

Pollution Reduction Estimators

Megan Lennon

Eric Mohring

October 27, 2010

BWSR Academy

Agenda

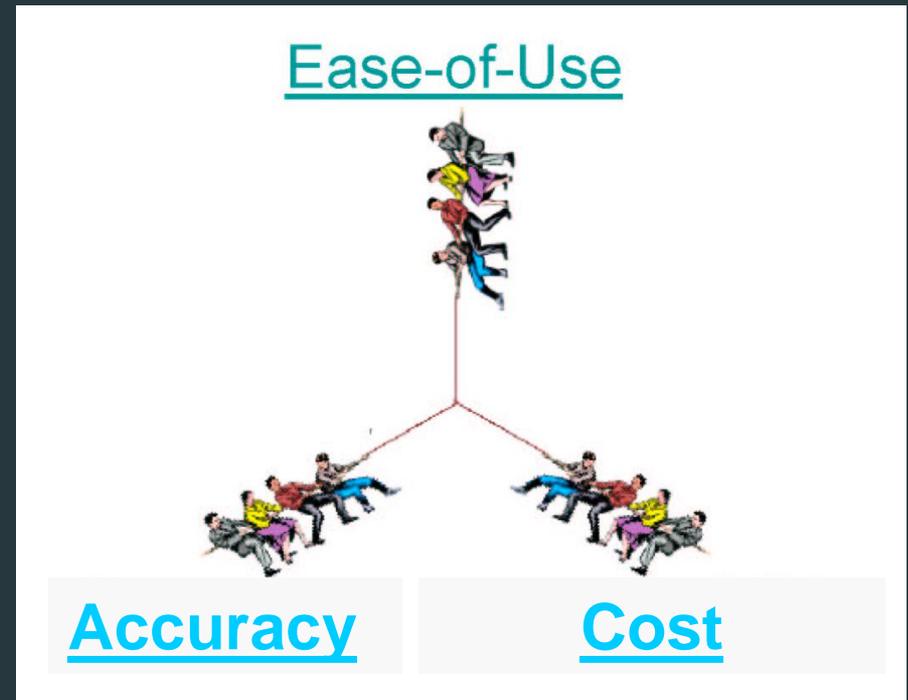
- Philosophy on estimators
- What's new: 'Prevention' label & Bioretention
- BWSR water erosion pollution reduction calculator examples
- Feedback on what works

Environmental Outcomes

Goals
Accomplishment reporting
Outcomes
Beneficial
Outcome Measurement
Measurable
Accountable
Milestones
Indicators

BWSR's philosophy on estimators

- Prompted by requests for measurable outcomes
- Balancing act
 - ❑ Ease of use
 - ❑ Accuracy
 - ❑ Cost effectiveness



Recognizing Limitations

- Simple models
- Limited to info routinely collected
- Sacrifice accuracy
- More general than site specific
- Catastrophic events

Benefits

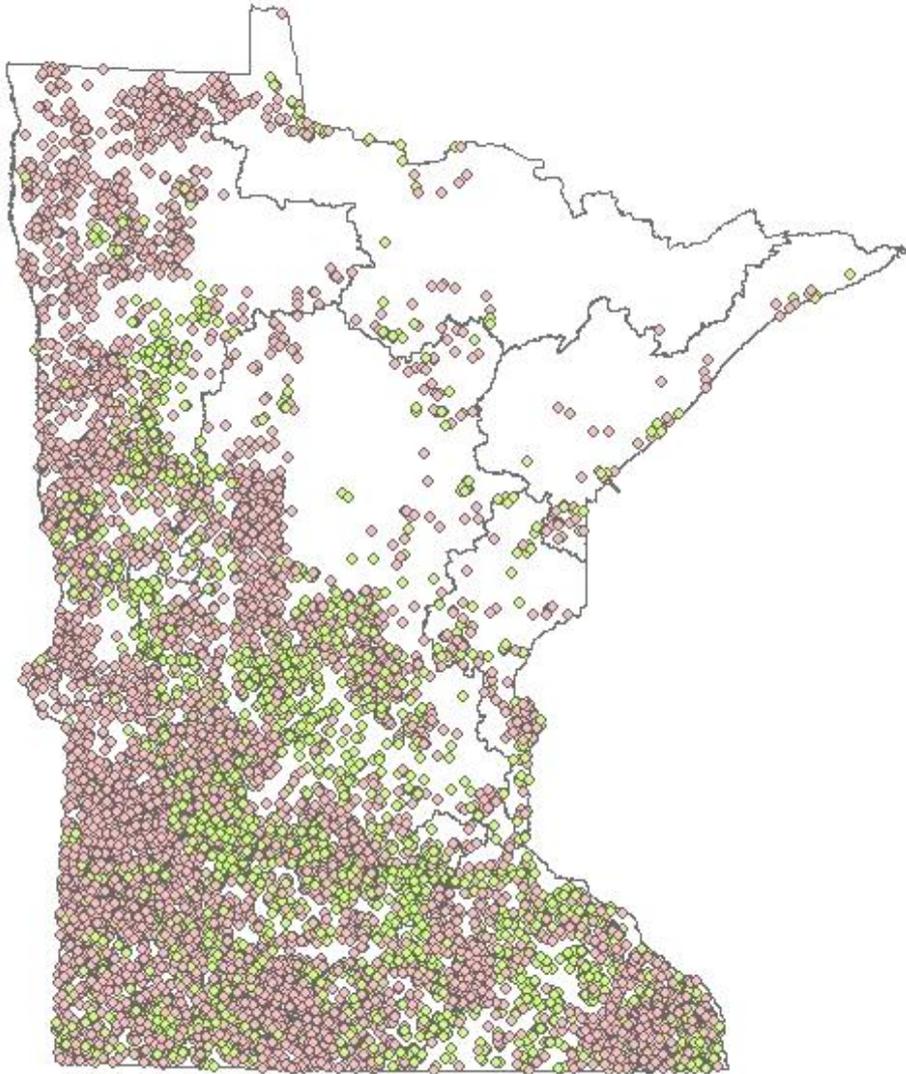
- Quick, easy to use
- No additional data collection
- No lab analysis
- Provides an estimated pollution reduction
- Addresses requests for measureable outcomes

Common Calculators

- WEQ (Wind Erosion Equation)
- RUSLE2
- MinnFARM
- BWSR water erosion calculator



How are we doing?



Pink dots represent conservation projects without outcome data or an available estimator (n = 9,290)

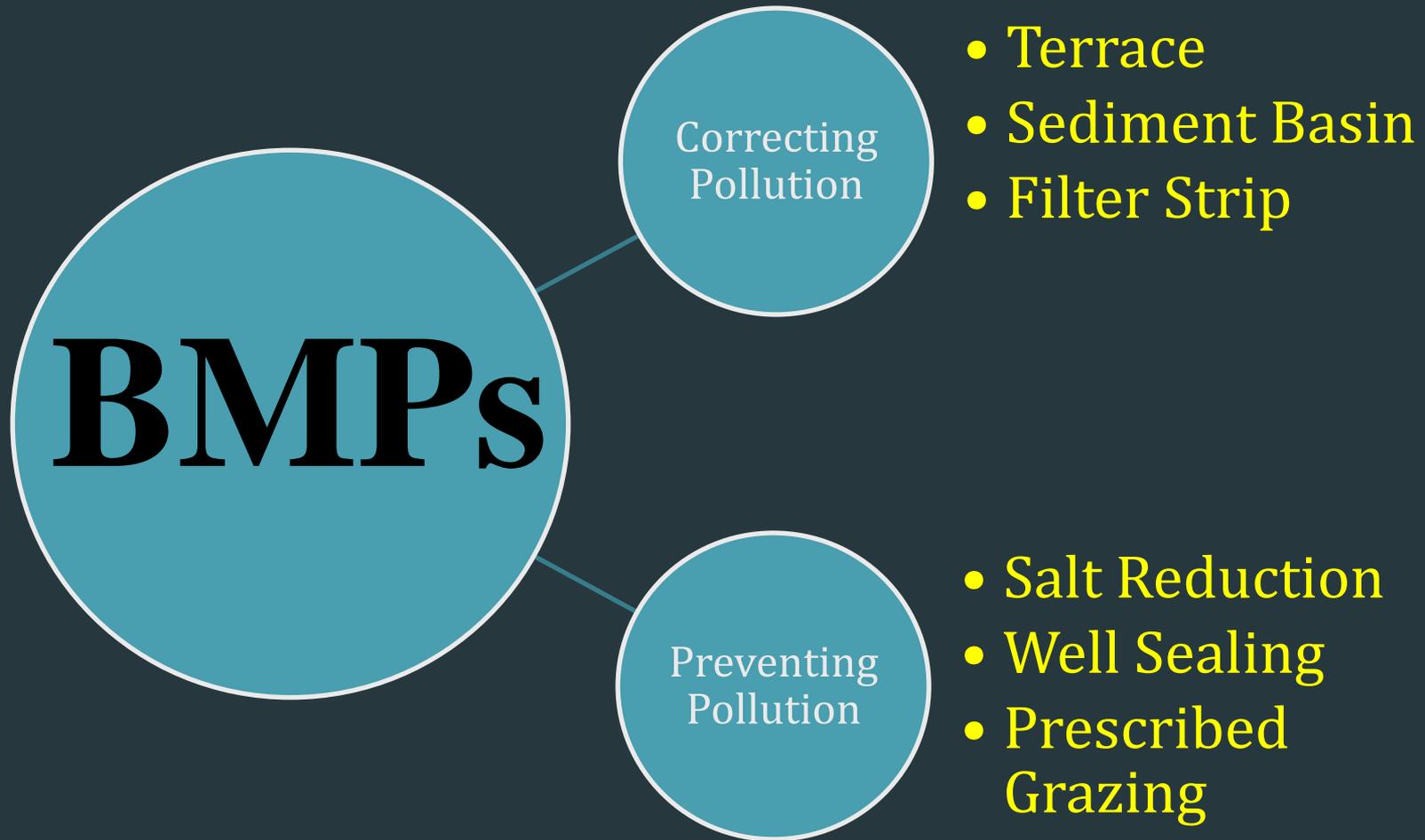
Green dots represent conservation projects with outcome data (n = 4,575)

What we're doing now

- Re-evaluate BMPs
- Deploy 'bioretention' estimator
- LCCMR project

Do all practices need
an estimate?

A new perspective on BMPs



Preventative BMPs

BMPs that do not have an associated pollution reduction estimate because implementation of such BMP does not always result in a measurable reduction in pollution, rather the BMP implementation minimizes the risk of pollution occurring.

BMPs categorized as “prevention”

- Pasture and Hayland Management
- Planned Grazing System
- Prescribed Grazing
- Nutrient Management
- Pond Maintenance
- Salt Reduction
- Sinkhole Treatment
- Use Exclusion
- Well Sealing, Well Decommissioning, Abandoned Well Sealing
- Windbreak Shelterbelt Renovation

ennon(Logout)

BWSR - Central Office (BWSR)

October 22, 2010

eLINK4Web

Land & Water Projects - BWSR Academy Example



Home > Land & Water Projects > Add Project

- Information Center
- Operators
- Plans
- Projects
- Land & Water Projects
- [Project Search](#)
- [Add Project](#)
- [Help](#)
- Initiatives
- and Manager
- Map Viewer
- Summary Reports
- Preferences

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

- Details
- Indicators**
- Cooperators
- BMPs/Activities
- Financial Services
- Inspections
- Attachments
- Comm Notes

	Category	Indicator	Numeric Value	Unit	Bmp/Activity	Calculation M
▶	Pollution Prevention	Prevention			1 - Abandoned Well Sealing	



Print Ok Cancel A

BWSR wants your input

What other practices
belong on the
“prevention” list?

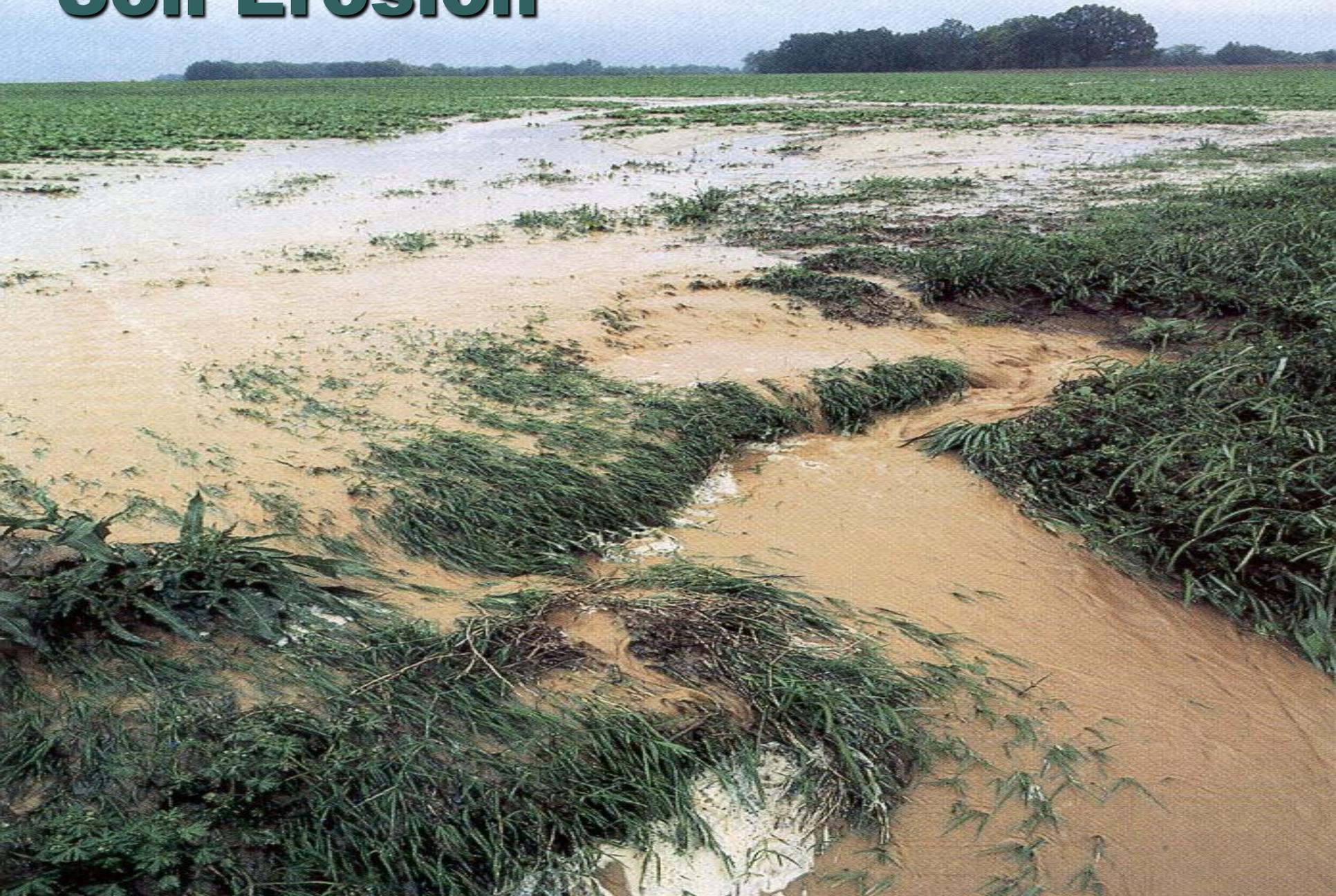
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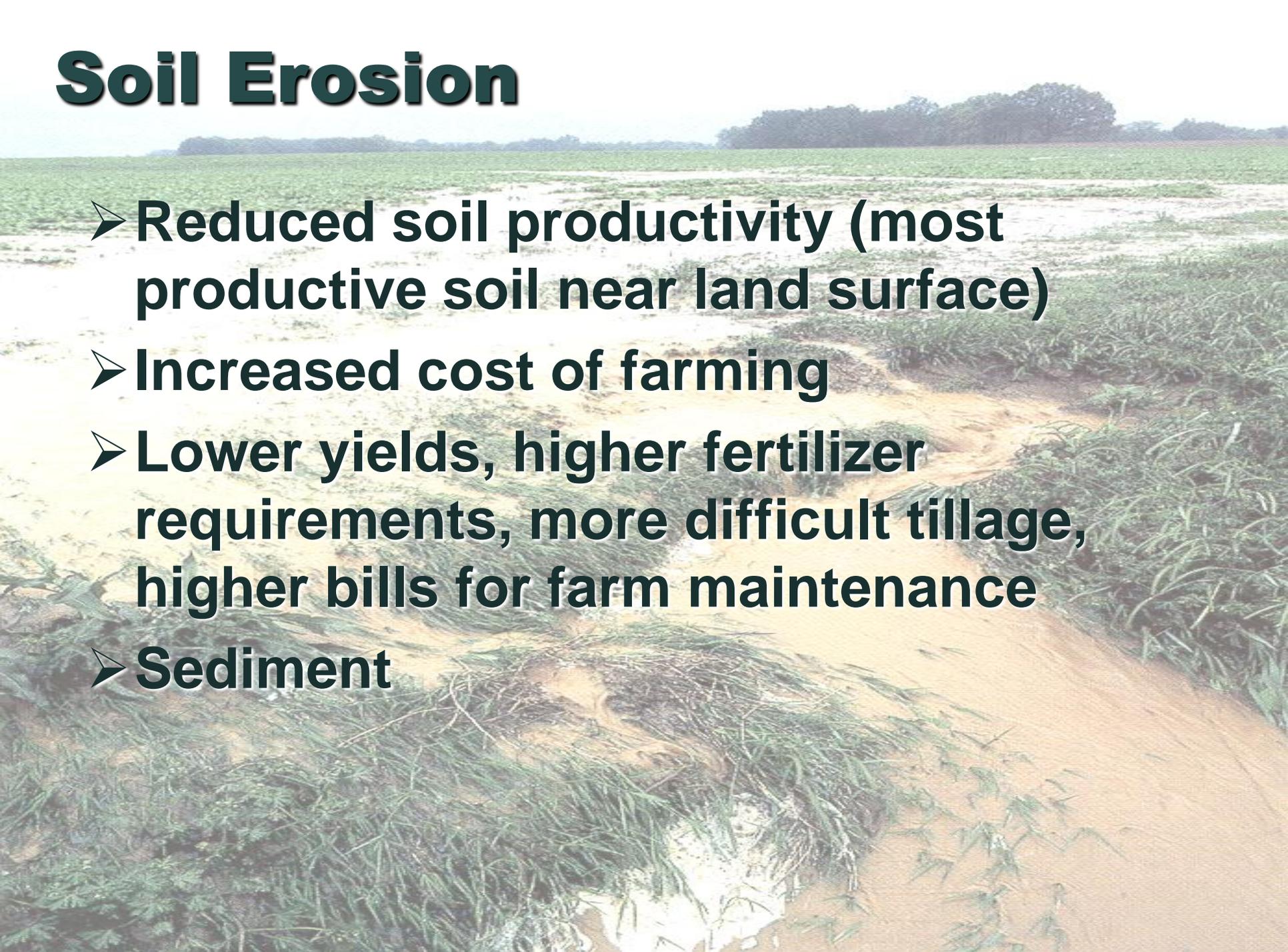
BWSR Water Erosion Pollution Reduction Estimator

- Soil-erosion based. Estimates:
 - ☐ Soil Loss Reduction (“Soil Saved”)
 - ☐ Sediment Reduction
 - ☐ Phosphorus Reduction

Soil Erosion



Soil Erosion



- **Reduced soil productivity (most productive soil near land surface)**
- **Increased cost of farming**
- **Lower yields, higher fertilizer requirements, more difficult tillage, higher bills for farm maintenance**
- **Sediment**



Sedimentation

Sedimentation

- **Clogs rivers, lakes, wetlands**
- **Decreases storage capacity**
- **Restricts navigation**
- **Reduces recreation and scenic value**
- **Increases flood hazard and severity**
- **Can destroy fish and wildlife habitat and pollute water supplies**
- **Accompanying nutrients and pesticides**



Phosphorus

Phosphorus

- **Eutrophication: excess nutrients causing proliferation of algae and aquatic vegetation**
- **Excess P causes nuisance algae blooms, reduced transparency**
- **Increased plant productivity uses up O₂**
- **Degrades fish habitat**
- **Makes water unsuitable for swimming, other activities**

BWSR Water Erosion Pollution Reduction Estimator

- MS-Excel spreadsheet
- Formerly “hard-wired” into eLINK
- Modified from **LARS** algorithms
Local Government Annual Reporting System
(1997-2002 R.I.P.)
- Original source: Michigan DEQ calculations

Pollution Reduction Estimator

LIMITATIONS



- Limited to data routinely gathered & analysis routinely performed by field office staff.
- Not prepared to ask landowners for info on nutrient application rates, cropping history, soil N & P data, etc.

Pollution Reduction Estimator

LIMITATIONS



- Many simplifying assumptions
- Applies to field scale
- Does not estimate dissolved N & P
- Does not estimate watershed yield of Sediment & Phosphorus.

BWSR Water Erosion Pollution Reduction Estimator

1. Estimate soil erosion before and after practice installation
2. Estimate resulting reduction in sediment to nearest surface water
3. Estimate of resulting reduction in soil-attached phosphorus

BWSR Water Erosion Pollution Reduction Estimator

Soil Loss Reduction:

RUSLE2, Volume voided, other



Sediment reduction:

Distance to surface water? Filter strip? channelized? Gully characteristics?

⇒ *sediment delivery ratio (SDR)*



Phosphorus Reduction:

Soil texture correction factor

BWSR Water Erosion Pollution Reduction Estimator

➤ Sub models:

- Sheet/Rill

- Filter Strip

- Stream & Ditch

- Gully

A to Z Topics

Contact

Search



Easements



Grants

Resource Management
and PlanningConservation
Implementation[Partners](#)[Drainage](#)[Pollution Reduction
Calculators](#)[State Soils Office](#)

Wetlands



Minnesota Board of Water and Soil Resources

Featured Projects

Each month BWSR highlights a project that demonstrates the outcomes achieved through Minnesota's local-state-federal conservation delivery system.

October 2010: Wetland replacement for airport expansion project

An airport expansion project in Forest Lake required local, state and federal government agency staff to design the project to comply with federal regulations for airport safety, which prohibit open water near runways, and state and federal wetland regulations, which require wetlands that are drained or filled to be replaced.

The final project involved restoring 2.27 acres of high-quality wetlands to replace 1.7 acres of wetlands that needed to be filled to accommodate the airport expansion. The results were 2.27 acres



About BWSR

BWSR Mission: Improve and protect Minnesota's water and soil resources by working in partnership with local organizations and private landowners

BWSR is the state soil and water conservation agency, and it administers programs that prevent sediment and nutrients from entering our lakes, rivers, and streams; enhance fish and wildlife habitat; and protect wetlands. The 20-member board consists of representatives of local and state government agencies and citizens.

See [About BWSR](#) for more information. 30

[BWSR Meetings and Events](#)

BWSR - Conservation Implementation - Mozilla Firefox

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http://www.bwsr.state.mn.us/practices/index.l

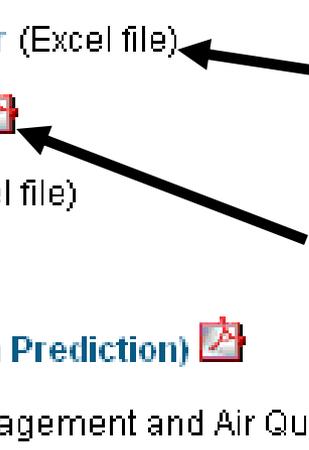
BWSR - Conservation Implementation

Tools for calculating pollution reduction estimates

- [Login to eLINK 4 Web](#) (BWSR tool for tracking local outcomes of conservation practices)
- [Download BWSR Water Erosion Pollution Reduction Estimator](#) (Excel file)
- [Instructions for using BWSR pollution reduction estimators](#) 
- [Download RUSLE](#) (Revised Universal Soil Loss Equation - Excel file)
- [RUSLE2](#)  (Revised Universal Soil Loss Equation)
- [USDA NRCS Field Office Technical Guide - Section 1C \(Erosion Prediction\)](#) 
- [MinnFARM](#)  (University of Minnesota Extension - Manure Management and Air Quality Research)
- [Wind Erosion Equation](#) 
- [Wind Erosion Prediction System](#) 

BWSR Calculator

BWSR Calculator Instructions



BWSR Water Erosion Calculator

➤ User's Guide:

[www.bwsr.state.mn.us/elinkupdate/
Pollution Reduction Calculator Manual.pdf](http://www.bwsr.state.mn.us/elinkupdate/Pollution%20Reduction%20Calculator%20Manual.pdf)

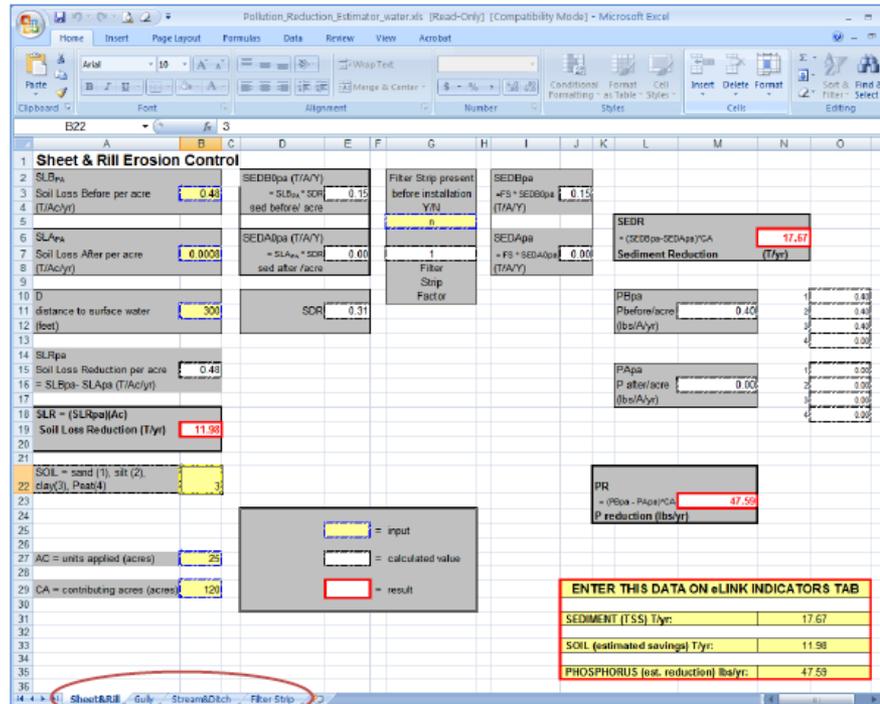
➤ Excel document download:

[http://www.bwsr.state.mn.us/elinkupdate/
Pollution Reduction Estimator water.xls](http://www.bwsr.state.mn.us/elinkupdate/Pollution%20Reduction%20Estimator%20water.xls)

Pollution Reduction Estimator

Water Erosion - Microsoft Excel® Version

September 2010



eLINK INDICATORS TAB	
SEDIMENT (TSS) T/yr:	17.67
SOIL (estimated savings) T/yr:	11.98
PHOSPHORUS (est. reduction) lbs/yr:	47.53

Introduction

The Microsoft Excel® Spreadsheet **Pollution Reduction Estimator - water erosion.xls** is a version of the same pollution reduction estimator that was built-in to eLINK version 2. The inputs and results are the same. It requires Excel to Run.

There are 4 Water Erosion estimator types to choose from:

1. Sheet and rill erosion.
2. Gully stabilization.
3. Stream bank/ditch stabilization.
4. Filter strip projects.

The spreadsheet "workbook" contains 4 worksheets, one for each of the 4 estimator types. These are accessed via the worksheet tabs at the bottom of the spreadsheets (circled in red above).

Each of the worksheets has cells that require user input (shaded yellow and outlined in blue), cells with intermediate calculated values (outlined in black), and final results (outlined in red). The results are **Soil Loss Reduction** (tons/year), **Sediment Reduction** (tons/year) and **Phosphorus Reduction** (lbs/year).



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Sheet & Rill Erosion Control														
2	SLB _{PA}			SEDB _{0pa} (T/A/Y)			Filter Strip present		SEDB _{pa}						
3	Soil Loss Before per acre (T/Ac/yr)	0.48		= SLB _{PA} * SDR	0.15		before installation		= FS * SEDB _{0pa}	0.15					
4				sed before/ acre			Y/N		(T/A/Y)						
5							n								
6	SLA _{PA}			SEDA _{0pa} (T/A/Y)					SEDA _{pa}						
7	Soil Loss After per acre (T/Ac/yr)	0.0008		= SLA _{PA} * SDR	0.00		1		= FS * SEDA _{0pa}	0.00					
8				sed after /acre			Filter Strip Factor		(T/A/Y)						
9															
10	D														
11	distance to surface water (feet)	300		SDR	0.31										
12															
13															
14	SLR _{pa}														
15	Soil Loss Reduction per acre = SLB _{pa} - SLA _{pa} (T/Ac/yr)	0.48													
16															
17															
18	SLR = (SLR _{pa})(Ac)														
19	Soil Loss Reduction (T/yr)	11.98													
20															
21															
22	SOIL = sand (1), silt (2), clay(3), Peat(4)	3													
23															
24															
25															
26															
27	AC = units applied (acres)	25													
28															
29	CA = contributing acres (acres)	120													
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= input
 = calculated value
 = result

ENTER THIS DATA ON eLINK INDICATORS TAB	
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BWSR - eLINK4Web - Mozilla Firefox

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http://www.bwsr.state.mn.us/outreach/eLINK/index.html

BWSR - eLINK4Web

Links

Pollution Reduction Calculators

- **Choosing the best calculator for eLINK**
(Includes list of conservation practices with recommended calculators for each practice - posted Sept. 2, 2009)
- **Instructions for using BWSR spreadsheet Pollution Reduction Estimator** (Sept. 2009)
- **Download BWSR Water Erosion Pollution Reduction Estimator**
- **Download RUSLE Calculator**
- **RUSLE 2 (ARS) program and guidance** 
- **NRCS Field Office Technical Guide - Section 1C (Erosion Prediction)**
- **Wind Erosion Equation** 
- **Wind Erosion Prediction System** 

Calculator Guidance Document

<http://www.bwsr.state.mn.us/outreach/eLINK/index.html>

Calculator Guidance
Document

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Choosing the best calculator for eLINK

This document is a guide to selecting pollution reduction calculators for Best Management Practices (BMPs). Table 1 contains BMPs that have a recommended pollution reduction calculator. Pollution reduction calculators are not available or applicable for all BMPs. Table 2 contains BMPs that either lack a peer reviewed/professionally accepted calculator or pollution reduction estimation is not applicable. To use this guidance document, first look for the BMP of interest in Table 1. Then look across the row to find the recommended pollution reduction calculator(s). Multiple calculators are listed for some BMPs and you may choose which are most appropriate. Not all calculators listed need to be used, however in many circumstances using more than one calculator is necessary to estimate a suite of pollutants. The choice of calculator depends on site specific characteristics. The 'eLINK Category' and 'eLINK Indicators' columns corresponds to drop down menus in the eLINK data entry window and is meant to facilitate entry of pollution reduction estimates into eLINK.

Note: This guidance document does not include all available pollution reduction calculators or models. Use of peer reviewed/professionally accepted calculators or models is acceptable when available and appropriate for the project. Please indicate the model used in the comments field of the indicators tab when reporting in eLINK.

Updated: 9/9/2009

Table 1

Practice	Suggested Calculator	eLINK Category	eLINK Indicator (s)
Closure of Waste Impoundments (360)	MinnFARM	MinnFARM	P reduction N reduction BOD5 COD Fecal Coliform
Conservation Cover (327)	WEQ	Wind Erosion	Soil (estimated savings)
	RUSLE2	Water Pollution	Soil (estimated savings)
	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
Conservation Crop Rotation (328)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)

Table 2

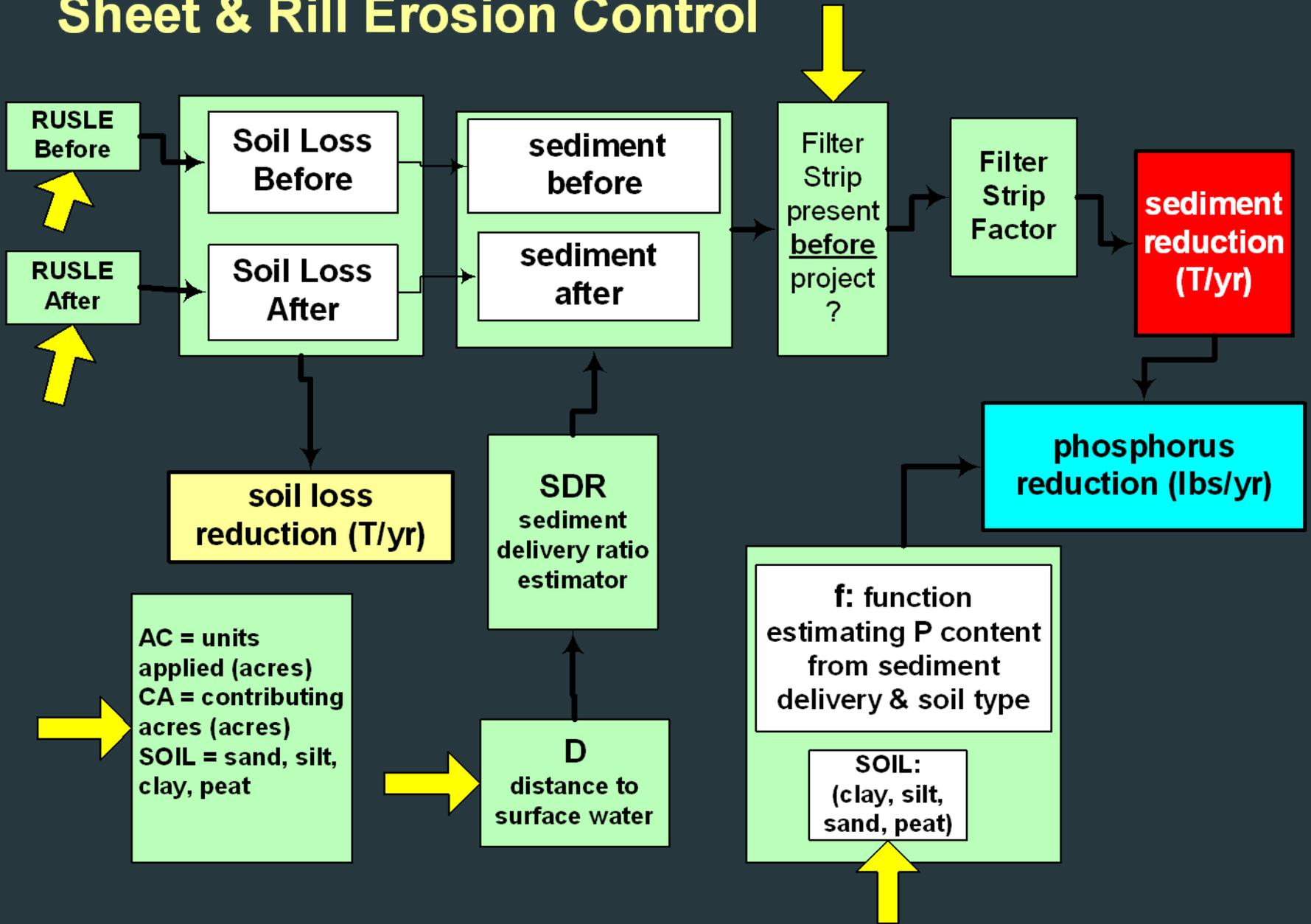
<p>Not Applicable - BMPs that are either unlikely to reduce pollution or pollution reduction is too site specific and a generalized calculator is not appropriate.</p>	<p>Not currently available or under development — calculators either do not exist for this BMP or BWSR is not currently recommending a specific calculator.</p>
<p>Access Road (560) Aeration (567M) Agricultural Development - crop (141M) Agricultural Development - no crop (142M) Aquaculture (160M) Bedding (310M) Brush Management (314) Commercial Fishponds (397M) Conservation Cover Easement (327M) Cooperative Weed Management Area (613M) Dam, Floodwater retarding (402) Dam, Multi-Purpose (349) Dike (356) Drainage Modification System (363M) Early Successional Habitat Development/Management (647) Education - Equipment (106M) Education - Materials (107M) Education - Media (108M) Existing Private Road (136M) Fabricated Shelter for Livestock (771) Fence (382) Fish Management (391M) Fish Stream Improvement (395) Floodwater Diversion (400) Floodway (404) Forest Site Preparation (490) Land Clearing (460M) Land Reconstruction Abandoned Mine (543M) Mole Drain (482M) New Private Road (137M) Obstruction Removal (500) Pest Management (595) Pipeline (516) Pond Sealing or Lining, Bentonite Seal (521C) Pond, pushup (163M)</p>	<p>Abandoned Well Sealing (100) Alley Cropping (311) Alternative Tile Intake - Dense Pattern Tiling (170M) Alternative Tile Intake - Hickenbottom Intake (171M) Alternative Tile Intake - Other Blind Intake (173M) Alternative Tile Intake - Rock Inlet (172M) Anaerobic Digester (366) Animal Mortality Facility (316) Animal Trails and Walkways (575) Aquatic Vegetation Management (565M) Bioretention (712) Clearing & Snagging (326) Composting Facility (317) Critical or Sensitive Area Protection (343M) Deferred Grazing (GB6) Diversion (362, RR-5) Drainage Water Management (554) Field Windbreak (RR-4/a, RR-4/b) Forest Stand Improvement (666) Forestry Management (147) Heavy Use Area Protection (561) Nutrient Management (590) Pond (378) Pond Maintenance (164M) Roof Runoff Management (558) Salt Reduction (610) Septage Management (127M) Septic System Improvement (126M) Sinkhole Treatment (571) Storm Water Retention Basin (155M) Tree/Shrub Establishment (612, RR-3/a, RR-3/b, RR-3/c) Underground Outlet (620) Urban Landscaping (621M) Urban Landscaping - Raingarden (622M) Use Exclusion (472)</p>

Sheet/Rill Calculator

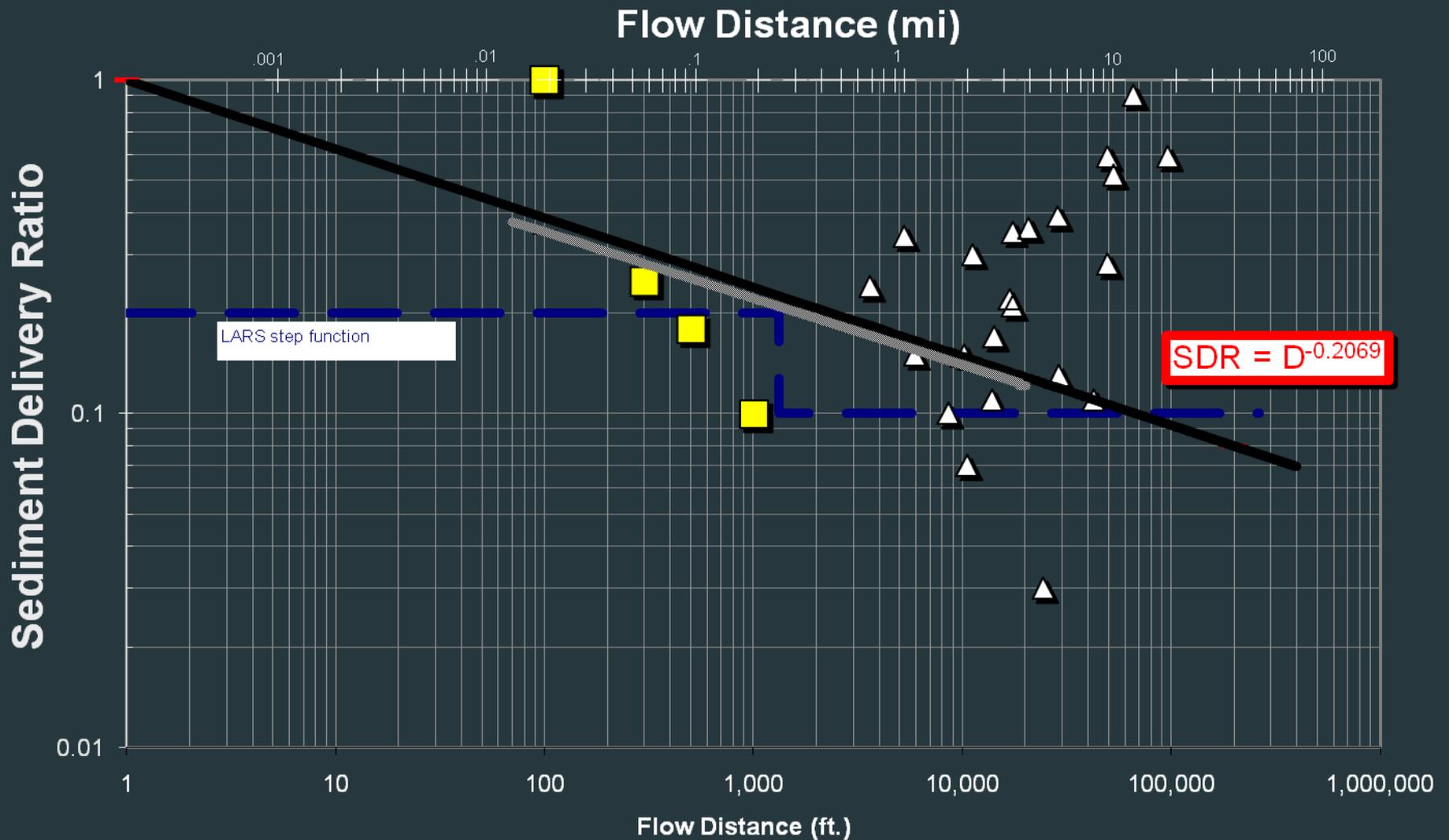
➤ Inputs

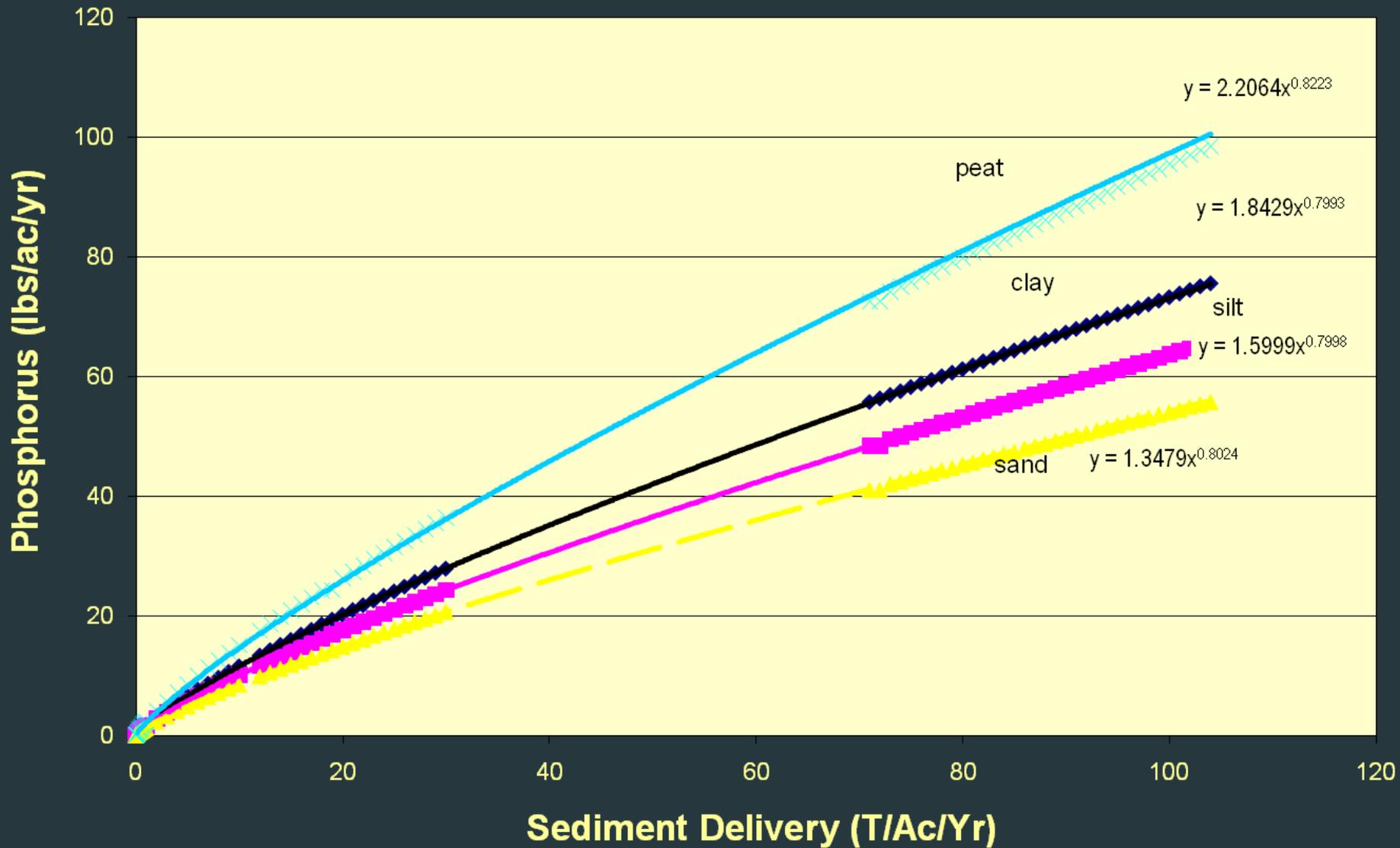
- Soil loss before treatment (RUSLE2)
- Soil loss after treatment (RUSLE2)
- Distance to surface water
- Soil Type
- Units applied (acres)
- Contributing watershed (acres)
- Presence of a filter strip

Sheet & Rill Erosion Control



Estimator Sediment Delivery Ratio relationship





Example 1

- A landowner in Stevens County wants to stabilize a 20 acre portion of a crop field using a **critical area planting** that lies 300 feet from the nearest surface water. The contributing watershed is 100 acres and there is no filter strip present. The site has silt loam soils.

Find suggested calculator

Table 1 continued

Practice	Suggested Calculator	eLINK Category	eLINK Indicator (s)
Contour Buffer Strips (332)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
Contour Farming (330)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
Cover Crop (340)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)
Critical Area Planting (342)	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)
Erosion Control (148)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction) Soil (estimated savings)
	BWSR Filter strip	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Gully	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
			Soil (estimated savings)

Determine inputs

Excel spreadsheet showing the calculation of erosion control inputs and results. The spreadsheet is titled "Sheet & Rill Erosion Control" and contains various input fields, calculated values, and results.

Legend:

- = input
- = calculated value
- = result

Key Calculations and Results:

- Soil Loss Before per acre (T/Ac/yr):** 0.48
- Soil Loss After per acre (T/Ac/yr):** 0.0008
- Soil Loss Reduction per acre (T/Ac/yr):** 0.48
- Soil Loss Reduction (T/yr):** 11.98
- Soil (sand (1), silt (2), clay(3), Peat(4)):** 3
- SED Bpa (T/A/Y):** 0.15
- SED A pa (T/A/Y):** 0.00
- SED R (Sediment Reduction T/yr):** 17.67
- P Bpa (lbs/A/yr):** 0.40
- P A pa (lbs/A/yr):** 0.00
- P R (P reduction lbs/yr):** 47.59

Legend for Results:

Indicator	Value
SEDIMENT (TSS) T/yr:	17.67
SOIL (estimated savings) T/yr:	11.98
PHOSPHORUS (est. reduction) lbs/yr:	47.59

ENTER THIS DATA ON eLINK INDICATORS TAB

Soil Loss Calculation - Before Treatment

RUSLE2 Version 1.26.6.4 (Nov 13 2006) - [Profile: stevens*]

File Database Edit View Options Tools Window Help

STEP 1: Choose location to set climate: Location

STEP 2: Choose soil type: Soil

STEP 3: Set slope topography: Slope length (along slope) Avg. slope steepness, %

STEP 4a: Select base management Base management

STEP 4b: Modify/build man. sequence if desired: Management sequence

Man.	Management	Starting date, m/d/y	Ending date, m/d/y	Correct dates by:
1	...A.Single Year/Single Crop Templates\Corn grain\corn grain; FP, z1	10/15/1	10/15/2	===>

STEP 4c: adjust management inputs if desired:

Adjust yields

General yield level

Adjust res. burial level

Adjust ext. res. additions

Rock cover, %

Fuel type for entire run

Equiv. diesel use for entire simulation, gal/ac	5.0
Energy use for entire simulation, BTU/ac	690000
Fuel cost for entire simulation, US\$/a	14.94

Apply rot. builder manage. sequence to erosion calc. Save temp. management as permanent

STEP 5: Set supporting practices:

Contouring Actual row grade, % Crit. slope length, ft

Strips/barriers

Diversion/terrace, sediment basin

Subsurface drainage

Yrs offset from start year

Segment	Yrs offset from start year, yr
1	0

Results Additional Results **Track Residue and Canopy**

Soil loss for cons. plan, t/a/yr	5.6
T value, t/a/yr	5.0
Surf. res. cov. values	<input type="text" value="open"/>
Soil conditioning index	<input type="text" value="Soil conditioning index"/>

Info

Finished calculating

R2_NRCS_Fld_Office NRCS simple SCI and Fuel Use110206 Area 2_moses October 2007

start Google Inbox - Microsoft Out... RUSLE2 Version 1.26... Microsoft PowerPoint ... Microsoft Excel - Pollu... 10:49 AM

Sheet/Rill Calculator

➤ Inputs

- Soil loss before treatment (RUSLE2)=5.6 tons
- Soil loss after treatment (RUSLE2)
- Distance to surface water
- Soil Type
- Units applied (acres)
- Contributing watershed (acres)
- Presence of a filter strip

Soil Loss Calculation-After Treatment

RUSLE2 Version 1.26.6.4 (Nov 13 2006) - [Profile: stevens*]

File Database Edit View Options Tools Window Help

STEP 1: Choose location to set climate: Location

STEP 2: Choose soil type: Soil

STEP 3: Set slope topography: Slope length (along slope) Avg. slope steepness, %

STEP 4a: Select base management Base management

STEP 4b: Modify/build man. sequence if desired:

Man.	Management	Starting date, m/d/y	Ending date, m/d/y	Correct dates by:
1	Strip/Barrier Managements\Dense grass; not harvested	1/1/1	1/1/1	==>

STEP 4c: adjust management inputs if desired:

Adjust yields

General yield level

Adjust res. burial level

Adjust ext. res. additions

Rock cover, %

Fuel type for entire run

Equip. diesel use for entire simulation, gal/ac

Energy use for entire simulation, BTU/ac

Fuel cost for entire simulation, US\$/a

Apply rot. builder manage. sequence to erosion calc. Save temp. management as permanent

STEP 5: Set supporting practices:

Contouring Actual row grade, % Crit. slope length, ft

Strips/barriers

Diversion/terrace, sediment basin

Subsurface drainage

Yrs offset from start year ()

Segment	Yrs offset from start year, yr
1	0

Results Additional Results **Track Residue and Canopy**

Soil loss for cons. plan, t/ac/yr	0.027
T value, t/ac/yr	5.0
Surf. res. cov. values	<input type="text" value="open"/>
Soil conditioning index	<input type="text" value="Soil conditioning index"/>

Info

Finished calculating

R2_NRC5_Fld_Office NRC5 simple SCI and Fuel Use110206 Area_2_moses October 2007

start Google Inbox - Microsoft Out... RUSLE2 Version 1.26... Microsoft PowerPoint ... Microsoft Excel - Pollu... 10:54 AM

Sheet/Rill Calculator

➤ Inputs

- ❑ Soil loss before treatment (RUSLE2)=5.6 tons
- ❑ Soil loss after treatment (RUSLE2)=0.027 tons
- ❑ Distance to surface water
- ❑ Soil Type
- ❑ Units applied (acres)
- ❑ Contributing watershed (acres)
- ❑ Presence of a filter strip

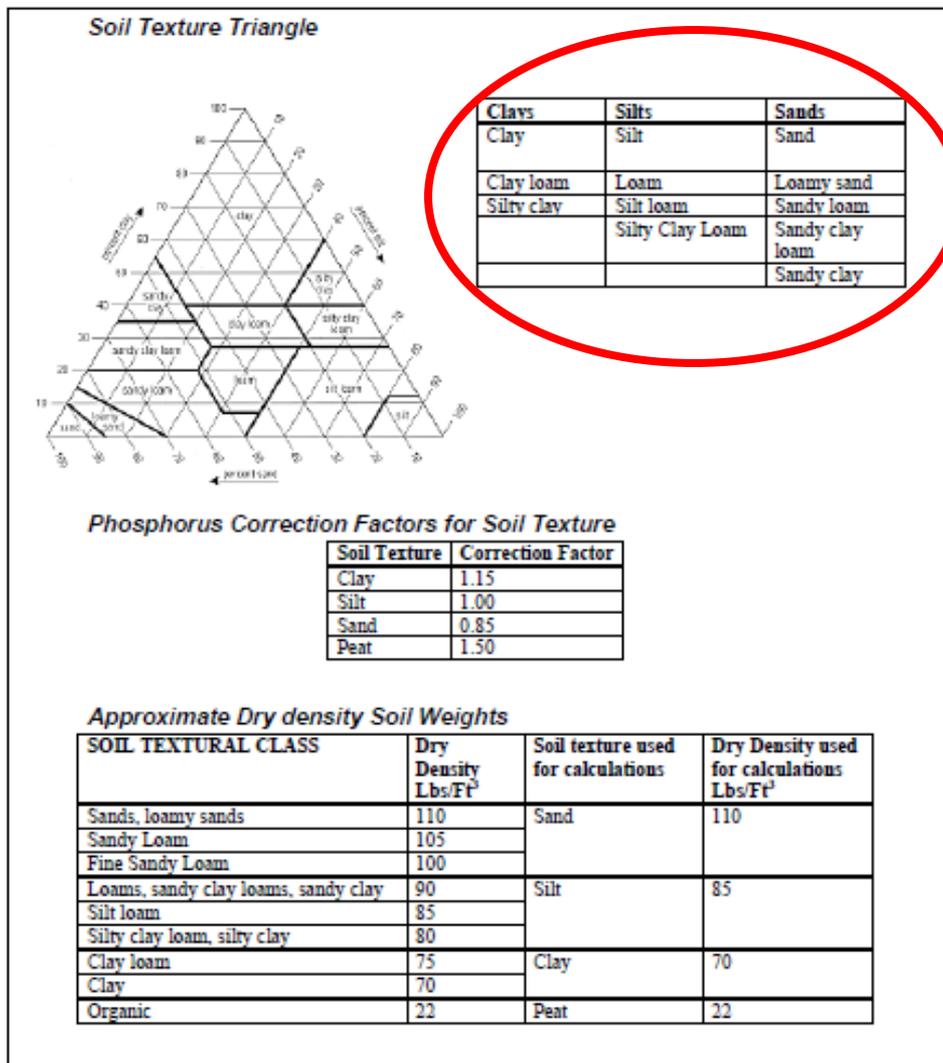
Sheet/Rill Calculator

➤ Inputs

- ❑ Soil loss before treatment (RUSLE2)=5.6 tons
- ❑ Soil loss after treatment (RUSLE2)=0.027 tons
- ❑ Distance to surface water=300 ft
- ❑ Soil Type
- ❑ Units applied (acres)
- ❑ Contributing watershed (acres)
- ❑ Presence of a filter strip

Soil Type (Page A9 from *Instructions for using spreadsheet Pollution Reduction Calculator*)

Fig 5 – Soil Properties



Sheet/Rill Calculator

➤ Inputs

- ❑ Soil loss before treatment (RUSLE2)=5.6 tons
- ❑ Soil loss after treatment (RUSLE2)=0.027 tons
- ❑ Distance to surface water=300
- ❑ Soil Type=**silt**
- ❑ Units applied (acres)
- ❑ Contributing watershed (acres)
- ❑ Presence of a filter strip

Sheet/Rill Calculator

➤ Inputs

- ❑ Soil loss before treatment (RUSLE2)=5.6 tons
- ❑ Soil loss after treatment (RUSLE2)=0.027 tons
- ❑ Distance to surface water=300
- ❑ Soil Type=silt
- ❑ Units applied (acres)=20 acres
- ❑ Contributing watershed (acres)
- ❑ Presence of a filter strip

Sheet/Rill Calculator

➤ Inputs

- ❑ Soil loss before treatment (RUSLE2)=5.6 tons
- ❑ Soil loss after treatment (RUSLE2)=0.027 tons
- ❑ Distance to surface water=300
- ❑ Soil Type=silt
- ❑ Units applied (acres)=20 acres
- ❑ Contributing watershed (acres)=100 acres
- ❑ Presence of a filter strip

Sheet/Rill Calculator

➤ Inputs

- ❑ Soil loss before treatment (RUSLE2)=5.6 tons
- ❑ Soil loss after treatment (RUSLE2)=0.027 tons
- ❑ Distance to surface water=300
- ❑ Soil Type=silt
- ❑ Units applied (acres)=20 acres
- ❑ Contributing watershed (acres)=100 acres
- ❑ Presence of a filter strip=**No**

Inputting data

Pollution_Reduction_Estimator_water [Read-Only] [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Normal Page Layout Page Break Custom Full
Layout Preview Views Screen

Workbook Views Show/Hide

Ruler Formula Bar
Gridlines Headings
Message Bar

Zoom 100% Zoom to Selection

New Window Arrange All Freeze Panes
Split Hide
View Side by Side Synchronous Scrolling
Reset Window Position Window

Save Workspace Switch Windows
Macros

E20

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Sheet & Rill Erosion Control																			
2	SLB _{pa}		SEDB _{0pa} (T/AY)			Filter Strip present		SEDB _{pa}												
3	Soil Loss Before per acre	5.6	= SLB _{pa} * SDR _{pa}	1.72		before installation		= FS * SEDB _{0pa}	1.72											
4	(T/Ac/yr)		sed before /acre			Y/N		(T/AY)												
5						n														
6	SLA _{pa}		SEDA _{0pa} (T/AY)			1		SEDA _{pa}												
7	Soil Loss After per acre	0.027	= SLA _{pa} * SDR _{pa}	0.01		Filter		= FS * SEDA _{0pa}	0.01											
8	(T/Ac/yr)		sed after /acre			Strip		(T/AY)												
9						Factor														
10	D																			
11	distance to surface water	300																		
12	(feet)		SDR	0.31																
13																				
14	SLR _{pa}																			
15	Soil Loss Reduction per acre	5.57																		
16	= SLB _{pa} - SLA _{pa} (T/Ac/yr)																			
17																				
18	SLR = (SLR _{pa})(Ac)																			
19	Soil Loss Reduction (T/yr)	111.46																		
20																				
21																				
22	SOIL = sand (1), silt (2),	2																		
23	clay(3), Peat(4)																			
24																				
25																				
26																				
27	AC = units applied (acres)	20																		
28																				
29	CA = contributing acres (acres)	100																		
30																				
31																				

SEDR = (SEDB_{pa} - SED_{pa}) * CA = 171.23 (T/yr)

PB_{pa} = 2.47 (lbs/A/yr)

P before/acre = 2.47

PA_{pa} = 0.03 (lbs/A/yr)

P after/acre = 0.03

PR = (PB_{pa} - PA_{pa}) * CA = 243.47 (lbs/yr)

Input Data

Legend:
 = input
 = calculated value
 = result

ENTER THIS DATA ON eLINK INDICATORS TAB

SEDIMENT (TSS) T/yr:	171.23
----------------------	--------

Sheet&Rill Gully Stream&Ditch Filter Strip

Output Information

ENTER THIS DATA ON eLINK INDICATORS TAB	
SEDIMENT (TSS) T/yr:	171.23
SOIL (estimated savings) T/yr:	111.46
PHOSPHORUS (est. reduction) lbs/yr:	243.47

Inputting Data into eLINK: Open the Land & Water Project

Land & Water Projects - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add

Google Search

jweinerman(Logout)
Central Office (BWSR)
September 10, 2009

eLINK4Web
Land & Water Projects -

Home > Land & Water Projects > Add Project

Information Center
Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Cooperators
Grants
Objectives
Land & Water Projects
Project Search
Add Project
Help
Initiatives
Fund Manager
Map Viewer
Summary Reports
User Preferences

Details Indicators Cooperators BMPs/Activities Financial Services Inspections Attachments Comm N

Project Name: Calculator training test example

Project Number: Calc examp 1

Approval Date: 09/09/2009 Project Status: Initial Interest

Primary Practice Code: D01 - Critical Area Planting

Planned Start Date: 09/09/2009 Planned Completion Date: 09/09/2009

Actual Start Date: 09/09/2009 Actual Completion Date: 09/09/2009

Objective: County Feedlot Program

Landowner: Land Occupier:

Fund	Amount Budgeted	Amount Approved	Amount Spent	Amount Not Spent

Description:

57

Done Internet

start Google Inbox - Microsof... RUSLE2 Version ... Microsoft Power... Microsoft Excel ... Board of Water ... Land & Water Pr... Document1 - Mic... 11:34 AM

Inputting Data into eLINK: Select the Indicator Tab

Land & Water Projects - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add

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September 10, 2009

eLINK4Web
Land & Water Projects -

Home > Land & Water Projects > Add Project

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Details **Indicators** Cooperators BMPs/Activities Financial Services Inspections Attachments Comm

Category	Indicator	Unit	Indicator Numeric Value	Indicator Pick List Value	E
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Add
Delete

Print Ok Cancel Apply

Minnesota Board of Water & Soil Resources

Done Internet

start Google Inbox - Microsof... RUSLE2 Version ... Microsoft Power... Microsoft Excel ... Board of Water ... Land & Water Pr... Document1 - Mic... 11:36 AM

Inputting Data into eLINK: Select the Category

Land & Water Projects - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add>

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Central Office (BWSR)
September 10, 2009

eLINK4Web

Land & Water Projects -

Home > Land & Water Projects > Add Project

Information Center
Cooperators
Grants
Objectives
Land & Water Projects
Project Search
Add Project
Help
Initiatives
Fund Manager
Map Viewer
Summary Reports
User Preferences

Minnesota Board of Water & Soil Resources

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Details Indicators Cooperators BMPs/Activities Financial Services Inspections Attachments Comm

Category	Indicator	Unit	Indicator Numeric Value	Indicator Pick List Value	
*					Add Delete

Cost Share Inspection
FLEVAL (only to show
MinnFARM
Water Pollution (Reduc
Wind Erosion (Reductio

Print Ok Cancel Apply

Done Internet

start Google Inbox - Microsof... RUSLE2 Version ... Microsoft Power... Microsoft Excel ... Board of Water ... Land & Water Pr... Document1 - Mic... 11:38 AM

Inputting Data into eLINK: Select the Indicator

Land & Water Projects - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add>

Google Search

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eLINK4Web

Land & Water Projects -



Home > Land & Water Projects > Add Project

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Information Center
Cooperators
Grants
Objectives
Land & Water Projects
Project Search
Add Project
Help
Initiatives
Fund Manager
Map Viewer
Summary Reports
User Preferences

Details Indicators Cooperators BMPs/Activities Financial Services Inspections Attachments Comm

Category	Indicator	Unit	Indicator Numeric Value	Indicator Pick List Value		Add
* Water Pollution (Reduction Estir	<input type="text" value="Water Pollution (Reduction Estir"/>					Delete

Nitrogen (estimated re
Phosphorus (estimated
Sediment (TSS)
Soil (estimated savings
pH

Print Ok Cancel Apply



Done

Internet

start Google Inbox - Microsof... RUSLE2 Version ... Microsoft Power... Microsoft Excel ... Board of Water ... Land & Water Pr... Document1 - Mic... 11:39 AM

Inputting Data into eLINK:

Enter the Numeric Value from the Calculator

Land & Water Projects - - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add

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eLINK4Web
Land & Water Projects -

Home > Land & Water Projects > Add Project

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Details Indicators Cooperators BMPs/Activities Financial Services Inspections Attachments Comm

Category	Indicator	Unit	Indicator Numeric Value	Indicator Pick List Value	E	Add
* Water Pollution (Reduction Estir	Sediment (TSS)	Tons/Yr	171.23			Delete

Print Ok Cancel Apply

Minnesota Board of Water & Soil Resources

Done Internet

start Google Inbox - Microsof... RUSLE2 Version ... Microsoft Power... Microsoft Excel -... Board of Water ... Land & Water Pr... Document1 - Mic... 11:42 AM

Inputting Data into eLINK: Identify Calculation Method

Land & Water Projects - - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add>

Google Search

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September 10, 2009

eLINK4Web
Land & Water Projects -

Home > Land & Water Projects > Add Project

Information Center
Cooperators
Grants
Objectives
Land & Water Projects
Project Search
Add Project
Help
Initiatives
Fund Manager
Map Viewer
Summary Reports
User Preferences

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Details Indicators Cooperators **BMPs/Activities** Financial Services Inspections Attachments Comm

Calculation Method	Target Start Date	Target End Date	Comments	Instructions	Add	Delete
BWSR Calc (Filter Strip)						
BWSR Calc (Gully Stabilization)						
BWSR Calc (Sheet and Rill)						
BWSR Calc (Stream & Ditch Stabilization)						
FLEVAL						
MinnFARM						
RUSLE (old)						
RUSLE2 (updated)						
Wind Erosion Equation (WEQ)						

Print Ok Cancel Apply

Step 1: Scroll Left

Step 2: Identify calculator

Minnesota Board of Water & Soil Resources

Done Internet

start Google Inbox - Microsof... RUSLE2 Version ... Microsoft Power... Microsoft Excel ... Board of Water ... Land & Water Pr... Document1 - Mic... 11:45 AM

Inputting Data into eLINK: Use one line for each indicator

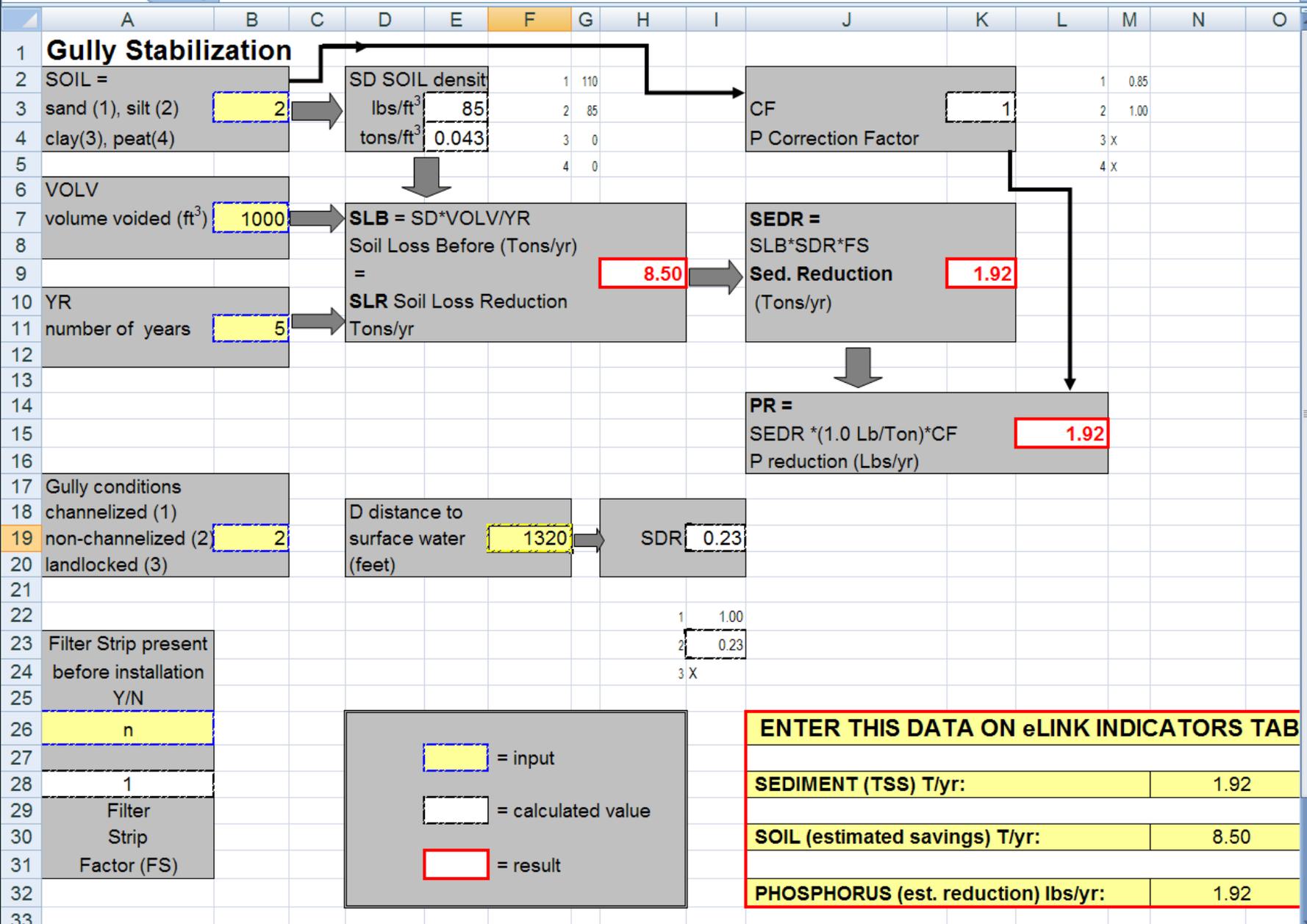
The screenshot shows the eLINK4Web interface in Microsoft Internet Explorer. The browser title is "Land & Water Projects - Calculator training test example - Microsoft Internet Explorer". The address bar shows the URL: <http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add>. The page header includes the user name "jweinerman(Logout)", the organization "Central Office (BWSR)", the date "September 10, 2009", and the page title "Land & Water Projects - Calculator training test example". A navigation menu on the left lists various options like "Information Center", "Cooperators", "Grants", "Objectives", "Land & Water Projects", "Initiatives", "Fund Manager", "Map Viewer", "Summary Reports", and "User Preferences". The main content area features a warning: "Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved." Below this is a table with tabs for "Details", "Indicators", "Cooperators", "BMPs/Activities", "Financial Services", "Inspections", "Attachments", and "Comm". The "Indicators" tab is active, displaying a table with the following data:

Category	Indicator	Unit	Indicator Numeric Value	Indicator Pick List Value	E	Add	Delete
Water Pollution (Reduction Estir	Sediment (TSS)	mg/L	171.23				
Water Pollution (Reduction Estir	Phosphorus (estimated reduction	Lbs/Yr	243.37				

Two red arrows point from yellow callout boxes to the "Indicator" column of the table. The top arrow points to "Sediment (TSS)" and is labeled "Sediment". The bottom arrow points to "Phosphorus (estimated reduction" and is labeled "Phosphorous". At the bottom of the page, there are buttons for "Print", "Ok", "Cancel", and "Apply". The Windows taskbar at the bottom shows the Start button, Google search, and several open applications including "Inbox - Microsof...", "RUSLE2 Version ...", "Microsoft Power...", "Microsoft Excel -...", "Board of Water ...", "Land & Water Pr...", and "Document1 - Mic...". The system clock shows "11:49 AM".

Gully Stabilization



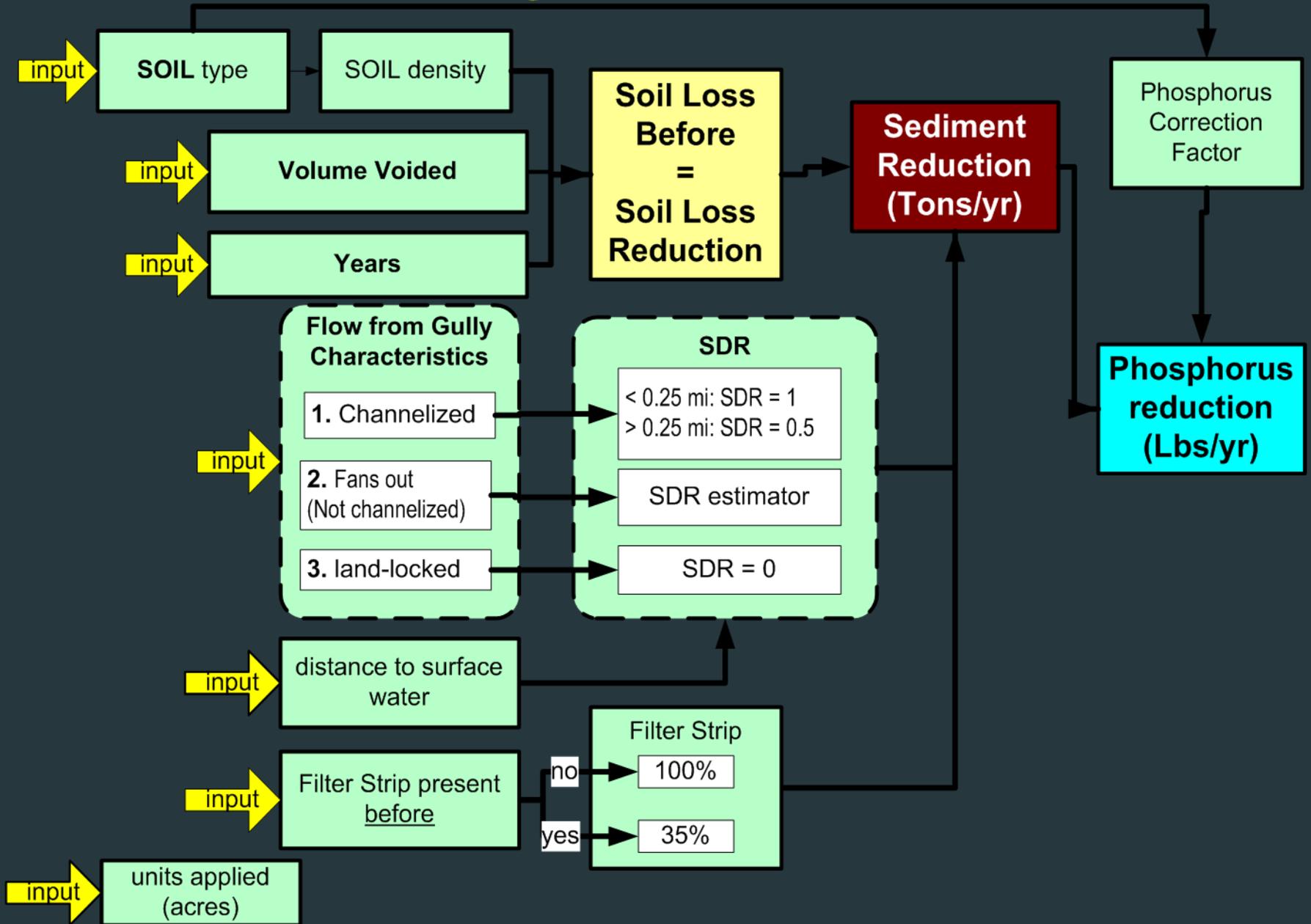


Gully Calculator

➤ Inputs

- ❑ Soil Type
- ❑ Volume Voided
- ❑ Number of years to form gully
- ❑ Distance to surface water
- ❑ Presence of a filter strip

Gully Stabilization



Example 2

- A landowner has a gully problem. The gully is 10 feet deep, 50 feet long, has a top width of 60 feet and a bottom width of 30 feet and took 4 years to form. The end of the gully is 400 feet from the nearest surface water and it is not channelized. There is no filter strip present and the entire site has sandy loam soil.

Find suggested calculator

Critical Area Planting (342)	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)
Erosion Control (148)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Gully	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Stream & Ditch	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)
Field Border (386)	WEQ	Wind Erosion	Soil (estimated savings)
Field Windbreak (RR-4/a, RR-4/b)	WEQ	Wind Erosion	Soil (estimated savings)
Filter Strip (393)	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
Grade Stabilization Structure (410)	BWSR Gully	Water Pollution	Soil (estimated savings) Sediment (TSS)

Determine appropriate inputs

Gully Stabilization

SOIL = sand (1), silt (2) clay(3), peat(4)

VOLV volume voided (ft³)

YR number of years

Gully conditions channelized (1) non-channelized (2) landlocked (3)

Filter Strip present before installation Y/N

Filter Strip Factor (FS)

SD SOIL density lbs/ft³ 85 tons/ft³ 0.043

CF P Correction Factor

D distance to surface water (feet)

SDR

SDR 1 1.00 2 0.23 3 X

SLB = SD*VOLV/YR
Soil Loss Before (Tons/yr) = **8.50**

SLR Soil Loss Reduction
Tons/yr

SEDR = SLB*SDR*FS
Sed. Reduction (Tons/yr) **1.92**

PR = SEDR *(1.0 Lb/Ton)*CF
P reduction (Lbs/yr) **1.92**

ENTER THIS DATA ON eLINK INDICATORS TAB

SEDIMENT (TSS) T/yr:	1.92
SOIL (estimated savings) T/yr:	8.50
PHOSPHORUS (est. reduction) lbs/yr:	1.92

Legend:
 = input
 = calculated value
 = result

Gully Calculator

➤ Inputs

- Soil Type=**Sand**
- Volume Voided
- Number of years to form gully
- Distance to surface water
- Presence of a filter strip

Gully Calculator

➤ Inputs

- ❑ Soil Type=**Sand**
- ❑ Volume Voided= $\frac{1}{2} * (\text{top width} + \text{bottom width}) * \text{depth} * \text{length} = \frac{1}{2} * (60 + 30) * 10 * 50 =$
22,500 cubic feet
- ❑ Number of years to form gully
- ❑ Distance to surface water
- ❑ Presence of a filter strip

Gully Calculator

➤ Inputs

- ❑ Soil Type=**Sand**
- ❑ Volume Voided=**22,500 cubic feet**
- ❑ Number of years to form gully= **4 years**
- ❑ Distance to surface water
- ❑ Presence of a filter strip

Gully Calculator

➤ Inputs

- ❑ Soil Type=**Sand**
- ❑ Volume Voided=**22,500 cubic feet**
- ❑ Number of years to form gully= **4 years**
- ❑ Distance to surface water= **400 feet**
- ❑ Presence of a filter strip

Gully Calculator

➤ Inputs

- ❑ Soil Type=**Sand**
- ❑ Volume Voided=**22,500 cubic feet**
- ❑ Number of years to form gully= **4 years**
- ❑ Distance to surface water= **400 feet**
- ❑ Presence of a filter strip=**No**

Inputting data into the pollution reduction calculator

Pollution_Reduction_Estimator_water [Read-Only] [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Function Library: Insert Function, AutoSum, Recently Used, Financial, Logical, Text, Date & Time, Lookup & Reference, Math & Trig, More Functions, Name Manager, Define Name, Use in Formula, Create from Selection, Defined Names, Trace Precedents, Trace Dependents, Remove Arrows, Show Formulas, Error Checking, Evaluate Formula, Formula Auditing, Watch Window, Calculation Options, Calculate Now, Calculate Sheet

A27

Gully Stabilization

SOIL = sand (1), silt (2) 2, clay(3), peat(4)

VOLV volume voided (ft³) 22500

YR number of years 4

Gully conditions channelized (1), non-channelized (2) 2, landlocked (3)

Filter Strip present before installation Y/N N

SD SOIL density lbs/ft³ 85, tons/ft³ 0.043

CF P Correction Factor 1

SLB = SD*VOLV/YR Soil Loss Before (Tons/yr) = 239.06

SLR Soil Loss Reduction (Tons/yr)

SEDR = SLB*SDR*FS Sed. Reduction (Tons/yr) = 69.21

PR = SEDR *(1.0 Lb/Ton) CF P reduction (Lbs/yr) = 69.21

D distance to surface water (feet) 400

SDR 0.29

Legend: = input, = calculated value

ENTER THIS DATA ON eLINK INDICATORS TAB

SEDIMENT (TSS) T/yr:	69.21
SOIL (estimated erosion) T/yr:	239.06

Input Data

Output Information

ENTER THIS DATA ON eLINK INDICATORS TAB

SEDIMENT (TSS) T/yr:

69.21

SOIL (estimated savings) T/yr:

239.06

PHOSPHORUS (est. reduction) lbs/yr:

69.21

Inputting Data into eLINK:

- Follow the same process as for the previous example

Land & Water Projects - - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://elink4web.bwsr.state.mn.us/eLINK4Web/WatershedProjects/WatershedProjectPage.aspx?type=Cooperator&function=add>

Google Search

jweinerman (Logout) Central Office (BWSR) September 10, 2009 eLINK4Web Land & Water Projects -

Home > Land & Water Projects > Add Project

Information Center
Cooperators
Grants
Objectives
Land & Water Projects
Initiatives
Fund Manager
Map Viewer
Summary Reports
User Preferences

Please Note: New BMPs/Activities will not be available in drop down lists until after the project has been saved.

Details Indicators Cooperators BMPs/Activities Financial Services Inspections Attachments Comm

Category	Indicator	Unit	Indicator Numeric Value	Indicator Pick List Value	Action
*					Add Delete

Cost Share Inspection
FLEVAL (only to show
MinnFARM
Water Pollution (Reduc
Wind Erosion (Reductio

Print Ok Cancel Apply

Done

start Google Inbox - Microsof... RUSLE2 Version... Microsoft Power... Microsoft Excel... Board of Water... Land & Water Pr... Document1 - Mic... 11:38 AM

Stream & Ditch Bank Stabilization



Stream & Ditch Bank Stabilization

SOIL =
 sand (1), silt (2) **3**
 clay(3), peat(4)

SD SOIL density
 lbs/ft³ 70
 tons/ft³ 0.035

CF 1.15
 P Correction Factor

VOLV
 volume voided (ft3) 10000

SLB = SD*VOLV/YR
 Soil Loss Before (Tons/yr)
 = **35.00**
SLR Soil Loss Reduction
 Tons/yr

SEDR =
 SLB*SDR = SLB * 1
 (= SLR) **35.00**
Sediment Reduction
 (Tons/yr)

YR
 number of years 10
 to erode bank to
 current position

PR =
 SEDR *(1.0 Lb/Ton)*CF
P reduction (Lbs/yr) 40.25

D = 0 → SDR = 1

= input
 = calculated value
 = result

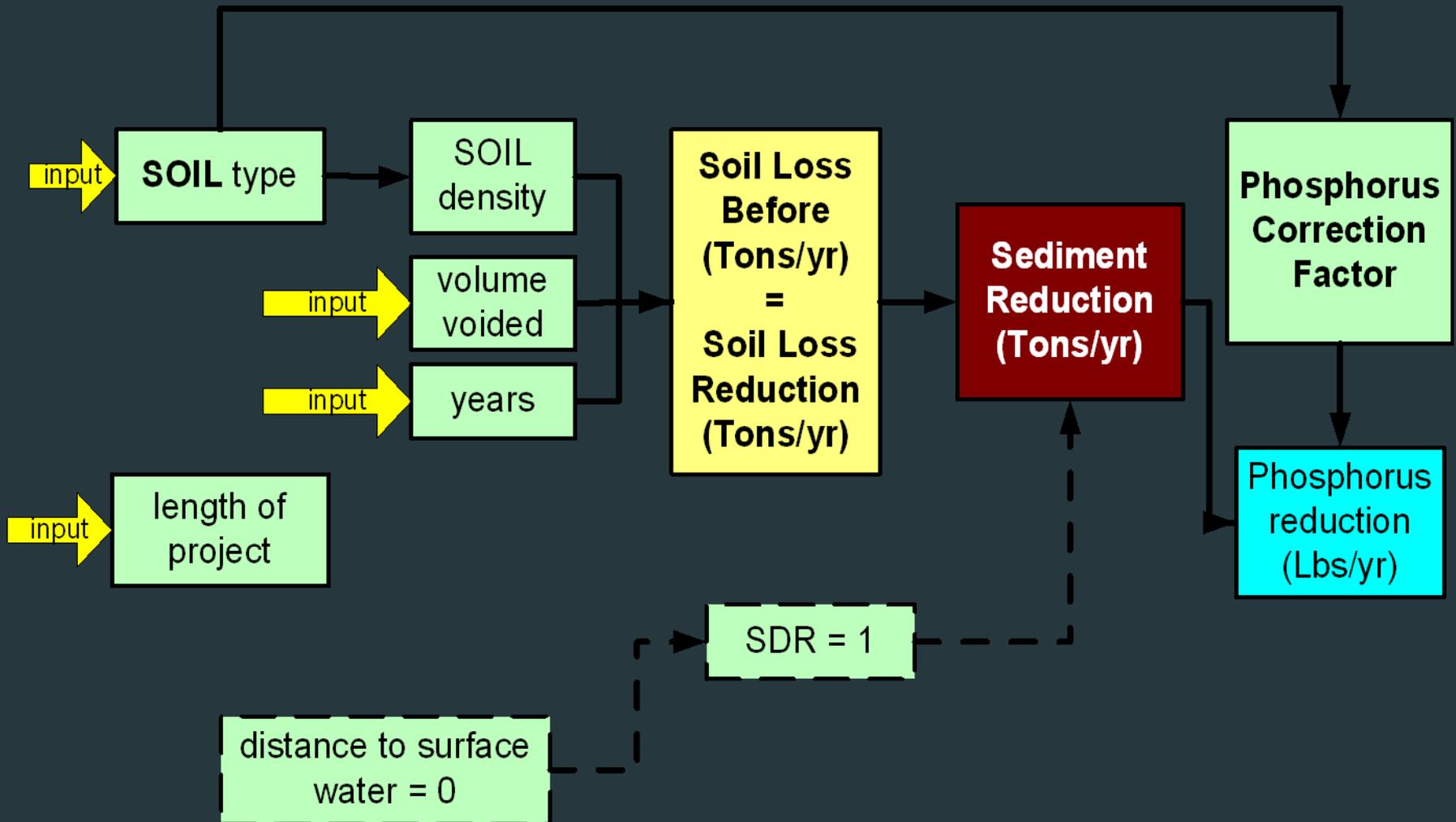
ENTER THIS DATA ON eLINK INDICATORS TAB	
SEDIMENT (TSS) T/yr:	35.00
SOIL (estimated savings) T/yr:	35.00
PHOSPHORUS (est. reduction) lbs/yr:	40.25

Stream & Ditch Bank Stabilization Calculator

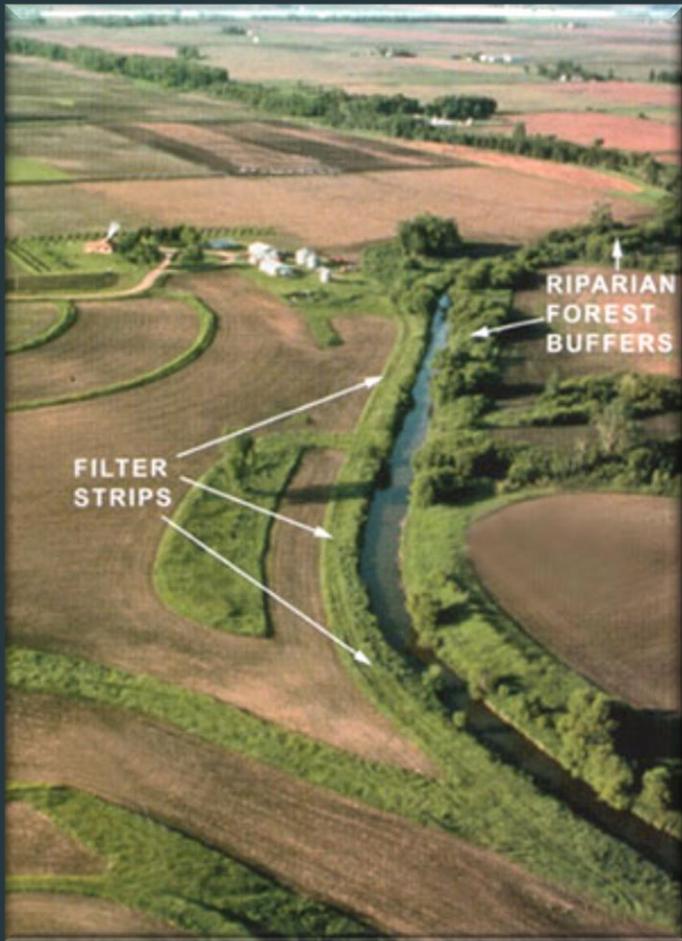
➤ Inputs

- Soil Type
- Volume Voided
- Number of years to erode bank to current position

Stream & Ditch Bank Stabilization



Filter Strip Projects



1. Area of Filter Strip Itself

SLB_{rs,pa}
Soil Loss Before from filter strip area /acre (T/Ac/yr) **2.9**

SLA_{rs,pa}
Soil Loss After from filter strip area /acre (T/Ac/yr) **0.044**

SLR_{rs,pa}
Soil Loss Reduction /acre (T/Ac/yr) **2.856**

AFS = area of filter strip (acres) **0.2**

SLR_{rs} = (SLR_{rs,pa})(AFS)
Soil Loss Reduction From Filter Strip area (T/yr) 0.57

SOIL = sand (1), silt (2), clay(3), Peat(4) **2**

SDR_{rs}
SDR estimator using 1/2 filter strip width **0.51**

VFS
filter strip width (feet) **50**

SEDB_{rs,pa}
SDR_{rs} = SEDB_{rs,pa} * delivery ratio
sed before per acre (T/Ac/yr) **1.49**

SEDA_{rs,pa}
SDR_{rs} = SEDA_{rs,pa} * delivery ratio
sed after per acre (T/Ac/yr) **0.02**

SEDR_{rs}
(SEDB_{rs,pa} - SEDA_{rs,pa}) * AFS
sediment reduction filter strip area itself (T/yr) **0.29**

PB_{rs}
P before/acre (lbs/A/yr) **2.20**

PA_{rs}
P after/acre (lbs/A/yr) **0.08**

PR_{rs}
(PB_{rs} - PA_{rs}) * AFS
P reduction (lbs/yr) **0.4**

Legend:

- = input
- = calculated
- = result

ENTER THIS DATA ON eLINK INDICATORS TAB	
SEDIMENT (TSS) T/yr:	10.71
SOIL (estimated savings) T/yr:	0.57
PHOSPHORUS (est. reduction) lbs/yr:	15.65

2. Filter Strip Treatment of Upland Runoff

CA = area contributing to filter strip (acres) **20**

SLB_{up,pa}
Upland Soil Loss Before /acre (T/Ac/yr) **1.8**

Is filter strip functioning as designed?
Y or N
Y

FS_c
Filter Strip Channelized Factor **0.35**

SLT_{up} = SLB_{up,pa} * CA
Upland soil loss treated by filter strip (T/yr) **36.00**

SEDB_{up,pa}
SLB_{up,pa} * SDR_{up}
upland sed before /acre (T/Ac/yr) **0.80**

SEDA_{up,pa}
SEDB_{up,pa} * FS_c
upland sed after /acre (T/Ac/yr) **0.28**

SEDR_{up}
(SEDB_{up,pa} - SEDA_{up,pa}) * CA
sed reduction from filter strip treatment of upland runoff (T/yr) **10.42**

SDR_{up}
SDR estimator using 1 filter strip width **0.45**

PB_{up,pa}
P before/acre (lbs/A/yr) **1.34**

PA_{up,pa}
P after/acre (lbs/A/yr) **0.58**

PR_{up}
(PB_{up,pa} - PA_{up,pa}) * CA
P reduction from filter strip treatment of upland runoff (lbs/yr) **15.23**

3. Total Benefits

SLR_{rs} = (SLR_{rs,pa})(AFS)
Soil Loss Reduction From Filter Strip area (T/yr) 0.57

Sediment reduction:
SEDR_{tot} = SEDR_{rs} + SEDR_{up} (T/yr) **10.71**

Phosphorus reduction:
PR_{tot} = PR_{rs} + PR_{up} (lbs/yr) **15.65**

Input Data-Need 2 different Areas

➤ Filter Strip

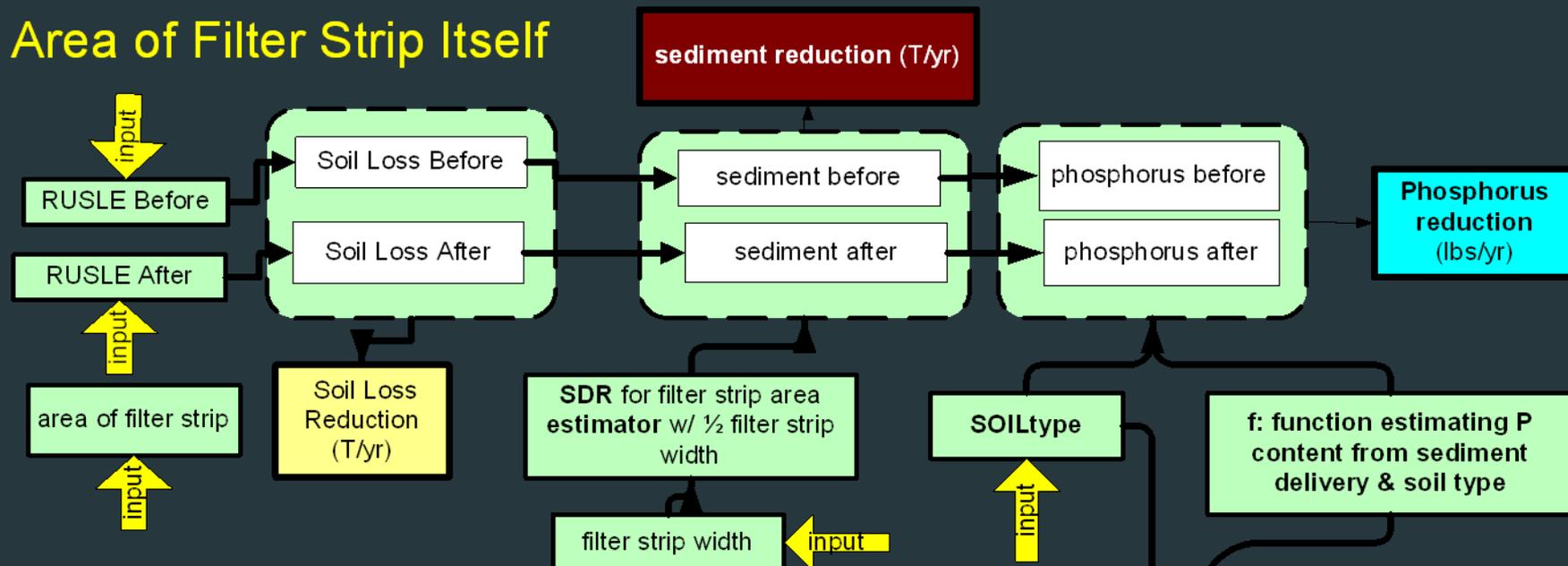
- ❑ Soil Loss Before
- ❑ Soil Loss After
- ❑ Area
- ❑ Soil
- ❑ Width of filter strip

➤ Contributing Area

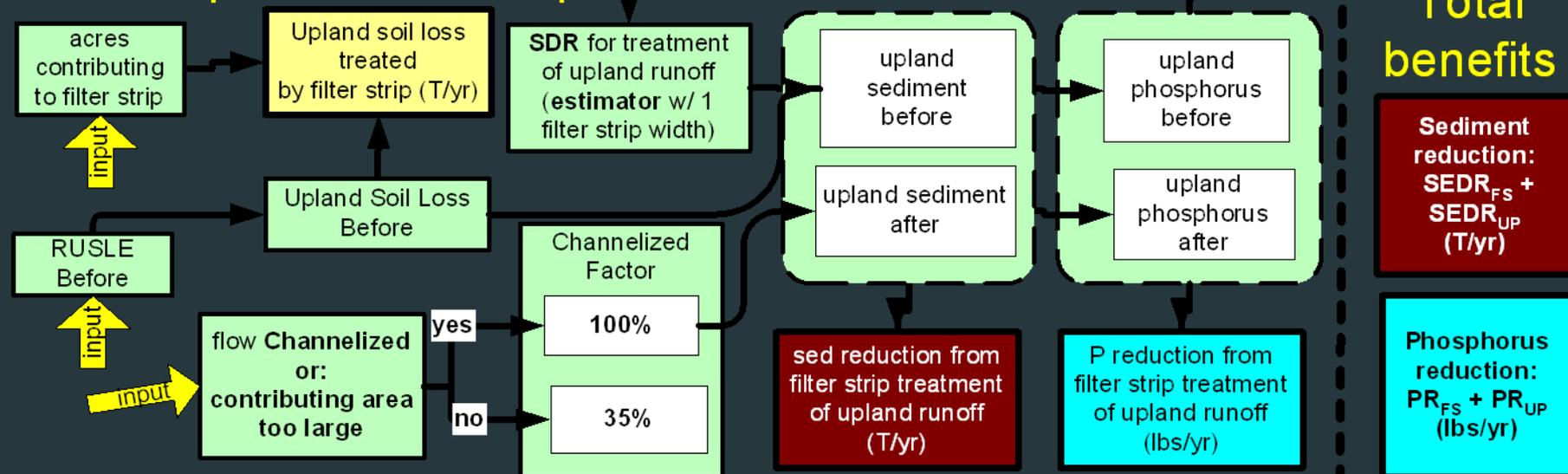
- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Filter Strip Projects

Area of Filter Strip Itself



Filter Strip treatment of upland runoff



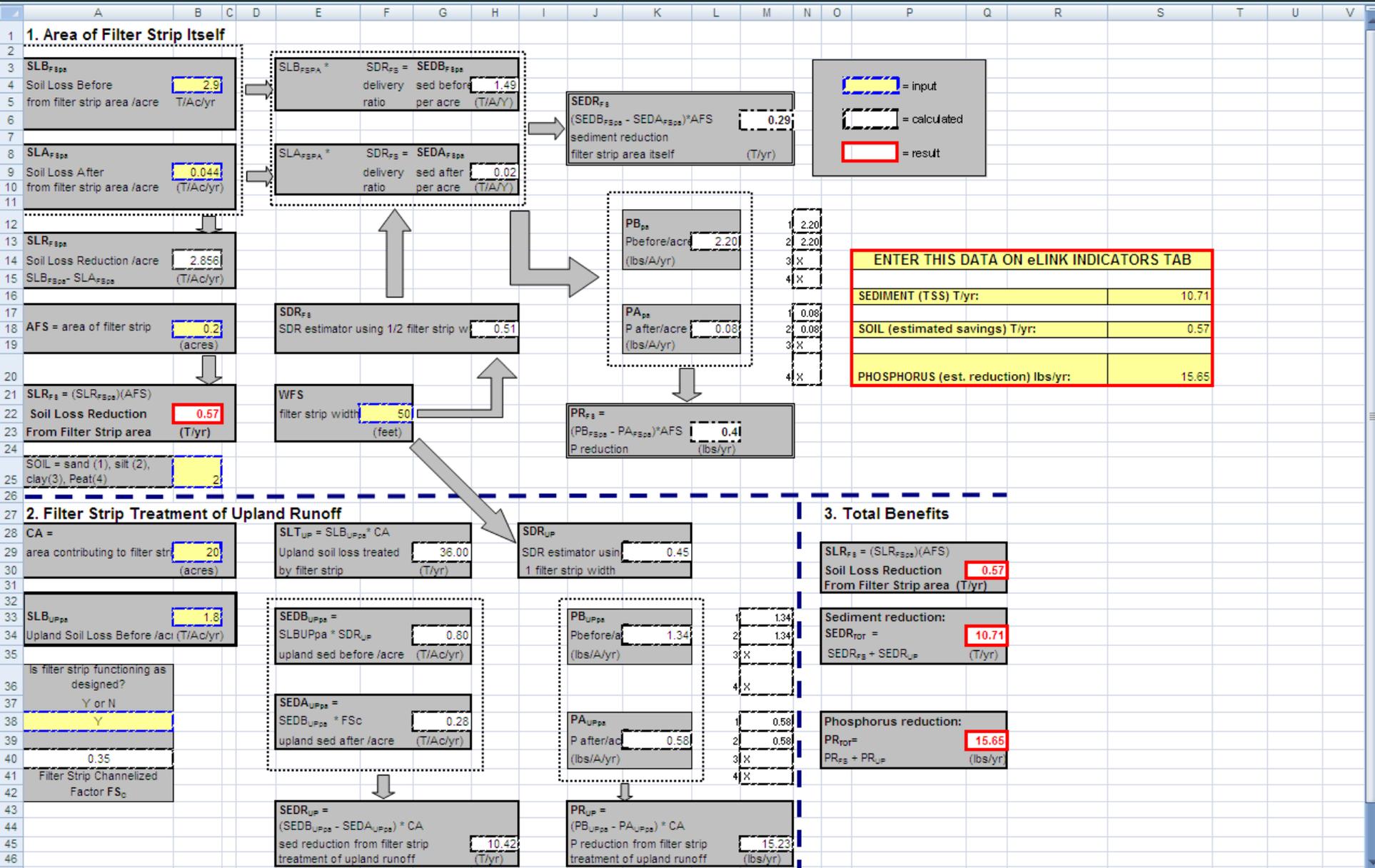
Example 3

- A landowner in Stevens County wants to install a filter strip that is 20 feet wide and 0.8 acres in total size. The site is on clay loam soil. The area contributing to the filter strip is 30 acres in size and has a soil loss of 1.9 tons/acre/year. The filter strip functions as designed.

Find suggested calculator

	WEQ	Wind Erosion	Soil (estimated savings)
Critical Area Planting (342)	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)
Erosion Control (148)	BWSR Sheet/Rill	Water Pollution	Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Gully	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	BWSR Stream & Ditch	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
	WEQ	Wind Erosion	Soil (estimated savings)
Field Border (386)	WEQ	Wind Erosion	Soil (estimated savings)
Field Windbreak (RR-4/a, RR-4/b)	WEQ	Wind Erosion	Soil (estimated savings)
Filter Strip (393)	BWSR Filter strip	Water Pollution	Soil (estimated savings) Sediment (TSS) Phosphorus (estimated reduction)
	RUSLE2	Water Pollution	Soil (estimated savings)
Grade Stabilization Structure (410)	BWSR Gully	Water Pollution	Soil (estimated savings) Sediment (TSS)

Determine appropriate inputs



Soil Loss Calculations-Before Treatment

RUSLE2 Version 1.26.6.4 (Nov 13 2006) - [Profile: stevens*]

File Database Edit View Options Tools Window Help

STEP 1: Choose location to set climate: Location

STEP 2: Choose soil type: Soil

STEP 3: Set slope topography: Slope length (along slope) Avg. slope steepness, %

STEP 4a: Select base management Base management

STEP 4b: Modify/build man. sequence if desired: Management sequence

Man.	Management	Starting date, m/d/y	Ending date, m/d/y	Correct dates by:
1	...va.Single Year/Single Crop Templates\Corn grain\corn grain; FP, z1	10/15/1	10/15/2	===>

STEP 4c: adjust management inputs if desired:

Adjust yields

General yield level

Adjust res. burial level

Adjust ext. res. additions

Rock cover, %

Fuel type for entire run

Equip. diesel use for entire simulation, gal/ac	6.0
Energy use for entire simulation, BTU/ac	830000
Fuel cost for entire simulation, US\$/a	17.93

Apply rot. builder manage. sequence to erosion calc. Save temp. management as permanent

STEP 5: Set supporting practices:

Contouring Actual row grade, % Crit. slope length, ft

Strips/barriers

Diversion/terrace, sediment basin

Subsurface drainage

Yrs offset from start year

Segment	Yrs offset from start year, yr
1	0

Results Additional Results Track Residue and Canopy

Soil loss for cons. plan, /ac/yr	0.87
T value, /ac/yr	5.0
Surf. res. cov. values	<input type="text" value="open"/>
Soil conditioning index	<input type="text" value="Soil conditioning index"/>

Info

Finished calculating

R2_NRCS_Fld_Office NRCS simple SCI and Fuel Use110206 Area 2_moses October 2007

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Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After
- ❑ Area
- ❑ Soil
- ❑ Width of filter strip

➤ Contributing Area

- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Soil Loss Calculation-After Treatment

RUSLE2 Version 1.26.6.4 (Nov 13 2006) - [Profile: stevens*]

File Database Edit View Options Tools Window Help

STEP 1: Choose location to set climate: Location

STEP 2: Choose soil type: Soil

STEP 3: Set slope topography: Slope length (along slop) Avg. slope steepness, %

STEP 4a: Select base management Base management

STEP 4b: Modify/build man. sequence if desired:

Man.	Management	Starting date, m/d/y	Ending date, m/d/y	Correct dates by:
1	Strip/Barrier Managements\Dense grass; not harvested	1/1/1	1/1/1	==>

STEP 4c: adjust management inputs if desired:

Adjust yields

General yield level

Adjust res. burial level

Adjust ext. res. additions

Rock cover, %

Fuel type for entire run

Equiv. diesel use for entire simulation, gal/ac

Energy use for entire simulation, BTU/ac

Fuel cost for entire simulation, US\$/a

Apply rot. builder manage. sequence to erosion calc. Save temp. management as permanent

STEP 5: Set supporting practices:

Contouring Actual row grade, % Crit. slope length, ft

Strips/barriers

Diversion/terrace, sediment basin

Subsurface drainage

Yrs offset from start year

Segment	Yrs offset from start year, yr
1	0

Results Additional Results Track Residue and Canopy

Soil loss for cons. plan, t/ac/yr	<input type="text" value="0.0065"/>
T value, t/ac/yr	<input type="text" value="5.0"/>
Surf. res. cov. values	<input type="text" value="open"/>
Soil conditioning index	<input type="text" value="Soil conditioning index"/>

Finished calculating

R2_NRCS_Fld_Office NRCS simple SCI and Fuel Use110206 Area 2_moses October 2007

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Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After
- ❑ Area
- ❑ Soil
- ❑ Width of filter strip

➤ Contributing Area

- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area
- ❑ Soil
- ❑ Width of filter strip

➤ Contributing Area

- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area = 0.8
- ❑ Soil
- ❑ Width of filter strip

➤ Contributing Area

- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area = 0.8
- ❑ Soil = **clay**
- ❑ Width of filter strip

➤ Contributing Area

- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area = 0.8
- ❑ Soil = clay
- ❑ Width of filter strip = 20

➤ Contributing Area

- ❑ Upland soil loss
- ❑ Upland area
- ❑ Effective filter strip

Soil Loss Calculation-Upland Area

RUSLE2 Version 1.26.6.4 (Nov 13 2006) - [Profile: stevens*]

File Database Edit View Options Tools Window Help

STEP 1: Choose location to set climate: Location

STEP 2: Choose soil type: Soil

STEP 3: Set slope topography: Slope length (along slop) Avg. slope steepness, %

STEP 4a: Select base management Base management

STEP 4b: Modify/build man. sequence if desired: Management sequence

Man.	Management	Starting date, m/d/y	Ending date, m/d/y	Correct dates by:
1	...\.a.Single Year/Single Crop Templates\Corn grain\corn grain; FP, z1	10/15/1	10/15/2	==>

STEP 4c: adjust management inputs if desired:

Adjust yields open

General yield level

Adjust res. burial level

Adjust ext. res. additions Residue inputs

Rock cover, %

Fuel type for entire run

Equiv. diesel use for entire simulation, gal/ac	6.0
Energy use for entire simulation, BTU/ac	830000
Fuel cost for entire simulation, US\$/a	17.93

Apply rot. builder manage. sequence to erosion calc. Save temp. management as permanent

STEP 5: Set supporting practices:

Contouring Actual row grade, % Crit. slope length, ft

Strips/barriers

Diversion/terrace, sediment basin

Subsurface drainage

Yrs offset from start year ()

Segment	Yrs offset from start year, yr
1	0

Results Additional Results **Track Residue and Canopy**

Soil loss for cons. plan, t/ac/yr	1.9
T value, t/ac/yr	5.0
Surf. res. cov. values	<input type="checkbox"/> open
Soil conditioning index	<input type="checkbox"/> Soil conditioning index

Info

Finished calculating

R2_NRCS_Fld_Office NRCS simple SCI and Fuel Use110206 Area 2_moses October 2007

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Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area = 0.8
- ❑ Soil = clay
- ❑ Width of filter strip = 20

➤ Contributing Area

- ❑ Upland soil loss = 1.9
- ❑ Upland area
- ❑ Effective filter strip

Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area = 0.8
- ❑ Soil = clay
- ❑ Width of filter strip = 20

➤ Contributing Area

- ❑ Upland soil loss = 1.9
- ❑ Upland area = 30
- ❑ Effective filter strip

Input Data-Need 2 different Areas

➤ Filter Strip

- ❑ Soil Loss Before = 0.87
- ❑ Soil Loss After = 0.0065
- ❑ Area = 0.8
- ❑ Soil = clay
- ❑ Width of filter strip = 20

➤ Contributing Area

- ❑ Upland soil loss = 1.9
- ❑ Upland area = 30
- ❑ Effective filter strip = **yes**

Inputting data into the pollution reduction calculator

Pollution_Reduction_Estimator_water [Read-Only] [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Clipboard Font Alignment Number Styles Cells Editing

F22 20

1 **1. Area of Filter Strip Itself**

2

3 SLB_{Fspa} Soil Loss Before from filter strip area /acre (T/Ac/yr) **0.87**

4 SLA_{Fspa} Soil Loss After from filter strip area /acre (T/Ac/yr) **0.0065**

5 SLR_{Fspa} Soil Loss Reduction /acre (T/Ac/yr) **0.8635**

6 $SLB_{Fspa} - SLA_{Fspa}$

7

8 AFS = area of filter strip (acres) **0.8**

9 SLR_{F_s} = $(SLR_{Fspa})(AFS)$ Soil Loss Reduction From Filter Strip area (T/yr) **0.69**

10 $SOIL$ = sand (1), silt (2), clay(3), Peat(4) **3**

11

12 **2. Filter Strip Treatment of Upland Runoff**

13 CA =

14 $SLT_{UP} = SLB_{UPspa} * CA$

15 SDR_{UP}

16

17 **3. Total Benefits**

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Inputting data into the pollution reduction calculator

Pollution_Reduction_Estimator_water [Read-Only] [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Clipboard Font Alignment Number Styles Cells Editing

F22 20

22 Soil Loss Reduction From Filter Strip area (T/yr) 0.69

23 filter strip width (feet) 20

24 $PR_{FS} = (PB_{FSPa} - PA_{FSPa}) * AFS$
P reduction (lbs/yr) 0.8

25 SOIL = sand (1), silt (2), clay(3), Peat(4) 3

27 2. Filter Strip Treatment of Upland Runoff

28 CA =

29 area contributing to filter strip (acres) 20

30 $SLT_{Up} = SLB_{UpPa} * CA$
Upland soil loss treated by filter strip (T/yr) 36.00

31 SDR_{Up}
SDR estimator using 1 filter strip width 0.45

32 SLB_{UpPa}
Upland Soil Loss Before /ac (T/Ac/yr) 1.8

33 $SEDB_{UpPa} = SLB_{UpPa} * SDR_{Up}$
upland sed before /acre (T/Ac/yr) 0.80

34 $SEDA_{UpPa} = SEDB_{UpPa} * FSc$
upland sed after /acre (T/Ac/yr) 0.28

35 Is filter strip functioning as designed? Y or N Y

36 0.35

37 Filter Strip Channelized Factor FSc

38 $SEDR_{Up} = (SEDB_{UpPa} - SEDA_{UpPa}) * CA$
sed reduction from filter strip treatment of upland runoff (T/yr) 10.42

39 PB_{UpPa}
P before/a (lbs/A/yr) 1.54

40 PA_{UpPa}
P after/a (lbs/A/yr) 0.67

41 $PR_{Up} = (PB_{UpPa} - PA_{UpPa}) * CA$
P reduction from filter strip treatment of upland runoff (lbs/yr) 17.53

42 1742.4

43 3. Total Benefits

44 $SLR_{FS} = (SLR_{FSPa}) * (AFS)$
Soil Loss Reduction From Filter Strip area (T/yr) 0.69

45 Sediment reduction:
 $SEDR_{TOT} = SEDR_{FS} + SEDR_{Up}$
(T/yr) 10.77

46 Phosphorus reduction:
 $PR_{TOT} = PR_{FS} + PR_{Up}$
(lbs/yr) 18.29

Input Data

start Google Microsoft PowerPoin... Adobe Reader Internet Explorer Document1 - Micros... Microsoft Excel - Poll... RUSLE2 Version 1.26... 3:55 PM

Output Information

ENTER THIS DATA ON eLINK INDICATORS TAB

SEDIMENT (TSS) T/yr:

20.36

SOIL (estimated savings) T/yr:

0.69

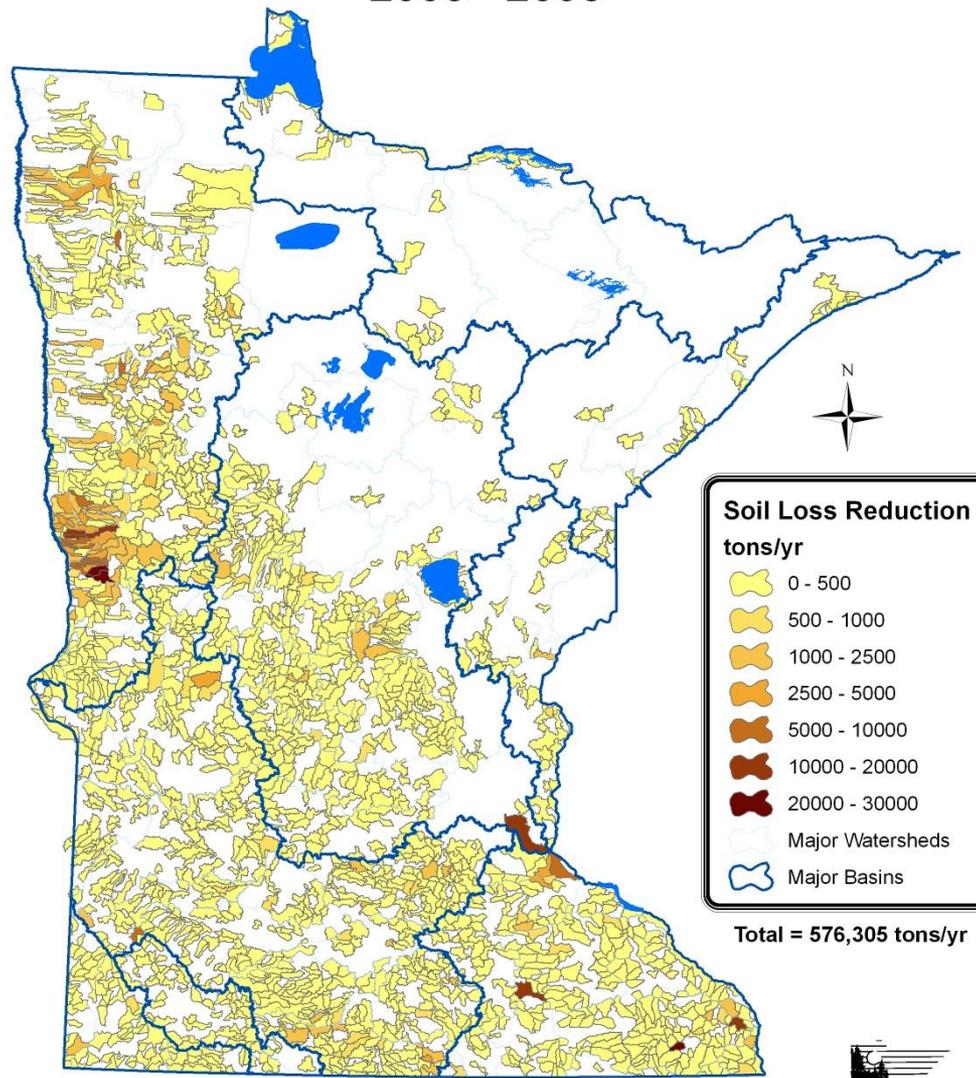
PHOSPHORUS (est. reduction) lbs/yr:

32.84

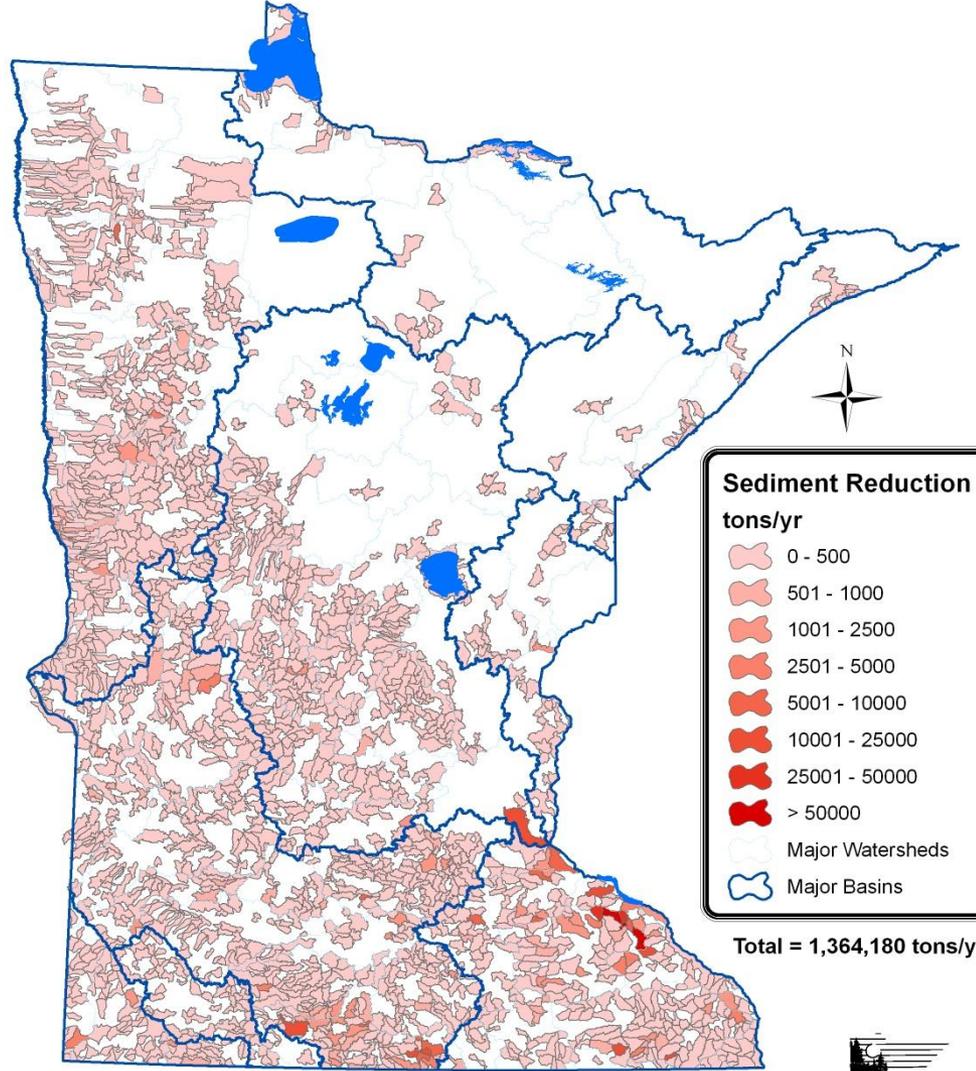
eLINK Output

- Data is compiled for a statewide basis
 - ❑ Provides an outstanding tool for visually showing the benefits of conservation
- Can be compiled on a smaller scale
 - ❑ Excellent tool for use with local officials

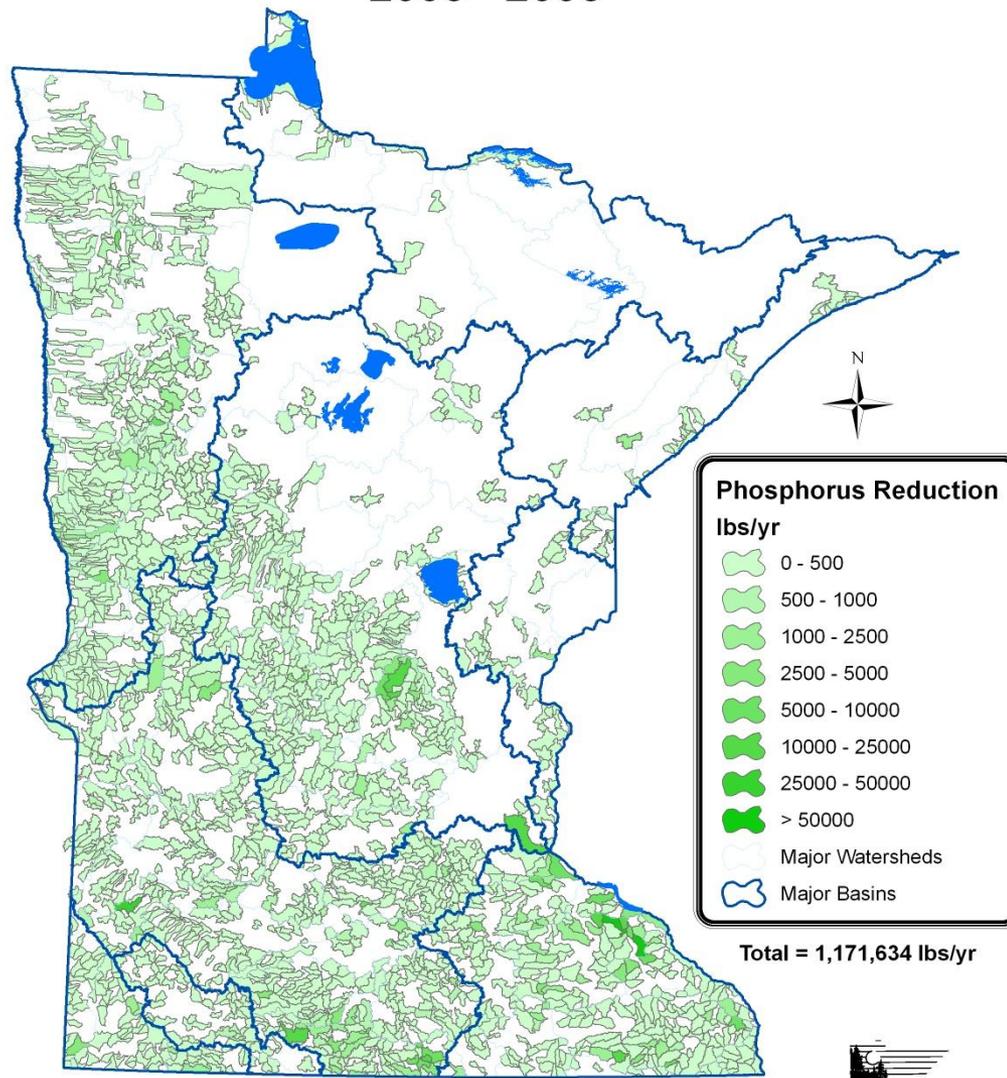
Estimated Soil Loss Reduction by Minor Watershed Reported in eLINK 2003 - 2008



Estimated Sediment Reduction by Minor Watershed Reported in eLINK 2003 - 2008



Estimated Phosphorus Reduction by Minor Watershed Reported in eLINK 2003 - 2008



BWSR Water Erosion Pollution Reduction Estimator

- Useful, but...
- Remember limitations
- Not the main point of all this
- Be careful out there...

- Some BMPs are not designed to prevent soil erosion.
- How do you estimate the pollution reduction benefit of these practices?

Bioretention Estimator

Generates pollution reduction estimates for:

- Total Phosphorus
- Total Nitrogen
- Total Suspended Sediment

Minnesota Stormwater Manual

Urban Stormwater Retrofit Practices Manual

The “Simple Method”

$$\text{Loading} = P * R * C * A * 0.2$$

P= Rainfall depth per year

R = Runoff Coefficient

C = Pollutant Concentration

A = Area of Contributing Watershed

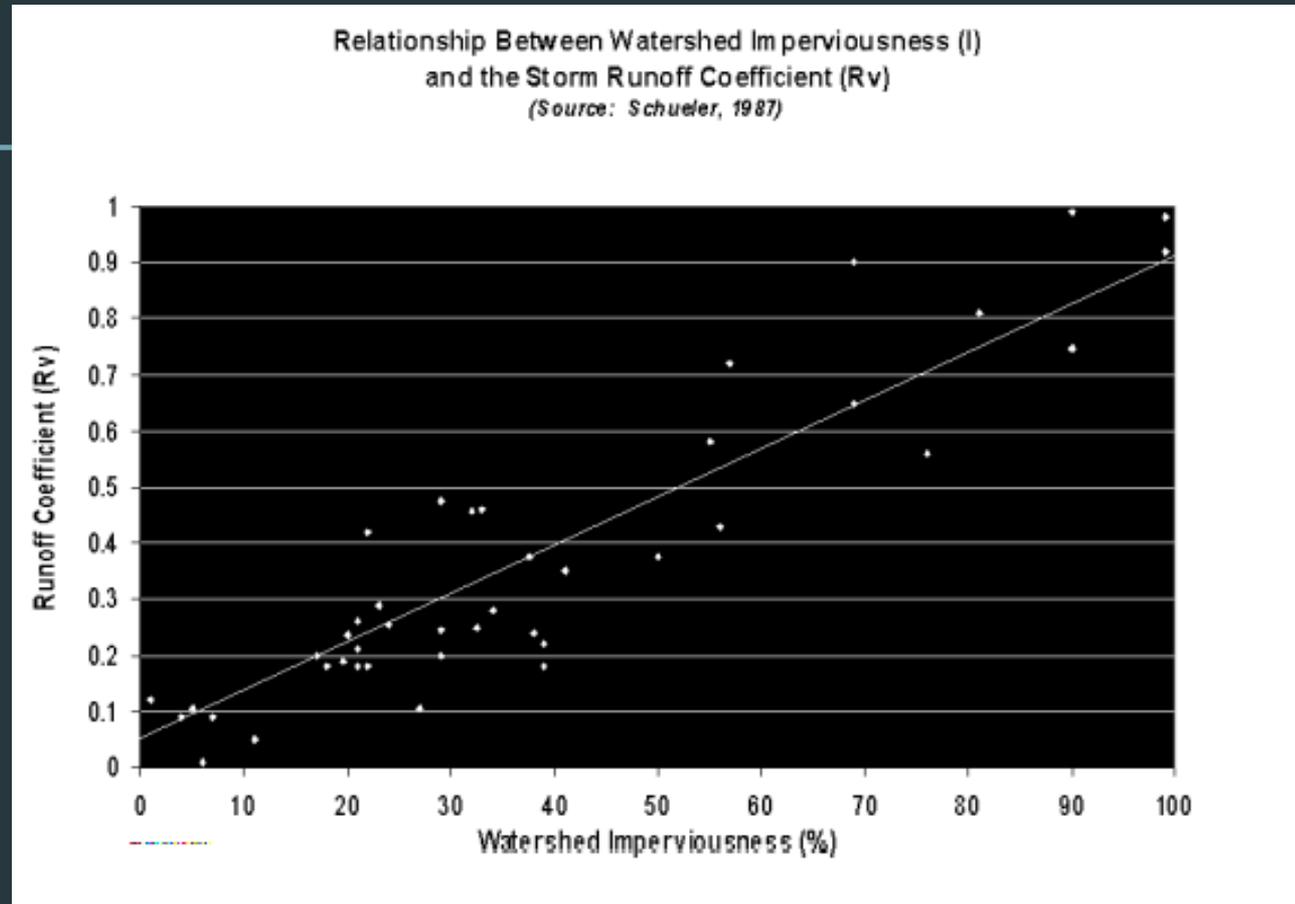
0.2 = a regional constant and unit converter

Input Values

- P, Average Rainfall in inches
- I, watershed imperviousness
- A, area of contributing watershed
- Type of BMP : Bioretention, Infiltration, Filtration
- Land Use

I - Watershed Imperviousness

% imperviousness of site relates to Runoff Coefficient



Area of Contributing Watershed



If the total area of the site is greater than 640 acres the Bioretention estimator may not be appropriate

Type of BMP

- Bioretention
- Filtration
- Infiltration

Bioretention

Designed and engineered systems with an underdrain.



Infiltration

Natural or constructed depressions that capture and infiltrate stormwater.

Examples: Infiltration trench, pervious pavers, infiltration basin.



Filtration

Stormwater controls that improve stormwater quality by passing stormwater through a filter media.

Examples: Swales, filter strips, sand filters



Important Caveats

- “Bioretention” BMP type assumes underdrain system
- Use “infiltration” BMP type for raingardens



Example 1

Raingarden in a mixed residential area in St. Paul. Area of contributing watershed is .15 acres.

Example 1 – Input values

P = Annual precipitation = 31.5"

I = Watershed imperviousness = 70%

A = Watershed = .15 acres

BMP Type = Infiltration

Landuse = Residential

Example 2

A local company installs a sand filter to treat stormwater runoff from a parking lot.

Example 2 – Input Values

P = Annual precipitation = 28.5"

I = Watershed imperviousness = 100%

A = Watershed = .5 acres

BMP Type = Filtration

Landuse = Commercial

An example on your own.

Take a few minutes and apply the estimator to a site you are familiar with.

We want your feedback !

- What worked well? What do you like about this tool?
- What is not intuitive about the estimator?
- What about this estimator doesn't work well?
- Other comments or suggestions?

