CHAPTER 2 EROSION CONTROL

2.1 EROSION AND EROSION CONTROL

Understanding Erosion

Erosion occurs when soil particles are detached from the land surface and carried downslope by moving water. Figure 2.1-1 illustrates how this process commonly occurs. First, a raindrop's velocity increases as it approaches the soil surface. This velocity, plus the drop's weight, provides sufficient energy at impact to detach soil particles. Once detached, upslope soil particles are carried by runoff until the flow spreads out, the gradient decreases and energy dissipates. As the flow loses the energy needed to suspend particles, it deposits the particles as sediment.

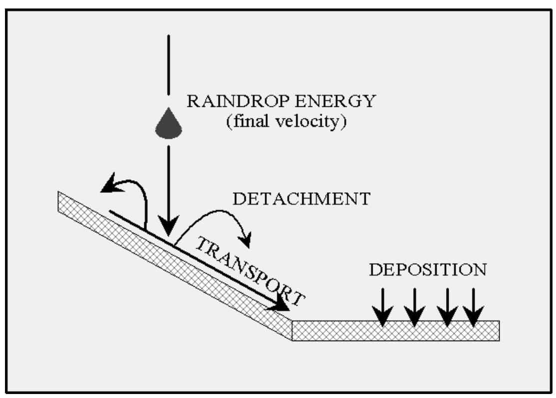


Figure 2.1-1 Conceptual Model of Erosion

Dane County construction sites are highly susceptible to erosion for several reasons. First, soil is easily detached from the land surface because vegetation and the surface layer of organic soil are stripped. Second, heavy machinery compacts the soil causing it to lose infiltration capacity, which increases the volume of water that becomes runoff and the potential to wash soil downhill. Third, since there is no vegetation to spread runoff into sheet flow, it is more likely to concentrate and cause gully erosion. Fourth, Dane County soils are comprised of large amounts of silt, which is easily detached from the other soil particles.

Erosion Control

There are a variety of strategies for minimizing soil loss from construction sites. These include preventing soil detachment, diverting runoff around disturbed areas, and trapping sediment carried by runoff before it leaves the site. The most important strategy for controlling construction site erosion is preventing soil particle detachment through soil stabilization. Vegetation should be re-established as soon as possible after land is disturbed. In the meantime, other erosion control practices, such as polymer application, erosion matting, and mulching, must be in place. A second line of defense is to prevent runoff from contacting detached soil particles by diverting runoff around disturbed areas. Diversions minimize the opportunity for runoff to entrain detached soil particles and carry them offsite. Finally, when soil particles are detached and carried by runoff, practices that slow and/or trap sediment must be installed to prevent suspended sediment from leaving the site and entering water bodies. Figure 2.1-2 is an illustration of how erosion prevention, diversion, and inlet protection can be integrated to minimize erosion.

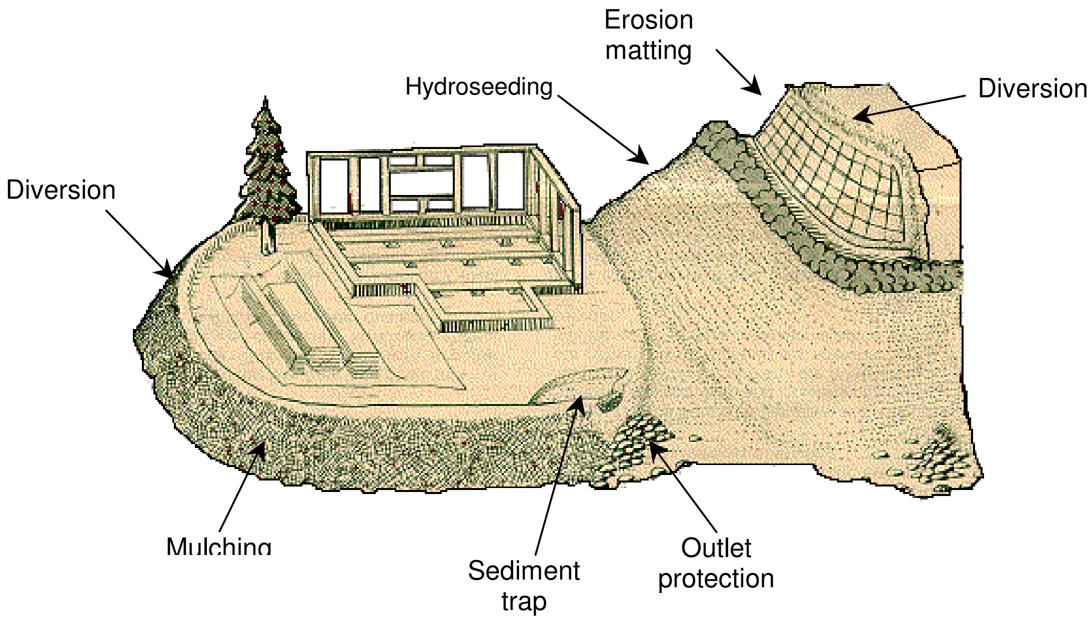


Figure 2.1-2 Construction Site Erosion Control, Adapted from Association of Bay Area Governments, 2006, http://www.abag.ca.gov/bayarea/enviro/erosion/eyoudo.html

2.2 DANE COUNTY EROSION CONTROL STANDARDS AND REQUIREMENTS

To minimize erosion from construction sites and protect the county's lakes and streams from sediment pollution, the Erosion Control and Stormwater Management Ordinance requires that plans for all construction sites include practices that meet the standards in Table 2.2-1.

	Standard	Purpose	Applicability
Sheet and Rill Erosion	Maximum allowable cumulative soil loss is 7.5 tons/acre/year	Minimize soil loss and prevent water quality and aquatic habitat degradation	All sites requiring an erosion control plan
Gully and Streambank Erosion	Prevent gully and streambank erosion	Minimize soil loss and prevent water quality and aquatic habitat degradation	All sites requiring an erosion control plan

Table 2.2-1

In addition, submitted erosion control plans must address the following 19 required elements.

1. **Detailed, written description of how the site will be developed** to ensure appropriate practices are being proposed and can implemented with the proposed construction schedule.
2. **Plan drawing of site** to show the location of property lines, lot dimensions, limits of disturbed area, limits of impervious area, land cover type, natural and artificial water features, 100-yr flood plain boundaries, wetland boundaries, and locations of proposed erosion controls.
3. **Direction of runoff flow** to determine effects of stormwater quantity and quality.
4. **Watershed size for each drainage area** to determine how much of the area to be developed is affected by other drainage flowing through the construction site; to design culvert sizes and drainage channels; to determine the sediment produced by the site under construction.
5. **Provisions to prevent mud tracking off site** including the tracking pad design (length, depth, etc.).
6. **Provisions to prevent the delivery of sediment to stormwater conveyance systems** to ensure capacity is not compromised and sediment is not transported off-site to receiving waters.
7. **Universal Soil Loss Equation worksheet(s)** to show the 7.5 ton/acre/year soil loss standard is being met.
8. **Provision for sequential steps mitigating erosive effect of land disturbing activities** including a series and schedule of practice installation to mitigate the increase in runoff and the pollutants it carries.
9. **Time schedules for completion and installation of all elements of the erosion control plan** to calculate the amount of sediment that will leave the site and to select the site practice(s).
10. **Fertilizer and seeding rates and recommendations** to illustrate how the disturbed areas will be returned to stable conditions.
11. **Itemized estimated cost (including labor) of erosion control practices** to determine the applicability of a financial security document.
12. **Design discharge for ditches and structural measures** to accommodate a 10-year, 24-hour storm and safely pass the 100-year, 24-hour storm event.
13. **Cross sections** of, as well as profiles within, road ditches to ensure non-erosive velocities.
14. **Culvert sizes** to maintain water quantity control to pre-development conditions and ensure that the time of concentration of runoff does not affect existing structures.
15. **Runoff velocities** to illustrate that they are not erosive and to ensure all slopes are stable.
16. **Proof of a stable outlet** to ensure that stormwater is being discharged from the site at a non-erosive velocity.
17. **Copy of preliminary review letter, permits, or approvals** by other agencies to ensure applicable permits have been applied for.
18. **Any other information necessary to reasonably determine the location, nature and condition of any physical or environmental features of the site.**
19. **Acknowledgment that any proposed changes to the erosion control plan will be submitted for approval prior to implementation** to ensure the plan and site stay in compliance.

In order to assist in meeting the standards and requirement set forth by the ordinance, Tables 2.2-2 and 2.2-3 list practices that could be used to achieve the performance standards. The table briefly describes where practices should be used along with maintenance requirements, environmental concerns and any special considerations for the practices. A more descriptive explanation of each practice is provided in the Appendices.

Non-Structural Practices	Applicable Standard	Applicability to Sites	Maintenance Requirement	Environmental Concerns	Special Considerations	Appendix Page #
Construction Scheduling	7.5 Tons/Acre/Year	Widely applicable	Low	None	Can greatly reduce erosion from a site	I.C-2
Deep Tilling	7.5 Tons/Acre/Year	Widely applicable on sites where heavy grading has occurred	Very Low	None	Should be timed after grading has occurred; Buried Utilities	I.D-1
Mulching	7.5 Tons/Acre/Year	Widely applicable	Moderate	Limited effectiveness on steep slopes depending on the type of mulch	Must be reapplied/replaced frequently and crimped	I.M-2
Polymer Application	7.5 Tons/Acre/Year	Applicable on sites that are not actively being graded	Moderate	Risk of adverse impacts if over applied	Must be re-applied if site is disturbed after initial application	I.P-3
Seeding, Permanent	7.5 Tons/Acre/Year	Widely applicable	Moderate; Low once established	Possible erosion during establishment; fertilizer runoff	Must match seed mix with the time of year and site conditions; Requires > 3" of topsoil	I.S-3
Seeding, Temporary	7.5 Tons/Acre/Year	Widely applicable	Moderate; Low once established	Possible erosion during establishment; fertilizer runoff	Effective for a maximum of 1 year; Requires > 3" of topsoil	I.S-4
Sod	7.5 Tons/Acre/Year	Widely applicable	Low after establishment	Fertilizer runoff; Overwatering	May need to be staked on steep slopes & channels; Proper selection of species; Requires > 3" of prepared topsoil	I.S-7
Surface Roughening	7.5 Tons/Acre/Year	Widely applicable	Moderate	Erosion may increase if not done on the contour of the slope	Need a specially selected tracked or wheeled vehicle	I.S-15

Table 2.2-2 Non-Structural Erosion Control Practices, Adapted from Massachusetts Stormwater Technical Handbook (1997)

Structural Practices	Applicable Standard	Applicability to Sites	Maintenance Requirement	Environmental Concerns	Special Considerations	Appendix Page #
Vegetated Buffer Strip	7.5 Tons/Acre/Year	Applicable when already installed	Low	None	Sufficient/suitable land area; Must be used in conjunction with other practices	I.V-1
Diversion, Permanent	7.5 Tons/Acre/Year	Widely applicable	Moderate	Possible erosion of diversion structure if diverted runoff carries a large sediment load	Must be carefully designed to prevent property damage	I.D-3
Diversion, Temporary	7.5 Tons/Acre/Year	Widely applicable	Moderate	Possible erosion of diversion structure if diverted runoff carries a large sediment load	May need frequent repair/replacement; Channel must be stabilized on slopes with a grade of >2%	I.D-4
Erosion Matting	7.5 Tons/Acre/Year	Widely applicable on low to moderate slopes	Low	Limited effectiveness on steep slopes	Proper installation	I.E-1
Gabion	7.5 Tons/Acre/Year, Prevents Gully Erosion	Applicable to vegetated ditches and swales	Low	Does not remove smaller suspended solids	Usually used in conjunction with other practices	I.G-1
Sediment Basin	7.5 Tons/Acre/Year	Applicable to sites with a drainage area of <25 acres	Low	Maximum sediment removal capacity of 60-80%; Does not remove fine silts and clays	May need frequent repair/replacement; Sufficient/ suitable land area; Proper design and construction	I.S-1
Sediment Trap	7.5 Tons/Acre/Year	Applicable to sites with a drainage area of <25 acres	Low	Maximum sediment removal capacity of 60-80%; Does not remove fine silts and clays	May need frequent repair/replacement; Sufficient/ suitable land area; Proper design and construction	I.S-2
Silt Fence	7.5 Tons/Acre/Year	Widely applicable	High	Sediment transport; High rates of failure if not properly installed and maintained; Disposal	Longevity, proper installation	I.S-5
Slope Drain, Temporary	7.5 Tons/Acre/Year; Prevents gully erosion	Applicable on sites that are vulnerable to convey runoff downslope	Moderate	Possible erosion around inlet & outlet	Pipe Size	I.S-6
Stone Check Dam	7.5 Tons/Acre/Year; Prevents gully erosion	Applicable to vegetated ditches and swales, Drainage areas <2 acres	Low to Moderate	Does not remove smaller suspended solids		I.S-8
Stone Tracking Pad	7.5 Tons/Acre/Year	Widely applicable	Low to High	None	Cost-effective; Must use >3" clear stone	I.S-11
Stone Weeper	7.5 Tons/Acre/Year; Prevents gully erosion	Applicable to vegetated ditches and swales, Drainage areas <2 acres	Low to Moderate	Does not remove smaller suspended solids		I.S-12
Stormwater Inlet Protection	7.5 Tons/Acre/Year	Widely applicable	Moderate to High	Ineffective for large storm events; Limited effectiveness with large sediment loads	May need frequent cleaned/replacement; used in conjunction with other practices	I.S-13

Table 2.2-3 Structural Practices, Adapted from Massachusetts Stormwater Technical Handbook (1997)

2.3 THE 7.5 TONS/ACRE/YEAR STANDARD

Research has shown the average soil loss on uncontrolled construction sites is approximately 30 tons/acre/year. By limiting soil loss from construction sites to 7.5 tons/acre/year, an average reduction of at least 75% from uncontrolled conditions will be achieved. By analyzing the USDA Natural Resources Conservation Service's definition of particle size distribution for Plano Silt loam (Figure 2.3-1), a soil that is similar to the majority of Dane County's soils, it is shown that in order to achieve a trapping efficiency of 75% during construction, the 5 micron (μm) particle will need to be trapped.

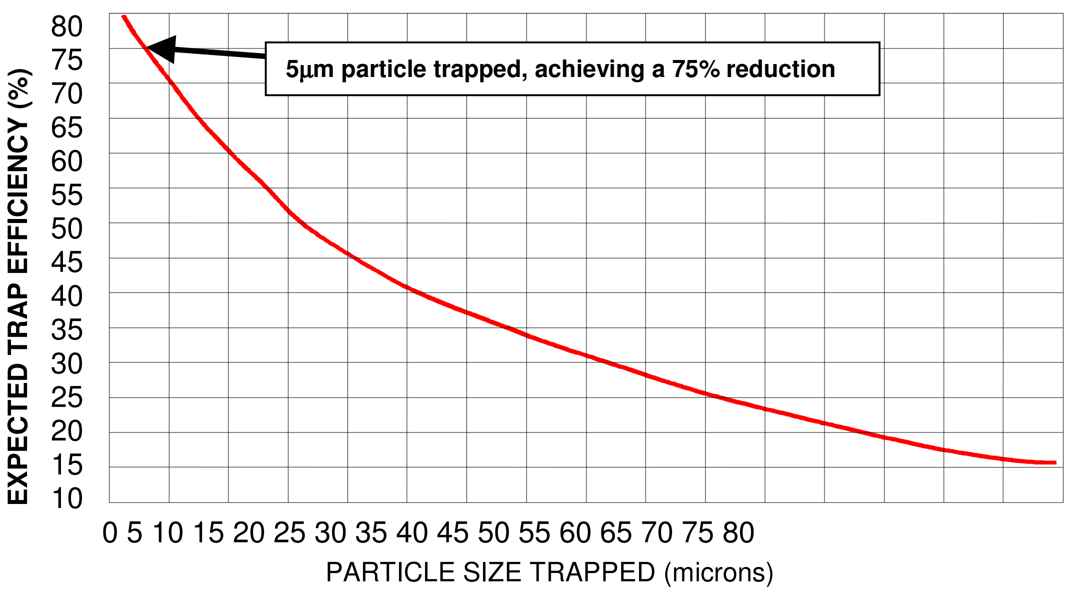


Figure 2.3-1. Particle Size Distribution for Plano Silt Loam,
Source: National Soil Survey Characterization Database

In Dane County, it is not feasible to trap particles smaller than 5 μm from a cost/benefit and engineering standpoint. In a pond that is two feet deep, trapping the 5 μm particle requires a settling time of 6 hours, which is feasible for pond design. However, the particle settling time increases exponentially with decreasing particle size (Figure 2.3-2). For example, trapping the 3 μm instead of the 5 μm particle increases the required settling time from 6 to 24 hours, but only increases the expected trapping efficiency by 5%. Designing a pond with a settling time of 24 hours would be much more costly and require a larger land area. Thus, a soil loss standard lower than 7.5 tons/acre/year would provide small additional benefit at a very high cost. Dane County's approach is equivalent to the intent of the performance standards for construction sites in the Department of Natural Resources' Chapter NR 151, Wis. Adm. Code (refer to Chapter 1, section 1.3).

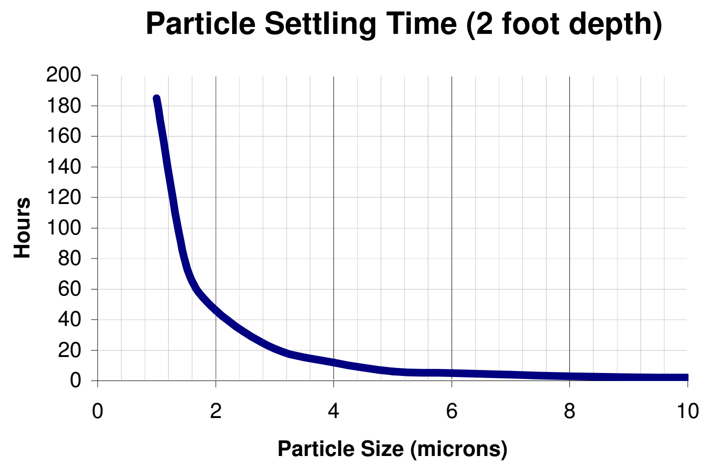


Figure 2.3-2 Particle Settling Time

2.4 CALCULATING SOIL LOSS FROM CONSTRUCTION SITES

The Dane County Land and Water Resources Department has developed an Excel worksheet that calculates soil loss from construction sites. This spreadsheet uses the Universal Soil Loss Equation (USLE) to determine whether the combination of proposed erosion control practices will limit soil loss from sheet and rill erosion to 7.5 tons/acre/year or less. The USLE, its variables, and an example calculation are provided below. Note that the USLE estimates soil loss from sheet and rill erosion only. It does not predict soil loss resulting from high channel velocities, gully erosion or streambank erosion.

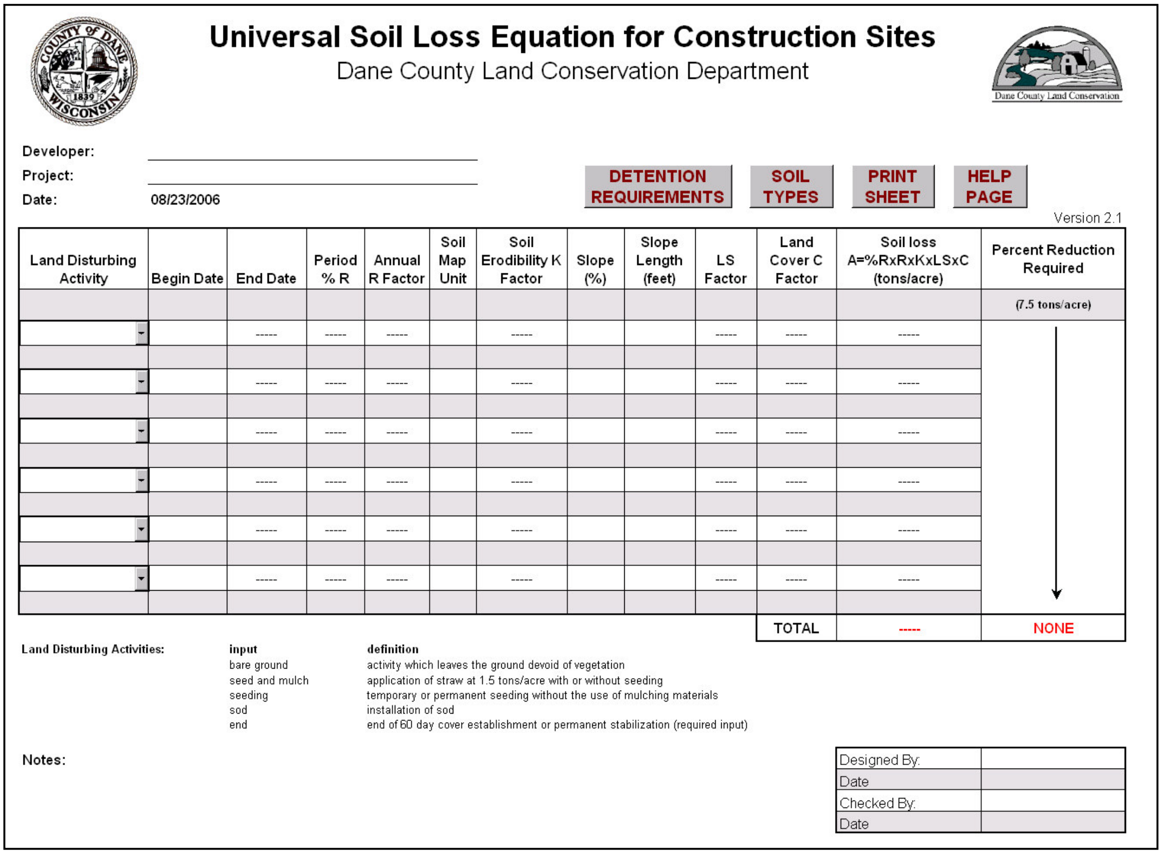
Universal Soil Loss Equation for Construction Sites

A = (R) x (% R) x (K) x (LS) x (C) x (P)

A: Computed Soil Loss Rate (ton/acre)
R: Annual Rainfall Factor (150 for Dane County)
% R: The percentage of the annual R factor that has passed to date
K: Soil Erodibility Factor (based on soil type)
LS: Slope Length/Steepness Factor (based on slope length and percent slope)
C: Land Cover Factor (based on condition of soil cover)
P: Not used for construction site calculations. The P factor accounts for the effect of support practices such as contouring, strip cropping, or installing terraces in an agricultural setting. This factor does not apply to construction sites.

USLE Spreadsheet

An Excel spreadsheet for use in calculating soil loss is available online at http://www.co.dane.wi.us/landconservation/uslepg.htm. Figure 2.4-1 shows what the user sees online. This spreadsheet calculates soil loss from inputs entered by the user. Note that the user only needs to enter the following information: type of land disturbing activity in column 1, begin date in column 2, soil map unit in column 6, slope in column 7, and slope length in column 8. The remainder of the USLE variables are automatically determined or calculated by the spreadsheet, based on the input data.



Universal Soil Loss Equation for Construction Sites

Dane County Land Conservation Department

Developer:
Project:
Date: 08/23/2006

DETENTION REQUIREMENTS | SOIL TYPES | PRINT SHEET | HELP PAGE

Version 2.1

Land Disturbing Activity	Begin Date	End Date	Period % R	Annual R Factor	Soil Map Unit	Soil Erodibility K Factor	Slope (%)	Slope Length (feet)	LS Factor	Land Cover C Factor	Soil loss A=%RxRxKxLSxC (tons/acre)	Percent Reduction Required
												(7.5 tons/acre)
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
										TOTAL	-----	NONE

Land Disturbing Activities:

input	definition
bare ground	activity which leaves the ground devoid of vegetation
seed and mulch	application of straw at 1.5 tons/acre with or without seeding
seeding	temporary or permanent seeding without the use of mulching materials
sod	installation of sod
end	end of 60 day cover establishment or permanent stabilization (required input)

Notes:

Designed By:	
Date	
Checked By:	
Date	

Figure 2.4-1 USLE Spreadsheet

Description of Spreadsheet Columns

Column #	Variable	Type
1	Land Disturbing Activity	pull-down menu
2	Begin Date	entered by user
3	End Date	automatically calculated
4	Period % **R**	automatically calculated
5	Annual **R** Factor	automatically calculated
6	Soil Map Unit	entered by user, or use button
7	Soil Erodibility **K** Factor	automatically calculated
8	Slope	entered by user
9	Slope Length	entered by user
10	**LS** Factor	automatically calculated
11	Land Cover **C** Factor	automatically calculated
12	Soil Loss	automatically calculated
13	Percent Reduction to Meet Ordinance	automatically calculated

Variable Descriptions

Land Disturbing Activity (pull-down menu)

The land disturbing activity relates to the type of disturbance that is occurring on the ground. The land disturbing activity inputs must be selected from the pull-down menu.

Activity Inputs:

bare ground	Usually the initial disturbance occurs when the ground is left bare due to stripping vegetation, grading, or other actions that leave the soil devoid of cover.
mulch with seed	The application of a minimum of 1.5 tons/acre straw or other comparable mulch. Enter this if the seeding and mulching are done at the same time. It is not necessary to also enter *seeding* if this input is used. Requires 60 days of cover establishment during the growing season. Mulching is recommended on all disturbed areas that are to be seeded to control erosion and establish cover.
seeding	The application of permanent or temporary seeding without the use of mulch. Not to be used with *mulch with seed.* Requires 60 days of cover establishment during the growing season.
sod	The installation of sod for cover establishment.
end	This entry is made at the end of cover establishment. It is recommended that a 60 day cover establishment period be used. Refer to notes listed under *Date.* **(Required Input)**

Begin Date (entered by user)

The date the planned land disturbing activity begins, e.g. 5/15/07. The activity is assumed to continue until the next activity is entered. A 60-day cover establishment period, during the growing season, is recommended for the establishment of seeding.

Notes:
1. Permanent seeding should be completed by September 15.
2. Temporary seeding should be completed by October 15. Temporary seeding of oats or sudan grass are normally sown between May 15 and July 15, and rye grass or winter wheat are normally sown between July 15 and September 15. To minimize competition, it is recommended that the temporary seeding be incorporated into the soil prior to application of permanent seeding.
3. When the seeding dates are later than the date guidelines, the *end* of the cover establishment period should be extended to **May 15** of the following spring to allow for growth.

End Date (automatically calculated)

The date when the land disturbing activity ends. This cell is automatically calculated when the next *Begin Date* is entered.

Period % R (automatically calculated)

The percentage of the annual R factor calculated for the period from one land disturbing activity to the next. The % R is the percentage of the annual R factor that has passed to date. In the Midwest over half of the rainfall energy occurs during July, August, and September. Final raindrop energy is the primary cause for soil detachment. For these reasons, the R factor needs to be adapted to the construction schedule of the project.

Annual R factor (automatically calculated)

The rainfall factor, R, is the number of erosion index units in a normal year's rain. The erosion index is a measure of the erosive force of a specific rainfall. The rainfall, or R factor represents the total amount of rainfall energy that occurs during an average year. The R factor was developed by using the average 30-minute storm intensity and raindrop energy. In Dane County the rainfall factor is 150.

R = (EI30)/100 = (energy of rainstorm x max. 30 minute intensity)/100

Soil Map Unit (entered by user)

The soil-mapping unit symbol for the predominant soil type in the area of the land disturbing activity, e.g. PnB. This information is available in the published soil survey of Dane County at the Land and Water Resources Department office or may be accessed by clicking the *Soil Types* button.

Soil Erodibility K Factor (automatically calculated)

The erosiveness of a specific layer and type of soil. The spreadsheet uses the highest K factor published for the soil type, typically a subsoil layer. The USLE's soil erodibility, or K factor represents a soil's ability to resist breakdown and erosion. The factor is determined by documenting erosion of a soil in a bare condition on a unit test plot. The higher the erosion rates, the higher the K factor will be. On construction sites, the subsoil K factor is used because topsoil is usually stripped. The K factor can be found in soil characterization tables. The soil properties that affect erodibility are: 1) soil structure, 2) soil particle size distribution, 3) permeability, 4) organic matter content, and 5) iron content-aluminum oxides (e.g. whether the subsoil has a high clay content). These are listed for Dane County soil series in appendix A of this manual.

Slope (entered by user)

The percent slope for the representative portion of the disturbed area, regarding overland flow and not channel flow, e.g., .05 or 5 (depending on version of Excel).

Slope Length (entered by user)

Slope length (in feet) is measured along the overland flow path from the top to the bottom of the slope of the representative disturbed area. Channel lengths are not included in the slope length.

LS Factor (automatically calculated)

The program calculates this ratio based on the relationship between the percent slope and the length of slope of the representative disturbed area. The slope length/steepness or LS factor in the USLE equation relates the length and steepness of the slope. The rate of erosion increases exponentially as the length of the slope becomes longer. Erosion rates rise even more drastically as the steepness of the slope increases. The function used to calculate LS is:

$$LS=(L/76.6)^{M}(65.41\sin^2\theta+4.56\sin\theta+0.065)$$

Where:
- L= slope length in feet
- θ= angle of slope (in degrees)
- M= 0.2 for slopes <1%
- M= 0.3 for slopes 1.0 to 3.0%
- M= 0.4 for slopes 3.0 to 4.5%
- M= 0.5 for slopes >4.5%

Land Cover C Factor (automatically calculated)
The cover and management factor is the ratio of soil loss from an area with a specified cover and management practice to that from a unit plot of bare land. The input from the *Land Disturbing Activity* corresponds to the C factor value. The C, or land cover factor, is the ratio of soil loss from an area with specified cover and management to the corresponding loss from a clean-tilled, continuously fallow condition. It is based on the type and condition of the cover on the soil surface. In construction site erosion control, the cover is extremely important. The vegetative cover provides the needed protection from rainfall impact and runoff water. If the condition of the cover is poor, the C factor will be higher. Conversely, when the vegetation is well established, the erosion and C factor will be reduced. C factors for construction sites can be found from tables in *Predicting Rainfall Erosion Losses*, published by the USDA. Commonly used C factors are:

Bare Ground	1.00
Seeding	0.40
Seeding and Mulching	0.12
Sod	0.01

Soil Loss (automatically calculated)
The predicted value of soil loss (tons per acre) that corresponds to the time period of each land disturbing activity. This value is calculated using the equation: A=(% R) x (R) x (K) x (LS) x (C).

Percent Reduction Required to Meet Ordinance (automatically calculated)
The percentage value in the TOTALS row corresponds to the reduction in soil loss necessary to comply with Dane County's Erosion Control and Stormwater Management Ordinance. It is required that the cumulative soil loss rate not exceed 7.5 tons per acre for all sites.

Compliance with the ordinance standards can be achieved by:
1. Adjusting the management of the disturbed area, i.e., tightening schedule or installing erosion control measures.
2. Installing a sediment basin or other sediment control measures below the disturbed area.
3. Obtaining cooperative efforts of adjoining landowners.

Button Controls:
Detention Requirements
Clicking on the Detention Requirements button will cause a pop-up box to appear that returns the size of the soil particle that would need to be trapped to obtain compliance with the Dane County Erosion Control and Stormwater Management Ordinance soil loss standard (7.5 tons/acre/year). The soil particle size distribution used for the calculation is a Plano silt loam, a typical and common distribution for Dane County.

If the percent reduction is greater than what can theoretically be trapped by a single sediment control structure, a message stating "Trap efficiencies greater than 80% are not possible with detention alone." is returned.

If there is no reduction necessary to comply with the ordinance, clicking the Detention Requirements button will return: "Detention is not necessary. The soil loss rate is below standards."

Soil Types
Clicking on the Soil Types button will activate a combo box listing the soil mapping units and soil descriptions for Dane County soil types. Once highlighted and OK is clicked, another pop-up box will appear asking if the user wants the soil mapping unit to be automatically entered into the spreadsheet.

Print Sheet
Once the spreadsheet is completed, clicking the 'Print Sheet' button will print a copy using the proper layout and print range.

Help Page
Clicking the 'Help Page' button will activate a help page. Use one of the 'Back to USLE' buttons on the help page to return to the spreadsheet.

Example of Soil Loss Calculation

Assumptions

- Need to calculate the soil loss from construction of a 25,000 sq. ft. mini-warehouse
- Plan to break ground on April 1, 2007
- Site stabilization is planned to be completed by seed and mulch by August 12, 2007
- The soil type was found in the Dane County Soil Survey to be Kidder Loam, 2 to 6% slopes (soil map unit = KdB)
- The representative slope on the site is 4.5% and has a length of 50 feet

1. Select the initial land-disturbing activity. When breaking ground on a construction site the land-disturbing activity will be bare ground, which can be selected from the pull-down menu. This represents the fact that soil will be exposed from this date on.
2. Enter the date that you expect to break ground, 04/01/07, in the next column.
3. In the Soil Mapping Unit column enter KdB.
4. Under the column titled Slope (%), enter the representative slope percentage, 4.5.
5. Enter the slope length in feet, 50, in the next column.
6. Go back to the Land Disturbing Activity column and just below the *bare ground* row select *mulch with seed* from the pull-down menu.
7. In the next column enter the date that you expect to seed and mulch the site, 08/12/07. The rest of the columns in this row will fill in automatically.
8. In the next row in the Land Disturbing Activity select *end* from the pull-down menu.
9. Under the date column enter a date, at least sixty-days after the site is expected to be seeded and mulched (10/12/07) during the growing season. This represents the time necessary to establish vegetative cover. If the seed and mulch date had been after September 15, the end date would have been extended to May 15 of the following year to allow for 60 days of establishment during the growing season.

Below is an example of how the spreadsheet should look.

Universal Soil Loss Equation for Construction Sites

Dane County Land Conservation Department

Developer: Name of Developer

Project: Mini-Warehouse Development

Date: 08/23/2006

DETENTION REQUIREMENTS | SOIL TYPES | PRINT SHEET | HELP PAGE

Version 2.1

Land Disturbing Activity	Begin Date	End Date	Period % R	Annual R Factor	Soil Map Unit	Soil Erodibility K Factor	Slope (%)	Slope Length (feet)	LS Factor	Land Cover C Factor	Soil loss A=%RxRxKxLSxC (tons/acre)	Percent Reduction Required
												(7.5 tons/acre)
bare ground	04/01/2007	08/12/2007	66.6%	150	KdB	0.37	4.5%	50	0.33	1.00	12.3	
seed and mulch	08/12/2007	10/12/2007	22.9%	150	KdB	0.37	4.5%	50	0.33	0.12	0.5	
end	10/12/2007	-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
		-----	-----	-----		-----			-----	-----	-----	
										TOTAL	12.9	42%

Land Disturbing Activities:

input	definition
bare ground	activity which leaves the ground devoid of vegetation
seed and mulch	application of straw at 1.5 tons/acre with or without seeding
seeding	temporary or permanent seeding without the use of mulching materials
sod	installation of sod
end	end of 60 day cover establishment or permanent stabilization (required input)

Notes:

Designed By:	JDB
Date	08/23/2006
Checked By:	JAH
Date	08/23/2006

Figure 2.4-2 Spreadsheet from Example USLE Calculation

As can be seen from the calculation, a reduction of 42% is still necessary to comply with the ordinance. This can be accomplished in a number of ways including reducing the time that the ground is left exposed, changing the time of year that construction takes place and/or designing erosion control practices to reduce the amount of soil that leaves the site.

Other USLE Spreadsheet Notes:
If the slope or schedule that is required for the calculation is not representative of the whole site, more than one calculation may be submitted. The area with the higher expected soil loss would then need to receive different erosion control treatment than the other areas on the site.

- When a slope is dramatically changed by grading during the *bare ground* period and it is desired to take credit for this change, select another *bare ground* row under Land Disturbing Activity and enter its corresponding date. Then enter a new slope and/or slope length in the appropriate columns.
- If the site is to be graded, but the entire site is to be stabilized by methods other than vegetation establishment (i.e., by paving or gravelling), skip the *seed and mulch* or *sod* activities and select *end*.

- When sites are to be temporarily seeded and mulched, enter land disturbing activities of *bare ground*, *seed and mulch*, and *end*. The date for *end* will be when grading is expected to resume. Under these rows select *bare ground*, *seed and mulch*, and *end* for the second phase of grading.

2.5 GULLY AND STREAMBANK EROSION

Gully erosion is caused by concentrated overland flow of surface water in depressions and drainage ways. The surface water's erosive force removes topsoil while increasing energy as it moves downslope. Once an unprotected gully begins to form, lateral erosion takes place, widening the gully and undercutting the sides where additional soil is removed. Preventive practices and proper management of gullies are required on construction sites.

Streambank erosion removes soil along the banks and bed of a channel. The erosion is the result of high flow within the stream channel after rain events. The erosive force of the flow causes undercutting of the banks, which deposits large amounts of sediment directly into the stream channel. The sediment is then carried and deposited downstream.

Practices and management techniques to prevent gully and streambank erosion can be found in Table 2.2-3 with additional description, design and maintenance recommendations found in the Appendices.