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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021**

COURSE NAME : URBAN STORM WATER
MANAGEMENT

COURSE CODE : BFW 40503

PROGRAMME CODE : BFF

EXAMINATION DATE : JULY 2021

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

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- Q1** (a) Discuss **TWO (2)** the importance of Muskingum method in managing urban stormwater
(5 marks)
- (b) The landuse composition for the working site as shown in **Table Q1 (b)** with the overland flow time, t_o and drain flow, t_d are 8 min and 7 min, respectively.
- (i) Determine rainfall intensity, i and landuse coefficient, C by referring to **Figure Q1 (b)** and **Table Q1 (b)(i)**
(5 marks)
- (ii) Estimate the design peak flow for minor (5-year) and major (100-year) ARIs.
(5 marks)
- (c) The Intensity-Duration-Frequency curve (IDF) is used to estimate peak flow or discharge.
- (i) Outline the typical steps to develop IDF curve
(6 marks)
- (ii) Justify **TWO (2)** the important of IDF in solving flood problems.
(4 marks)
- Q2** (a) Discuss **TWO (2)** the application and limitation bio-retention system in stormwater management planning.
(6 marks)
- (b) Total Suspended Solid (TSS) is required to be reduced by 80% from a 15 ha of residential area as shown in **Figure Q2 (b)(i)** by using swale, wetlands and water quality pond. Estimate the preliminary size of these treatment facility, if the average contributing impervious of the residential area is 70%. Refer **Figure Q2 (b)(ii) – (iv)** to solve this problem.
(10 marks)
- (c) A proposed detention pond is suggested in the development project. Explain a detail procedure and justification in designing a detention pond.
(9 marks)

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- Q3** (a) A rainwater harvesting system is proposed for semi-detached 2-storey house development in Ipoh, Perak. Four rooms with single flush toilet are proposed to be designed, with a car porch for two cars and small garden area. If the house has roof area of 250 m² and domestic water demand is 350 litres/capita/day. By referring to **Table Q3 (a)(i) – (ii)**, estimate;
- (i) Annual rain water demand and rainwater tank size (6 marks)
 - (ii) Percentage of rainwater yield over rainwater demand and domestic water demand (4 marks)
- (b) A theme park project is proposed to be developed at Kota Tinggi, Johor and the concept of this park is natural village.
- (i) Recommend type of channel and critically review the suitability with the theme parks concept. (10 marks)
 - (ii) Support your idea with a sketch based on map location given in **Figure Q3 (b)** (5 marks)
- Q4** You are appointed as project manager for a dam construction in Selangor. One of the tasks is to prepare an erosion and sediment control plan to ensure that construction works will not affect quality and quantity of runoff within the area. Refer **Figure Q4** for map location.
- (a) Propose an erosion and sediment control plan with sketches of some imaginary contour lines (15 marks)
 - (b) Justify the consideration being used to proposed the mentioned BMPs in Q4 (a) (10 marks)

– END OF QUESTIONS –

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TABLE Q1 (b): Landuse for Catchment Area

Land use	Area (ha)
Roads	7
Lawn (Grass)	10
Condominium	40
Industrial	8

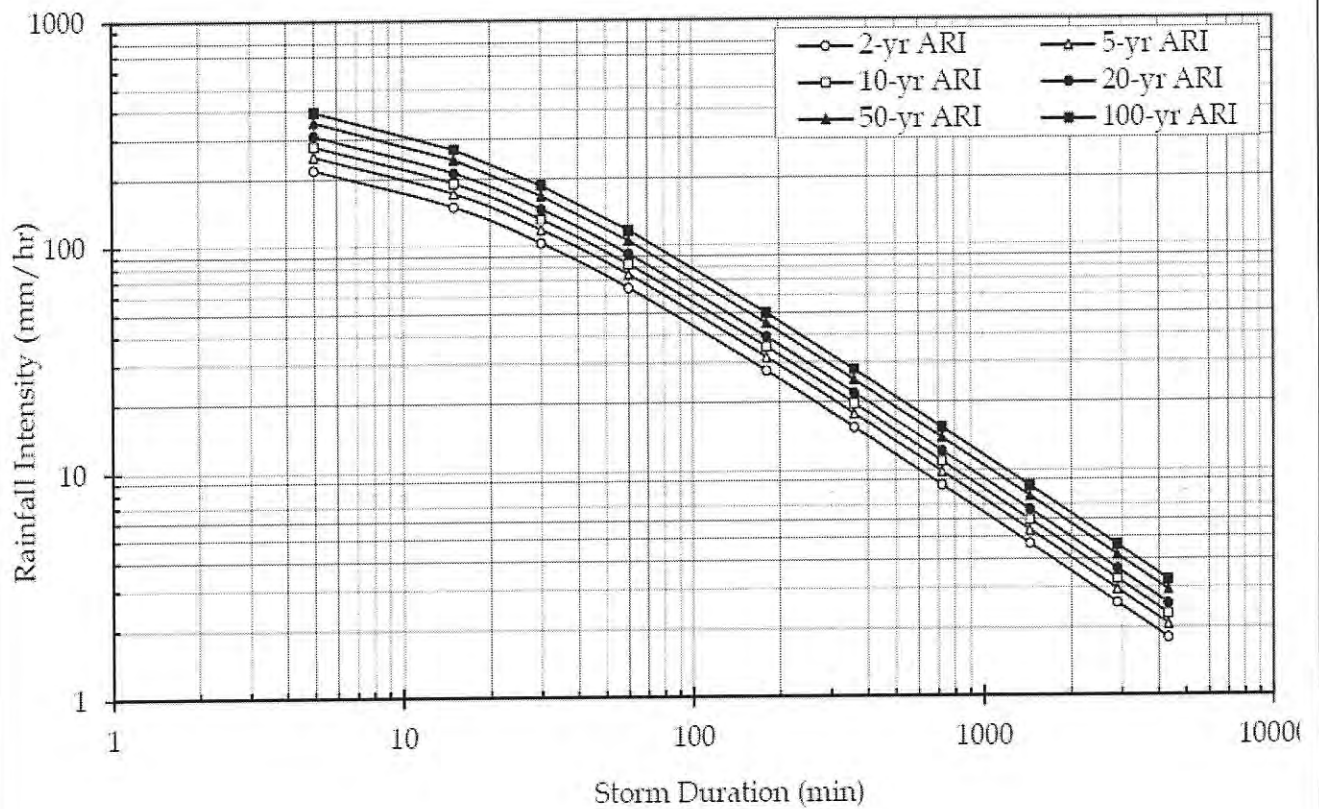


FIGURE Q1 (b)(i): IDF Curve for Catchment Area

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TABLE Q2 (b)(i): Runoff Coefficients for Various Landuse

Landuse	Runoff Coefficient (C)	
	For Minor System (≤10 year ARI)	For Major System (> 10 year ARI)
Residential		
Bungalow	0.65	0.70
Semi-detached Bungalow	0.70	0.75
Link and Terrace House	0.80	0.90
Flat and Apartment	0.80	0.85
Condominium	0.75	0.80
Commercial and Business Centres	0.90	0.95
Industrial	0.90	0.95
Sport Fields, Park and Agriculture	0.30	0.40
Open Spaces		
Bare Soil (No Cover)	0.50	0.60
Grass Cover	0.40	0.50
Bush Cover	0.35	0.45
Forest Cover	0.30	0.40
Roads and Highways	0.95	0.95
Water Body (Pond)		
Detention Pond (with outlet)	0.95	0.95
Retention Pond (no outlet)	0.00	0.00

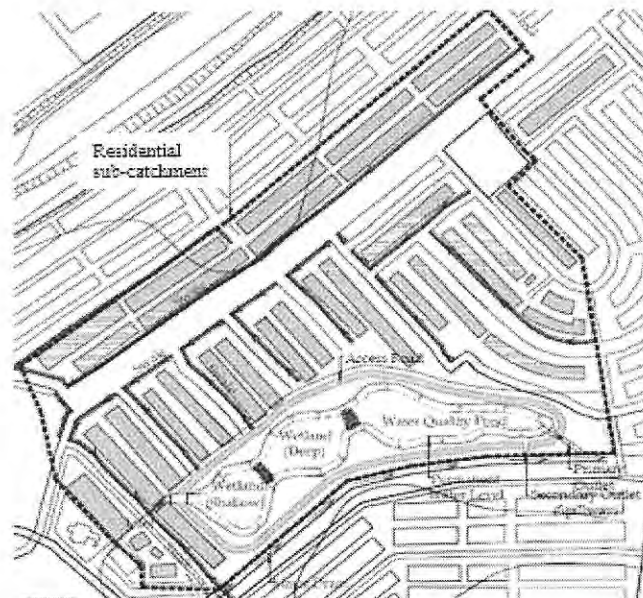


FIGURE Q2 (b) (i): Catchment Area

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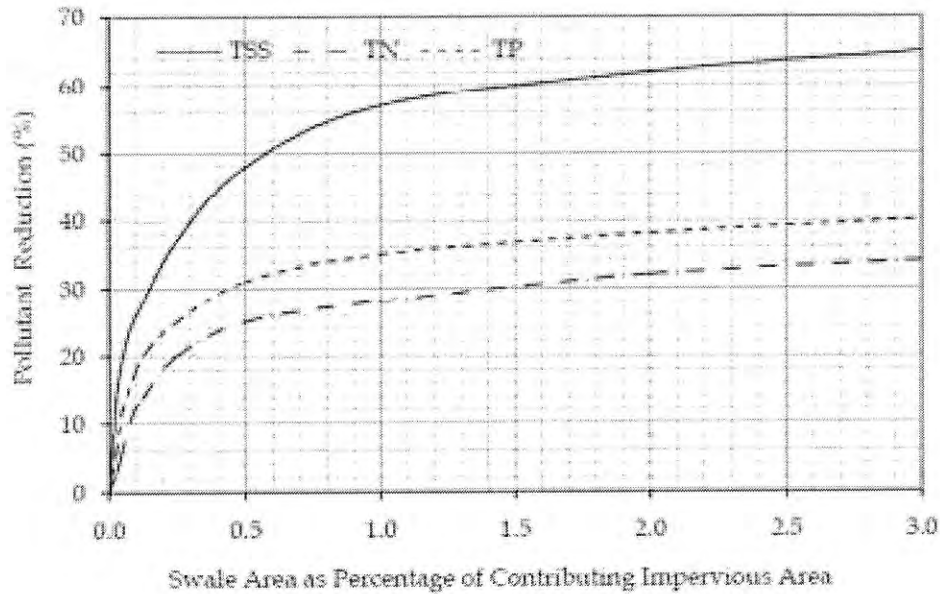


FIGURE Q2 (b)(ii): Pollutant Reduction Curve for Swale

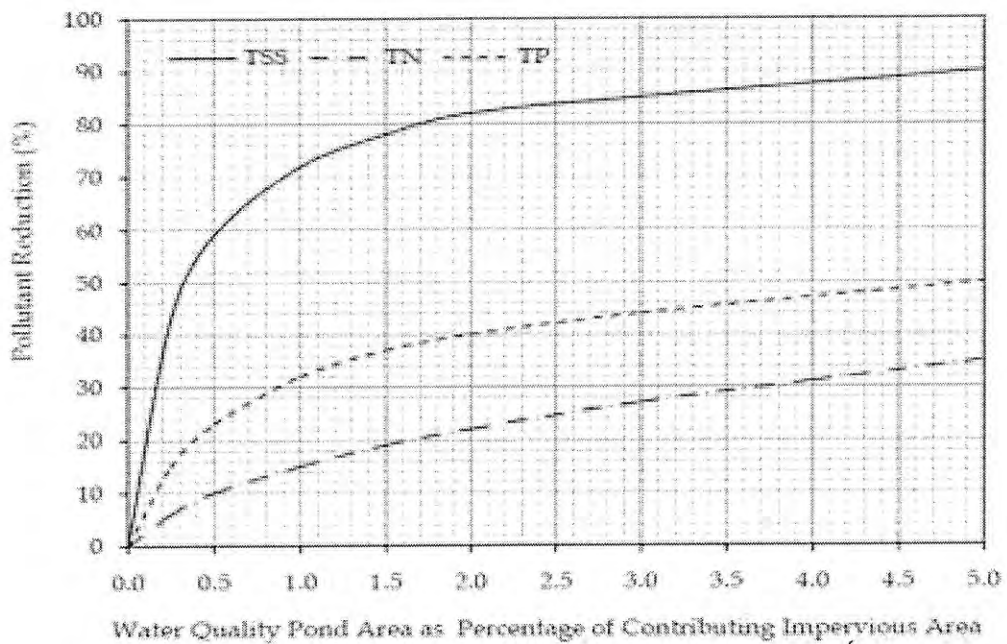


FIGURE Q2 (b)(iii): Pollutant Reduction Curve for Water Quality Pond

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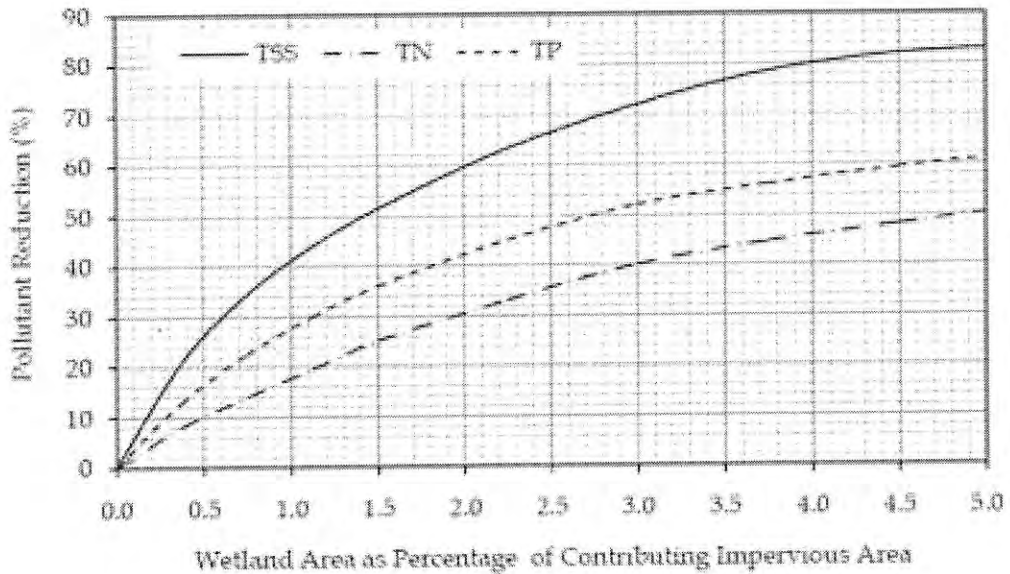


FIGURE Q2 (b)(iv): Pollutant Reduction Curve for Wetland

TABLE Q3 (a)(i): Average Annual Rainwater Yield

No	Name of Town	Average Annual Rainwater Yield (mm)
1	Alor Star	103
2	Ipoh	99
3	Klang	107
4	Kuala Lumpur	116
5	Seremban	98
6	Melaka	100
7	Kluang	115
8	Johor Bahru	128
9	Kota Bharu	95
10	Kuala Terengganu	94
11	Kuantan	111
12	Kuching	156
13	Sibu	144
14	Bintulu	148
15	Kota Kinabalu	109
16	Sandakan	120
17	Tawau	89

Note: AARY was computed from tank size of 1m³ and roof area of 100m²

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TABLE Q3 (a)(ii): Rainwater Demand for Domestic Application

Use (Appliance)	Type	Average Consumption	Average Total Rainwater Demand
A. Indoor			
Toilet	Single Flush	9 litres per flush	120 litres per day
	Dual Flush	6 or 3 litres per flush	40 litres per day
Washing Machine	Twin Tub		40 litres per wash
	(Semi- auto)		
	Front Loading		80 litres per wash
	Top Loading		170 litres per wash
Dishwasher	-		20-50 litres per load
General Cleaning	-	10-20 litres per minute	150 litres per day
B. Outdoor			
Sprinkler or Handheld Hose		10-20 litres per minute	1000 litres per hour
Drip System			4 litres per hour
Hosing Paths/Driveways		20 litres per minute	200 litres per wash
Washing Car with a Running Hose		10-20 litres per minute	100-300 litres per wash

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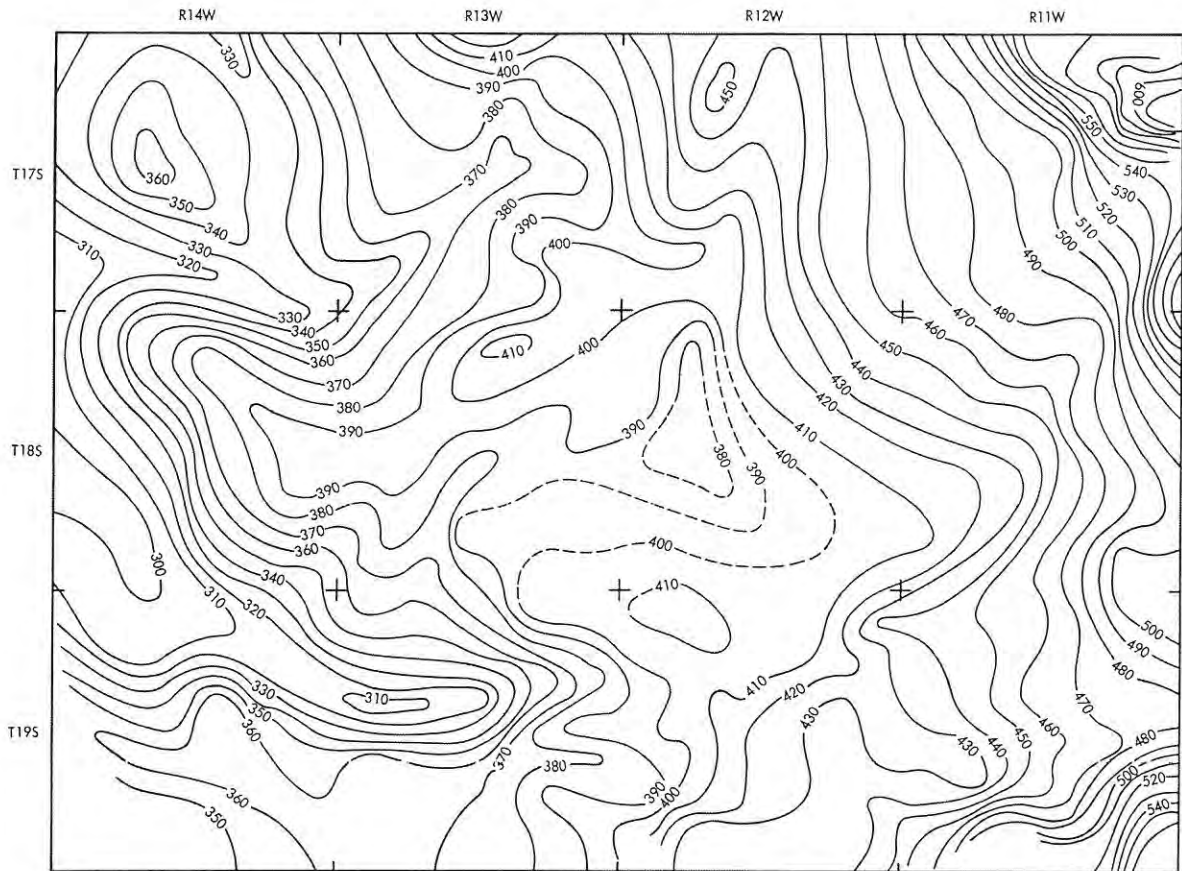


FIGURE Q3 (b): Map location

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TABLE Q4: Map location

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