Appendix F: Revised Pages of DIA Report

capacity of the U-channel) will increase from 0.700m^3/s to 0.734m^3/s, i.e. an increase of 0.034m^3/s. However, the runoff from the overall catchment is estimated to be in the order of 22.3m^3/s, so the local increases would be no more than 0.15% of the overall runoff. This is well within the level of accuracy of runoff estimation and the increases are therefore insignificant. It is noted that there are no nearby buildings or roads which might be affected by any changes in runoff.

5.2.3 A further factor to consider is that rainwater harvesting may be considered for the development, and, although the details of this have yet to be developed, this may help to reduce the runoff from the Site and surrounding catchment areas. As noted above, there would also be some retention within the pond/water feature, which would further reduce the actual peak runoff.

5.2.4 The Site currently receives runoff from the local upstream catchment (in excess of the available capacity of the U-channel adjacent to the road) and this will continue after the proposed development. As the runoff is expected to be widespread (rather than at discrete locations), peripheral channels will be provided. The exact arrangement(s) for the peripheral channels will be determined during later stages of Project implementation, although indicative arrangements and capacities for U-channel and trapezoidal options are included in **Appendix F**.

5.2.5 As the area is rural in nature and the Nature Academy is intended to retain a similar environment, it is proposed to use vegetated open channels (or "swales") for the Site drainage, rather than standard concrete channels. Also, a standard Terminal Manhole would not be appropriate for the Site, so it is intended to provide a simple catchpit instead (e.g. in accordance with CEDD Standard Drawing C2406). The main Site drainage will convey flow generally from the peripheral channel(s) adjacent to the access road across the Site towards the main streamcourse, with runoff from the eastern portion of the Site being conveyed to the pond (water feature). However, as for the peripheral channels, the main Site drainage will be determined in detail during later stages of Project implementation.

5.2.6 All drainage facilities within the Site will be constructed and maintained by the Project Proponent.

5.2.7 Drainage monitoring requirements and programmes for the construction and operation stages will be prepared at the detailed design stage.

C197 - Proposed Tai Po Kau Nature Academy
Overall Catchment Areas and Run-off (1 in 10 Year)

Refer:
DSD Stormwater Drainage Manual
GeoInfo Map
MLP for the Site

Notes:
The existing Site comprises gently sloping vegetated soil; C = 0.25, and some existing buildings/paved areas; C = 0.95
The future Site will comprise some buildings and various other surfaces - see Runoff Coefficients below.
The overall catchment and local upstream catchment mostly comprise steep naturally vegetated hillsides; C = 0.35.
The Site will be used for "Agriculture", but also overnight camping, so check the 1 in 10-year Scenario.
The discharge from the Site will be to a Main Rural Drainage Channel (a large natiral streamcourse), so also check the 1 in 50-year Scenario for reference.
The Site Catchment is small, so Rational Method is appropriate. Overall Catchment is large (>1.5km^2), but adopt the Rational Method for simplicity and as an indication of magnitude.
Allowances for increased rainfall intensity are to be included, in accordance with Section 6.8 of the DSD Stormwater Drainage Manual. The Site is at high elevation and will not be tidally affected.

Intensity = $a/(t_c+b)^c$

a, b and c from the DSD Stormwater Manual (Table 3a - HKO)

	a	b	c
1 in 10 year	471.9	3.02	0.397

Catchment	Area (m^2)	Levels (mPD)[1] Upsteam	Downstream	Fall (m)	Overland, L (m)	Fall, H (m/100m)	Overland t_c (min)	Total t_c* (min)	Intensity (mm/h)	Runoff Coefficient	Run-off (m^3/s)	Remarks
Existing Situation												
The Site (Proposed Area)												
Overall Site Area	9,054	120	105	15	76	19.7	2.4	3.0	231	0.35	0.204	See separate Runoff Coefficient Calculation (Appendix C)
Total											**0.204**	
The Site + Local Upstream Catchment												
Overall Local Catchment Area (including the Site)	46,177	235	103	132	276	47.8	6.3	6.3	195			Measured from GeoInfo Map
The Site	9,054									0.35	0.171	See separate Runoff Coefficient Calculation (Appendix C)
Access Road (Paved)	786									0.95	0.040	
External Vegetated Areas (Unpaved - mostly steep)	36,337									0.35	0.688	
Total											**0.900**	
Available Capacity of U-channel adjacent to the Access Road											0.200	
Resultant Discharge from the Site											**0.700**	
Overall Catchment												
Overall Catchment Area	2,470,000	590	95	495	3,080	16.1	58.7	58.7	92			Catchment data from Grassy Hill
Access Roads & The existing Site Buildings/Paving (Paved)	19,301									0.90	0.444	
Vegetated Areas (Unpaved)	2,450,699									0.35	21.905	
Total											**22.349**	Indicative order of magnitude only
Future Situation												
The Site												
Overall Site Area	9,054							3.0	231	0.41	0.239	See separate Runoff Coefficient Calculation (Appendix C)
STP Discharge (Nominal)											0.005	
Total											**0.244**	
The Site + Local Upstream Catchment												
Overall Local Catchment Area (including the Site)	46,177	235	103	132	276	47.8	6.3	6.3	195			
The Site	9,054									0.41	0.201	See separate Runoff Coefficient Calculation (Appendix C)
Access Road (Paved)	786									0.95	0.040	
External Vegetated Areas (Unpaved - mostly steep)	36,337									0.35	0.688	
STP Discharge (Nominal)											0.005	
Total											**0.934**	
Available Capacity of U-channel adjacent to the Access Road											0.200	Separate discharge via existing U-channel
Resultant Discharge from the Site											**0.734**	
Discharge Towards The Site												
Access Road (Paved)											0.040	
External Vegetated Areas (Unpaved - mostly steep)											0.688	
											0.728	
Available Capacity of U-channel adjacent to the Access Road											0.200	Separate discharge via existing U-channel
Overall Discharge Towards the Site											**0.528**	To be collected by Peripheral Channel(s)
Increase over Existing Situation (The Site)											**0.040**	
%age Increase											**19.6%**	
%age Increase Compared to Existing Overall Catchment											**0.18%**	
Future Site Runoff with climate change increase to mid-21st Century (STP Discharge + 10.4% increase in rainfall)											**0.269**	
Future Site Runoff with climate change increase to end-21st Century (STP Discharge + 13.8% increase in rainfall)											**0.277**	

C197 - Proposed Tai Po Kau Nature Academy
Overall Catchment Areas and Run-off (1 in 50 Year)

Refer:
DSD Stormwater Drainage Manual
GeoInfo Map
MLP for the Site

Notes:
The existing Site comprises gently sloping vegetated soil; C = 0.25, and some existing buildings/paved areas; C = 0.95
The future Site will comprise some buildings and various other surfaces - see Runoff Coefficients below.
The overall catchment and local upstream catchment mostly comprise steep naturally vegetated hillsides; C = 0.35.
The Site will be used for "Agriculture", but also overnight camping, so check the 1 in 10-year Scenario.
The discharge from the Site will be to a Main Rural Drainage Channel (a large natiral streamcourse), so also check the 1 in 50-year Scenario for reference.
The Site Catchment is small, so Rational Method is appropriate. Overall Catchment is large (>1.5km^2), but adopt the Rational Method for simplicity and as an indication of magnitude.
Allowances for increased rainfall intensity are to be included, in accordance with Section 6.8 of the DSD Stormwater Drainage Manual. The Site is at high elevation and will not be tidally affected.

Intensity = $a/(t_c+b)^c$

a, b and c from the DSD Stormwater Manual (Table 3a - HKO)

	a	b	c
1 in 50 year	451.3	2.46	0.337

Catchment	Area (m^2)	Levels (mPD)[1] Upsteam	Downstream	Fall (m)	Overland, L (m)	Fall, H (m/100m)	Overland t_c (min)	Total t_c* (min)	Intensity (mm/h)	Runoff Coefficient	Run-off (m^3/s)	Remarks
Existing Situation												
The Site (Proposed Area)												
Overall Site Area	9,054	120	105	15	76	19.7	2.4	3.0	255	0.35	0.224	See separate Runoff Coefficient Calculation (Appendix C)
Total											**0.224**	
The Site + Local Upstream Catchment												
Overall Local Catchment Area (including the Site)	46,177	235	103	132	276	47.8	6.3	6.3	217			Measured from GeoInfo Map
The Site	9,054									0.35	0.191	See separate Runoff Coefficient Calculation (Appendix C)
Access Road (Paved)	786									0.95	0.045	
External Vegetated Areas (Unpaved - mostly steep)	36,337									0.35	0.768	
Total											**1.005**	
Available Capacity of U-channel adjacent to the Access Road											0.200	
Resultant Discharge from the Site											**0.805**	
Overall Catchment												
Overall Catchment Area	2,470,000	590	95	495	3,080	16.1	58.7	58.7	113			Catchment data from Grassy Hill
Access Roads & The existing Site Buildings/Paving (Paved)	19,301									0.90	0.545	
Vegetated Areas (Unpaved)	2,450,699									0.35	26.910	
Total											**27.455**	Indicative order of magnitude only
Future Situation												
The Site												
Overall Site Area	9,054							3.0	255	0.41	0.263	See separate Runoff Coefficient Calculation (Appendix C)
STP Discharge (Nominal)											0.005	
Total											**0.268**	
The Site + Local Upstream Catchment												
Overall Local Catchment Area (including the Site)	46,177	235	103	132	276	47.8	6.3	6.3	217			
The Site	9,054									0.41	0.224	See separate Runoff Coefficient Calculation (Appendix C)
Access Road (Paved)	786									0.95	0.045	
External Vegetated Areas (Unpaved - mostly steep)	36,337									0.35	0.768	
STP Discharge (Nominal)											0.005	
Total											**1.042**	
Available Capacity of U-channel adjacent to the Access Road											0.200	Separate discharge via existing U-channel
Resultant Discharge from the Site											**0.842**	
Discharge Towards The Site												
Access Road (Paved)											0.045	
External Vegetated Areas (Unpaved - mostly steep)											0.768	
											0.813	
Available Capacity of U-channel adjacent to the Access Road											0.200	Separate discharge via existing U-channel
Overall Discharge Towards the Site											**0.613**	To be collected by Peripheral Channel(s)
Increase over Existing Situation (The Site)											**0.043**	
%age Increase											**19.4%**	
%age Increase Compared to Existing Overall Catchment											**0.16%**	
Future Site Runoff with climate change increase to mid-21st Century (STP Discharge + 10.4% increase in rainfall)											**0.296**	
Future Site Runoff with climate change increase to end-21st Century (STP Discharge + 13.8% increase in rainfall)											**0.305**	

C197 - Proposed Tai Po Kau Nature Academy
Capacity of Future Peripheral Channels
U-Channel Option

Check required sizing for peripheral channels. Assume a vegetated U-channel arrangement

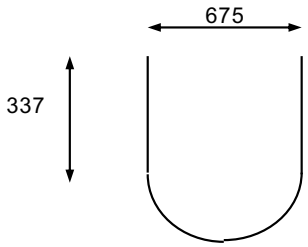
From Runoff Calculations (Appendix E), Total (10-year) Flow Towards The Site = 0.528 m^3/s

With Potential Increased Rainfall Intensity, Total Flow Towards the Site @ end-21st Cent = 0.601 m^3/s

Assume Peripheral Channel divided into only 2 sections. Flow/section = 0.300 m^3/s

Assume Gradient = 1 in **100**

Using Manning's Equation:



D = 675 mm

A* = 0.366 m^2

P = 1.735 m

R = A/P = 0.211 m

n = 0.040 (SDM Table 13, Canals and ditches, 6. Canals with rough stoney beds, weeds on earth banks (bad))

(R^2/3)/n = 8.808

* Assumes 10% loss for siltation (gradient < 1:25)

s = 0.010

V = 0.88 m/s

Q = 0.322 m^3/s (> Flow/section)

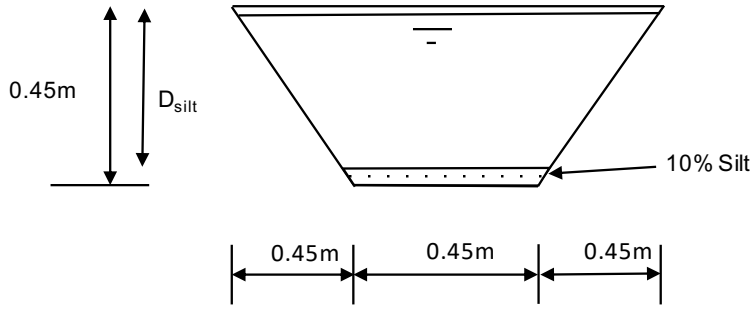
Note: Actual arrangement may be more trapezoidal (natural)

C197 - Proposed Tai Po Kau Nature Academy
Capacity of Future Peripheral Channels
Trapezoidal Option

Assume:

1. Peripheral Channel is trapezoidal

Peak Flow/section (1 in 10-year, end 21st Century) = 0.300 m^3/s



Overall channel gradient, say = 1 in 100 0.010

Canals with stony bed and weeds, (bad condition): say, Manning's n = 0.040 (DSD SDM Table 13)

Without Freeboard Allowance

B =	0.45	m
D (with 0.3m Freeboard) =	0.45	m
D_{silt} =	0.41	m (allowing for 10% silt)
Top Width =	1.35	m
A (m^2) =	0.36	m^2
P (m) =	0.45	m (base)
	1.21	m (side walls)
	1.66	m
R (m) = A/P =	0.22	m

Q (m^3/s) = Av = A x $R^{2/3}$ x $S^{1/2}$ /n = 0.33 m^3/s (> Peak Flow/section)