Pollution Reduction Estimators

Megan Lennon
Eric Mohring

October 27, 2010
BWSR Academy

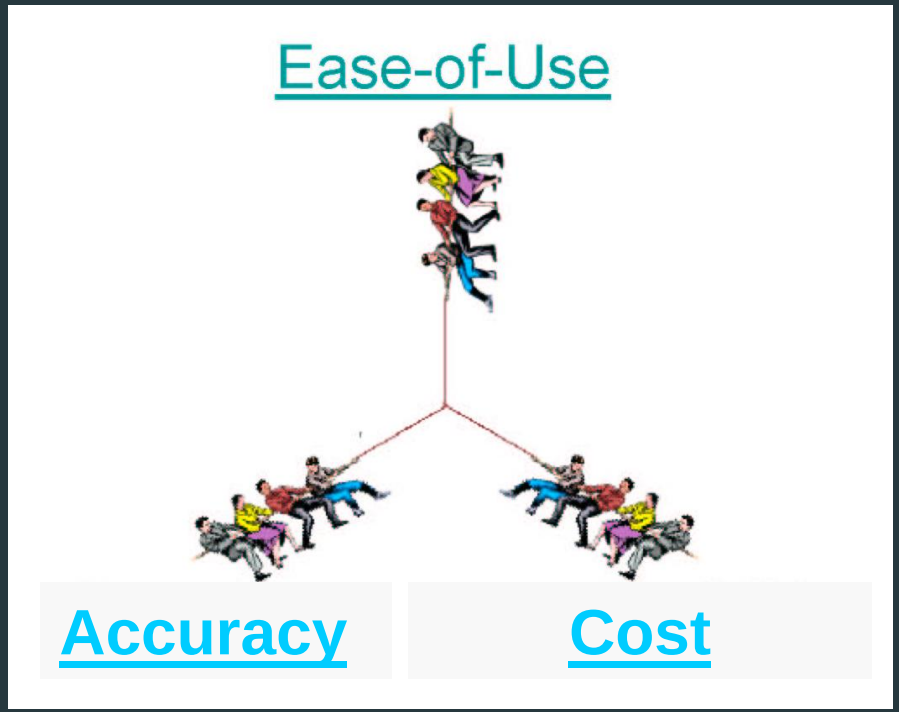
Agenda

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


Environmental Outcomes
Accomplishment reporting
Goals
Outcomes
Outcome Measurement
Benefits
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

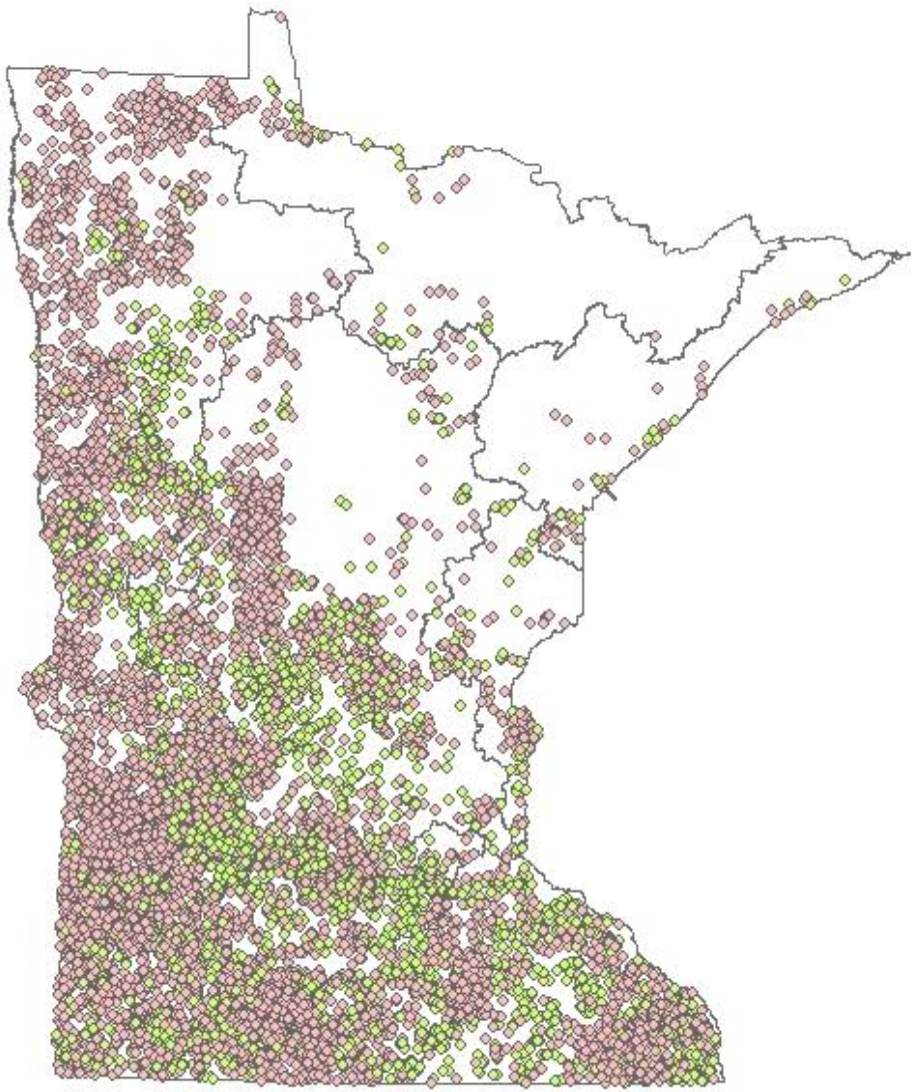
Benefits

- 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)

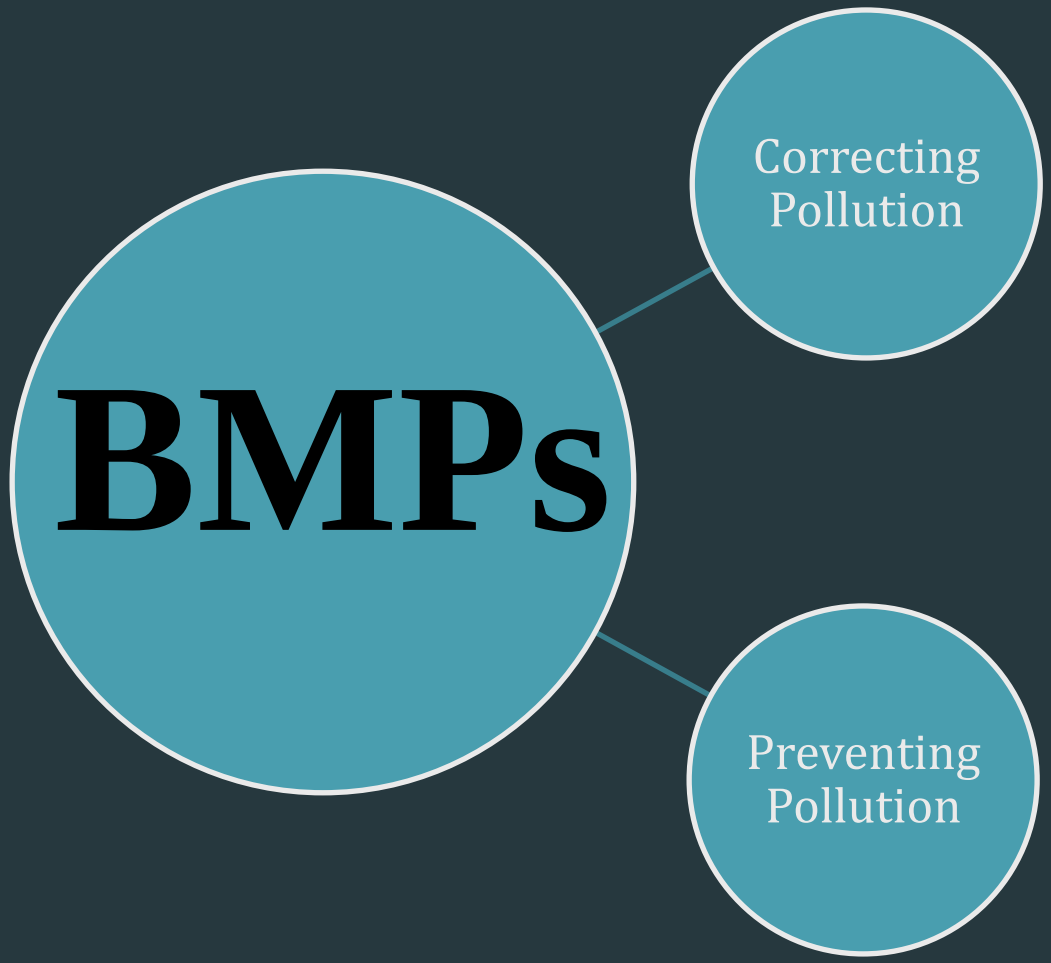
Green dots represent conservation projects with outcome data (n = 4,575)

What we're doing now

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

Do all practices need an estimate?

A new perspective on BMPs



- Terrace
- Sediment Basin
- Filter Strip

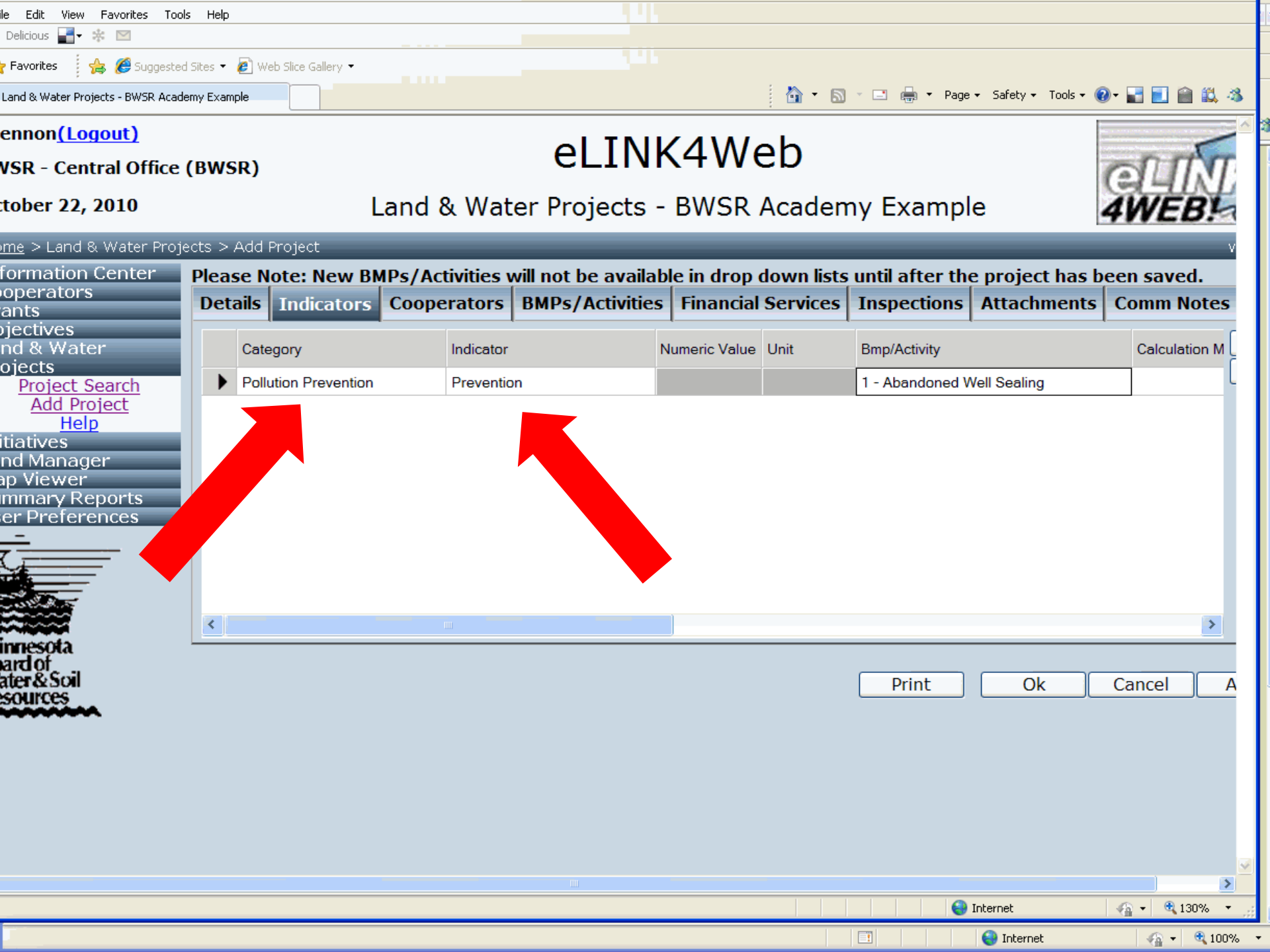
- Salt Reduction
- Well Sealing
- Prescribed Grazing

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


Edit View Favorites Tools Help
Delicious
Favorites
Suggested Sites
Web Slice Gallery
Land & Water Projects - BWSR Academy Example
Page Safety Tools
ennon(Logout)
WSR - Central Office (BWSR)
tober 22, 2010
eLINK4Web
Land & Water Projects - BWSR Academy Example
eLINK 4WEB!
me > Land & Water Projects > Add Project
formation Center
ooperators
rants
jectives
nd & Water
ojects
Project Search
Add Project
Help
itiatives
nd Manager
ap Viewer
mmary Reports
er Preferences
innesota
oard of
ater & Soil
esources
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
Internet
130%
Internet
100%

BWSR wants your input

What other practices belong on the “prevention” list ?

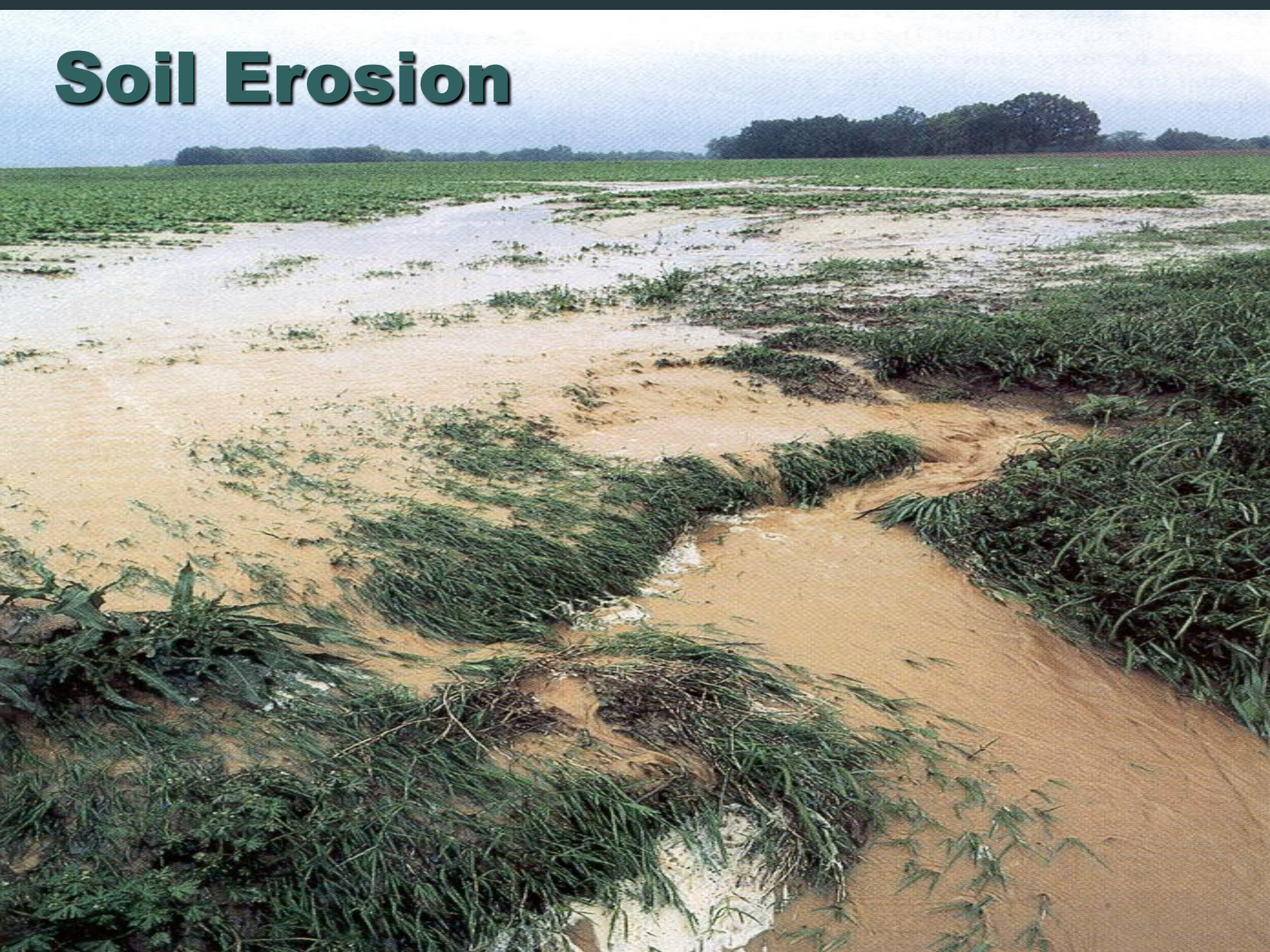
BMPs categorized as “prevention”

- 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

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 O_2**
- **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

Minnesota Board of Water and Soil Resources - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.bwsr.state.mn.us/

Minnesota Board of Water and Soil R...

A to Z Topics Contact Search

Minnesota Board of Water & Soil Resources

Easements | Grants | Resource Management and Planning | Conservation Implementation | Wetlands



- Partners
- Drainage
- Pollution Reduction Calculators
- State Soils Office

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

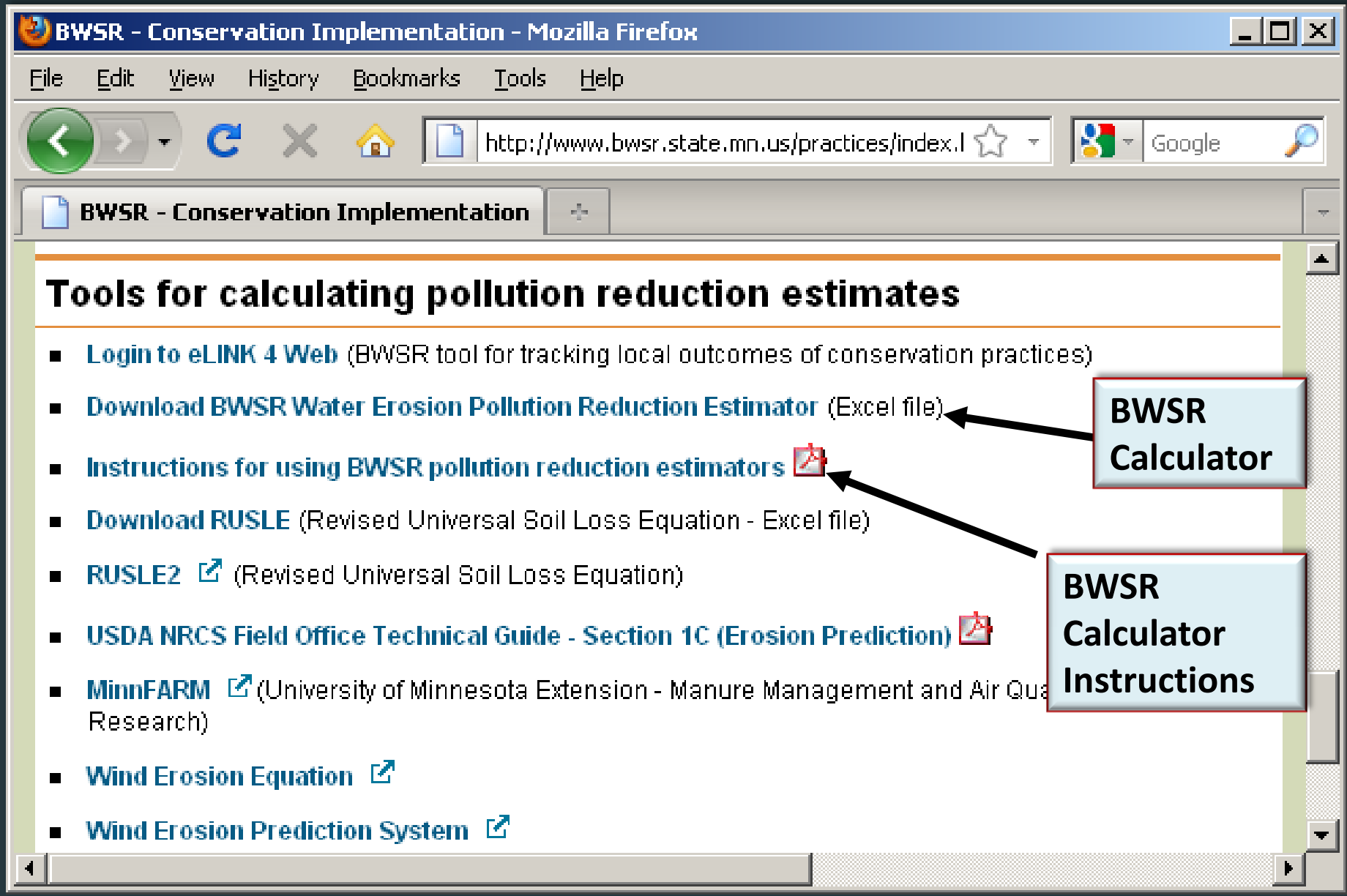
About BWSR

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.

BWSR Meetings and Events


BWSR - Conservation Implementation - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://www.bwsr.state.mn.us/practices/index.l
Google
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 Qua
Research)
Wind Erosion Equation
Wind Erosion Prediction System
BWSR Calculator
BWSR Calculator Instructions

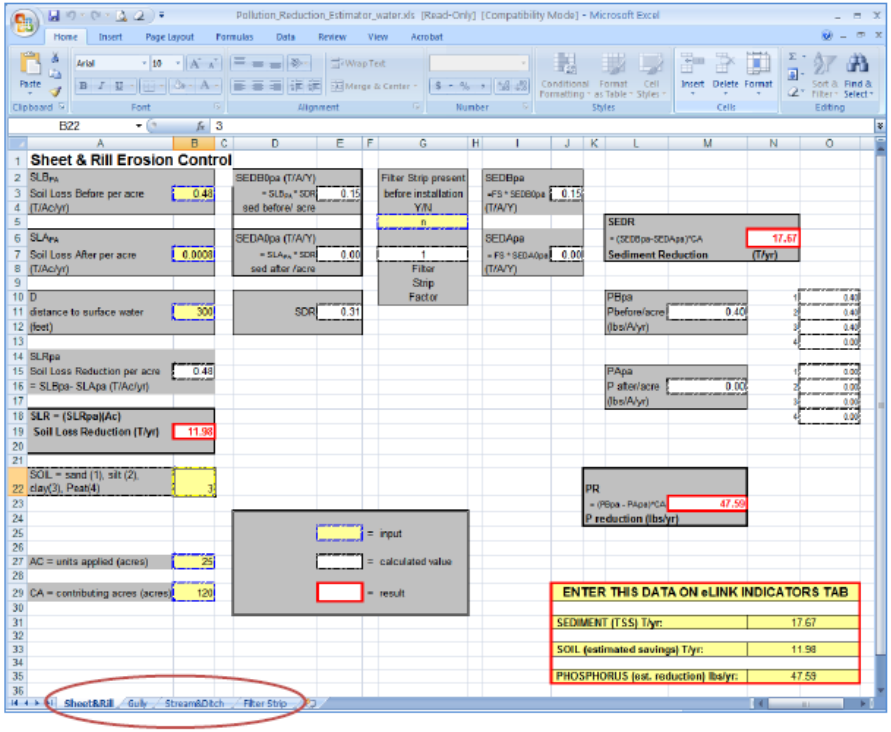
BWSR Water Erosion Calculator

- User's Guide: www.bwsr.state.mn.us/elinkupdate/Pollution_Reduction_Calculator_Manual.pdf
- Excel document download: http://www.bwsr.state.mn.us/elinkupdate/Pollution_Reduction_Estimator_water.xls

Pollution Reduction Estimator

Water Erosion - Microsoft Excel® Version

September 2010



Introduction

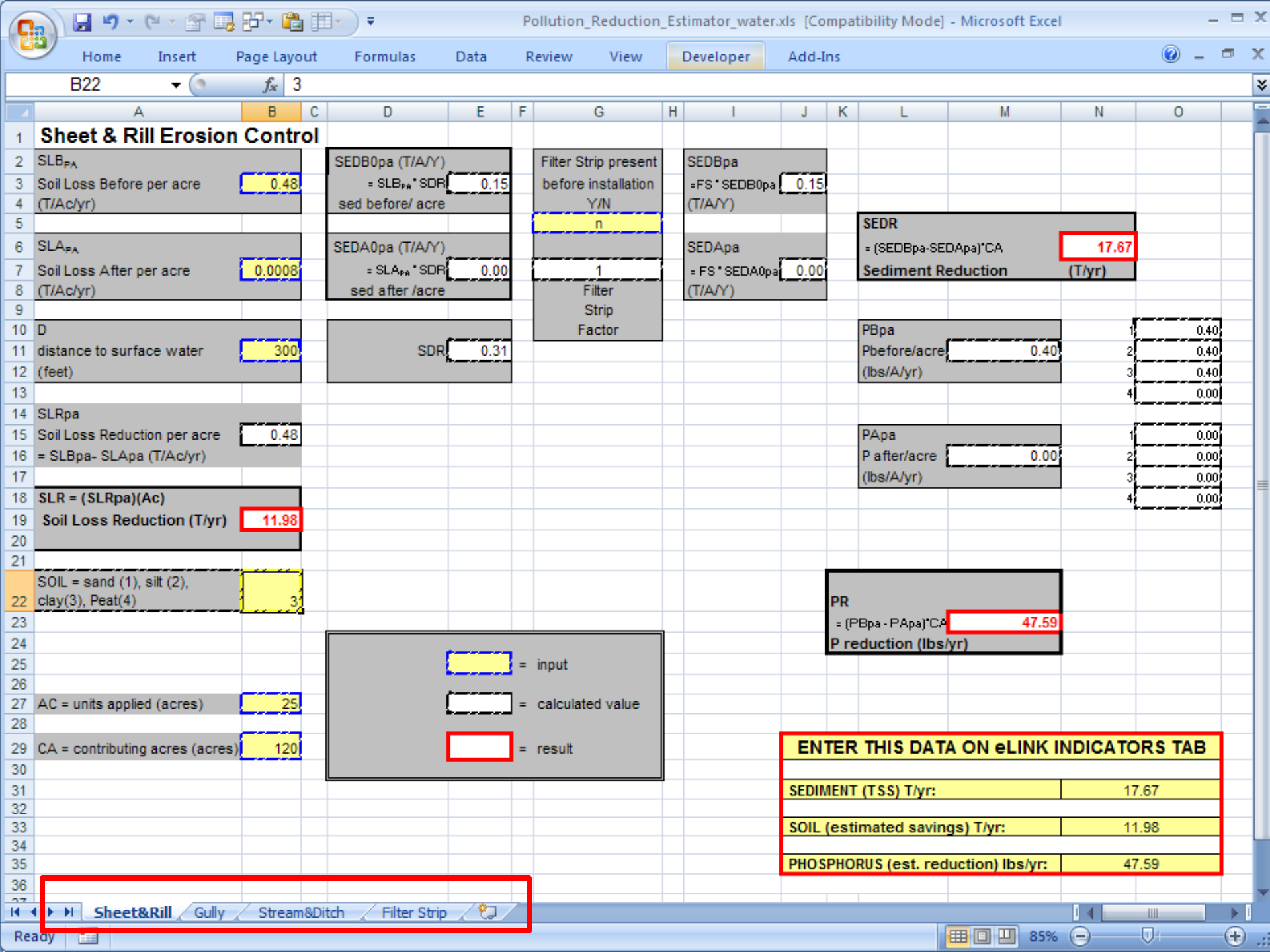
The Microsoft Excel® Spreadsheet ***Pollution Reduction Estimator - water erosion.xls*** is a version of the same pollution reduction estimator that was built-in to eLINK version 2. The inputs and results are the same. It requires Excel to Run.

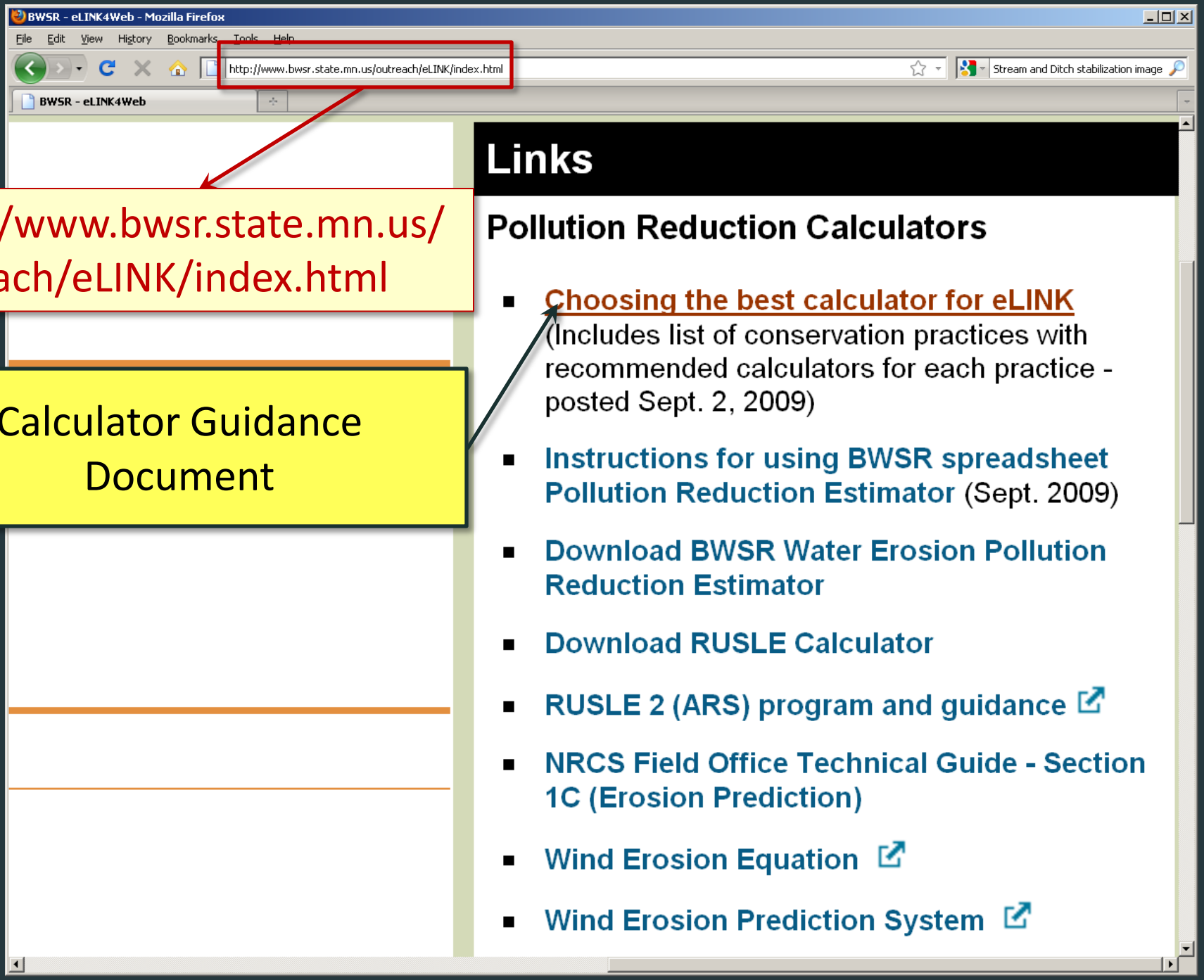
There are 4 Water Erosion estimator types to choose from:

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).


Pollution_Reduction_Estimator_water.xls [Compatibility Mode] - Microsoft Excel
Home Insert Page Layout Formulas Data Review View Developer Add-Ins
B22
3
Sheet & Rill Erosion Control
SLB$_{PA}$
Soil Loss Before per acre
(T/Ac/yr)
0.48
SLA$_{PA}$
Soil Loss After per acre
(T/Ac/yr)
0.0008
D
distance to surface water
(feet)
300
SLRpa
Soil Loss Reduction per acre
= SLBpa- SLApa (T/Ac/yr)
0.48
SLR = (SLRpa)(Ac)
Soil Loss Reduction (T/yr)
11.98
SOIL = sand (1), silt (2), clay(3), Peat(4)
3
AC = units applied (acres)
25
CA = contributing acres (acres)
120
SEDB0pa (T/A/Y)
= SLB$_{PA}$ * SDR
0.15
sed before/ acre
SEDA0pa (T/A/Y)
= SLA$_{PA}$ * SDR
0.00
sed after /acre
SDR
0.31
Filter Strip present before installation Y/N
n
1
Filter Strip Factor
SEDBpa
=FS * SEDB0pa
0.15
(T/A/Y)
SEDApa
= FS * SEDA0pa
0.00
(T/A/Y)
SEDR
= (SEDBpa-SEDApa)*CA
17.67
Sediment Reduction (T/yr)
PBpa
Pbefore/acre
0.40
(lbs/A/yr)
1 0.40
2 0.40
3 0.40
4 0.00
PApa
P after/acre
0.00
(lbs/A/yr)
1 0.00
2 0.00
3 0.00
4 0.00
PR
= (PBpa - PApa)*CA
47.59
P reduction (lbs/yr)
= input
= calculated value
= result
ENTER THIS DATA ON eLINK INDICATORS TAB
SEDIMENT (TSS) T/yr: 17.67
SOIL (estimated savings) T/yr: 11.98
PHOSPHORUS (est. reduction) lbs/yr: 47.59
Sheet&Rill Gully Stream&Ditch Filter Strip
Ready
85%



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

Calculator Guidance Document

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)

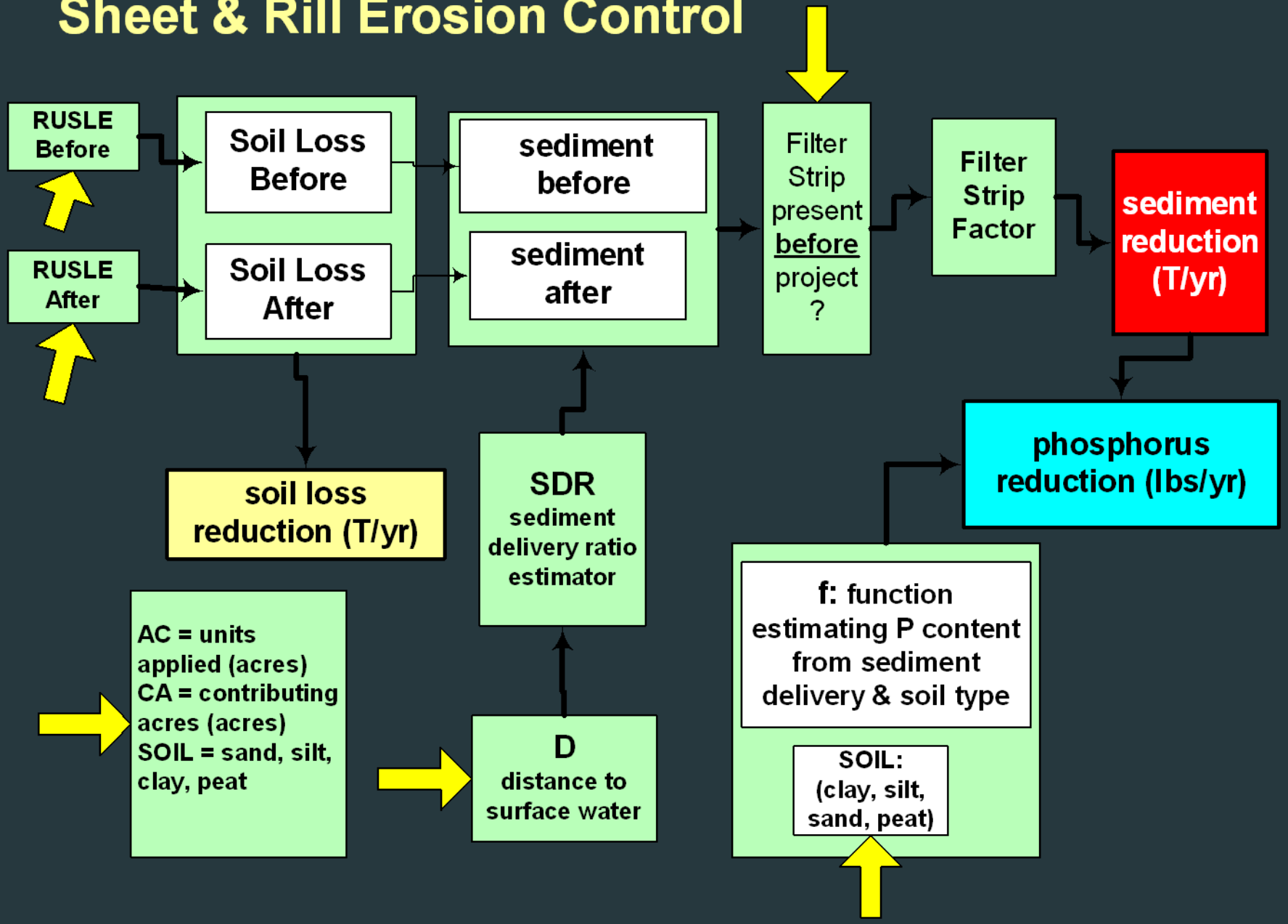
Table 2

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

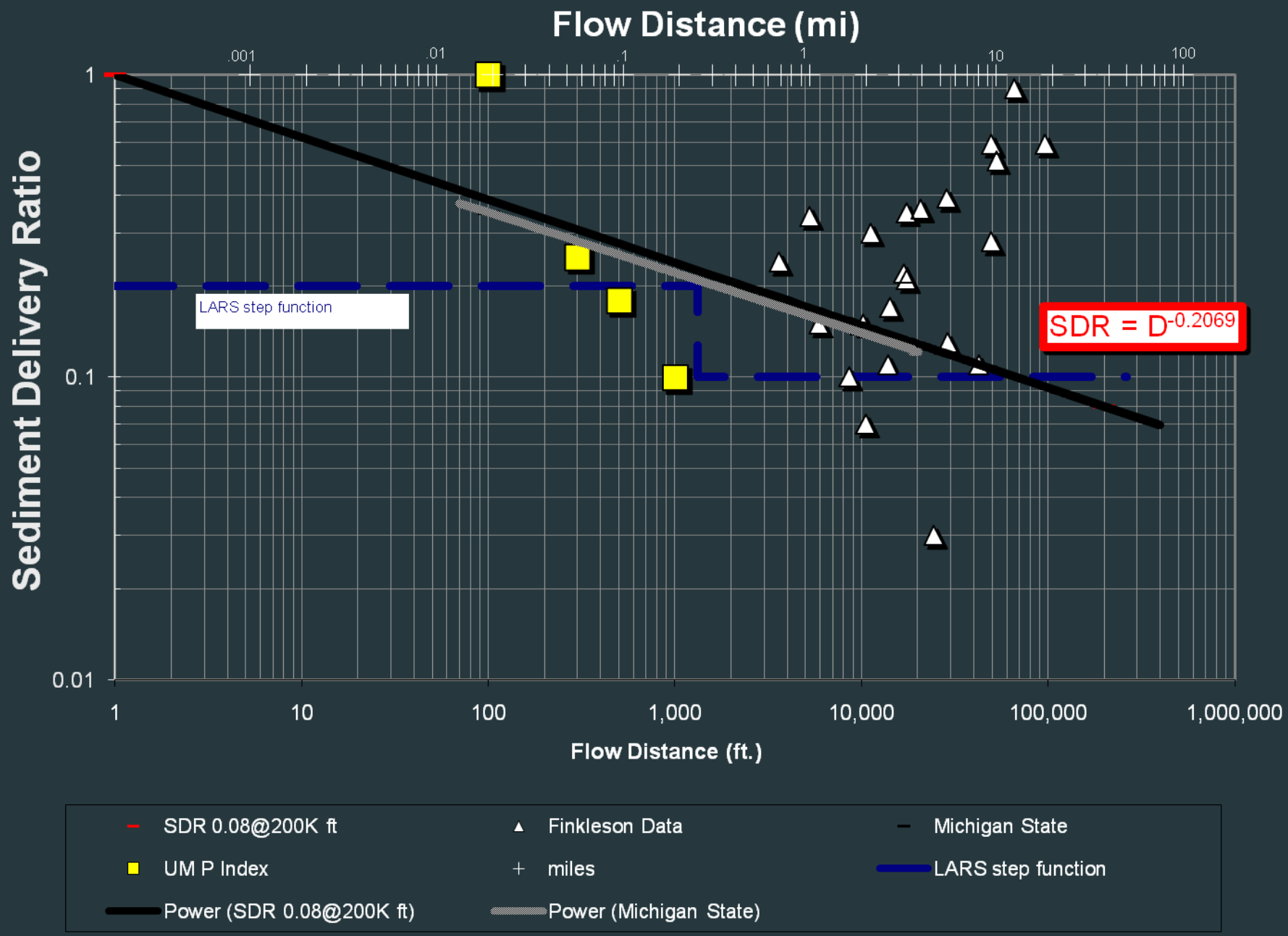
Sheet/Rill Calculator

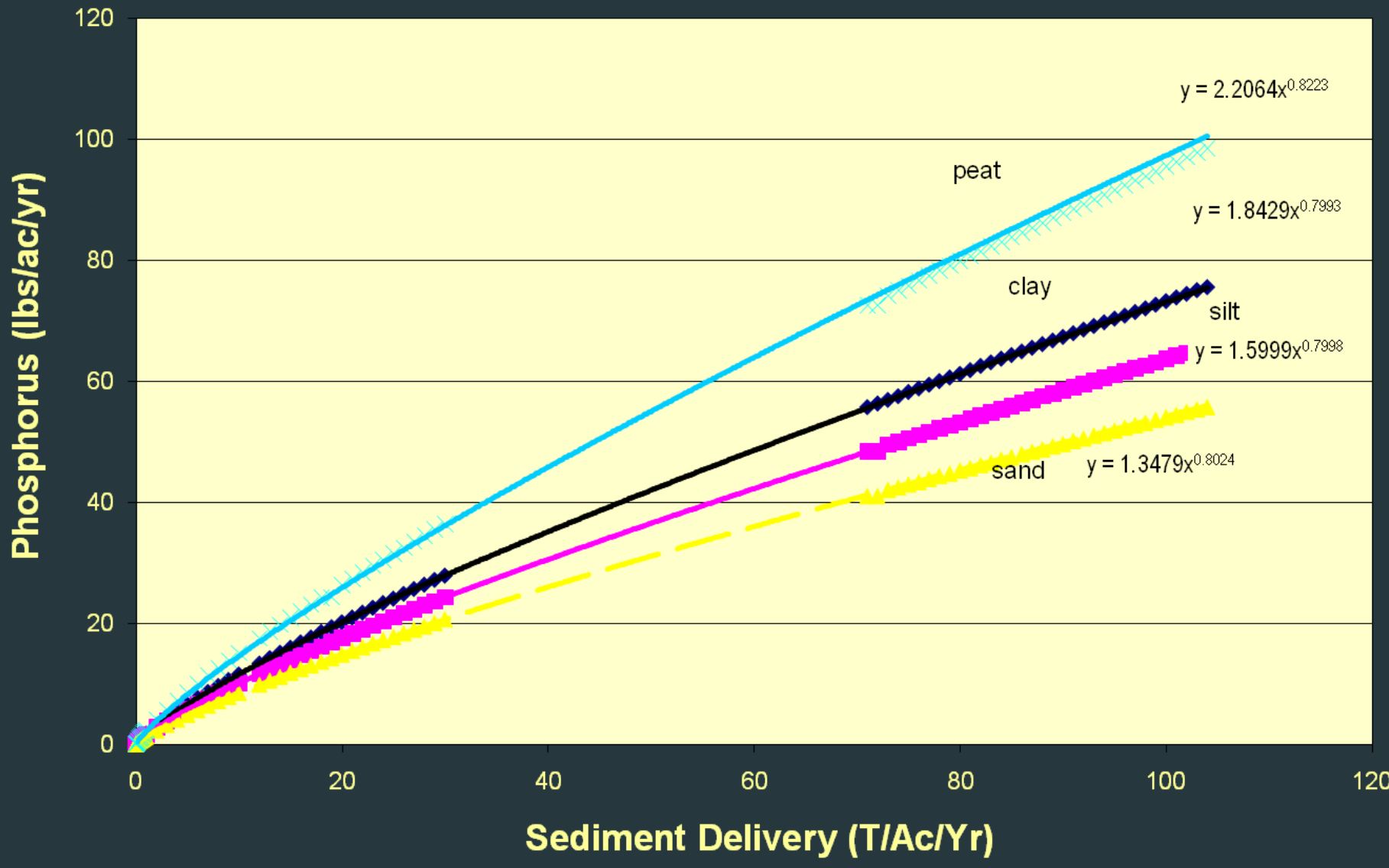
- Inputs
  - Soil loss before treatment (RUSLE2)
  - Soil loss after treatment (RUSLE2)
  - Distance to surface water
  - Soil Type
  - Units applied (acres)
  - Contributing watershed (acres)
  - Presence of a filter strip

Sheet & Rill Erosion Control



Estimator Sediment Delivery Ratio relationship




Phosphorus (lbs/ac/yr)
120
100
80
60
40
20
0
0
20
40
60
80
100
120
Sediment Delivery (T/Ac/Yr)
peat
y = 2.2064x^0.8223
clay
y = 1.8429x^0.7993
silt
y = 1.5999x^0.7998
sand
y = 1.3479x^0.8024

Example 1

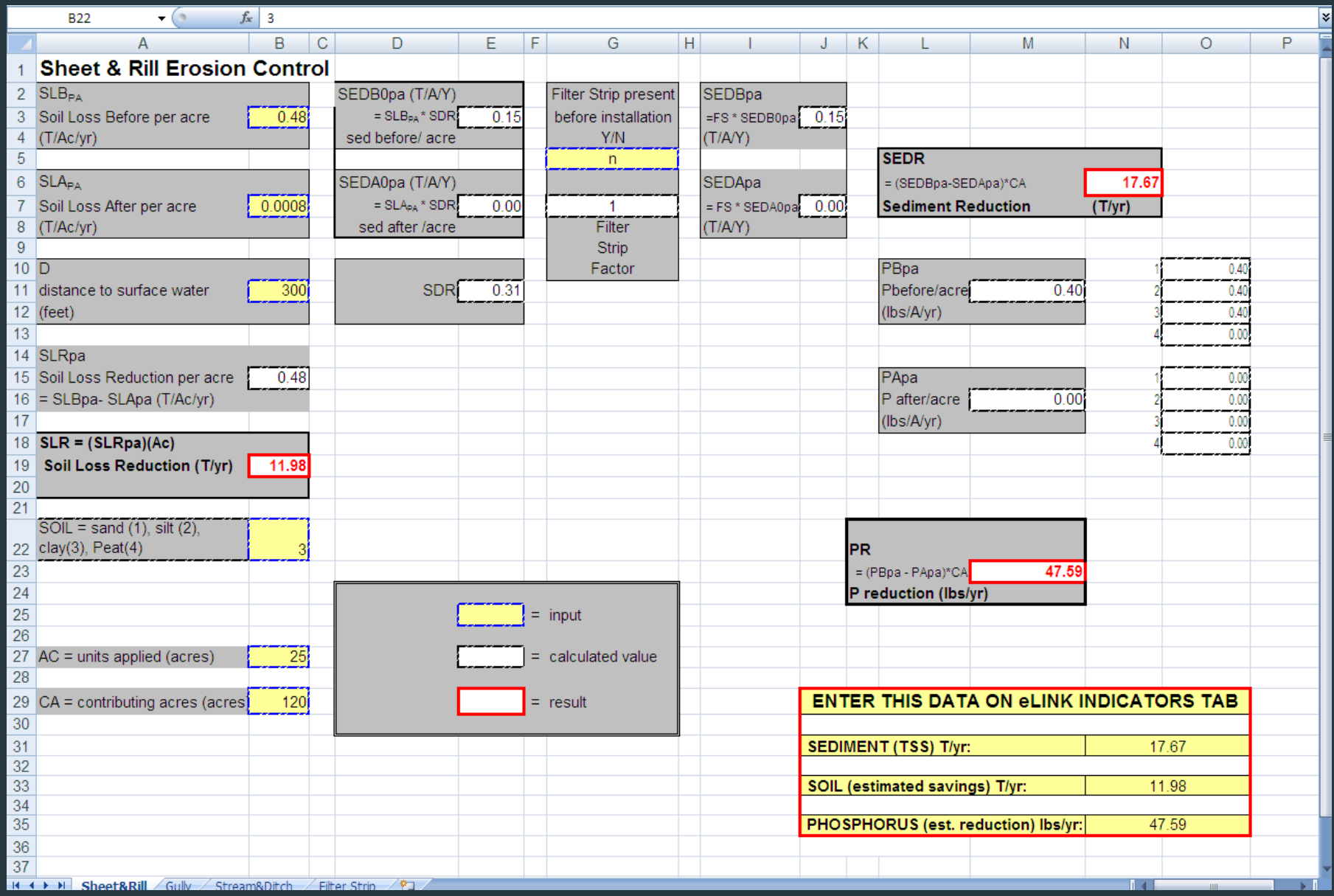
- A landowner in Stevens County wants to stabilize a 20 acre portion of a crop field using a **critical area planting** that lies 300 feet from the nearest surface water. The contributing watershed is 100 acres and there is no filter strip present. The site has silt loam soils.

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)
	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)
			Soil (estimated savings)

Determine inputs



B22 | 3

Sheet & Rill Erosion Control

SLB_{PA} Soil Loss Before per acre (T/Ac/yr)	0.48	
SLA_{PA} Soil Loss After per acre (T/Ac/yr)	0.0008	
D distance to surface water (feet)	300	
SLRpa Soil Loss Reduction per acre = SLBpa- SLApa (T/Ac/yr)	0.48	
SLR = (SLRpa)(Ac) Soil Loss Reduction (T/yr)	11.98	
SOIL = sand (1), silt (2), clay(3), Peat(4)	3	
AC = units applied (acres)	25	
CA = contributing acres (acres	120	

SEDB0pa (T/A/Y) = SLB_{PA} * SDR sed before/ acre	0.15	
SEDA0pa (T/A/Y) = SLA_{PA} * SDR sed after /acre	0.00	
SDR	0.31	

Filter Strip present before installation Y/N	n
Filter Strip Factor	1

SEDBpa =FS * SEDB0pa (T/A/Y)	0.15
SEDApa = FS * SEDA0pa (T/A/Y)	0.00

SEDR = (SEDBpa-SEDApa)*CA **Sediment Reduction (T/yr)**	17.67

PBpa Pbefore/acre (lbs/A/yr)	0.40	1 0.40 2 0.40 3 0.40 4 0.00
PApa P after/acre (lbs/A/yr)	0.00	1 0.00 2 0.00 3 0.00 4 0.00

PR = (PBpa - PApa)*CA **P reduction (lbs/yr)**	47.59

= input

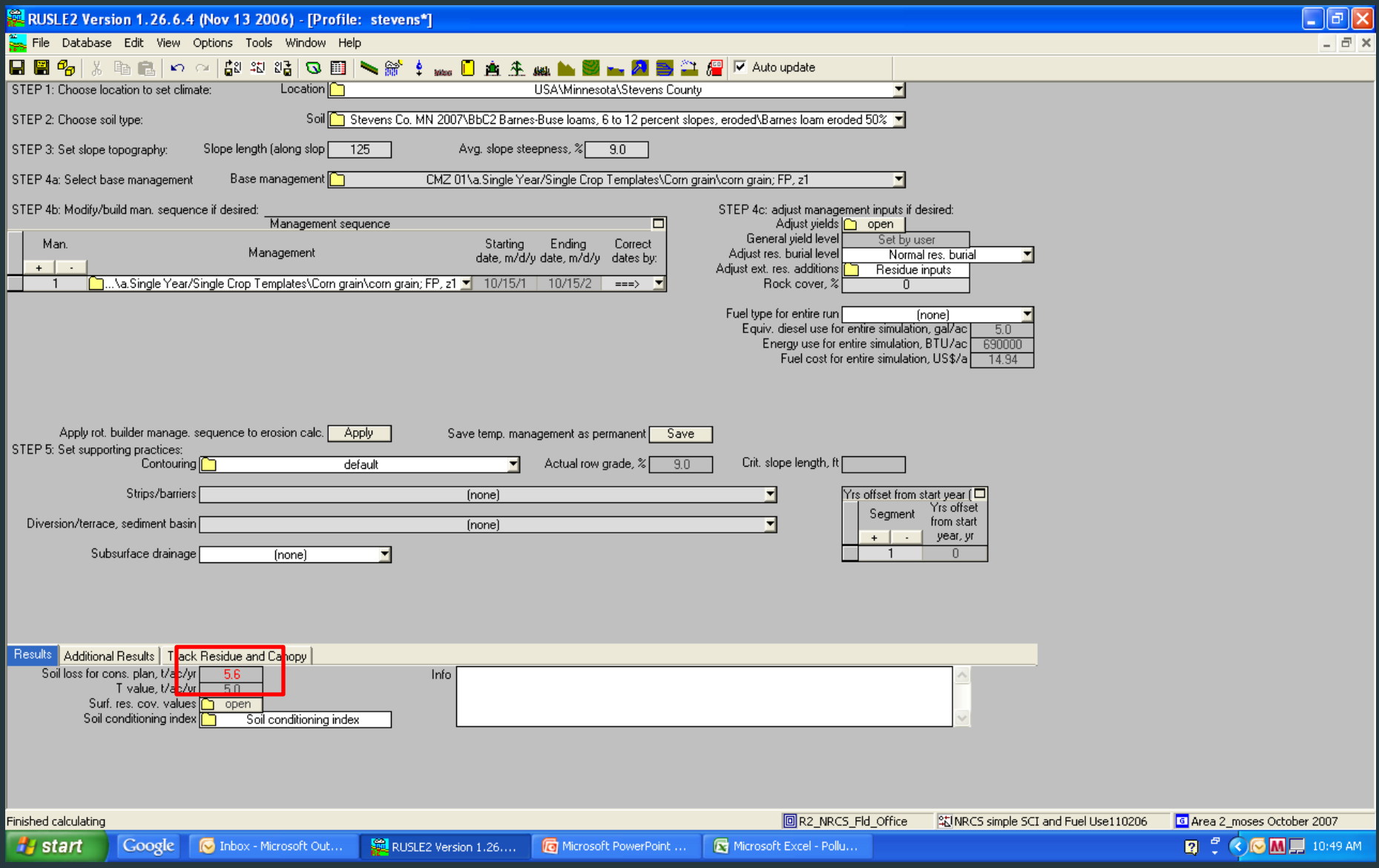
= calculated value

= result

ENTER THIS DATA ON eLINK INDICATORS TAB	
SEDIMENT (TSS) T/yr:	17.67
SOIL (estimated savings) T/yr:	11.98
PHOSPHORUS (est. reduction) lbs/yr:	47.59

Sheet&Rill | Gully | Stream&Ditch | Filter Strip

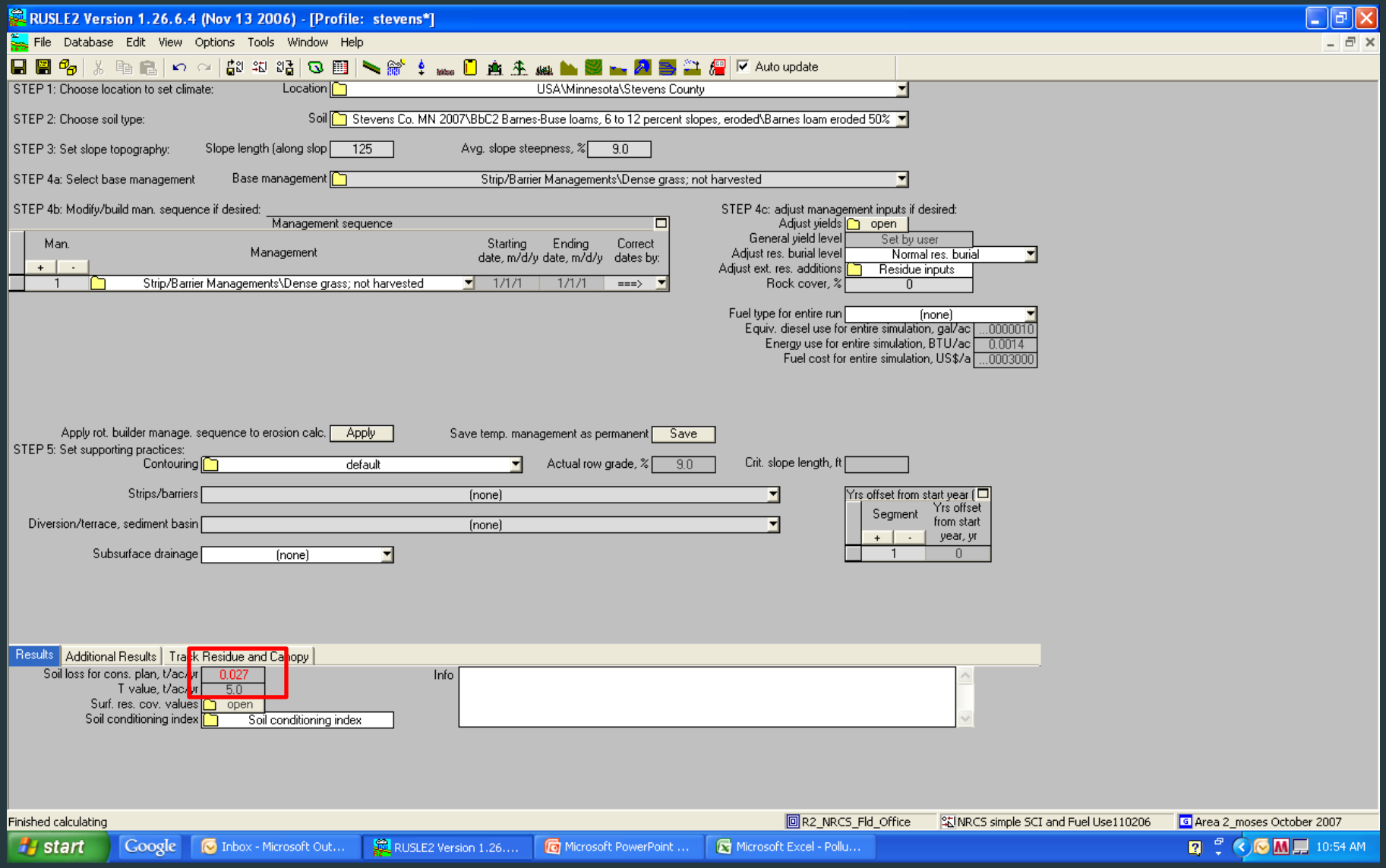
Soil Loss Calculation - Before Treatment



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



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

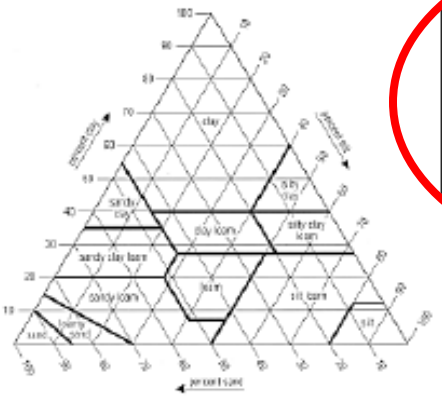
Sheet/Rill Calculator

- 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

Soil Texture Triangle



Clays	Silts	Sands
Clay	Silt	Sand
Clay loam	Loam	Loamy sand
Silty clay	Silt loam	Sandy loam
	Silty Clay Loam	Sandy clay loam
		Sandy clay

Phosphorus Correction Factors for Soil Texture

Soil Texture	Correction Factor
Clay	1.15
Silt	1.00
Sand	0.85
Peat	1.50

Approximate Dry density Soil Weights

SOIL TEXTURAL CLASS	Dry Density Lbs/Ft^3	Soil texture used for calculations	Dry Density used for calculations Lbs/Ft^3
Sands, loamy sands	110	Sand	110
Sandy Loam	105		
Fine Sandy Loam	100		
Loams, sandy clay loams, sandy clay	90	Silt	85
Silt loam	85		
Silty clay loam, silty clay	80		
Clay loam	75	Clay	70
Clay	70		
Organic	22	Peat	22

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

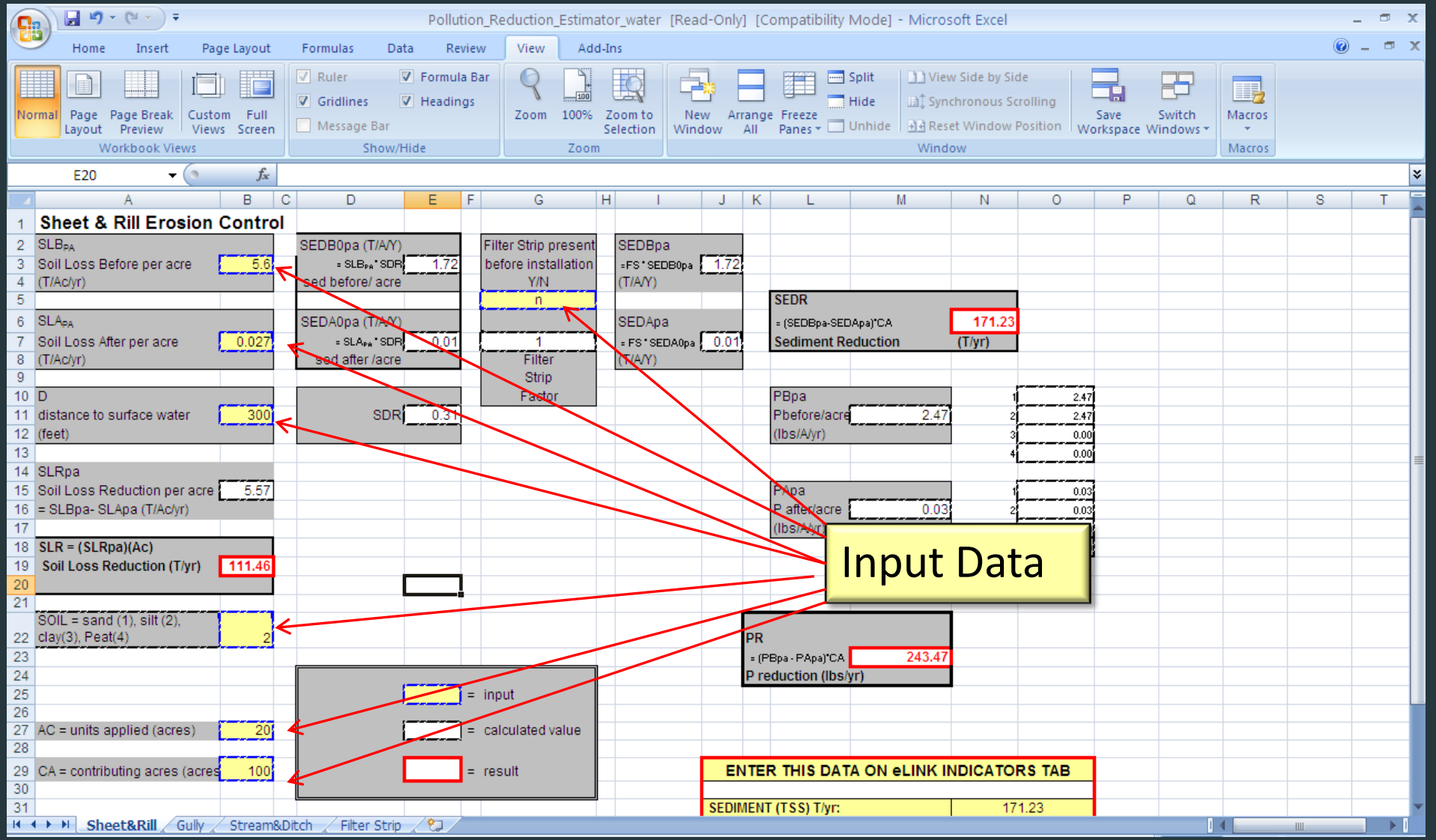
Sheet/Rill Calculator

- 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

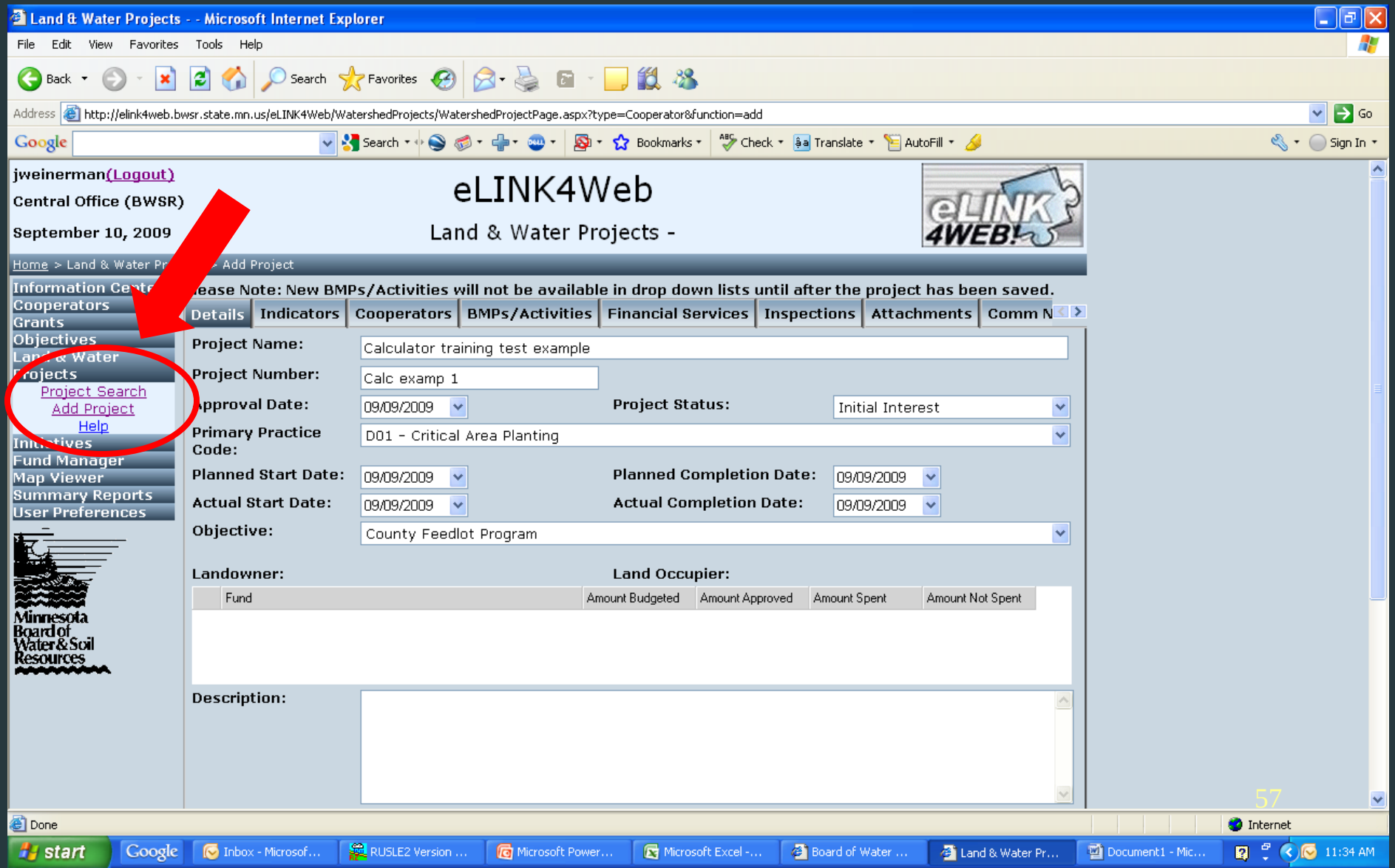
Inputting data



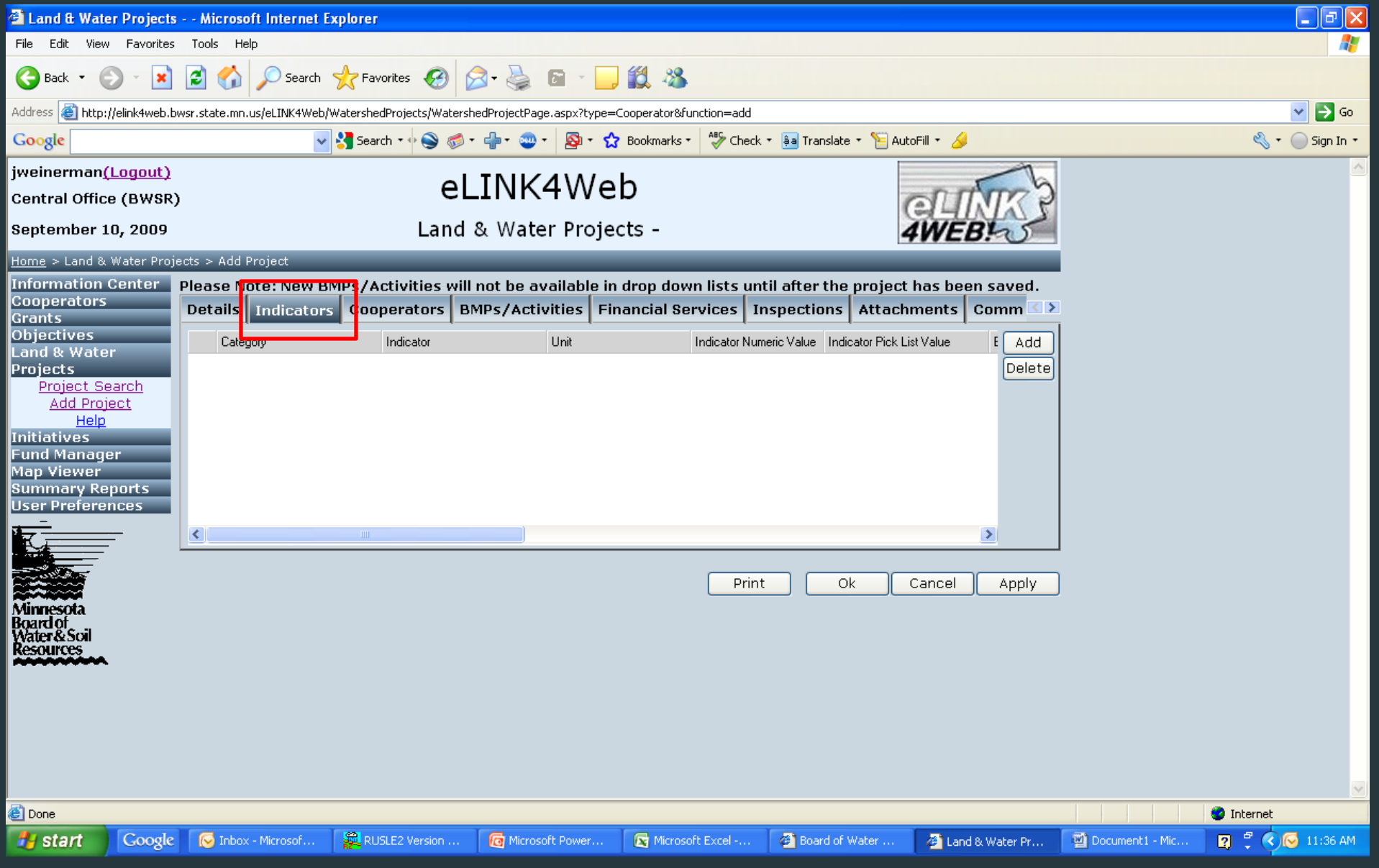
Output Information

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

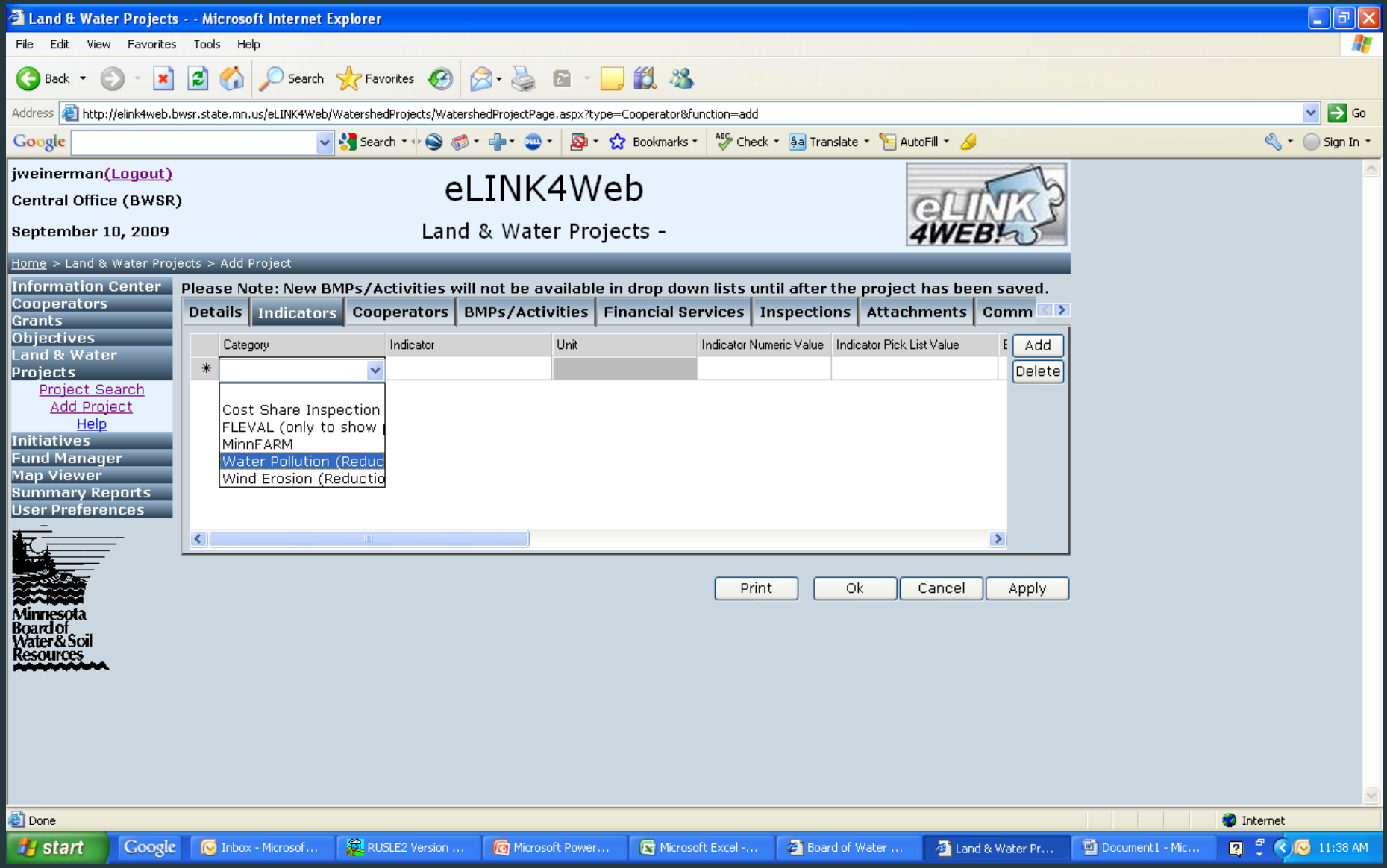
Inputting Data into eLINK: Open the Land & Water Project



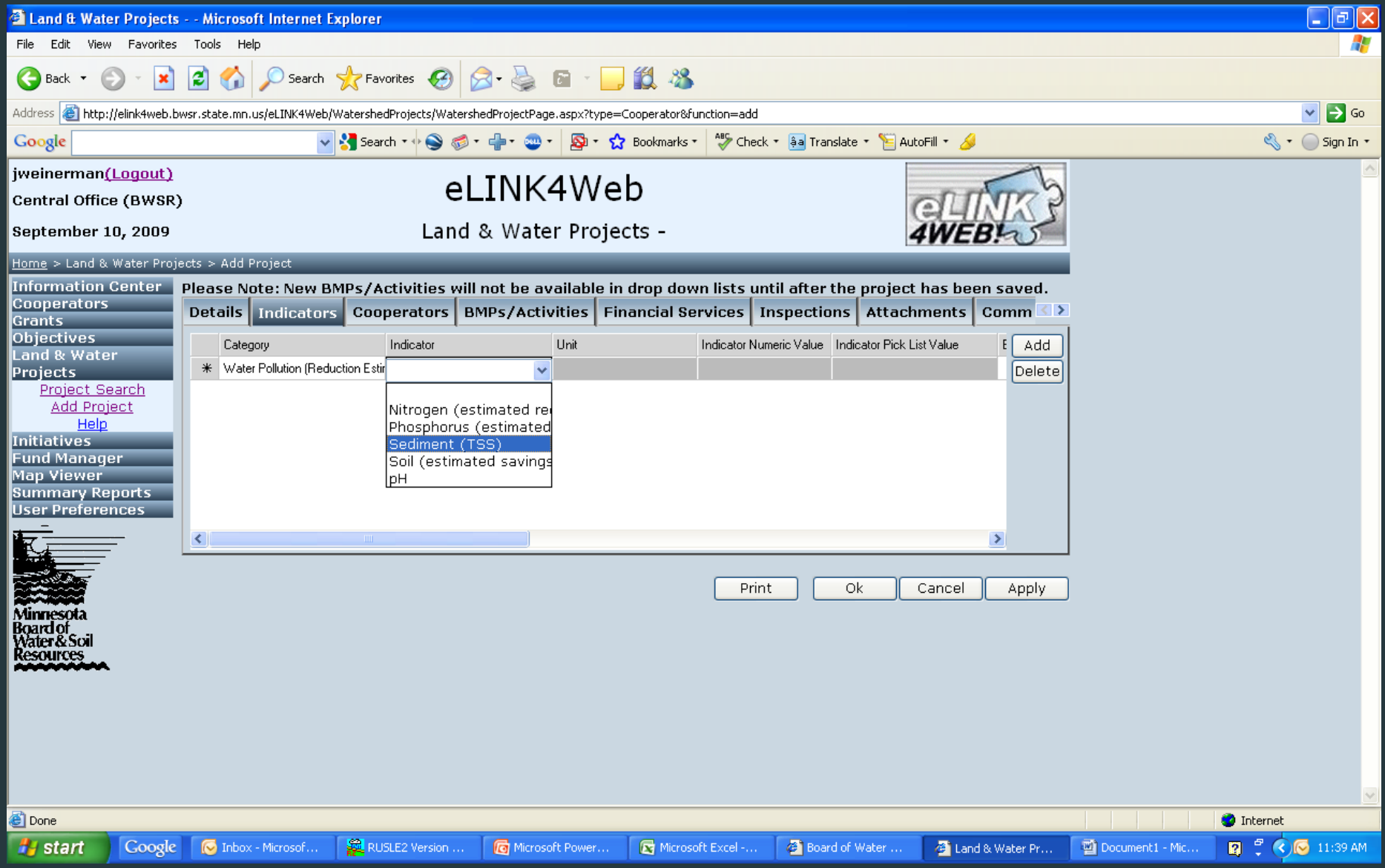
Inputting Data into eLINK: Select the Indicator Tab



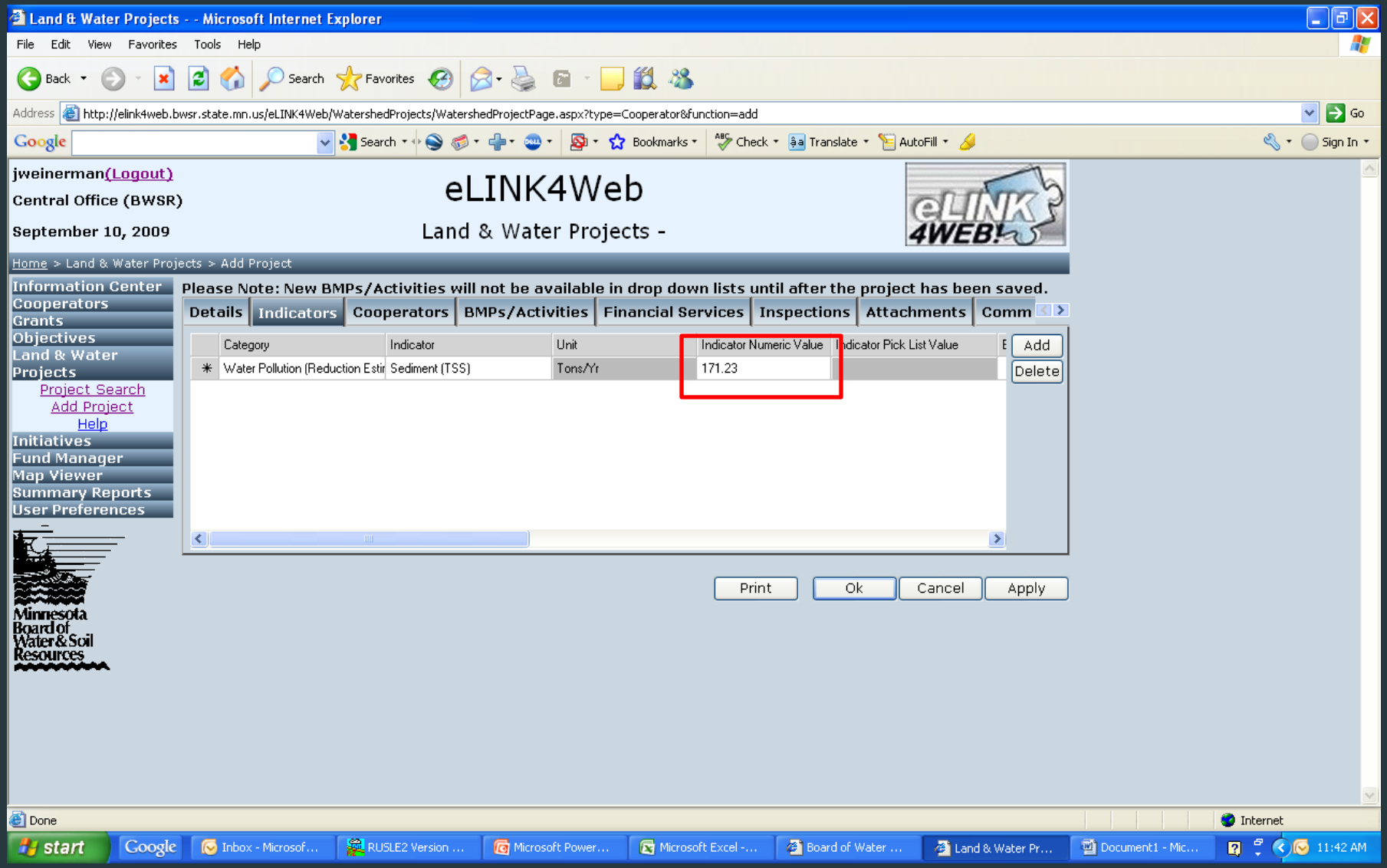
Inputting Data into eLINK: Select the Category



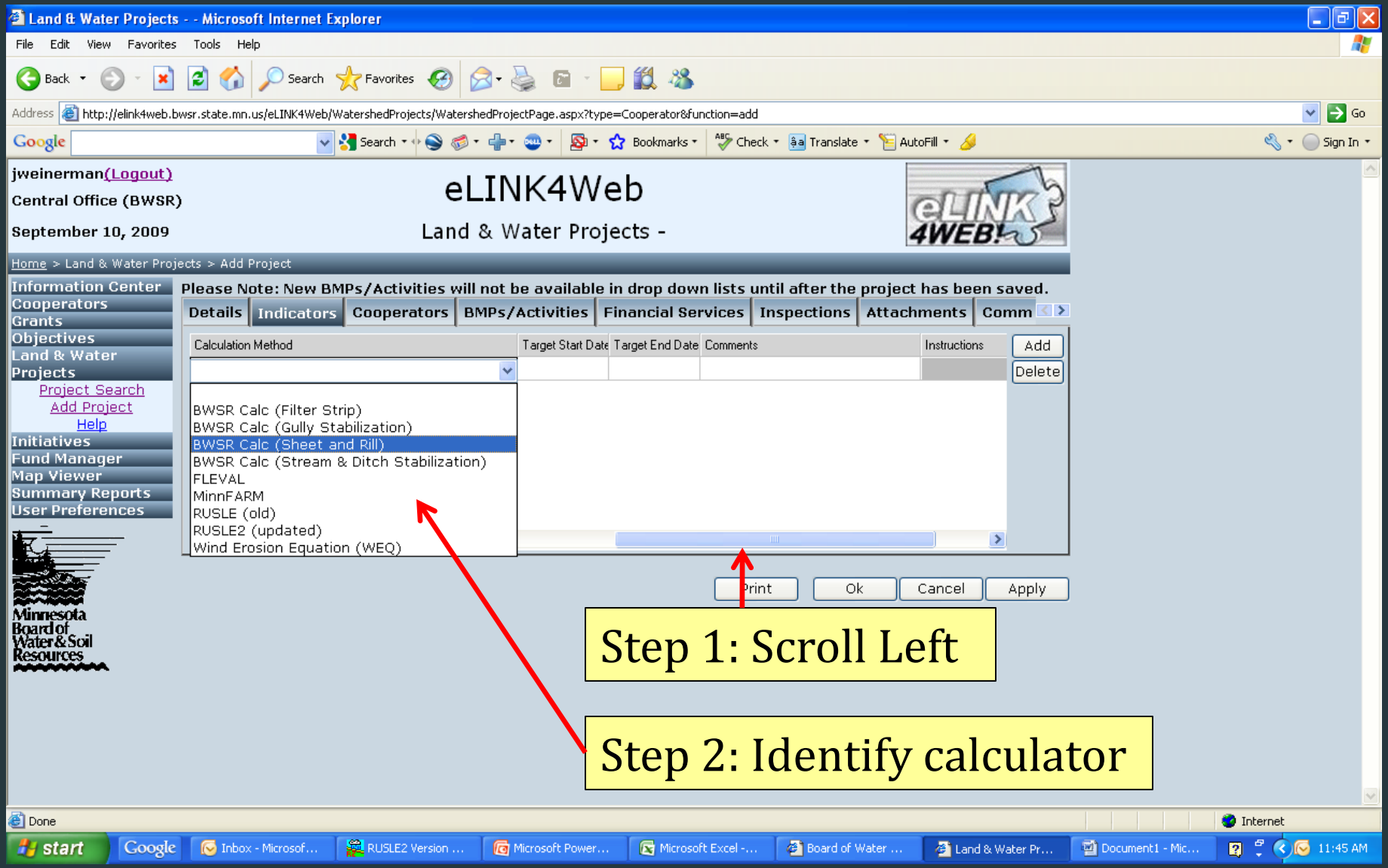
Inputting Data into eLINK: Select the Indicator



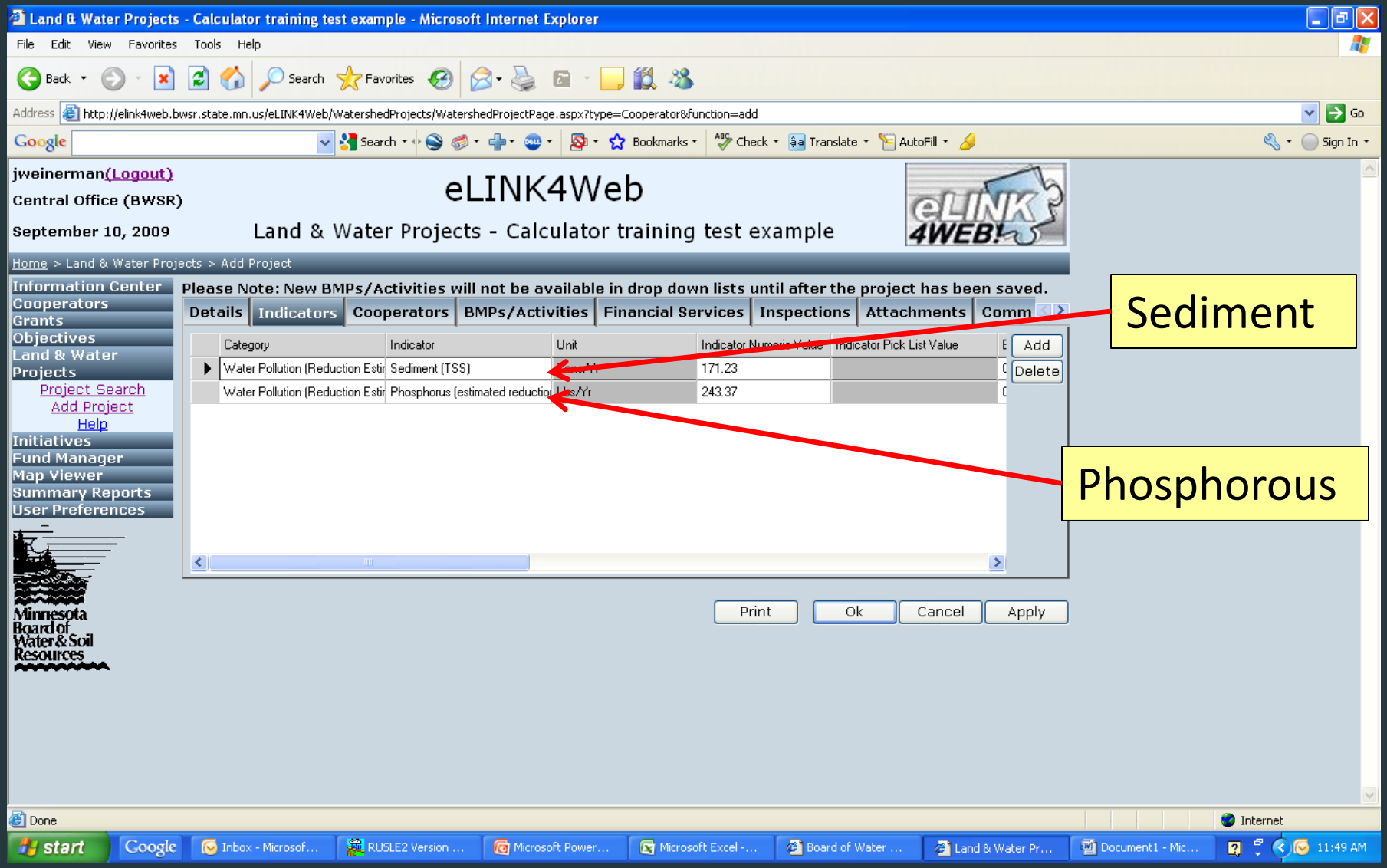
Inputting Data into eLINK:
Enter the Numeric Value from the Calculator



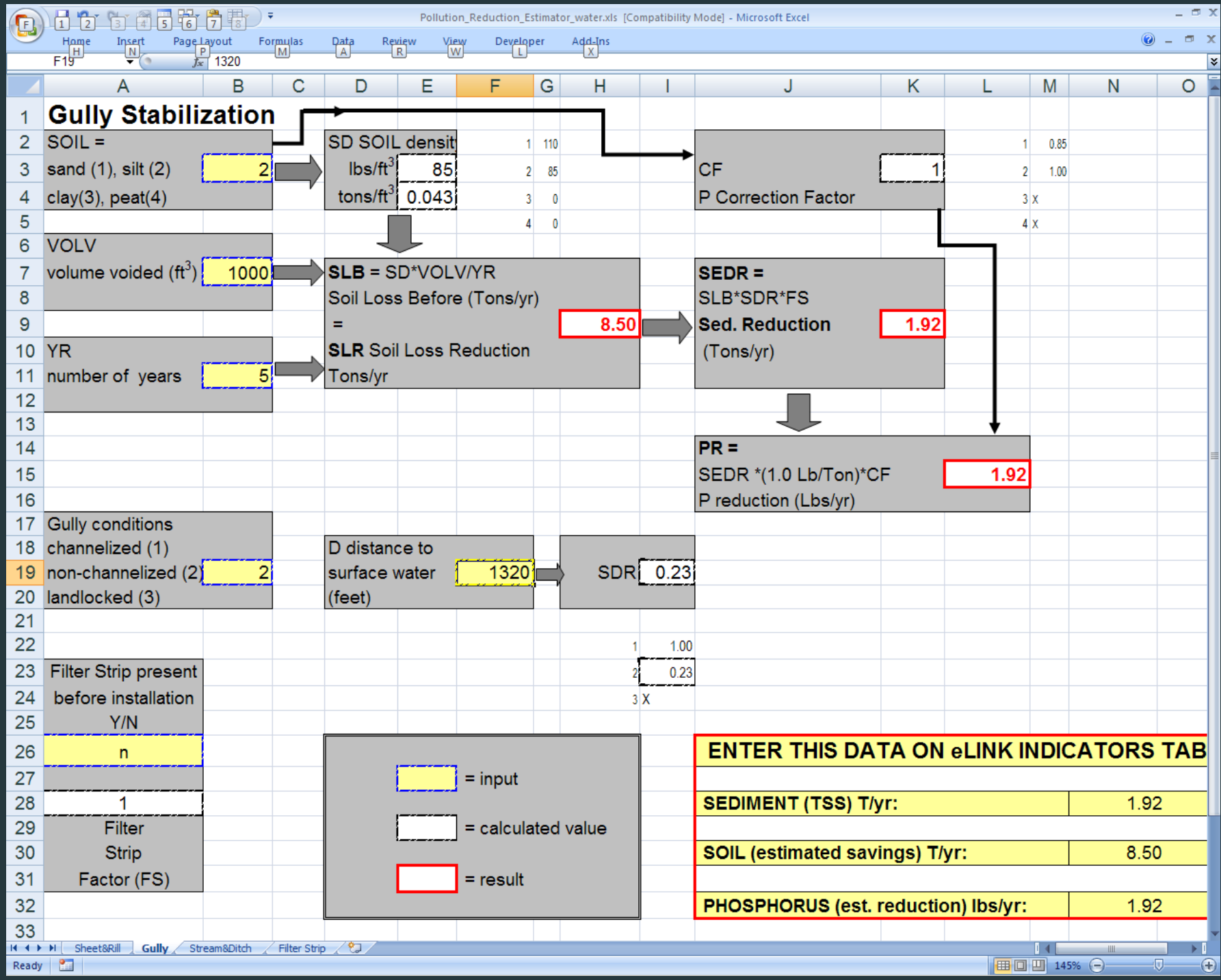
Inputting Data into eLINK: Identify Calculation Method



Inputting Data into eLINK:
Use one line for each indicator



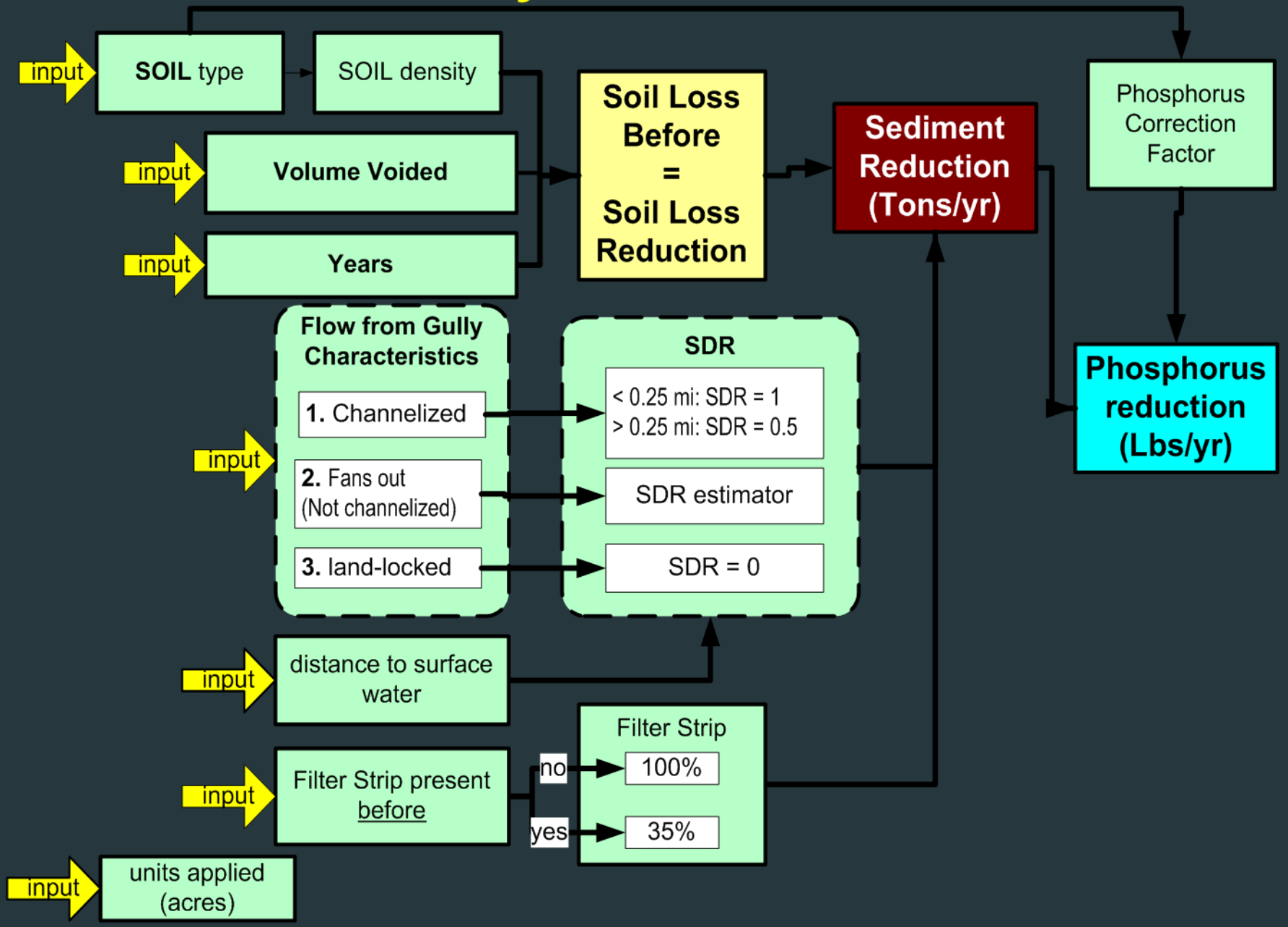
Gully Stabilization


Pollution_Reduction_Estimator_water.xls [Compatibility Mode] - Microsoft Excel
Home Insert Page Layout Formulas Data Review View Developer Add-Ins
F19
1320
Gully Stabilization
SOIL =
sand (1), silt (2)
clay(3), peat(4)
2
SD SOIL densit
lbs/ft3
85
tons/ft3
0.043
1 110
2 85
3 0
4 0
CF
P Correction Factor
1
1 0.85
2 1.00
3 X
4 X
VOLV
volume voided (ft3)
1000
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
YR
number of years
5
PR =
SEDR *(1.0 Lb/Ton)*CF
P reduction (Lbs/yr)
1.92
Gully conditions
channelized (1)
non-channelized (2)
landlocked (3)
2
D distance to
surface water
(feet)
1320
SDR
0.23
1 1.00
2 0.23
3 X
Filter Strip present
before installation
Y/N
n
1
Filter
Strip
Factor (FS)
= input
= calculated value
= result
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
Sheet&Rill
Gully
Stream&Ditch
Filter Strip
Ready
145%

Gully Calculator

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

Gully Stabilization



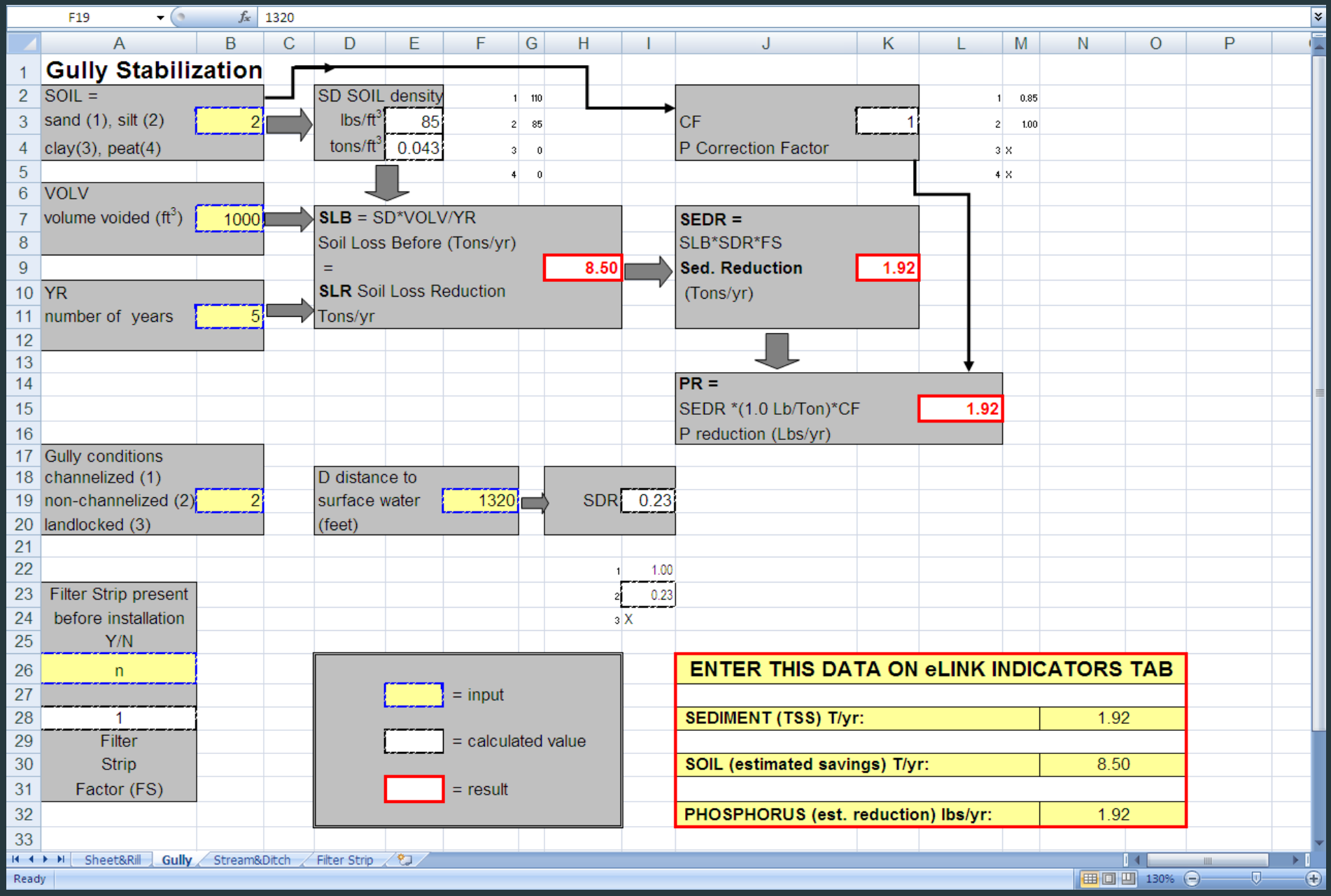
Example 2

- 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 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=½*(top width+bottom width)*depth*length = ½*(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

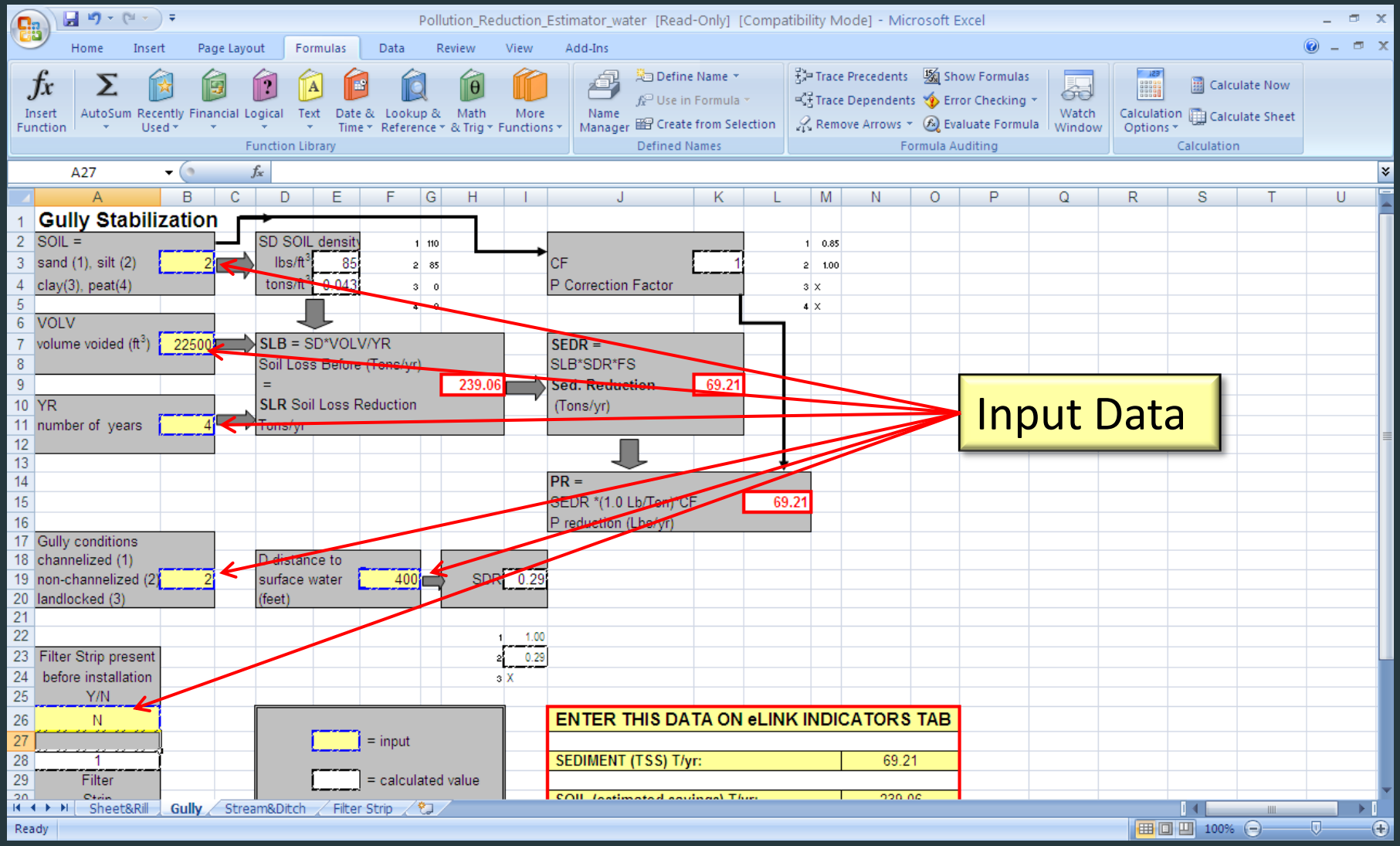
Gully Calculator

- 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

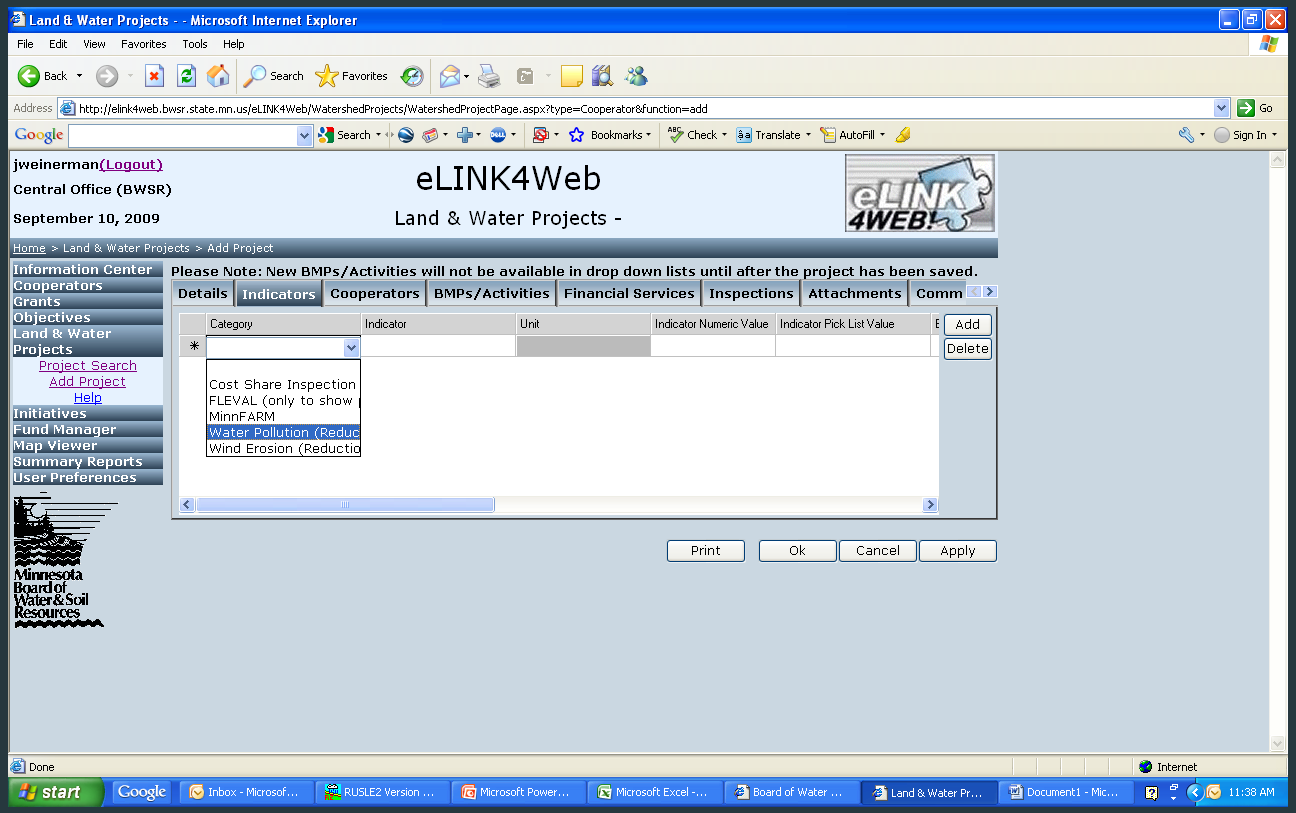


Output Information

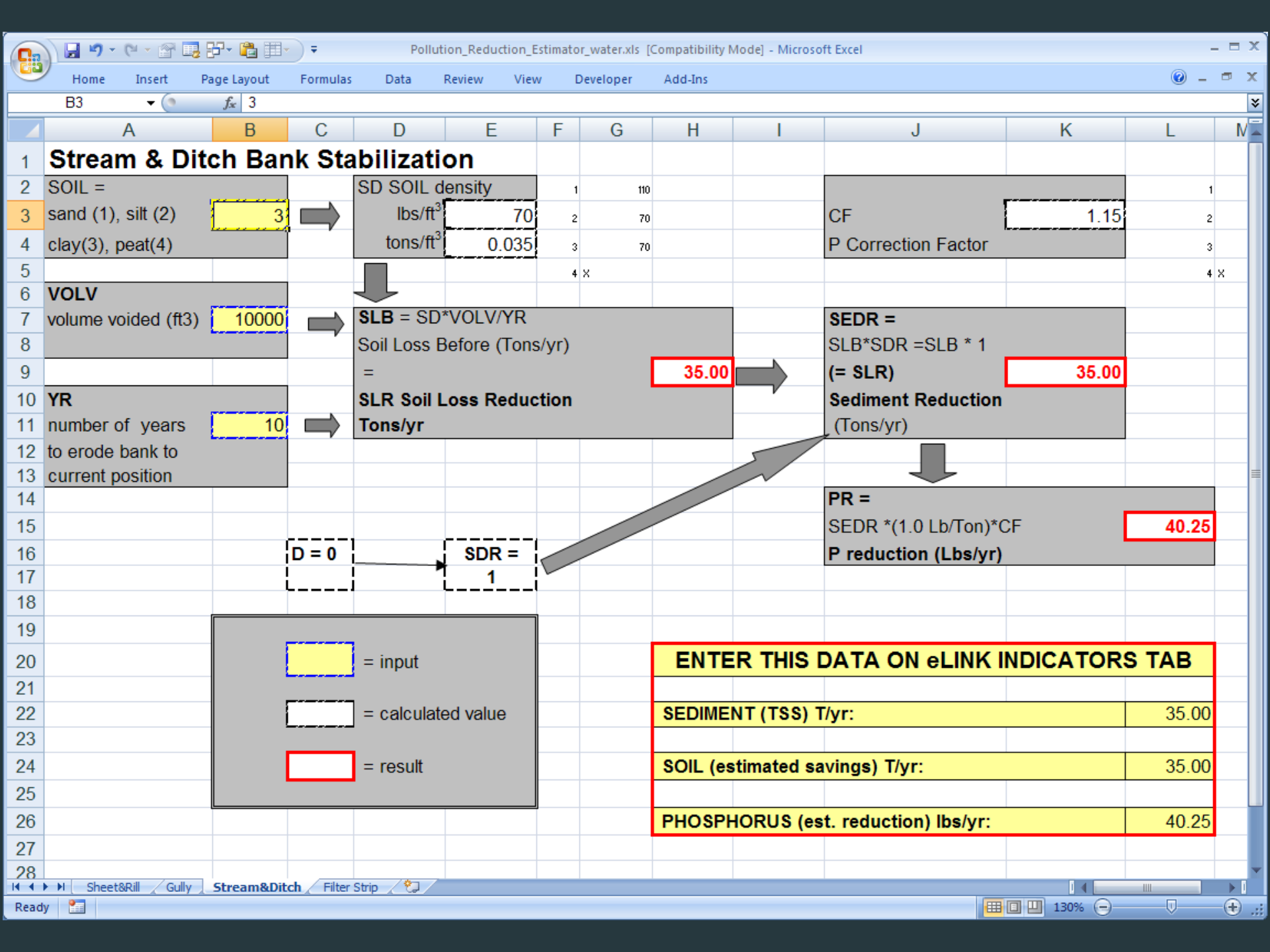
ENTER THIS DATA ON eLINK INDICATORS TAB	
SEDIMENT (TSS) T/yr:	**69.21**
SOIL (estimated savings) T/yr:	**239.06**
PHOSPHORUS (est. reduction) lbs/yr:	**69.21**

Inputting Data into eLINK:

- Follow the same process as for the previous example



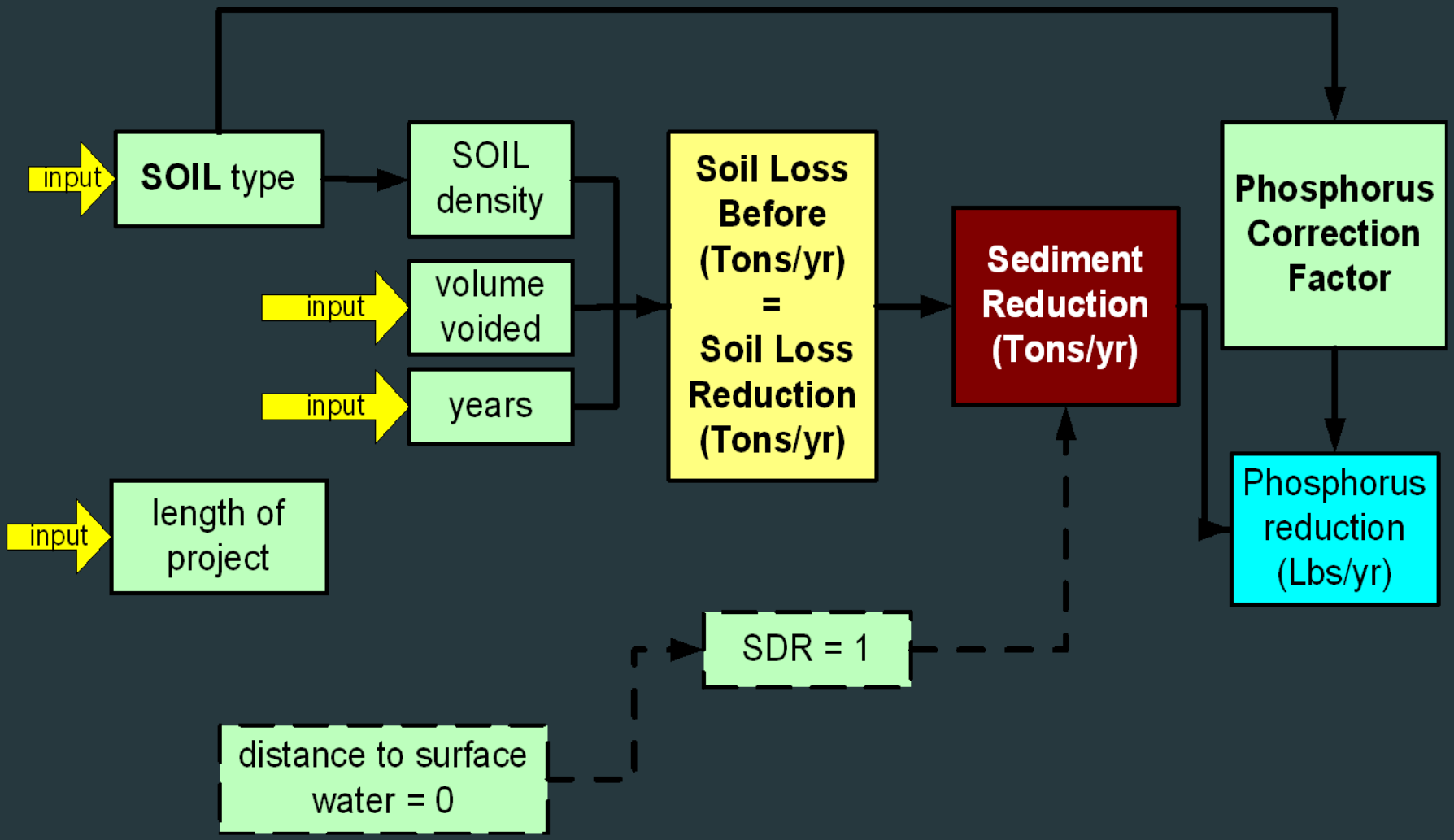
Stream & Ditch Bank Stabilization


Pollution_Reduction_Estimator_water.xls [Compatibility Mode] - Microsoft Excel
Home Insert Page Layout Formulas Data Review View Developer Add-Ins
B3
3
Stream & Ditch Bank Stabilization
SOIL =
sand (1), silt (2)
clay(3), peat(4)
3
SD SOIL density
lbs/ft3
70
tons/ft3
0.035
1 110
2 70
3 70
4 X
CF
P Correction Factor
1.15
1
2
3
4 X
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
to erode bank to
current position
10
PR =
SEDR *(1.0 Lb/Ton)*CF
40.25
P reduction (Lbs/yr)
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
Sheet&Rill
Gully
Stream&Ditch
Filter Strip
Ready
130%

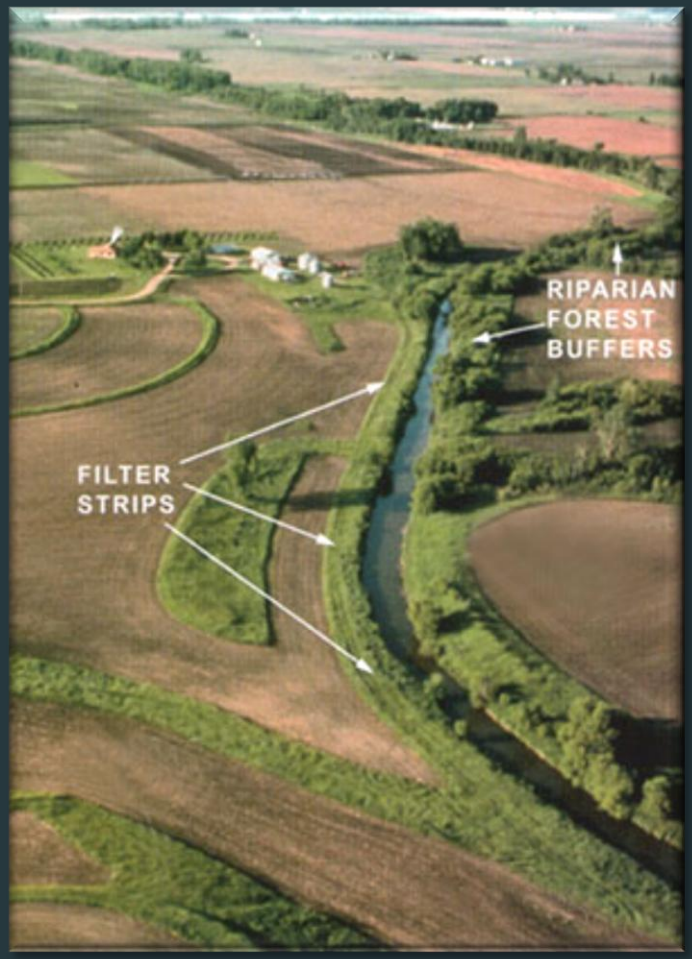
Stream & Ditch Bank Stabilization Calculator

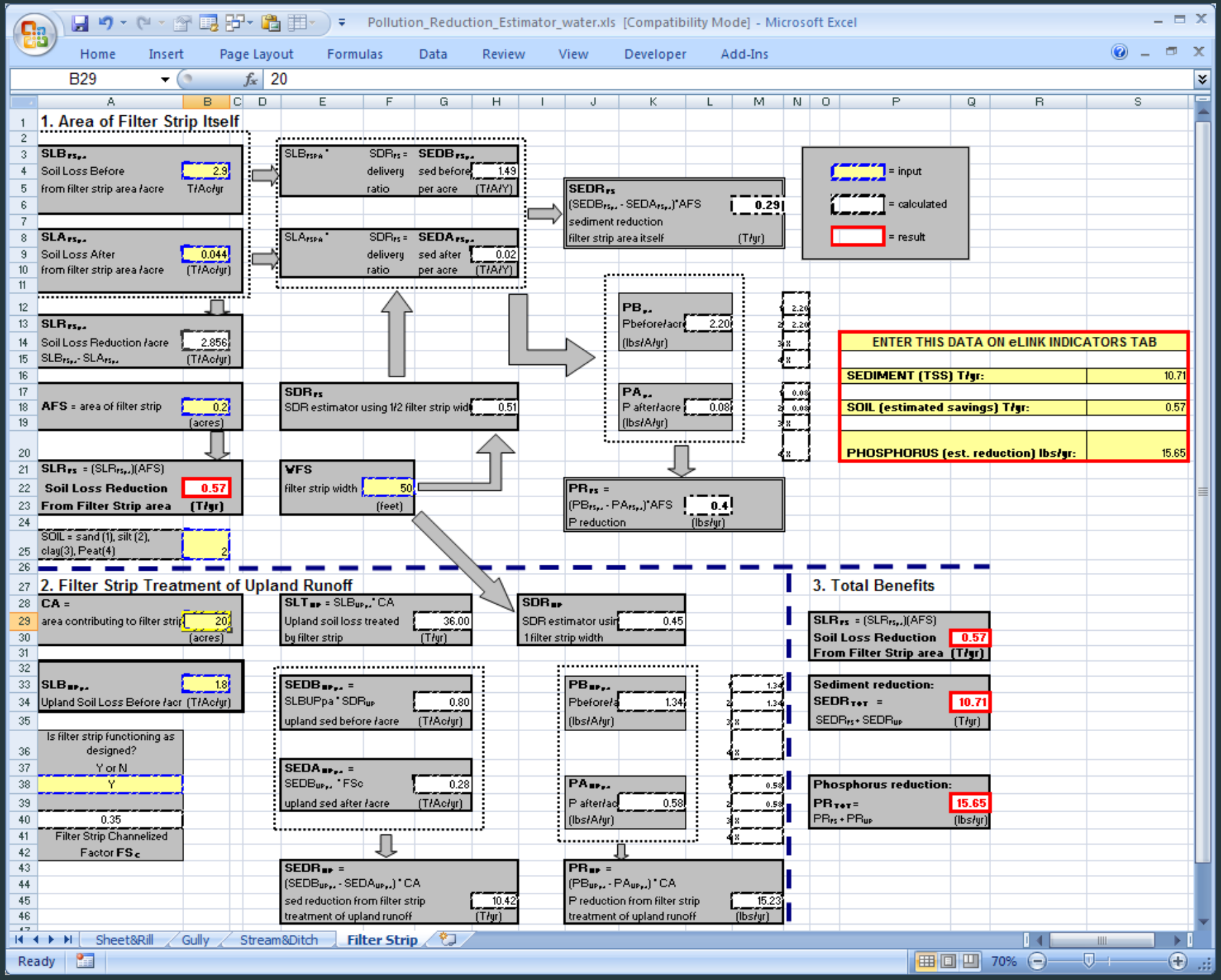
- Inputs
  - Soil Type
  - Volume Voided
  - Number of years to erode bank to current position

Stream & Ditch Bank Stabilization



Filter Strip Projects

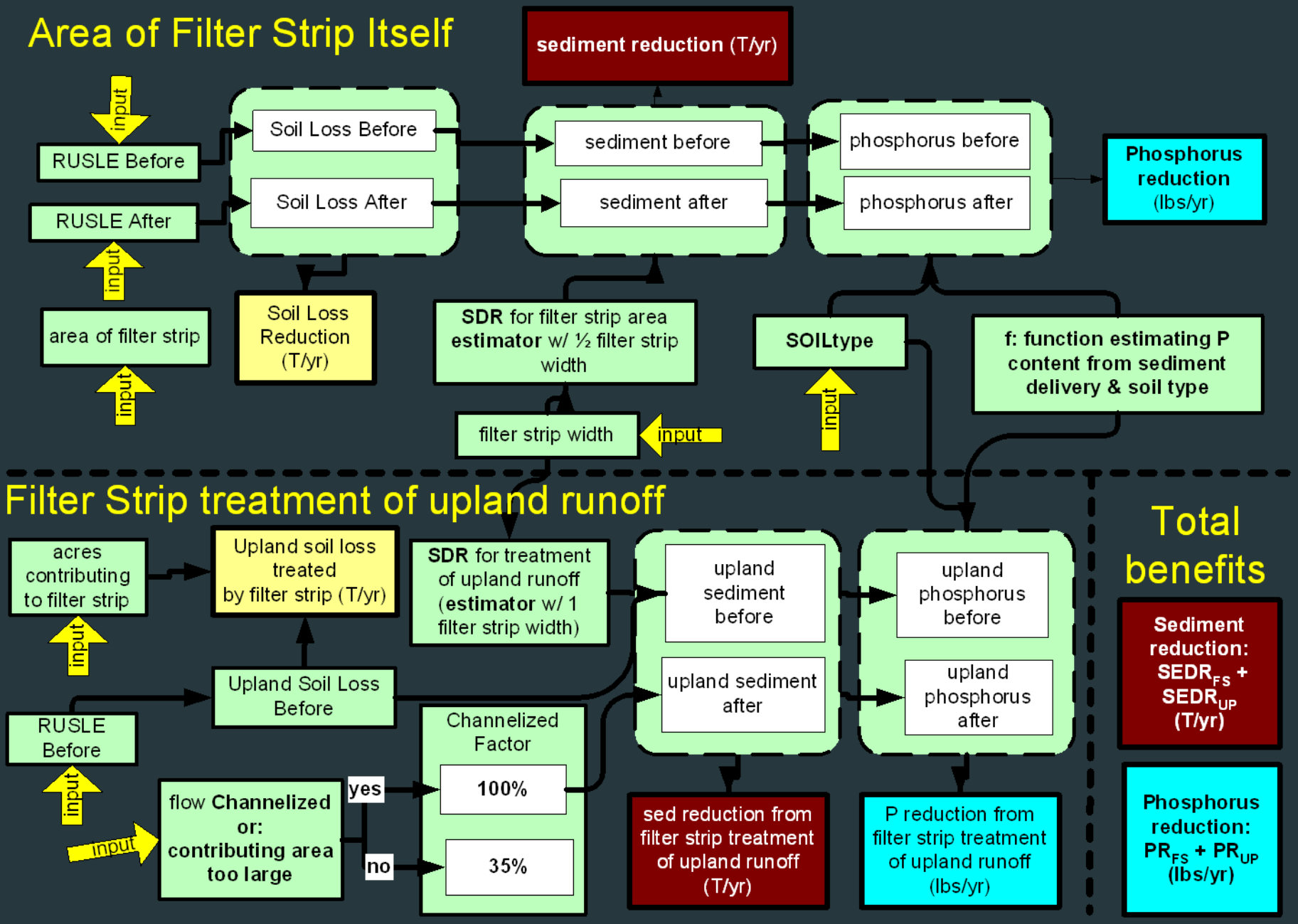



Pollution_Reduction_Estimator_water.xls [Compatibility Mode] - Microsoft Excel
Home Insert Page Layout Formulas Data Review View Developer Add-Ins
B29
20
1. Area of Filter Strip Itself
SLB rs,.
Soil Loss Before
from filter strip area /acre
2.9
T/Ac/yr
SLA rs,.
Soil Loss After
from filter strip area /acre
0.044
(T/Ac/yr)
SLR rs,.
Soil Loss Reduction /acre
SLB rs,.- SLA rs,.
2.856
(T/Ac/yr)
AFS = area of filter strip
0.2
(acres)
SLR rs = (SLR rs,.)(AFS)
Soil Loss Reduction
From Filter Strip area
0.57
(T/yr)
SOIL = sand (1), silt (2), clay(3), Peat(4)
2
SLB rspa * SDR rs = delivery ratio
SEDB rs,. sed before per acre
1.49
(T/A/Y)
SLA rspa * SDR rs = delivery ratio
SEDA rs,. sed after per acre
0.02
(T/A/Y)
SEDR rs
(SEDB rs,. - SEDA rs,.)*AFS
sediment reduction
filter strip area itself
0.29
(T/yr)
= input
= calculated
= result
PB rs,.
Pbefore/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
0.4
(lbs/yr)
SDR rs
SDR estimator using 1/2 filter strip wid
0.51
VFS
filter strip width
50
(feet)
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
20
(acres)
SLB up,.
Upland Soil Loss Before /acr
1.8
(T/Ac/yr)
Is filter strip functioning as designed?
Y or N
Y
0.35
Filter Strip Channelized Factor FS c
SLT up = SLB up,.* CA
Upland soil loss treated by filter strip
36.00
(T/yr)
SEDB up,. = SLBUPpa * SDR up
upland sed before /acre
0.80
(T/Ac/yr)
SEDA up,. = SEDB up,. * FSc
upland sed after /acre
0.28
(T/Ac/yr)
SDR up
SDR estimator usin
1 filter strip width
0.45
PB up,.
Pbefore/a
(lbs/A/yr)
1.34
PA up,.
P after/ac
(lbs/A/yr)
0.58
SEDR up = (SEDB up,. - SEDA up,.) * CA
sed reduction from filter strip treatment of upland runoff
10.42
(T/yr)
PR up = (PB up,. - PA up,.) * CA
P reduction from filter strip treatment of upland runoff
15.23
(lbs/yr)
3. Total Benefits
SLR rs = (SLR rs,.)(AFS)
Soil Loss Reduction
From Filter Strip area
0.57
(T/yr)
Sediment reduction:
SEDR TOT = SEDR rs + SEDR up
10.71
(T/yr)
Phosphorus reduction:
PR TOT = PR rs + PR up
15.65
(lbs/yr)
Sheet&Rill Gully Stream&Ditch Filter Strip
Ready
70%

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



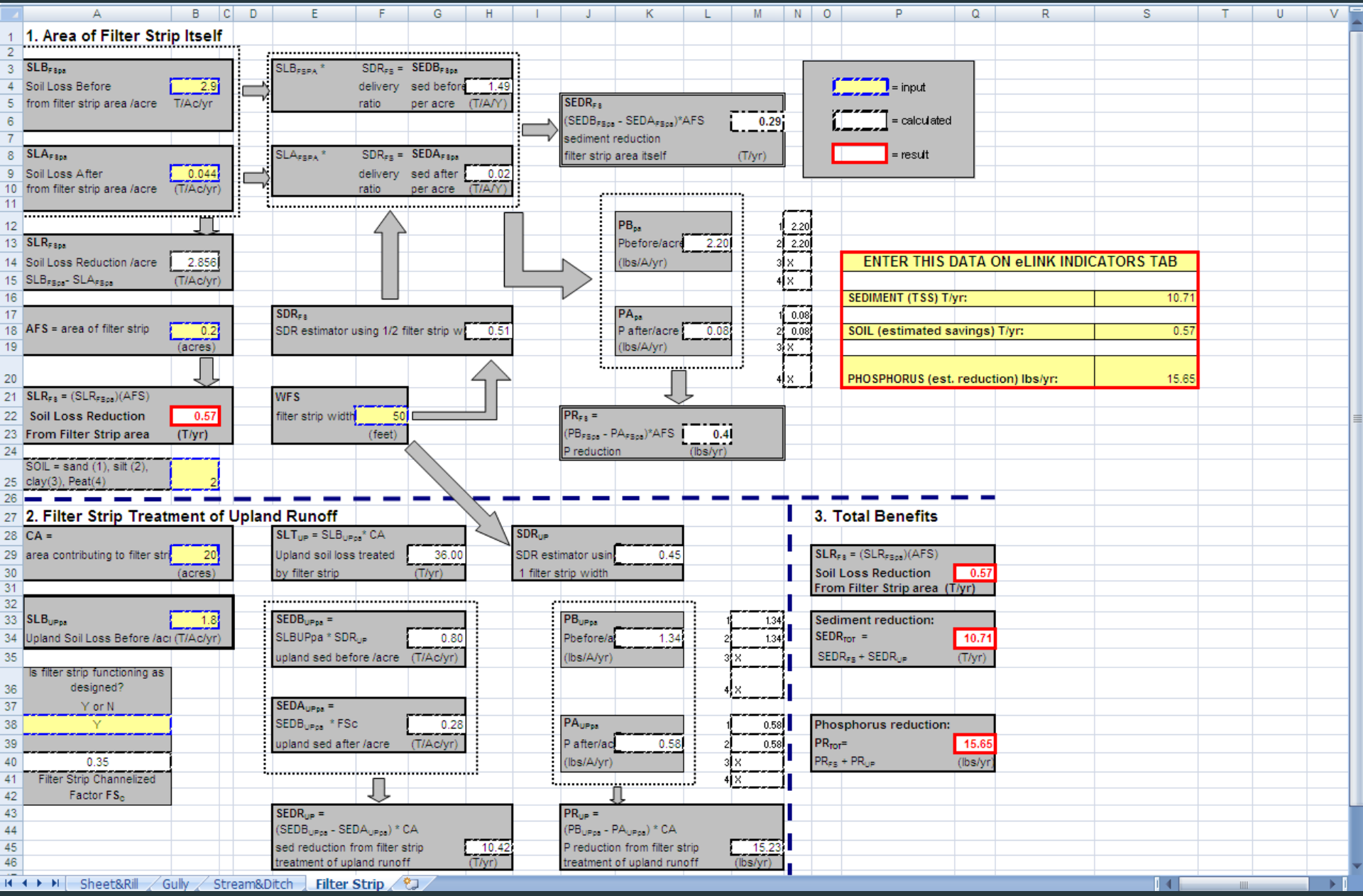
Example 3

- 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.

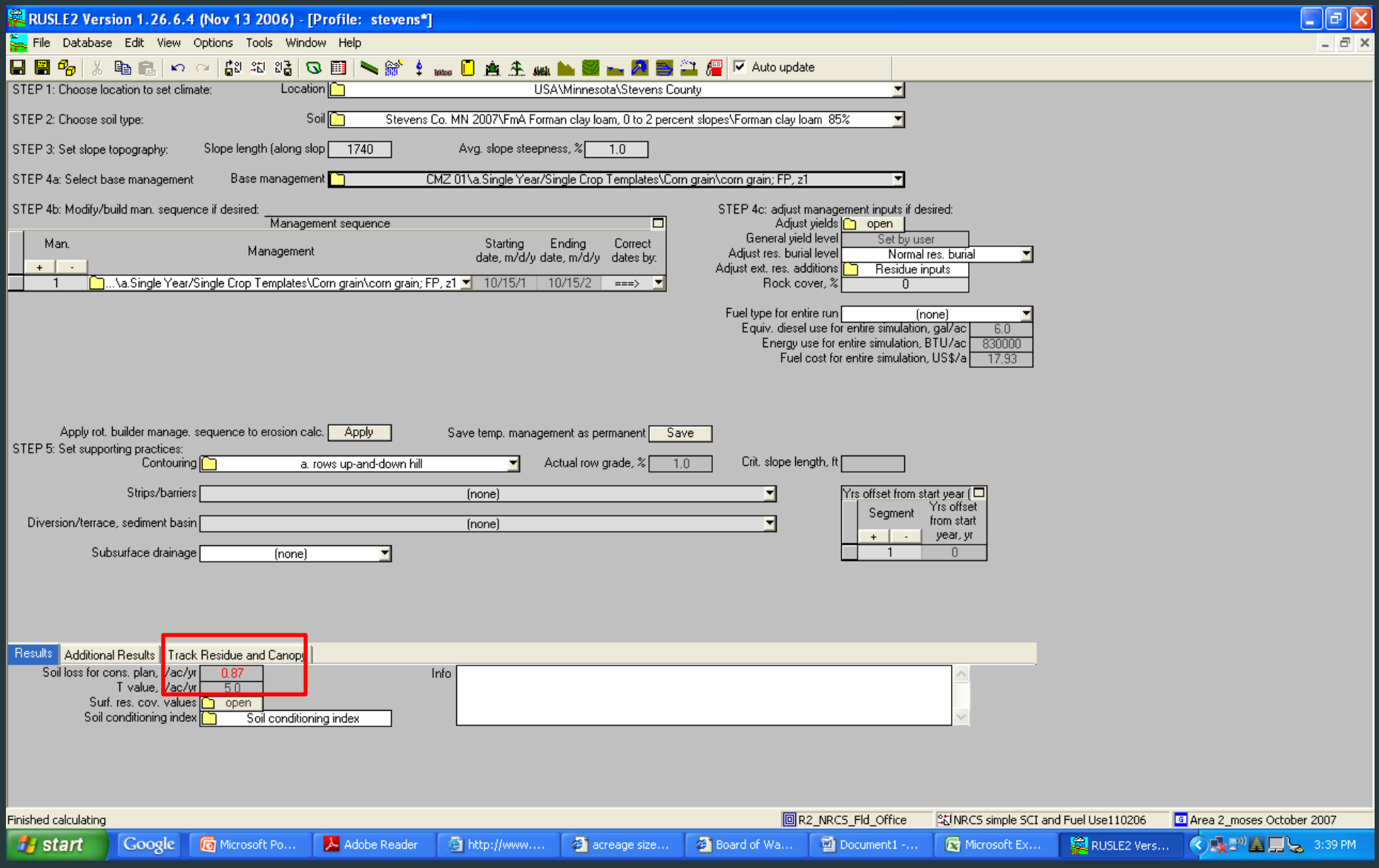
Find suggested calculator

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



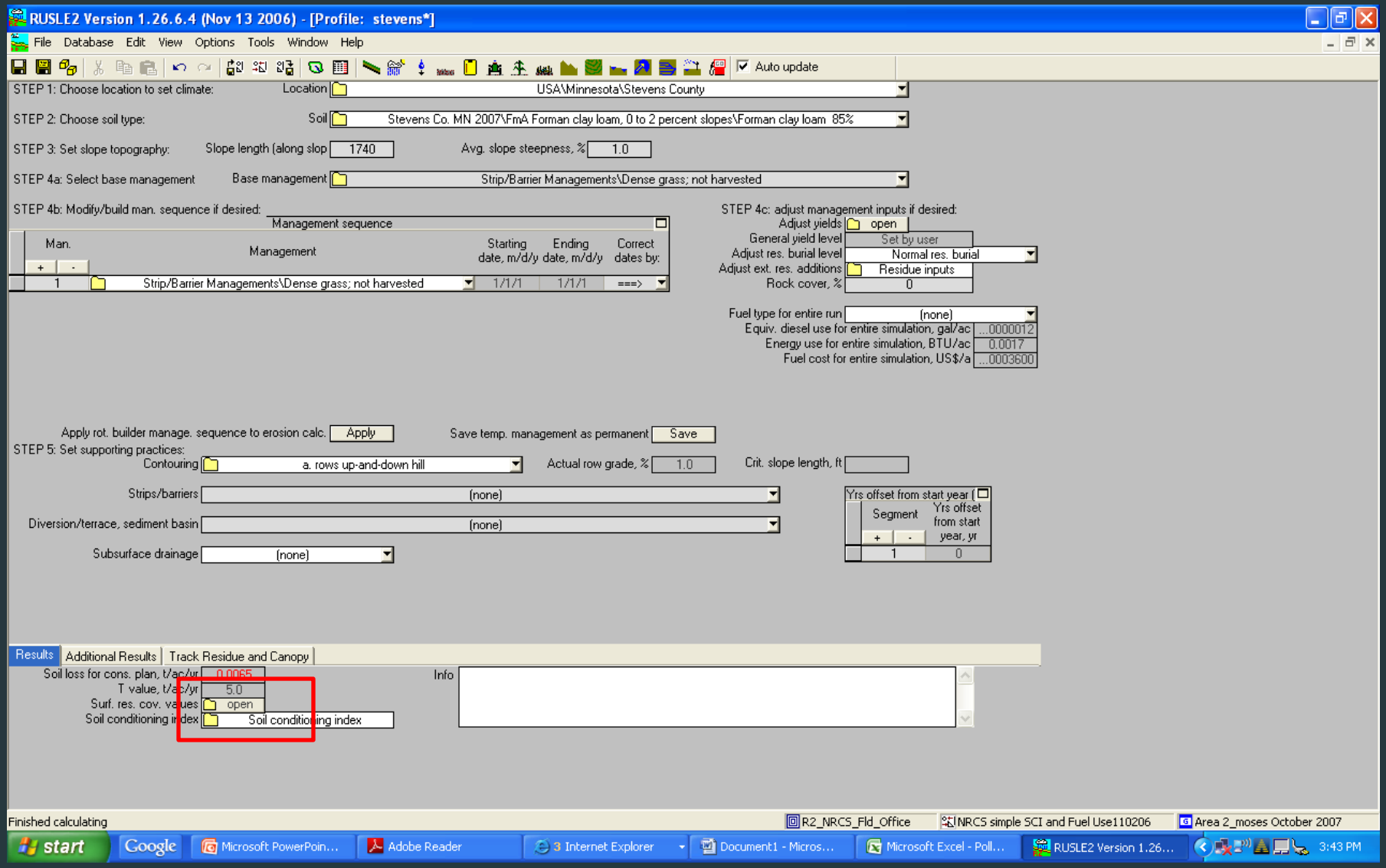
Soil Loss Calculations-Before Treatment



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



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

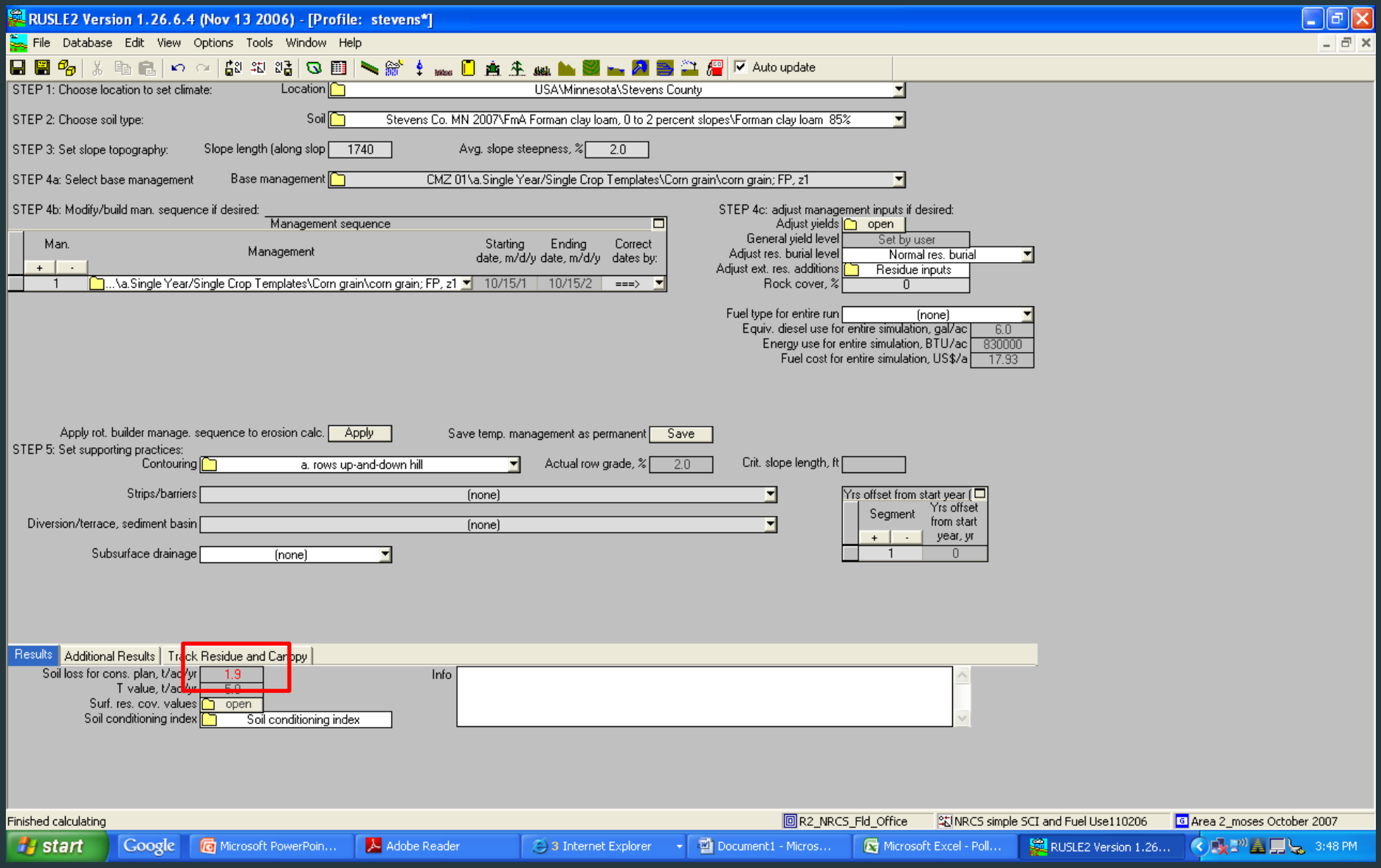
Input Data-Need 2 different Areas

- 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



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

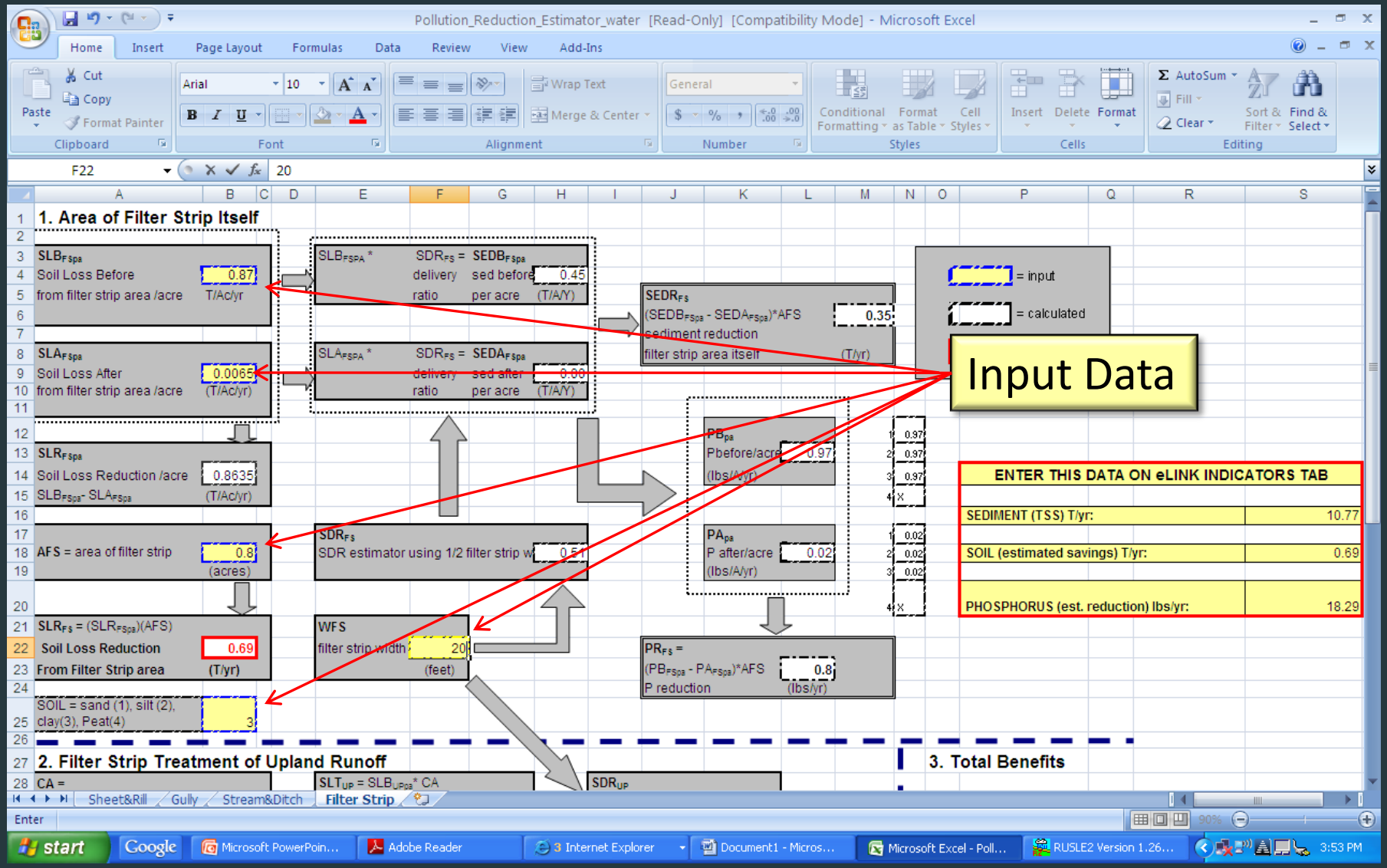
Input Data-Need 2 different Areas

- 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

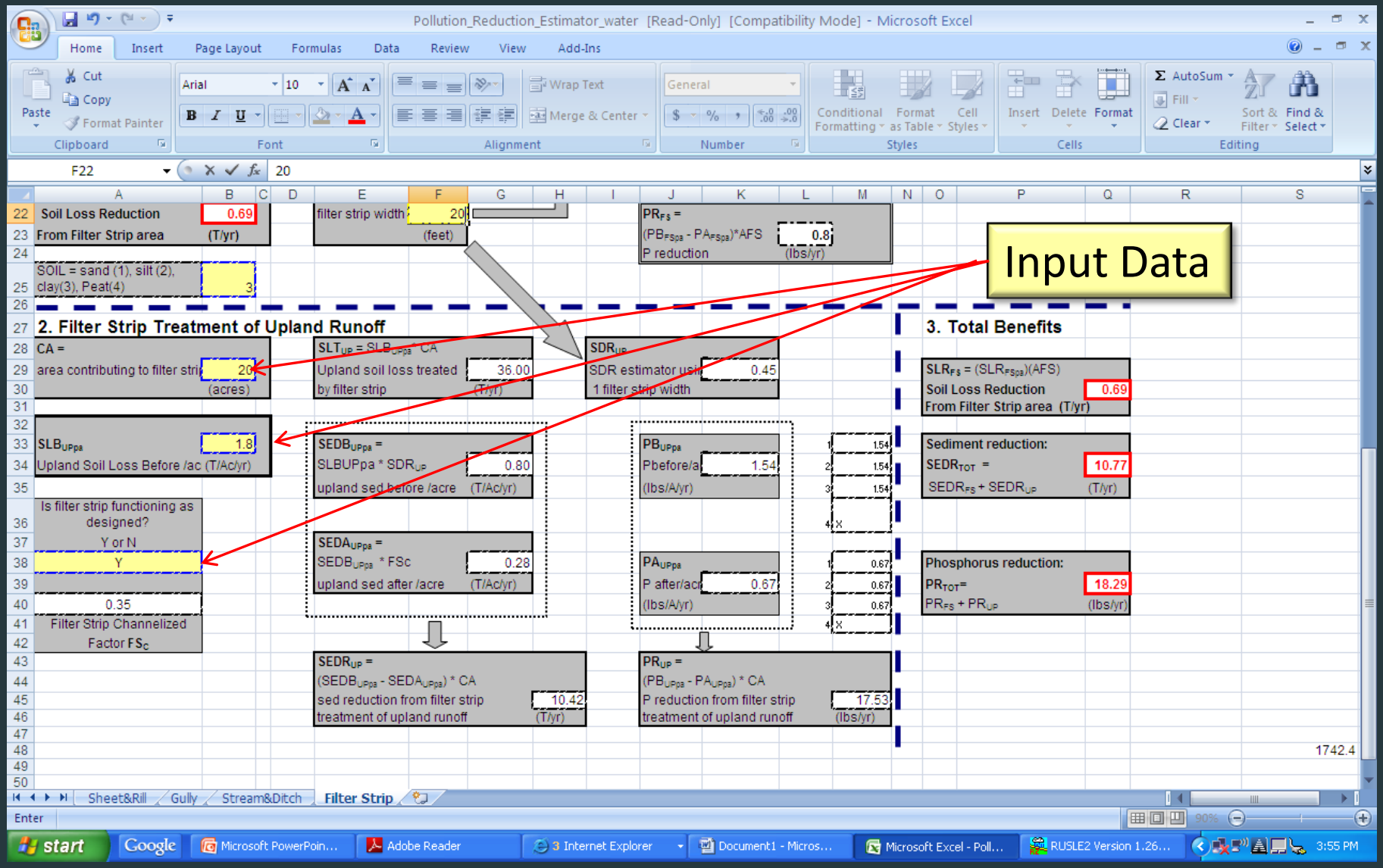
Input Data-Need 2 different Areas

- 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



Inputting data into the pollution reduction calculator



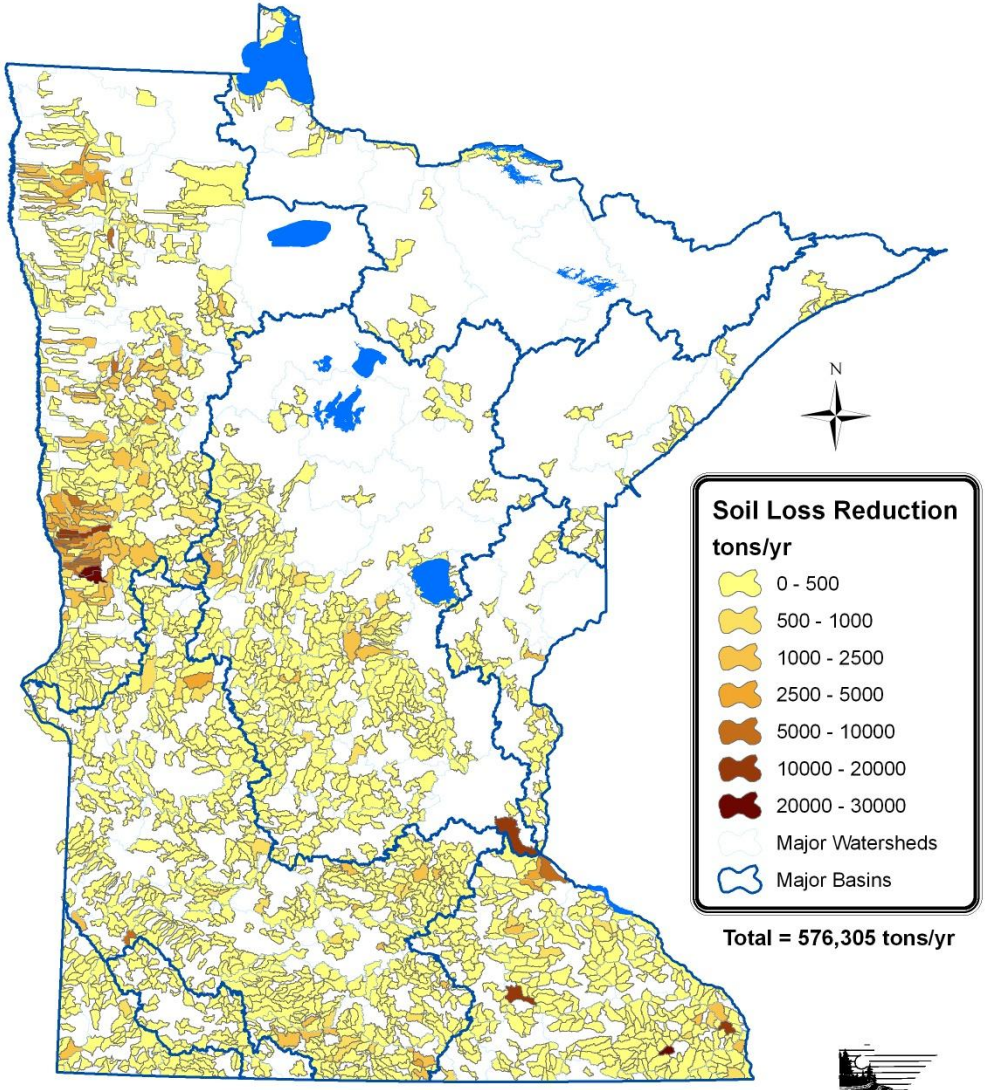
Output Information

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

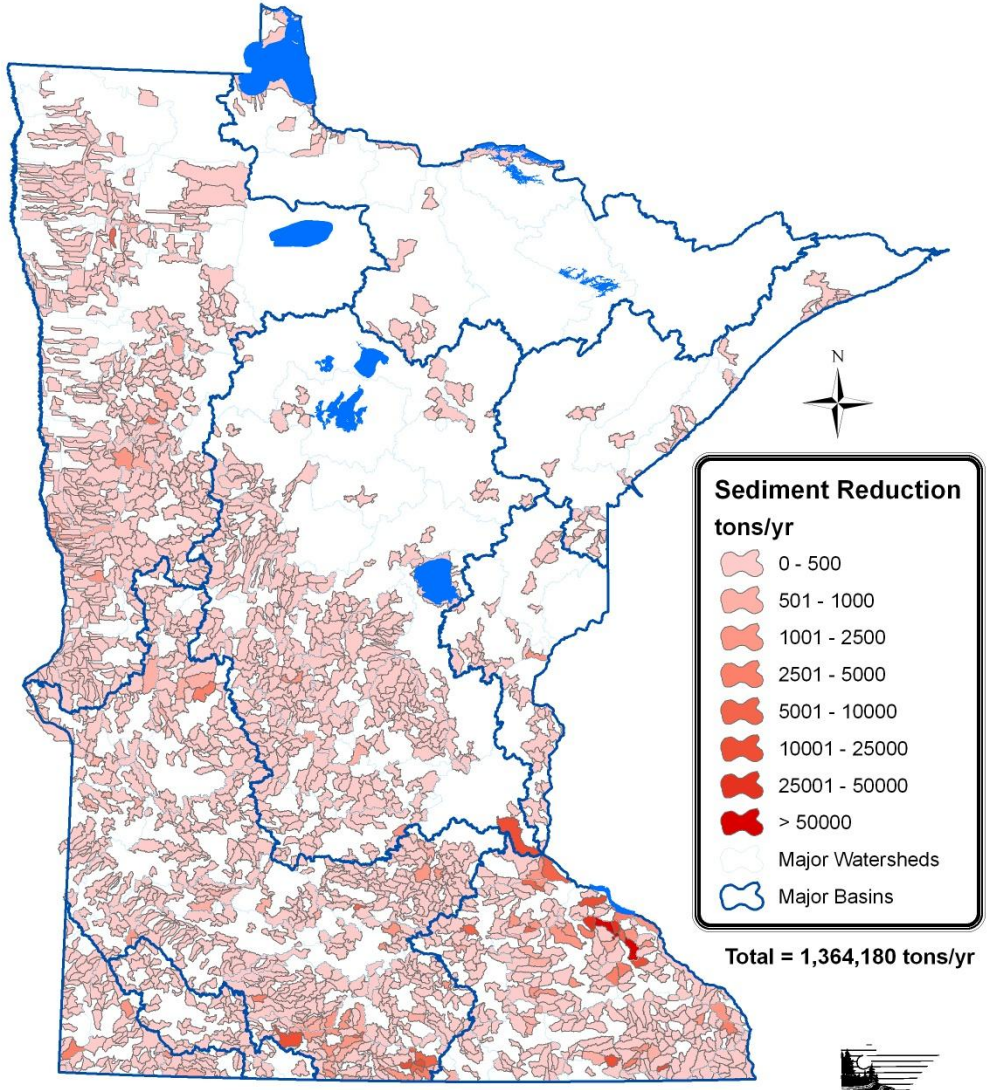
- Data is compiled for a statewide basis
  - Provides an outstanding tool for visually showing the benefits of conservation
- Can be compiled on a smaller scale
  - Excellent tool for use with local officials

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

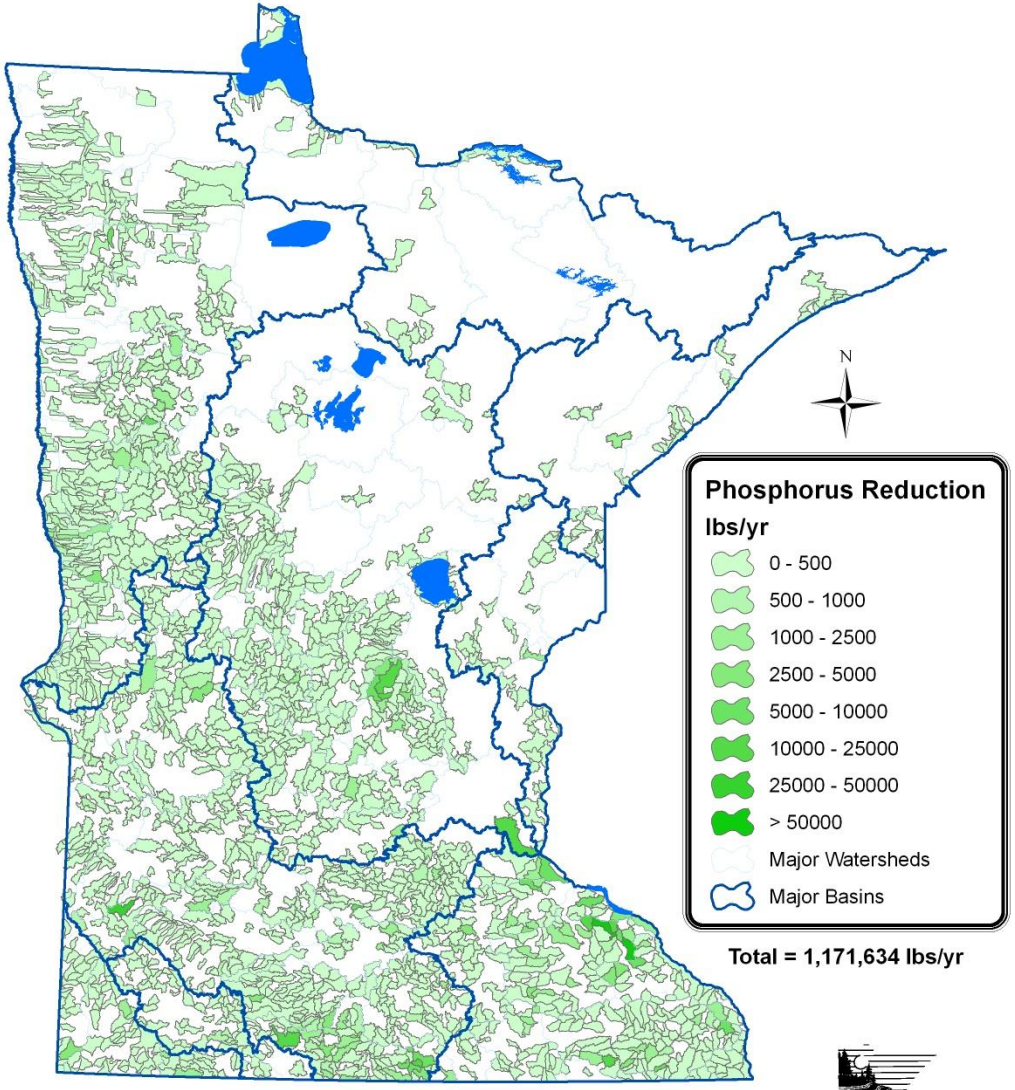


Minnesota Board of Water & Soil Resources
WWW.BWSR.STATE.MN.US

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



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



Total = 1,171,634 lbs/yr

Minnesota Board of Water & Soil Resources
WWW.BWSR.STATE.MN.US

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”

Loading = P*R*C*A*0.2

P= Rainfall depth per year

R = Runoff Coefficient

C = Pollutant Concentration

A = Area of Contributing Watershed

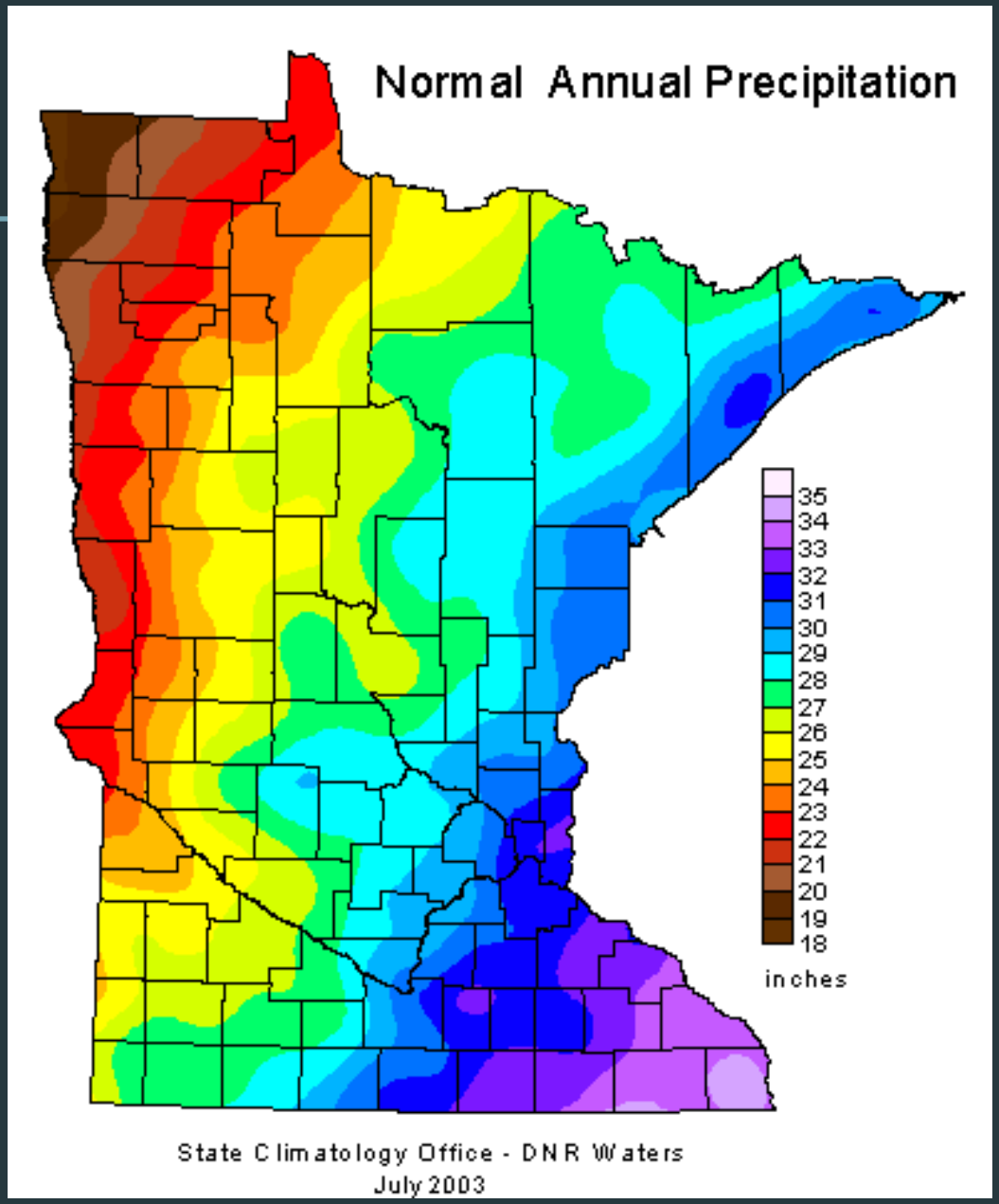
0.2 = a regional constant and unit converter

Input Values

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

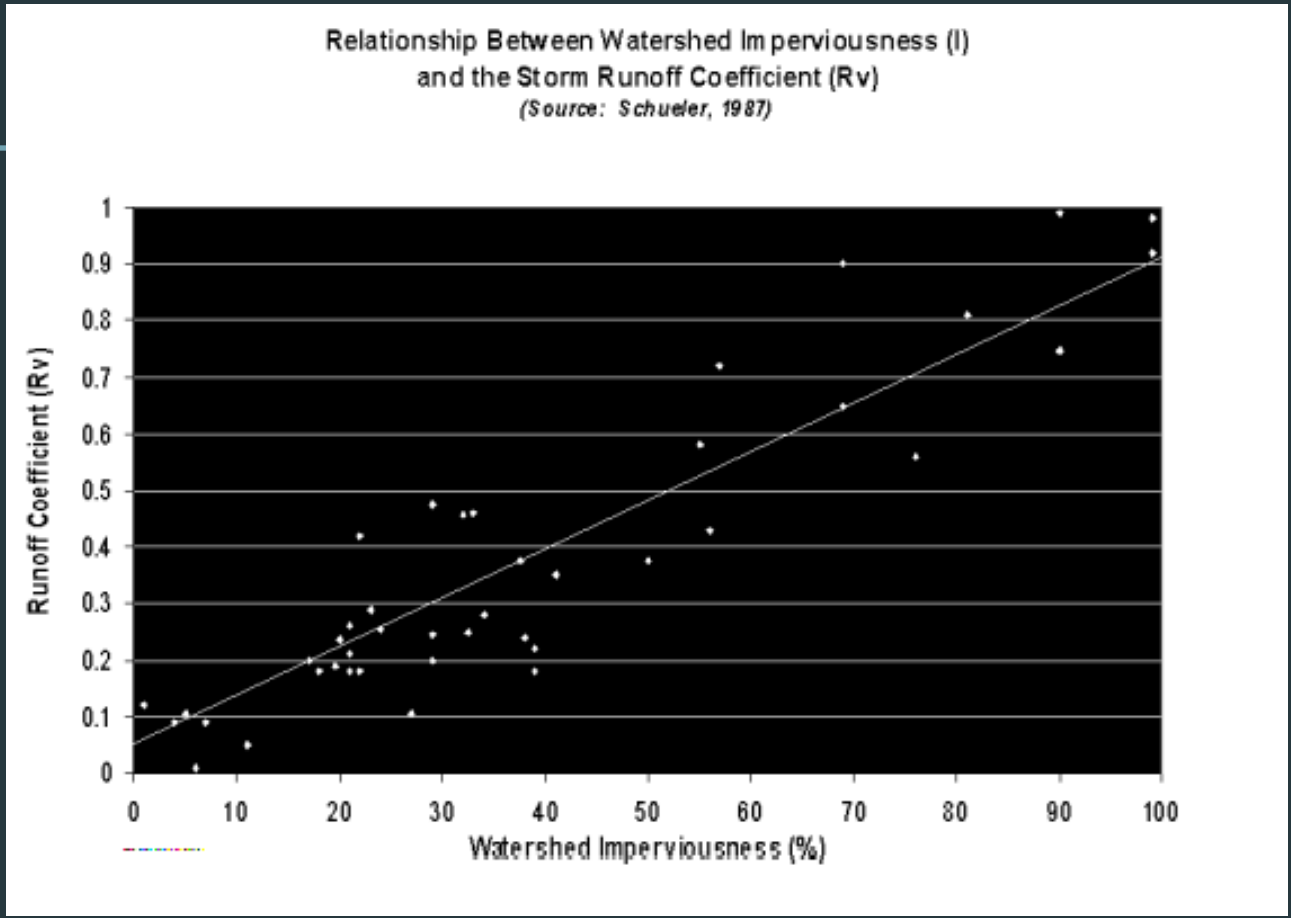
P – Average Rainfall Depth per year

- MN stormwater manual uses statewide average of 26”
- Use State Climatology Map
- Use NWS long-term weather station



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?