Example #1: Culvert Replacement Plan

EXISTING ARRANGEMENT
SCALE 1" = 10'

PROPOSED ARRANGEMENT
SCALE 1" = 10'

UPSTREAM ELEVATION

PROPOSED CULVERT REPLACEMENT
ROAD CROSSING

SHEET 3 OF 5
REvised: 07/10/08
Example #1: Culvert Replacement Plan

EXISTING ARRANGEMENT
SCALE 1" = 10'

PROPOSED ARRANGEMENT
SCALE 1" = 10'

DOWNSTREAM ELEVATION

PROPOSED CULVERT REPLACEMENT
ROAD CROSSING

SHEET 4 OF 5
REVISED: 07/10/08
Example #1: Culvert Replacement Plan

1. Two 6 inch diameter PVC wastewater force mains from the Cresap Bay Park cross the fill above the existing culverts. Only one of the pipes is in service at any one time, the other thought to be standing by for emergency service in case of pipeline failure. The horizontal and vertical location of these pipes is not known. Before construction of the culvert replacement begins, these pipes will be located and a temporary diversion consisting of one flexible hose bypass will be installed. The bypass will be downstream of the project work, and cross the stream channel over a temporary wooden bridge.

2. Silt fences will be erected both upstream and downstream of the work site. The fences will be continuous across the lowest existing culvert until the excavation reaches that point where the lower culvert must be removed and the excavation extended below the present channel bottom to receive the counterstream culvert.

3. Fill and bank material removed to place the new, multi-plate arch culvert will be temporarily stockpiled on the property in the vicinity of the wastewater drainfields serving the project. The haul road will be the existing access road to the drain field. The haul distance will be approximately 700 feet.

4. All the suitable material referenced in 3) will be used as backfill over the new culvert. Any excess occasioned by replacement of the existing culverts with one of larger displacement will be consumed by raising the grade of the crossing.

5. The completed crossing fill will be stabilized against erosion. A mix of perennial grass and forbs will be established after construction activities cease.

6. When the work is likely to obstruct the water course or when the work risks disruption of the channel within the work site, stream diversion will be accomplished by pumping streamflow around the project. A sandbag diversion dam will be constructed 25 to 50 feet upstream of the existing culvert entrance. Just upstream of the diversion dam a 300-gallon round-end stock tank, 2 feet high x 3 feet wide x 6 feet long will be partially buried in the channel bottom. Two sump pumps, each capable of pumping normal, late summer flows estimated to be 100 cpm, 0.22 cfs will be set in the tank. The two pumps will be coupled to separate hoses that will discharge downstream of the work site. The top of the tank will be covered with a fish screen. The screen will be made of 4 mesh wire cloth composed of 14ga. wire. There will be three removable sections so the screen can be reversed for cleaning.

Erosion Control & Water Diversion Plan

Proposed Culvert Replacement

Road Crossing

Revised 01/10/15
Revised 01/10/08
Revised 01/01/08
The existing 48" diameter culvert, which will be replaced with a stream simulation 144"x68' aluminized steel pipe. The culvert will be buried and filled 50% and installed on a grade of 8.9%. Rock bands consisting of 16"+ diameter rock will be installed within the culvert. Please see the attached plans for details.

During the installation of the pipe the stream flow will be pumped or diverted around the construction site. All exposed banks will be strawed and grass seeded upon completion of the project in a manner that will prevent delivery of sediment to the stream.

The rock pit for this project is shown as [redacted] on the attached map.

The waste site is marked “Waste Site” on the attached map and is flagged on the ground with pink flagging and painted “WA”.

If you have any questions or concerns pertaining to this project please don’t hesitate to contact me.
EXISTING 18" CULVERTS

144' x 6' ASP @ 8.9% - BURIED 50%
(SEE DETAIL SHEET 4)

PROJECT LOCATION
LATITUDE: N 46.88750°
LONGITUDE: W 122.11333°

INDEX TO SHEETS
SITE OVERVIEW 1
PLAN VIEW 2
PROFILE VIEWS 3
CULVERT DETAIL 4
STAKE-OUT DETAIL 5

NOTE: VERTICAL AND HORIZONTAL CONTROL BY SCHINNELL & ASSOCIATES. MERIDIAN ASSUMED: ELEVATION APPROXIMATED FROM GPS.

CULVERT REPLACEMENT

APRIL 27, 2011
8-9-2012

SCALE 1" = 40'

Example #2: Culvert Replacement Plan
Example #2: Culvert Replacement Plan

- **144" x 68' ASP @ 8.9% - BURIED 50%** (SEE DETAIL SHEET 4)
- **EXISTING ROADWAY**
- **MACHINE-PLACED MEDIUM RIP-RAP AT INLET AND ALONG STREAM B**
- **DIVERT STREAMFLOW THROUGH BYPASS CULVERT**
- **REvised ROAD (18" @ FILL)**
- **REVISED CHANNEL**

**PLAN VIEW**
GENERAL CONSTRUCTION NOTES

1) IF REQUIRED, STREAMFLOW SHALL BE ISOLATED FROM ACTIVE WORK AREA THROUGH RELOCATION INTO BYPASS CULVERT SIMILARLY TO AS SHOWN ON PLAN VIEW. NO BYPASS WILL BE NECESSARY IF CHANNEL IS DRY DURING OPERATIONS.

2) 144" x 68" REPLACEMENT CULVERT SHALL BE BURIED 50% AND PLACED ON A GRADIENT OF 8.9%. BACKFILL MATERIAL SHALL BE STREAMBED GRAVELS (MAXIMUM SIZE = 12") TO BE OBTAINED FROM SOURCE(S) BANDS AS SHOWN ON DETAIL SHEET 4.

3) ROAD WIDTH THROUGH FILL SECTION TO BE 14-FEET PLUS 2-FEET CURVE WIDENING. SURFACE SHALL BE CROWNED AT 3%. FILLSLOPES SHALL NOT EXCEED 1:1.

4) MEDIUM RIP-RAP (16") TO BE MACHINE-PLACED AT INLET AS DIRECTED. RIP-RAP AT INLET TO BE PLACED AT LEAST 24-INCHES BELOW CHANNEL ELEVATION.

5) REFER TO DETAIL SHEET 4 FOR ADDITIONAL CULVERT BACKFILL DETAILS.
GENERAL CONSTRUCTION NOTES

1) ROCK "BANDS" WITHIN CULVERT MAY BE ANGULAR ROCK, AT LEAST 12" IN SIZE. BANDS SHALL BE SPACED 12± FEET APART, 8 TO 10 FEET FROM ENDS AND EXTEND TO WITHIN 12" OF STREAM SURFACE. BOTTOM 42± INCHES OF CULVERT SHALL BE BEDDED WITH RIP-RAP AND TOPPED WITH "FISH-MIX" GRAVELS.

2) STREAMBED MATERIAL FOR "FISH-MIX" GRAVELS SHALL BE NATIVE MATERIAL OF MIXED SIZING UP TO D100 (12") FROM SOURCE.

3) CREATE THALWEG INSIDE CULVERT BY USE OF JUMPING-JACK COMPACTOR.

4) ROAD BASE SHALL BE 18 FEET WIDE OVER CULVERT; SURFACE SHALL BE CROWNED AT 3%; FILLSLOPES SHALL NOT EXCEED 1½:1.

5) MEDIUM (16") RIP-RAP TO BE MACHINE-PLACED AT INLET AS DIRECTED. RIP-RAP AT INLET TO BE BURIED AT LEAST 24" BELOW CHANNEL BED AS SHOWN.
Example #3: Culvert Replacement Plan

Site Plan

Stream Profile

Scale: 1" = 50'

Site Overview

Proposed Culvert

Ex. Culvert to Remove

 designer: 

 Date: 5/15/13

Job No.

Sheet 2/5

Example #3: Culvert Replacement Plan
Example #3: Culvert Replacement Plan

REMOVE 48" CULVERT

INSTALL CULVERT: 96" X 52'

PV = 498.10  
PV STA = 11+39.84  
K = 8.41

11+39.48 CULVERT 96" X 52" OMP: IE=485.96

SCALE: 
HOR: 1" = 20'  
VER: 1" = 20'

DESIGNER:  
DATE: 5/15/13

JOB NO. 13.29.07  
SHEET 3

BY DATE REVISIONS FOR
Example #3: Culvert Replacement Plan
**Example #4: Culvert Plan**

- Benchmark 1
- Light Loose Rip Rap applied to embankment slopes
- Ex. road edge & shoulder
- Benchmark 2
- Pt 155
- Pt 151
- Ex. Side channel to be filled in.
- Benchmark 3

**Benchmark Information**

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>HD (ft)</th>
<th>VD (ft)</th>
<th>Az</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM 1</td>
<td>Inlet</td>
<td>33.40</td>
<td>-14.24</td>
<td>113°</td>
</tr>
<tr>
<td>BM 2</td>
<td>PT 151</td>
<td>13.70</td>
<td>-5.03</td>
<td>135°</td>
</tr>
<tr>
<td>BM 2</td>
<td>PT 155</td>
<td>20.00</td>
<td>-5.87</td>
<td>240°</td>
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<tr>
<td>BM 3</td>
<td>Outlet</td>
<td>29.00</td>
<td>-10.08</td>
<td>29°</td>
</tr>
</tbody>
</table>

BM 1 is a spike in a 23° DF Tree
BM 2 is a spike in a 22° DF Tree
BM 3 is a spike in a 22° DF Tree

0° declination

*Station 11+55
*Station 12+01
*Station 12+48
*Station 12+95
*Station 14+18
*Station 14+62
*Station 13+35

Date: 20 December 2011
Sheet 1 of 3
PROFILE - CENTERLINE OF CULVERT

Armor fill at inlet & outlet w/ Light Loose Rip Rap.
Armoring shall extend from 2 ft. below stream grade to top of culvert.

Finished EL of road @ Road CL above culvert = 103.24
Ex. EL @ RCL above pipe = 98.58

Ex. Conditions

Ex. 36" Culvert to be removed.
Ex. 30" Culvert not shown for clarity.

A) Construct stream channel from point 151 to point 155 according to CHANNEL CONSTRUCTION CROSS SECTION. Also fill in approx. 40 feet of old channel from point 151 to new culvert inlet. Apply 2 Foot Minus Engineered Streambed Material to a depth of 2 feet if existing material is unsuitable.

B) Extend 2 Foot Minus Engineered Streambed Material to excavation Extents.

C) 3 Inch Crushed Rock applied to a compacted depth of 6 inches over excavation extents.

D) Select Borrow backfill material.

E) 3 Inch Crushed Rock Pipe Bedding

Note:
1) Crown at centerline not shown
2) Culvert Dimensions:
   - 132" x 59", 3" x 1" or 5" x 1" corrugations
   - 10 gauge aluminized steel
3) Culvert lay = Approx. 8 %
4) Culvert AZ = 8.3" (Outlet to Inlet)
Example #4: Culvert Plan

CULVERT CROSS SECTION - CENTERLINE OF ROAD LOOKING DOWNSTREAM

Finished EL of road @ Road CL above culvert = 103.24

Design Road Profile

Excavation Extents (approx.)

3 Inch Crushed Rock
Engineered Streambed Material

2 Foot Minus Culvert bedding

Ex. 36" culvert

3.35

1.00

Note:
1) Begin fill @ Sta. 12+95.
2) End fill @ Sta. 14+18.
3) Grade from Sta. 12+95 to Sta. 13+35 = +4.0%
4) Grade from Sta. 13+35 to Sta. 14+18 = -9.4%

Date: 20 December 2011
Sheet 3 of 3

1 inch - 30 feet
Example #5: Culvert Removal and Bridge Installation
Plan
Example #5: Culvert Removal and Bridge Installation

Plan
Example #5: Culvert Removal and Bridge Installation

Plan

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**Legend**

- Existing Thalweg
- Proposed Thalweg

---

**Contactor Designed Bridge**
10' Clear Lane
64' Clear Span

**Existing Culvert (To Be Removed)**

**Approximate 100-Year**

**Approximate 2-Year**

**Match Existing STA. 11+16 ELEV. 982.3**

**Roughened Step Pool Channel**
Overall Gradient ~11%
Grade to Mimic Natural Conditions

**Match Existing STA. 10+40 ELEV. 974.0**

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**Sheet Design**

- Date: 09/11/2012
- Designed By:
- Drawn By:
- Checked By:

---

**Overall Gradient ~11%**

**Grade to Mimic Natural Conditions**
Example #6: Hand-Drawn Culvert Plan

**Plan View**
- **BM2 = 100.0**
- **Inlet**
- **70° skew shown**
- **Choose best fit in field**

**Stream Profile View**
- **BM2 = 100.00**
- **Outlet**
- **18 x 18 pipe arch**
- **No-slope culvert**
- **Set culvert flat**

**Existing Creek & Road Profile**
- **103.9**
- **10 ft**
- **1.5:1**

**Notes:**
- **NOT TO SCALE**
Example #6: Hand-Drawn Culvert Plan

**Culvert Section**

- **Final Road Elevation**
  - Min. = 3.5 ft

- **Pipe Arcl**
  - 117" x 79"

**Outlet**
- C.S. = 20' (26%)

**Inlet**
- C.S. = 26' (31%)

**Wall Elevation**

**Wculvebed = 110 in.**

**Area Calculations**

- \( A_{\text{req}} = 28.5 \text{ ft}^2 \)
  - by physical meas. 
  \( \frac{(W_1 + W_2) \times BFD}{2} = A_{\text{req}} \)
  - \( \left( \frac{7'}{4} + \frac{12'}{10} \right) \times 1.5' = 28.5 \text{ ft}^2 \)

- \( A_{\text{bed}} = (1 - 0.53) \left( 7' \times 7' \text{ ft}^2 \right) = 35.7 \text{ ft}^2 \)

**Bankful Width**

- BFW = 7.0 FT

**Wculvebed = 9.2 FT**

- BFW = 7 FT