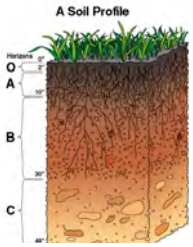

United States Department of Agriculture
NATURAL RESOURCES CONSERVATION SERVICE
No. 100.2 Erosion Control
Agronomy Technical Note MT-90
January 2009

ECOLOGICAL SCIENCES—AGRONOMY TECHNICAL NOTE

Using RUSLE2 for the Design of Vegetative Filter Strips (VFS) For Sediment Control in Montana

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The following provides basic instructions for using the Revised Universal Soil Loss Equation (RUSLE2) in the design of vegetative filter strips for control of sediment. In Montana, this method is required in designing vegetative filter strips to trap sediment in field runoff as detailed in the Filter Strip (Code 393) standard. The Filter Strip (Code 393) job sheet can be completed manually or the automated version may be used that completes calculations as data is input. The automated job sheet provides an efficient means of designing filter strips according to policy and technical guidelines. The job sheet can be downloaded from the Montana NRCS website at:

http://efotg.nrcs.usda.gov/references/public/MT/393_JobSheet_Dec_2008.xls

BACKGROUND. Vegetative Filter Strips (VFS) have proven to be an effective practice to trap contaminants, especially sediment, in field runoff. The effectiveness of a vegetative filter strip is dependent on the (1) proper design, (2) proper location and layout, and (3) the proper assessment of the contributing runoff area. When properly designed and located, VFS can remove 70-85% of the sediment entering the VFS (R.A. Fasching, C.-X. Jin, M.J.M. Romkens).

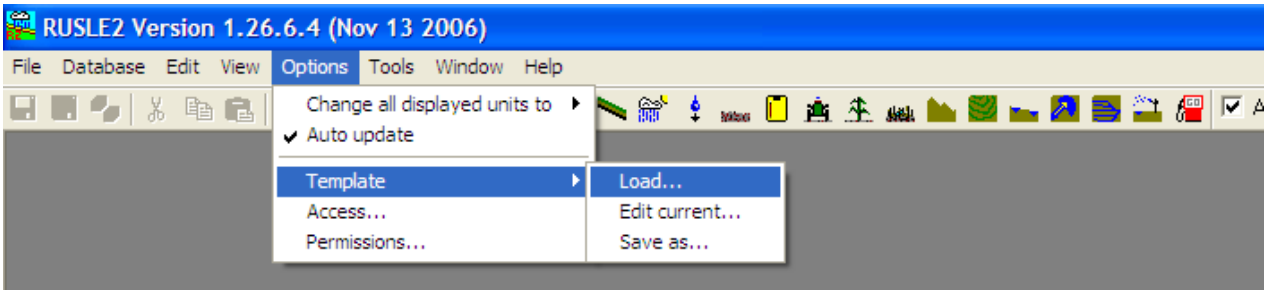
However, even properly designed VFS will eventually fill with sediment and inhibit the proper function of the VFS strip. The life span of the VFS, for sediment removal purposes, is dependent upon the rate of soil loss from the contributing area, the size of the VFS compared to the contributing area, and the trapping efficiency of the vegetation established in the strip.

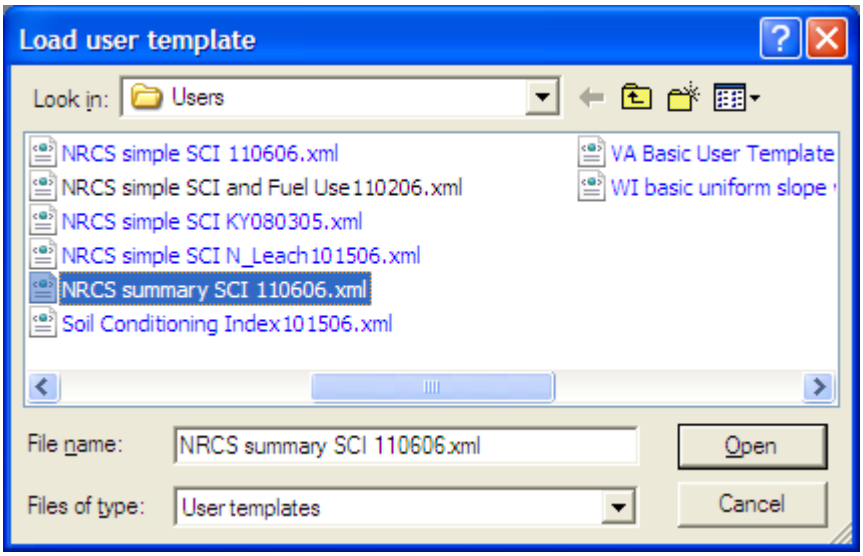
RUSLE2 is effective in automating the design and predicting the effective lifespan of a VFS when it is designed for the purpose of sediment removal.

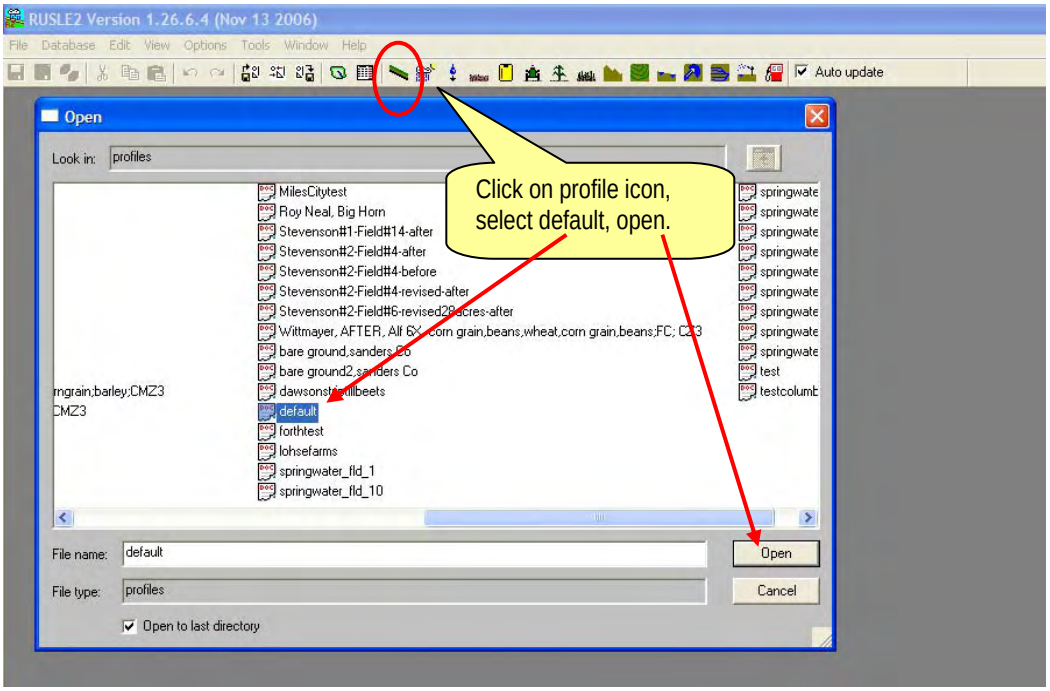
Step-by-Step

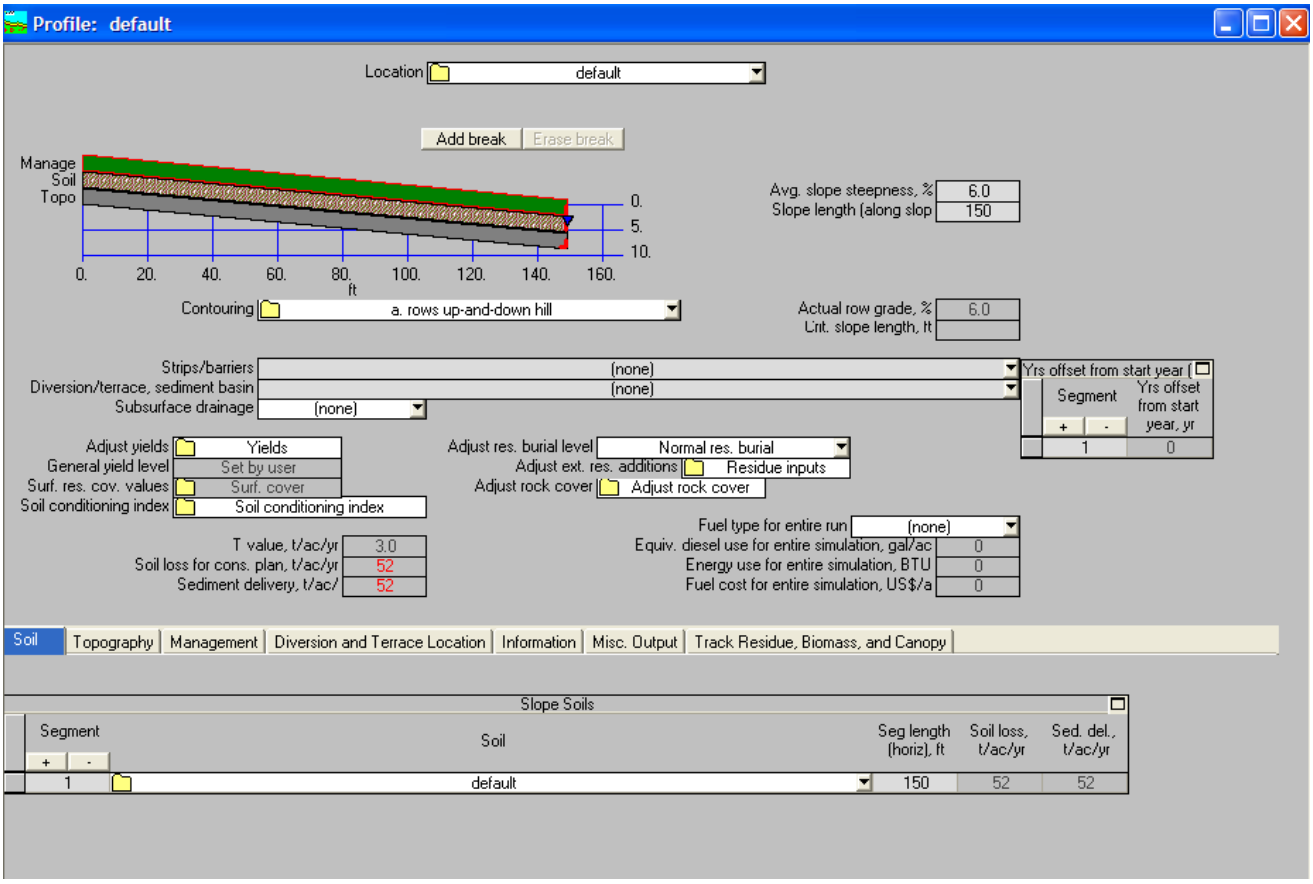
The following is a step by step instruction for completing the automated Filter Strip (Code 393) job sheet using the RUSLE2 prediction tool.

STEP 1. Boot RUSLE2. In the gray screen, left click on **options**; **template**; **load**. Then select **"NRCS summary SCI 110606.xml"**; **open**. Then click on the **profile icon**; select **"default"; open** (see the screen shots below).

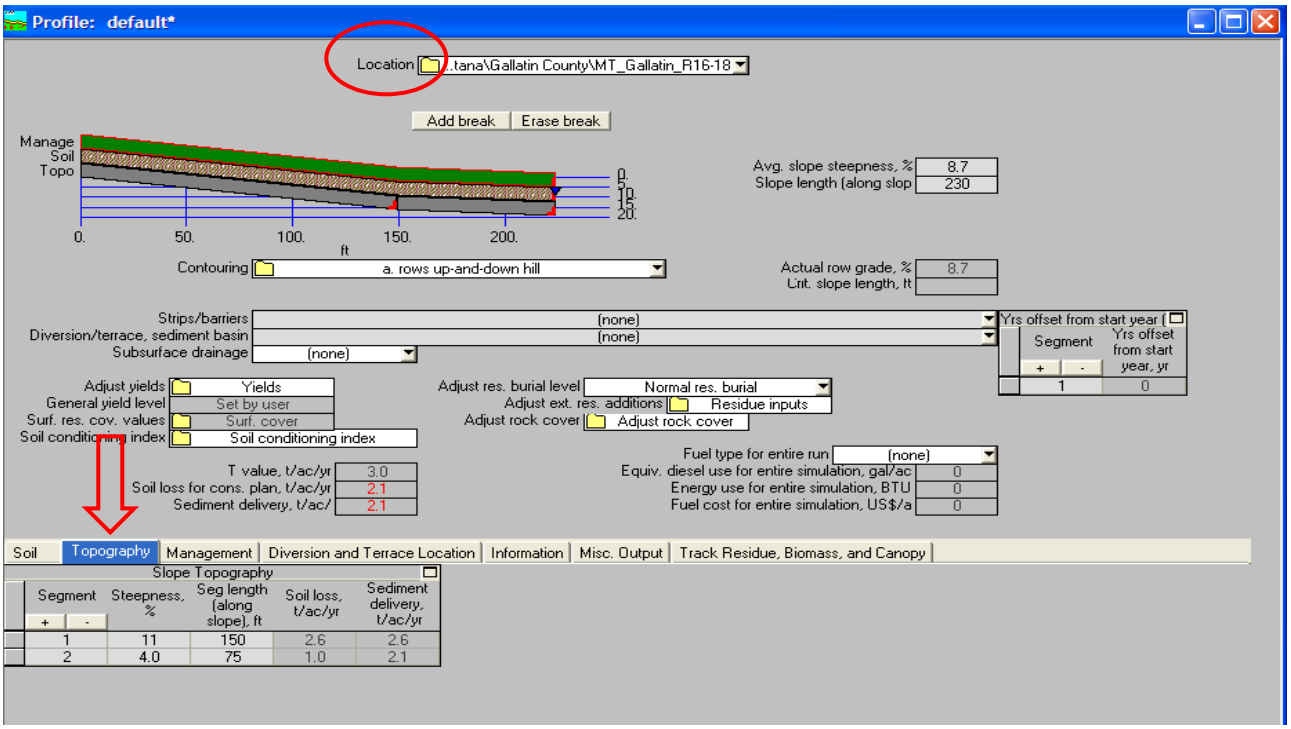

RUSLE2 Version 1.26.6.4 (Nov 13 2006)
File Database Edit View Options Tools Window Help
Change all displayed units to
Auto update
Template
Access...
Permissions...
Load...
Edit current...
Save as...


Load user template
Look in: Users
NRCS simple SCI 110606.xml
NRCS simple SCI and Fuel Use110206.xml
NRCS simple SCI KY080305.xml
NRCS simple SCI N_Leach101506.xml
NRCS summary SCI 110606.xml
Soil Conditioning Index101506.xml
VA Basic User Template
WI basic uniform slope
File name: NRCS summary SCI 110606.xml
Open
Files of type: User templates
Cancel


RUSLE2 Version 1.26.6.4 (Nov 13 2006)
Auto update
Open
Look in: profiles
Click on profile icon, select default, open.
MilesCitytest
Roy Neal, Big Horn
Stevenson#1-Field#14-after
Stevenson#2-Field#4-after
Stevenson#2-Field#4-before
Stevenson#2-Field#4-revised-after
bare ground,sanders Co
bare ground2,sanders Co
default
forthtest
lohsefarms
springwater_fld_1
springwater_fld_10
springwate
test
testcolumb
File name: default
File type: profiles
Open
Cancel
Open to last directory

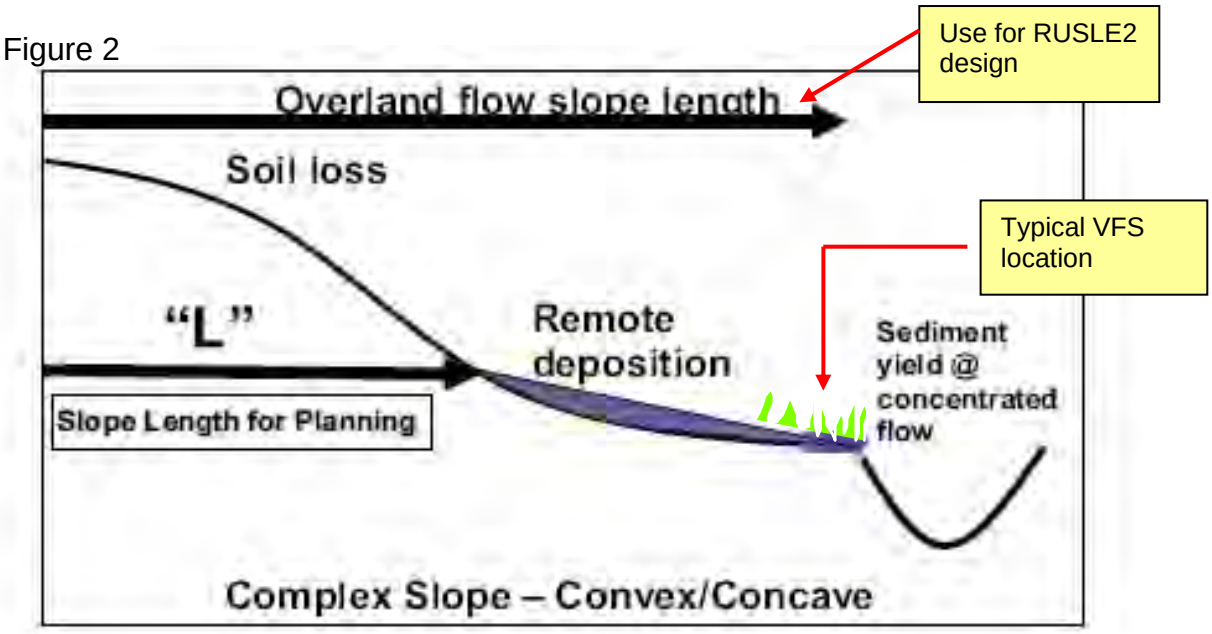


Step 2. In RUSLE2 on the profile screen, select the **location** (annual precipitation for the VFS), then click on **topography**, and add segments as needed by clicking the + or – (example below shows two segments: 1 @ 11% slope, 150 ft; 2 @ 4% slope, 75 ft).

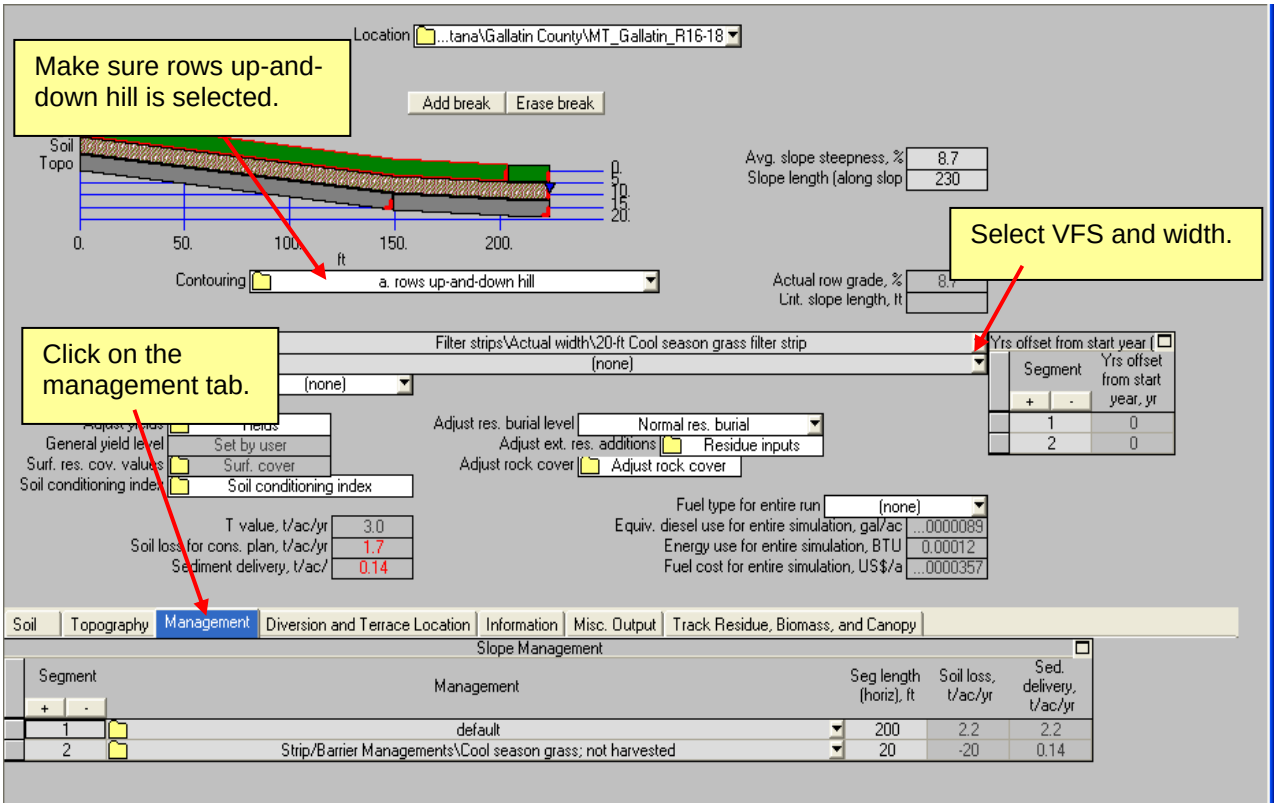


IMPORTANT: This method, using RUSLE2, requires the use of the "overland flow slope length (see Figure 2 below). The overland flow slope length is defined as the *slope length from the point of origin of flow to the point where the slope enters concentrated flow."* This differs from the slope length used for conservation planning which is the length designated for the plan map unit (see example in Figure 2).

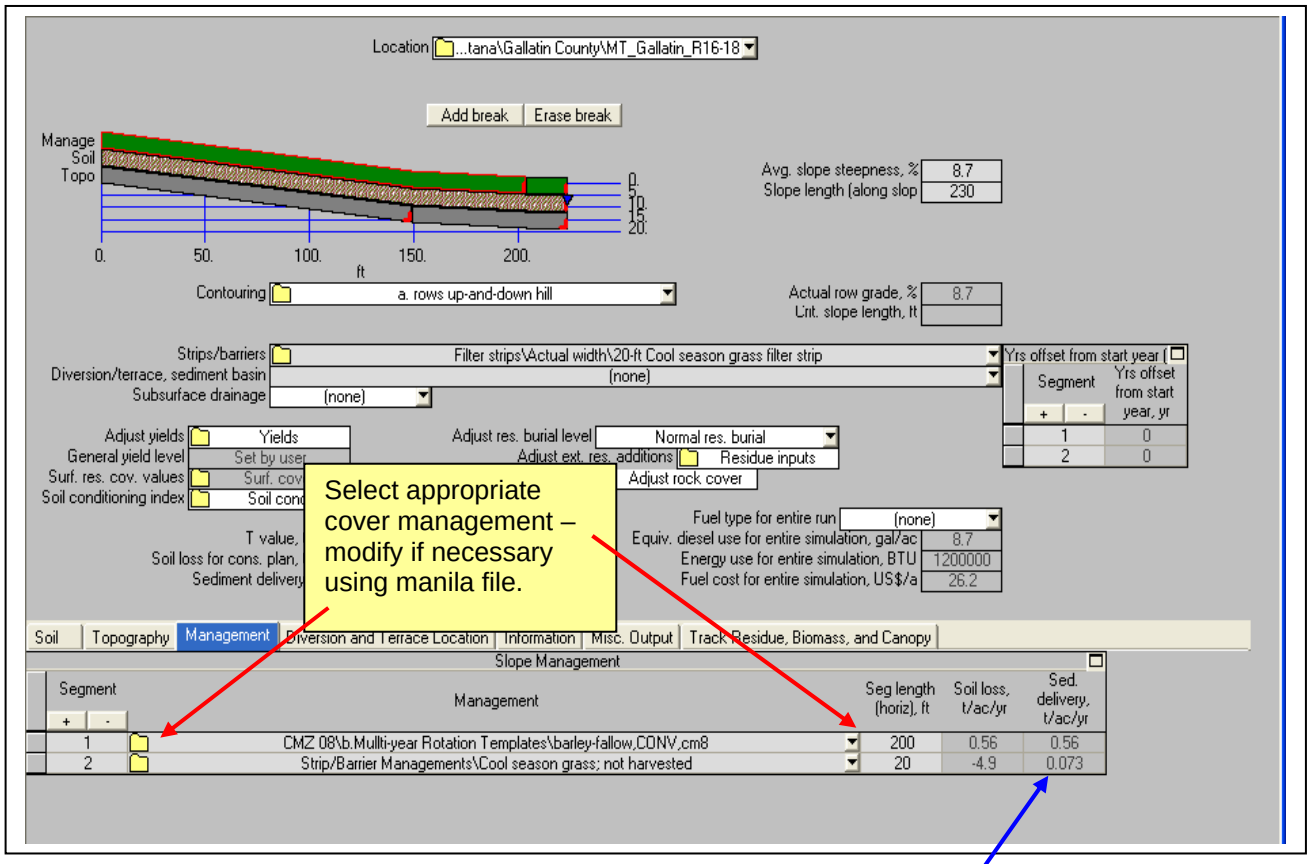
Figure 2



Step 3. Make sure that **rows up-and-down hill** is selected in the contouring block in RUSLE2. Select an appropriate filter strip width (in this example 20 ft. of cool season grass). Then click on the management tab to assign cover management practice.



Step 4. When you select the management tab, the slope segments you added earlier appear. Each segment requires a management cover practice assigned to it. The bottom of the slope will automatically have the VFS strip already assigned based on your selection in Step 3. You must now select the cover management for the upper segment(s). Use the pull-down block to select the appropriate management practice. If necessary, edit the management cover practice by clicking the manila envelope.



Step 5. Note that the **sediment delivery** at the end of segment two is **0.073 t/ac/y**. The sediment flowing onto the VFS **is 0.56 t/ac/yr**. The filter strip traps**:** 0.56 – 0.073 = 0.49 t/ac/yr. **Trap efficiency** is calculated: 0.49/0.56 = 88%.

Step 6. Aside from knowing the sediment delivery rate that enters the VFS and the sediment trapping efficiency, you must also determine the ratio of "contributing area" above the VFS to the "VFS area." [**Note:** The contributing area above the VFS contributes sheet flow. Do NOT count acres that contribute concentrated flow.] Divide the "contributing area" (acres) by the "VFS area" acres. For example, a 12-acre contributing area located above the VFS divided by .23 acre VFS area (500' x 20') = 12/.23 = 52.1. Therefore the ratio of contributing area to VFS is 52:1.

VFS are designed to have a minimum life span of ten (10) years. To maintain VFS, the rate of sediment accumulation should not exceed 0.6 inches per year (Dillaha and Hayes). This rate of accumulation allows grass to adjust and survive. However, once the accumulation reaches six (6) inches, the VFS will need to be re-graded and/or re-established.

Step 7. With the above data, you can now complete the Filter Strip (Code 393) job sheet. Notice that the filter strip life span is approximately 39 years, meeting the criteria in the standard.

Go to Link: http://efotg.nrcs.usda.gov/references/public/MT/393_JobSheet_Dec_2008.xls to retrieve excel worksheet

NATURAL RESOURCES CONSERVATION SERVICE
MONTANA CONSERVATION PRACTICE JOB SHEET

FILTER STRIPS (ACRE)

CODE 393

Cooperator _____ Date _____

Tract/Field _____ Job Class _____

Purpose for planning and applying this practice (check all that apply)

- □ Reduce suspended solids and associated contaminates (perennial vegetation => 20' wide)
- □ Reduce dissolved contaminate loadings (perennial vegetation => 30' wide)
- □ Reduce suspended solids and associated contaminates in irrigation tailwater (annual vegetation => 20' wide)
- □ Restore, create, or enhance herbaceous habitat for wildlife and beneficial insects (=>20' wide)

Perennial Vegetation Layout	Strip 1	Strip 2	Strip 3
Filter strip width, or flow path (feet)	20		
Filter strip length (feet)	500		
Filter strip gradient, upper edge (percent)	.5		
Contributing area (acres)	12		
Contributing area slope (percent)	11		
Sediment delivery to filter strip (tons/acre/year)*	.56		
Sediment delivery from filter strip (tons/acre/year)*	.073		
Filter strip area (acres)	.23	0	0
Contributing area to filter strip area ratio	52	0	0
Sediment trapping efficiency (percent)	87	0	0
Filter strip life span (years to accumulate 6 inches of sediment)	39.4	0	0

Annual Vegetation Layout	Strip 1	Strip 2	Strip 3
Filter strip width, or flow path (feet)			
Filter strip length (feet)			
Filter strip gradient, upper edge (percent)			
Contributing area slope (percent)			
Filter strip area (acres)	0	0	0

*Revised Universal Soil Loss Equation, Version 2 (RUSLE2) data.

Plant Materials (species/cultivars)		Seeding Rate (lbs/acre PLS)	Seeding Date
Strip 1:			
Strip 2:			
Strip 3:			

Site Preparation

Prepare a firm seedbed that is weed-free, clod-free, firm and moist (firm is a foot print no deeper than 1/8"). Apply fertilizer according to soil test recommendations. Additional requirements:

Planting Methods

Refer to Plant Materials Technical Note MT-58 for Seedbed preparation and seeding guidelines. Drill grass and legume seed_____inches deep uniformly over the entire area. Establish vegetation according to the specified seeding rate. If necessary, mulch newly seeded area with_____tons per acre of mulch material. A small grain crop may be used as a companion crop at the rate of_____pounds per acre (clip and harvest before it heads out). Additional requirements:

Operation and Maintenance

Maintain original width and length of the filter strip. Mow filter strips (and harvest if possible) as necessary to encourage dense vegetative growth. If established for wildlife habitat, avoid mowing during the nesting period for ground-nesting wildlife. Control undesirable weed species. Inspect and repair after storm events to fill in gullies, remove flow-disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow into and across the filter strip. Fertilize according to soil test recommendations to maintain a vigorous stand. Exclude livestock and vehicular traffic from filter strips during wet periods of the year to reduce compaction that will limit infiltration. This type of traffic should be excluded at all times to the extent practical. Restoration is required if the filter strip has accumulated sediment to a point that it no longer functions.

Approval:

_____ _____

Producer Date

_____ _____ _____

NRCS Conservationist Job Approval Authority Date

CERTIFICATION STATEMENT:

I certify that this practice has been installed in accordance with NRCS standards and specifications.

_____ _____ _____

Planner Job Approval Authority Date

_____ _____

Producer Date