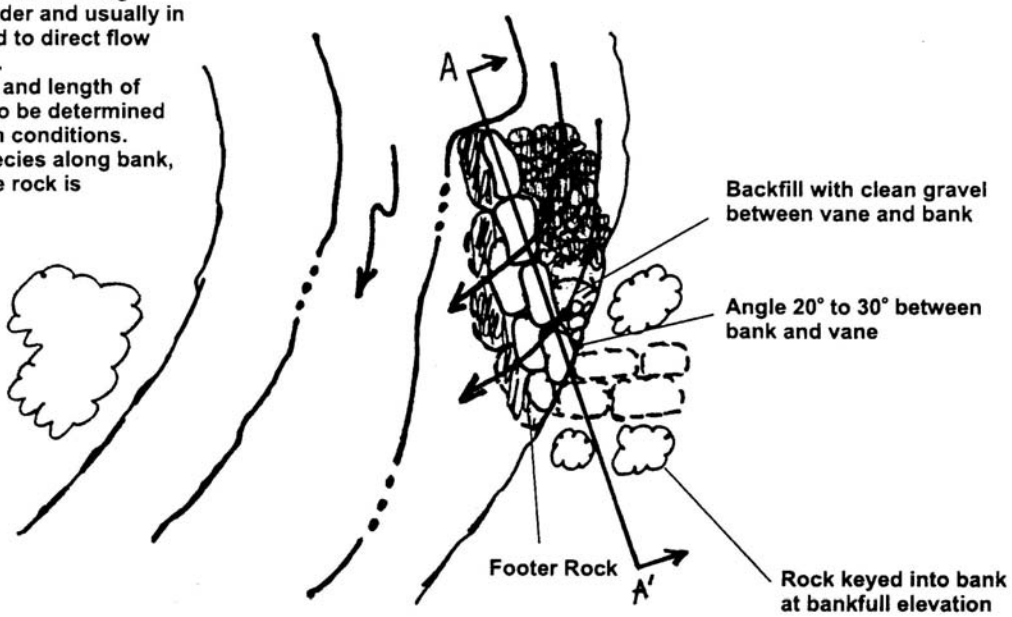
Appendices

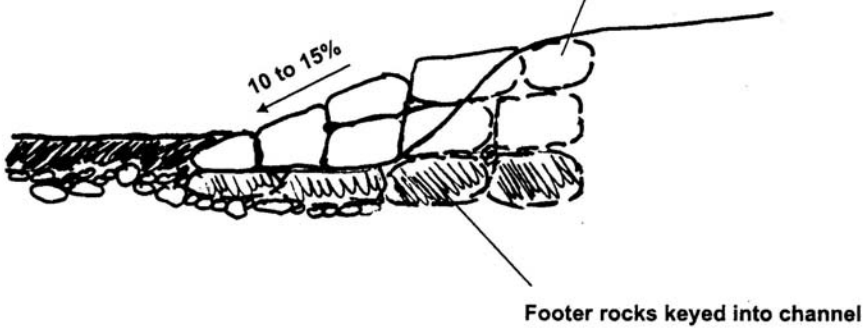
Appendix A – Best Management practices Typical Drawings

BMP #1 ROCK VANE TYPICAL
(NOT TO SCALE)

NOTES:
- Vanes are constructed along outside of meander and usually in series as needed to direct flow away from bank.
- The size of rock and length of structure need to be determined based on stream conditions.
- Plant woody species along bank, especially where rock is keyed in bank.

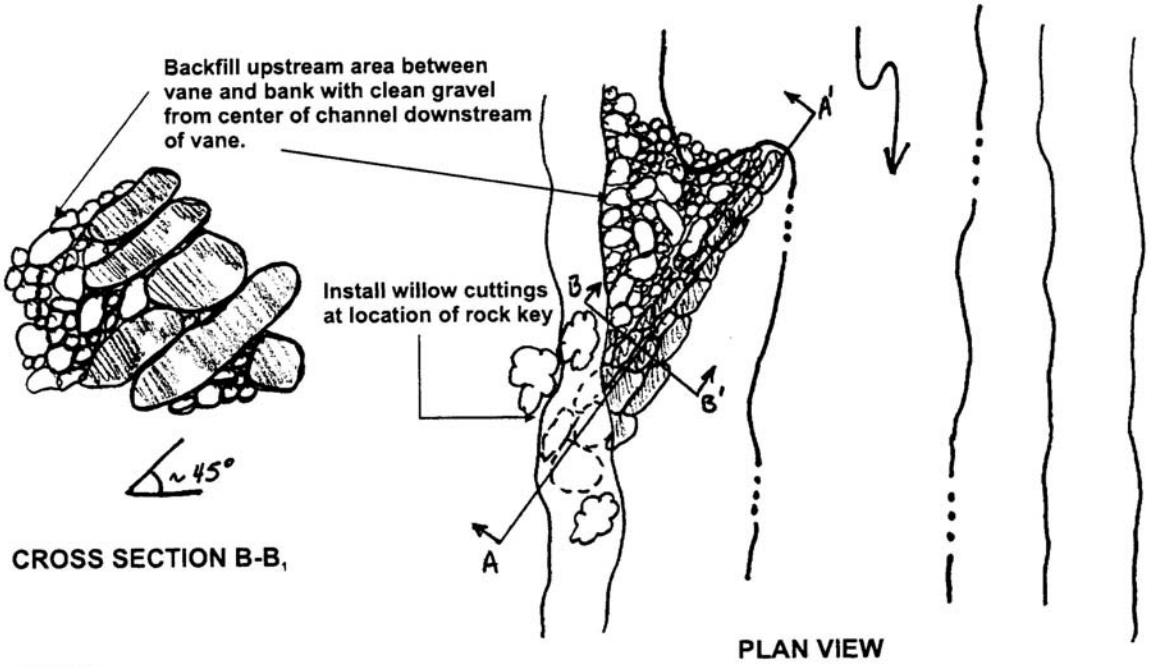


PLAN VIEW

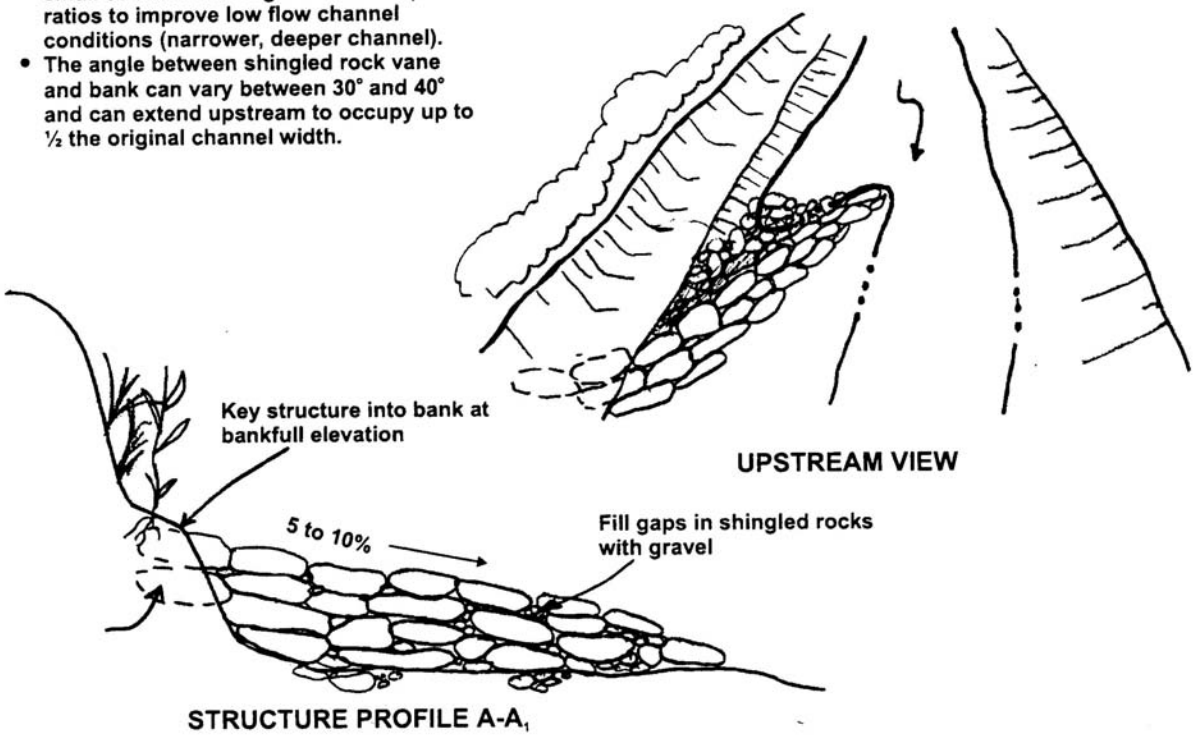


STRUCTURE PROFILE A-A$_1$

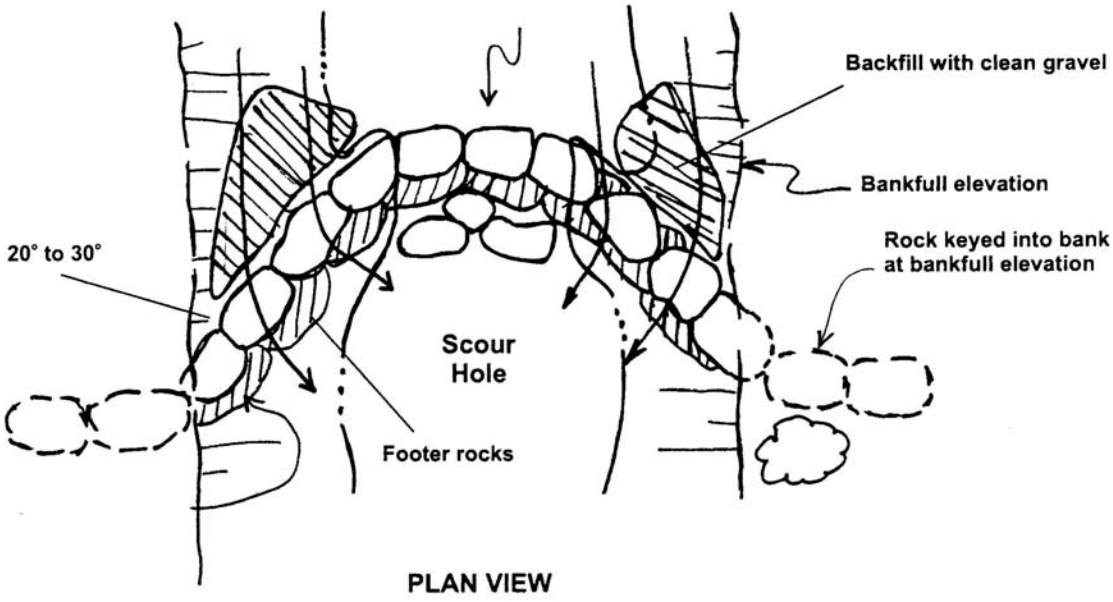
BMP #1A SHINGLED ROCK VANE TYPICAL
(NOT TO SCALE)



NOTES:
- This BMP can be installed manually on small streams with high width to depth ratios to improve low flow channel conditions (narrower, deeper channel).
- The angle between shingled rock vane and bank can vary between 30° and 40° and can extend upstream to occupy up to ½ the original channel width.



BMP #2 CROSS ROCK VANE TYPICAL
(NOT TO SCALE)

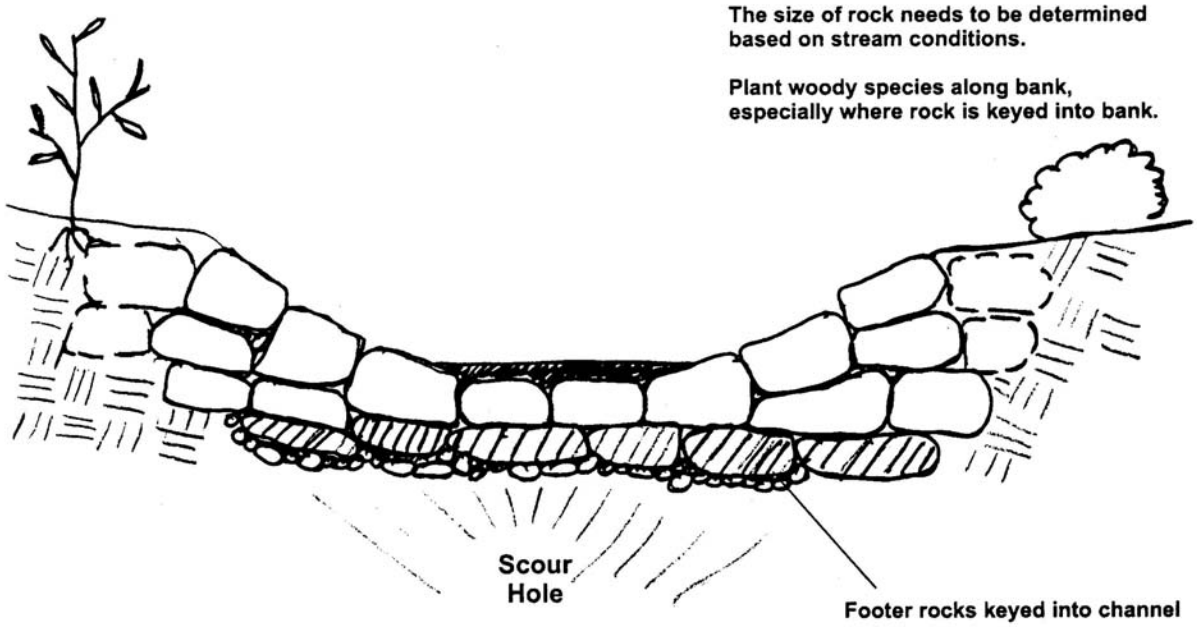


PLAN VIEW

Notes: Cross rock vanes are constructed on straight reaches and crossover reaches between meanders.

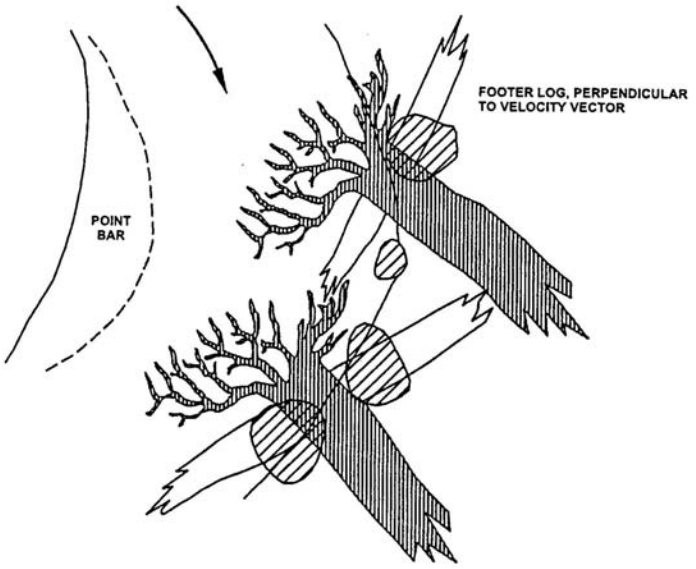
The size of rock needs to be determined based on stream conditions.

Plant woody species along bank, especially where rock is keyed into bank.

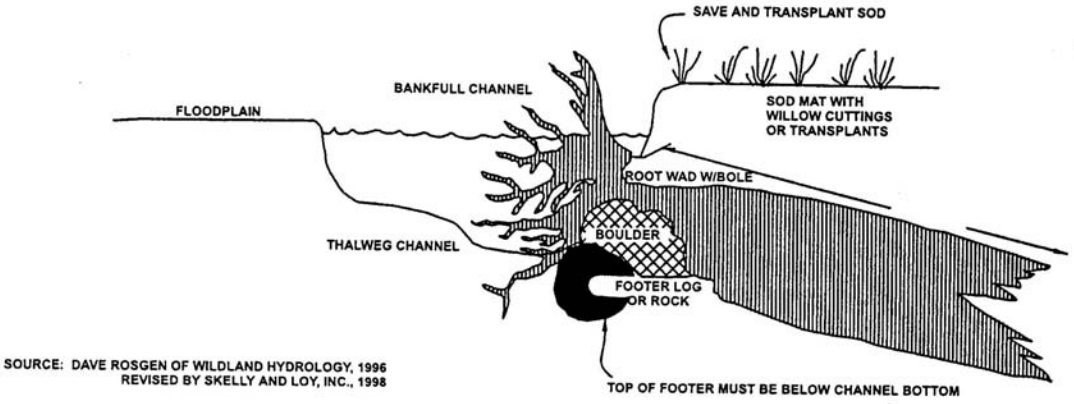


VIEW LOOKING UPSTREAM

BMP #3 ROOT WAD TYPICAL
(NOT TO SCALE)



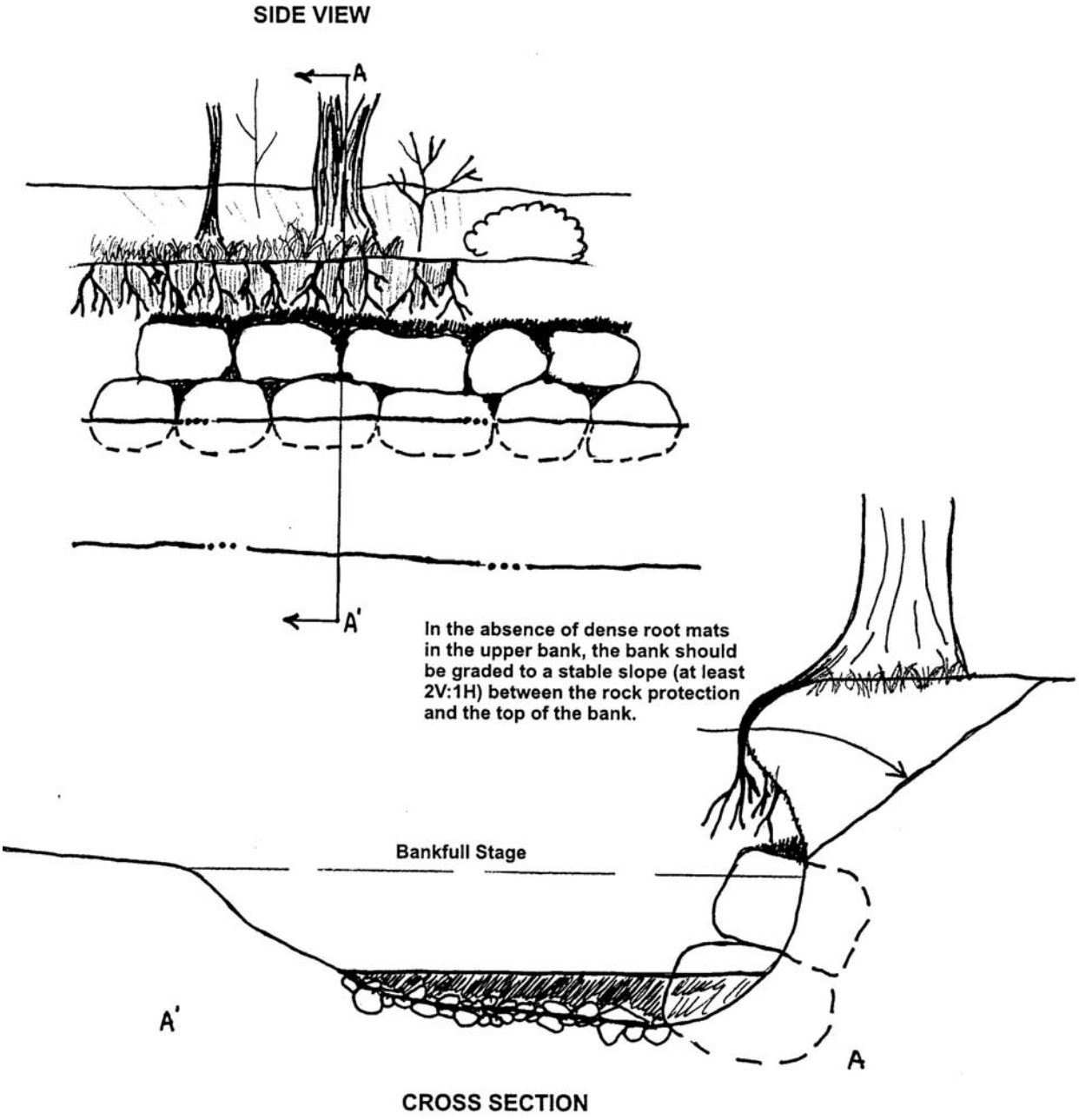
PLAN VIEW



SOURCE: DAVE ROSGEN OF WILDLAND HYDROLOGY, 1996
REVISED BY SKELLY AND LOY, INC., 1998

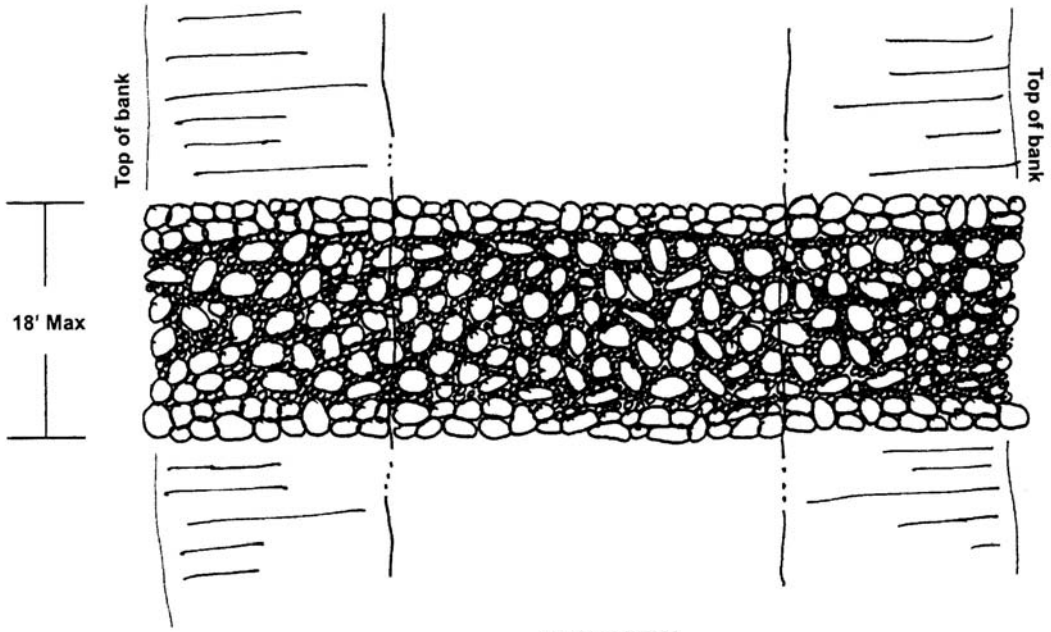
PROFILE

BMP #4 ROCK TOE PROTECTION/BANK GRADING TYPICAL
(NOT TO SCALE)

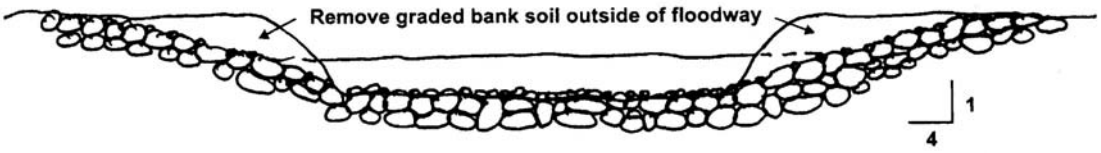


NOTES:
- Use large rock at least 2'x2'x2' for bank protection.
- Rock should be keyed into bank at least one-half the diameter of the rock.
- Rock should be placed so that each course overlaps joints between rocks.
- All voids between rocks should be backfilled with gravel on site.

BMP #5 AGRICULTURAL AND TEMPORARY STREAM CROSSING TYPICAL
(NOT TO SCALE)



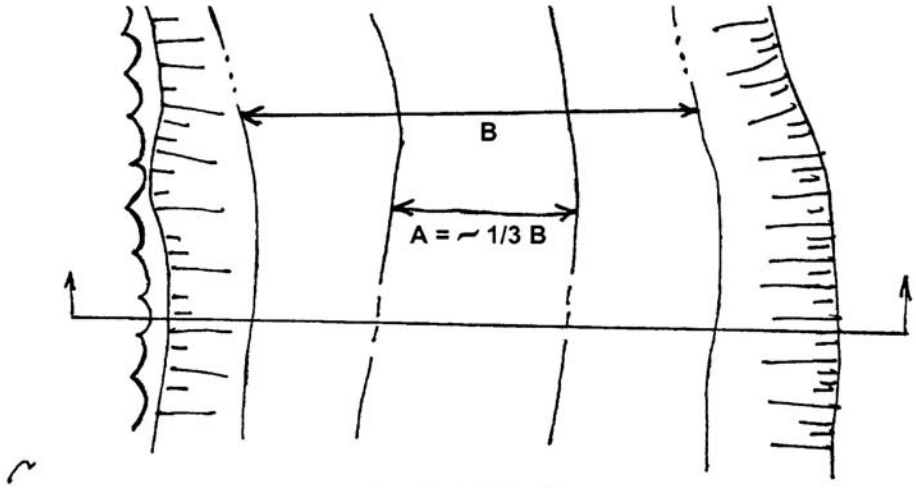
PLAN VIEW



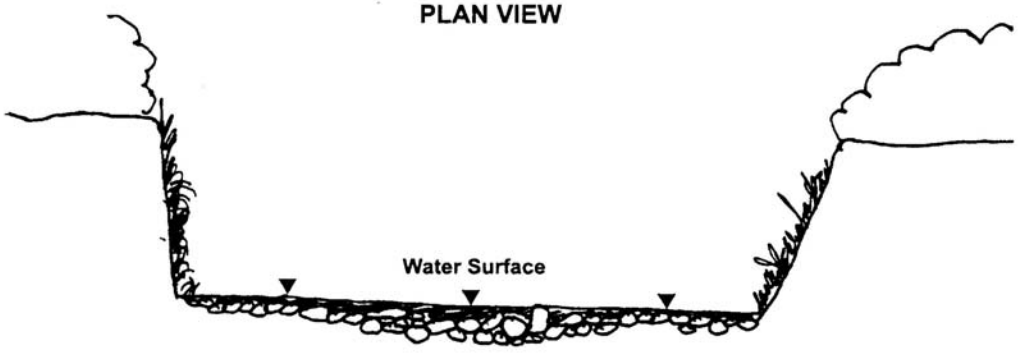
CROSS SECTION

NOTES:
- Crossings should be located along reaches where channel is straight and least entrenched.
- Spoil removed for bank grading or keying in stone across channel and ramps, should be placed outside of floodway.
- No. 4 or No. 5 stone should be used as a base up to a depth of 12 inches. No. 2 stone should be used on top of base to fill voids up to depth of 2 inches. The crossing should not be more than 4 inches above natural stream channel.
- For temporary crossings, stone should be removed along banks and should be distributed and/or worked into the stream bed to provide conditions similar to pre-construction conditions.

BMP #6 LOW FLOW CHANNEL MODIFICATION TYPICAL
(NOT TO SCALE)



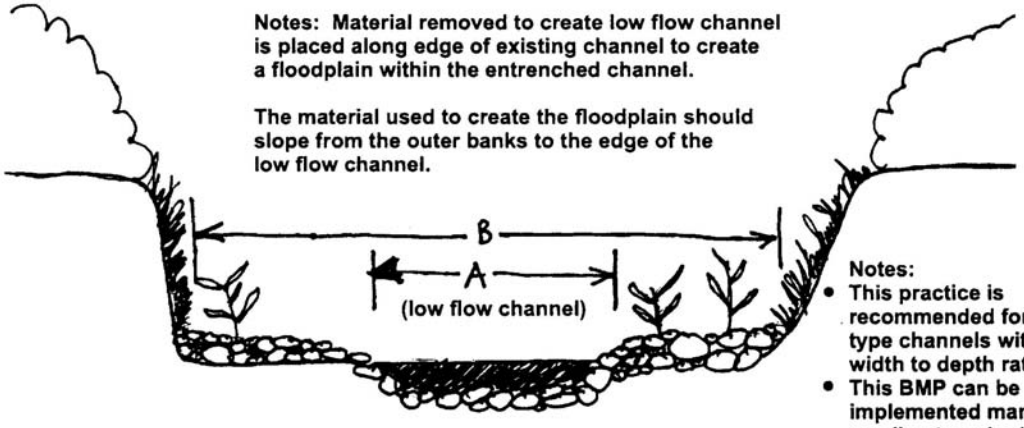
PLAN VIEW



CROSS SECTION (PRE-BMP)

Notes: Material removed to create low flow channel is placed along edge of existing channel to create a floodplain within the entrenched channel.

The material used to create the floodplain should slope from the outer banks to the edge of the low flow channel.

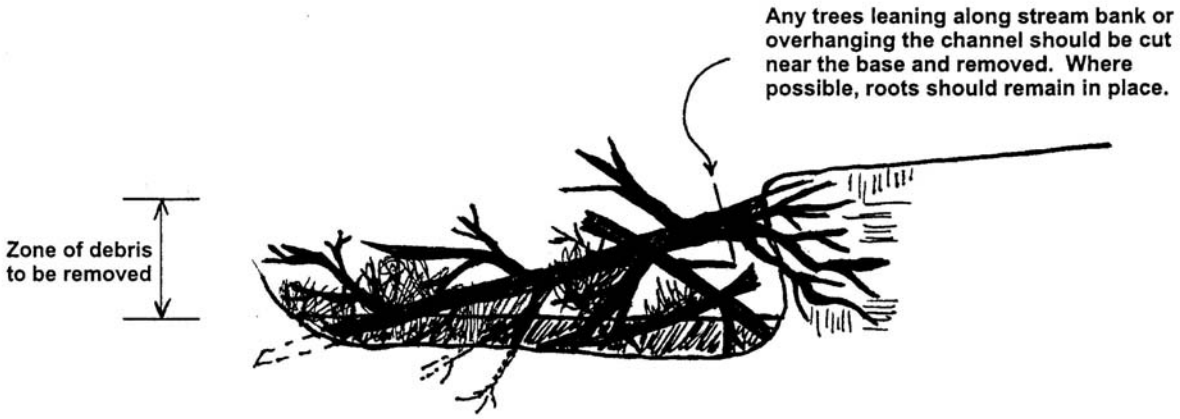


CROSS SECTION (POST-BMP)

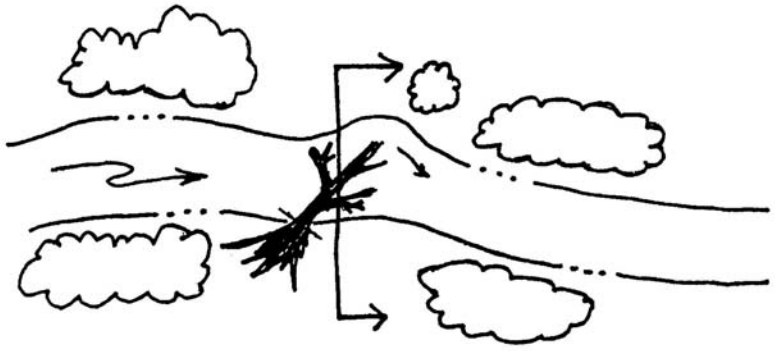
Notes:
- This practice is recommended for "F" type channels with high width to depth ratios.
- This BMP can be implemented manually on small entrenched streams and is effective in improving aquatic habitat.

BMP #7 DEBRIS JAM REMOVAL TYPICAL
(NOT TO SCALE)

NOTES:
- **Remove channel debris above base flow water level and dispose of outside the floodplain area.**
- **Large woody debris which is buried in substrate serves as a channel grade control and should remain in place.**
- **All root material in stream bank should remain in place.**



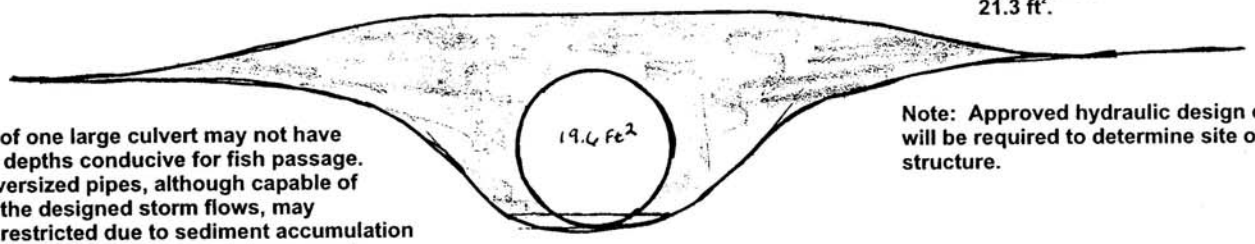
CROSS SECTION



PLAN VIEW

BMP #8 CULVERTED CROSSINGS TYPICAL
(NOT TO SCALE)

Example: The cross sectional area of a 5' diameter pipe (19.6 ft²) can be achieved by using (3) 3' diameter pipes at 7.1 ft² or 21.3 ft².

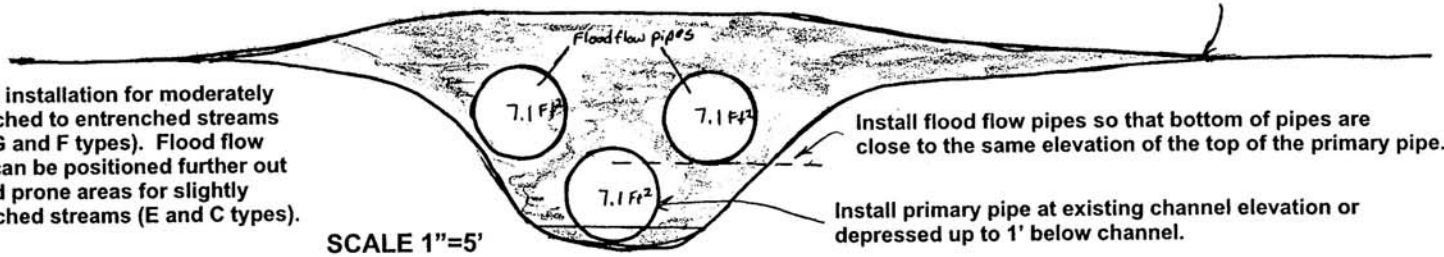


The use of one large culvert may not have low flow depths conducive for fish passage. These oversized pipes, although capable of passing the designed storm flows, may become restricted due to sediment accumulation from the smaller more frequent storm events.

Note: Approved hydraulic design calculations will be required to determine site of drainage structure.

X-SECTION
(SINGLE PIPE)
SCALE 1"=5'

The grade of the approach should be set slightly above the top of the flood flow pipes so that crossing will be restrict excess flows.



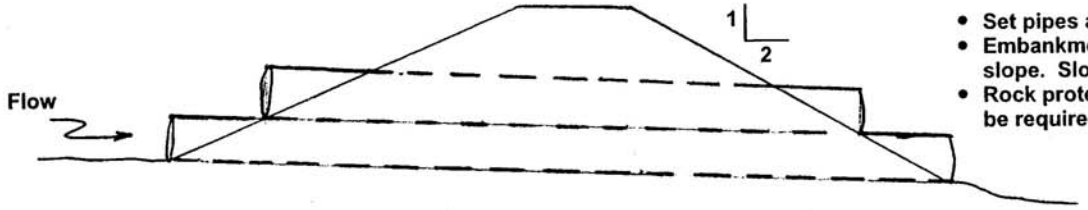
Typical installation for moderately entrenched to entrenched streams (A, B, G and F types). Flood flow pipes can be positioned further out in flood prone areas for slightly entrenched streams (E and C types).

Install flood flow pipes so that bottom of pipes are close to the same elevation of the top of the primary pipe.

Install primary pipe at existing channel elevation or depressed up to 1' below channel.

SCALE 1"=5'

X-SECTION (MULTIPLE PIPE)

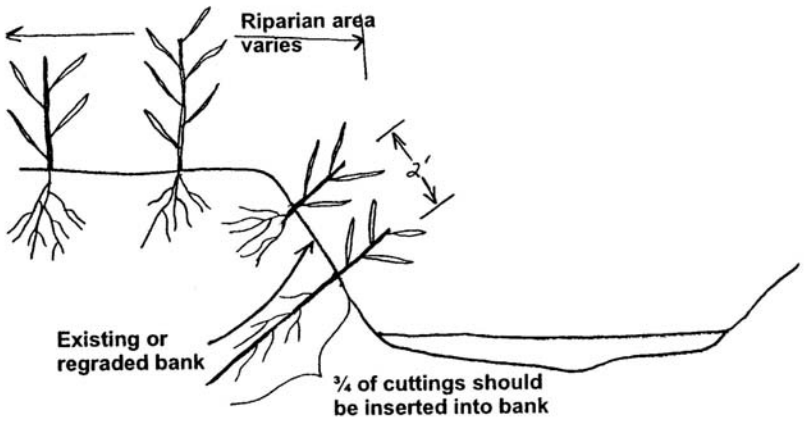


- Set pipes at pre-determined grade.
- Embankment should not exceed a 2:1 slope. Slopes less than 2:1 are preferred.
- Rock protection along embankment may be required with steeper slopes.

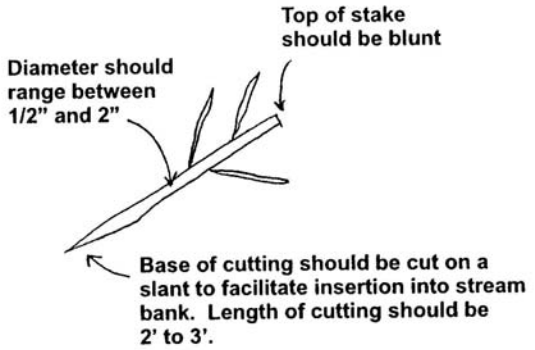
1"=10'
PROFILE

BMP #9 STREAM BANK FENCING TYPICAL
(NOT TO SCALE)

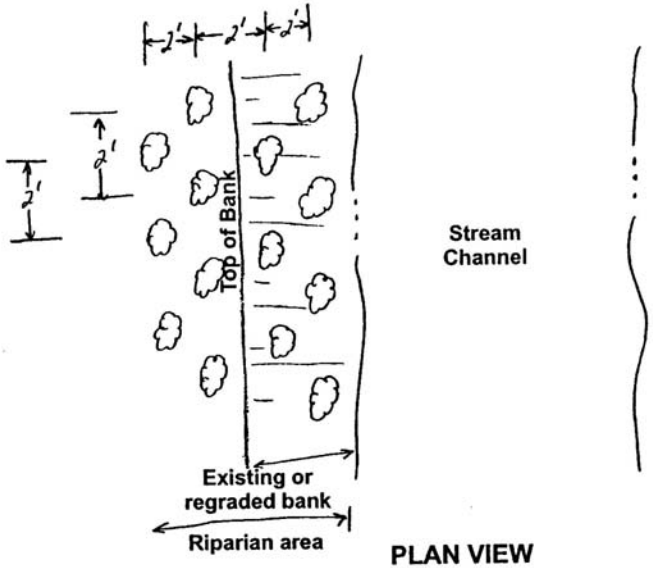
BMP #10 STREAM BANK REVEGETATION TYPICAL
(NOT TO SCALE)



X-SECTION



WILLOW STAKES



PLAN VIEW

NOTES:
- Place woody plants, cuttings or stakes as shown in horizontal rows.
- Plantings should be spaced at 2' intervals with a 1 foot offset between consecutive rows.
- Planting should take place during dormant season (November to March).

Recommended riparian woody species on stream bank:
- Willow (several species)
- Red osier dogwood
- Silky dogwood