Conservation and Management Plan for a Tributary on the VT Animal and Poultry Sciences Farm

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Biological Systems Engineering

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Purpose

To utilize conservation strategies and best management practices to reduce the nonpoint source pollution entering the tributary and minimize the effects of the surrounding cattle on the stream.

The tributary with high turbidity after a heavy snowmelt.

Background

The unnamed tributary at the Animal and Poultry Sciences Farm drains into Stroubles Creek, an impaired waterway on the Virginia State 303(d) list. The tributary suffers extreme sediment pollution from cattle walking near and through the stream. The cattle strip the area of vegetation, damage the stream bank, and compact the soil, contributing to severe erosion. In addition, their fecal matter enters the stream and adds nitrogen, phosphorous and bacterial pollution[1].

Cattle movement kills vegetation, erodes soil, and destabilizes channel morphology.

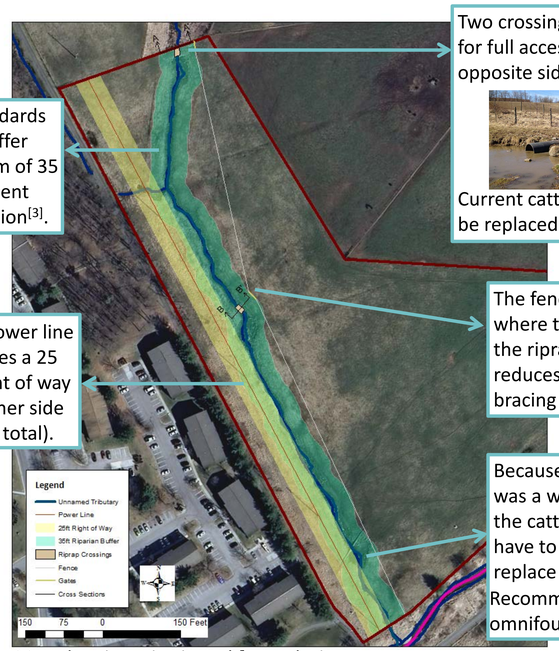
Project Site Characteristics	
Watershed Area (ac.)	259
Tributary Length (ft.)	4397
Total Watershed Slope (%)	2.4
Area of Pasture (ac.)	15
Length of Tributary within Pasture (ft.)	1362

At the confluence of Stroubles Creek and the tributary, a high sediment load discharges into Stroubles.

As part of the Stroubles Creek TMDL implementation, a conservation plan was created to reduce pollution in the unnamed tributary. The plan includes the following components:

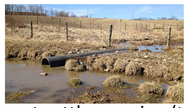
- Establishment of a Riparian Forest Buffer
- Cattle Exclusion Fencing
- Riprap Crossings (to allow access to the other side of the tributary)

The Riparian Buffer and Exclusion Fencing

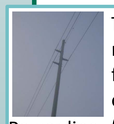


NRCS practice standards dictate that the buffer must be a minimum of 35 ft. to reduce sediment and nutrient pollution[3].

Two crossings are necessary for full access to the opposite side of the stream.



Current cattle crossing (to be replaced by riprap).



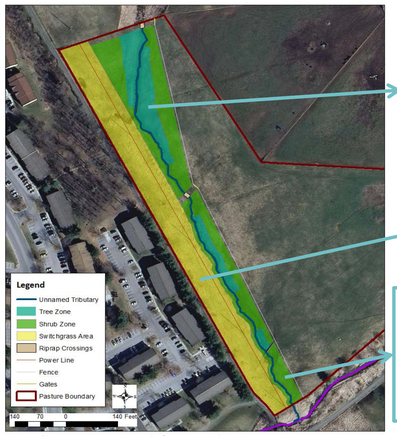
Power line.

The power line requires a 25 ft. right of way on either side (50 ft. total).

The fence may only bend where there are gates at the riprap locations. This reduces cost by reducing bracing posts.

Because the tributary was a water source for the cattle, a waterer will have to be purchased to replace this. Recommended omnifount waterer[5].

Map showing criteria and fence design.



Final riparian and fence design map.

Tree zone: contains Red Maple, Pin Oak, Sycamore and Canada Serviceberry. Trees to be planted 10 ft. on center. Trees assist in reducing elevated water temperatures by providing shade[2]. All vegetation was selected to be native riparian species.

Switchgrass: To be planted in the power line right of way and on its west side.

Shrub zone: contains Spicebush, Arrowwood Viburnum and Black Huckleberry. Shrubs to be planted 5 ft. on center. Vegetation aids in sedimentation by reducing water runoff velocity. It also aids in nutrient uptake[2].

A native wetland mix will be planted to create a vegetated understory and provide more species diversity. A 5 ft. gap will separate the riparian buffer from the fence. This will reduce insect-cattle contact and cattle congregation beneath areas of shade. Along with reducing pollution, the buffer will provide wildlife habitat.

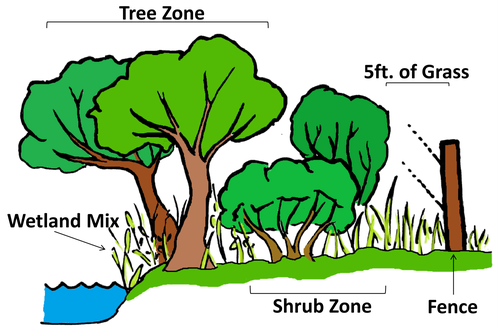
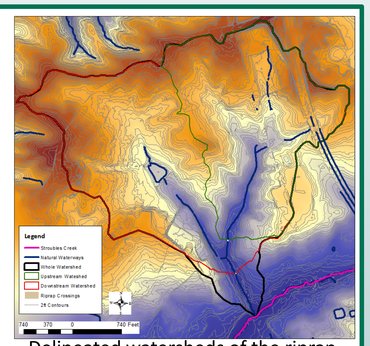


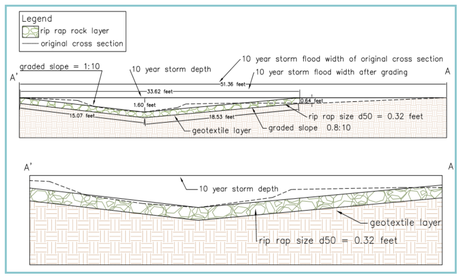
Illustration of the riparian buffer.

Riprap Crossing Design

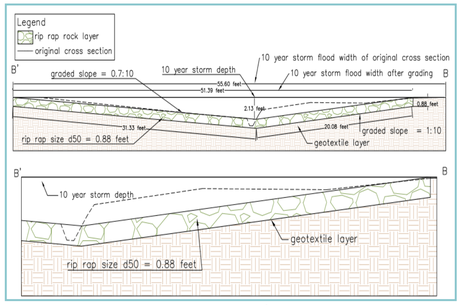
Two crossings were designed to be constructed across the tributary: one to allow for tractor access (for maintenance beneath the power line) and the other for tractor access and also cattle herding through the pasture's back gate. Riprap was chosen because it is an inexpensive crossing of low impact to the stream. Cross sections were found by laser level survey, and watersheds were delineated using GIS software.



Delineated watersheds of the riprap crossings and total tributary using 2 ft. contours.



Upstream riprap crossing design.



Downstream riprap crossing design.

Surveying the site.

The peak storm flow was calculated at both locations for 2, 5 and 10 year storm events. The diameter of the rock for the riprap was chosen to ensure the rocks remain stationary in a 10 year storm event. This rock size determined the thickness of the crossing and the needed geotextile base material. The NRCS Stream Crossing Practice Standard was followed throughout the design process[4]

Cost Analysis

The materials budget is $11,300. Manual labor will match the budget in unpaid volunteer hours.

Material	Quantity	Unit Cost ($)	Total Cost ($)
Fence (ft.)	1152	4	4608
Gates (ea.)	2	100	200
Ritchie Omni 5 Waterer	1	900	900
Waterer Platform (ea.)	1	100	100
Vegetation (ea.)	2625	1	2625
Upland Wetland Mix (lbs.)	29.7	30	891
Herbicide (ac.)	3.99	17	67.83
Switchgrass (ac.)	2	25	50
Riprap (tons)	18.6	16	297.6
Geotextile (15 by 360 ft. roll)	1	369	369
		Total Materials Cost	*$10,112.00*

References

Belsky, A. J., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. Journal of Soil and Water Conservation Vol 54: 419-431.

Gumbert, Amanda A., Steve Higgens, and Carmen Agouridis. "Riparian Buffers: A Livestock Best Management Practice for Protecting Water Quality." *University of Kentucky*. University of Kentucky: College of Agriculture. 2009.

NRCS Conservation Practice Standard: Riparian Forest Buffer. 391. USDA NRCS.

NRCS Conservation Practice Standard: Stream Crossing. 578. USDA NRCS.

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