

DESIGN FOR Abakhil, Village Mahterlam

TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION

B. Hydraulic Calculation for Trapezoidal Section of Canal

Reshaping / Cleaning

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m ²)	(m)	(m)					(m/sec)	(Lit/sec)	(m ³ /sec)
1.00	3.00	0.90	4.80	1.00	3.51	5.55	0.63	0.74	2.59	0.04	0.03	1.22	4267	4.27

$$A = h (b + Z \times h)$$

$$P = b + 2h(n^2 + 1)^{0.5}$$

$$R = A / P$$

$$V = (R^{2/3} \times S^{1/2}) / n$$

$$Q = (A \times R^{2/3} \times S^{1/2}) / n$$

$$Q \text{ (m³/sec)}$$

$$4.270$$

For Economical Section

$$n$$

$$0.025$$

$$\text{Stipulation}$$

$$\text{Calculation}$$

$$\text{Result}$$

$$\text{Slope (m/m)}$$

$$0.0017$$

$$R / (h/2) = 1$$

$$0.97$$

$$OK$$

$$Q \text{ (L/Sec)}$$

$$4267$$

$$FB = (1/3 \times h \text{ to } 15 \text{ or more then that some time})$$

C. Design X-Sections at Different Locations

Table A1

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Start Point Mullah Agha Jan	0+000	0+467	467	0.00170	3.00	0.90	1.30	1.22	4267	4.80
Total Length (m)			467							

Table A2

Table of Roughness Coefficient "n" for Small Channels					
Description		Minimum	Maximum	Recommended	
Unlined Earthen Channels					
1. new- straight and uniform		0.020	0.025	0.025	
2. aged and vegetated with;					
a. Short grass		0.030	0.040	0.035	
b. Long grass		0.050	0.080		
Lined Channels					
1. concrete		0.012	0.018	0.014	
2. brick plastered		0.012	0.018	0.013	
3. brick unplastered		0.016	0.020	0.018	

1/ Source : Engineering Design Standards Soil Conservation Service, USDA.

2/ Source : Irrigation Canal Lining, APO and Water Development Series No.1 1977, Table 9

SUB-PROJECT NAME: Abakhel VILLAGE

SCOUR CALCULATION

Note: Fill the values in yellow highlighted cells

INPUT

Location	Severity factor X	Discharge Q (m3/s)	Bed width B (m)	Flow depth y (m)	Silt factor f
Canal at sraight reach	1.25	4.27	3.00	0.90	2

OUTPUT

Unit discharge q (m2/s)	Scour R	Factored Scour XR	Scour depth Ds	Apron length Lu and Ld
1.42	1.36	1.69	0.79	1.59

Lacey's silt factor

Material	Average d ₅₀ size (mm)	Silt factor f
Very fine SILT	0.05	0.4
Fine SILT	0.12	0.5
Medium SILT	0.15	0.7
Standard SILT	0.32	1
Medium SAND	0.5	1.2
Coarse SAND	0.72	1.5
Fine GRAVEL	1.3	2
Medium GRAVEL	7.3	4.7
Heavy GRAVEL	26	9
Small BOULDERS	50	12
Medium BOULDERS	72	15
Large BOULDERS	185	24

Scour dep X * R - y

X = severity factor

R = scour, in m $1.35 * (q^2/f)^{1/3}$

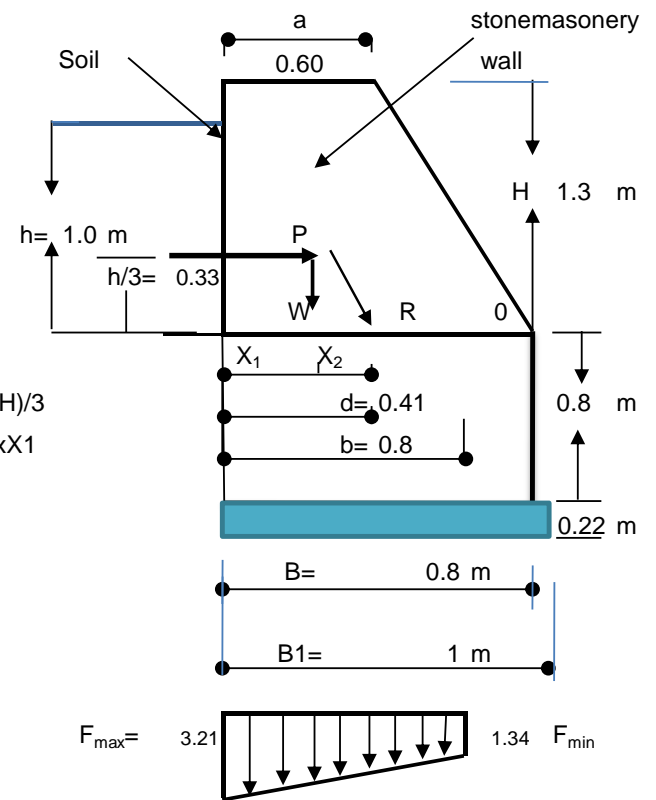
Y = tail wate level, in m

Severity factor

Location	Severity
Upstream of structure	1.25
Downstream of structure	1.5
Nose of spur	2.25
Transition from nose to straight	1.5
Straight reach of guide bank	1.75

Design of Protection wall

Item	Data	Formula	ation	Formula	ation	Result	arks
a=	0.6	$P = (w_s \cdot h^2) / 2 \cdot (1 - \sin \phi) / (1 + \sin \phi)$	0.30	Checking of stability			
b=	0.8			1-against sliding			
h=	1.0			$P < \mu W =$			
W wall=	2000	$W = W_{\text{wall}} \cdot (a+b) / 2 \cdot H$	1.82	P=	0.30		
$\phi =$	30			$\mu \cdot W =$	1.092		
$\sin \phi =$	0.5			$S_f = \mu W / P =$	3.64	>1.5	Ok,
W soil=	1800	$X_1 = (a^2 + ab + b^2) / 3(a+b)$	0.35	2-against over turning			
$1 - \sin \phi =$	0.5			$MP \leq MW$			
$1 + \sin \phi =$	1.5			MP=	0.10	$MP < MW$	$MP = (P \cdot H) / 3$
h2=	1			MW=	0.64		$MW = W \cdot X_1$
$a^2 + ab + b^2 =$	1.480			$S_f = (MW / MP \geq 1.5)$	6.41	>2	Ok,
$3(a+b) =$	4.20	$X_2 = (p \cdot h) / 3w$	0.05	3-against Crushing			
ph=	0.30	$d = x_1 + x_2$	0.41	R be in middle third			
3w=	5.46	$b/3 =$	0.2667	$2b/3 =$	0.53		
$\mu =$	0.6	$b/3 \leq d \leq (2b/3)$		$0.3 < 0.4 < 0.53$		Ok,	
hw=	1.82						
$(a+b)/2 =$	0.7	$e = (x_1 + x_2) - b/2$	0.007	4- against settlement			
b/6	0.133	$e \leq b/6$				Ok,	
B	0.8						
Wstone	1.28	$W_{\text{stone}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		Total w foundation=	1.676	T/M	
Wpcc	0.396	$W_{\text{pcc}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		W pcc=	1800	$\Sigma W = w_{\text{stone}} + W_{\text{pcc}}$	3.496
$\mu \cdot W =$	1.092	$1 + (6 \cdot e) / b =$	1.41	$F_{\text{max}} = W / b (1 + 6e/b)$	3.21		
$6 \cdot e =$	0.330	$1 - (6 \cdot e) / b =$	0.59	$F_{\text{min}} = W / b (1 - 6e/b)$	1.34	Ok,	



DESIGN FOR Mazagal Village Mahterlam TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION

B. Hydraulic Calculation for Trapezoidal Section of Canal

Reshaping / Cleaning

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m ²)	(m)	(m)					(m/sec)	(Lit/sec)	(m ³ /sec)
1.00	3.10	0.90	4.90	1.00	3.60	5.65	0.64	0.74	2.67	0.04	0.03	1.22	4399	4.40

$$A = h (b + Z \times h)$$

$$P = b + 2h(n^2 + 1)^{0.5}$$

$$R = A / P$$

$$V = (R^{2/3} \times S^{1/2}) / n$$

$$Q = (A \times R^{2/3} \times S^{1/2}) / n$$

Q (m³/sec)

4.830

For Economical Section

n

0.025

Stipulation

Calculation

Result

Slope (m/m)

0.0017

R / (h/2) = 1

0.97

OK

Q (L/Sec)

4399

FB = (1/3 * h to 15 or more then that some time)

C. Design X-Sections at Different Locations

Table A1

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Start Point Mazagal	0+000	0+063	63	0.00170	3.10	0.90	1.30	1.22	4399	4.90
Total Length (m)			63							

Table A2

Table of Roughness Coefficient "n" for Small Channels					
Description		Minimum	Maximum	Recommended	
Unlined Earthen Channels					
1. new- straight and uniform		0.020	0.025	0.025	
2. aged and vegetated with;					
a. Short grass		0.030	0.040	0.035	
b. Long grass		0.050	0.080		
Lined Channels					
1. concrete		0.012	0.018	0.014	
2. brick plastered		0.012	0.018	0.013	
3. brick unplastered		0.016	0.020	0.018	
1/ Source : Engineering Design Standards Soil Conservation Service, USDA. 2/ Source : Irrigation Canal Lining, UNDP and Water Development Series No.1 1977, Table 9					

SUB-PROJECT NAME: MazagaI VILLAGE**SCOUR CALCULATION****Note: Fill the values in yellow highlighted cells****INPUT**

Location	Severity factor X	Discharge Q (m ³ /s)	Bed width B (m)	Flow depth y (m)	Silt factor f
Canal at sraight reach	1.25	4.40	3.10	0.90	2

Lacey's silt factor

Material	Average d ₅₀ size (mm)	Silt factor f
Very fine SILT	0.05	0.4
Fine SILT	0.12	0.5
Medium SILT	0.15	0.7
Standard SILT	0.32	1
Medium SAND	0.5	1.2
Coarse SAND	0.72	1.5
Fine GRAVEL	1.3	2
Medium GRAVEL	7.3	4.7
Heavy GRAVEL	26	9
Small BOULDERS	50	12
Medium BOULDERS	72	15
Large BOULDERS	185	24

Severity factor

Location	Severity
Upstream of structure	1.25
Downstream of structure	1.5
Nose of spur	2.25
Transition from nose to straight	1.5
Straight reach of guide bank	1.75

OUTPUT

Unit discharge q (m ² /s)	Scour R	Factored Scour XR	Scour depth Ds	Apron length Lu and Ld
1.42	1.35	1.69	0.79	1.58

Scour dep X * R - y

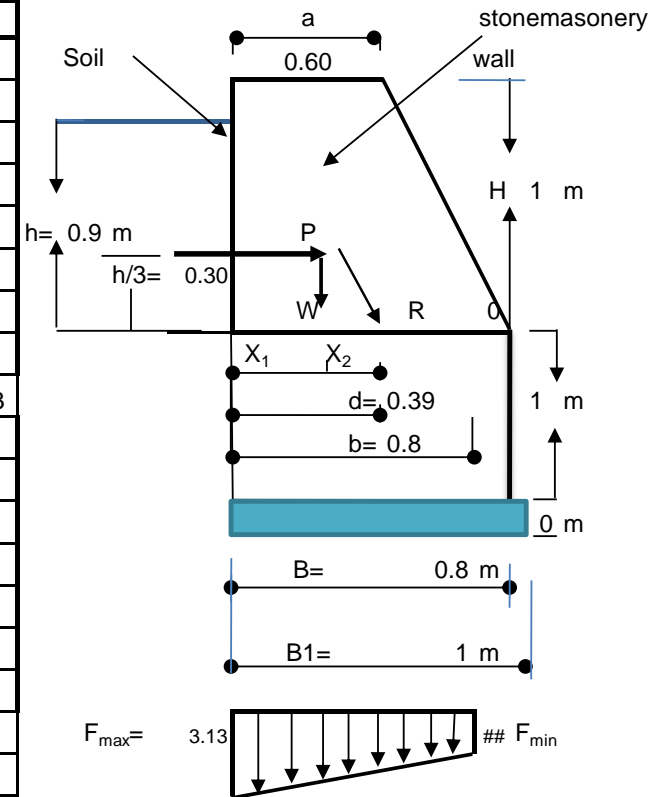
X = severity factor

R = scour, in m $1.35 * (q^2/f)^{1/3}$

Y = tail wate level, in m

Design of Protection wall

Item	Data	Formula	Calcol	Formula	Calcol	Result	Remarks
a=	0.6	$P = (w_s \cdot h^2) / 2 \cdot (1 - \sin\phi) / (1 + \sin\phi)$	0.24	Checking of stability			
b=	0.8			1-against sliding			
h=	0.9			$P < \mu W =$			
W wall=	2000	$W = W_{wall} \cdot (a+b) / 2 \cdot H$	1.96	P=	0.24		
$\phi =$	30			$\mu \cdot W =$	1.176		
$\sin\phi =$	0.5			$Sf = \mu W / P =$	4.84	>1.5 Ok,	
W soil=	1800	$X_1 = (a^2 + ab + b^2) / 3(a+b)$	0.35	2-against over turning			
$1 - \sin\phi =$	0.5			$MP \leq MW$			
$1 + \sin\phi =$	1.5			MP=	0.07	$MP < MW$	$MP = (P \cdot H) / 3$
h2=	0.81			MW=	0.69		$MW = W \cdot x_1$
a2+ab+b2	1.480			$Sf = (MW / MP \geq 1.5)$	9.47	>2 Ok,	
3(a+b)=	4.20	$X_2 = (p \cdot h) / 3w$	0.04	3-against Crushing			
ph=	0.22	$d = x_1 + x_2$	0.39	R be in middlr third			
3w=	5.88	b/3=	0.2667	2b/3 =	0.53		
$\mu =$	0.6	$b/3 \leq d \leq (2b/3)$		$0.3 < 0.4 < 0.53$		Ok,	
hw=	1.764						
(a+b)/2 =	0.7	$e = (x_1 + x_2) - b/2$	-0.010	4- against settlement			
b/6	0.133	$e \leq b/6$				Ok,	
B	0.8						
Wstone	1.28	$W_{stone} = (W_{wall} \cdot B \cdot \text{depth}) / 1000$		Total w foundation=	1.676	T/M	
Wpcc	0.396	$W_{pcc} = (W_{wall} \cdot B \cdot \text{depth}) / 1000$		W pcc=	1800	$\Sigma W = w_{stone}$	3.636
$\mu \cdot W =$	1.176	$1 + (6 \cdot e) / b =$	1.28	$F_{max} = W / b (1 + 6e/b)$	3.13		
$6 \cdot e =$	0.223	$1 - (6 \cdot e) / b =$	0.72	$F_{min} = W / b (1 - 6e/b)$	1.77	Ok,	



DESIGN FOR panj Padar Village Mahterlam

TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION

B. Hydraulic Calculation for Trapezoidal Section of Canal

Reshaping / Cleaning

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m ²)	(m)	(m)					(m/sec)	(Lit/sec)	(m ³ /sec)
1.00	3.40	0.90	5.20	1.00	3.87	5.95	0.65	0.75	2.91	0.04	0.03	1.24	4794	4.79

A =h (b +Z x h)	Q (m3/sec)	4.790	For Economical Section		
P = b + 2h(n ² +1) ^{0.5}	n	0.025	Stipulation	Calculation	Result
R = A / P	Slope (m/m)	0.0017	R / (h/2) = 1	0.97	OK
V = (R ^{2/3} x S ^{1/2})/n	Q (l/Sec)	4794			
Q = (A x R ^{2/3} x S ^{1/2})/n					

FB = (1/3 * h to 15 or more then that some time)

C. Design X-Sections at Different Locations

Table A1

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Start Point panj Padar	0+000	0+204	204	0.00170	3.40	0.90	1.30	1.24	4794	5.20
Total Length (m)			204							

Table A2

Table of Roughness Coefficient "n" for Small Channels					
Description		Minimum	Maximum	Recommanded	
Unlined Earthen Channels					
1. new- straight and uniform		0.020	0.025	0.025	
2. aged and vegetated with;					
a. Short grass		0.030	0.040	0.035	
b. Long grass		0.050	0.080		
Lined Channels					
1. concrete		0.012	0.018	0.014	
2. brick plastered		0.012	0.018	0.013	
3. brick unplastered		0.016	0.020	0.018	

1/ Source : Engineering Design Standards Soil Conservation Service, USDA.

2/ Source : Irrigation Canal Lining, UNDP and Water Development Series No.1 1977, Table 9

SUB-PROJECT NAME: panj Padar VILLAGE

SCOUR CALCULATION

Note: Fill the values in yellow highlighted cells

INPUT

Location	Severity factor X	Discharge Q (m3/s)	Bed width B (m)	Flow depth y (m)	Silt factor f
Canal at sraight reach	1.25	4.79	3.40	0.90	2

Lacey's silt factor

Material	Average d ₅₀ size (mm)	Silt factor f
Very fine SILT	0.05	0.4
Fine SILT	0.12	0.5
Medium SILT	0.15	0.7
Standard SILT	0.32	1
Medium SAND	0.5	1.2
Coarse SAND	0.72	1.5
Fine GRAVEL	1.3	2
Medium GRAVEL	7.3	4.7
Heavy GRAVEL	26	9
Small BOULDERS	50	12
Medium BOULDERS	72	15
Large BOULDERS	185	24

Severity factor

Location	Severity
Upstream of structure	1.25
Downstream of structure	1.5
Nose of spur	2.25
Transition from nose to straight	1.5
Straight reach of guide bank	1.75

OUTPUT

Unit discharge q (m2/s)	Scour R	Factored Scour XR	Scour depth Ds	Apron length Lu and Ld
1.41	1.35	1.68	0.78	1.57

Scour dep X * R - y

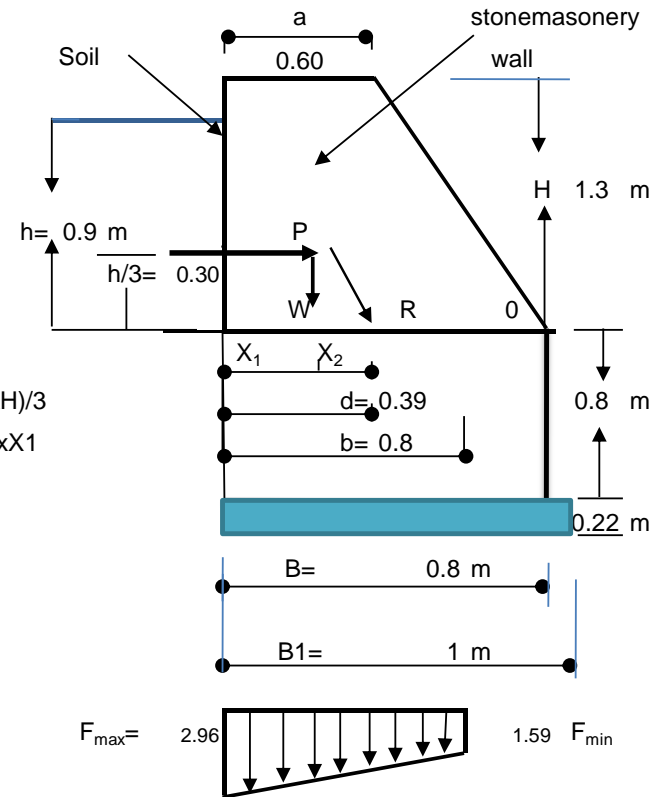
X = severity factor

R = scour, in m $1.35 * (q^2/f)^{1/3}$

Y = tail wate level, in m

Design of Protection wall

Item	Data	Formula	Ratio	Formula	Ratio	Result	Remarks
a=	0.6	$P = (w_s \cdot h^2) / 2 \cdot (1 - \sin\phi) / (1 + \sin\phi)$	0.24	Checking of stability			
b=	0.8			1-against sliding			
h=	0.9			$P < \mu W =$			
W wall=	2000	$W = W_{\text{wall}} \cdot (a+b) / 2 \cdot H$	1.82	$P =$	0.24		
$\phi =$	30			$\mu \cdot W =$	1.092		
$\sin\phi =$	0.5			$S_f = \mu W / P =$	4.49	>1.5	Ok,
W soil=	1800	$X_1 = (a^2 + ab + b^2) / 3(a+b)$	0.35	2-against over turning			
$1 - \sin\phi =$	0.5			$MP \leq MW$			
$1 + \sin\phi =$	1.5			$MP =$	0.07	$MP < MW$	$MP = (P \cdot H) / 3$
h2=	0.81			$MW =$	0.64		$MW = W \cdot X_1$
a2+ab+b	1.480			$S_f = (MW / MP \geq 1.5)$	8.80	>2	Ok,
3(a+b)=	4.20	$X_2 = (p \cdot h) / 3w$	0.04	3-against Crushing			
ph=	0.22	$d = x_1 + x_2$	0.39	R be in middle third			
3w=	5.46	$b/3 =$	0.267	$2b/3 =$	0.53		
$\mu =$	0.6	$b/3 \leq d \leq (2b/3)$		$0.3 < 0.4 < 0.53$		Ok,	
hw=	1.638						
(a+b)/2 =	0.7	$e = (x_1 + x_2) - b/2$	-0.008	4- against settlement			
b/6	0.133	$e \leq b/6$				Ok,	
B	0.8						
Wstone	1.28	$W_{\text{stone}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		Total w foundation=	1.676	T/M	
Wpcc	0.396	$W_{\text{pcc}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		W pcc=	1800	$\Sigma W = w_{\text{stone}} + W_{\text{pcc}}$	3.496
$\mu \cdot W =$	1.092	$1 + (6 \cdot e) / b =$	1.30	$F_{\text{max}} = W / b(1 + 6e/b)$	2.96		
$6 \cdot e =$	0.240	$1 - (6 \cdot e) / b =$	0.70	$F_{\text{min}} = W / b(1 - 6e/b)$	1.59	Ok,	



DESIGN FOR Maidani Village Mahterlam **TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION**

B. Hydraulic Calculation for Trapezoidal Section of Canal

Reshaping / Cleaning

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m ²)	(m)	(m)					(m/sec)	(Lit/sec)	(m ³ /sec)
1.00	3.40	0.90	5.20	1.00	3.87	5.95	0.65	0.75	2.91	0.04	0.03	1.24	4794	4.79

A =h (b +Z x h)	Q (m3/sec)	4.790	For Economical Section		
P = b + 2h(n ² +1) ^{0.5}	n	0.025	Stipulation	Calculation	Result
R = A / P	Slope (m/m)	0.0017	R / (h/2) = 1	0.97	OK
V = (R ^{2/3} x S ^{1/2})/n	Q (l/Sec)	4794			
Q = (A x R ^{2/3} x S ^{1/2})/n					

FB = (1/3 * h to 15 or more then that some time)

C. Design X-Sections at Different Locations

Table A1

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Start Point Maidani	0+000	0+55	55	0.00170	3.40	0.90	1.30	1.24	4794	5.20
Total Length (m)			55							

Table A2

Table of Roughness Coefficient "n" for Small Channels					
Description		Minimum	Maximum	Recommended	
Unlined Earthen Channels					
1. new- straight and uniform		0.020	0.025	0.025	
2. aged and vegetated with;					
a. Short grass		0.030	0.040	0.035	
b. Long grass		0.050	0.080		
Lined Channels					
1. concrete		0.012	0.018	0.014	
2. brick plastered		0.012	0.018	0.013	
3. brick unplastered		0.016	0.020	0.018	
1/ Source : Engineering Design Standards Soil Conservation Service, USDA. 2/ Source : Irrigation Canal Lining, UNDP and Water Development Series No.1 1977, Table 9					

SUB-PROJECT NAME: Maidani VILLAGE

SCOUR CALCULATION

Note: Fill the values in yellow highlighted cells

INPUT

Location	Severity factor X	Discharge Q (m3/s)	Bed width B (m)	Flow depth y (m)	Silt factor f
Canal at sraight reach	1.25	4.79	3.40	0.90	2

Lacey's silt factor

Material	Average d_{50} size (mm)	Silt factor f
Very fine SILT	0.05	0.4
Fine SILT	0.12	0.5
Medium SILT	0.15	0.7
Standard SILT	0.32	1
Medium SAND	0.5	1.2
Coarse SAND	0.72	1.5
Fine GRAVEL	1.3	2
Medium GRAVEL	7.3	4.7
Heavy GRAVEL	26	9
Small BOULDERS	50	12
Medium BOULDERS	72	15
Large BOULDERS	185	24

Severity factor

Location	Severity
Upstream of structure	1.25
Downstream of structure	1.5
Nose of spur	2.25
Transition from nose to straight	1.5
Straight reach of guide bank	1.75

OUTPUT

Unit discharge q (m2/s)	Scour R	Factored Scour XR	Scour depth Ds	Apron length Lu and Ld
1.41	1.35	1.68	0.78	1.57

Scour dep X * R - y

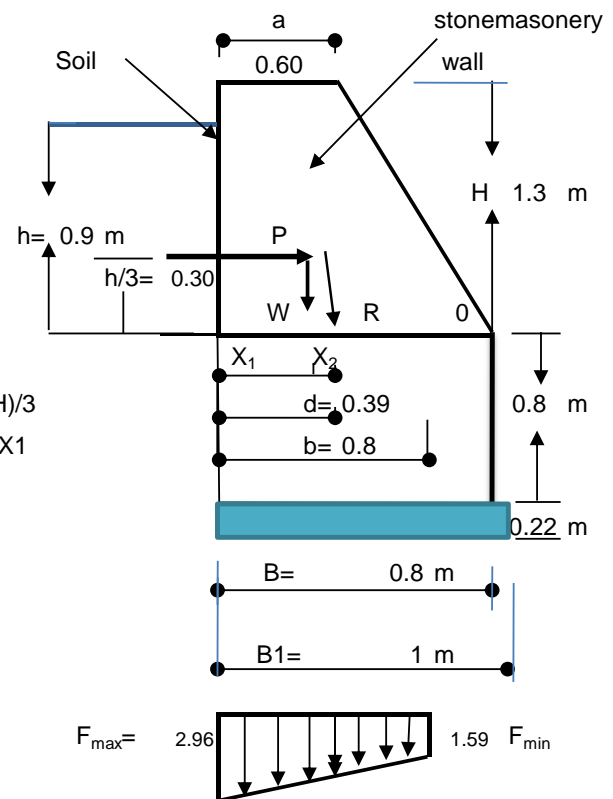
X = severity factor

R = scour, in m $1.35 * (q^2/f)^{1/3}$

Y = tail wate level, in m

Design of Protection wall

Item	Data	Formula	Calco	Formula	Calco	Result	Rema
a=	0.6	$P = (w s \cdot h^2) / 2 \cdot (1 - \sin \phi) / (1 + \sin \phi)$	0.24	Checking of stability			
b=	0.8			1-against sliding			
h=	0.9			$P < \mu W =$			
W wall=	2000	$W = W_{\text{wall}} \cdot (a+b) / 2 \cdot H$	1.82	$P =$	0.24		
$\phi =$	30			$\mu \cdot W =$	1.092		
$\sin \phi =$	0.5			$Sf = \mu W / P =$	4.49	> 1.5	Ok,
W soil=	1800	$X_1 = (a^2 + ab + b^2) / 3(a+b)$	0.35	2-against over turning			
$1 - \sin \phi =$	0.5			$MP \leq MW$			
$1 + \sin \phi =$	1.5			$MP =$	0.07	$MP < MW$	$MP = (P \cdot H) / 3$
h2=	0.81			$MW =$	0.64		$MW = W \cdot X_1$
a2+ab+b2	1.480			$Sf = (MW / MP \geq 1.5)$	8.80	> 2	Ok,
3(a+b)=	4.20	$X_2 = (p \cdot h) / 3w$	0.04	3-against Crushing			
ph=	0.22	$d = x_1 + x_2$	0.39	R be in middlr third			
3w=	5.46	$b/3 =$	0.2667	$2b/3 =$	0.53		
$\mu =$	0.6	$b/3 \leq d \leq (2b/3)$		$0.3 < 0.4 < 0.53$		Ok,	
hw=	1.638						
(a+b)/2 =	0.7	$e = (x_1 + x_2) - b/2$	-0.008	4- against settlement			
b/6	0.133	$e \leq b/6$				Ok,	
B	0.8						
Wstone	1.28	$W_{\text{stone}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		Total w foundation=	1.676	T/M	
Wpcc	0.396	$W_{\text{pcc}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		W pcc=	1800	$\Sigma W = w_{\text{stone}} + W_{\text{pcc}}$	3.496
$\mu \cdot W =$	1.092	$1 + (6 \cdot e) / b =$	1.30	$F_{\text{max}} = W / b (1 + 6e/b)$	2.96		
$6 \cdot e =$	0.240	$1 - (6 \cdot e) / b =$	0.70	$F_{\text{min}} = W / b (1 - 6e/b)$	1.59	Ok,	



DESIGN FOR Dado Mohammad, Harmal Village Mahterlam TRAPEZOIDAL SHAPED WATERCOURSE HYDRAULIC SECTION

B. Hydraulic Calculation for Trapezoidal Section of Canal

Reshaping / Cleaning

Method	b	h	T	Z	A	P	R	$R^{2/3}$	$A \cdot R^{2/3}$	$S^{0.2}$	n	V	Q	Q
Trial	(m)	(m)	(m)		(m ²)	(m)	(m)					(m/sec)	(Lit/sec)	(m ³ /sec)
1.00	3.50	0.80	5.10	1.00	3.44	5.76	0.60	0.71	2.44	0.04	0.03	1.17	4022	4.02

A =h (b +Z x h)	Q (m3/sec)	4.020	For Economical Section		
P = b + 2h(n ² +1) ^{0.5}	n	0.025	Stipulation	Calculation	Result
R = A / P	Slope (m/m)	0.0017	R / (h/2) = 1	0.97	OK
V = (R ^{2/3} x S ^{1/2})/n	Q (l/Sec)	4022			
Q = (A x R ^{2/3} x S ^{1/2})/n					

FB = (1/3 * h to 15 or more then that some time)

C. Design X-Sections at Different Locations

Table A1

Location	From	To	Length (m)	Longitudinal Slope (m/m)	Bottom Width (b) (m)	Flow Depth (h) (m)	Total Depth (D) (m)	Velocity (m/sec)	Discharge (Lit/sec)	Top Width (T) (m)
Start Point Dad Mohammad.	0+000	0+55	55	0.00170	3.50	0.80	1.10	1.17	4022	5.10
Total Length (m)			55							

Table A2

Table of Roughness Coefficient "n" for Small Channels					
Description		Minimum	Maximum	Recommended	
Unlined Earthen Channels					
1. new- straight and uniform		0.020	0.025	0.025	
2. aged and vegetated with;					
a. Short grass		0.030	0.040	0.035	
b. Long grass		0.050	0.080		
Lined Channels					
1. concrete		0.012	0.018	0.014	
2. brick plastered		0.012	0.018	0.013	
3. brick unplastered		0.016	0.020	0.018	
1/ Source : Engineering Design Standards Soil Conservation Service, USDA. 2/ Source : Irrigation Canal Lining, UNDP and Water Development Series No.1 1977, Table 9					

SUB-PROJECT NAME: Dado Mohammad,Harmal VILLAGE

SCOUR CALCULATION

Note: Fill the values in yellow highlighted cells

INPUT

Location	Severity factor X	Discharge Q (m3/s)	Bed width B (m)	Flow depth y (m)	Silt factor f
Canal at sraight reach	1.25	4.02	3.50	0.80	2

OUTPUT

Unit discharge q (m2/s)	Scour R	Factored Scour XR	Scour depth Ds	Apron length Lu and Ld
1.15	1.18	1.47	0.67	1.34

Lacey's silt factor

Material	Average d_{50} size (mm)	Silt factor f
Very fine SILT	0.05	0.4
Fine SILT	0.12	0.5
Medium SILT	0.15	0.7
Standard SILT	0.32	1
Medium SAND	0.5	1.2
Coarse SAND	0.72	1.5
Fine GRAVEL	1.3	2
Medium GRAVEL	7.3	4.7
Heavy GRAVEL	26	9
Small BOULDERS	50	12
Medium BOULDERS	72	15
Large BOULDERS	185	24

Scour dep X * R - y

X = severity factor

R = scour, in m $1.35 * (q^2/f)^{1/3}$

Y = tail wate level, in m

Severity factor

Location	Severity
Upstream of structure	1.25
Downstream of structure	1.5
Nose of spur	2.25
Transition from nose to straight	1.5
Straight reach of guide bank	1.75

Design of Protection wall

Item	Data	Formula	ation	Formula	ation	Result	rks
a=	0.6	$P = (ws \cdot h^2) / 2 \cdot (1 - \sin\phi) / (1 + \sin\phi)$	0.24	Checking of stability			
b=	1			1-against sliding			
h=	0.9			$P < \mu W =$			
W wall=	2000	$W = W_{\text{wall}} \cdot (a+b) / 2 \cdot H$	2.08	P=	0.24		
$\phi =$	30			$\mu \cdot W =$	1.248		
$\sin\phi =$	0.5			$Sf = \mu W / P =$	5.14	>1.5	Ok,
W soil=	1800	$X_1 = (a^2 + ab + b^2) / 3(a+b)$	0.41	2-against over turning			
$1 - \sin\phi =$	0.5			$MP \leq MW$			
$1 + \sin\phi =$	1.5			MP=	0.07	$MP < MW$	$MP = (P \cdot H) / 3$
h2=	0.81			MW=	0.85		$MW = W \cdot X_1$
a2+ab+b2	1.960			$Sf = (MW / MP \geq 1.5)$	11.65	>2	Ok,
3(a+b)=	4.80	$X_2 = (p \cdot h) / 3w$	0.04	3-against Crushing			
ph=	0.22	$d = x_1 + x_2$	0.44	R be in middlr third			
3w=	6.24	$b/3 =$	0.3333	$2b/3 =$	0.67		
$\mu =$	0.6	$b/3 \leq d \leq (2b/3)$		$0.33 < 0.44 < 0.67$		Ok,	
hw=	1.872						
$(a+b)/2 =$	0.8	$e = (x_1 + x_2) - b/2$	-0.057	4- against settlement			
b/6	0.167	$e \leq b/6$				Ok,	
B	1						
Wstone	4.4	$W_{\text{stone}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		Total w foundation=	4.8752	T/M	
Wpcc	0.475	$W_{\text{pcc}} = (W_{\text{wall}} \cdot B \cdot \text{depth}) / 1000$		W pcc=	1800	$\Sigma W = w_{\text{stone}}$	6.955
$\mu \cdot W =$	1.248	$1 + (6 \cdot e) / b =$	1.21	$F_{\text{max}} = W / b(1 + 6e/b)$	2.52		
$6 \cdot e =$	0.210	$1 - (6 \cdot e) / b =$	0.79	$F_{\text{min}} = W / b(1 - 6e/b)$	1.64	Ok,	

