  
 A1 1: 500

**DIMENSION UNIT**  
 尺寸單位  
 METRES



**PROJECT NO.**  
 項目編號  
 60335576

**CONTRACT NO.**  
 合約編號  
 ND/2019/05

**SHEET TITLE**  
 圖紙名稱  
 GENERAL LAYOUT

**SHEET NUMBER**  
 圖紙編號  
 60335576/C5B/C00/1007C

SHEET 7 OF 10

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