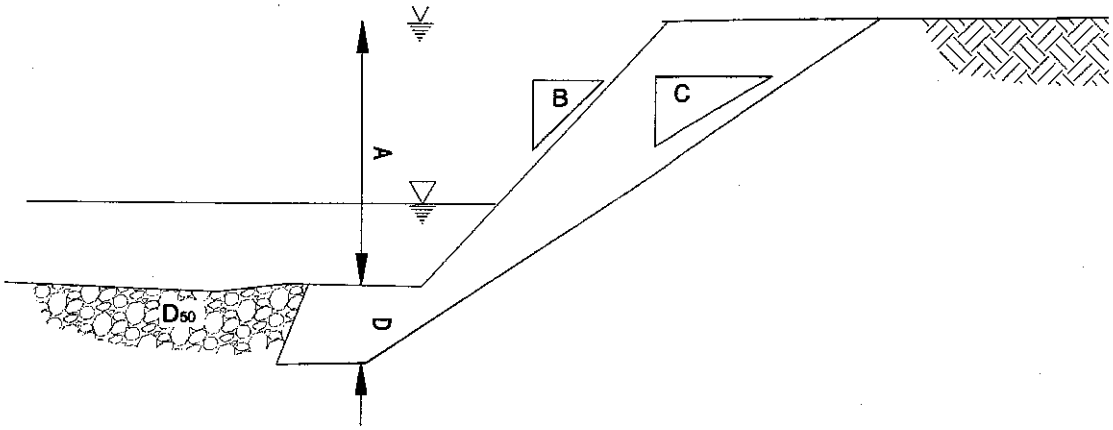
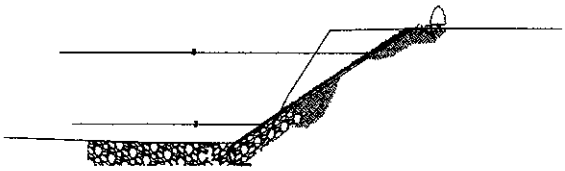
Bank Protection Treatment

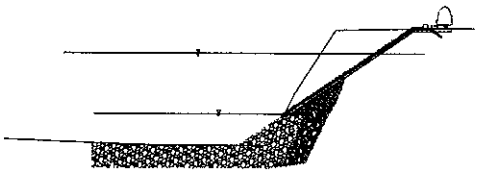


Bankfull Depth (Avg)	A = _____	
Existing Slope	B = _____	(vertical, 1:1, 1.5:1, 2:1 3:1)
Bed Material (Avg Diameter)	D_{50} = _____	
Bank Material (silt/clay, gravel, sand,	_____	(silt/clay, gravel, sand)
Existing Vegetation (none, grass, shrubs, trees)	_____	(none, grass, shrubs, trees)
Channel Slope (from Topo Map)	_____	
Shear Stress (lb/ft^2) (τ ~62.4AB)	_____	
Constructed Slope	C = _____	(vertical, 1:1, 1.5:1, 2:1 3:1)
Footer Depth	D =	
Bank Length		
Design Bank Protection	_____	max moderate low
Design Bank Protection Technique:		

Geotextile with Stone Toe

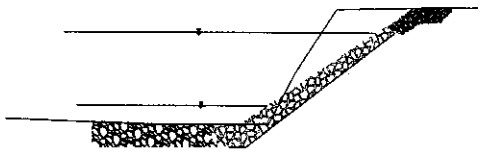


Geotextile with Rock Toe

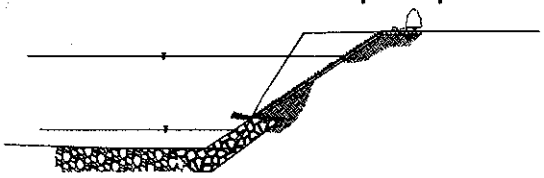


Root Wad

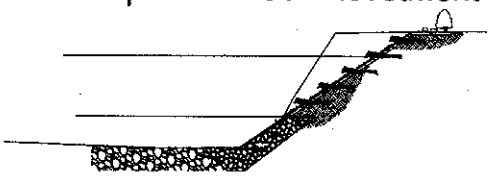
Rip Rap



Geotextile with Rip Rap Toe

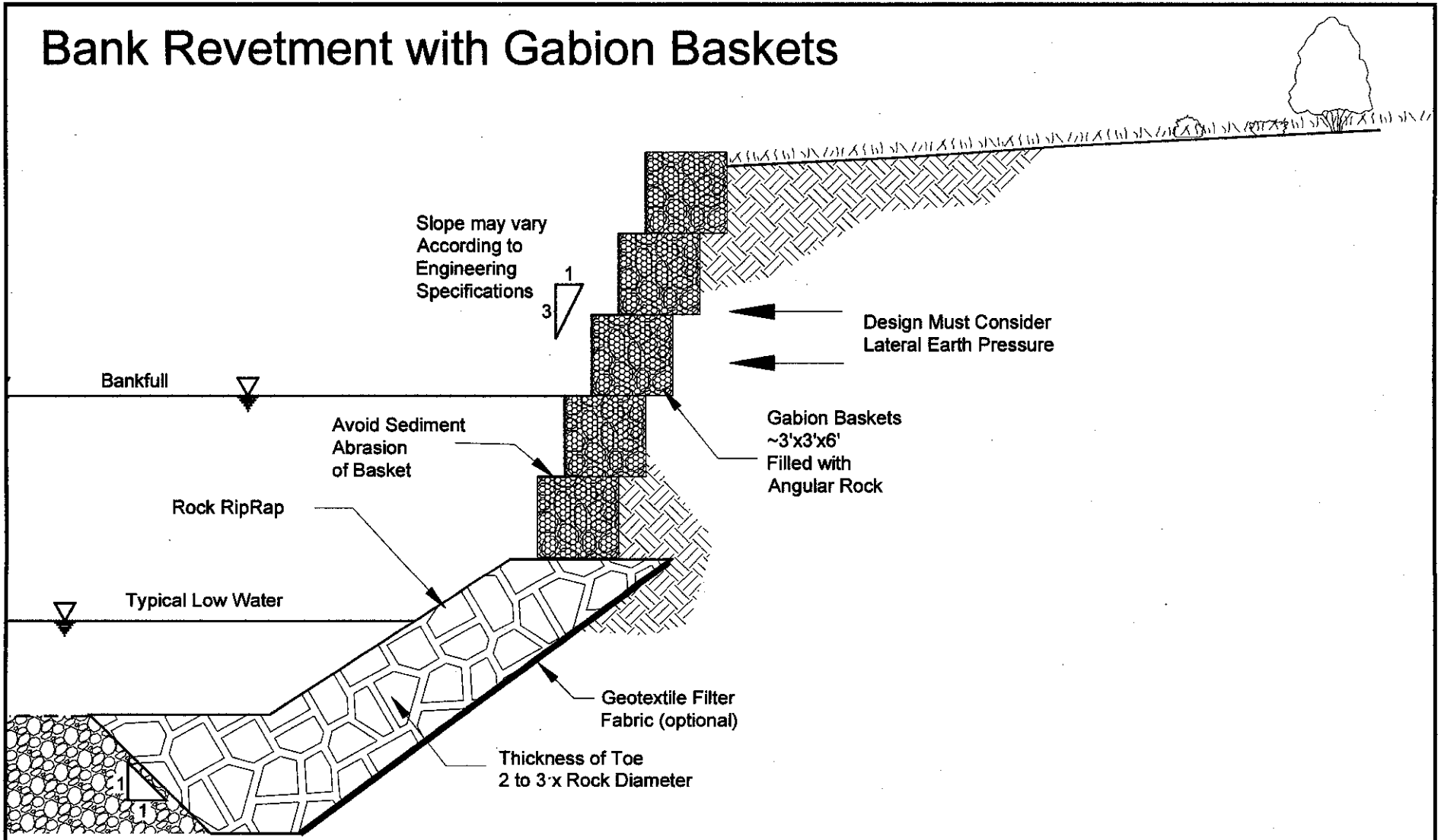


Encapsulated Soil Revetment



LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	DRAWING TITLE: Bank Protection Treatment
	DRAWN BY: MW	CHECKED:	FIGURE:	

Bank Revetment with Gabion Baskets



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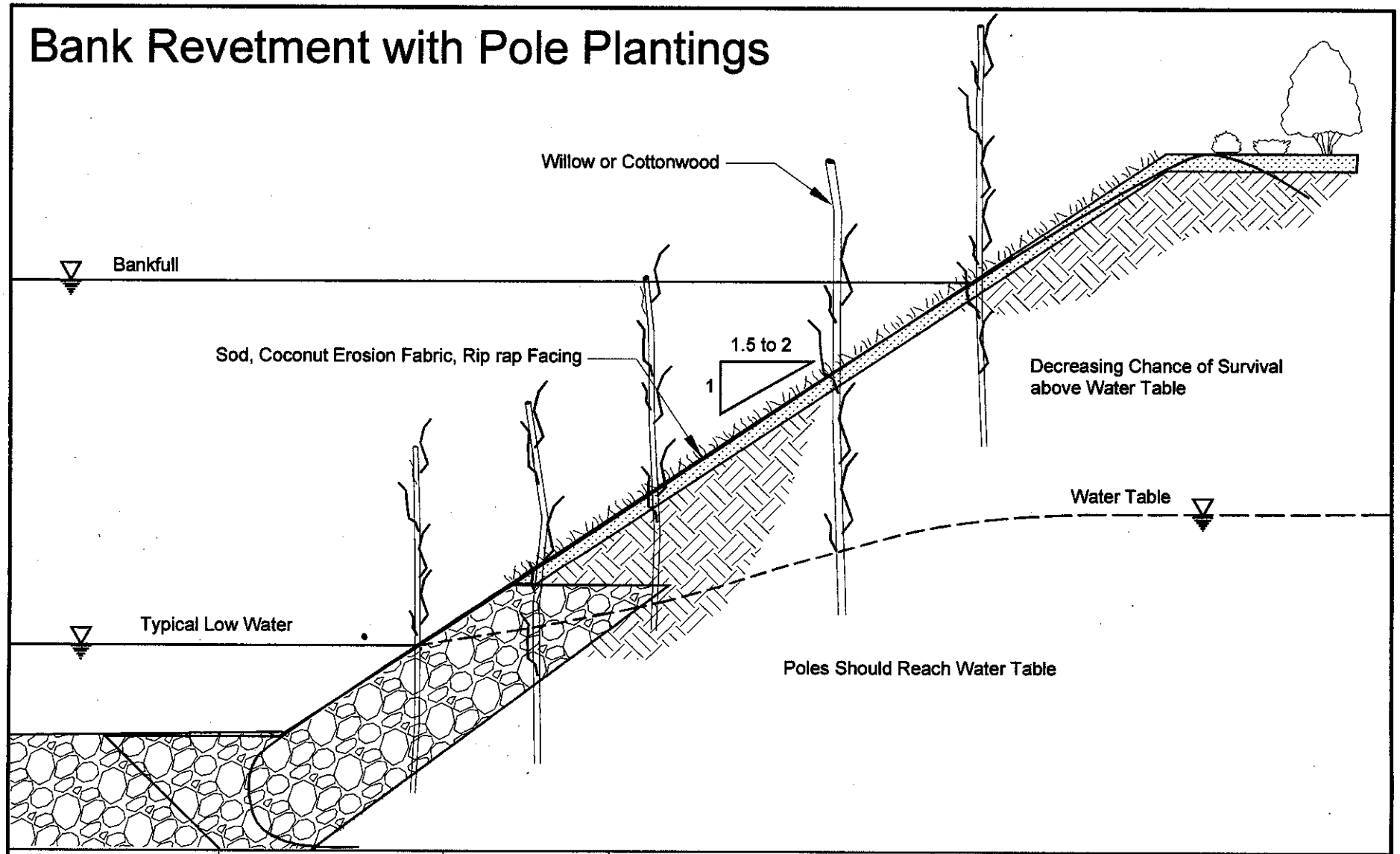
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Bank Revetment with Gabion Baskets
	DRAWN BY: MW	CHECKED:	FIGURE:	

Bank Revetment with Pole Plantings



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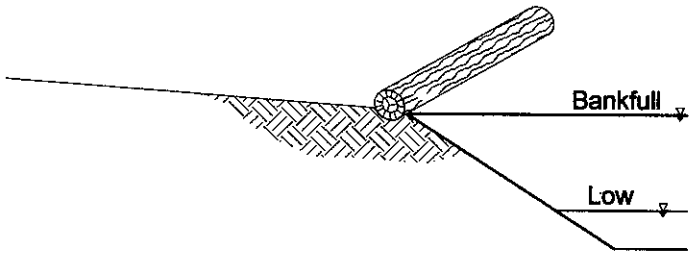
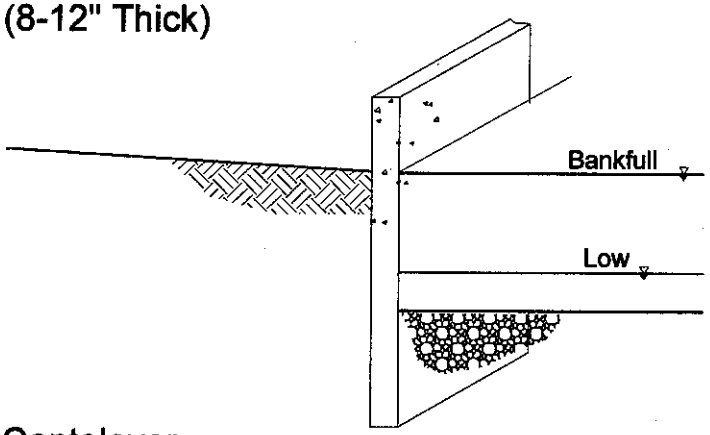
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Pole Planting
	DRAWN BY: MW	CHECKED:	FIGURE:	

Bridge Abutments

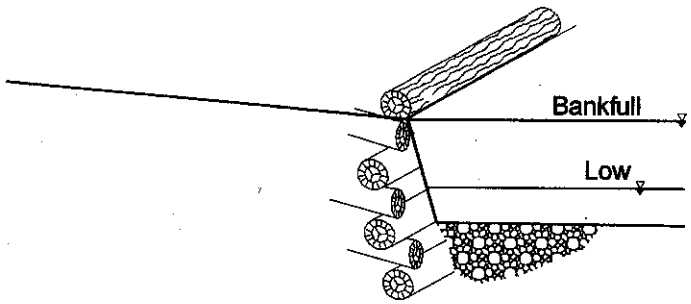
Log Sill
(24" Diameter)



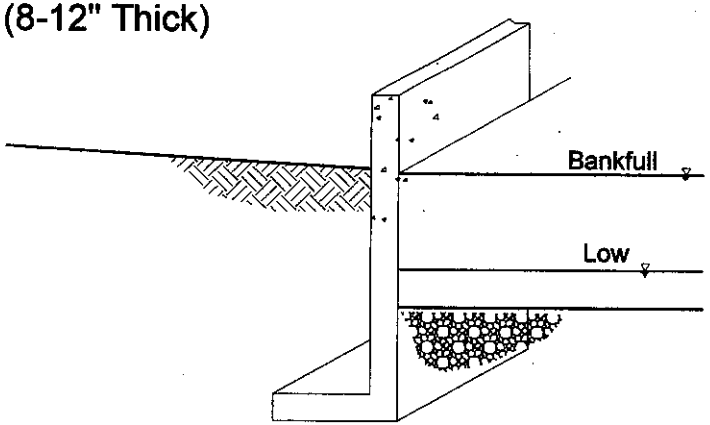
Concrete Wall
(8-12" Thick)



Log Crib



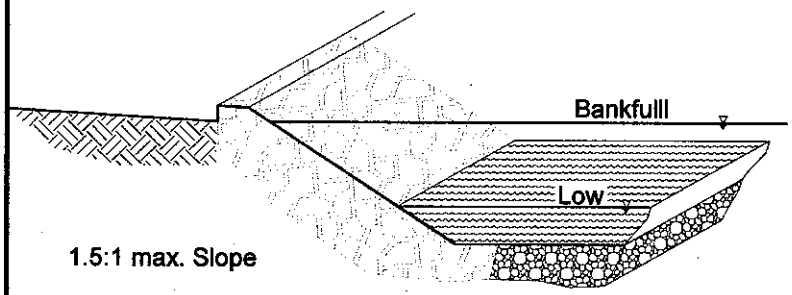
Cantelever
(8-12" Thick)



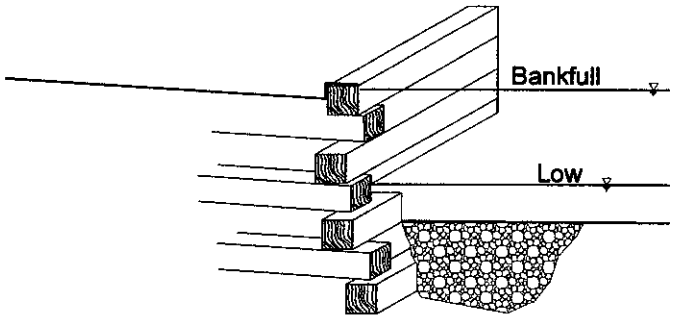
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Bridge Abutments
	DRAWN BY: MW	CHECKED:	FIGURE:	

Bridge Abutments

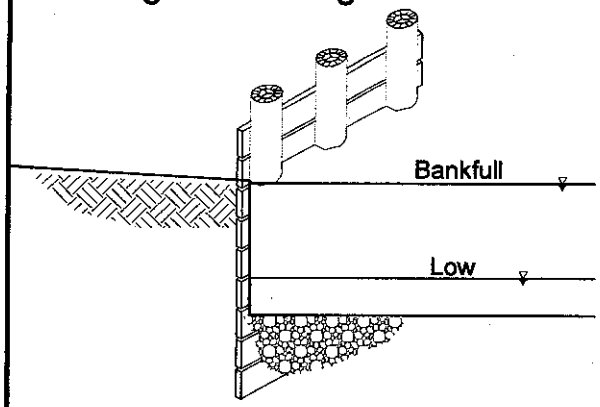
Rip Rap



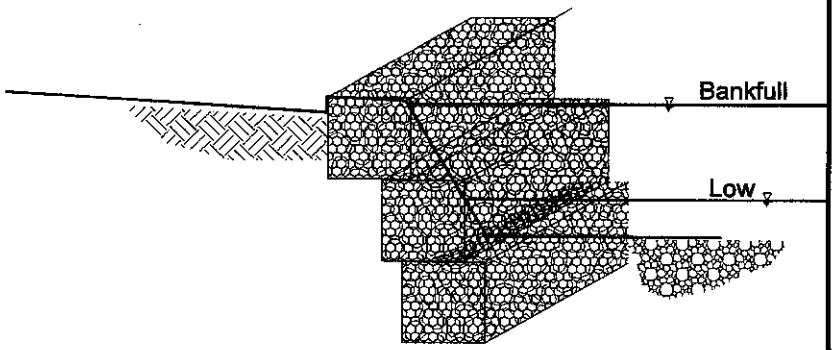
Timber Crib



Piling with Facing



Gabion Basket



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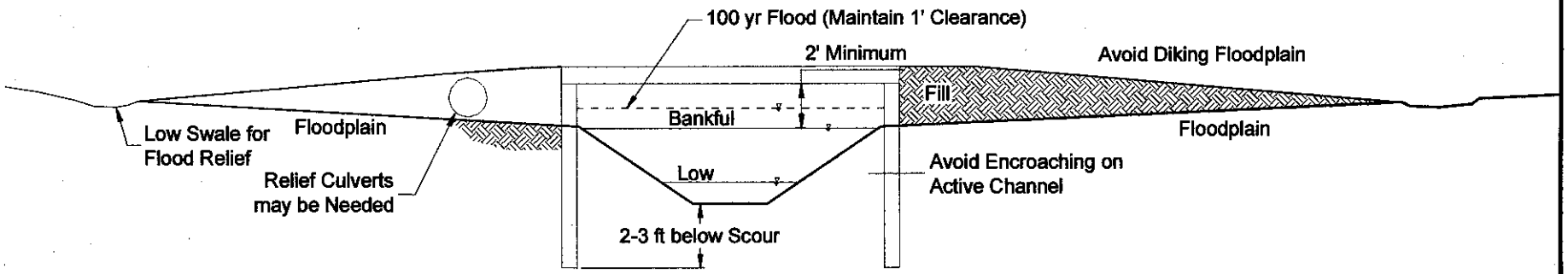
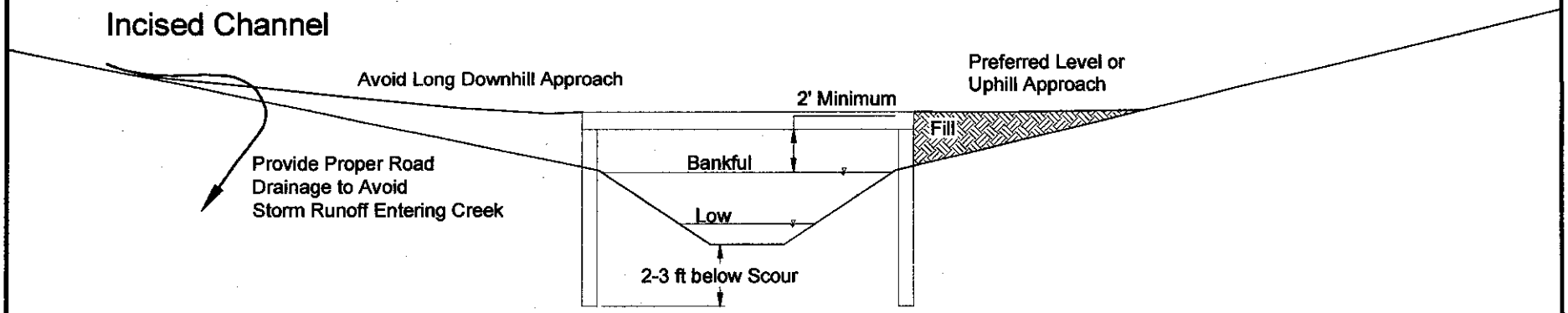
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Bridge Abutments
	DRAWN BY: MW	CHECKED:	FIGURE:	

Bridge Cross Sections

Unincised Channel

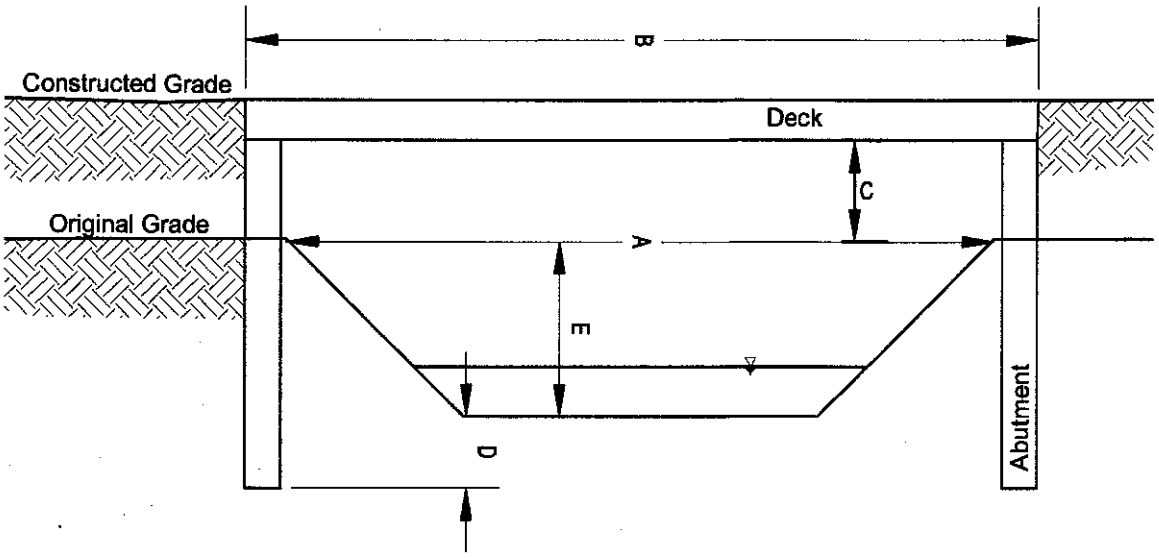


Incised Channel

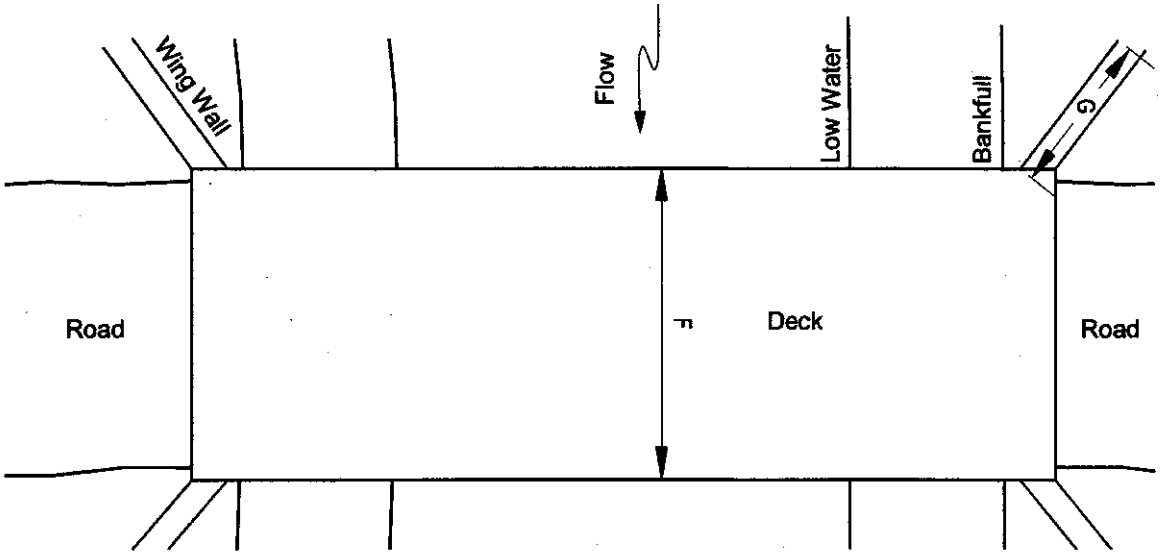


LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Bridge Cross Sections
	DRAWN BY: MW	CHECKED:	FIGURE:	

Bridge Template



Bankfull Width	A=_____	Road Width	F=_____
Span	B=_____	Wingwall Length (E+C)x1.5	G=_____
Stringer/Bankfull Clearance	C=_____	Bridge Type	_____
Abutment Footing Depth	D=_____	Abutment Type	_____
Bankful Depth	E=_____		



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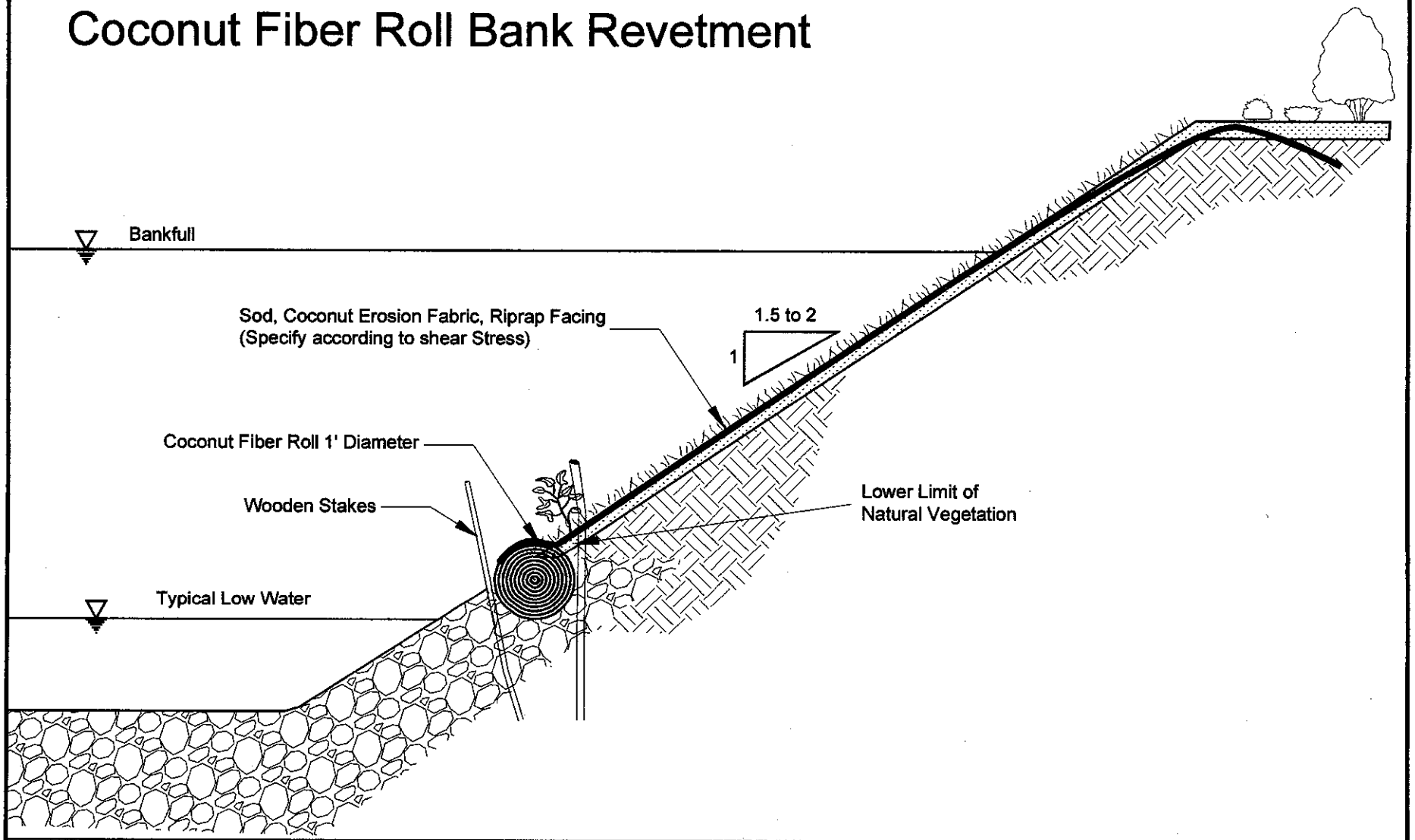
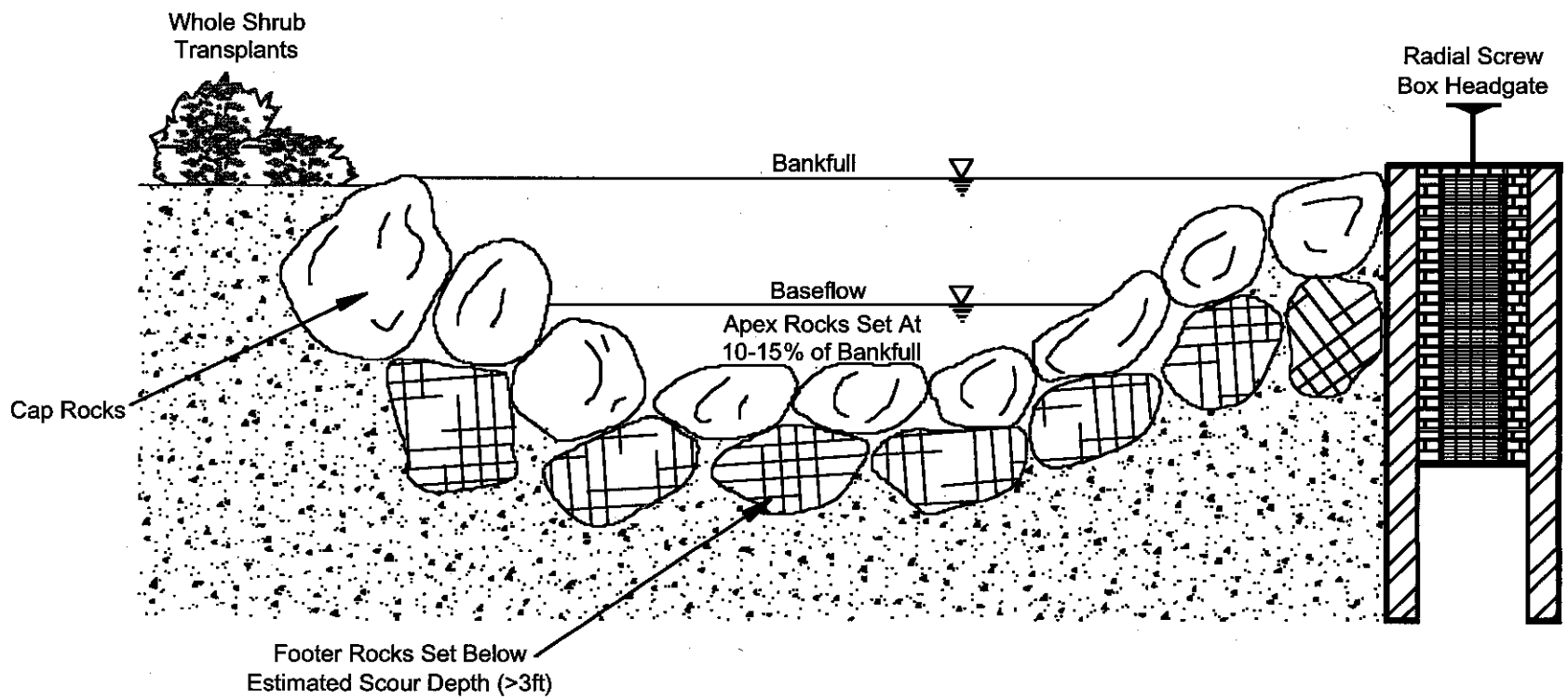
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	DRAWING TITLE: Bridge Template
	DRAWN BY: MW	CHECKED:	FIGURE:	

Coconut Fiber Roll Bank Revetment



LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Fiber Roll Revetment
	DRAWN BY: MW	CHECKED:	FIGURE:	

Cross Vane Diversion Structure
Cross Sectional View



Note: Design specifications are site specific and subject to change.

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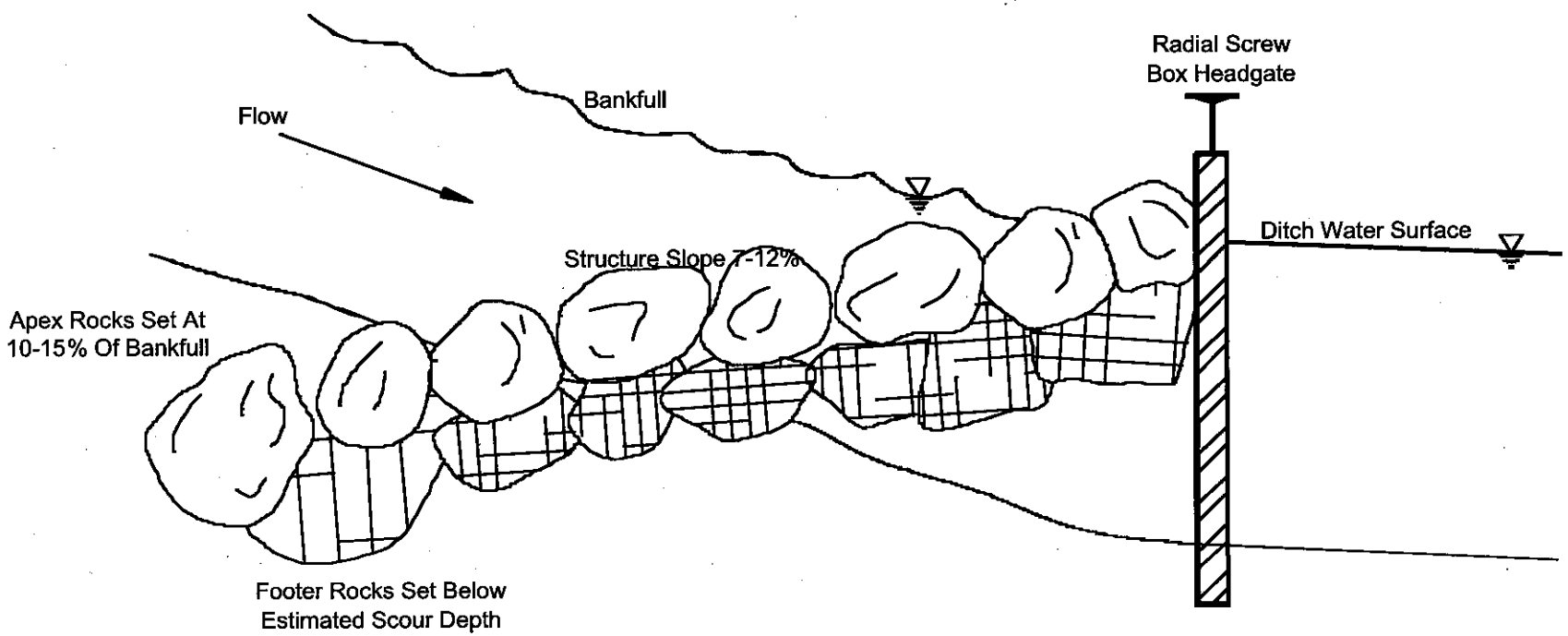
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME: crsv.dwg	DRAWING TITLE: Cross Vane Diversion Structure
	DRAWN BY: J.S.	CHECKED:	FIGURE:	

Cross Vane Diversion Structure
Longitudinal Profile View

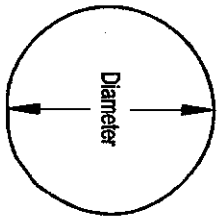


Note: Design specifications are site specific and subject to change.

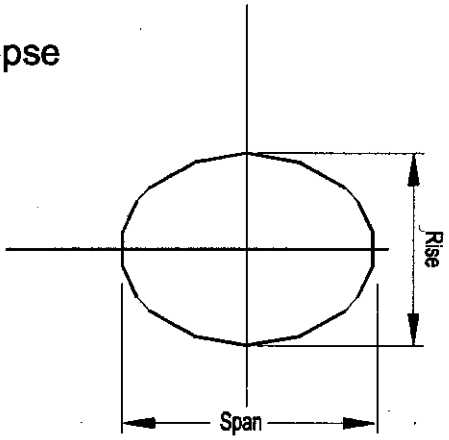
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME: lngv.dwg	DRAWING TITLE: Cross Vane Diversion Structure
	DRAWN BY: J.S.	CHECKED:	FIGURE:	

Steel Culvert Shapes

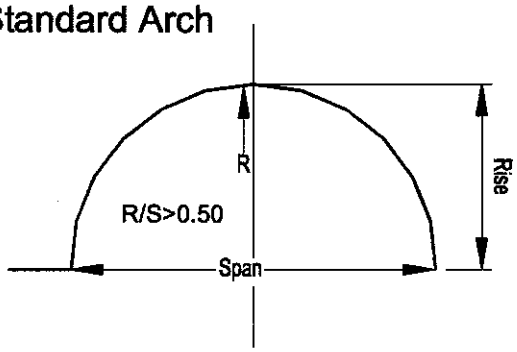
Round



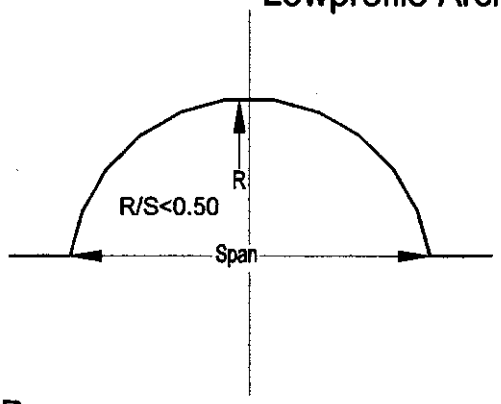
Ellipse



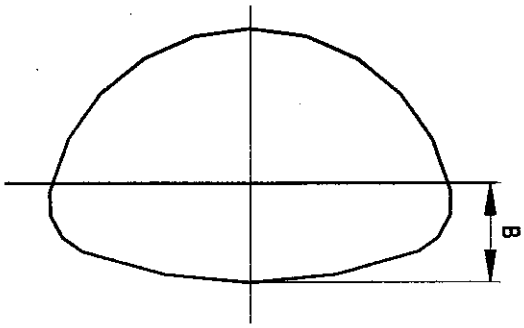
Standard Arch



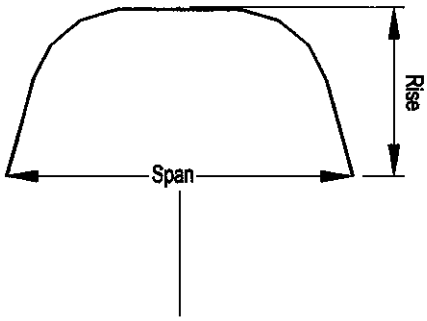
Lowprofile Arch



Pipe-Arch or Squashed



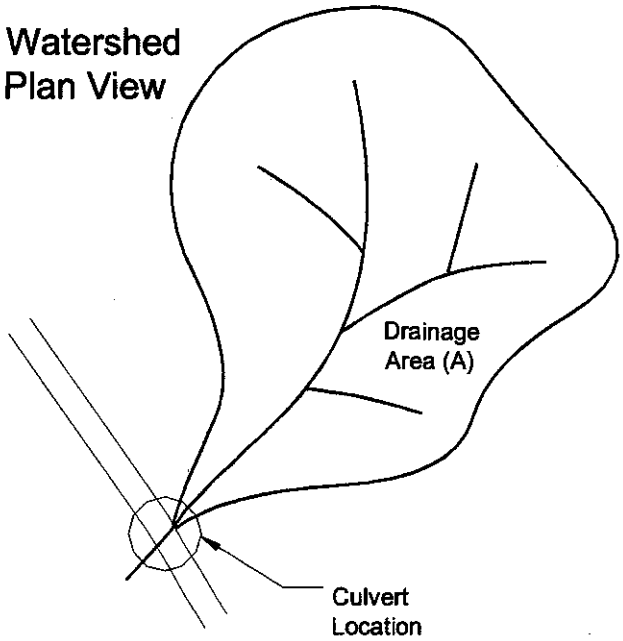
Box



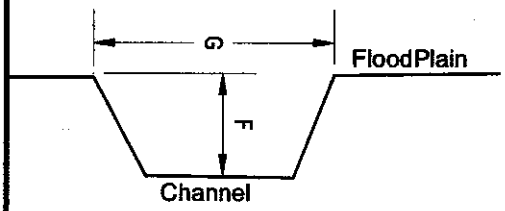
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	DRAWING TITLE: Culvert Shapes
	DRAWN BY: MW	CHECKED:	FIGURE:	

Culvert Sheet

Watershed Plan View

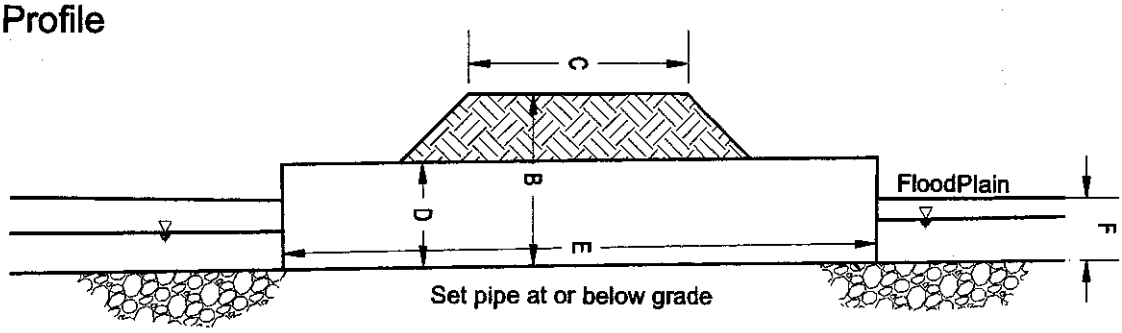


Cross Section



Drainage Area	A=_____	Culvert Length (C+(3xB))	E=_____
Precipitation (in)	ppt=_____	Channel Depth	F=_____
Design 25 yr. 100 yr. Flood	Q=_____	Channel Width	G=_____
		Culvert Type (Round, Arch, Box, _____)	
Fill Height (ft) (Channel Bottom to Road)	B=_____	Culvert Diameter (in)	D=_____
Road Width (ft)	C=_____		

Profile



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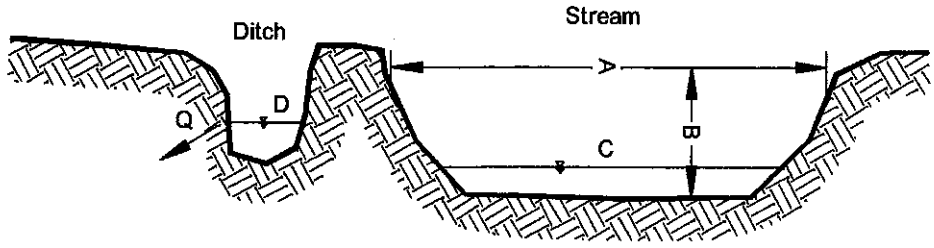
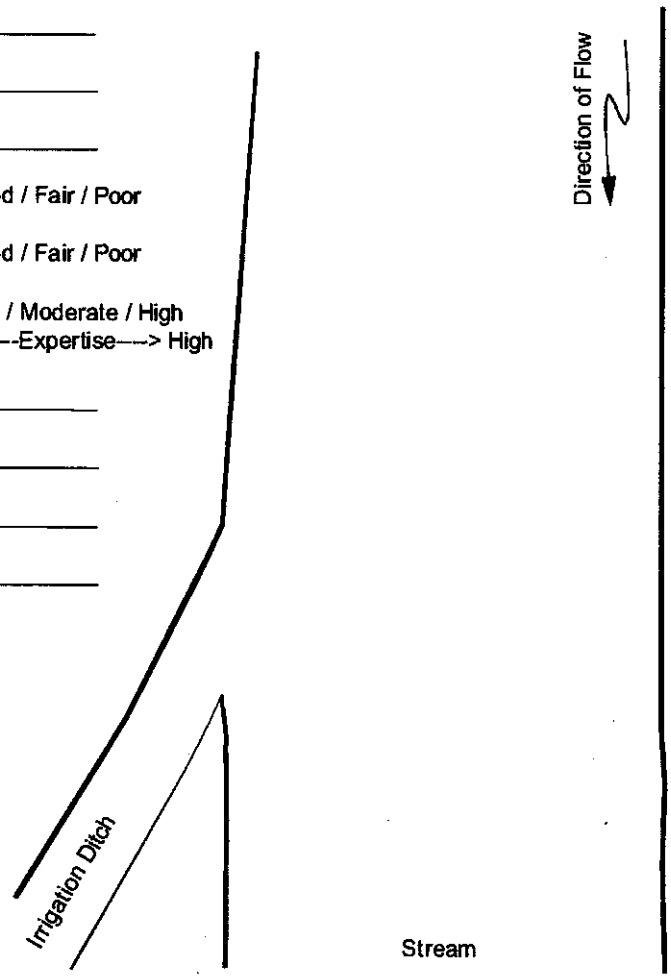
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	DRAWING TITLE: Willow Wattle Bank Reveg
	DRAWN BY: MW	CHECKED:	FIGURE:	

Diversion Design



Cross Section

Channel Width	A =_____
Bankfull Depth	B =_____
Low Water Elevation	C =_____
Required Ditch Operating Level	D =_____
Headwater Requirement (D-C)	_____
Peak Ditch Diversion Rate (cfs)	_____
Channel Stability Lateral	Good / Fair / Poor
Channel Stability Vertical	Good / Fair / Poor
Bedload/Sediment	Low / Moderate / High Low <---Expertise---> High
Diversion Structure Type	_____
Headgate Type	_____
Bank Protection Type	_____
Provisions for Fish Passage	_____



Plan View
(Sketch Details)

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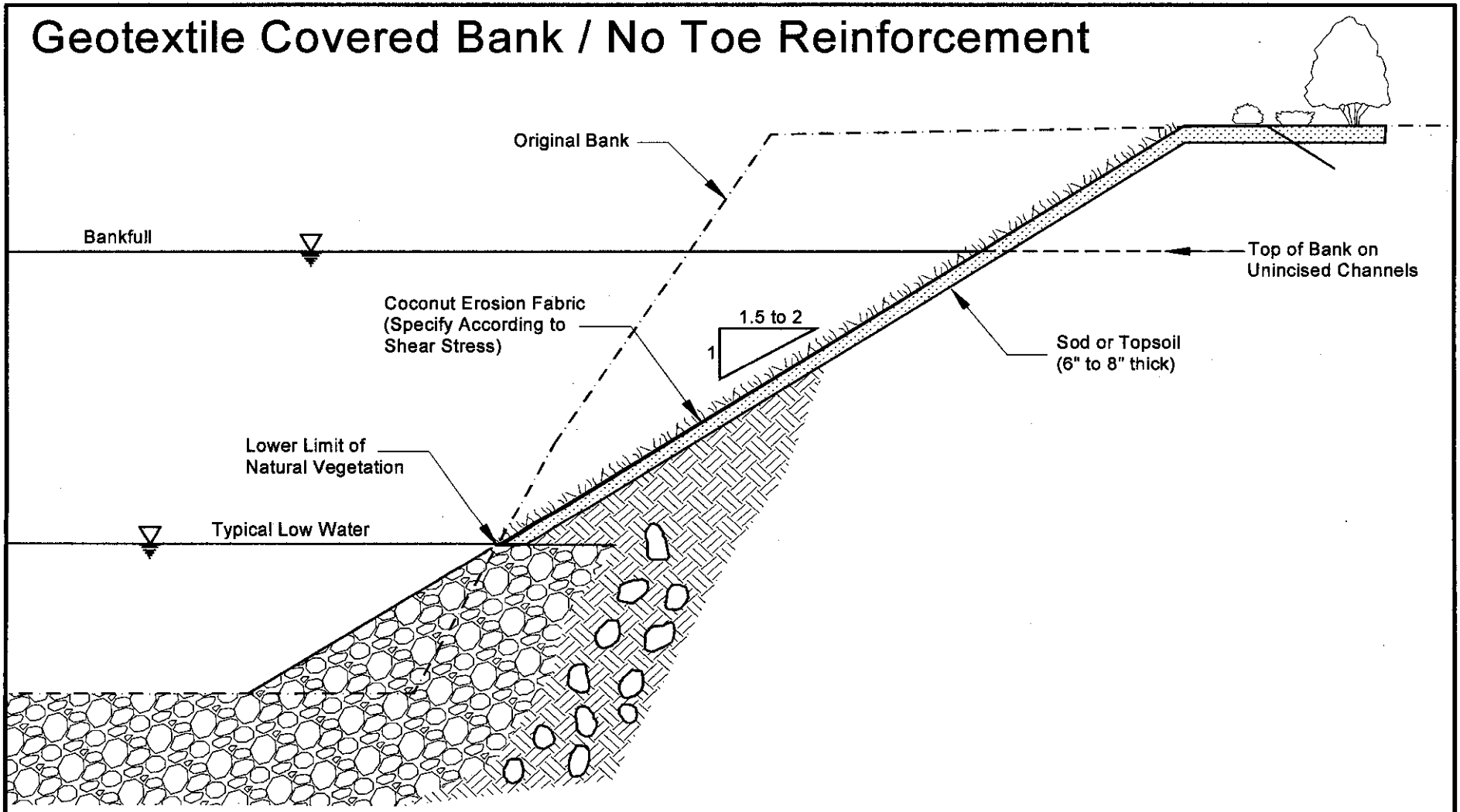
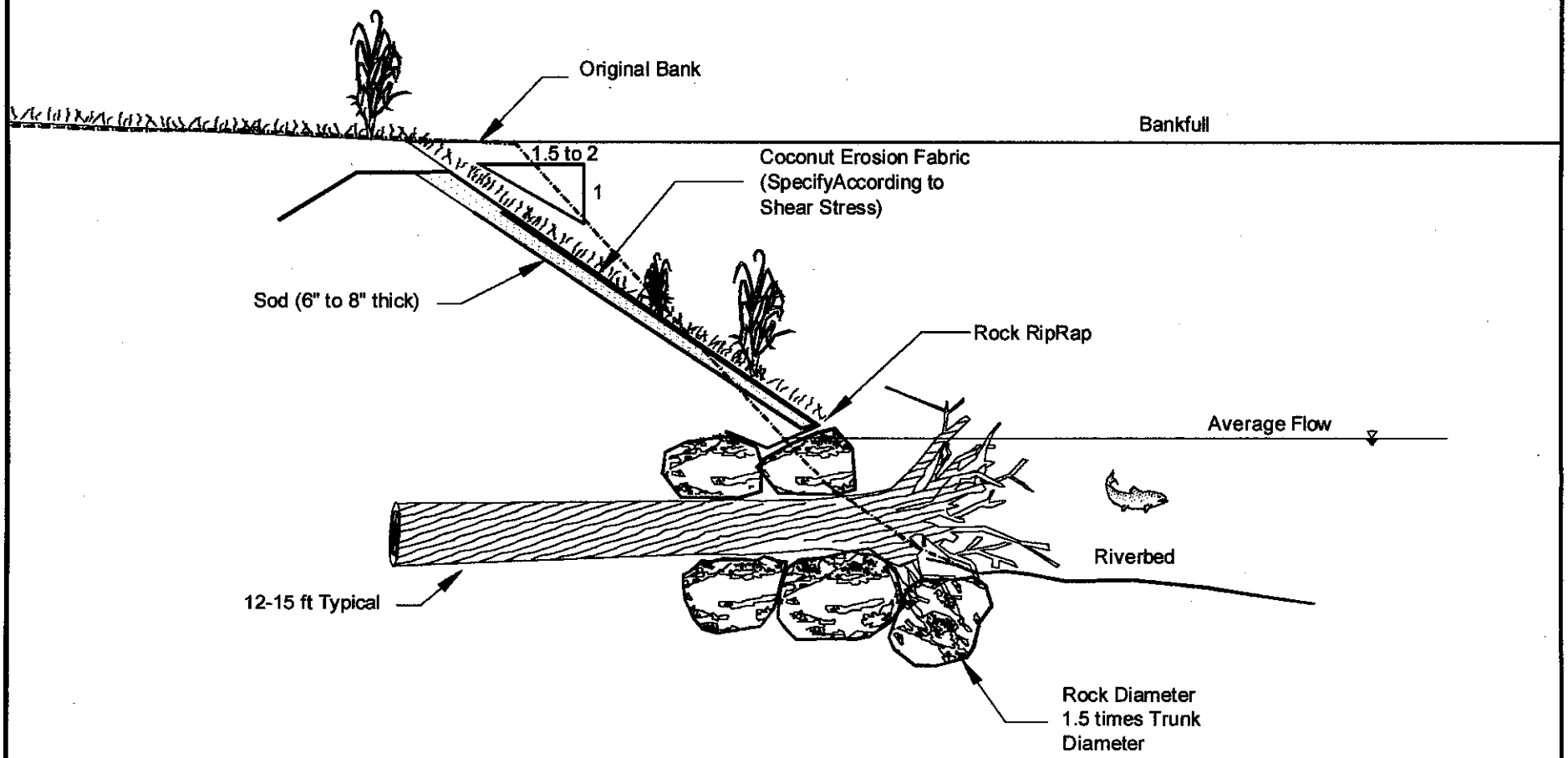
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	DRAWING TITLE: Diversion Design
	DRAWN BY: MW	CHECKED:	FIGURE:	

Geotextile Covered Bank / No Toe Reinforcement



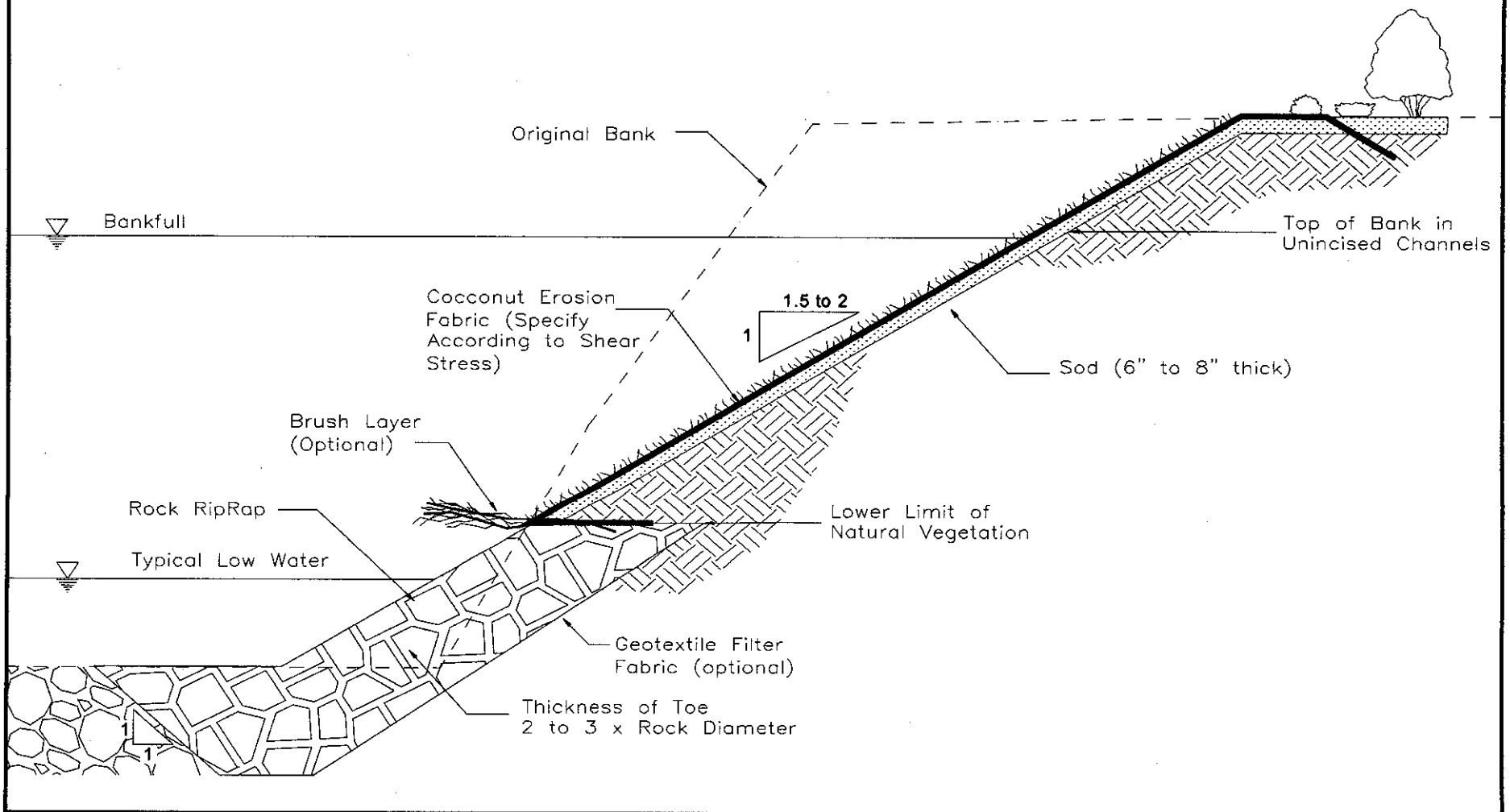
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Geotextile Covered Bank / No Toe Reinforcement
	DRAWN BY: MP/MW	CHECKED:	FIGURE:	

Geotextile Covered Bank with Single Root Wad Footer



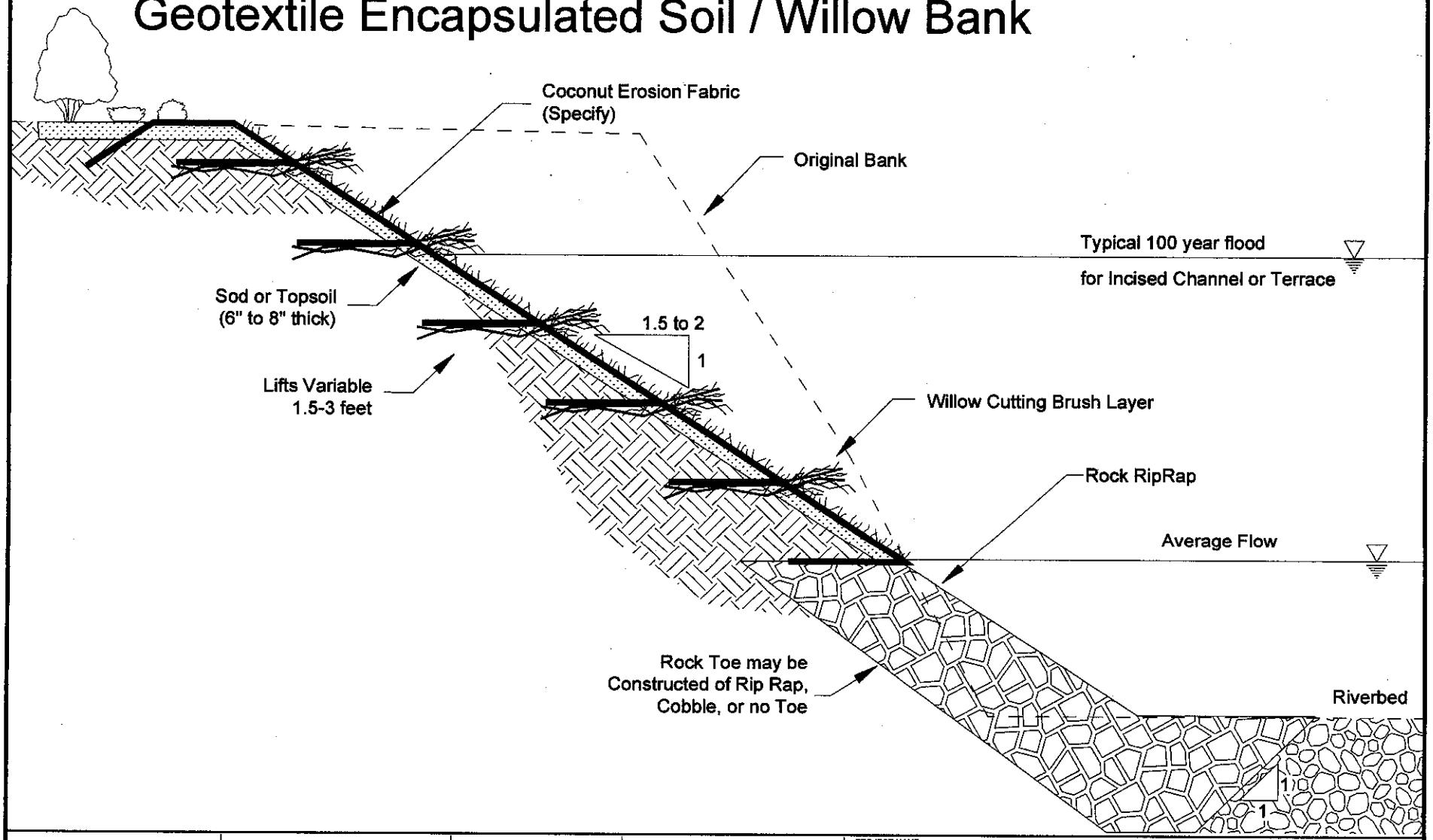
LAND & WATER CONSULTING, INC. P.O. BOX 8264 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Geotextile Bank with Root Wad
	DRAWN BY: MP/MW	CHECKED:	FIGURE:	

Geotextile Single Wrap Bank with Rip Rap Toe



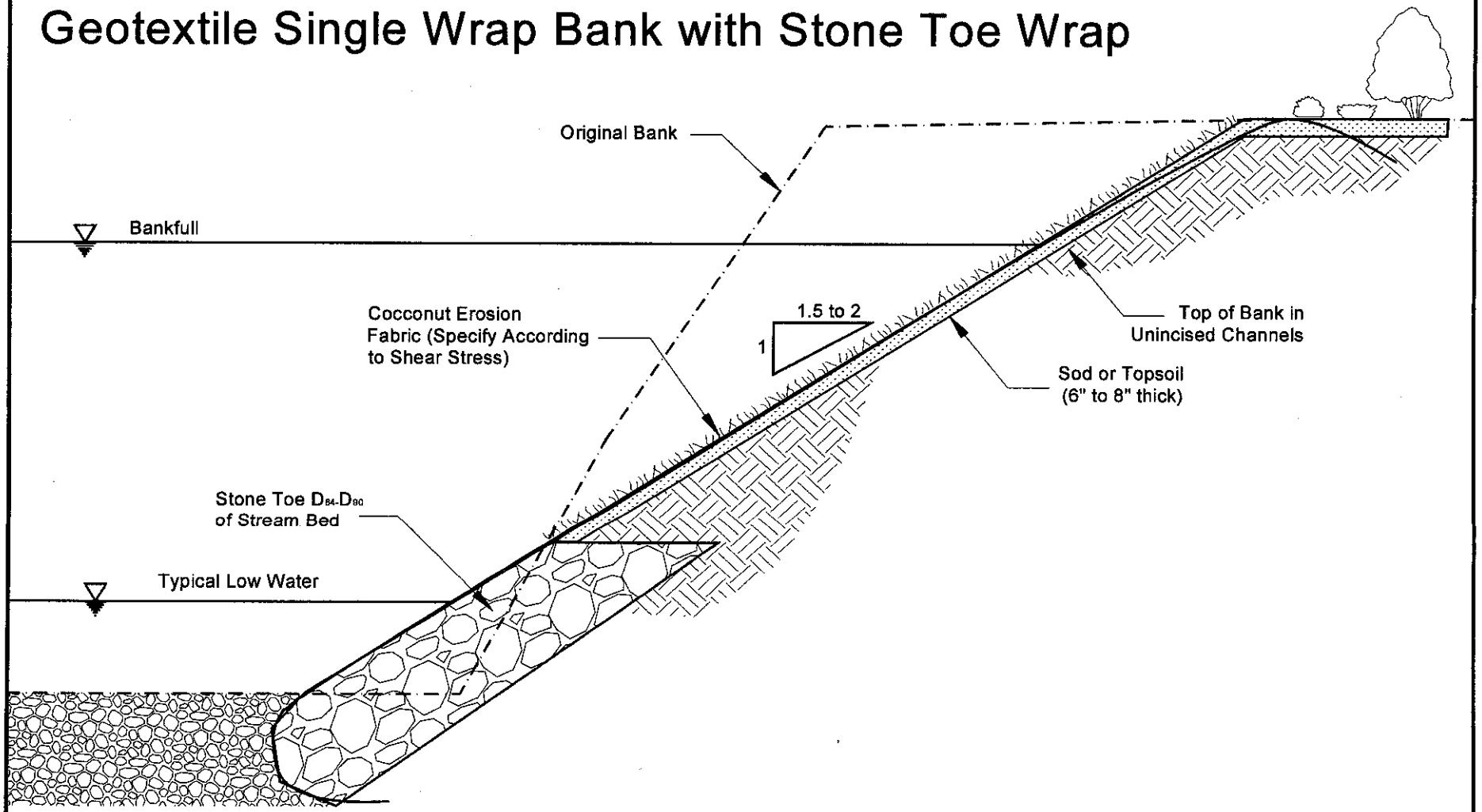
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PROJECT NO: H98-143	DATE: Sept 98	LOCATION: Missoula, MT	PROJECT NAME: CD Manual
	PROJECT MANAGER: B.Anderson	SCALE: N/A	FILENAME: GEO_RRToe	DRAWING TITLE: Geotextile single wrap bank with Rip Rap Toe
	DRAWN BY: MP	CHECKED:	FIGURE: 1	

Geotextile Encapsulated Soil / Willow Bank



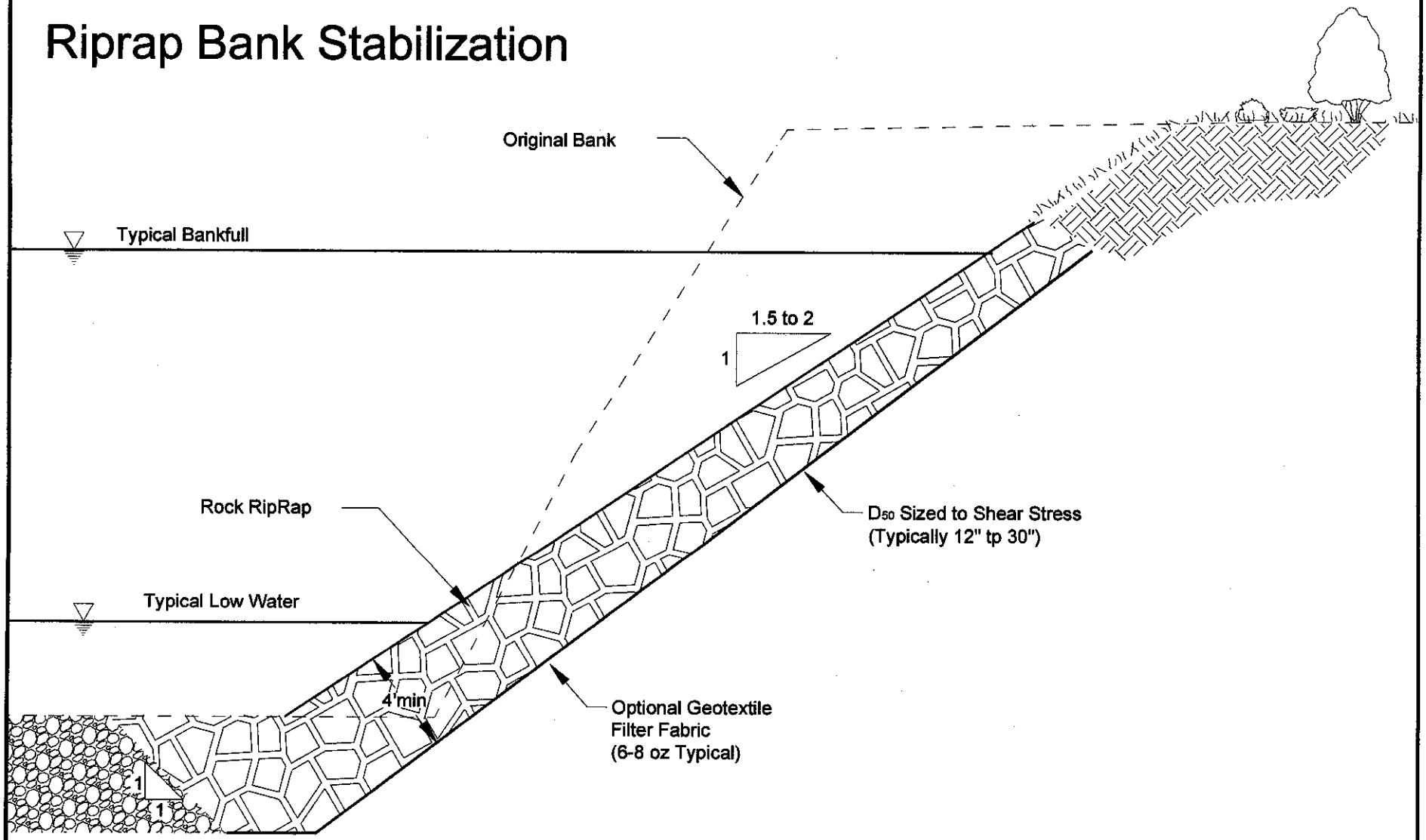
LAND & WATER CONSULTING, INC. P.O. BOX 8264 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Geotextile Encapsulated Soil / Willow Bank
	DRAWN BY: MP/MW	CHECKED:	FIGURE:	

Geotextile Single Wrap Bank with Stone Toe Wrap



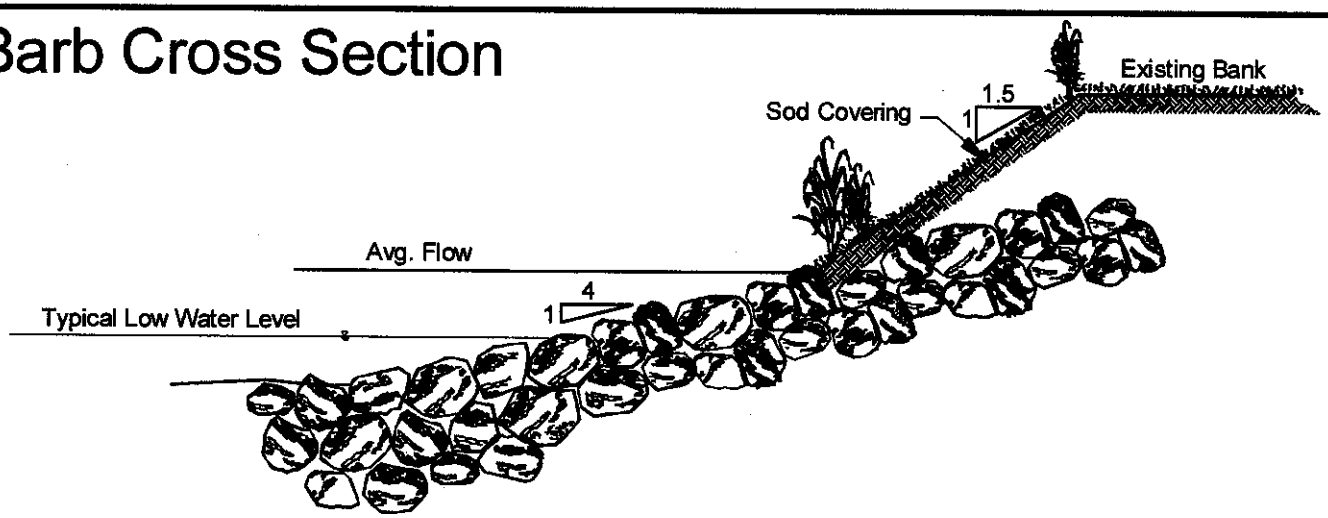
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Geotextile single wrap bank with Stone Toe Wrap
	DRAWN BY: MP/MW	CHECKED:	FIGURE:	

Riprap Bank Stabilization

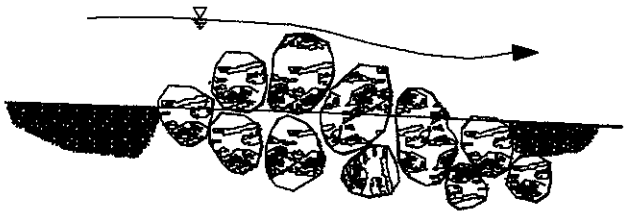


LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Riprap Bank Stabilization
	DRAWN BY: MW	CHECKED:	FIGURE:	

Rock Barb Cross Section

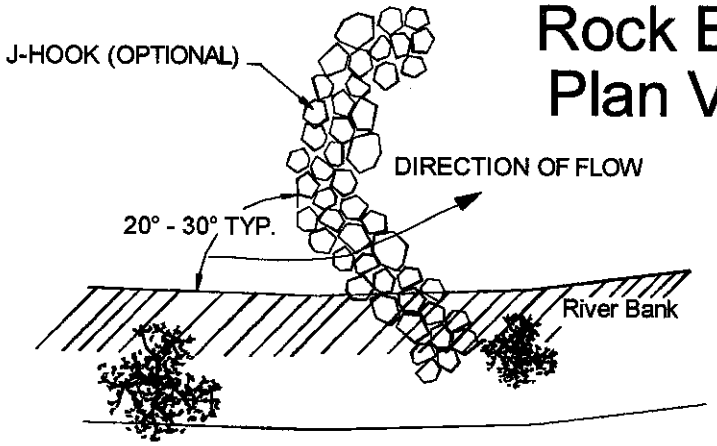


Rock Barb Cross Section



Rock 2-4 ft Diameter Typical

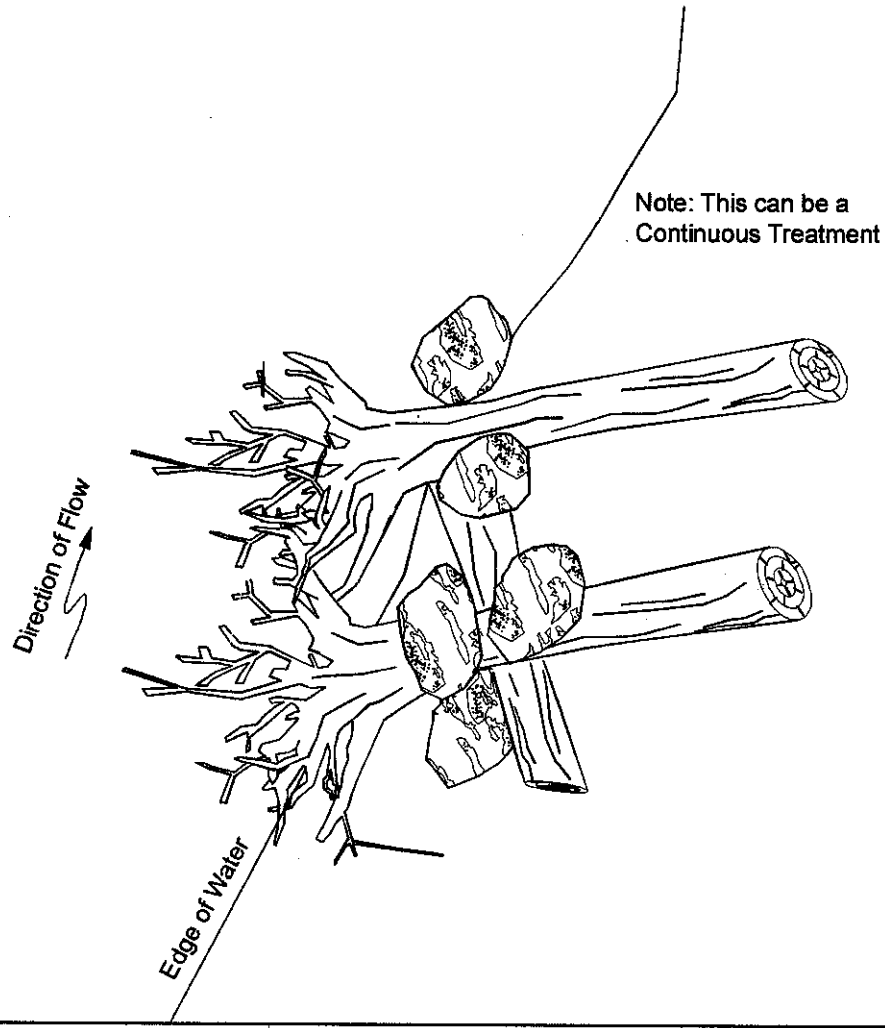
Rock Barb Plan View



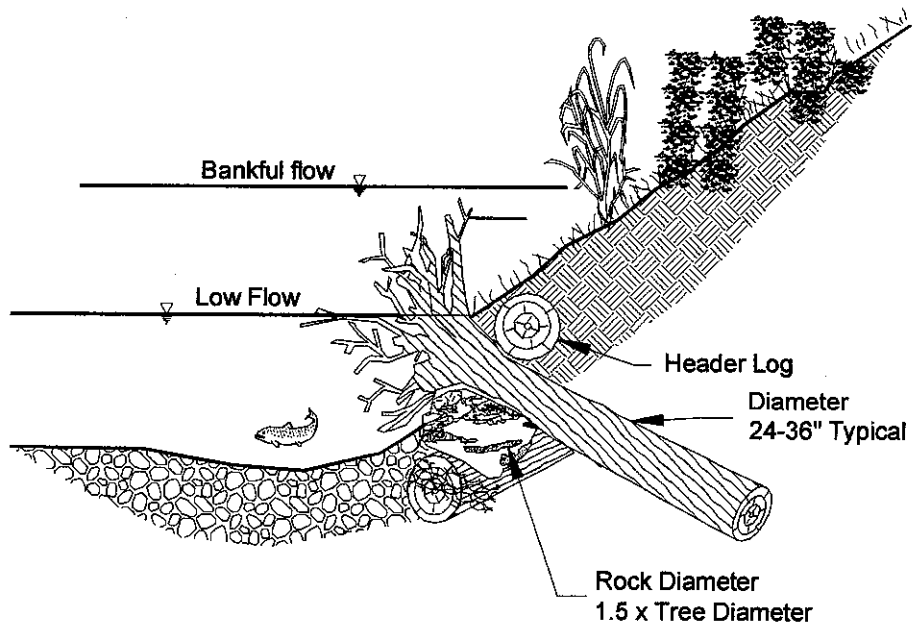
Top of Existing Bank

LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Rock Barb
	DRAWN BY: MW	CHECKED:	FIGURE:	

Root Wad Detail Plan View



Root Wad Detail Cross Section



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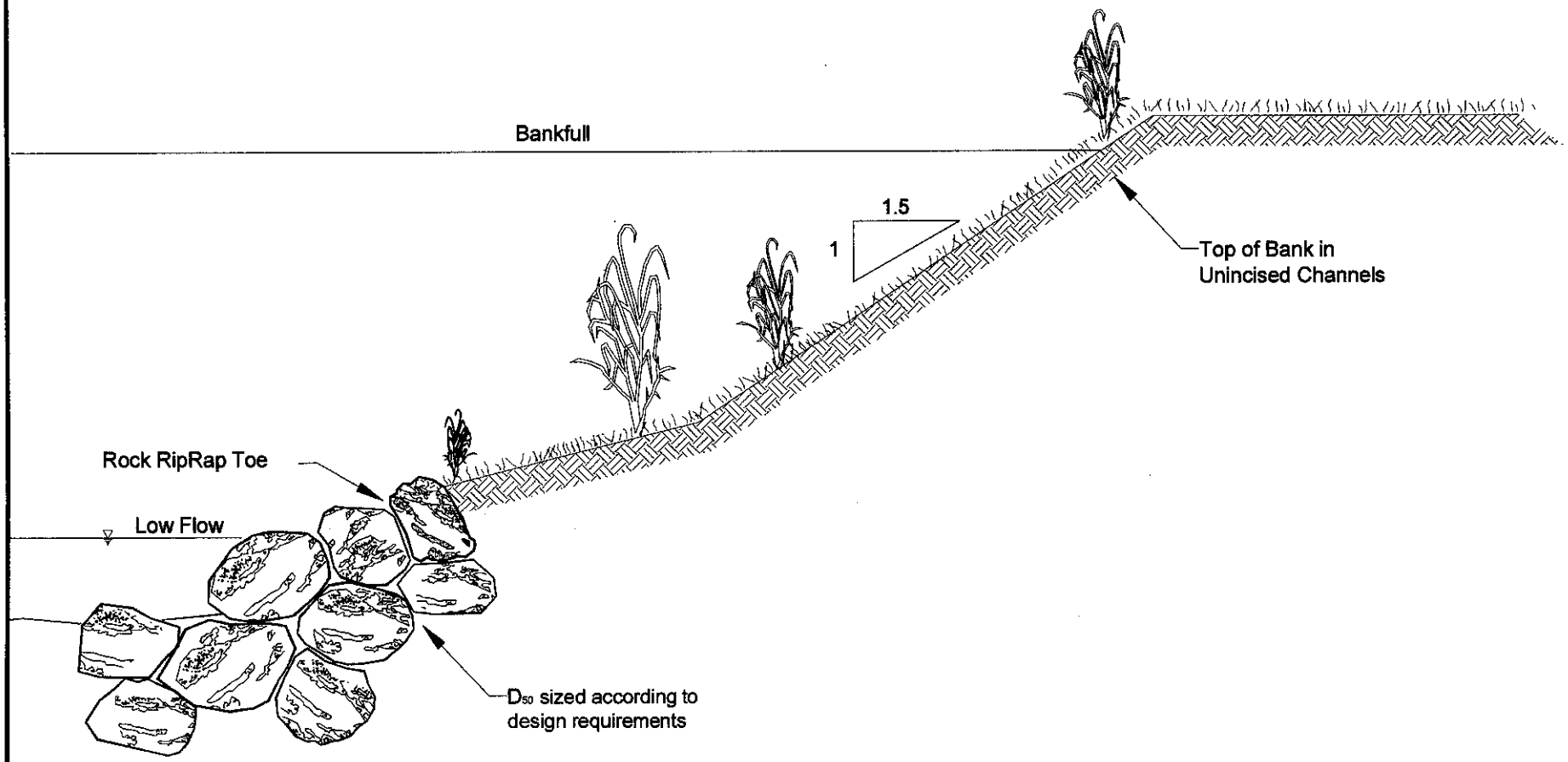
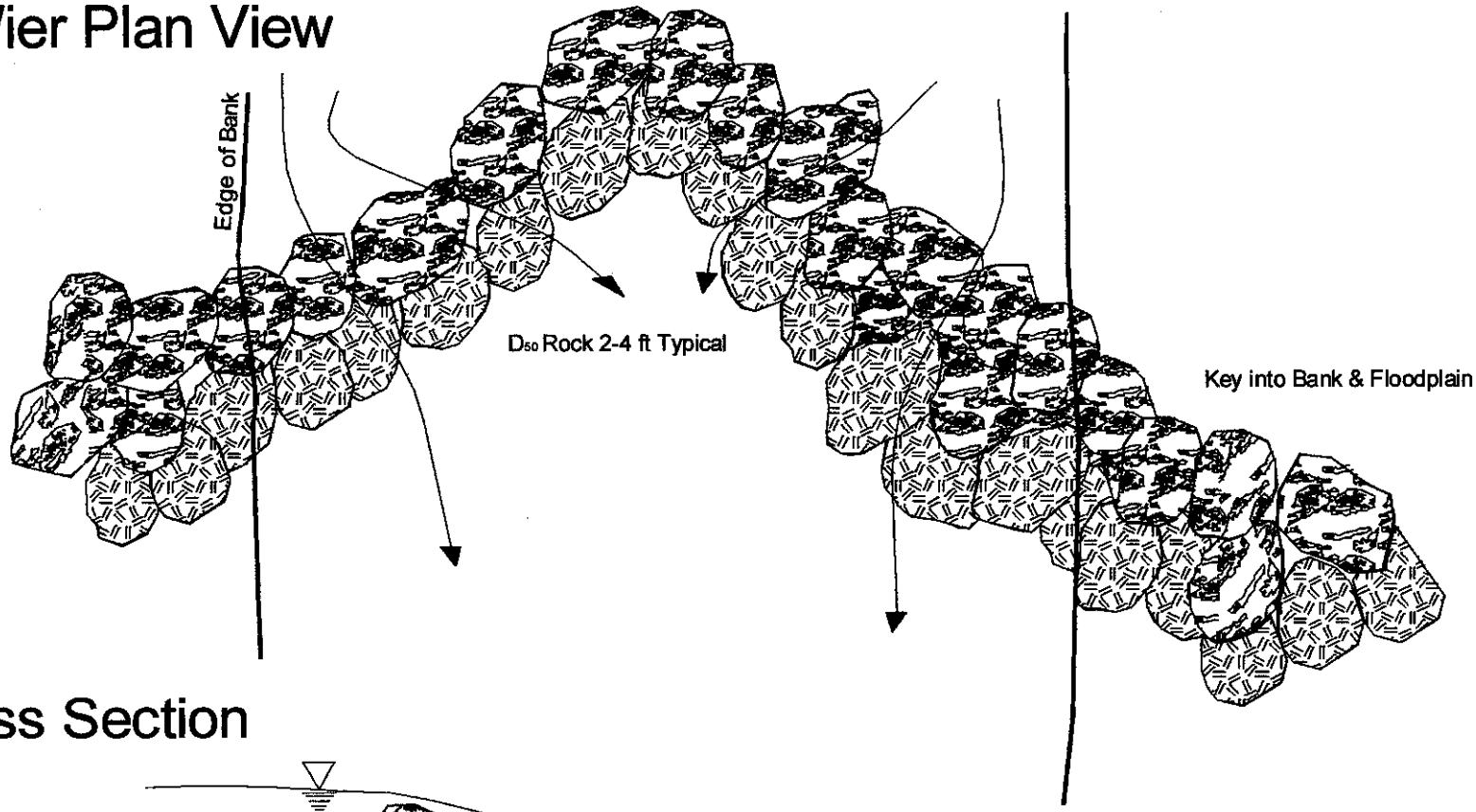
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Rootwad Detail
	DRAWN BY: MW	CHECKED:	FIGURE:	

Stone Toe

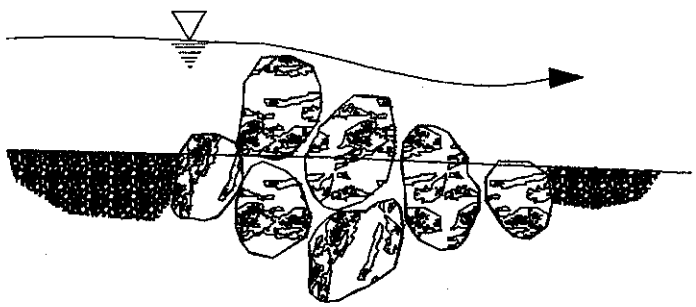


LAND & WATER CONSULTING, INC. P.O. BOX 8264 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: Stone Toe
	DRAWN BY: MW	CHECKED:	FIGURE:	

V Wier Plan View



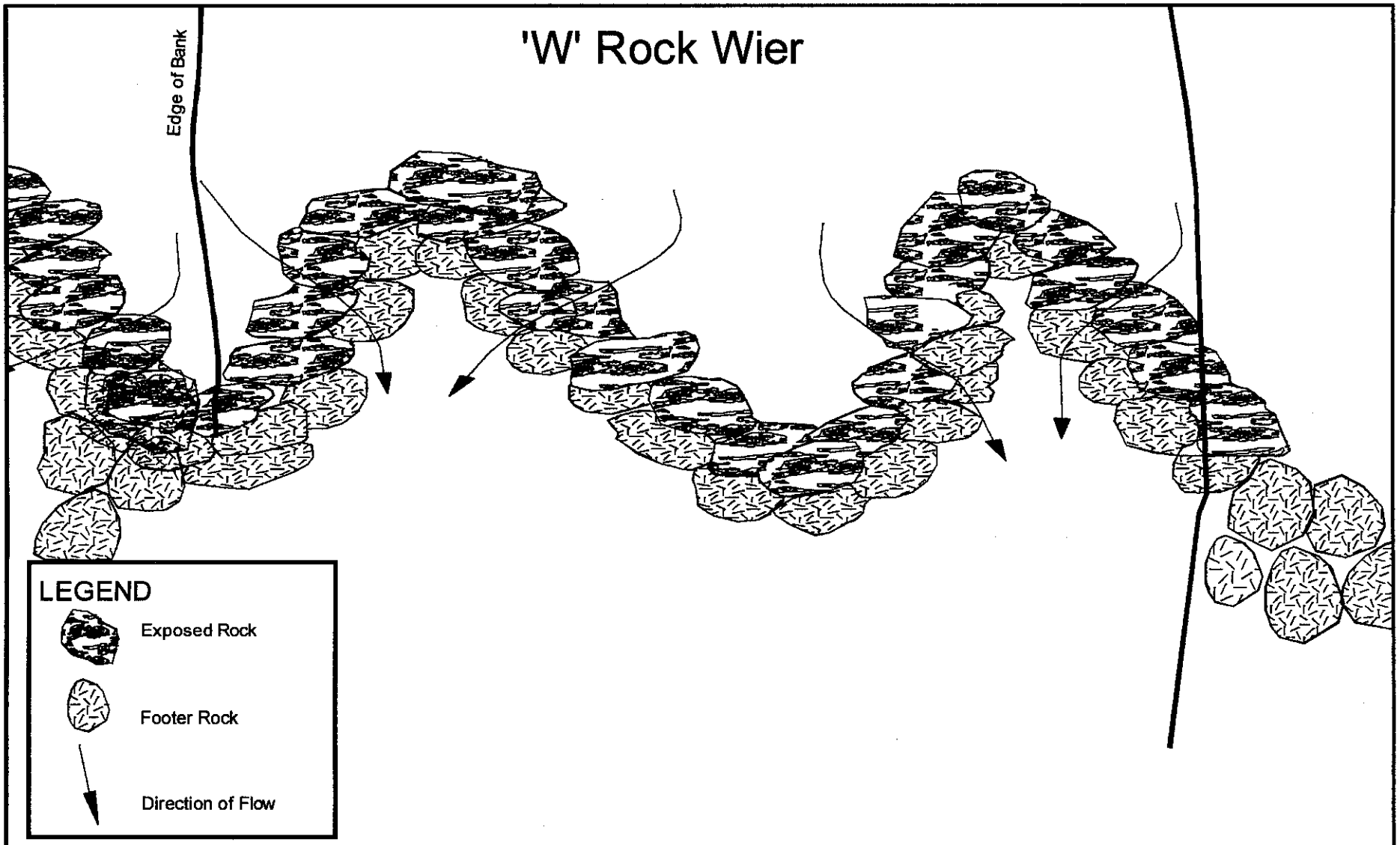
Cross Section



LEGEND
- Exposed Rock
- Footer Rock
- Direction of Flow

LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: "V" Rock Weir
	DRAWN BY: MW	CHECKED:	FIGURE:	

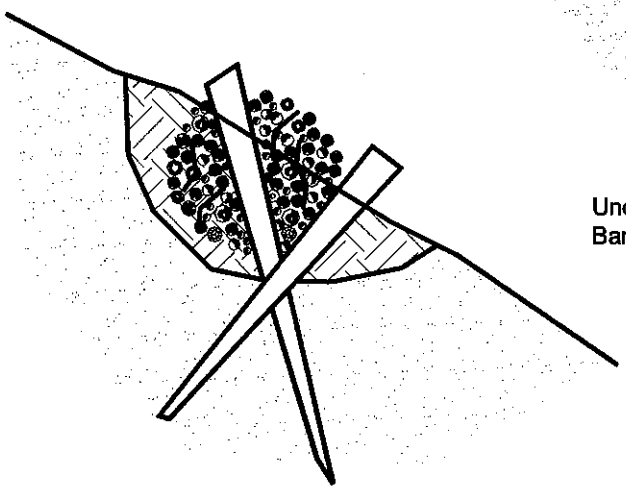
'W' Rock Wier



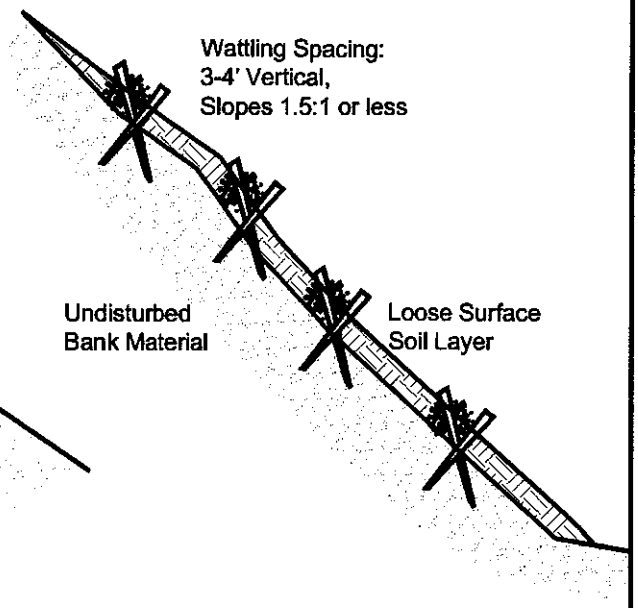
LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	SCALE: Not to Scale	FILENAME:	DRAWING TITLE: "W" Rock Weir
	DRAWN BY: MW	CHECKED:	FIGURE:	

Willow Wattling Bank Revegetation

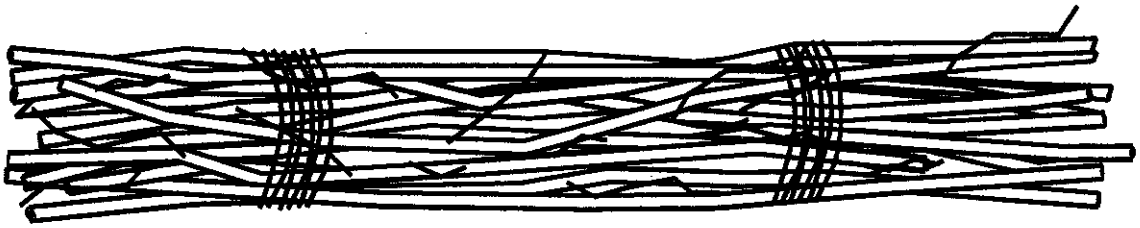
Cross Section Installation Detail



Bank Installation



Willow Wattle Detail



Stems 1/2" to 1 1/2" Diameter 12-18 per a Bundle
3-8 ft Long, 50% Dead Brush can be used

LAND & WATER CONSULTING, INC. P.O. BOX 8254 Missoula, MT 59807	PERMIT NO:	DATE:	LOCATION:	PROJECT NAME: CD Manual
	PROJECT MANAGER:	NOT TO SCALE	FILENAME:	DRAWING TITLE: Willow Wattle Bank Reveg
	DRAWN BY: MW	CHECKED:	FIGURE:	