# Appendix D

**Drainage Submission**

**in support of Planning Application No. A/SLC/185**

**for a Proposed Temporary Holiday Camp for a Period of 5 Years at Various Lots in D.D. 332L and adjoining Government Land, Cheung Sha, Lantau Island**

(HT24117)

**October 2024**

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| Prepared & Approved by: | K. C. LEE<br>*MICE, MHKIE* |

何田顧問工程師有限公司
HO TIN & ASSOCIATES
CONSULTING ENGINEERS LIMITED
[redacted]

# CONTENT

## 1. Introduction

1.1 Ho Tin & Associates Consulting Engineers Limited (HTA) was appointed by the client to prepare a Drainage Impact Assessment (DIA) in support of the Planning Application No. A/SLC/185 for a Proposed Temporary Holiday Camp for a Period of 5 Years at Lots 332 (part), 333 (part), 334 (part), 335 (part), 337 (part), 338 (part), 339 (part), 340 (part), 341 (part), 342 (part), 344, 345 (part), 346 (part), 347 (part), 348, 350, 351, 352 (part), 354 (part), 355 (part), 356 (part), 357, 358, 360 (part), 361, 362 (part), 363 (part), 365 (part), and 366 (part) and adjoining Government land in DD332L, Cheung Sha, Lantau Island, New Territories (the 'subject site').

1.2 This report presents the Drainage Submission for the proposed temporary uses at the subject site.

1.3 The objectives of this Drainage Submission are to:-

- indicate any changes/increase in drainage characteristics due to the proposed development;
- assess any potential drainage impacts of the existing/planned drainage facilities nearby due to the proposed development; and
- propose mitigation measures and drainage improvement work, if necessary, to minimize any adverse drainage impact.

1.4 The scope of this Drainage Submission includes:-

- site description and existing land use;
- identification of stormwater flow pattern before and after proposed development of the Subject site;
- assessment of impact on the existing drainage facilities due to the proposed development; and
- proposal of new drainage facilities for the proposed development if found necessary.

## 2. General Site Description and the Proposed Development

2.1 The subject site is currently zoned "Green Belt" on the Approved South Lantau Coast Outline Zoning Plan No. S/SLC/23. It is located at the downhill on the southern toe of Tung Chung Road and is on the eastern side of a watercourse running downhill from Sunset Peak (Tai Tung Shan) toward Sha Tsui. The subject site area is about 6,035m$^2$ and

irregular in shape. It is in terrace form descending southward from about +40.0mPD to +23.7mPD.

2.2 It is proposed to construct a temporary holiday camp accommodating a total of 20 temporary structures (consisting of 6 static camping tents atop raised wooden platforms, 7 one-storey seating out areas with platforms and pavilions, 1 one-storey office/visitor centre, 1 one-storey storeroom, 2 one-storey rain shelters, 1 one-storey stage with cover, 1 one-storey meter room and 1 one-storey washroom) with a total GFA of about 780m$^2$ for a period of 5 years. The proposed development is shown in the Layout Plan on **Figure D1**.

2.3 At present, the subject site is mainly grassland with some obsolete temporary on-stilt structures and walkways (because it was previously used as holiday camp) (refer to **Plate 1** to **9** below). Locations of photo taken is shown on **Figure D2**.

Plate 1 – Existing entrance of the subject site on the east side

Plate 2 – View eastward toward the existing entrance of the subject site

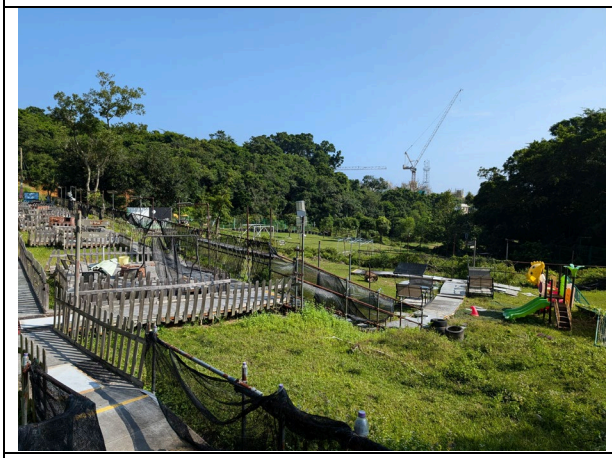
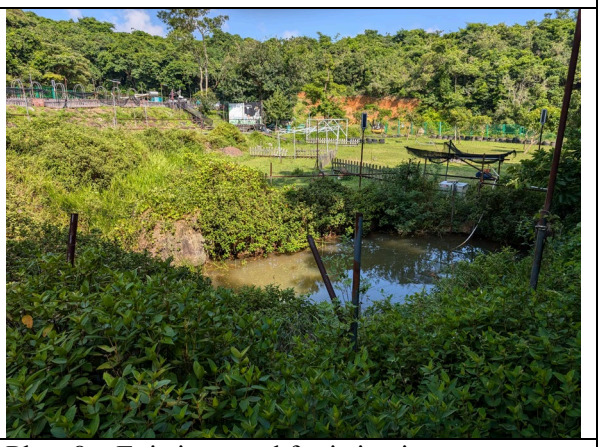


Plate 3 – View southward from the subject site (1)

Plate 4 – View southward from the subject site (2)

| | |
|---|---|
|  |  |
| Plate 5 – View westward from the subject site | Plate 6 – View northward from the subject site |
|  |  |
| Plate 7 – Existing ditch near the western subject site boundary | Plate 8 – Existing pond for irrigation |
|  | [BLANK] |
| Plate 9 – The lowest platform at the southern corner of the subject site | |

2.4 The layout and construction of the proposed development will respect the existing terrain and ground conditions such that no substantial site formation works will be carried out and the vegetated areas will be maintained in general.

## 3. Existing Drainage System of the Area

3.1 The subject site is located at the downhill side of Tung Chung Road and bounded by two watercourses running downward from Tai Tung Shan. The area bounded by Tung Chung Road and the two watercourses naturally contribute to the stormwater catchment area of the subject site. The overall flow direction of the surface runoff of the concerned catchment is from the north to the south into an existing watercourse running toward Sha Tsui.

3.2 At present, there are ditches (please refer to **Plate 7**) formed by the previous campsite mainly running near the western subject site boundary. Besides, a pond (please refer to **Plate 8**) for irrigation was also constructed near the southwest side of the subject site.

## 4. Proposed Drainage Works

4.1 The existing terrain, vegetated ground and the pond for irrigation will be maintained in general. In order to blend in with the natural environment, ditches with earth bottom and rubble sides will be used in lieu of concrete channels to collect and convey surface runoff on the subject site.

4.2 It is noticed that the proposed development should not obstruct any overland flows and causing flooding, and at the same time the subject development should not be affected by excessive overland flows, therefore ditches with earth bottom and rubble sides will be constructed near the subject site boundary to collect and convey all surface runoff properly to the designated discharge point.

4.3 A Stormwater Drainage Management Plan is shown in **Figure** D**2**. In general, the existing ground conditions, i.e. grassland, will be maintained after the proposed development. Besides, the existing flow paths of surface runoff of the area will be maintained after the proposed development, i.e. the surface runoff of the subject area will still flow/be conveyed from the north to the south and be discharged via a sandtrap (refer to **Figure D3**) into the existing watercourse outside the southern corner of the subject site.

4.4 Chain-linked fence wall of the subject site will be constructed for security reasons. The proposed development will not obstruct any flow paths of the area.

4.5 The Applicant is committed to obtain consents from owners of adjacent relevant land/lots prior to commencement of the proposed drainage works outside the subject site and to maintain the completed drainage works to the satisfaction of relevant Government

departments, and to clear the vegetation at the existing watercourse to which the surface runoff of the subject site would be discharged into.

## 5. Hydraulic Calculation

5.1 Assessment criteria is based on the recommendation set out in the Stormwater Drainage Manual (Fifth edition, Jan 2018) (SDM) and its Corrigendum Nos. 1/2022, 1/2024 and 2/2024 issued by DSD. Design Return Period of 50 years (recommended for 'Main Rural Catchment Drainage Channels' in SDM) is being adopted.

5.2 The corresponding runoffs under rainfall intensity for various return period are worked out with reference to Rational Method. Brandy-Williams method is used in calculation of the time of concentration. A uniformly distributed rainfall with an intensity is determined by the Intensity-Duration-Frequency. With referenced to Table 3a - Storm Constants for different return periods of HKO Headquarters from SDM, the rainfall profiles are derived based on the following equation:

$$i = \frac{a}{(t_d + b)^c}$$

where $i$ = extreme mean intensity in mm/hr,
$t_d$ = duration in minutes ($t_d \leq 240$), and
$a, b, c$ = storm constants given in the table below

| Return Period (years) | 50 |
|---|---|
| a | 505.5 |
| b | 3.29 |
| c | 0.355 |

A 16.0% rainfall increase is adopted in the hydraulic calculation to cater for effects due to climate change in accordance with the table 28 with projection to End of 21st Century (it is very conservative, as the subject application is only for 5 years) as stipulated in the item (e) and (k) of the SDM - Corrigendum No. 1/2022. Besides, taking into consideration of design allowance in End of 21st Century, a further 12.1% rainfall increase is incorporated into the hydraulic assessment.

5.3 Hydraulic assessment is enclosed in the **Appendix**. 10% reduction in flow area has been incorporated to cater for potential deposition of sediment in stormwater channels and pipes as recommended in the SDM. The proposed channels and underground drainage were designed to cater for the estimated runoff under the designed rainstorms. With respect to the calculation, the proposed stormwater drainage system is capable to cater for the surface

runoff without causing any adverse drainage impacts on the subject site and its surroundings.

5.4 Since all proposed ditches would have sufficient spare capacity, no water backup will occur at the upstream under rainstorms of 50-year (or lower) return periods.

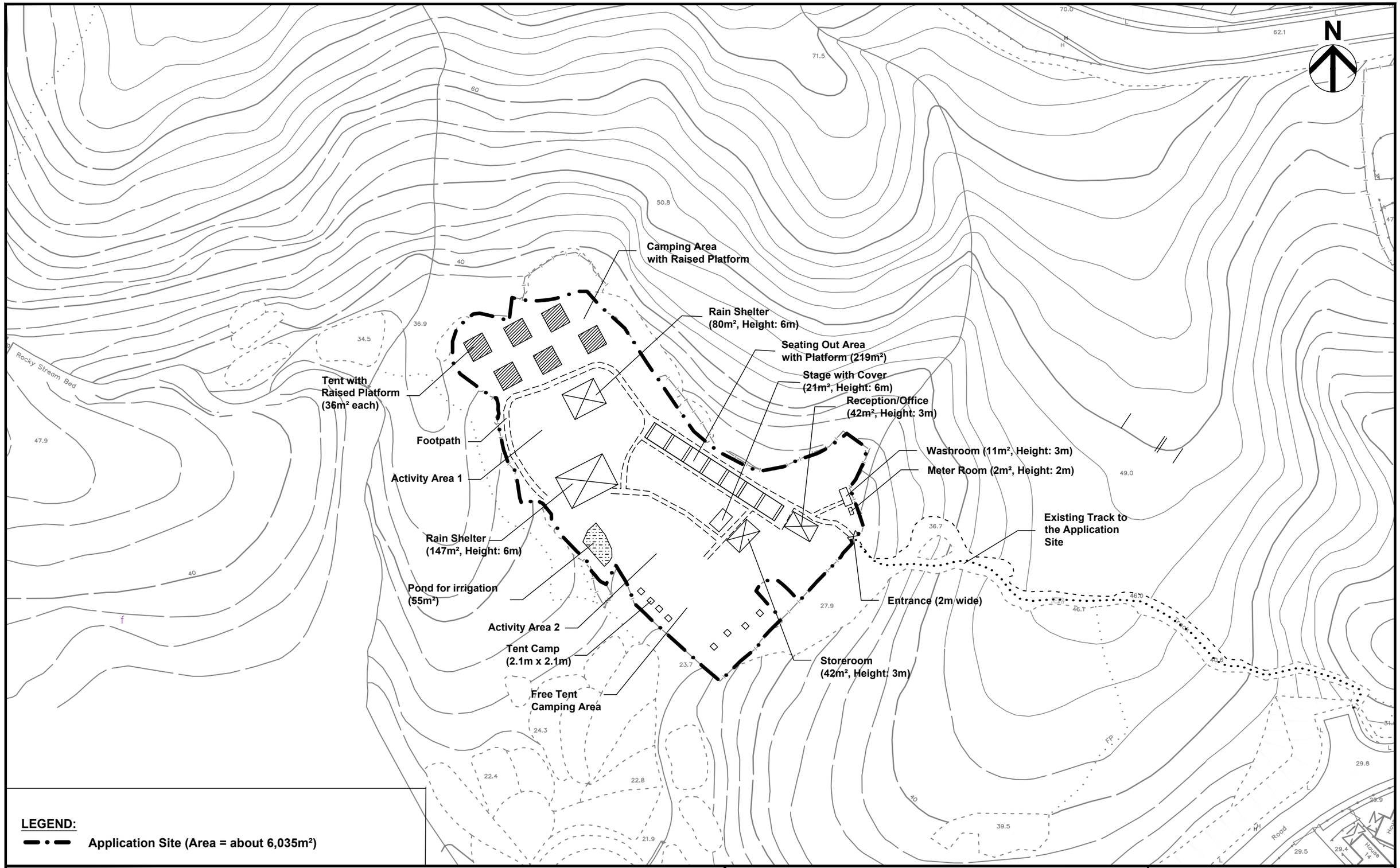
## 6. Conclusion

6.1 The subject site will be for a Proposed Temporary Holiday Camp for a Period of 5 Years.

6.2 Ditches with earth bottom and rubble sides will be constructed around the subject site to intercept all surface runoff crossing the boundary. The flows inside the ditches will be discharged into a proposed sandtrap and from which discharges into the existing watercourse at the southern corner of the subject site. There is generally no change in ground characteristics, i.e. grassland, after the proposed development. Besides, there would be no change in principle nor obstruction to the existing flow paths of the area.

6.3 The Applicant is committed to obtain consents from owners of adjacent relevant land/lots prior to commencement of the proposed drainage works outside the subject site and to maintain the completed drainage works to the satisfaction of relevant Government departments, and to clear the vegetation at the existing watercourse to which the surface runoff of the subject site would be discharged into.

6.4 In conclusion, the Proposed Development would not cause any adverse drainage impact onto the area.




**LEGEND:**

Application Site (Area = about 6,035m²)

| | | |
|---|---|---|
| | PROJECT | 何田顧問工程師有限公司<br>HO TIN & ASSOCIATES<br>CONSULTING ENGINEERS LIMITED |
| | TITLE: LAYOUT PLAN | SCALE: 1 : 1000 - A3 / DRAWING No.: FIGURE D1 |

813 800 E

814 000 E

811 000 N

N

TUNG CHUNG ROAD

① 4189m²

② 9935m²

③ 13890m²

④ 3777m²

⑤ 1298m²

⑥ 4673m²

⑦ 1362m²

PROPOSED 400 DEEP 45° TRAPEZOIDAL CHANNEL@1 IN 80

A I.L. +36.70

C I.L. +36.70

B I.L. +36.29

PROPOSED 400 DEEP 45° TRAPEZOIDAL CHANNEL@1 IN 80

PROPOSED 400 DEEP 45° TRAPEZOIDAL CHANNEL@1 IN 80

I.L. +36.10

I.L. +25.80

I.L. +25.05

PROPOSED 500 DEEP 45° TRAPEZOIDAL CHANNEL@1 IN 50

PROPOSED 500 DEEP 45° TRAPEZOIDAL CHANNEL@1 IN 25

I.L. +25.70

PROPOSED SAND TRAP

EXISTING WATERCOURSE

Rain Shelter (80m², Height: 6m)

Seating Out Area with Platform (219m²)

Stage with Cover (21m², Height: 6m)

Reception/Office (42m², Height: 3m)

Washroom (11m², Height: 3m)

Meter Room (2m², Height: 2m)

Existing Track to the Application Site

Footpath

Activity Area 1

Activity Area 2

Rain Shelter (147m², Height: 6m)

Pond for irrigation (55m²)

Tent Camp

Raised Platform (36m² each)

Rocky stream

Wayfoong Holiday Houses

Whitesands Road

C

FINISHED GROUND LEVEL

300

CHANNEL DEPTH

RUBBLE SIDE

45°

EARTH BOTTOM

TYPICAL SECTION OF PROPOSED 45° TRAPEZOIDAL CHANNEL

N.T.S.

LEGEND:

- SUBJECT SITE BOUNDARY
- STORMWATER
- CATCHMENT BOUNDARY
- LOCATION OF PHOTO TAKEN

PROJECT

何田顧問工程師有限公司
HO TIN & ASSOCIATES
CONSULTING ENGINEERS LIMITED

TITLE

STORMWATER DRAINAGE MANAGEMENT PLAN

SCALE

1 : 1500 – A3

DRAWING No.

FIGURE D2

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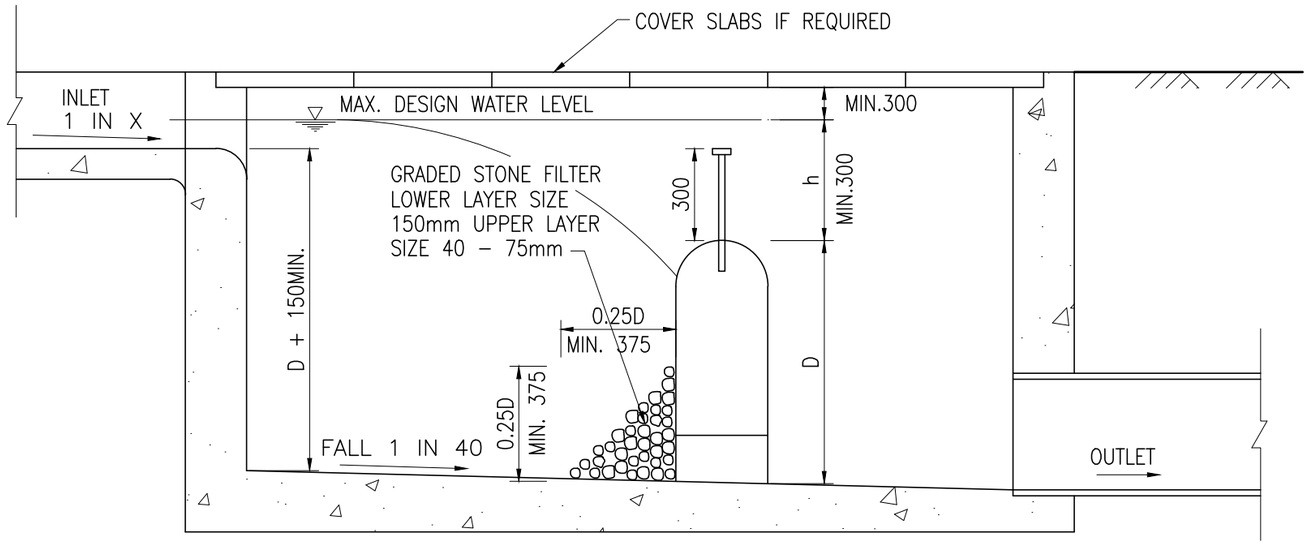
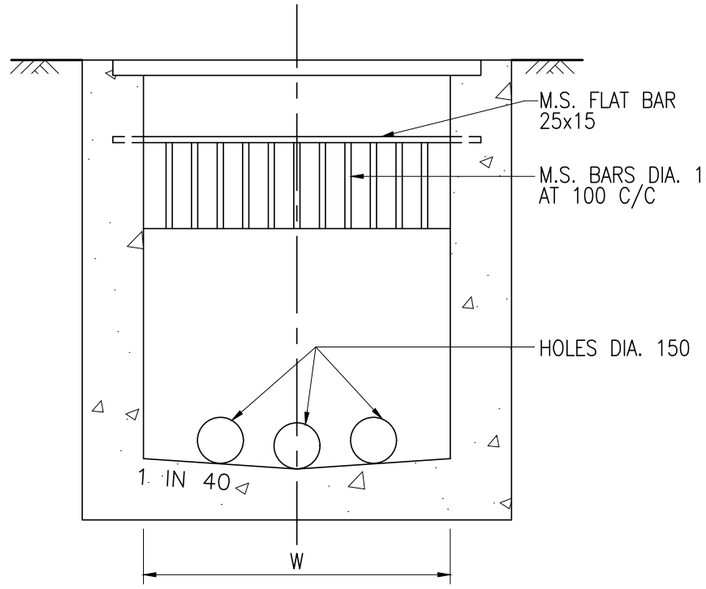
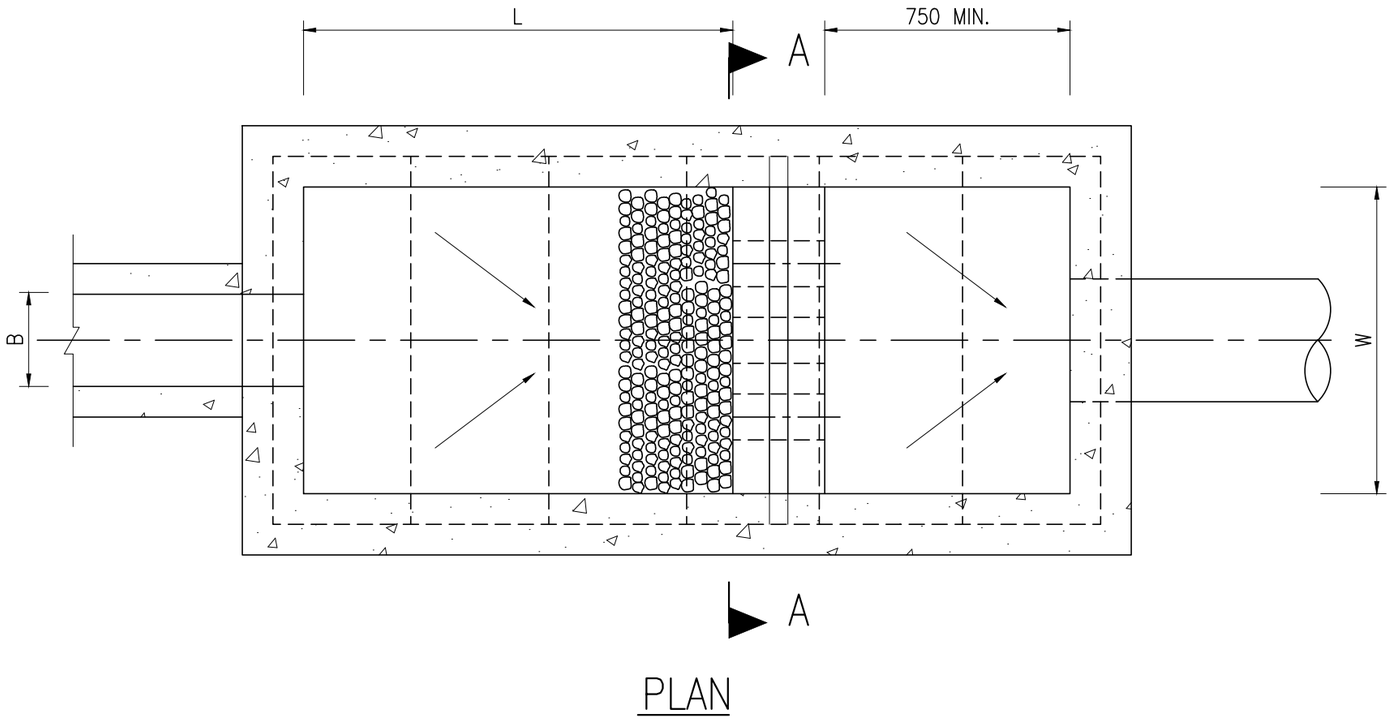



LONGITUDINAL SECTION




SECTION A – A




PLAN

## NOTES:–

1. ALL DIMENSIONS IN MILLIMETRES.
2. NORMALLY FOR DRAINS OF 900mm DIA. AND BELOW. FOR BIGGER DRAINS AND STEEP TERRAIN, SAND TRAP SHOULD BE SPECIALLY DESIGNED.
3. SIZE
   DEPTH : $D \leqslant 750$
   WIDTH : $W \geqslant 3B$
   LENGTH : $L = 4.8D^{0.67}h^{0.5}X^{-0.5} \geqslant 4B$
4. GRADE STONE FILTER SHALL BE CRUSHER RUN GRANITE AGGREGATE.
5. CAPACITY D W L TO BE ACCORDING TO SIZE AND NATURE OF CATCHMENT. PROVIDING DETENTION TIME NOT LESS THAN 5 MINUTES FOR MAX. DESIGN FLOW OF INLET.

PROJECT

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CONSULTING ENGINEERS LIMITED

TITLE
LAYOUT OF PROPOSED SANDTRAP

SCALE
N.T.S.

DRAWING No.
FIGURE D3

**Assessment of Hydraulic Capacities of the Drainage System for 1 in 50 year design return period**

**Using Rational Method**
Design Flow = 0.278CiA $m^3/s$ for grassland (heavy soil) - steep, C = 0.35
for asphalt/concrete surface, C = 0.95

**Using Manning Equation (for channel flow)**
Design Mean Velocity = $R^{1/6}/n(RS_f)^{1/2}$ and n= 0.035 for ditch with earth bottom and rubble sides in bad condition

**Using Gumbel Solution in frequency analysis**
Rainfall intensity = $a / (t_d+b)^c$ where a= 505.5 , b= 3.29 and c= 0.355 in 50 year design return period
referenced from Table 3a in SDM Corrigendum No. 1/2022 - Storm Constants for Different Return Periods of HKO Headquarters

**Using Bransby William's Equation (for surface water travelling from the catchment boundary to the drainage)**
Inlet time $t_0$ = $0.14465L/ (H^{0.2}A^{0.1})$ or 2 when the distance is too short

**Using Colebrook's White Equation (for pipe flow)**
V = - Sqt (8gDs) x log [($k_s$ / 3.7D) + (2.51v / D x Sqt (2gDs))]

**Parameters Input**
$k_s$ (mm) = 0.6 $k_s$ (m) = 0.0006
v ($m^2/s$) = 1.00E-06
g ($m^2/s$) = 9.81

* - conservative, as the subject proposed development is for temporary use for 5 years only

| (1) USCP/USMH | (2) DSCP/DSMH | (3) Collected Runoff from Catchment (refer to Figure D3) | (4) USGL (mPD) | (5) DSGL (mPD) | (6) USIL (mPD) | (7) DSIL (mPD) | (8) INVERT DIFF. (m) | (9) LENGTH OF CHANNEL/ DRAIN (m) | (10) SLOPE s | (11) SLOPE 1 IN | (12) LENGTH FOR CALCULATING OF INLET TIME L (m) | (13) INLET TIME $t_0$ (min) | (14) TIME OF FLOW INSIDE CHANNEL/ DRAIN = I/V (i.e. Column (9)/Column (26)/60) = $t_f$ (min) | (15) TIME OF CONCENTRATION = $t_0 + t_f$ = $t_c$ (min) | (16) RAINFALL INTENSITY i (mm/hr) | (17) RAINFALL INTENSITY INCLUDING EFFECT OF CLIMATE CHANGE (+16.0%*) (mm/hr) [refer to item (e) and (k) in SDM Corrigendum No. 1/2022] | (18) ADOPTED RAINFALL INTENSITY INCLUDING EFFECT OF CLIMATE CHANGE (+16.0%) & DESIGN ALLOWANCE (12.1%) (mm/hr) [refer to item (e), (k) and (n) in SDM Corrigendum No. 1/2022] | (19) RUNOFF COEF. C | (20) SUB-CATCHMENT AREA ($m^2$) | (21) EFF. AREA ($m^2$) | (22) CUM. EFF. AREA ($m^2$) | (23) DESIGN FLOW ($m^3/s$) | (24) SIZE (mm) | (25) CHANNEL TYPE | (26) VELOCITY V (m/s) | (27) FLOW CAPACITY ($m^3/s$) | (28) 90% FLOW CAPACITY (for pipe) ($m^3/s$) | (29) SPARE CAPACITY ($m^3/s$) | (30) Occupancy of the Proposed Pipe / Channel | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Starting Point A | Point B | 1 | 37.10 | 36.90 | 36.70 | 36.29 | 0.41 | 33.00 | 0.013 | 80 | 310 | 10.84 | 0.43 | 11.27 | 195.32 | 226.57 | 253.99 | 0.35 | 4,189 | 1,466 | 1,466 | 0.104 | 400 | $45^0$ trapezoidal | 1.28 | 0.66 | | 0.553 | 15.8% | OK! |
| Point B | Sandtrap | 1 + 5 + 6 | 36.90 | 26.20 | 36.29 | 25.80 | 1.63 | 130.00 | 0.013 | 80 | - | 11.27 | 2.01 | 13.29 | 186.55 | 216.40 | 242.58 | 0.35 | 5,971 | 2,090 | 3,556 | 0.240 | 400 | $45^0$ trapezoidal | 1.08 | 0.30 | | 0.062 | 79.6% | OK! |
| Starting Point C | Point D | 2 | 37.10 | 30.60 | 36.70 | 30.20 | 1.13 | 90.00 | 0.013 | 80 | 290 | 9.18 | 1.39 | 10.58 | 198.76 | 230.57 | 258.46 | 0.35 | 9,935 | 3,477 | 3,477 | 0.250 | 400 | $45^0$ trapezoidal | 1.08 | 0.30 | | 0.052 | 82.9% | OK! |
| Point D | Sandtrap | 2 + 3 + 4 + 7 | 30.60 | 26.20 | 30.10 | 25.70 | 2.20 | 55.00 | 0.040 | 25 | - | 10.58 | 0.42 | 11.00 | 196.65 | 228.12 | 255.72 | 0.35 | 19,029 | 6,660 | 10,137 | 0.721 | 500 | $45^0$ trapezoidal | 2.17 | 0.87 | | 0.146 | 83.2% | OK! |
| **External** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sandtrap | Existing Watercourse | 1 to 7 | 26.20 | 23.70 | 25.05 | 23.20 | 0.06 | 3.00 | 0.020 | 50 | - | 13.29 | 0.02 | 13.30 | 186.48 | 216.32 | 242.50 | 0.35 | 0 | 0 | 13,693 | 0.923 | 500 | $45^0$ trapezoidal | 3.08 | 1.23 | 1.11 | 0.185 | 83.3% | OK! |

| | | | | | |
|---|---|---|---|---|---|
| | subcatchment | | | | 39,124 |
| | | 1 | 4,189 | | |
| | | 2 | 9,935 | | |
| | | 3 | 13,890 | | |
| | | 4 | 3,777 | | |
| | | 5 | 1,298 | | |
| sub total = | | | 33,089 | the subject site area = | 6,035 |