WATER BALANCE ANALYSIS WORKSHOP SESSION

Calculation of evapotranspiration-absorption/seepage area size by the water balance method.

Using the following information using your Course Notes, calculate the minimum area and depth of an evapotranspiration-absorption/seepage area for a three bedroom / five person dwelling.

Bureau of Meteorology rainfall (Mornington) and pan evaporation (Melbourne Airport) data is provided below.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DAILY PAN EVAPORATION (mm)	8.1	7.0	5.7	3.8	2.5	1.8	2.0	2.7	4.0	5.2	6.0	7.4
MEAN MONTHLY RAINFALL (mm)	44.3	42.6	48.7	62.3	70.0	71.6	68.5	71.1	71.0	68.9	60.8	53.5

Three test pits excavated on the proposed disposal area indicate that the soils are 475 mm weakly structured clay loam overlying moderately structured light clay to a depth of 2,000 mm. Use the recommended design loading rate derived from Table L1 of AS/NZS1547:2012 (see the Field Workshop and Design Exercise section of these Course Notes).

Calculate the evapotranspiration-absorption/seepage area using the worksheets provided on the following two pages.

The evapotranspiration-absorption area is to be constructed of imported aggregate, is to have a maximum depth of 400 mm with a minimum of 50 mm freeboard (i.e. maximum depth of stored effluent is 350 mm).

A blank water balance spreadsheet template and worked example is presented on the following pages.

Calculation of evapotranspiration-absorption area size by water balance method

Size of area for each month

(1) Month	(2) Pan evaporation E mm	(3) Evapo transpiration ET ET = 0.75E mm	(4) Rainfall R mm	(5) Retained rainfall R_r R_r = 0.75R mm	(6) DLR per month mm	(7) Disposal rate per month (3)-(5)+(6) mm	(8) Effluent applied per month L	(9) Size of area (8)/(7) m^2
Jan								
Feb								
Mar								
Apr								
May								
Jun								
Jul								
Aug								
Sep								
Oct								
Nov								
Dec								
First trial area = average monthly area =								m^2

Depth of stored effluent (first trial)

(1) Month	(2) First trial area m^2	(3) Application rate (8)/(2) mm	(4) Disposal rate per month (7) mm	(5) (3) - (4) mm	(6) Increase in depth of stored effluent (5)/n mm	Depth of effluent for month (X - 1) mm	(7) Increase in depth of effluent + (6) mm	Computed depth of effluent month (X) mm
Dec		-	-	-	-	0		
Jan								
Feb								
Mar								
Apr								
May								
Jun								
Jul								
Aug								
Sep								
Oct								
Nov								
Dec								

n = effective void space factor. For imported durable aggregate, n = 0.3

Size of area for each month								
1	2	3	4	5	6	7	8	9
Month	Pan Evaporation	Evapotranspiration	Rainfall	Retained Rainfall	DLR	Disposal Rate	Applied Effluent	Size of area
	E	ET	R	Rr	per month	per month	per month	
		ET = 0.75E		Rr = 0.75R		(3)-(5)+(6)		(8)/(7)
	mm	mm	mm	mm	mm	mm	L	m^2
Jan	251.1	188.3	44.3	33.2	155	310.1	18600	60.0
Feb	196.0	147.0	42.6	32.0	140	255.1	16800	65.9
Mar	176.7	132.5	48.7	36.5	155	251.0	18600	74.1
Apr	114.0	85.5	62.3	46.7	150	188.8	18000	95.4
May	77.5	58.1	70.0	52.5	155	160.6	18600	115.8
Jun	54.0	40.5	71.6	53.7	150	136.8	18000	131.6
Jul	83.7	62.8	68.5	51.4	155	166.4	18600	111.8
Aug	120.0	90.0	71.1	53.3	155	191.7	18600	97.0
Sep	129.0	96.8	71.0	53.3	150	193.5	18000	93.0
Oct	161.2	120.9	68.9	51.7	155	224.2	18600	83.0
Nov	180.0	135.0	60.8	45.6	150	239.4	18000	75.2
Dec	229.4	172.1	53.5	40.1	155	286.9	18600	64.8
First trial area = average monthly area m^2								**89.0**

Depth of stored effluent								
1	2	3	4	5	6		7	
Month	First trial area	Application rate	Disposal Rate		Increase in depth of stored effluent	Depth of effluent for month	Increase in depth of effluent	Computed depth of effluent
			per month		per month		per month	month X
		(8)/2)	(7)	(3)-(4)	(5)/n (void space ratio)	(X - 1)	+ (6)	
	m^2	mm	mm	mm	mm	mm	mm	mm
Jan	98.0	189.8	310.1	-120.3	-401.0	0.0	-401.0	0.0
Feb		171.4	255.1	-83.6	-278.7	0.0	-278.7	0.0
Mar		189.8	251.0	-61.2	-204.0	0.0	-204.0	0.0
Apr		183.7	188.8	-5.1	-17.0	0.0	-17.0	0.0
May		189.8	160.6	29.2	97.2	0.0	97.2	97.2
Jun		183.7	136.8	46.9	156.2	97.2	156.2	253.5
Jul		189.8	166.4	23.4	78.0	253.5	78.0	331.5
Aug		189.8	191.7	-1.9	-6.3	331.5	-6.3	325.2
Sep		183.7	193.5	-9.8	-32.8	325.2	-32.8	292.4
Oct		189.8	224.2	-34.4	-114.8	292.4	-114.8	177.7
Nov		183.7	239.4	-55.7	-185.8	177.7	-185.8	0.0
Dec		189.8	286.9	-97.1	-323.8	0.0	-323.8	0.0

89m^2 maximum depth 655.1mm
95m^2 returns to 0 in December
95m^2 maximum depth 406.8mm
97m^2 maximum depth 351.1mm
98m^2 maximum depth 331.5mm
100m^2 maximum depth 293.9mm