List of changes implemented in the latest printing of the Applied River Morphology textbook by Dave Rosgen - 1/15/01.

PAGE #	DESCRIPTION OF CHANGES MADE.
Dedication Page:	Added a comma after “Luna B. Leopold”.
Table of Contents:	Last page; deleted the appendix information and replaced it with an index.
xv	1st paragraph, 3rd line, added a hyphen to “flood-ravaged”.
	2nd paragraph, 3rd line, changed “effected” to “affected”.
xvi	2nd paragraph, 5th and 6th lines, closed up the spacing between words.
xvii	All paragraphs, closed up the spacing between words.
1-4	1st column, 1st paragraph, 6th line, closed up the spacing between words.
1-5	2nd column, 1st paragraph, 2nd line, changed “to include” to “including”.
2-1	1st column, 1st paragraph, 6th line, changed “stream flow” to “streamflow”.
2-3	2nd column, 2nd paragraph, 8th line, added period after “(Nash, 1994)”.
2-4	1st column, 1st paragraph, 36th line, changed “et al ,1964” to read “et al. 1964”.
2-5	2nd column, 3rd paragraph, 3rd line, closed up spacing between words.
2-7	1st column, Changed part of equation to read “$L_m K^{1.5}$”.
2-9	1st column, 3rd paragraph, 3rd line, changed “an example” to “the following example”.
3-8	1st column, 1st 2nd & 3rd bullets, added period at end of each sentence.
4-1	1st column, 7th line, changed “inspires” to “inspire”.
4-5	Stream type Aa+, Slope, changed to “>0.10”.
4-6	1st column, 1st paragraph, 3rd line, changed “Stream flow” to “Streamflow”.
4-13	Montana photograph, changed to read “Wyoming”.
4-15	1st paragraph of both columns, closed up spacing between words.
4-23	1st column, 2nd paragraph, 13th line, closed up spacing between words.
	1st column, 4th paragraph, 6th line, changed “(Valley Slope/Sinuosity).” to read “by dividing valley slope by sinuosity.”.
	2nd column, 1st paragraph, 2nd line, replaced semi-colon with a comma.
4-25	Upper left photo, changed “Montana” to “Wyoming”.
4-29	2nd column, 1st paragraph, 7th line, changed “discreet” to “discrete”.
5-2	1st column, 2nd paragraph, 3rd line, removed hyphen from planform.
	1st column, 3rd paragraph, previous change applied to new issue.
5-5	Replaced entire chart with new chart.
5-6	Replaced entire chart with new chart.
5-9	1st column, 1st paragraph, 2nd column 2nd paragraph, closed up spacing between words.
5-14	1st column, 3rd paragraph, 5th line, changed “indicated with an arrow on the photograph at each stream reach.” to “described for each photograph.”.
5-22	2nd column, 2nd paragraph, previous change applied to new issue.
5-25	1st column, 3rd paragraph, 3rd line, replaced semi-colon with a comma.
5-26	1st column, closed up spacing between words.
5-27	Both columns, closed up spacing between words.
5-42	Replaced chart with chart from page XI of the Appendix.
5-48	1st column, 1st paragraph, previous change applied to new issue.
5-61	Text below illustrations, previous change applied to new issue.
5-65	Text below illustrations, previous change applied to new issue.
5-73	Text below illustrations, previous change applied to new issue.
5-75	Previous change applied to new issue.
5-97	Text below illustrations, Sinuosity, changed to “>1.2”.
5-101	Text below illustrations, Sinuosity, changed to “>1.2”.
5-105	Text below illustrations, Sinuosity, changed to “>1.2”.
5-120	1st column, previous chage applied to new issue.
5-123	Text below illustrations, previous change applied to new issue.
5-124	2nd photo, “Anastamosed” changed to “Anastomosed”.
5-125	All 3 photos, “Anastamosed” changed to “Anastomosed”.
5-138	1st column, 9th line, “E5” changed to “E6”.
5-155	Text below illustrations, Sinuosity, changed to “>1.2”.
5-159	Text below illustrations, previous change applied to new issue.
6-13	1st column, 2nd paragraph, 6th line, changed equasion to read as folows: “$(\omega=\rho g Q s/w)$”.
	1st column, 2nd paragraph, 10th line, changed to read: : “…ρ = water density;…”.

PAGE #	DESCRIPTION OF CHANGES MADE.
6-15	1st column, last paragraph, last line "(P;2,6)" changed to "(P:2,6)". 2nd column, 4th paragraph, changed to read "The photographs in figure 6-9 depict three B3 stream types in North Carolina, California and Arizona for three different flow regimes. Interpretations…".
6-17	Chart, #5 and #6, added period to end of each sentence.
6-18	2nd column, 2nd paragraph, 3rd line, changed "indices" to "index".
6-19	2nd column, 2nd paragraph, added parenthesis to all three dates.
6-23	Lower left photo, changed "Montana" to "Wyoming".
6-31	1st column, 5th paragraph, 3rd line, changed "stream flows" to "streamflows".
6-36	2nd column, 2nd paragraph, changed "correlates Numerical stress indices using velocity gradients ratio…" to "Converts numerical stress indices using velocity gradients and ratio…".
6-37	Photo a, changed "(Montana)" to "(Colorado)".
6-38	Photo a, changed "C4" to "C5".
6-39	2nd column, last paragraph, 5th line, changed "even produced" to "event produced".
6-40	2nd column, 2nd paragraph, 2nd line, changed "density;" to "density"
6-41	See copy of page 6-41 attached.
6-43	Text below illustration, changed "…1989) (Rosgen 1990)" to …1988-1989) (Rosgen, 1993_c)".
6-47	2nd column, 1st paragraph, 11th line, added a comma after "slope".
6-50	Last paragraph, changed semi-colon to a colon and changed "Stability" to "stability".
7-1	1st column, 1st paragraph, 6th line, changed "stream flow" to "streamflow".
7-3	1st column, 2nd paragraph, 1st line, changed "VIII" to "7". 1st column, 3rd paragraph, last 2 lines, changed "…1963; Stall and Fok, 1967; and Marston, 1978." to …(1963), Stall and Fok, (1967), and Marston, (1978).". 2nd column, 2nd paragraph, 9th line, changed "#1" to "number one".
7-6	Figure 7-4a text, changed "Rating Curves" to "rating curves".
7-7	Two right hand charts, switched positions of the words "bedload" and "suspended". 2nd column, 1st paragraph, changed "Rating Curves" to "rating curves".
7-15	2nd column, 2nd paragraph, 2nd line, changed "reds" to "redds".
7-16	1st column, 2nd paragraph, 6th line, changed "Discreet" to "Discrete".
8-3	Chart, last plotted coordinate in bottom right hand corner moved up to line up with .02.
8-4	1st column, Under Shear Stress and Velocity Relationships, changed "density of water," to "specific weight of water,"
8-13	Figure 8-8a text, changed "C4" to "C5".
8-17	2nd column, 4th paragraph, 6th line, changed "Andromous" to "andromous".
8-20	1st column, 2nd paragraph, changed "*Vortex Rock Weh*" to "*Cross-Vane*" 1st column, 2nd paragraph, 16th line, changed "reds" to "redds". 1st column, last sentence, replaced this sentence with "*J-Hook Vane* — This structure is designed to re-direct velocity distribution and high velocity gradient in the near-bank region, stabilize streambanks, dissipate energy in deep, wide and long pools created below the structure ***(Figure 8-23)***. Materials can vary using native boulders, and logs." 1st column, last paragraph, replaced this entire paragraph (including overflow onto column 2) with "Native Material Transplants and Log Vanes — Woody riparian vegetation is transplanted along streambanks for stabilization, shade, detritus, terrestrial insects and over-head cover for fish habitat. Vanes reduce back-eddy erosion for root wads and transplanted vegetation plus instream cover up and downstream of log and/or rock structure ***(Figure 8-27)*** (Rosgen, 1993a).".
8-21	Upper left illustration, current illustration replaced with Cross-Vane illustration. Upper right illustration, current illustration replaced with J-Hook Vane illustration. Figure 8-22 text changed to read "Cross-Vane structure". Figure 8-23 text changed to read "J-Hook Vane". Figure 8-27 text changed to read "Log-Vane bank feature. (Rosgen, 1993a)".
8-25	See copy of page attached.
8-26	See copy of page attached.
8-27	See copy of page attached.
8-28	See copy of page attached.
8-29	See copy of page attached.
8-30	See copy of page attached.
8-32	Text under illustration, previous change applied to new issue.
8-43	2nd column, last paragraph, changed "Applied River Morphology" with "*Applied River Morphology".*
XI	Replaced all the Appendix pages with a Subject Index.

TABLE 6-8. Streambank characteristics used to develop Bank Erosion Hazard Index (BEHI)

Adjective Hazard or risk rating categories		Bank Height/ Bankfull Ht	Root Depth/ Bank Height	Root Bank Height	Bank Angle (Degrees)	Surface Protection %	Totals
Very Low	Value	1.0-1.1	1.0-0.9	100-80	0-20	100-80	
	Index	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	1.0-1.9	5-9.5
Low	Value	1.11-1.19	0.89-0.5	79-55	21-60	79-55	
	Index	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	2.0-3.9	10-19.5
Moderate	Value	1.2-1.5	0.49-0.3	54-30	61-80	54-30	
	Index	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	4.0-5.9	20-29.5
High	Value	1.6-2.0	0.29-0.15	29-15	81-90	29-15	
	Index	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	6.0-7.9	30-39.5
Very High	Value	2.1-2.8	0.14-0.05	14-5.0	91-119	14-10	
	Index	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	8.0-9.0	40-45
Extreme	Value	>2.8	<0.05	<5	<119	<10	
	Index	10	10	10	10	10	46-50

For adjustments in points for specific nature of bank materials and stratification, the following is used:
Bank Materials: Bedrock (very low), Boulders (low), cobble (subtract 10 points unless gravel/sand > 50%, then no adjustment), gravel (add 5-10 points depending on % sand), sand (add 10 points), silt/clay (no adjustment).
Stratification: Add 5-10 points depending on the number and position of layers.

TABLE 6-9. Velocity gradient and near-bank stress indices

Bank Erosian Risk Rating	Velocity Gradient*	Near-Bank Stress/ Shear Stress**
Very Low	Less than 0.5	Less than 0.8
Low	0.5-1.0	0.8-1.05
Moderate	1.1-1.6	1.06-1.14
High	1.61-2.0	1.15-1.19
Very High	2.1-2.4	1.20-1.60
Extreme	greater than 2.4	greater than 1.60

* Velocity gradient in ft/sec/ft is the difference in velocity from the core of the velocity isovel along the orthogonal length to the near-bank region in feet.

** Near-bank shear stress/mean shear stress
where shear stress = (mean depth) (slope) (specific weight of water)

Submerged Shelter			Gravel Traps					Native Material Vegetation		
Meander	Straight	Migration Barrier	"V" Shaped	Log Sill	Spawning Gravel Placement	Cross Vane	"W" Weir	Bank Placed Root Wads	J-Hook, Log & Rock Vanes	Stream Type
N/A	N/A	EXC	N/A	N/A	POOR	N/A	N/A	N/A	N/A	A1
N/A	N/A	EXC	N/A	N/A	POOR	N/A	N/A	N/A	N/A	A2
POOR	POOR	FAIR	POOR	POOR	POOR	FAIR	POOR	GOOD	POOR	A3
POOR	POOR	FAIR	POOR	POOR	POOR	FAIR	POOR	GOOD	POOR	A4
POOR	POOR	POOR	POOR	POOR	POOR	FAIR	POOR	GOOD	POOR	A5
POOR	POOR	FAIR	POOR	POOR	POOR	FAIR	POOR	GOOD	POOR	A6
GOOD	EXC	GOOD	GOOD	GOOD	FAIR	GOOD	GOOD	N/A	N/A	B1
N/A	N/A	GOOD	EXC	EXC	FAIR	N/A	N/A	N/A	N/A	B2
GOOD	EXC	GOOD	GOOD	GOOD	GOOD	EXC	EXC	EXC	EXC	B3
GOOD	EXC	GOOD	N/A	N/A	N/A	EXC	EXC	EXC	EXC	B4
GOOD	EXC	FAIR	POOR	POOR	POOR	GOOD	EXC	EXC	GOOD	B5
GOOD	EXC	FAIR	POOR	POOR	POOR	GOOD	GOOD	EXC	EXC	B6
EXC	EXC	POOR	GOOD	FAIR	FAIR	GOOD	GOOD	EXC	GOOD	C1
N/A	N/A	POOR	GOOD	GOOD	GOOD	N/A	N/A	EXC	GOOD	C2
EXC	EXC	POOR	GOOD	GOOD	GOOD	EXC	EXC	EXC	EXC	C3
FAIR	GOOD	POOR	N/A	N/A	N/A	EXC	GOOD	EXC	EXC	C4
FAIR	GOOD	POOR	POOR	POOR	POOR	GOOD	FAIR	EXC	GOOD	C5
FAIR	GOOD	POOR	POOR	POOR	POOR	GOOD	GOOD	EXC	GOOD	C6
POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	FAIR	FAIR	D3
POOR	POOR	POOR	N/A	N/A	N/A	POOR	POOR	FAIR	FAIR	D4
POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	FAIR	FAIR	D5
POOR	POOR	POOR	POOR	POOR	POOR	POOR	POOR	FAIR	FAIR	D6
GOOD	GOOD	POOR	FAIR	FAIR	FAIR	GOOD	N/A	GOOD	GOOD	E3
GOOD	GOOD	POOR	N/A	N/A	N/A	GOOD	N/A	GOOD	GOOD	E4
GOOD	GOOD	POOR	POOR	POOR	POOR	GOOD	N/A	GOOD	GOOD	E5
GOOD	GOOD	POOR	POOR	POOR	POOR	GOOD	N/A	GOOD	GOOD	E6
GOOD	GOOD	POOR	POOR	POOR	POOR	N/A	N/A	N/A	N/A	F1
N/A	N/A	POOR	FAIR	FAIR	FAIR	N/A	N/A	N/A	N/A	F2
GOOD	GOOD	POOR	FAIR	FAIR	FAIR	GOOD	FAIR	GOOD	GOOD	F3
GOOD	GOOD	POOR	N/A	N/A	N/A	GOOD	FAIR	GOOD	GOOD	F4
GOOD	GOOD	POOR	POOR	POOR	POOR	GOOD	FAIR	GOOD	GOOD	F5
GOOD	GOOD	POOR	POOR	POOR	POOR	GOOD	FAIR	GOOD	GOOD	F6
FAIR	FAIR	GOOD	N/A	N/A	POOR	N/A	N/A	N/A	N/A	G1
N/A	N/A	GOOD	N/A	N/A	POOR	N/A	N/A	N/A	N/A	G2
FAIR	FAIR	POOR	POOR	POOR	POOR	GOOD	POOR	GOOD	FAIR	G3
FAIR	FAIR	POOR	POOR	POOR	POOR	GOOD	POOR	GOOD	FAIR	G4
FAIR	FAIR	POOR	POOR	POOR	POOR	GOOD	POOR	GOOD	FAIR	G5
FAIR	FAIR	POOR	POOR	POOR	POOR	GOOD	POOR	GOOD	FAIR	G6

STREAM TYPES:
A1 → A6 **Typically no fish habitat structures are installed in these stream types**
DA4 → Da6

TABLE 8-2b. Fish habitat improvement structures - suitability to stream types. (cont.)

LOW STAGE CHECK DAM			MEDIUM STAGE CHECK DAMS		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc	B2,B3,B4	No limitations	Exc	B2	No limitations
Good	B5,B6 C2,C3	Bank erosion due to lateral migration will occur unless bank stabilization is utilized	Good	B3, B4	Stage increase will result in floodplain encroachment. Limit dam height to less than 75% of bankfull stage and select sites with high stable banks
Fair	A3-A6 C4-C6 F2-F6 G3-G6	Low dams must be constructed in conjunction with bank stabilization in these channel types. Use in conjunction with confinement measures and bank stabilization to reduce lateral migration	Fair	A6, B5, B6, C2, C3	Banks must be adequately protected both up and downstream of structure
Poor	B1,C1	Bedrock streambed limits the development of pools	Poor	A3-A5 C4-C6 D3-D6 F2-F6 G3-G6	Increased stream aggradation accelerated bank erosion, slope rejuvenation and floodplain encroachment can result. Extensive bank stabilization measures must accompany installation. Exceptions are on headwater streams in ephemeral channels to stop gully headcuts, which rate fair.
	D3-D6	High width/depth ratio and high sediment yields makes ineffective. Increases bank erosion.		B1, C1, F1	Bedrock streambed limits pool scour depth, anchoring difficult.
N/A	A1,A2,F1E3-E6 F1,G1,G2	Pools not limiting in these stream types	N/A	A1,A2,G1,G3 E3-E6	Pools not limiting factor in these channel types. These stream types provide excellent fish habitat and generally do not require modification.

RANDOM BOULDER PLACEMENT			BANK PLACED BOULDER		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc	B3,B4	No limitations	Exc	B1,B3 B6 C1,C3	No limitations
Good	C3	Lower gradient provides more opportunity for bar development up and downstream of rock - unless placed on meander points (See Bank placed rock). Use in conjunction with deflectors to increase velocity sufficient to create pools	Good	A3-A6 C4-C6 E3-E6 F1,F3 F6 G3-G6	Boulders must be keyed into the bank.
Fair	B5,B6	Potential bar deposition and lateral migration can be offset by stabilizing the banks and by strategic placement.	Fair	D3-D6	Difficult to locate thalweg channel and where the banks will be inundated from one year to another
	F3	Due to bed armor and flatter gradients, it is advantageous to create deep pools with a combination of deflectors, boulders and/or rock clusters	Poor		
Poor	B1,C1,F1, G1 A3-A6 C4-C6 D3-D6 E3-E6 F4,F5,F6 G3-G6	Bedrock limits bed scour, difficult to stabilize in place with high flows. The high sediment supply and highly unstable banks limit the effectiveness of boulders placed in the channel (other than along banks). Bar deposition up and downstream of boulder and excessive bank erosion often occur. Deflectors can reduce sediment deposition, but stress banks.	N/A	B2,C2,F2,G1 G2, A1,A2	Bank rock and streamside boulders naturally occur and banks are naturally stable. Cover and pools not limiting in this channel type
N/A	A1,A2, B2,C2 F2,G2	Large boulder and/or pools are not a limiting factor in these channel types			

TABLE 8-3a. Limitations and discussions of various fish habitat improvement structures by stream types.

SINGLE WING DEFLECTOR			DOUBLE WING DEFLECTOR		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	B2-B4	No limitations.	Exc.	B2-B4	No limitations.
Good	B5,B6 C2,C3,F3	May need bank stabilization.	Good	B5,B6 C2,C3,F3	May need bank stabilization in conjunction with double deflector.
Fair	C4,D3 D6 F1,F2, F4-F6	Must be done with corresponding bank protection. Extensive construction may be needed to gain stabilization of the channel.	Fair	A3-A6 C4,D3 D6 E3-E6, G3-G6,F2, F4-F6	Need bank stabilization. Extensive construction may be needed to gain stabilization.
Poor	A3-A6 C5,C6 E3-E6 G3-G6 C1,B1	Channel instability and high sediment supply reduces effectiveness. Increases W/D ratio. Increase bank erosion. Bedrock bed limits effectiveness.	Poor	C5,C6 F1,C1,B1	Channel instability and high sediment supply reduces effectiveness. Bedrock bed limits effectiveness.
N/A	A1,A2 G1,G2	Pools not a limiting factor.	N/A	A1,A2 G1,G2	Pools not a limiting factor.

CHANNEL CONSTRICTOR			BANK COVER		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	B2-B4	No limitations.	Exc.	B1-B6 C1	No limitations.
Good	B5,B6,C2, C3		Good	C2-C4,C6	Locate on mid-lower 1/3 of outside bank only.
Fair	C4,C6 F2-F6 D3-D6	Need bank protection downstream from constrictor. Need to reshape channel to W/D ratio less than 40 to use - high bedload	Fair	C5,F1-F6	Lateral migration may result in undermining the structure.
Poor	C5 C1,F1,B1	Bank and bed instability and high sediment supply limits effectiveness. Bedrock bed limits effectiveness.	Poor	A3-A6 G1-G6 D3-D6	Channel instability limits effectiveness. Structure loss common. Change in annual thalweg position makes these structures impractical.
N/A	E3-E6 G1-G6 A1-A6	Not limiting due to existing low width/depth ratios.	N/A	E3-E6 A1,A2	Good cover generally available within these channel types - low W/D ratio promotes good bank cover.

TABLE 8-3a. Limitations and discussions of various fish habitat improvement structures by stream types. (Cont.)

HALF LOG COVER			FLOATING LOG COVER		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	B3,B4,B6 C1	No limitations.	Exc.	B3-B6 C1	No limitations.
Good	B1,B5,C3	Will have to use anchoring techniques compatible with substrate.	Good	B1,C3 C6	Overlapping logs reduces bank erosion.
Fair	A6,C4,C6 F1-F6 G1,G2	Increased sedimentation may cause bar formation which results in decreased channel capacity and increased bank erosion. Key is the use low deflectors in conjunction with half log structures.	Fair	F1,F3-F6 A3-A6, G1, G3-G6	Undercutting will cause undermining of the anchor and eventual loss of the structure. Take extra precautions to protect banks.
			Poor	D3-D6	Shifting active channel makes this structure infeasible.
Poor	A3-A5 C5,D3-D6 G3-G6	Extremely unstable bed conditions - degrading and aggrading reaches which limit the effectiveness of this structure.			
			N/A	A1 E3-E6,A2, B2,C2,F2,G2	Steep, bedrock, high velocity. These stream types provide excellent fish habitat and generally do not require modification.
N/A	C2,B2 E3-E6 A1-A2	Cover generally not limiting in these stream types.			

SUBMERGED SHELTERS LOCATED ON MEANDERS			SUBMERGED SHELTERS LOCATED ON STRAIGHT REACHES		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	C1,C3	No limitations.	Exc.	B1,B3-B6 C1,C3	No limitations.
Good	B1,B3-B6 E3-E6 F1,F3-F6	Because structures are located on meanders (high velocity areas of the channel), these channel types may be subject to some bank erosion.	Good	C4-C6 E3-E6 F1, F3-F6	Submerged shelters can be placed on straight reaches in these channel types.
Fair	C4-C6	Need bank stability measures on opposite bank to prevent accelerate bank erosion and lateral migration. Done in conjunction with bank stabilization, this structure can deepen and narrow C1, C4, C5, and C6 channels in particular.	Fair	G3-G6	High bedload transport and high stream power/high sediment supply and channel instability limits effectiveness.
			Poor	D3-D6	Shifting active and thalweg channel makes this structure ineffective.
	G3-G6	Unstable channel, high sediment supply, and bank erosion.		A3-A6	Steep gradient makes difficult to stabilize, structure loss common.
Poor	D3-D6	Shifting active and thalweg channel makes this structure ineffective.			
	A3-A6	Very high sediment supply, Highly unstable channel	N/A	A1,A2,C2,B2, F2,G2,G1,G2	Cover naturally available.
N/A	A1, A2 B2,C2,F2, G1,G2	Cover naturally available.			

TABLE 8-3c. Limitations and discussions of various fish habitat improvement structures by stream types. (Cont.)

V-SHAPED GRAVEL TRAP*			LOG SILL GRAVEL TRAPS		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	B2	No limitations.	Exc.	B2	No limitations.
Good	B1,B3, C1-C3		Good	B1,B3, C2,C3	
Fair	E3, F2,F3	Higher sediment yields make invasion of fines possible. Use with pervious trap so intra-gravel flow rate is maintained.	Fair	C1,F2,F3,E3	Frequent bed scour or bank erosion may inundate gravel with fines.
			Poor	B5,B6,C5,C6, D3,D5,D6,F1	High transport of fine sediments. gravel size bedload unavailable.
Poor	G3-G6	Entrench. and low w/d struct. unstable		F5,F6,E5,E6,	Unstable bed and banks, hi. bedload,
	B5,B6, C5,C6, D3,D5,D6, E5,E6,F1, F5,F6,	Unstable bank and bed with high sediment supply limits effectiveness and/or no source for suitable spawning gravel.		A3-A6 G3-G6	Channel too steep and/or unstable for structures.
	A3-A6	Stream too steep and/or unstable	N/A	B4,C4,E4,F4, D4 A1,A2, G1,G2	Gravel bed stream types that have spawning potential. Not associated with spawning habitat
N/A	B4,C4,E4, F4, A1,A2, G1,G2	Stream types that have gravel sizes for spawning potential. Not associated with spawning habitat			
*Note: Downcutting often occurs at the apex which can undermine the structure.					

GRAVEL PLACEMENT			MIGRATION BARRIER		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.		No limitations.	Exc.	A1,A2	No limitations.
Good	B3,C2,C3	Must select lower velocity areas within the reach - transition zones between pool and riffle.	Good	B1-B4 G1,G2	Proper site selection must be made within the reach where banks are high and stable.
Fair	B1,B2,C1 E3,F2 F3	May not be effective considering the limited area where critical shear velocities would not be exceeded. Can cause capacity reduction and increase bank erosion. Treat smaller percentage of the channel area and/or stabilize banks. Potential for fine sediment invasion with minimal disturbance due to frequent bed shifts.	Fair	A3-A6 B5,B6	Erodible banks and moderate confinement limit barrier placement.
			Poor	C1-C6 D3-D6 E3-E6 F1-F6 G3-G6	Bank and bed instability can result in structure failure. Low banks - cannot create adequate height for falls.
			N/A		
Poor	B5,B6,C5, C6,D3,D5, D6,F5,F6 E5,E6,F1, A1-A6 G1-G6	Will fill in with finer bed load transported material. Channel too steep, deeply incised and/or unstable for spawning channel.			
N/A	B4,C4,D4, E4,F4	Gravel bed stream type.			

TABLE 8-3d. Limitations and discussions of various fish habitat improvement structures by stream types. (Cont.)

CROSS-VANE STRUCTURE			"W" WEIRS		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	B3,B4, C3,C4	No limitations	Exc.	B3,B4,B5 C3	No limitations
Good	B1,B5,B6, C1,C5,C6, E3-E6, F4-F6, G3-G6	Minor limitations, need bank vegetation to optimize habitat. Use on E types when starting to incise-bank height ratio >1.0.	Good	B1,B6, C1,C4,C6	Minor limitations
			Fair	F3-F6	High width/depth ratio along with erodible banks limits effectiveness.
				C5	Deposition of sand bedload occurs in backwater.
Fair	A3-A6	Steep banks need cut-off trench, difficult to install, debris flows add high risk-need extra footers/larger rock	Poor	A3-A6 G3-G5	Low width/depth ratio, unstable, channel makes this structure inappropriate.
Poor	D3-D6	High width/depth ratio makes structure impractical.		D3-D6	Braided pattern not conducive for this structure.
N/A	A1,A2, B2,C2. F1,F2, G1,G2	Cross-vane structure not required for Bedrock and boulder channels.		A1,B1,C1, F1,G1,	Bedrock bed could not stabilize boulders, nor scour to make deep pools or holding water.
			N/A	B2,C2, F2,G2 E3-E6	These stream types provide excellent fish habitat and generally do not require modification.

ROOT WADS/VEGETATION TRANSPLANTS			J-HOOK VANES, ROCK AND LOG VANES		
Rating	**Channel Types**	**Limitation/Discussion**	**Rating**	**Channel Types**	**Limitation/Discussion**
Exc.	B3-B6 C1-C6	No limitations	Exc.	B3,B4,B6, C3,C4	No limitations
Good	A3-A6 F3-F6 G3-G6 E3-E6	Need to use extensive re-vegetation above bankfull on entrenched stream types. Use log vane to stop back eddy bank erosion.	Good	B5, C1,C2,C5,C6, E3-E6, F3-F6	Need woody vegetation for optimum function. Need extra footers for rock vanes in sand.
Fair	D3-D6	Need to decrease W/D ratio to improve depth of flow in near bank region.	Fair	G3-G6 D3-D6	Steep banks make vanes difficult to install, need extensive transplants and cut-off trench. Braided channels need to reduce high width/depth ratio to be effective.
Poor					
N/A	A1,A2 B1,B2 F1,F2 G1,G2	Bedrock/boulder banks do not require stabilization.	Poor	A3-A6	Steep banks make difficult to install, entrenched, high bedload, rejuvenated slopes, debris torrents/flows create high risk.
			N/A	A1,A2 B1,B2 F1,F2 G1,G2	Bedrock/boulder channels would not generally require this structure. Pools and cover are normally not limiting habitat components in these stream types.

TABLE 8-3e. Limitations and discussions of various fish habitat improvement structures by stream types.

This procedure is designed to evaluate the suitability of a wide range of fishery enhancement structures for various stream types. These guidelines are intended for application in planning and designing enhancement structures over a wide variety of streams.