	Calculation Sheet	Job No.	Sheet No.	Rev.
	-SEDIMENT TRAP -Catchment 20 ha	SB1		
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SEDIMENT TRAP DESIGN

1 Sizing a Wet Sediment Trap

Limitation in design

Table 12.15 Rain Fall = 50.00 mm

STAGE 1 - Completing Earthworks

Catchment Area

Total Catchment Area = 20 ha — Soil type :

= **200000** m2 — **Clay/Loam**

Therefore design wet sediment basin.

To provide wet sediment basin with earth embankment and emergency spillway.

Assumptions

Table 12.16 1 Most of the surface soil type is clay/Loam.

Table 12.19 2 Site runoff potential as :

Moderate to high runoff for settling zone volume.

Moderate to high runoff for total volume.

Table 12.17 3 Design Criteria of Sediment Basin for Sediment Control as per Table 12.17

4 The temporary basin design life is 12 to 18 months.

Calculation Sheet

-SEDIMENT TRAP
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1 **Sizing of sediment trap.**

Table 12.16 The predominant soil type is categorised as HSG Type C

Rainfall = 50.00 mm

Table 12.19 **Settling zone volume** = 290 m^3/ha

Total volume = 435 m^3/ha

(a) **Settling Zone Volume & Total Volume**

Wet Sediment Basin Sizing Guidelines,

the nearest magnitud of design storm event in mm = 50.00 mm

Therefore :

Ave. Basin Surface area = **290** m^3/ha x 20.0 ha = **5800** m2 Req. Surface

Total Basin volume = **435** m^3/ha x 20.0 ha = **8700** m3 Req. Volume

Table 12.17 **(a) Settling Zone**

The Required settling zone, V1 = **4350.0** m3 (Half the Total Volume)

Minimum settling zone depth, y_1 = **1.00** m Note: min 0.6m

Try settling zone average width, W_1 = **40.0** m

The settling zone average length, L_1 = V_1 / (W_1 x y_1) = 4350.0 / (40.0 x 1.00) = **108.8** m , say **180** m

Average Surface Area Provided = W_1 x L_1 = **7200** m2 > 5800 → OK!

Check settling zone dimensions,

L_1 / y_1 ratio = 180 / 1.00 = **180** < 200 → OK!

L_1 / W_1 ratio = 180 / 40 = **4.5** > 2.0 → OK!

(b) **Sediment Storage Zone**

The required sediment storage zone volume is Half the total volume, V_2

V_2 = 1/2 x Total Volume = **4350** m^3

For a side slope z = 2 (H) : 1 (V), the dimensions at the top of the sediment storage zone are :

W_2 = W1 - 2 (d1/2)(z) = **60.0** m

L_2 = L1 - 2 (d1/2)(z) = **120.0** m

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The required depth for the sediment storage zone, which must be at least 0.3m, can be calculated from the following relationship :

$$V_2 = Z^2 Y_2^3 - Z Y_2^2 (W_2 + L_2) + Y_2 (W_2 L_2)$$

which gives,

$$4350 = (2)^2 Y_2^3 - (2) Y_2^2 (180.0) + Y_2 (7200.0)$$

$$= 4 Y_2^3 - (360.0) Y_2^2 + Y_2 (7200.0)$$

use trial and error method to find Y_2 ,

For Y_2 = 0.7 m , V_2 = 4865.0 m^3

For Y_2 = 0.64 m , V_2 = 4461.6 m^3

For Y_2 = 0.8 m , V_2 = 5531.6 m^3

Table 12.17

Y_2 = **0.640** > 0.300 m minimum storage zone depth requirement

V_2 = **4461.6** > 4350 m^3 of sediment storage volume → OK!

(c) Overal Basin Dimension

Base :

W_B = $W_1 - 2 \times Z \times [y_1/2 + y_2]$ = 35.44 m say **35** m

L_B = $L_1 - 2 \times Z \times [y_1/2 + y_2]$ = 175.4 m say **175** m

Depth : Settling zone y_1 = **1.00** m

Sediment Storage Zone y_2 = **0.64** m

Side slope , Z = 2.0 (H): 1.0 (V)

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2 SIZING OF BASIN OUTLET

Table 12.17

The emergency spill way must be designed for a 10-yr ARI

The Sill level must be set at minimum 300 mm above the basin top water level.

Assumpption :-

i) Assume riser pipe flow is orifice flow through the top of the pipe only

ii) Riser pipe head is 300mm, i.e the height between the top of the pipe and spillway crest level

$$Q_{Spillway} = Q_{10} - Q_{Riser}$$

A) Determine of Q_{10}

Eqn. 2.2

$$i = \frac{\lambda T^{k}}{(d+\theta)^{\eta}}$$

where;

i = the ave. rainfall (mm/hr) for selected ARI(T) and storm duration

T = ave. recurrence interval, ARI (years)

d = storm duration (hrs) ; $0.20 \leq d \leq 72$

λ, k, ɵ and ŋ = fitting constants dependent on the raingauge location

Appendix 2B
Table 2B

Location & Station ID	ARI, T (years)	Storm Duration , d	Derived Parameters λ	k	ɵ	ŋ
JPS Kemaman Jambatan	10	15	75.8258	0.2385	0.3811	0.7303

As Such;

$$i = \frac{75.8258 \times 10^{0.2385}}{\left(\left(\frac{15}{60}\right) + 0.3811\right)^{0.7303}} = \frac{131.32}{0.71} = 184 \text{ mm/hr}$$

Section 2.3.1
Table 2.5

Rational Method

Coefficient of Runoff, C = 0.5 (Bare Soil)

Catchment Area, A = 20 ha

$$Q_{10} = \frac{C \cdot I \cdot A}{360} = \frac{0.50 \times 184 \times 20}{360} = \mathbf{5.11} \text{ m}^3/\text{s}$$

Calculation Sheet

-SEDIMENT TRAP
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Try with 1 orifice with diameter 1 m at same level. Allow head of 0.3 m from centroid of orifice

Sec. 2.4.1 **B) Determine of Q_{riser}**

Eqn. 2.6 $Q_{Riser} = C_o A_o \sqrt{(2gH_o)}$

$= 0.6 \times \frac{\Pi (1)^2}{4} \times \sqrt{(2 \times 9.81 \times 0.3)}$

$= \mathbf{1.14}\ m^3/s$

C) Determine the size of Spillway

$Q_{required} = Q_{10} - Q_{riser}$

$Q_{required} = 5.11 - 1.14 = \mathbf{3.97}\ m^3/s$

Eqn. 2.6 $Q_{spillway} = C_{sp}\, B\, H_p^{1.5}$

where :

- Q = emergency spillway discharge (m3/sec)
- C_{sp} = spillway discharge coefficient
- B = emergency spillway base width (m)
- H_p = effective head on the spillway crest (m)

Trial spillway dimensions :

- $B = 4.00$ m
- $H_p = 0.90$ m
- $C_{sp} = 1.45$ m

$Q_{spillway} = \mathbf{4.95}\ m^3/sec > Q_{10} = \mathbf{3.97}\ \mathbf{m^3/sec}$ → OK!

D) Trapping Efficiency

From previous calculation, The Sediment Yield = 27.80 tonnes for the design storm.

Design Sediment Trapping Effeciency of 90% = 25.02 tonnes or 15.64 m^3

The Sediment Storage Capacity is = 4461.6 m^3

No. of Storm Events estimated to fill up the Sediment = 286

Assuming the design storm is equivalent to 3-months ARI

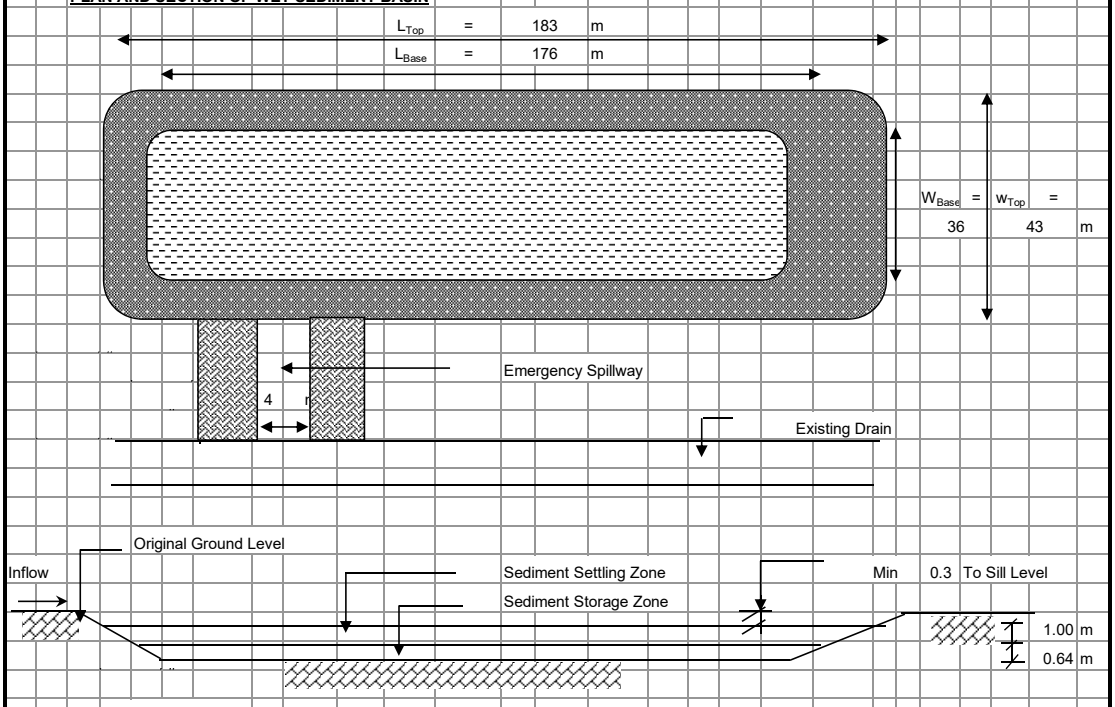
the Storage zone is likely to be filled up in = 286 Years

Calculation Sheet

-SEDIMENT TRAP
-Catchment 20 ha

Job No.		Sheet No.	Rev.
SB1			
Member/Location :			
Drg. Ref.	:		
Job Title :	SEDIMENT BASIN	Made by NAS	Date 13.11.2018 Remark

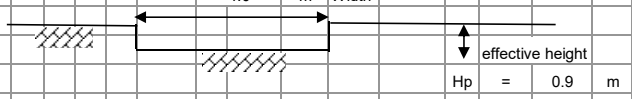
PLAN AND SECTION OF WET SEDIMENT BASIN



Total water depth = 1.64 m

Total Basin Depth = 2.84 m

SECTION OF EMERGENCY SPILLWAY



Hp = 0.9 m

Note:

All sketches shown herein are N.T.S