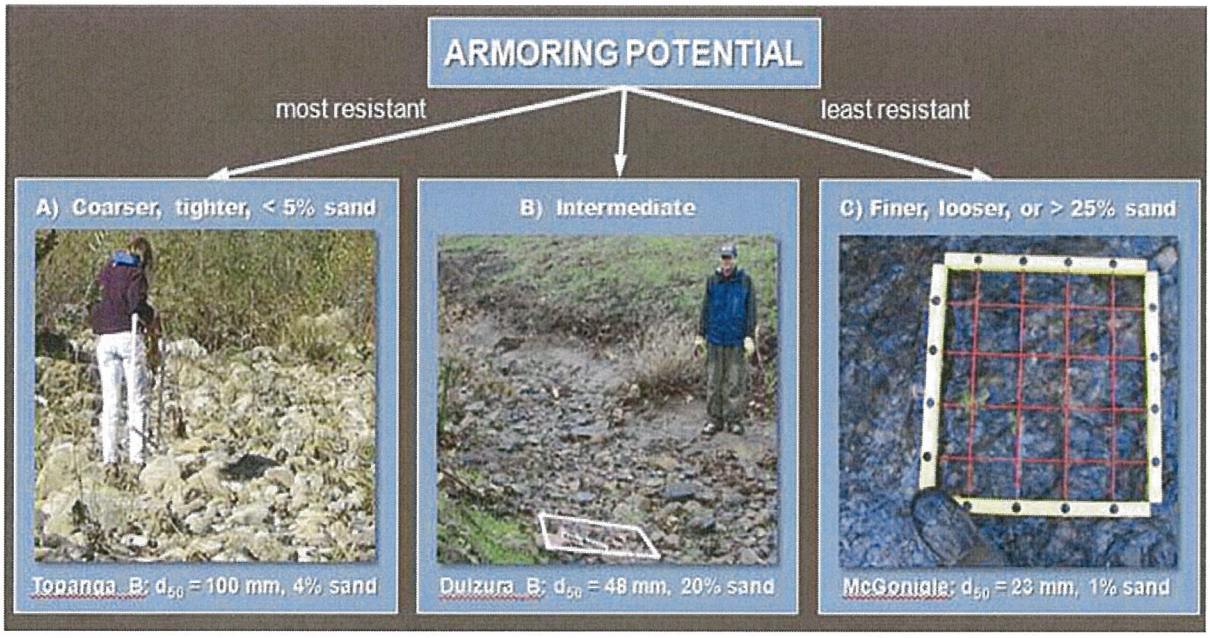
Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☒	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used i**n conjunction with Form 3 Checklist 1.**

REACH 1 THROUGH 4 RESULTS

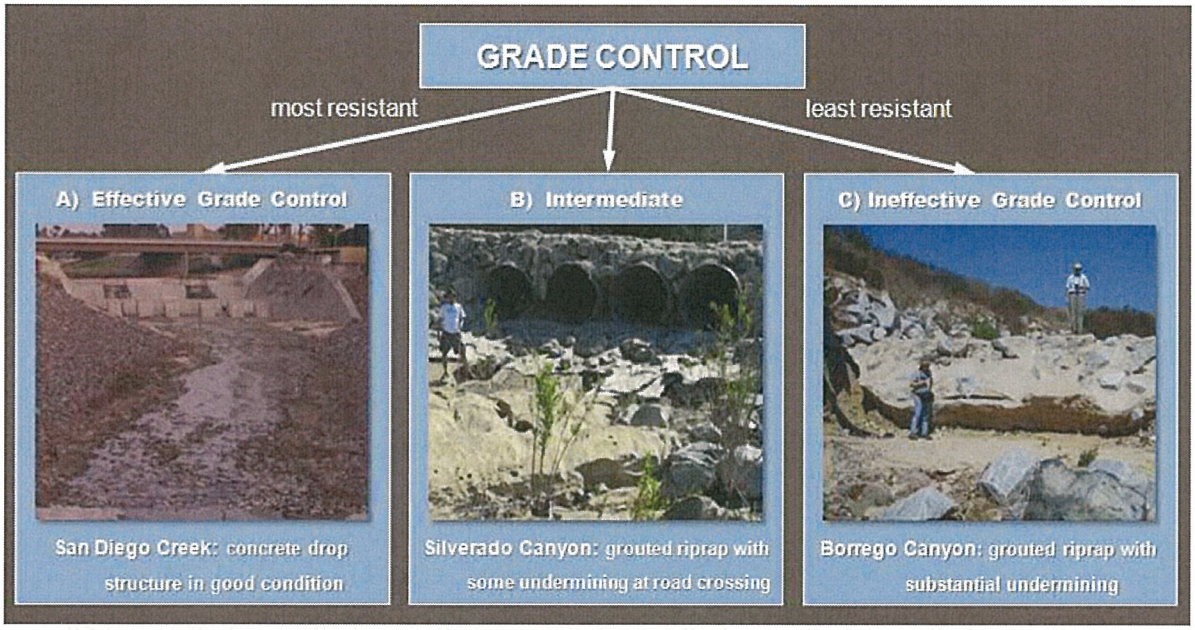
Form 3 Checklist 2: Grade Control

□ A Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

X B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

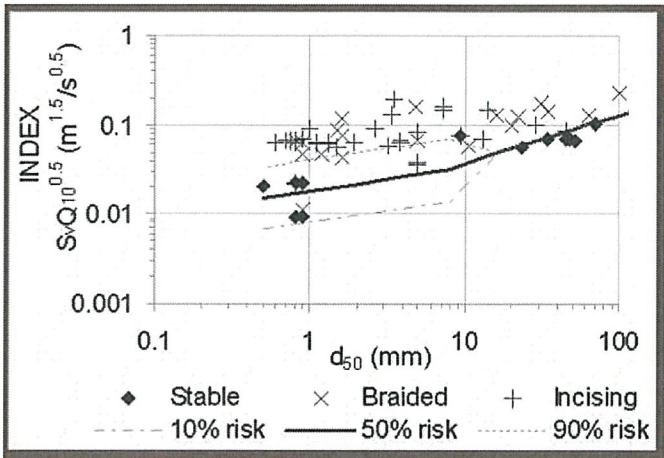
□ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness



Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Model Type	d_{50} (mm)	50% Risk $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)
Logistic Regression $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. $d_{50} < 16$ mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

6 x 6 x 3 = 4.2

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

Pebble Count

#	Reach 1 diameter, mm	Reach 2 diameter, mm
1	2	2
2	2	2
3	2	2
4	2	2
5	2	2
6	2	2
7	2	2
8	2	2
9	2	2
10	2	2
11	2	2
12	2	2
13	2	2
14	2	2
15	2	2
16	2	2
17	2	2
18	2.8	2
19	2.8	2.8
20	2.8	2.8
21	2.8	2.8
22	2.8	2.8
23	2.8	2.8
24	2.8	2.8
25	2.8	2.8
26	2.8	2.8
27	2.8	2.8
28	2.8	2.8
29	2.8	2.8
30	2.8	2.8
31	2.8	2.8
32	4	2.8
33	4	4
34	4	4
35	4	4
36	4	4
37	4	4
38	4	4
39	4	4
40	4	4
41	5.6	5.6

Pebble Count

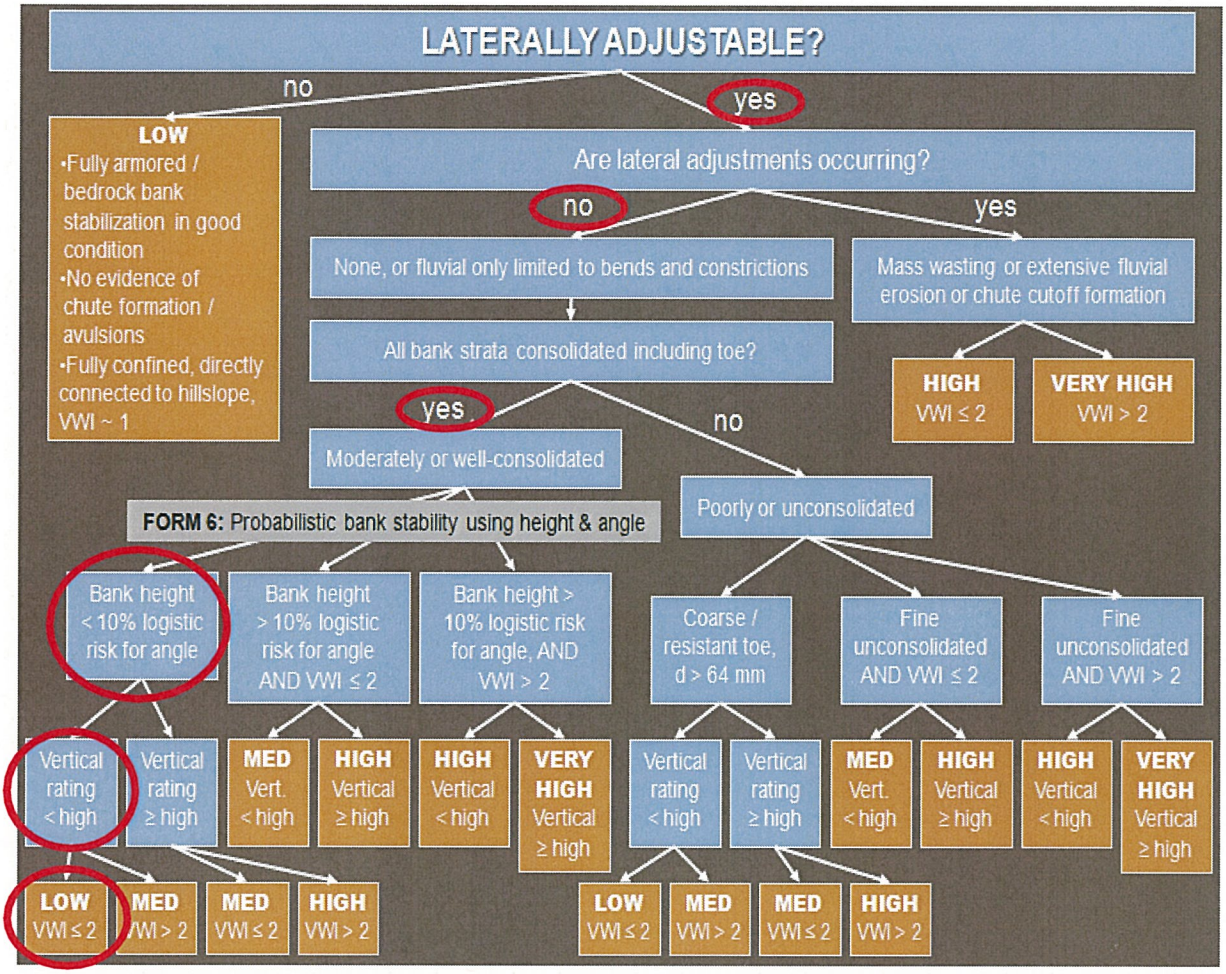
#	Reach 1 diameter, mm	Reach 2 diameter, mm	
42	5.6	5.6	
43	5.6	5.6	
44	5.6	5.6	
45	5.6	5.6	
46	5.6	5.6	
47	5.6	8	
48	8	8	
49	8	8	
50	8	8	D50
51	8	8	
52	8	8	
53	8	8	
54	8	8	
55	8	8	
56	8	8	
57	8	11	
58	8	11	
59	8	11	
60	8	11	
61	11	11	
62	11	11	
63	11	11	
64	11	11	
65	11	11	
66	11	11	
67	11	11	
68	11	11	
69	11	11	
70	11	11	
71	11	16	
72	11	16	
73	16	16	
74	16	16	
75	16	16	
76	16	16	
77	16	16	
78	16	16	
79	16	16	
80	16	16	
81	16	16	
82	16	22.6	

Pebble Count

#	Reach 1 diameter, mm	Reach 2 diameter, mm
83	16	22.6
84	16	22.6
85	22.6	22.6
86	22.6	22.6
87	22.6	22.6
88	22.6	22.6
89	22.6	22.6
90	22.6	22.6
91	32	22.6
92	32	22.6
93	32	32
94	32	32
95	32	32
96	32	32
97	32	32
98	45	32
99	45	45
100	45	45

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



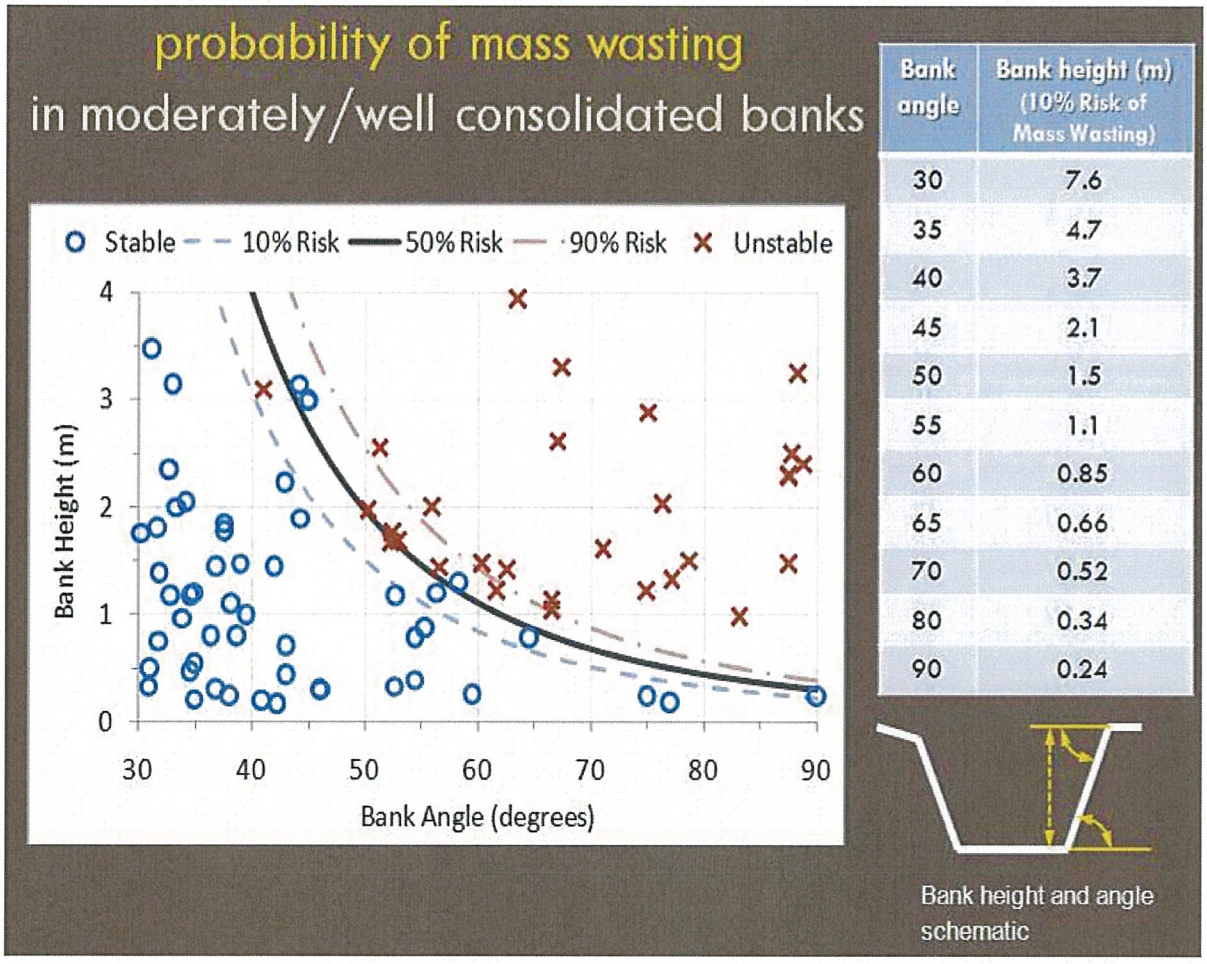
(Sheet 1 of 1)

REACH 1 THROUGH 4 RESULTS

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	Bank Height (m) *(from Field)*	Corresponding Bank Height for 10% Risk of Mass Wasting (m) *(from Form 6 Figure 1 below)*	Bank Failure Risk *(<10% Risk) (>10% Risk)*
Left Bank	<26.6 (2:1)	---	---	<10%
Right Bank	<26.6 (2:1)	---	---	<10%



Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

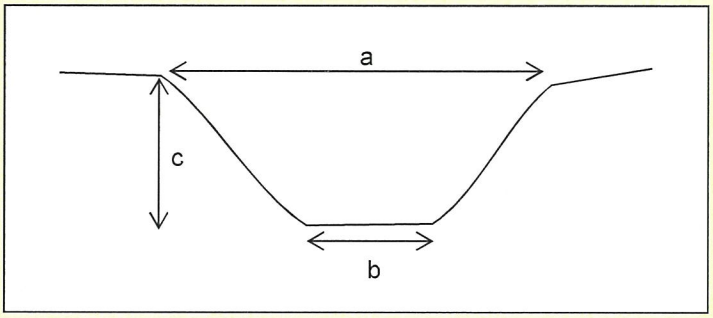
(Sheet 1 of 1)

REACH 1 THROUGH 4 RESULTS

Critical Flow Calculator

Reach 1 Results

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	160
b) Channel width at bed (ft)	43
c) Bank height at top of bank (ft)	1
Channel gradient (ft/ft)	0.0081
Receiving channel roughness	Sluggish reaches, weedy, deep pools n=0.07
Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.	unconsolidated sandy loam 0.035 lb/sq ft alluvial silt (non coloidal) 0.045 lb/sq ft medium gravel 0.12 lb/sq ft alluvial silt/clay 0.26 lb/sq ft 2.5 inch cobble 1.1 lb/sq ft enter own d50 (variable) vegetation (bed and banks) 0.6 lb/sq ft
Select method of calculating Q2	Input own Q2 Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	9.75	Receiving water watershed area at PoC (sq mi)	0.2758
Project watershed annual precipitation (inches)	9.75	Project watershed area draining to PoC (sq mi)	0.2758

Outputs - Flow control range

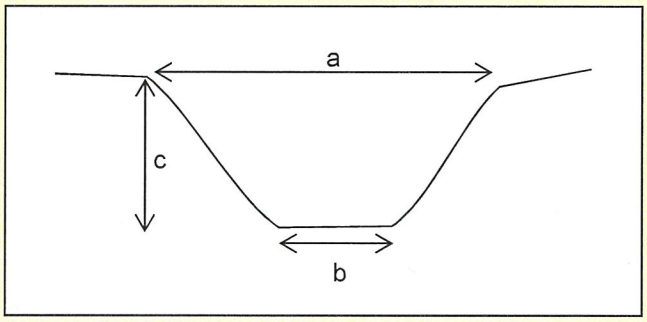
Receiving water Q2	2.2	**Point of Compliance low flow rate (cfs)**	1.1
Project site Q2	2.2	**Low flow class**	0.5Q2
		Channel vulnerability	Low

Critical Flow Calculator

Reach 2 Results

enter all values in green cells
and drop down boxes

Inputs



a) Receiving channel width at top of bank (ft) - see figure on right	300
b) Channel width at bed (ft)	34
c) Bank height at top of bank (ft)	1
Channel gradient (ft/ft)	0.0090
Receiving channel roughness	Sluggish reaches, weedy, deep pools n=0.07

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	9.75	Receiving water watershed area at PoC (sq mi)	0.2898
Project watershed annual precipitation (inches)	9.75	Project watershed area draining to PoC (sq mi)	0.2898

Outputs - Flow control range

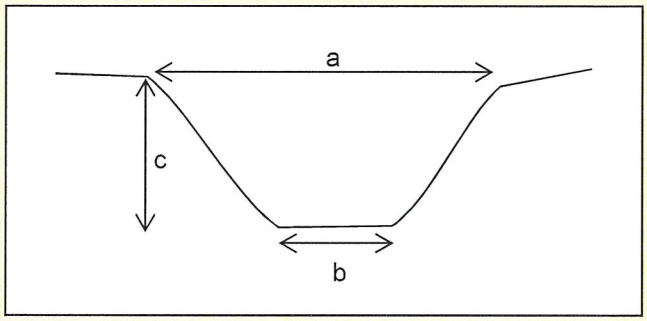
Receiving water Q2	2.3	**Point of Compliance low flow rate (cfs)**	1.1
Project site Q2	2.3	**Low flow class**	0.5Q2
		Channel vulnerability	Low

Critical Flow Calculator

Reach 3 Results

enter all values in green cells
and drop down boxes

Inputs



a) Receiving channel width at top of bank (ft) - see figure on right	21
b) Channel width at bed (ft)	5
c) Bank height at top of bank (ft)	4
Channel gradient (ft/ft)	0.0126
Receiving channel roughness	Same as above, but some weeds and stones n=0.045
Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.	unconsolidated sandy loam 0.035 lb/sq ft alluvial silt (non coloidal) 0.045 lb/sq ft medium gravel 0.12 lb/sq ft alluvial silt/clay 0.26 lb/sq ft 2.5 inch cobble 1.1 lb/sq ft enter own d50 (variable) vegetation (bed and banks) 0.6 lb/sq ft
Select method of calculating Q2	Input own Q2 Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	9.75	Receiving water watershed area at PoC (sq mi)	0.2728
Project watershed annual precipitation (inches)	9.75	Project watershed area draining to PoC (sq mi)	0.2728

Outputs - Flow control range

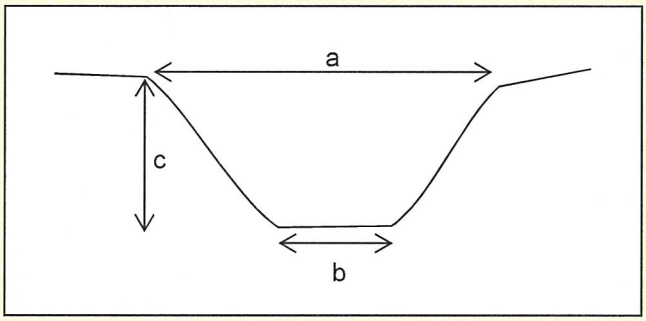
Receiving water Q2	2.2	**Point of Compliance low flow rate (cfs)**	1.1
Project site Q2	2.2	**Low flow class**	0.5Q2
		Channel vulnerability	Low

Critical Flow Calculator

Reach 4 Results

enter all values in green cells
and drop down boxes

Inputs



a) Receiving channel width at top of bank (ft) - see figure on right	60
b) Channel width at bed (ft)	5
c) Bank height at top of bank (ft)	1
Channel gradient (ft/ft)	0.0118
Receiving channel roughness	Same as above, but some weeds and stones n=0.045
Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.	unconsolidated sandy loam 0.035 lb/sq ft alluvial silt (non coloidal) 0.045 lb/sq ft medium gravel 0.12 lb/sq ft alluvial silt/clay 0.26 lb/sq ft 2.5 inch cobble 1.1 lb/sq ft enter own d50 (variable) vegetation (bed and banks) 0.6 lb/sq ft
Select method of calculating Q2	Input own Q2 Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	9.75	Receiving water watershed area at PoC (sq mi)	0.2728
Project watershed annual precipitation (inches)	9.75	Project watershed area draining to PoC (sq mi)	0.2728

Outputs - Flow control range

Receiving water Q2	2.2	**Point of Compliance low flow rate (cfs)**	1.1
Project site Q2	2.2	**Low flow class**	0.5Q2
		Channel vulnerability	Low