

Unit Eight

REVISED UNIVERSAL SOIL LOSS EQUATION

INTRODUCTION

Information regarding potential soil loss from a site is very useful when developing soil erosion and sedimentation control plans and for scheduling site inspections. The Universal Soil Loss Equation (USLE), developed in 1956, was one of the first “tools” available to predict soil loss resulting from sheet and rill erosion. Although it was initially developed to estimate long-term average soil loss for agricultural purposes, it could be used, with some limitations, for estimating soil loss from construction sites. The USLE used six variables or factors to predict soil loss.

In the mid 1990's, the USLE was replaced with the Revised Universal Soil Loss Equation (RUSLE). The RUSLE utilizes the same factors as the USLE for predicting annual soil loss. However, the values of the factors were modified or adjusted for use in the RUSLE. In some instances, the factor values are specific to conditions found on construction sites. The RUSLE uses the same equation as the USLE, which is:

A = R x K x LS x C x P where,

A is the predicted average annual soil loss in tons per acre.

R is the rainfall-runoff erosivity factor. It represents an average rainfall intensity over a 22-year period. R values for Michigan counties range from 75 to 135 (Figure 8-1). It is important to note that approximately 70 percent of the rainfall erosivity in Michigan occurs in the months of May, June, July, and August. Therefore, if your construction activities will occur during these months the predicted average annual soil loss may be underestimated.

K is the soil erodibility factor. When determining the K value, both the soils susceptibility to erode and the rate of runoff associated with that soil are taken into account. K values range from 0.10 to 0.43 in Michigan. Generally the K_w factors found in Appendix 8A are used for the K factor in the RUSLE.

LS is the slope factor. The LS factor takes into account the slope length (feet) and the slope steepness (percent). Table 8-1 provides tabular values for construction sites. Separate tables are available from the Natural Resources Conservation Service (NRCS) for pasture lands and cultivated row crops.

Table 8-1: LS Values for Construction Sites¹

Slope (%)	Horizontal Slope Length (ft.)																
	<3	6	9	12	15	25	50	75	100	150	200	250	300	400	600	800	1000
0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
0.5	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13
1.0	0.09	0.09	0.09	0.09	0.09	0.10	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.24	0.26	0.27
2.0	0.13	0.13	0.13	0.13	0.13	0.16	0.21	0.25	0.28	0.33	0.37	0.40	0.43	0.48	0.56	0.63	0.69
3.0	0.17	0.17	0.17	0.17	0.17	0.21	0.30	0.36	0.41	0.50	0.57	0.64	0.69	0.80	0.96	1.10	1.23
4.0	0.20	0.20	0.20	0.20	0.20	0.26	0.38	0.47	0.55	0.68	0.79	0.89	0.98	1.14	1.42	1.65	1.86
5.0	0.23	0.23	0.23	0.23	0.23	0.31	0.46	0.58	0.68	0.86	1.02	1.16	1.28	1.51	1.91	2.25	2.55
6.0	0.26	0.26	0.26	0.26	0.26	0.36	0.54	0.69	0.82	1.05	1.25	1.43	1.60	1.90	2.43	2.89	3.30
8.0	0.32	0.32	0.32	0.32	0.32	0.45	0.70	0.91	1.10	1.43	1.72	1.99	2.24	2.70	3.52	4.24	4.91
10.0	0.35	0.37	0.38	0.39	0.40	0.57	0.91	1.20	1.46	1.92	2.34	2.72	3.09	3.75	4.95	6.03	7.02
12.0	0.36	0.41	0.45	0.47	0.49	0.71	1.15	1.54	1.88	2.51	3.07	3.60	4.09	5.01	6.67	8.17	9.57
14.0	0.38	0.45	0.51	0.55	0.58	0.85	1.40	1.87	2.31	3.09	3.81	4.48	5.11	6.30	8.45	10.40	12.23
16.0	0.39	0.49	0.56	0.62	0.67	0.98	1.64	2.21	2.73	3.68	4.56	5.37	6.15	7.60	10.26	12.69	14.96
20.0	0.41	0.56	0.67	0.76	0.84	1.24	2.10	2.86	3.57	4.85	6.04	7.16	8.23	10.24	13.94	17.35	20.57
25.0	0.45	0.64	0.80	0.93	1.04	1.56	2.67	3.67	4.59	6.30	7.88	9.38	10.81	13.53	18.57	23.24	27.66
30.0	0.48	0.72	0.91	1.08	1.24	1.86	3.22	4.44	5.58	7.70	9.67	11.55	13.35	16.77	23.14	29.07	34.71
40.0	0.53	0.85	1.13	1.37	1.59	2.41	4.24	5.89	7.44	10.35	13.07	15.67	18.17	22.95	31.89	40.29	48.29
50.0	0.58	0.97	1.31	1.62	1.91	2.91	5.16	7.20	9.13	12.75	16.16	19.42	22.57	28.60	39.95	50.63	60.84
60.0	0.63	1.07	1.47	1.84	2.19	3.36	5.97	8.37	10.63	14.89	18.92	22.78	26.51	33.67	47.18	59.93	72.15

¹ Prepared for construction and other highly disturbed soil conditions with little or no cover.

C is the cover-management factor. This factor takes into account the effects of plant growth, surface cover, and surface roughness. Surface cover is any material in contact with the soil surface that intercepts raindrops and slows runoff. Surface cover includes rock fragments, live vegetation, and plant residue. C factors range from 0.006 for dense grass or hay to 1.0 for bare soil conditions. The C factor for mulch is 0.20 when placed at one ton per acre and 0.06 when placed at two tons per acre.

P is the support practice factor. Support practices include such things as terracing, contouring, and strip cropping. The P factor for construction sites is generally considered to be 1.0. However, some researchers are attempting to assign P values for structural practices used on construction sites. For example, placing silt fence intermittently up a slope would result in a P value of less than 1.0. If one assumes that the P value on construction sites is 1.0, then the RUSLE becomes $A = RKLSC$.

Often it is more useful to express soil loss in cubic yards per acre instead of tons per acre. Table 8-2 provides the multiplication factors to convert tons per acre to cubic yards per acre for different soil types.

Additional information on the RUSLE can be obtained from the Natural Resources Conservation Service or on the Internet at: www.iwr.msu.edu/rusle. A computer program is available at the website that automatically calculates the potential soil loss after the appropriate factor values have been entered into the equation. The computer program utilizes “drop boxes” to allow you to select site specific values for each factor.

Table 8-2: Multiplication Factors to Convert Tons per Acre (air-dry weight) to Cubic Yards per Acre

<u>Soil Texture</u>	<u>Multiplication Factor</u>
Sand and Loamy Sands.....	0.67
Sandy Loam.....	0.70
Fine Sandy Loam.....	0.74
Loam	0.82
Silt Loam	0.87
Clay Loam.....	0.98
Silty Clay Loam.....	0.92
Silty Clay.....	1.06

PRACTICE PROBLEM A: CALCULATING POTENTIAL SOIL LOSS

Situation: Twelve-acre parcel in Cheboygan County where all vegetation has been removed to build a shopping center.

Site: Soil: Boyer Sandy Loam
Slope: 6 percent
Water Flow Length: 800 feet

Problem: Calculate the annual potential soil loss (in tons and in cubic yards) from the construction site using the Revised Universal Soil Loss Equation.

Solution: $A = R \times K \times LS \times C \times P$

R = Rainfall erodibility factor = _____

K = Soil erodibility factor = _____

LS = Length/Slope factor = _____

C = Cover management factor = _____

P = Support practice factor = _____

A = _____ tons/acre/year

A₁₂ = _____ tons/acre x 12 acres = _____ tons

Converting tons to cubic yards (use Table 8-2).

_____ tons x 0.7 = _____ cubic yards

PRACTICE PROBLEM B: CALCULATING POTENTIAL SOIL LOSS

Situation: The same twelve-acre parcel described in Practice Problem A that has been covered with mulch at a rate of one ton per acre.

Site: Soil: Boyer Sandy Loam
Slope: 6 percent
Water Flow Length: 800 feet

Problem: Calculate the annual potential soil loss (in tons and in cubic yards) from the mulched construction site using the Revised Universal Soil Loss Equation.

Solution: $A = R \times K \times LS \times C \times P$

R = Rainfall erodibility factor = _____

K = Soil erodibility factor = _____

LS = Length/Slope factor = _____

C = Cover management factor = _____

P = Support practice factor = _____

A = _____ tons/acre/year

A₁₂ = _____ tons/acre x 12 acres = _____ tons

Converting tons to cubic yards (use Table 8-2).

_____ tons x 0.7 = _____ cubic yards

ANSWER TO PRACTICE PROBLEM A:

Situation: Twelve-acre parcel in Cheboygan County where all vegetation has been removed to build a shopping center.

Site: Soil: Boyer Sandy Loam
Slope: 6 percent
Water Flow Length: 800 feet

Problem: Calculate the annual potential soil loss (in tons and in cubic yards) from the construction site using the Revised Universal Soil Loss Equation.

Solution: $A = R \times K \times LS \times C \times P$

$$R = \text{Rainfall erodibility factor} = \underline{75}$$

$$K = \text{Soil erodibility factor} = \underline{0.24}$$

$$LS = \text{Length/Slope factor} = \underline{2.89}$$

$$C = \text{Cover management factor} = \underline{1.0}$$

$$P = \text{Support practice factor} = \underline{1.0}$$

$$A = \underline{52} \text{ tons/acre/year}$$

$$A_{12} = \underline{52} \text{ tons/acre} \times 12 \text{ acres} = \underline{624} \text{ tons}$$

Converting tons to cubic yards (use Table 8-2).

$$\underline{624} \text{ tons} \times 0.7 = \underline{437} \text{ cubic yards.}^*$$

*Answer rounded to nearest whole number.

ANSWER TO PRACTICE PROBLEM B:

Situation: The same twelve-acre parcel described in Practice Problem A that has been covered with mulch at a rate of one ton per acre.

Site: Soil: Boyer Sandy Loam
Slope: 6 percent
Water Flow Length: 800 feet

Problem: Calculate the annual potential soil loss (in tons and in cubic yards) from the mulched construction site using the Revised Universal Soil Loss Equation.

Solution: $A = R \times K \times LS \times C \times P$

$$\begin{aligned} R &= \text{Rainfall erodibility factor} &= & \underline{75} \\ K &= \text{Soil erodibility factor} &= & \underline{0.24} \\ LS &= \text{Length/Slope factor} &= & \underline{2.89} \\ C &= \text{Cover management factor} &= & \underline{0.2} \\ P &= \text{Support practice factor} &= & \underline{1.0} \\ A &= \underline{10.4} \text{ tons/acre/year} \\ A_{12} &= \underline{10.4} \text{ tons/acre} \times 12 \text{ acres} &= & \underline{125} \text{ tons}^* \end{aligned}$$

Converting tons to cubic yards (use Table 8-2).

$$\underline{125} \text{ tons} \times 0.7 = \underline{88} \text{ cubic yards}$$

* Answer is rounded to nearest whole number.

SOIL ERODIBILITY "K_w" VALUES FOR MICHIGAN SOILS
 (Source: NRCS Michigan Technical Guide – Table 4, October 1996: adapted and revised 2002)

<u>SOIL</u>	<u>TEXTURE</u> ¹	<u>K_w</u> ²	<u>SOIL</u>	<u>TEXTURE</u> ¹	<u>K_w</u> ²
Abbaye	SL,FSL,ST-SL, ST-FSL	.24	Amadon	GR-FSL,GR-SL SL, FSL	.17 .20
	LS, LFS,ST-LS, ST-LFS	.17		Amasa	VFSL
Abscota	LS,LFS	.17	SIL,		.37
	L	.32	CB-SIL,CB-VFSL, CB-FS		.28
	SL,FSL	.24	FSL		.24
	S	.15	Angelica	SL,SIL,MK-SIL	.28
Adams	LFS, LS,FS, S,COS	.17		SL,MK-SL	.20
	MUCK	none		MUCK	none
Alabaster	C,SIC	.32	Arcadian	CBV-SIL, GRV-SIL	.28
Alcona	SL,FSL,VFSL LFS,LVFS	.24 .17		CBV-VFSL, CBV-FSL,GRX-SL	.17
	Alganssee	LS,LFS	.17	Arkona	S,FS
SL,FSL		.24	LS,LFS		.17
S,FS		.15	SL	.24	
Algonquin	L	.32	Arkport	FSL,SL,VFSL,SIL LFS,FS,LVFS	.28 .17
	SIL	.37		Arnheim	MK-SIL,SIL,LVFS
Allendale	LS,LFS	.17	Ashkum		SICL,SIC,SIL
	S,FS	.15		Assinins	S
	SL,FSL	.24	LS		.17
Allouez	GR-SL,GR-FSL, GR-COSL	.17	Aubarque	L,SIL	.32
	GR-SIL,GR-L	.24		SL	.24
	Alpena	SL	.20	Aubbeenaubbee	SL,FSL
GR-SL		.15	Au Gres		S
GR-LS, GRV-SL, GRV-LS,CB-LS		.15		LS	.17
CB-SL		.17	Aurelius	MUCK	none
GR-L		.17		Avoca	LS,LFS
Alstad	SIL,L	.37	S,FS		.15
	FSL,SL	.24	AuSable		MUCK
	MK-SIL	.20		Bach	VFSL,SIL
Altmar	FSL,SL,LFS	.17	FSL		.20
	Alvin	LS,LFS	.17		
VFSL,FSL,SL		.24			

¹ Texture abbreviations identified on last page.

² Erodibility factor K_w quantifies the susceptibility of soil detachment by water of the whole soil. Another factor (K_f) may be used to consider only the fine earth fraction (< 2.0 mm) of the soil.

Badaxe	SL,FSL LS,CB-SL	.24 .17	Borgstrom	S,FS	.15
Bamfield	FSL	.24	Borochemists	MPT,HM	none
Banat	SIL,L FSL,SL	.37 .24	Borosaprists	MUCK	none
Barry	MK-L,SIL SL,FSL SCL L	.28 .20 .24 .28	Borski	SL,FSL	.24
Battlefield	S,COS LS	.10 .15	Bowers	SL,FSL L,SIL	.24 .32
Battydoe	ST-FSL	.24	Bowstring	MUCK	none
Beavertail	MUCK	none	Boyer	LS,LFS,GR-SL, GR-FSL SL,FSL,GR-L L GR-LS	.17 .24 .32 .10
Beechwood	SIL,L	.37	Brady	SL,FSL LS,LFS L,SIL	.20 .17 .28
Belding	SL,FSL LS	.24 .17	Branch	LFS,LS FS,S	.17 .15
Belleville	LFS,LS FS,S SL	.17 .15 .24	Breckenridge	SL,FSL L	.20 .32
Benona	S LS	.15 .17	Brems	LS,LFS S,FS	.17 .15
Bergland	SICL,SIL C,SIC,MK-SIC, MK-SICL MUCK	.37 .28 none	Brevort	LS,LFS,MK-LS SL,FSL S,MK-S MUCK	.17 .20 .15 none
Berville	L SL	.20 .17	Brimley	FSL,VFSL,SIL,L	.32
Biscuit	VFSL VFS,LVFS	.37 .17	Bronson	SL LS	.24 .17
Bixby	L,SIL	.32	Brookston	SIL,L,MK-SIL,SICL,CL	.28
Blount	SICL,SIL,L	.43	Bruce	SIL,MK-L,L,MK-SIL, VFSL MK-FSL FSL	.28 .24 .28
Blue Lake	LS S	.17 .15	Burleigh	S,FS, MK-S,MK-FS LS,LFS,MK-LFS, MK-LS MUCK	.15 .17 none
Bohemian	SIL,L VFSL,FSL LFS,LVFS	.37 .24 .17			
Bonduel	L,SIL	.32			
Bono	SICL,SIC,MK-SIC	.28			
Boots	MUCK,HM,MPT	none			

Burt	MK-S,MK-FS	.15	Cheboygan	LS	.17		
	MK-LS	.17		S	.15		
	MK-SL	.24		Chelsea	LFS,LS	.17	
	GRV-S,GRV-LS	.10			FS,S	.15	
Cadmus	L	.32	Chesaning	SIL,VFSL,FSL	.37		
	SL	.24		Chestonia	SICL	.32	
	GR-SL	.17			L	.28	
Caffey	MK-S	.15	Chinwhisker	S	.10		
	MUCK	none		Chippeny	MUCK	none	
Capac	L,SIL	.32	Claybanks		SIL	.37	
	SL,FSL	.24			Cohoctah	FSL,SL,MK-VFSL, MK-L,MK-FSL	.24
	CB-SL	.17				LFS	.17
	GR-SL	.15		L		.28	
Carbondale	MUCK,MPT,PEAT	none	SIL,VFSL	.28			
	Carlisle	MUCK	none	SL,FSL	.20		
L				.32			
Cassopolis	SL,FSL	.24	Coloma	LS	.17		
	L	.32		S	.15		
Cathro	MUCK, MPT,BYV-MPT, BYV-MUCK	none	Colonville	FSL,SL	.20		
				L,SIL	.24		
				LS,LFS	.17		
				L,SIL	.24		
Champion	ST-FSL,STV-SIL	.15	Colwood	SIL,L,SICL	.28		
	CB-SIL	.28		FSL,VFSL	.20		
	SIL,VFSL	.28	Conover	SL	.20		
	SL,FSL	.24		L	.28		
	CB-VFSL	.24		SIL	.32		
	CB-SL,ST-SIL, ST-VFSL,STV-VFSL, STV-FSL	.17	Coral	FSL,SL	.24		
	Channahon	L,SIL		.32	Corliss	LCOS,LS,S,COS	.15
Channing		FSL,SL,VFSL	.24	Corunna		SL,FSL	.20
		ST-FSL,ST-VFSL, ST-SL	.17	L	.24		
Charity	FSL	.24	Cosad	FS,S,LFS,LS	.17		
	SICL	.37		FSL,SL	.28		
Charlevoix	SL,FSL,CB-L	.24	Coupee	L,SIL	.32		
	LS,CB-SL	.17		SL	.24		
	L	.32	Covert	LS	.17		
Chatham	FSL,SL	.24		S	.15		
	L	.32	Cozy	CB-FSL,CB-SL	.17		
Chesaning	SIL,VFSL,FSL	.37		SL,FSL	.24		
	Chestonia	SICL	.32	Crosier	L,SIL	.32	
L		.28	SL,FSL		.24		

Croswell	CB-LS	.10	East Lake	S,COS	.15
	CB-S	.05		LS	.17
	S	.10		GR-LS,GR-S	.10
	LS	.17			
Cunard	FSL,SL	.24	Eastport	S, FS	.15
	L	.32	Edmore	SL	.20
	GR-L,GR-FSL, GR-SL	.17	LS	.17	
Dawson	MUCK,PEAT,MPT	none	Edwards	MUCK	none
Deerheart	L	.32	Eel	CL,SIL,L,SICL	.37
	SICL,SIL	.37	Eleva	SL,FSL	.24
Deer Park	FS,S	.15	L,SIL	.32	
Deerton	S,ST-S	.15	LS,CN-SL,CN-FSL	.17	
	LS,ST-LS	.17	CB-SIL,CN-FSL	.28	
	GR-LS	.10	Elmdale	SL,FSL	.24
Deford	MUCK,MPT	none	L	.32	
	LFS,LS,MK-S ,	.17	Elston	SL,FSL	.20
	MK-LFS,MK-FS		L	.28	
DeI Rey	SIL,L,SICL	.43	Elvers	SIL	.37
Detour	SL,FSL	.24	Emmet	CB-SL,CB-FSL	.17
	CB-L,CB-SL,FL-L	.17	L	.32	
	L	.32	LS, GR-SL	.17	
Dighton	L,CL	.32	SL,FSL	.24	
	SL	.24	Engadine	FSL	.24
Dinky	MUCK	none	VFSL	.37	
			Ensign	FSL	.17
Dixboro	FSL,SL,LFS,LVFS	.20	L,SIL	.24	
	VFSL	.32	GR-FSL,GR-L,	.15	
Dora			CB-L,CB-SIL,		
	MUCK,MPT,HM	none	FL-L,FL-SIL		
Dorval			CB-FSL	.10	
	MPT,MUCK	none	Ensley	SL,FSL,MK-L,	.24
Dowagiac	L,SIL	.28	MK-SL,		
	SL	.20	MK-SIL, VFSL		
Dresden			STV-L,STV-SIL		
	SL	.20	ST-SL,ST-FSL	.2	
	SIL,L	.28	ST-VFSL	.28	
Dryburg			L,SIL	.32	
	SL,FSL	.24	Epoufette	LS,MK-LS,LFS	.17
Dryden			SL,COSL,MK-SL	.20	
	SL	.24	MK-S	.15	
Duel	L	.32	Epworth	FS	.15
	LS,STV-LS	.17	Ermatinger	MK-SIL,MK-VFSL,	.37
Duneland	S,STV-S	.15	SIL,VFSL		
	FS	.15	LVFS	.24	

Esau	FL-SL	.15	Froberg	SIL,SICL	.37
	GRV-SL,GRX-SL	.10		GR-SIL	.28
Escanaba	LFS,LS	.17	Fulton	SIL,L,SICL	.43
	FS	.15		FSL	.24
Essexville	LS,LFS	.17	Furlong	LS	.17
	FS,S	.15		S	.15
	SL	.20	Gaastra	SIL,VFSL	.37
Ewart	S,FS	.15		LVFS	.24
	LS	.17		ST-SIL	.28
	L,SIL	.28	Gagetown	SIL,VFSL	.32
Fabius	SL	.20		FSL	.20
	L	.24	Gay	MK-SL,MK-FSL,	.24
	SIL	.28		SL,FSL,ST-SL,ST-FSL	
Fairport	SIL	.37		MK-SL,MK-FSL,MK-LS	.17
	L	.32	ST-MUCK,MUCK	none	
	FSL	.24	Genesee	FSL,SL	.24
Feldhauser	FSL	.20		SIL,L	.37
	L,SIL	.24	Gilchrist	LS,LFS	.17
	Feldtman	LCOS,LS		.15	S
Fence		SIL,VFSL	.37	Gilford	FSL,MK-FSL,
	Fern	FS,S	.15		SL,MK-SL
LFS		.17	L	.28	
Fibre	MUCK	none	Gladwin	LS,GR-SL	.17
	S,FS	.15		SL	.24
Filion	ST-L,ST-SL	.17		S	.15
	Finch	S		.15	GR-LS
LS		.17	Glawe	MK-SIL,SIL,VFSL,	.28
CB-LS		.10		MK-VFSL	
CB-S		.05	FSL,LVFS	.20	
Fox	SIL,L	.37	Glendora	LS,LFS,MK-S,	.17
	CL,SCL	.32		MK-LS,MK-LFS	
	GR-L,GR-SIL	.28		L	.24
	GR-SL,GR-FSL	.17		MK-SIL	.28
	GR-SCL,SL,FSL	.24		SL,FSL	.20
	GR-CL,GR-SICL,			S	.15
Frankenmuth	VFSL	.37	MUCK	none	
	Freda	FSL,VFSL	.28	Glennie	LS
SIL,L		.37	Glynwood		SIL,L,SICL,CL
Freesoil	LFS	.17		SIC	.32
	LVFS	.24	Gogebic	VFSL	.37
Gogomain				SL,FSL	.24
			CB-FSL,CB-SL,	.17	
			CB-VFSL		
			VFSL,SIL	.37	
			LVFS	.24	

Goodman	SIL	.37	Hatmaker	FSL,SL L	.24 .32
Gowdy	FS LFS,LS	.15 .17	Heinz	FSL,SL	.20
Grace	VFSL,SIL FSL	.37 .24	Henrietta	MUCK	none
Granby	LS,LFS,MK-LFS, MK-LS	.17	Hessel	L,MK-L CB-L,GR-L, FL-L,MK-GR-L	.32 .24
	SL,L	.20	Hettinger	CL,SICL, MK-L,SIL,L	.32
	FSL	.20	Hillsdale	SL,FSL	.24
	S,FS,MK-FS, MK-S	.15		LS	.17
Grattan	S	.15		L	.32
	LS	.17	Histosols	MUCK,MPT, HM	none
Graveraet	L CB-SIL	.37 .20	Hixton	L SL,FSL	.32 .24
Graycalm	LCOS LS S	.15 .17 .10	Hodenpyl	FSL,SL L	.24 .32
Grayling	S	.15	Hoist	SL	.24
Greenwood	PEAT,MPT,MUCK	none	Houghton	MUCK,MPT, PEAT	none
Greylock	FSL,SL	.24	Hoytville	CL SICL,SIL	.24 .28
Grindstone	L,CB-L SL	.28 .20	Huntington	SIL,L,SICL	.28
Grousehaven	MUCK	none	Ingalls	S,FS LS,LFS	.15 .17
Guardlake	SL,FSL L VFSL	.20 .28 .32	Ingersoll	SIL,VFSL FSL	.37 .24
Guelph	SL L SIL	.24 .32 .37	Ionia	SL SIL,L	.24 .32
Gutport	MUCK	none	Iosco	LFS,LS S	.17 .15
Hagensville	FSL,VFSL L	.20 .28	Isabella	L SL,FSL LS	.32 .24 .17
Halfaday	S LS	.15 .17	Ishpeming	S,FS,BYV-S LS,LFS,BYV-LS	.15 .17
Hamre	MUCK	none			
Hartwick	S	.15			

Ithaca	L	.32	Keweenaw	BYV-LS,BYV-LFS,	.15	
	SIL	.37		BY-LS,BY-LFS		
	SL,FSL	.24		BYV-SL,BY-SL	.20	
Jacobsville	MK-FSL,MK-SL	.24	LS,LFS,	.17		
	MUCK,ST-MUCK,	none	GR-LS	.15		
	STV-MUCK					
Jebavy	MK-S,MK-FS,FS,S	.15	Kibbie	L,SIL	.28	
Jeddo	L	.28	LFS	.17		
	SIL	.37	FSL,SL,VFSL	.20		
Johnswood	CB-L,CB-SIL,	.10	Kidder	SIL,L	.37	
	CB-SL,FLV-L,			SL,FSL	.24	
	STV-L			CL,GR-CL	.32	
Kalamazoo	L	.32	Killmaster	SL	.24	
	SL	.24		Kilmanagh	L	.28
	SIL	.37			CB-L	.20
Kalkaska	S,ST-S	.15	SL		.24	
	LS	.17	Kingsville	LFS,LS,MK-LFS,	.17	
	STV-S	.10		S,FS,MK-S	.15	
Kallio	CB-SIL,CB-VFSL	.28		Kinross	S,FS,MK-S,MK-FS	.15
	CB-FSL	.17	LS,LFS,MK-LS		.17	
			MUCK		none	
Kanotin	MUCK	none	Kiva	SL,FSL,GR-L	.20	
				L	.28	
				LS	.17	
Karlin	LFS,LS	.15	GR-FSL,GR-SL	.15		
	FSL,SL	.24	GR-LS	.10		
	L	.32	Klacking	S	.10	
	ST-FSL	.17		LS	.15	
Kawbawgam	SL,FSL	.24		Kneff	SIL,VFSL	.37
	LS	.17			Kokomo	SICL,CL,SIL,L
Kawkawlin	L,SIL	.37	MK-SIL			
	SL,FSL	.24	Krakow	FL-FSL,FL-SL	.17	
Kellogg	LS	.17		FL-L,FSL,SL	.24	
	S	.15	Lacota	CL	.32	
Kendallville	SIL,L,CL	.37		SL	.24	
	SL	.24		SIL,L	.37	
Kent	SIL,L	.37	Lamson	VFSL,FSL,SIL,	.28	
	FSL,SL	.24		MK-VFSL,MK-FSL,		
Keowns	SIL,L	.28		MK-L		
	SL,FSL,VFSL	.24	LVFS,LFS	.20		
Kerston	MUCK	none	MUCK	none		
	SIL	.28				

Landes	FSL,VFSL,SL	.20	Mahtomedi	GR-LS,S,COS,FS	.10	
	L	.28		LS,LCOS,LFS	.15	
	LS,LVFS,LFS	.17				
Lapeer	SL,FSL	.24	Manary	FSL	.28	
	L,SIL	.32		SICL,CL	.32	
	LFS	.17		SIL	.37	
Latty	SICL,C,SIC	.28	Mancelona	LS,LFS,GR-SL	.17	
				S	.15	
	SL	.24				
Leafriver	MPT,HM,MUCK	none	Manistee	LS,LFS	.17	
Leelanau	S	.15		S,FS	.15	
	LS	.17		FSL	.24	
Lenawee	SIC,MK-SICL	.28	Manitowish	SL	.24	
	SICL,SIL	.28				
	C,L	.24	Markey	MUCK	none	
Lenawee, Poned		.43		Marlette	L,SIL,CL	.32
			SL,FSL		.24	
Leoni	GR-SL,GRV-SL	.17	Martinsville	L,SIL	.37	
	GR-LS	.10		FSL,SL	.24	
	GR-L	.24				
Liminga	FS	.15	Martisco	MUCK	none	
Lindquist	S	.10	Matherton	L	.28	
Linwood	MUCK MK-SIL	none		SL	.20	
			.24	Mattix	LS	.15
Locke	L,SL,FSL	.20	SL		.20	
					Maumee	LFS,LS,MK-LS,
Lode	L	.32	MK-S,MK-LFS,S			
	FSL	.24	FSL,SL,MK-FSL	.20		
	SIL	.37	SIL	.28		
Londo	L	.32	McBride	SL,FSL	.24	
	FSL	.24		LS,GR-SL	.17	
	SIL	.37	McGinn	LS	.17	
Longrie	FSL,SL	.20		Mecosta	S	.15
	L,SIL	.28			LS,GR-LS	.10
	ST-FSL,ST-SL	.17	Medisaprists	MUCK	none	
ST-L,ST-SIL	.24					
Loxley	MUCK,MPT,PEAT	none	Melita	S,FS	.15	
Lupton	MUCK,MPT,PEAT	none		LS,LFS	.17	
Mackinac	L	.32	Menominee	S,FS,GR-S	.15	
	CB-L	.24		LS,LFS,GR-LS	.17	
Macomb	L	.28		GR-S,GR-LS,	.10	
	SL,FSL	.20	GR-LFS			
			Merwin	MPT,HM,MUCK, PEAT,FB	none	

Metamora	SL,FSL	.20	Monico	L,SIL	.37
	LS	.17		SL,FSL	.24
Metea	LS,LFS	.17	GR-L,GR-SL,	.28	
	S,FS	.15	CB-SL		
	CB-LS	.10	Monitor	L,SIL	.32
Miami	SIL,L,CL,SICL	.37	SL	.20	
	FSL,SL	.24	Montcalm	LS	.15
Michigamme			GR-LS	.10	
	SIL,L,VFSL	.37	SL	.20	
	SL,FSL	.24	Moquah	FSL,SL,VFSL	.24
	CB-FSL,CB-SL	.17	L,SIL	.32	
	CB-L,CB-SIL,	.28	Morley	SIL,L,SICL	.37
CB-VFSL,		CL	.32		
	BY-VFSL,				
	BYV-VFSL				
Mikado	SL	.28	Morocco	LFS,LS	.17
Millecoquins	FSL	.20	FS,S	.15	
	VFSL	.28	Munising	SL,FSL	.20
	FSL	.24	LS,LFS	.15	
Millersburg	LS	.17	Munuscong	FSL,SL	.20
	S	.15	Mussey	MK-SL,SL	.20
Millsdale	SICL	.28	L	.24	
	SIL,L	.32	Nadeau	LS	.15
	CL	.24	FSL,SL	.20	
Milton			VFSL	.28	
	SIL,L,SICL	.37	Nahma	MUCK	.none
	CL	.32	MK-SL,MK-FSL	.24	
Minoa	VFSL,SIL,LVFS	.32	MK-L	.32	
	L,FSL	.28	Napoleon	MUCK,MPT,	none
Minocqua			PEAT		
	SIL,MK-SIL,L	.37	Nappanee	CL,L,SIL	.37
	SL,MK-FSL,FSL	.24	SICL	.43	
	MUCK	.10	Negwegon	SICL,SIL	.37
Minong	PEAT	none	Nester	L,SIL	.32
			LS	.17	
Misery	VFSL,SIL	.37	SL,FSL	.24	
	FSL	.28	Net	ST-SIL	.37
Misteguay			ST-VFSL,ST-FSL,	.28	
	SIC,SICL	.32	STV-SIL		
Mitiwanga			STV-FSL,STV-VFSL	.17	
	SIL,L	.37	BYX-VFSL	.15	
	CN-L	.24			
Moltke					
	FSL,VFSL	.24			
	SIL,L	.37			

Newaygo	L	.32	Ormas	LS,LFS	.17
	SL	.24		S	.15
Newton	FSL,LFS,LS,S	.17	Oshtemo	SL,FSL	.24
	MK-FS	.20		LS,LFS	.17
Nipissing	CBX-SL,CBX-L, CBV-SIL	.05	Otisco	S	.15
Nordhouse	FS	.15		LS	.17
				SL	.24
Nottawa	L	.28	Ottokee	FS,S	.15
	SL	.20	Owosso	SL,FSL	.24
Nunica	SIL,L,VFSL	.37	Paavola	GR-LS,GRV-LS	.10
Oakville	FS,S	.15		ST-LS	
	LS	.17		GR-COSL,GR-SL	.17
	LFS	.17			
Ockley	CL,SIL,L	.37	Padus	SL,FSL	.24
	SL	.24		SIL,L	.32
Oconto	FSL,SL	.24	Padwet	L	.32
	L	.32		SL,FSL	.24
Ocqueoc	LS,LFS	.17	Palms	MUCK,MPT	none
	S,FS	.15		Paquin	FS,S
Ogemaw	LS	.17	Parkhill	L,CL,MK-L	.24
	S	.15		GR-L	.17
	SL	.24		GR-SL	.10
			Paulding	C,SIC,SICL	.28
Okee	LFS,LS	.17	Peavy	SIL,VFSL	.37
	FSL	.24		ST-SIL	.28
Oldman	CBV-SL,CBV-FSL	.10	Pelissier	GR-LS,CBV-SL	.17
	ST-SL,ST-FSL	.15		GR-S,GR-COS,	.10
Olentangy	MK-SIL,SIL,MUCK,CE	none		GR-COSL	
				GR-SL	.15
Omega	LS,LFS	.17	Pelkie	LVFS,LFS	.17
	S,FS	.15		VFSL,FSL	.24
Omena	SL,FSL	.24		FS	.15
Onaway	FSL,SL	.24	Pella	CL,SICL,SIL	.28
	L	.32		Pemene	LS,LFS,ST-FSL
Onota	LS	.17	FSL,SL	.24	
	SL	.24	Pence	LS	.17
	CN-S,CN-LS,	.10		SL,FSL	.24
GRV-S		L		.32	
Ontonagon	SIC,C	.28	Pequaming	LS	.17
	SICL,SIL,L	.43		ST-LS	.10

Perecheneey	LS,LFS	.17	Poseyville	S,FS	.15
	S	.15		LS,LFS	.17
Perrin	GR-LS	.10	Potagannissing	GR-SIL,CB-FSL	.24
	LS	.15		SIL	.32
	SL	.20	Poy	SICL,SIC,C,	.28
Perrinton	CL,SICL	.32		SIL,L	.24
	L,SIL	.37		CL,SICL	.24
	FSL,SL	.24	Psammaquents	COS	.15
Pert	SICL,L,SIL,CL	.37		FS,S	.15
Peshekee	VFSL,FSL,SL	.24		LS,VFS	.10
	SIL	.37	Psammets	S,COS,LS	.15
	CB-SIL,CB-VFSL,	.28		COS,GR-S,FS,S,	.02
	CB-SL,FLV-VFSL			LCOS	
Petticoat	CB-SIL,ST-SIL	.28		LFS,LS,VFS	.10
	STV-SIL		Pullup	FS,S	.15
	CB-L,ST-L,STV-L	.24	Quartzipsammets	S	.15
	VFSL	.37	Randolph	SIL,L	.37
Pewamo	CL,MK-CL,L	.24	Rapson	S	.15
	SICL,MK-SICL,	.28		LS,LFS	.17
	SIC,C,SIL		Remus	SL,FSL	.24
Pickford	SIL,L,MK-SIL	.43		LS	.17
	SICL,MK-SICL		Rensselaer	SICL,CL,SIL,L	.28
	SIC,C,MK-SICL,	.32		SL,FSL	.20
	SICL		Richter	L	.32
Pickford, Flooded	SICL	.37		SL,FSL,VFSL	.24
Pinconning	S,FS,MK-S	.15		LFS,LS	.17
	LS,LFS,MK-LS,	.17		VFSL	.37
	MK-LFS		Riddles	L,SIL	.32
	L	.24		SL,FSL	.24
	SL-FSL	.20	Rifle	MUCK,PEAT,MPT	none
	MUCK	none	Riggsville	LS,LFS	.17
Pinnebog	MUCK	none		S	.15
Pipestone	S,FS,COS	.15	Rimer	LFS,LS	.17
	LS,LFS,LCOS	.17		FS	.15
Plainfield	LS,LFS	.17	Riverdale	LS	.17
	S,FS	.15		SL	.24
Pleine	STV-MUCK,	none		S	.15
	CBV-MUCK		Rockbottom	ST-SIL,ST-L	.28
Posen	ST-FSL,CB-FSL,	.15	Rockcut	STX-LS,STX-SL,	.10
	CBV-LS			STV-SL	
	CBV-SIL	.28			
	CBV-FSL,CBV-SL,	.20			
	CBV-L,CB-L				

Rondeau	MUCK	none	Search	VFSL	.24
Roscommon	LS,MK-LS,LFS	.17	Sebewa	L,MK-L,SIL,L,	.24
	S,MK-S,FS	.15		SCL,CL	
	MUCK	none		SL,FSL	.20
Roselms	CL	.37	Selfridge	SIL,SICL	.28
	SICL,SIL,L	.43		S,FS	.15
Roundhead	MUCK	none	LS,LFS	.17	
Rousseau	FS	.15	Selkirk	SIL,L,SICL	.37
	LFS	.17		FSL	.24
Rubicon	BY-S	.10	Seward	LFS,LS,FS	.17
	LS	.17	Shebeon	SL	.20
	S	.15	CB-L,CB-SL,L	.28	
Rudyard	SIC,SICL,SIL,L	.37	Shelldrake	S	.15
Ruse	L,MK-L	.32	Shelter	STV-L,CBV-L,	.24
	SIL	.37		CBV-SIL	
	GR-L,MK-FSL,	.24	Shiawassee	GR-SL	.10
	MK-SL			SL	.20
MUCK	none	Shoals	SICL,CL,SIL,L	.37	
Saganing	SL,FSL,MK-SL				
Sagola	ST-LFS	.15	Shoepac	SL,FSL	.24
	ST-FSL,BY-FSL	.20	Sickles	SL	.24
Sanilac	VFSL,FSL,SIL	.37	LS,LFS,MK-LS,MK-FS	.17	
Saranac	CL	.24	Sims	SL	.20
	C,SIC,SICL,SIL	.28		L,CL	.24
	L	.24		LS	.17
		SICL		.28	
Sarona	SL,FSL,LS	.24	Sisson	FSL,SL,VFSL	.24
Sarwet	SL,FSL	.24		LFS	.17
		L,SIL		.32	
Satago	VFSL,SIL,L	.37	Skanee	SL,FSL,ST-SL,ST-FSL	.24
Saugatuck	S,FS	.15		ST-LS,LS	.17
	LS,LFS	.17	Sleeth	SL,L,SIL	.32
Saylesville	SIL,L,SICL	.37	Sloan	SIL,L,SICL	.28
Sayner	LS	.17	CL	.24	
	S	.15	Solona	L	.32
Scalley	LFS	.17	SL,FSL	.24	
	SL,FSL	.24	VFSL	.32	
	L	.32	Soo	SICL,SIL	.43
Schoolcraft	L	.28	Soperton	SIL	.37
	SIL	.32			
	SL	.20			

Sparta	LFS,LS	.17	Sundog	CB-SIL,CB-VFSL,	.28
	S,FS	.15		CB-FS	
Spinks	LS,LFS	.15		ST-SIL,ST-VFSL,	.20
	S,FS	.10		ST-FS	
	CB-LS	.05		SIL,VFSL,BYV-SIL,	.37
Spot	MUCK	none		BYV-VFSL	
Springlake	S	.10		FSL,BYV-FSL	.24
	LS,LCOS	.15	Superior	FSL,SL	.28
Springport	MK-SIL,SIL	.37		LFS,LS	.17
	SIC,SICL,CL	.32		L	.37
	MUCK	none		FSL	.24
Sprinkler	SL	.28	Tacoda	S	.15
St.Clair	L,SIL,CL	.37	Tacoosh	MUCK,MPT	none
	SICL	.43	Tappan	L	.28
St. Ignace	ST-SL	.17		SL	.20
	SIL	.28		MK-L	.32
Stambaugh	VFSL,SIL,VFSL	.32	Tawas	MPT,PEAT,MUCK	none
	ST-SIL	.28	Teasdale	FSL,SL	.24
Steamburg	SL	.24		L	.32
	LS	.17	Tedrow	FS	.15
Steuben	FSL,SL	.24		LFS,LS	.17
	LS	.17	Tekenink	LFS,LS	.17
Strawn	SIL,L,SICL	.37		FSL,SL	.24
	CL	.32	Thetford	LS,LFS	.17
Sturgeon	FSL	.28		S,FS	.15
	VFSL,SIL	.37	Thomas	MK-SIL,MK-L	.24
Sugar	LVFS	.24		MK-SL	.20
	VFSL	.32		MUCK	none
Sumava	SL,FSL	.15	Tobico	S,FS,MK-S,MK-FS	.15
Summerville	FSL,SL,VFSL	.24		LS,MK-LS,LFS,	.17
	CBA-L,CN-L,FL-L			MK,	
	L,SIL	.32		MUCK,SL,MK-SL	.24
	CBA-FSL,CBA-SL,	.17	Toledo	SICL,CL,SIC,C,SIL	.28
	CN-FS,FL-FSL		Tonkey	SL,MK-SL,FSL	.24
Sundell	SL,FSL,ST-SL,	.24		L,MK-L,SIL	.32
	ST-FSL			LFS,LS,MK-LS	.17
	L,ST-L	.32	Toogood	S	.15
	LFS	.17		LS	.17
			Trenary	FSL,SL,VFSL	.24
				STV-FSL,ST-FSL,	.17
				ST-VFSL	

Trimountain	CB-FSL,CB-VFSL, GR-SL,GR-LFS	.17	Waiska	LS,GR-LS, ST-LS,CB-LS	.17
	CB-LFS	.10		S,GR-S,ST-S,	.15
	GR-FSL,GR-SL, GR-LFS	.15		CB-S	
Tula	CB-VFSL,CB-FSL	.28		SL,GR-SL,CB-SL	.24
Tuscola	FSL,SL,VFSL	.24	Wakefield	FSL,SIL,L	.37
	SIL,L	.32		SIL	.43
	LFS	.17	Wakeley	MPT,MUCK	none
Tustin	LFS,LS	.17		MK-S	.10
	FS,S	.15	Wallace	FS,S,ST-FS,ST-S	.15
Twining	SL	.24	Wallkill	GR-SIL,GR-L, GR-FSL	.24
	L	.32	Warners	SIL,L,SICL MK-SIL	.43
Tyre	LS	.17	Wasepi	SL,FSL	.20
	S	.15		LS,LFS	.17
Ubly	SL	.24	Washtenaw	SIL,L	.37
	LS	.17	Wateska	FS,S,LFS,LS	.17
	VFSL	.37	Watton	SIL,L	.37
Udipsamments	COS	.12	Waucedah	MK-SL,MK-FSL	.20
	COS,GR-S,FS, LCOS	.02		MK-L	.24
	LFS,VFS	.10		MUCK	none
	LS	.15	Wauseon	L,SIL	.28
	S	.15		FSL,SL	.20
Udorthents	GR-SL,L,SL, FSL,VFSL	.24		LFS,LS	.17
	SCL,SICL,CL,C, SIC	.32	Wega	SIL,VFSL,SI	.37
Vanriper	CB-VFSL, CBV-VFSL, BYV-SIL	.28	Westbury	GS-FSL,GR-SIL, GR-SL,STX-L, STX-SIL,STX-FS, STV-L,STV-SIL, STV-FS	.24
Velvet	STV-LS,GRV-LS, GR-LFS,GRV-S CB-LFS,CBV-S	.10		SL,FSL,L,SILST-L, ST-SIL	.32
Vestaburg	LS,MK-LS	.17	Whalan	SIL,L	.32
	S,MK-S	.15		SL	.24
	SL	.24	Wheatley	MK-LS,LS,LFS,MK-S	.17
Vilas	LS	.17		MK-SL,SL	.24
	S	.15		S	.15
Wabeno	SIL,ST-SIL	.37		MUCK	none
	ST-FSL,FSL	.24	Whitaker	L,SIL	.37
Wabun	S,MK-S	.15		FSL,SL	.24
Wainola	FS	.15			
	LFS	.17			

Whittemore	S	.15
Willette	MUCK	none
Williamstown	SIL,L	.37
Winneshiek	FSL	.20
	L,SIL	.24
Winterfield	FSL,SL	.24
	LS,LFS	.17
	S,FS	.15
Wisner	CL,L	.28
	SL	.20
Witbeck	MUCK	none
	STV-MUCK	
	ST-MUCK	
	BYV-MUCK	
	BYX-MUCK	
Wixom	LS,LFS	.17
	S,FS	.15
Wolcott	CL,L,SICL	.28
Woodbeck	SIL	.37
	L	.32
	SL	.24
Yalmer	LS,S,FS,STV-S	.15
	LS,STV-LS	.17
Ypsi	SL	.20
	LS	.17
Zeba	LS,LFS	.17
	SL,FSL	.24
Zela	MUCK	none
Ziegenfuss	L	.28
	SICL,CL,SIL	.32
Zilwaukee	SIC,SIL,SICL	.28

SOIL TEXTURE ABBREVIATIONS

- | | |
|---|--|
| <p>C Clay
 SC..... Sandy Clay
 SIC..... Silty Clay</p> <p>L Loam
 COSL..... Coarse Sandy Loam
 SL Sandy Loam
 FSL..... Fine Sandy Loam
 VFSL..... Very Fine Sandy Loam
 SIL..... Silt Loam
 SCL..... Sandy Clay Loam
 CL..... Clay Loam
 SICL Silty Clay Loam</p> | <p>S Sand
 COS Coarse Sand
 FS Fine Sand
 VFS..... Very Fine Sand
 LCOS..... Loamy Coarse Sand
 LS Loamy Sand
 LFS Loamy Fine Sand
 LVFS Loamy Very Fine Sand</p> <p>SI Silt</p> |
|---|--|

TEXTURE MODIFIERS

- BY** **Bouldery** (rock fragments: greater than two feet)
 BYV Very Bouldery
 BYX Extremely Bouldery
- CN** **Channery** (flat fragments of limestone, sandstone, shale, and slate; up to 6 inches in length)
 CNV Very Channery
 CNX Extremely Channery
- CB** **Cobbly** (rock fragments: 3–10 inches)
 CBA Angular Cobbly
 CBV..... Very Cobbly
 CBX..... Extremely Cobbly
- FL** **Flaggy** (soil contains flagstone)
- GR** **Gravelly** (rock fragments: up to 3 inches)
 GRV Very Gravelly
 GRX Extremely Gravelly
- MK**..... **Mucky**
- ST** **Stony** (rock fragments: 10 inches to 2 feet)
 STV Very Stony
 STX Extremely Stony

PARTICLE SIZE (in millimeters)

- | | |
|--|---|
| Very Coarse Sand 2.0 to 1.0
Coarse Sand 1.0 to 0.5
Medium Sand..... 0.5 to 0.25
Fine Sand..... 0.25 to 0.10 | Very Fine Sand 0.10 to 0.05
Silt 0.05 to 0.002
Clay less than 0.002 |
|--|---|