

Culvert Treatment, Installation and Maintenance Short Course Resource List

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	Topic	Resource
1	Introduction: what is a culvert?	Use this video to train your staff, residents, or board members (20 minutes total length) Available: https://www.youtube.com/watch?v=foWTqL99zYQ
2	Culvert theory and design (module 2) Basic hydrology and flow calculations; geotech considerations; structural needs and cover. Culvert shapes and materials; inlet and outlet shapes. Debris, ice and safety; economics and availability Aquatic species and animals	Historical peak flow rates can be found for your region here: https://waterdata.usgs.gov/nwis/sw https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=mn Guidance for culvert shapes, materials and installation best practices can be found in Chapter 2 of the MnDOT Drainage Manual: https://www.dot.state.mn.us/bridge/hydraulics/drainagemanual.html See attached Table 5 for additional information http://www.lakesuperiorstreams.org/stormwater/toolkit/contractor/resources/ditchguide_seagrant.pdf

3	<p>Culvert installation and planning (module 3) Timing and control of water flow; Permits Safety: work zone, utilities and excavation</p>	<p>Permitting information can be found on the MN DNR web site: https://www.dnr.state.mn.us/permits/index.html</p> <p>Minnesota Board of Water and Soil Resources web site: https://bwsr.state.mn.us/</p> <p>US Army Corps of Engineers: https://www.usace.army.mil/</p> <p>MnDOT: https://www.dot.state.mn.us/</p> <p>Environmental Protection Agency: https://www.epa.gov/</p> <p>MN State Historic Preservation Office: https://mn.gov/admin/shpo/</p> <p>US Departments of Agriculture Natural Resources Conservation Service: https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/</p> <p>US Fish and Wildlife Service: https://www.fws.gov/</p> <p>Safety guidance is available in many places, including these fact sheets: https://www.osha.gov/pls/publications/publication.athruz?pType=Types&pID=2</p>
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4	<p>Typical open cut installations (module 4) Trench components, erosion and sedimentation control, handling and stockpiling pipe materials. Trench safety and final restoration</p>	<p>These MnDOT Standard Plates provide guidance on how to install bedding beneath reinforced concrete pipes, and how to install riprap at the ends: https://standardplates.dot.state.mn.us/</p> <p>These MnDOT Standard Plans provide guidance on general Erosion control methods and best practices: https://www.pca.state.mn.us/water/minnesotas-stormwater-manual</p>
5	<p>Other installation and rehabilitation methods (module 5) Trenchless installation, culvert rehabilitation methods</p>	<p>Source: https://www.researchgate.net/publication/245561426_Framework_for_Inspection_Maintenance_and_Replacement_of_Corrugated_Steel_Culvert_Pipes</p>
6	<p>Inspection and maintenance (module 6) Culvert deficiencies and inspection schedule What to look for? Causes of culvert deterioration; culvert repairs and maintenance</p>	<p>MnDOT's "Culvert Repair Best Practices, Specifications and Special Provisions – Best Practices Guidelines" Published January 2014: http://www.dot.state.mn.us/research/TS/2014/201401.pdf</p>

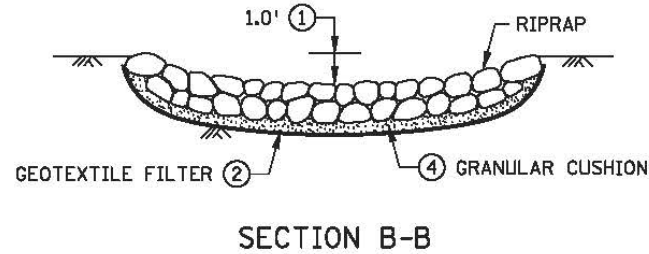
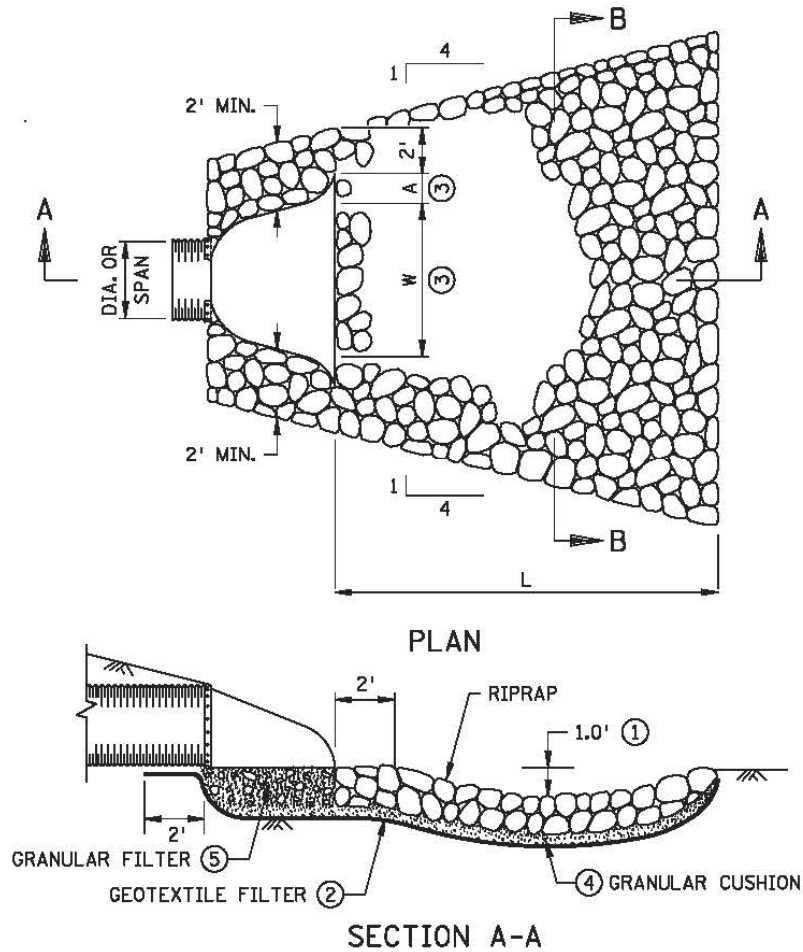
Table 5: Comparison of Common Culvert Materials

	Galvanized Steel - corrugated	Aluminized Steel - corrugated	Aluminum Alloy - corrugated	Plastic (HDPE)	Concrete
Cost (material, transportation, installation)	\$	\$	\$\$	\$\$	\$\$\$
Lifespan* (years)	20 - 30	75 +	25 - 30	25 - 50	50 - 100
Shorter lifespan when always wet (ex. wetlands)	X				
Ideal pH range	5.5 - 8.5	5.0 - 9.0	4.5 - 9.0	All	5.0 - 9.0
Bog Compatible (pH: 3 - 5)			X	X	
Fen Compatible (pH: 5 - 8)	>5.5	X	X	X	X
Swamp Compatible (pH: 7 - 8)	X	X	X	X	X
Light weight	X	X	X	X	
Easy to install	X	X	X	X	
Readily available	X			Not in larger sizes	Not in all areas
Smooth surface (good for heavy water flow)				X	X
Resistant to abrasion and corrosion		X	X	X	X
Easily punctured during backfill			X	Use granular backfill and handle carefully	
Salt resistant		X	X	X	
Notes		Susceptible to corrosion if coating is compromised	Minimum of 1 ft cover and proper backfill methods. Do not use for centerline culvert		

* Can vary widely depending on many factors such as acidity of soil, abrasive conditions, and installation practices

Source: http://www.lakesuperiorstreams.org/stormwater/toolkit/contractor/resources/ditchguide_seagrant.pdf

Figure 1. MnDOT Standard Rip Rap installation detail:



NOTES:

- REQUIREMENTS FOR GEOTEXTILE TYPE, RIPRAP SIZE AND THICKNESS SHALL BE DESIGNATED IN THE PLANS.
- PIPE SIZES LARGER THAN THOSE SHOWN REQUIRE A SPECIAL DESIGN.
- ① FOR PIPES GREATER THAN OR EQUAL TO 30", USE 1.5'.
- ② GEOTEXTILE FILTER, SPEC. 3733, SHALL COVER THE BOTTOM AND SIDES OF THE AREA EXCAVATED FOR THE RIPRAP, GRANULAR FILTER MATERIALS.
- ③ DIMENSIONS W AND A ARE GIVEN ON STANDARD PLATES 3122 AND 3123.
- ④ GRANULAR FILTER, SPEC. 3601, MAY BE USED AS A CUSHION LAYER. PLACE FILTER PER SPEC. 2511. THE CUSHION LAYER IS INCIDENTAL.
- ⑤ GRANULAR FILTER OR RIPRAP, SPEC. 3601, TO EXTEND UNDER ENTIRE OPEN PORTION OF PIPE APRON. DEPTH OF MATERIAL UNDER APRON SHALL MATCH RIPRAP DEPTH. WHEN USING RIPRAP INCREASE RIPRAP QUANTITY ACCORDINGLY AND PLACE A 3" LAYER OF 1.5" CRUSHED ROCK UNDER THE APRON TO AID IN GRADING FOR APRON PLACEMENT. CRUSHED ROCK IS INCIDENTAL.