RETREAT AT AMHERST

Intermittent Stream Crossing Evaluation

Crossing #1 (E) width is 10' +/-

14' x 4' open Bottom

STD #1 open Bottom Box Spans Stream – ✓

STD #2 N/A - No Embedment Req'd. ✓

STD #3 Crossing SPAN ✓

1.2 x 10' = 12' use 14'

STD #4 Substrate will match Existing ✓

STD #5 Matches water depth & Velocity of natural Stream ✓

STD #6 Openness

$\frac{4' \times 14'}{50} = 1.12' > 0.82'$ ✓

STD #7 MATCH BANK ON BOTH SIDES OF CROSSING ✓

## Crossing #2 (E) 5' wide

8' x 6' open bottom Box.

STD #1 open Bottom ✓

STD #2 N/A ✓

STD #3 Span
1.2 x 5 = 6.0
Use 8' ✓

STD #4 match Substrate ✓

STD #5 Matches water Depth & Velocity ✓

STD #6 Openness ratio

$\frac{8' \times 6'}{50} = 0.96' > 0.82'$ ✓

STD #7 Banks
Match Banks on Both sides of the Crossing ✓

Crossing #3 (E) 1.2' wide

24" culvert proposed

STD #1 open-bottom Not met ✗

STD #2 Embedment
Embed 25% or
6-inches into existing
Stream bed ✓

STD #3
1.2 x 1.2 = 1.44' < 2' ✓

STD #4 Substrate
Culvert to be embedded ✓
into existing Stream
bottom - substrate will
fill in bottom of culvert

STD #5 Once culvert bottom ✓
fills in the velocity
and depth will match
Natural

STD #6 Openness Ratio
24" = 3.142'/50' = 0.06 < 0.82' ✗ Not met
Stream very small would need
a 9ie" pipe to meet Standard
Not practical

STD #7 Banks - ✓
to Be matched

Crossing #4 (E) 3' wide

48" Culvert

STD #1 Open Bottom ✗ Not met

STD #2 Embed Culvert ✓
25% or 12 inches
into existing Streambed

STD #3 Span
1.2 x 3 = 3.6' use 4' ✓

STD #4 Substrate ✓
Culvert to be embedded
12" into existing channel.
Substrate will fill in
Culvert Bottom

STD #5 Once Culvert bottom ✓
fills in the velocity
and depth will
match natural
bottom

STD #6 Openness Ratio

48" = $\frac{12.567'}{50'}$ = 0.25' < 0.82' ✗ Not met.

Small stream would need a
96-inch Culvert to meet standard
Not Practical.

STD #7 Banks to be matched. ✓

CROSSING #5 (E) 8' channel.

12'x4' Open Bottom Box Culvert.

STD#1 Open Bottom Culvert ✓

STD#2 Embed N/A ✓

STD#3 Span

1.2 x 8 = 9.6' use 12' ✓

STD#4 SUBSTRATE

Open Bottom Culvert - Substrate to match Existing ✓

STD#5 Open Bottom Culvert velocity and depth to match Natural ✓

STD#6 Openness Ratio

12'x4'

$\frac{48'}{90'} = 0.96' > 0.82'$ ✓

STD#7 Banks to match ✓

# Crossing #6 (E) 2' wide
36" culvert

STD #1 Open Bottom Culvert — X Not met

STD #2 Embed Culvert ✓
25% or 9 inches
into existing Streambed

STD #3 Span ✓
1.2 x 2 = 2.4' use 3'

STD #4 SUBSTRATE ✓
Culvert to be embedded.
9" into existing Stream
Channel. Substrate will
fill in culvert bottom

STD #5 One Culvert bottom ✓
fills in the velocity
and depth will match
natural bottom

STD #6 Openness Ratio — X not met
$\frac{7.07'}{50'} = 0.14' < 0.82'$
Small stream would need
96-inch pipe to meet std.
Not practical ✓

STD #7 Banks will match ✓
existing

6. *Banks should be present on each side of the stream matching the horizontal profile of the existing stream and banks with sufficient headroom to provide dry passage for semi-aquatic and terrestrial wildlife*

   To prevent failure, all constructed banks should have a height-to-width ratio no greater than 1.5:1 (horizontal:vertical) unless the stream is naturally incised. Banks within the structure should generally align with the profile and cross section of banks upstream and downstream of the structure and should be stable during a 100-year storm event. The banks should be designed and constructed so as not to hinder wildlife use of the streambed and banks for passage.

## Standards Summary

| | General Standards | Optimal Standard |
|---|---|---|
| #1 Structure Type | Open-bottom span preferred | Bridge |
| #2 Embedment | If a culvert, then it should be embedded:<br>• A minimum of 2 feet for all culverts,<br>• A minimum of 2 feet and at least 25 percent for round pipe culverts<br>• When embedment material includes elements > 15 inches in diameter, embedment depths should be at least twice the $D_{84}$ of the embedment material | NA |
| #3 Crossing Span | Minimum: 1.2 x bankfull width | Minimum: 1.2 x bankfull width |
| #4 Substrate | Matches stream substrate | Matches stream substrate |
| #5 Water Depth & Velocity | Matches water depth & velocity in natural stream over a range of flows | Matches water depth & velocity in natural stream over a range of flows |
| #6 Openness (& height) | Openness: 0.82 ft. (0.25 m) | Conditions that inhibit wildlife passage over road<br>Openness: 2.46 ft. (0.75 m)<br>Height: 8 ft. (2.4 m)<br>Otherwise<br>Openness: 1.64 ft. (0.5 m)<br>Height: 6 ft. (1.8 m) |
| #7 Banks | • On both sides of the stream<br>• Match the horizontal profile of the existing stream and banks<br>• Constructed so as not to hinder use by riverine wildlife | • On both sides of the stream<br>• Match the horizontal profile of the existing stream and banks<br>• Constructed so as not to hinder use by wildlife<br>• Sufficient headroom for wildlife |