Appendix 14

Project :	PERMOHONAN KEBENARAN MERANCANG BAGI CADANGAN MENDIRIKAN SEBUAH KILANG KERTAS (FASA 1) DAN KOMPONEN SOKONGAN DI ATAS SEBAHAGIAN PT 441, MUKIM PADANG MEHA, DAERAH KULIM, KEDAH DARUL AMAN.
Client :	XSD INTERNATIONAL PAPER SDN BHD
Ref. No.	0919/HC/01/WC
Date	14/03/2019
Subject	Hydraulic Calculations [Urban Stormwater Management Manual for Malaysia 2]

<u>Introduction</u>

The proposed location is located at sebahagian pt 441, mukim Padang Meha, Daerah Kulim.
The purpose of this calculation is served to check the discharge (Q) of this development and confirm the excess discharge of this development will not affect and upset the surrounding drainage system.

This design calculation is based on latest version of MSMA 2nd edition (Updated 23 MAY 2013)

<u>DESIGN DATA</u>

STATE		= KEDAH DARUL AMAN	
STATION NAME	8	= IBU BEKALAN SG. KULIM	Appendix 2.B
LAND USE		= FLAT	
CATCHMENT AREA		= 404686 m^2	
UPPER CATCHMENT AREA		= 0.00 m^2	
TOTAL CATCHMENT AREA		= 404686.00 Or 40.4686 Hectares(Ha)	

CONTRIBUTION DEVELOPMENT AREA

Sub-catchment Area		=	78524 m^2	
	Or		7.85 Hectares(Ha)	
Impervious Area (Covered Up)		=	70672 m^2	90 %
	Or		7.07 Hectares(Ha)	
Pervious Area (Open Space)			7852 m^2	10 %
	Or		0.79 Hectares(Ha)	

DETERMINE TIME OF CONCENTRATION

Time of Concentration For Post-Development Where,		$Tc = T_o + t_d$	
Overland Sheet Flow Travel Time		$T_o = (107\ n\ L^{1/3})/S^{1/5}$	
Overland Sheet Flow Path Length		L= 33.1 M	
Hortons roughness Value for The Surface	1	N= 0.02 PAVED	Table 2.2
Slope of Overland Surface		S= 0.005 %	
Therefore , T_o		= 14.87 Min	
Where,			
Travel Time in the Drain		$T_d = N\ L\ /60\ R^{2/3}\ S^{1/2}$	
Manning's Roughness Coefficient		N= 0.015 CONCRETE	Table 2.3
Length of Drain		L= 957.00 M	
Hydraulic Radius		R= 0.471	
Friction Slope		S= 0.0010	
Therefore, T_d		= 12.49 Min	
Therefore, T_c,			
Critical Time of Concentration for Post development		T_c = 27.36	

Determine $Q_{(a\ Post)}$ for the Post-Development Condition

Empirical equation can be used to minimise error in estimating the rainfall intensity values from the IDF curves.
The following equation adopted from Hydrological Procedure (HP) No.1 revised based on MSMA 2

$$I = \Lambda\, T^{k}/((d/60)+ \Theta)^{л}$$

Where I = Average Rainfall Intensity (mm/hr)
T = Average recurrence interval – ARI (0.5<T<12 month and 2<T<100 year)
D= Storm duration (hours) , 0.0833<d<72
Variables = Fitting constant dependent on the raingauge location (Table 2.B1 Appendix 2B)

Using the Rational Method

Development Data		Post Development				
Design Storm ARI for Post-Development,T	Year	2	5	10	50	100
Time of Concentration,T_c	Min	27.36	27.36	27.36	27.36	27.36
IDF Constant	λ	57.832	57.832	57.832	57.832	57.832
	K	0.188	0.188	0.188	0.188	0.188
	ϴ	0.245	0.245	0.245	0.245	0.245
	л	0.751	0.751	0.751	0.751	0.751
Rainfall Intensity, I	mm/hr	86.02	102.19	116.42	157.55	179.48
Runoff Coefficient,C		0.90	0.90	0.90	0.95	0.95
Catchment Area, A	Hectares	7.85	7.85	7.85	7.85	7.85
Design ARI Peak Flow ,$Q_{(a\ Post)}$	m^3/s	**1.6887**	**2.0062**	**2.2854**	**3.2647**	**3.7191**

Therefore,

The Peak Flow for 2 Year ARI Q_2 = **1.6887** m^3/s

The Peak Flow for 5 Year ARI Q_5 = **2.0062** m^3/s

The Peak Flow for 10 Year ARI Q_{10} = **2.2854** m^3/s

The Peak Flow for 50 Year ARI Q_{50} = **3.2647** m^3/s

The Peak Flow for 100 Year ARI Q_{100} = **3.7191** m^3/s

Check capacity of Proposed 1800mm diameter Conceal Pipe Drain

DRAIN SIZE Computation : Manning Formula

Type of drain is Concrete Drain

Proposed Drainage Width,m	=	1.8 M
Proposed Average Drainage Height,m	=	1.80 M
Area of Drainage A,	A =	2.545 m^2
Wetted Perimeter of Drainage, P	P =	5.4 M
Hydraulic Radius , R = A/P	R =	0.471
Friction Slope, S	S =	0.001
Mannig Coeeficient , n	N =	0.013
Flow, Q_{all}	Q_{all} =	3.7493

The Peak Flow for 2 Year ARI	Q_2	=	**1.689** <Qall	**ok!**
The Peak Flow for 5 Year ARI	Q_5	=	**2.006** <Qall	**ok!**
The Peak Flow for 10 Year ARI	Q_{10}	=	**2.285** <Qall	**ok!**
The Peak Flow for 50 Year ARI	Q_{50}	=	**3.265** <Qall	**ok!**
The Peak Flow for 100 Year ARI	Q_{100}	=	**3.719** <Qall	**ok!**

Qall is greater than Q2,Q10 & Q100, therefore design drainage is OK

Reference	Calculation			Output
			Units	Units
Figure 5.A1	Region	3 - NORTHERN		
(MSMA2)	Project Area	=	40.47 ha	
	Terrain	=	Mild	
	Catchment Area	=	40.47 ha	
	Impervious Area	=	303515 m^2	
			(30.3515 ha)	
	Pervious Area	=	101171 m^2	
			(10.1171 ha)	
	% of Impervious Area	=	75 %	
Table 5.A1	Permissible Site Discharge (PSD)/ha:		=	69.9 l/s/ha
(MSMA2)	For area of 40.4686ha, PSD =	40.4686 x 69.9	=	2828.76 l/s
			=	2.829 m^3/s
Table 5.A1	Site Storage Requirement (SSR)/ha:		=	454 m^3/ha
(MSMA2)	For area of 40.4686ha, SSR =	40.4686 x 454	=	18372.74 m^3
	The required storage is 18372.744m3			

Determine Storage Dimension

Propose volume of OSD

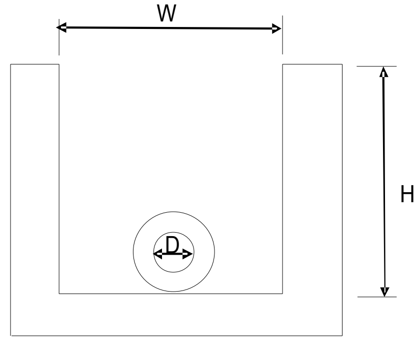
I) OSD

a) Detention pond

	width	=	102 m	
	length	=	195 m	
	Height	=	1.2 m	
Capacity of storage		=	23868.00 m^3	
Therefore,				
Total capacity of storage		=	23868 m^3	
		$\geq$	18372.74 m^3	O.K.

Sizes of Outlet Orifice

Project Area :	=	40.47
Impervious Area : (Covered Up)	=	75.0 %
From Table 5.A.3 (MSMA 2)		
Orifice Size of outlet flow	=	600 Mm



Conclusion

The On-site detention pond and drainage system to control the discharge.
The discharge generated by this development onto the existing drainage system will be retained at the proposed drain and flow through the outlet opening.
Therefore, the excess discharge created by this development will not affect and upset the surrounding drainage system.