

Appendix

Table of Contents

Soils in Alabama	1
Introduction	1
Using a Soil Survey	1
Soil Physical, Chemical, and Engineering Properties	3
Depth to Bedrock	3
Hydrologic Soil Group (HSG)	3
Saturated Hydraulic Conductivity (Ksat).....	4
Liquid Limit (LL).....	4
Plasticity Index (PI)	4
Slope.....	4
Soil Erodibility Factor(K-factor).....	4
Soil Reaction (pH)	5
Soil Texture	6
AASHTO classification	8
Unified Soil classification	9
References.....	10
Instructions for Use of Web Soil Survey for Generating Engineering, Physical & Chemical Properties of Soil	11
AASHTO M 288	22
Glossary	23
References	40
CAD Drawings	44
Local Information	46

This Page Intentionally Left Blank

Soils in Alabama

Introduction

A basic understanding of soils is essential when making erosion and sediments control management decisions. Erosion and sediment control practices along with stormwater management can be executed effectively when soil physical and chemical properties are considered throughout the planning and management phases. Information about soils within a geographic region can be obtained from the Web Soil Survey <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>. Soil survey information for all 67 counties within Alabama is available on the Web Soil Survey. It is highly recommended for detailed planning purposes that surveys are verified by an on-site investigation preferably performed by a professional soil scientist.

The word “Soil,” like many common words, has several meanings. The definition of Soil within this text is “a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment” (Soil Survey Staff, 1999).

Using a Soil Survey

“A soil survey describes the characteristics of the soils in a given area, classifies the soils according to a standard system of taxonomy, plots the boundaries of the soils on a map, stores soil property information in an organized database, and makes predictions about the suitability and limitations of each soil for multiple uses as well as their likely response to management systems”. “The information collected in a soil survey helps in the development of land use plans and can be used to evaluate and predict the effect of land use on the environment” (Soil Survey Manual – Agriculture Handbook No 18).

“A soil map consists of many individual delineations showing the location and extent of different soils. A soil map from a soil survey delineates areas occupied by different kinds of soil, each of which has a unique set of interrelated properties and characteristics of the material from which it formed, its environment and its pedogenic process. The soils mapped by the National Cooperative Soil Survey staff are identified by names that serve as references to a national system of soil classification (Keys to Soil Taxonomy)”. Soils identified on a map in a soil survey are defined as Soil Series and NOT Soil Type.

Pedon is a three-dimensional, individual unit of soil with sufficient size to describe the internal arrangement of horizons.

Soil map unit is a collection of same-named soil series plus soil and site characteristics important for land management (examples – surface texture, slope, degree of erosion, flooding and/or ponding frequencies etc.).

Soil series consist of pedons that are grouped together due to their similar morphology, soil chemistry, and physical properties. Specifically, each series consists of pedons having soil horizons that are similar in soil color, soil texture, soil structure, soil pH, mineral and chemical composition, along with other characteristics within the soil profile.

Soil surveys increase general knowledge about soils and serve for practical planning purposes. They provide soil information about specific geographic areas needed for regional or local land use planning. These plans include resource conservation for farms and ranches, development of reclamation projects, forest management, engineering projects, as well as other purposes.

The National Cooperative Soil Survey program, interpretive information is available in a public database and displayed within the Web Soil Survey (<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>).

Soil interpretations and/or ratings provide numerical and descriptive information pertaining to a wide range of soil interpretive predictions. Generally, soil interpretations and/or ratings are made for specified uses and are reported in the form of limitations, suitabilities, or potentials.

Limitation ratings are usually based on hazards, risks, or obstructions presented by properties or characteristics of undisturbed soil. Limitation ratings use terms such as slight, moderate, or severe (most commonly limitation ratings).

Suitability ratings are based on the characteristic of the soil that influence the ease of using or adapting a soil for a specific use. Suitability ratings classes use terms such as good, fair, or poor (most commonly suitability ratings).

Potential ratings are based on the local characteristics and/or conditions; potential rating predicts the ability for a particular soil to achieve maximum functionality based on local conditions. Potential ratings classes use terms such as high, medium, or low (most commonly potential ratings).

In addition, soil interpretations, either as suitability or limitations, may be incorporated into potential ratings along with other resource data and interpretive information. The following are some important interpretations generally used for erosion & sediment control & stormwater management planning purposes: depth to bedrock, hydrologic group, liquid limit, permeability, plasticity index, slope, soil erodibility factor (K Factor), pH, soil texture, etc.

Soil Physical, Chemical, and Engineering Properties

Below are definitions of various soil physical, chemical, and engineering properties commonly provided for Soils throughout the State of Alabama.

Depth to Bedrock

The depth to unweathered, continuous bedrock. The bedrock is commonly indurated but may also be strongly cemented, and excavation difficulty is very high or higher.

Hydrologic Soil Group (HSG)

Hydrologic soil groups are based on estimates of run-off potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low run-off potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained, or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high run-off potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classed.

Saturated Hydraulic Conductivity (Ksat) *Permeability is an out-of-date term used in prior literature therefore, saturated hydraulic conductivity is utilized for this content.* —

The amount of water that would move downward through a unit area of saturated in-place soil in unit time under hydraulic gradient. It is used to convey the rate of water movement downward through the soil under saturated conditions (and unit hydraulic gradient).

Liquid Limit (LL)

The water content of soil at the change between liquid and plastic states. It is measured on thoroughly puddled soil material that has passed a number 40 sieve (0.43 mm) and is expressed on a dry weight basis. Values are typically placed in interpretive classes.

Plasticity Index (PI)

The range in water content over which soil material is plastic. The value is the difference between the liquid limit and plastic limit of thoroughly puddled soil material that has passed a number 40 sieve (0.43 mm). The plastic limit is the water content at the boundary between the plastic and semisolid states. Values are typically placed in interpretive classes.

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance (rise/run*100).

Soil Erodibility Factor (K-factor)

A relative index of susceptibility of bare, disturbed soil to particle detachment and transport by rainfall. This interpretive factor is used in the Revised Universal Soil Loss Equation (Renard et al., 1997). Measurements are made on plots of standard dimensions. Erosion is adjusted to a standard of 9 percent slope. K factors are currently measured by applying simulated rainfall on freshly tilled plots. Earlier measurements integrated the erosion for the year for cultivated plots under natural rainfall. The K factor may be computed from the composition of the soil, saturated hydraulic conductivity, and soil structure.

Soil Reaction (pH) – (see figure 1-1 – pH Chart)

A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

- *Ultra acid:* Less than 3.5
- *Extremely acid:* 3.5 to 4.4
- *Very strongly acid:* 4.5 to 5.0
- *Strongly acid:* 5.1 to 5.5
- *Moderately acid:* 5.6 to 6.0
- *Slightly acid:* 6.1 to 6.5
- *Neutral:* 6.6 to 7.3
- *Slightly alkaline:* 7.4 to 7.8
- *Moderately alkaline:* 7.9 to 8.4
- *Strongly alkaline:* 8.5 to 9.0
- *Very strongly alkaline:* 9.1 and higher

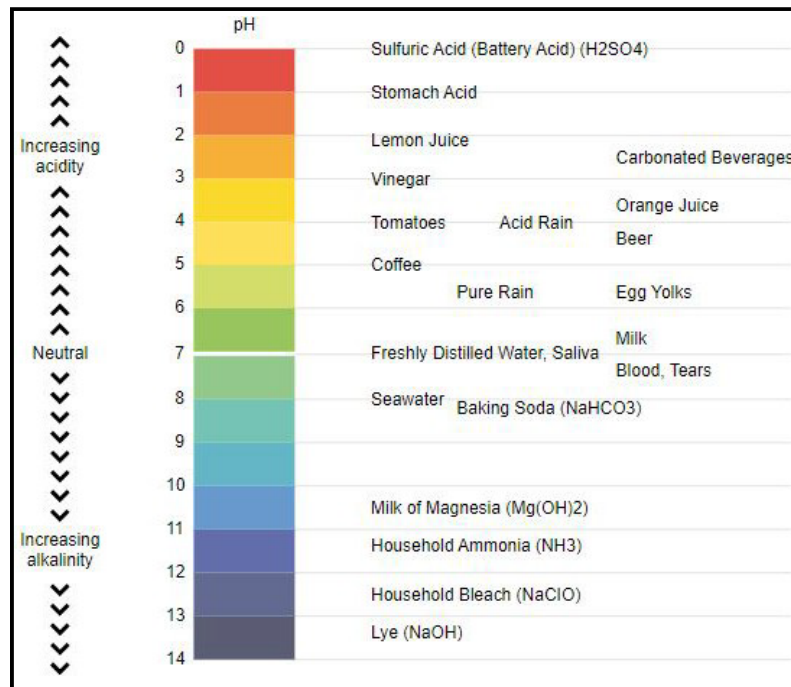


Figure 1-1. pH Chart

Appendix

USDA Soil Texture — (see figures 1-2-Texture Class; 1-3-Texture Triangle; 1-4-Texture Modifiers)

The numerical proportion (weight percentage) of the sand, silt, and clay separates in the fine-earth fraction ($\leq 2\text{mm}$). Soil texture is field estimated by hand or lab measured by hydrometer or pipette and placed within the textural triangle to obtain texture class.

Texture Class or Subclass	Code	
	Conv.	NASIS
Coarse Sand	cos	COS
Sand	s	S
Fine Sand	fs	FS
Very Fine Sand	vfs	VFS
Loamy Coarse Sand	lcos	LCOS
Loamy Sand	ls	LS
Loamy Fine Sand	lfs	LFS
Loamy Very Fine Sand	lvfs	LVFS
Coarse Sandy Loam	cosl	COSL
Sandy Loam	sl	SL
Fine Sandy Loam	fsl	FSL
Very Fine Sandy Loam	vfsl	VFSL
Loam	l	L
Silt Loam	sil	SIL
Silt	si	SI
Sandy Clay Loam	scl	SCL
Clay Loam	cl	CL
Silty Clay Loam	sicl	SICL
Sandy Clay	sc	SC
Silty Clay	sic	SIC
Clay	c	C

Figure 1-2. USDA Texture Class Chart

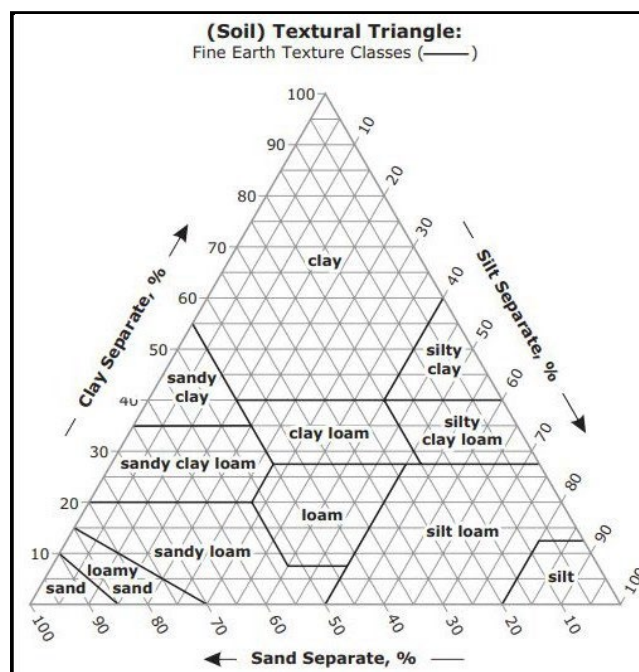


Figure 1-3. USDA Texture Triangle

Rock Fragments: Quantity and Size ¹	Code		Criteria: total (rock) fragment volume % dominated by (name size) ¹
	Conv.	NASIS	
ROCK FRAGMENTS (> 2 mm; ≥ Strongly Cemented)			
Gravelly	GR	GR	≥15% but <35% gravel
Fine Gravelly	FGR	GRF	≥15% but <35% fine gravel
Medium Gravelly	MGR	GRM	≥15% but <35% med. gravel
Coarse Gravelly	CGR	GRC	≥15% but <35% coarse gravel
Very Gravelly	VGR	GRV	≥35% but <60% gravel
Extremely Gravelly	XGR	GRX	≥60% but <90% gravel
Cobbly	CB	CB	≥15% but <35% cobbles
Very Cobbly	VCB	CBV	≥35% but <60% cobbles
Extremely Cobbly	XCB	CBX	≥60% but <90% cobbles
Stony	ST	ST	≥15% but <35% stones
Very Stony	VST	STV	≥35% but <60% stones
Extremely Stony	XST	STX	≥60% but <90% stones
Bouldery	BY	BY	≥15% but <35% boulders
Very Bouldery	VBY	BYV	≥35% but <60% boulders
Extremely Bouldery	XBY	BYX	≥60% but <90% boulders
Channery	CN	CN	≥15% but <35% channers
Very Channery	VCN	CNV	≥35% but <60% channers
Extremely Channery	XCN	CNX	≥60% but <90% channers
Flaggy	FL	FL	≥15% but <35% flagstones
Very Flaggy	VFL	FLV	≥35% but <60% flagstones
Extremely Flaggy	XFL	FLX	≥60% but <90% flagstones

Figure 1-4. USDA Texture Modifiers

Appendix

AASHTO classification – (see figure 1-5 – AASHTO Chart)

An interpretive classification system of soil material for highway and airfield construction (Procedure M 145-91; AASHTO, 1997). It is based on particle-size distribution of the < 75 mm fraction and on the liquid limit and plasticity index. The system separates soil materials having 35 percent or less particles passing the no. 200 sieve (< 0.074 mm in diameter) from those soil materials having more than 35 percent. Each of these two divisions is subdivided into classification groups based on the liquid limit and plasticity index in addition to percent of particles < 0.074 mm. The group is a numerical quantity based on a set of formulas.

General classification	Granular materials (35% or less passing US No. 200 sieve)			Silt-clay materials (More than 35% passing US No. 200 sieve)							
	A-1		A-3	A-2				A-4	A-5	A-6	A-7
Group classification	A-1a	A-1b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve analysis											
Percent passing											
US No. 10 (2 mm)	50 max										
US No. 40 (420 μ)	30 max	50 max	51 max								
US No. 200 (75 μ)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing US No. 40 (420 μ)											
Liquid limit											
Plasticity index											
	6 max		Non-plastic	40 max 10 max	41 min 10 max	40 max 11 min	41 min 11 min	40 max 10 max	41 min 10 max	40 max 11 min	41 min 11 min
Group index	0		0	0		4 max		8 max	12 max	16 max	20 max
Usual types of significant constituent materials	Stone fragments gravel and sand		Fine Sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General rating as subgrade	Excellent to good							Fair to poor			

Figure 1-5. AASHTO Chart

Unified Soil classification – (see figure 1-6 – Unified Soil Classification Chart)

An interpretive classification system of soil material designed for general construction purposes. It is dependent on particular-size distribution of the < 75 mm, liquid limit, and plasticity index and on whether the soil material has a high content of organic matter. There are three major divisions: mineral soil material having less than 50 percent particle size < 0.074 mm (passing 200 mesh), mineral soil material having 50 percent or more particle size < 0.074 mm, and certain highly organic soil materials. The major divisions are subdivided into groups based on liquid limit, plasticity index, and coarseness of the material more than 0.074 mm in diameter (retained on 200 mesh).

Major Divisions			Group Symbol	Typical Names
Course-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	Gravels 50% or more of coarse fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of coarse fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	Silts and Clays Liquid Limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
		CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays	
		OL	Organic silts and organic silty clays of low plasticity	
	Silts and Clays Liquid Limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
		CH	Inorganic clays or high plasticity, fat clays	
		OH	Organic clays of medium to high plasticity	
		Highly Organic Soils		PT
Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%				

Figure 1-6. Unified Soil Classification System

References

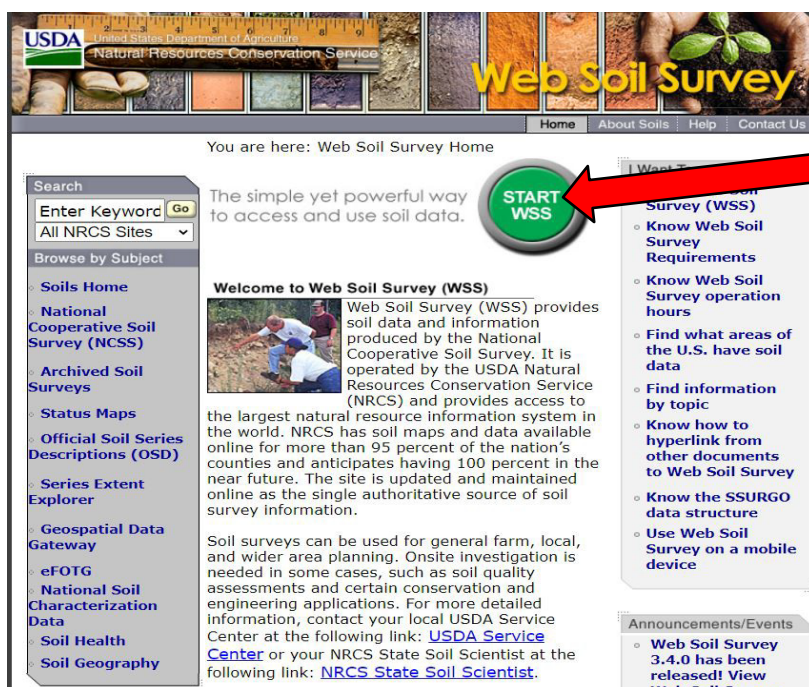
- Soil Survey Staff. 2024. Field book for describing and sampling soils, Version 4.0 Natural Resources Conservation Service. U.S. Government Printing Office. Available online at <https://www.nrcs.usda.gov/resources/guides-and-instructions/field-book-for-describing-and-sampling-soils>
- Soil Science Division Staff. 2017. Soil Survey Manual. C. Ditzler, K. Scheffe, and H.C. Monger (eds.). USDA Handbook 18. Government Printing Office, Washington, D.C. Available online at <https://www.nrcs.usda.gov/resources/guides-and-instructions/soil-survey-manual>
- Soil Survey Staff. 2022. Keys to Soil Taxonomy, 13th ed. USDA-Natural Resources Conservation Service, Washington, D.C. Available online at <https://www.nrcs.usda.gov/resources/guides-and-instructions/keys-to-soil-taxonomy>
- Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at <https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx> Accessed 03/31/2026.
- U.S. Department of Agriculture, Natural Resources Conservation Service. National Soil Survey Handbook, Title 430-VI. <https://www.nrcs.usda.gov/resources/guides-and-instructions/national-soil-survey-handbook> Accessed 03/31/2026.

Instructions for Use of Web Soil Survey (WSS) for Generating Engineering, Physical & Chemical Properties of Soils

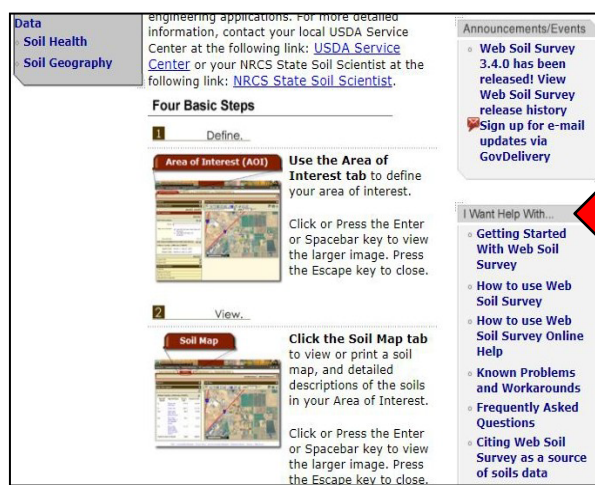
To access the Web Soil Survey Home page, click the following link:

<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>

The Web Soil Survey page should be displayed.



Click the Start Web Soil Survey (WSS) button.



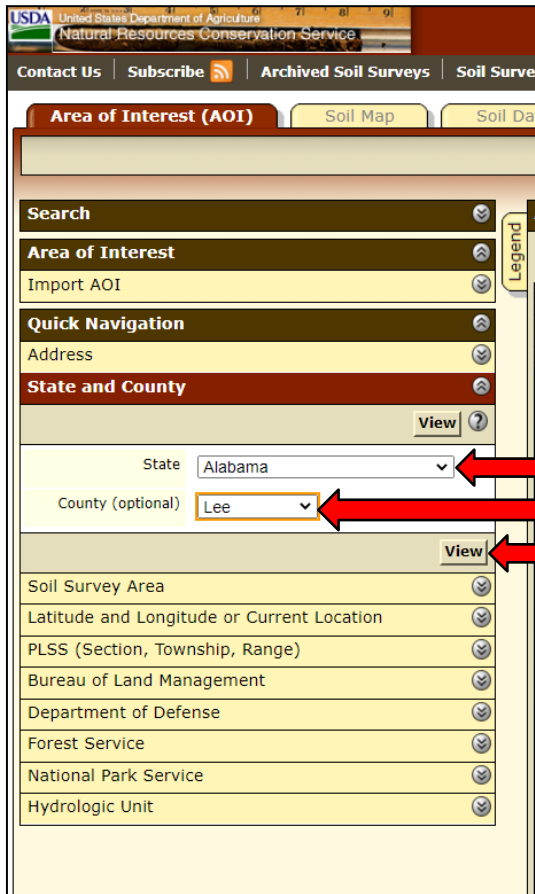
Note the “I Want Help With...” on the WSS page. This has some very useful information for the beginning user of WSS.

After clicking the Start WSS button, the Area of Interest (AOI) page should be displayed that shows the entire Continental U.S. There are numerous ways to find your AOI. Here is one method using the State and County.



Under the “Quick Navigation” area, click the drop-down button right of the “State and County” method.

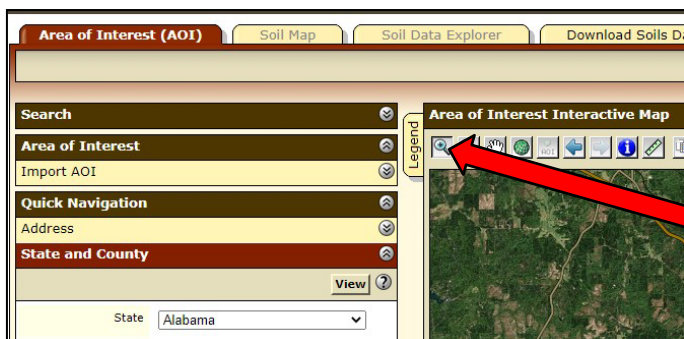
The State and County method of navigation will be expanded.



Select the State and County from the drop-down lists, and then click the “View” button.

In this example, Lee County, Alabama should be displayed in the Area of Interest Interactive Map.

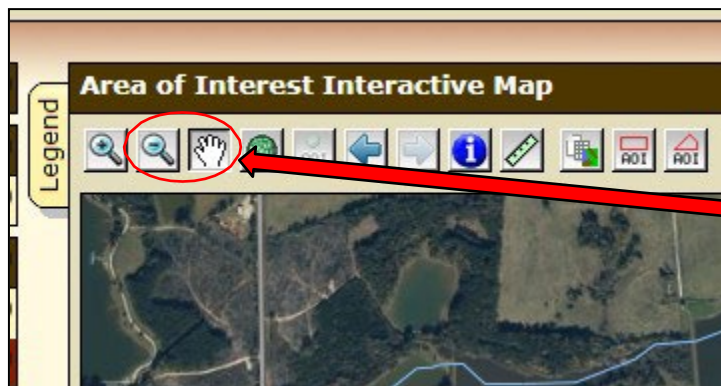
At this point you can start to zoom into your AOI by using the “Zoom In” button (+ magnifying glass).



Click the “Zoom In” button. Once selected, click and drag to draw a box around your AOI. Be sure to include a buffer area larger than your AOI.

You can continue to use the Click and Drag method with the “Zoom In” button until you are comfortable with the image in the Area of Interest Interactive Map. If you zoom in too far, use the “Zoom Out” button (- magnifying glass).

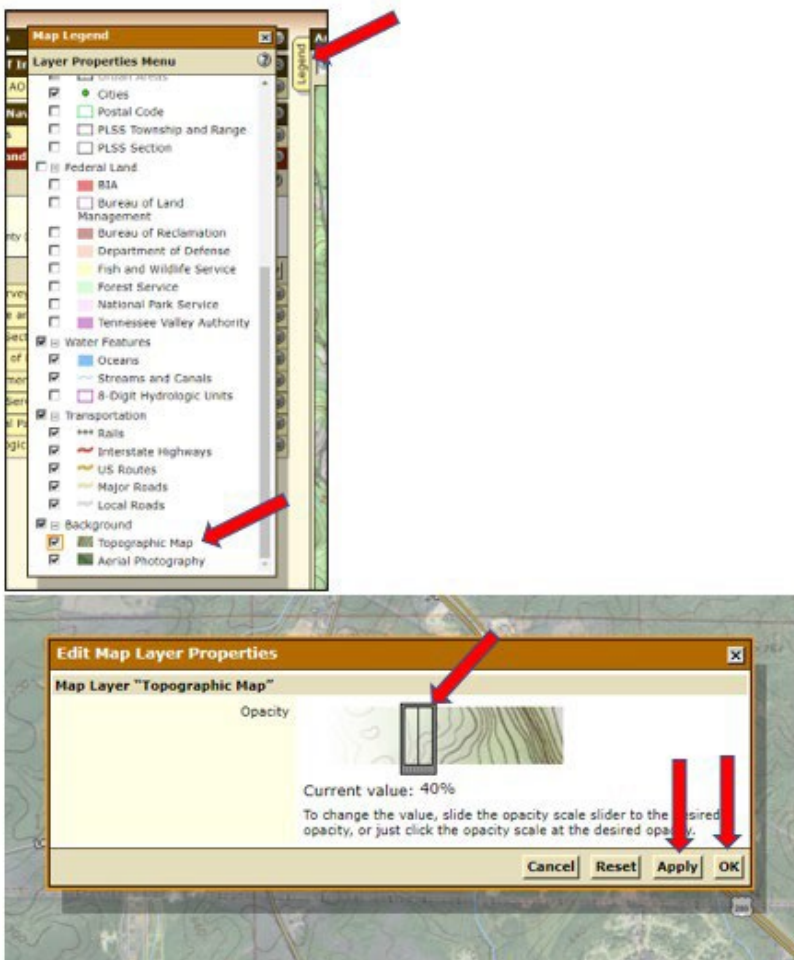
You can also use the “Hand” icon to pan the map to your location by clicking and holding the left click button of the mouse and panning the image to your location, release the left click button once you are over the AOI and to stop panning.



Zoom Out and Pan icons.

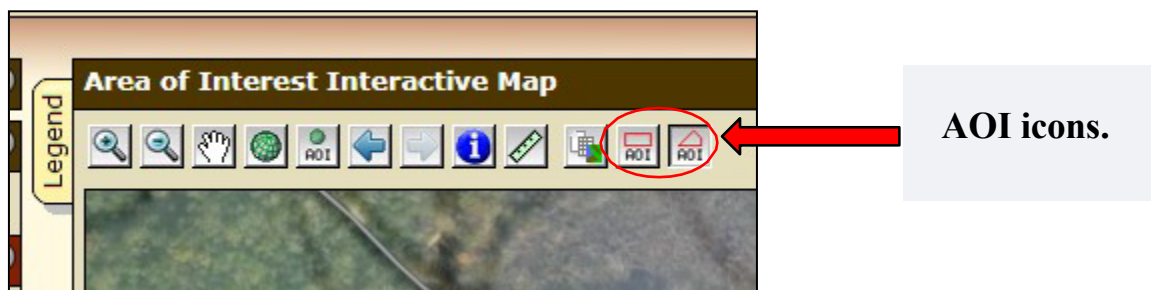
Another tool that makes the map easier to use for some professionals is to add a transparent USGS topographic map over the Area of Interest Interactive Map where you can see the satellite image and the USGS contours at the same time. To do this, click the “Legend” tab on the top left of the map, grab the scrolling bar at the right of the Layer Properties Menu, scroll down to “Background” and check the box next to the “Topographic Map”.

Hold your cursor over the term “Topographic Map” on the menu, right click your mouse, and then click “Edit Layer Properties”. An “Edit Map Layer Properties” will be displayed. Grab the Opacity sliding scale with your mouse and move it to the left to about 40%. Click the “Apply” button. If the image is OK, simply click the “OK” button. If not, adjust the opacity scale to what you want and then click “Apply” and “OK”.

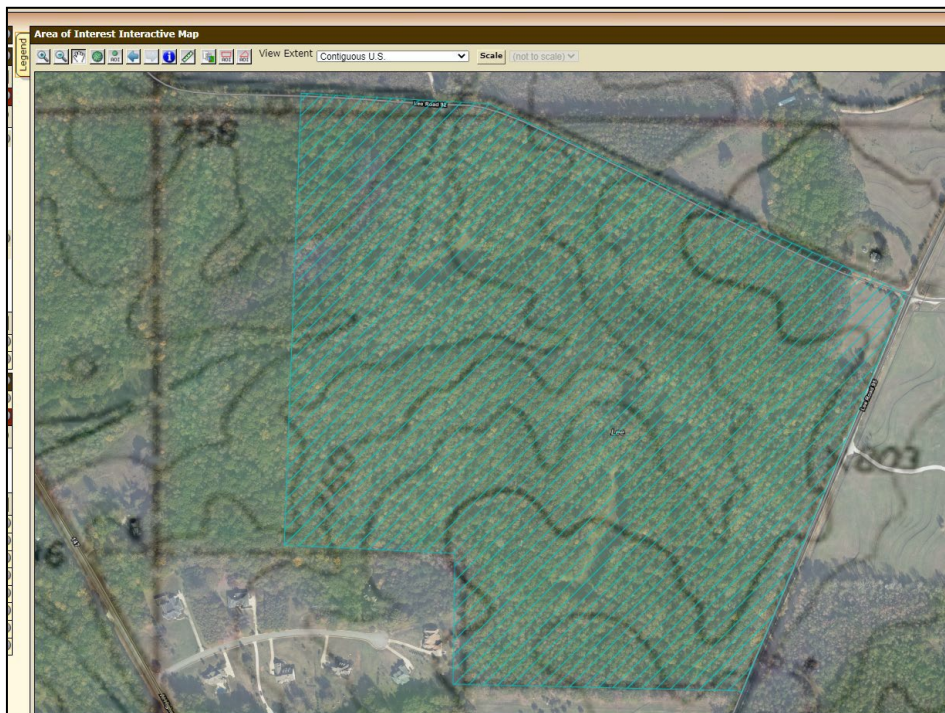


Now you are ready to identify the area of your project in which you need soil data. If your area is square or rectangular, use the “Define AOI by Rectangle” button (a red rectangle with AOI), then using the click and drag method, outline your AOI on the map.

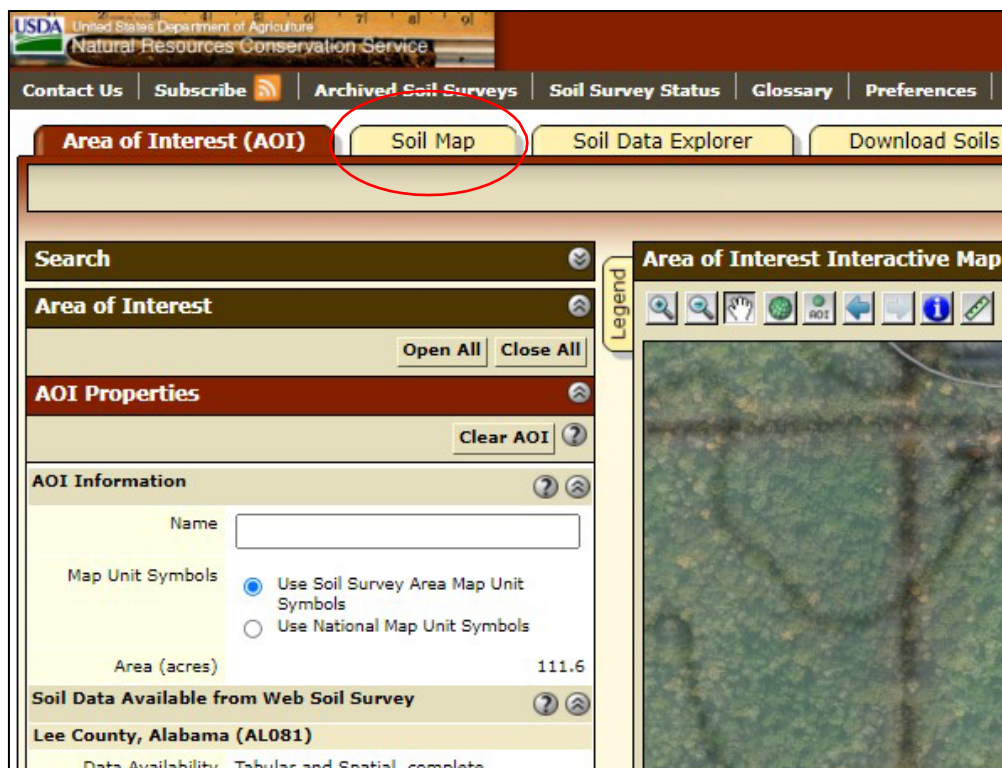
If your area is better defined with a polygon use the “Define AOI by Polygon” button (a red polygon with AOI) by clicking around your area and then double clicking when you are done. (Note: With the topographic background visible, you can use the polygon AOI feature to define a watershed boundary.)



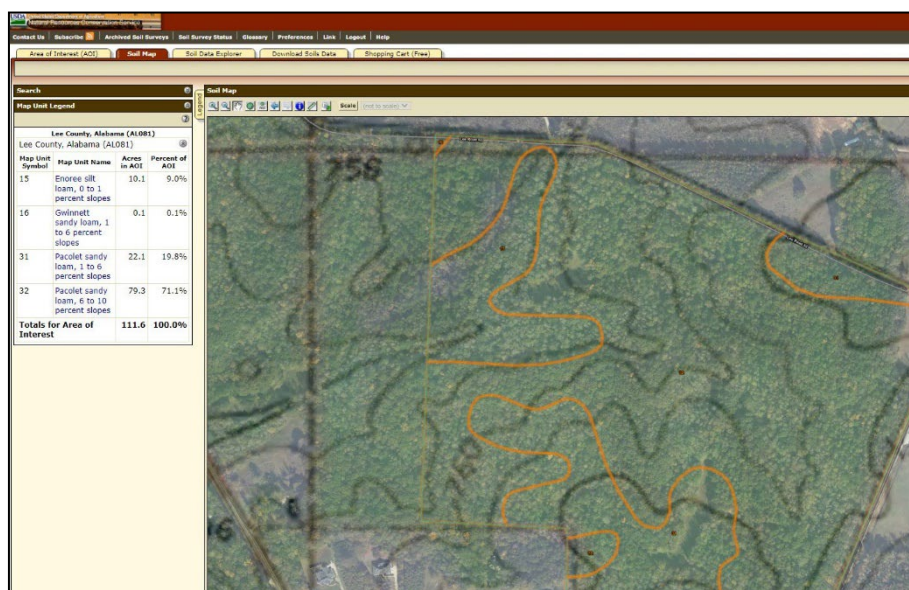
After you have defined your AOI, the Area of Interest Interactive Map should show your area cross-hatched.



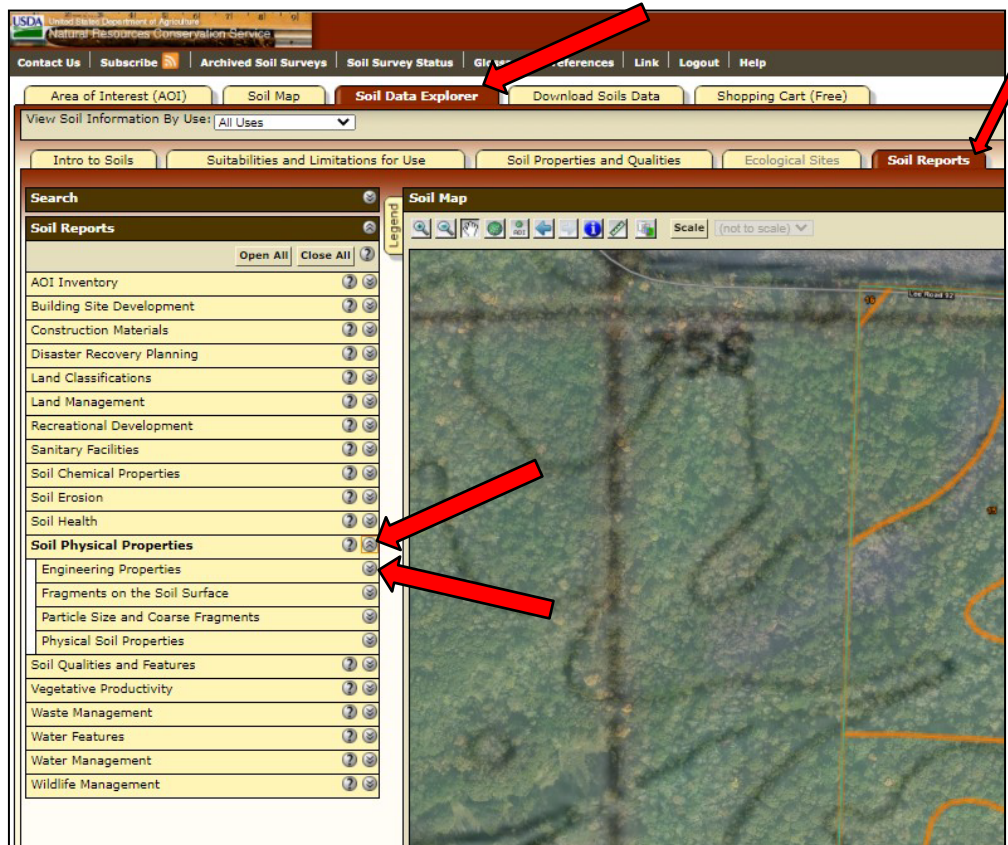
To generate your Soil Map for your AOI click the “Soil Map” tab just right of the AOI tab.



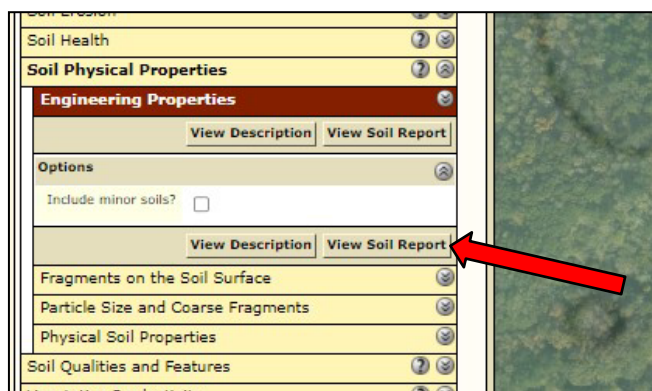
Your Soil Map will be generated along with a Map Unit Legend for the soils in your AOI that gives the Map Unit Names, acreage information, and percent of AOI.



To get to the Engineering Properties for the Soils within your Area of Interest, click the “Soil Data Explorer” tab, then click the “Soil Reports” tab on the new tabs that are displayed, click the drop-down icon to the right of “Soil Physical Properties”, and finally click the drop-down icon to the right of the “Engineering Properties”.



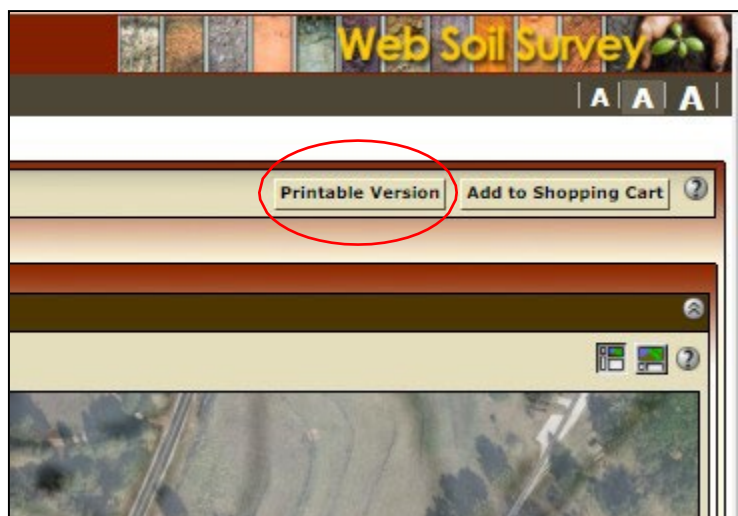
In the new Engineering Properties window click “View Soil Report”.



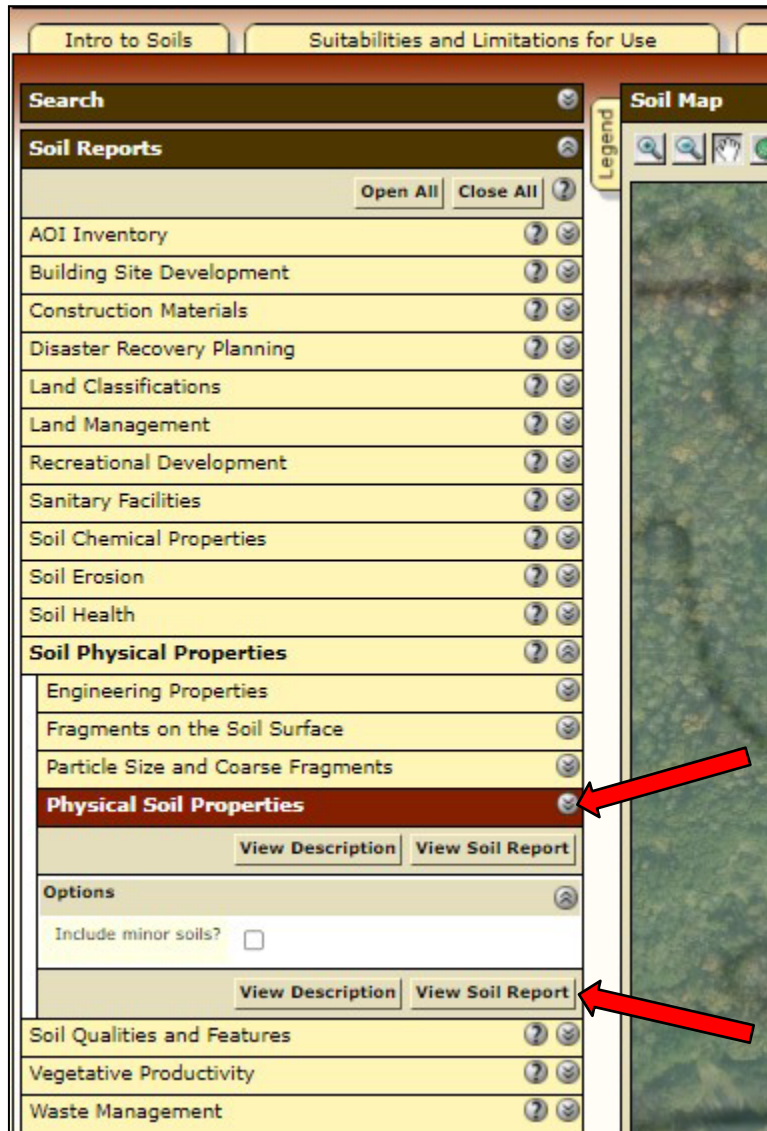
An Engineering Properties report along with the Descriptions for the properties should now be available below your AOI Soil Map.

Report — Engineering Properties														
Absence of an entry indicates that the data were not estimated. The asterisk "*" denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.vba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).														
Lee County, Alabama														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In					L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H	L-R-H
15—Enoree silt loam, 0 to 1 percent slopes														
Enoree	85	B/D	0-9	Silt loam	CL, CL-ML, ML	A-4, A-6, A-7	0-0-0	0-0-0	98-99-100	95-98-100	90-95-100	60-73-85	20-35-50	4-12-20
			9-42	Sandy loam, loam, silt loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0-0-0	0-0-0	95-98-100	90-95-100	50-73-95	25-43-60	0-20-40	NP-5-10
			42-60	Loam	CL-ML, ML, SC-SM, SM, CL	A-2, A-4	0-0-0	0-0-0	95-98-100	90-95-100	50-70-90	15-35-55	0-20-40	NP-5-10
16—Gwinnett sandy loam, 1 to 6 percent slopes														
Gwinnett	80	B	0-8	Sandy loam	ML, SC, SC-SM, SM	A-2, A-4, A-6, SM	0-0-0	0-2-3	95-98-100	85-93-100	65-78-90	30-40-50	0-16-32	NP-8-15
			8-39	Clay, sandy clay, clay loam	CH, CL, MH, ML	A-6, A-7	0-0-0	0-2-4	95-98-100	90-95-100	75-85-95	51-66-80	38-52-65	16-23-30
			39-50	Weathered bedrock	—	—	0-0-0	0-0-2	95-97-100	90-95-100	75-85-95	51-65-80	0-0-0	NP
31—Pacolet sandy loam, 1 to 6 percent slopes														
Pacolet	80	B	0-6	Sandy loam	SC-SM, SM	A-2, A-2-4	0-0-0	0-1-2	85-93-100	80-90-100	60-70-80	20-28-35	0-18-36	NP-5-10
			6-23	Sandy clay, clay loam, clay	CH	A-7	0-0-0	0-0-1	80-90-100	80-90-100	60-78-95	51-63-75	49-51-53	28-30-32
			23-40	Sandy loam, fine sandy loam, loam	SC-SM, SM	A-2-4, A-4	0-0-0	0-1-2	80-90-100	70-85-100	60-75-90	25-38-50	0-14-28	NP-3-6
32—Pacolet sandy loam, 6 to 10 percent slopes														
Pacolet	75	B	0-3	Sandy loam	SC-SM, SM	A-2, A-2-4	0-1-1	0-1-2	85-93-100	80-90-100	60-70-80	20-28-35	0-18-36	NP-5-10
			3-34	Sandy clay, clay loam, clay	CH	A-6, A-7	0-1-1	0-1-1	80-90-100	80-90-100	60-78-95	51-63-75	28-51-55	28-30-33
			34-60	Sandy clay, clay loam, clay	CH	A-7	0-1-1	0-1-1	80-90-100	80-90-100	60-78-95	51-63-75	50-52-54	28-30-32
Description — Engineering Properties														
Engineering Properties														
This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.														
Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.vba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups: A, B, C, and D, and three dual groups: A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.														
The four hydrologic soil groups are described in the following paragraphs:														
Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.														

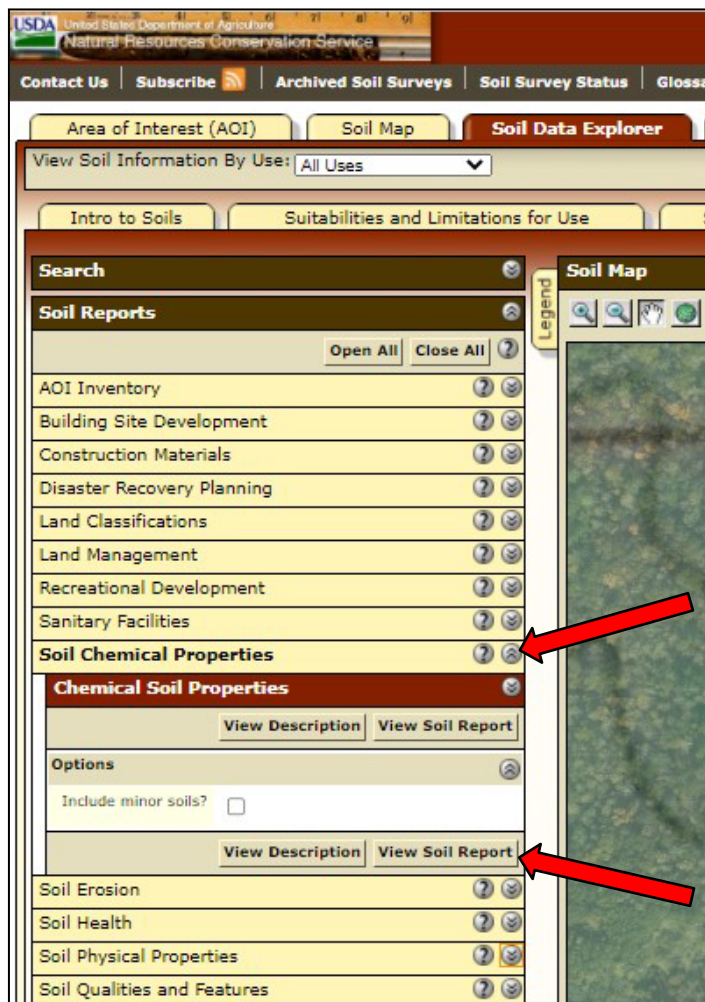
To create a Printable Version of the Engineering Properties of your AOI, scroll back up to the top of the page and click the “Printable Version” button. The Engineering Report will open as an Adobe document that can be printed or saved.



If you desire to also have the erodibility factors for the soils in your AOI, go to the Soil Reports menu and select “Physical Soil Properties” drop-down and then “View Soil Report”. Use the same process for printing or saving the information.



If you desire to have the pH of the soils in your AOI, go to the Soil Reports menu and select “Soil Chemical Properties” drop-down and then “View Soil Report”. Use the same process for printing or saving the information.



Hopefully this exercise helps you to understand how the WSS functions. There are volumes of data available through this web-based tool. Here is a link to the WSS informational brochure:

[WSS informational brochure](#)

Also, remember that a Soil Survey is a tool to provide “general” soils information. A site-specific soil survey completed by a professional soil scientist may be necessary to fully understand the soils in your AOI.

Standard Specification for
**Geosynthetic Specification
for Highway Applications**
AASHTO Designation: M 288-17
AASHTO
**Technical Section: 4e, Joints, Bearings,
and Geosynthetics**
Release: Group 2 (June 2017)

1. SCOPE

- 1.1. This is a materials specification covering geosynthetics for use in subsurface drainage, separation, stabilization, erosion control, temporary silt fence, paving, and soil (walls and slopes). This is a material purchasing specification and design review of use is recommended.
- 1.2. This specification sets forth a set of physical, mechanical, and endurance properties that must be met or exceeded by the geosynthetic being manufactured.
- 1.3. In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document. However, its general use is essentially as a recommended design document.
- 1.4. This specification is intended to assure both good quality and performance of geosynthetics used as listed in Section 1.1, but is possibly not adequate for the complete specification in a specific situation, especially in reinforcement applications. Additional tests, more restrictive values for the tests indicated, or values based on project specific design may be necessary under conditions of a particular application.
- 1.5. Minimum strength values provided in this specification are based on geosynthetic survivability from installation stresses. Designers should be aware that the classes and/or property requirements in this specification reflect this basic premise. Refer to Appendix X1 for most geosynthetic construction guidelines.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - R 69, Determination of Long-Term Strength for Geosynthetic Reinforcement
 - T 88, Particle Size Analysis of Soils
 - T 90, Determining the Plastic Limit and Plasticity Index of Soils
 - T 99, Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
 - T 289, Determining pH of Soil for Use in Corrosion Testing
- 2.2. *ASTM Standards:*¹

TS-4e

M 288-1

AASHTO

© 2017 by the American Association of State Highway and Transportation Officials.
All rights reserved. Duplication is a violation of applicable law.

The complete version of this standard is available for purchase in digitized form via the AASHTO Bookstore at:

<https://store.transportation.org/>

Glossary

This glossary includes terms pertinent to erosion and sediment control and stormwater management and most of the terms are used in this handbook.

AASHTO classification - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway and Transportation Officials (AASHTD).

Abutment - The sloping sides of a valley that support the ends of a dam.

Acid soil - A soil with a preponderance of hydrogen ions (and probably of aluminum) in proportion to hydroxyl ions. Specifically, soil with a pH value less than 7.0. For most practical purposes, a soil with a pH value less than 6.6.

Acre-foot - The volume of soil or water that will cover 1 acre to a depth of 1 foot.

Alkaline soil - A soil that has a pH greater than 7.0, particularly above 7.3, throughout most or all of the root, zone. The term is commonly applied to only the surface layer or horizon of a soil.

Alluvial soils - Soils developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes.

Alluvium - A general term for all detrital material deposited by water and includes gravel, sand, clay and mixtures of these. Unless otherwise noted, alluvium is unconsolidated.

Antecedent moisture conditions - The degree of wetness of a watershed at the beginning of a storm.

Anti-seep collar - A device constructed around a pipe or other conduit placed through a dam, levee, or dike for the purpose of preventing soil movement and piping failures.

Anti-vortex device - A facility placed at the entrance to a pipe conduit structure such as a drop inlet spillway or hood inlet spillway to prevent air from entering the structure when the pipe is flowing full.

Appendix

Apron - A pad of non-erosive material designed to prevent scour holes developing at the outlet ends of culverts, outlet pipes, grade stabilization structures, and other water control devices.

Balled and burlapped plant - A tree or shrub that has been dug up and the soil around the tree roots has been retained by enclosing it with burlap.

Bare-root - Trees or seedlings that have been removed from the soil and have exposed roots.

Barrel - A conduit placed through a dam, levee, or dike to control the release of water.

Base flow - Stream discharge derived from groundwater sources as differentiated from surface runoff. Sometimes considered to include flows from regulated lakes or reservoirs.

Bearing capacity - The maximum load that a material can support before failing.

Bedrock - The more or less solid rock in place either on or beneath the surface of the earth. It may be soft, medium or hard and have a smooth or irregular surface.

Berm - A narrow shelf or flat area that breaks the continuity of a slope.

Borrow area – An area where earth material is removed for use at another location for the construction of embankments or other earth fill structures.

Brownfield - The State of Alabama defines a “brownfield” as any abandoned, idled, or underused industrial and commercial property where expansion or redevelopment can be complicated by real or perceived contamination. Federal law expands this definition to include any real property, the expansion, redevelopment, or reuse of which may be complicated by the presences of a hazardous substance, pollutant, or contaminant. The Alabama Department of Environmental Management Land Division provides oversight of assessment and remediation activities concerning these types of sites through its Brownfield Redevelopment and Voluntary Cleanup Program.

Bunchgrass - A grass plant species that forms a distinct clump and does not spread by horizontal plant parts above or below ground (stolons or rhizomes).

Buoyant weight - The downward force exerted by an object with a specific gravity greater than 1, when it is submerged in water.

Butt joint – a technique in which two fiber rolls are firmly pressed together, end to end, during the field installation process ensuring that there are no gaps between the adjacent rolls to minimize potential for water flow and erosion between the rolls.

Channel stabilization - Protecting the sides and bed of a channel from erosion by controlling flow velocities and flow directions using jetties, drops or other structures and/or by lining the channel with a suitable liner such as vegetation, riprap, concrete or other similar material.

Chute - A high-velocity, open channel for conveying water down a steep slope without erosion, usually paved.

Clay – A clay particle is defined by the USDA as particles of soil materials less than 0.002 mm in diameter. Particle size may vary by soil classification system. A clay soil is defined by the USDA as a soil textural class (category) that contains 40% or more clay particles, less than 45% sand particles and less than 40% silt soil particles. Textural classification may vary by soil classification system.

Coir - A term used to refer to products such as rolled erosion control products and wattles manufactured from the fibers of coconuts.

Compaction - In soil engineering, the process by which the soil grains are rearranged to decrease void space and bring them into closer contact with one another, thereby increasing the weight of solid material per cubic foot. In soil quality, a dense layer of soil, created by traffic, that impedes root penetration and moisture movement through the soil.

Conservation district - A special-purpose entity created under state enabling law to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries, usually a subdivision of state government with a local governing body but with limited authorities. Other names include soil conservation district, soil and water conservation district and natural resources district.

Construction phasing - segmenting development of a large construction site to reduce the area of disturbance at a given time.

Construction sequencing - a construction schedule used to avoid conflicts and/or ensure desired performance of BMPs.

Containerized plant - A plant that is grown in a container for the purpose of being transplanted.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation.

Critical area - A severely eroded sediment producing area that requires special management to establish and maintain vegetation in order to stabilize soil conditions.

Cut - Portion of land surface or area from which earth has been removed or will be removed by excavating the depth below the original ground surface to the excavated surface.

Cut-and-fill - Process of earth grading by excavating part of a higher area and using the excavated material for fill to raise the surface of an adjacent lower area.

Appendix

Cutoff trench - A long, narrow excavation (keyway) constructed along the center line of a dam, dike, levee or embankment and filled with relatively impervious material intended to reduce seepage of water through porous strata.

Dam - A barrier to confine or impound water for storage or diversion, to prevent gully erosion, or for retention of soil, sediment, or other debris.

Design highwater - The elevation of the water surface at peak flow conditions of the design flood.

Design life - The period of time for which a facility is expected to perform its intended function.

Design storm - A selected rainfall pattern of specified amount, intensity, duration, and frequency that is used as a basis for design.

Dewatering - The removal of water temporarily impounded in a holding basin.

Dibble bar - A tool used for planting trees consisting of either a flat or pointed blade and a bar with a handle for pushing the blade into the soil.

Dike - An embankment to confine or control water, often built along the banks of a river to prevent overflow of lowlands; a levee.

Discharge - Usually the rate, of .water flow; a volume of a fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day.

Diversion - A channel with a supporting ridge on the lower side constructed at the top, across, or at the bottom of a slope for the purpose of controlling surface runoff.

Diversion dike - A barrier built to divert surface runoff.

Divide, drainage - The boundary between watersheds.

Drainageway - A natural or artificial depression that carries surface water to a larger watercourse or outlet such as a river, lake, or bay.

Drawdown - Lowering of the water surface in an open channel or lake or groundwater.

Drop inlet - Overall structure in which the water drops through a vertical riser connected to a discharge conduit or storm sewer.

Drop spillway - Overall structure in which the water drops over a vertical wall onto an apron at a lower elevation.

Drop structure - A structure for dropping water to a lower level and dissipating its surplus energy without erosion.

Earth dam - A dam constructed of compacted suitable soil materials.

Embankment - A man-made deposit of soil, rock, or other material often used to form an impoundment.

Emergency Spillway (Auxiliary Spillway)- Usually a vegetated earth channel used to safely convey flood discharges around an impoundment structure.

Energy Dissipator - A device used to reduce the energy of flowing water to prevent erosion.

Environment - The sum total of all the external conditions that may act upon a living organism or community to influence its development or existence.

Erodibility - Susceptibility to erosion.

Erosion - The process of detachment and transport of soil particles by water, wind, gravity, ice, or other natural forces. The following terms are used to describe different types of water erosion:

Accelerated erosion - erosion as a result of the activities of man.

Channel erosion - the erosion process whereby the volume and velocity of flow wears away the bed and/or banks of a well-defined channel.

Geologic erosion - the normal or natural erosion caused by geological processes acting over long geologic periods and resulting in the wearing away of mountains, the building up of floodplains, coastal plains, etc.

Gully erosion - a channel deeper than a rill formed by the action of concentrated flow exceeding the allowable shear stress of the soil.

Rill erosion - an erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils.

Splash erosion - the spattering of small soil particles caused by the impact of raindrops on bare soils.

Sheet erosion - the removal of a fairly uniform thin layer of soil from the surface layer by runoff water.

Interrill erosion – the combination of splash and sheet erosion.

Appendix

Evapotranspiration - The combined loss of water from an area by evaporation from the soil surface and by transpiration of plants.

Excess rainfall - The amount of rainfall that runs directly off an area.

Fertilizer - Any organic or inorganic material of natural or synthetic origin that is added to a soil to supply elements essential to plant growth.

Fertilizer analysis - The percentage composition of fertilizer, expressed in terms of nitrogen, phosphoric acid, and potash. For example, a fertilizer with a 6-12-6 analysis contains 6 percent nitrogen (N), 12 percent available phosphoric acid (P_2O_5) and 6 percent water-soluble potash (K_2O).

Filter diaphragm – A designed zone of filter material (usually well-graded, clean sand) constructed around a conduit to prevent problems associated with seepage or internal erosion in earthfill surrounding a conduit. Must include a filter compatible outlet.

Filter fabric - A woven or non-woven, water-permeable material generally made of synthetic products such as polypropylene and used in erosion and sediment control applications to trap sediment or prevent the movement of fine soil particles.

Flood peak - The highest stage or greatest discharge attained by a flood event. Thus, peak stage or peak discharge.

Floodplain - The lowland that borders a stream and is subject to flooding when the stream overflows its banks.

Flood stage - The stage at which overflow of the natural banks of a stream begins.

Floodway - A channel, either natural, excavated, or bounded by dikes and levees, used to carry flood flows.

Flume - A constructed channel lined with erosion-resistant materials used to convey water on steep grades without erosion.

Forebay - an impoundment upstream of detention-based practices intended to slow flow velocity, facilitate sedimentation, and capture larger soil particles.

Freeboard - A vertical distance between the elevation of the design high-water and the top of a dam, diversion ridge, or other water control device.

Frequency of storm (design storm frequency) - The anticipated period in years that will elapse before another storm of equal intensity and/or total volume will recur: a 10-year storm can be expected to occur on the average once every 10 years.

Froude no. (F) - A calculated number for classifying water flow as critical ($F=1$), supercritical ($F>1$) or subcritical ($F<1$).

Gabion - semi-flexible and permeable wire baskets typically filled with cobble or boulder-sized rock commonly used for erosion control of slopes and channels.

Gauge - A device for measuring precipitation, water level, discharge, velocity, pressure, temperature, etc., e.g., a rain gauge. A measure of the thickness of metal, e.g., diameter of wire or wall thickness of steel pipe.

Geotextile - permeable fabrics which, when used in association with soil, have the ability to separate, filter, reinforce, protect, or drain.

Gradation - The distribution of the various sized particles that constitute a sediment, soil, or other material such as riprap.

Grade - (1) The slope of a road, a channel, or natural ground. (2) The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared to a design elevation for the support of construction such as paving or the laying a conduit. (3) To finish the surface of a canal bed, roadbed, top of embankment, or bottom of excavation, or other land area to a smooth, even condition.

Grade stabilization structure - A structure for the purpose of stabilizing the grade of a gully or other watercourse, thereby preventing further head-cutting or lowering of the channel bottom (Drop Structure).

Gradient - Change of elevation, velocity, pressure, or other characteristics per unit length; slope.

Grading - The cutting and/or filling of the land surface to a desired slope or elevation.

Grass - A member of the botanical family Gramineae, characterized by blade-like leaves that originate as a sheath wrapped around the stem.

Grass or legume, annual - A plant which germinates, grows, reproduces, and dies in one growing season or 1 year's time.

Grass or legume, cool-season - A grass or legume which is usually planted in the fall or occasionally late winter and it makes most of its growth during the cool season of the year, (fall, late winter and spring). Flowering and seed production occur in late spring. Cool-season species are usually dormant or make little growth during the hot summer months.

Grass or legume, perennial - A plant which under suitable conditions has the ability to live for more than 1 year. A perennial may become dormant at certain times of the year, but will resume growth at the end of its dormant period.

Grass or legume, warm-season - A grass or legume which is usually planted in the spring and makes it growth during the warm season (late spring and summer months). Flowering and seed production usually occur in late summer or early fall. Warm-season species become dormant in late fall and resume growth in the early spring.

Grassed waterway - A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant, grasses and used to safely conduct surface water from an area. Usually referred to as a Grass Swale on construction sites.

Groundcover - Low-growing herbaceous plants that spread vegetatively to produce a dense, continuous cover over a landscape.

Ground water - That water that moves through the plant root zone and under the influence of gravity continues moving downward until it enters the ground water reservoir.

Head - The height of water above any plain of reference. The energy, either kinetic or potential, possessed by each unit weight of a liquid, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. Used in various compound terms such as pressure head or velocity head.

Head loss - Energy loss due to friction, eddies, changes in velocity, elevation or direction of flow.

Headwater - The source of a stream. The water upstream from a structure or point on a stream.

Hydraulic erosion control product (HECP) – a water-based mixture of materials that may include: mulch, seed, fertilizer, soil amendments, tackifiers, and polymers that are applied to provide soil stabilization.

Hydrograph - A graph showing for a given point on a stream - the discharge, stage (depth), velocity, or other property of water with respect to time.

Hydrologic cycle - The circuit of water movement from the atmosphere to the earth and back to the atmosphere through various stages or processes such as precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.

Hydrologic soil group - Categories that reflect runoff and are good indicators of infiltration and how rapidly water moves through the soil.

<u>Group</u>	<u>Soil Description</u>
A	Deep, well drained sands and gravels with low runoff potential and high infiltration rates.

- | | |
|---|--|
| B | Soils that are moderately deep to deep, moderately drained, moderately fine to moderately coarse texture with moderate runoff potential and moderate infiltration rates. |
| C | Soils with an impeding layer, or moderately fine to fine texture with high runoff potential and low infiltration rates. |
| D | Clay, or soils with high water table, or shallow over an impervious layer such as stone with very high runoff potential and very low infiltration rates. |

Hydrology - The science of the behavior of water in the atmosphere, on the surface of the earth, and underground.

Impact basin - A device used to dissipate the energy of flowing water to reduce erosion. Generally constructed of concrete partially submerged with baffles to dissipate velocities.

Impervious - Not allowing infiltration.

Impoundment - Generally, an artificial water storage area, as a reservoir, pit, dugout, sump, etc.

Infiltration - The gradual downward flow of water from the surface through soil to ground water and water table reservoirs.

Invert - The inside bottom of a culvert or other conduit.

Keyway - A cutoff trench dug beneath the entire length of a dam to cut through soil layers that may cause seepage and possible dam failure.

Laminar flow - Flow at relatively slow velocity in which fluid particles slide smoothly along straight lines everywhere parallel to the axis of a channel or pipe.

Legume - Any member of the pea or pulse family which includes peas, beans, peanuts, clovers, alfalfas, sweet clovers, lespedezas, vetches, black locust, and kudzu. Practically all legumes are nitrogen-fixing plants.

Level Spreader - a structure or berm designed to slow and evenly spread concentrated runoff and release it uniformly as sheet flow across its entire width onto a stabilized area.

Liquid limit - The moisture content at which the soil passes from a plastic to a liquid state.

Mean depth - Average depth; cross-sectional area of a stream or channel divided by its surface or top width.

Appendix

Mean velocity - The average velocity of a stream flowing in a channel conduit at a given cross-section or in a given reach. It is equal to the discharge divided by the cross-sectional area of the reach.

Mulch - A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Natural drainage - The flow patterns of stormwater runoff over the land in its pre-development state.

Nonpoint source pollution - Pollution that enters a water body from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.

Normal depth - The depth of flow in an open conduit during uniform flow for the given conditions.

Open drain - A natural watercourse or constructed open channel that conveys drainage water.

Outfall – a location where water discharges offsite from a pipe, stream, drain, or other conveyance.

Outlet - The point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Outlet channel - A waterway constructed or altered primarily to carry water from man-made structures, such as smaller channels, tile lines, and diversions.

Peak discharge - The maximum instantaneous flow from a given storm condition at a specific location.

Percolation - The movement of water through soil.

Percolation rate - The rate, usually expressed as inches/hour or inches/day, at which water moves through the soil profile.

Perennial stream - A stream that maintains water in its channel throughout the year.

Pervious - Allowing movement of water.

Pesticides - Chemical compounds used for the control of undesirable plants, animals, or insects. The term includes insecticides, herbicides, algacides, rodenticides, nematocides, fungicides, and growth regulators.

pH - A numerical measure of hydrogen ion activity. The neutral point is pH 7.0. All pH values below 7.0 are acid and all above 7.0 are alkaline.

Physiographic region (Province) - Large-scale unit of land defined by its climate, geology, and geomorphic history and, therefore, relatively uniform in physiographic features.

Plastic index - The numerical difference between the liquid limit and the plastic limit of soil; the range of moisture content within which the soil remains plastic.

Plastic limit - The moisture content at which a soil changes from a semi-solid to a plastic state.

Plunge pool - A basin used to dissipate the energy of flowing water usually constructed to a design depth and shape. The pool may be protected from erosion by various lining materials.

Point source - Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, vessel or other floating craft, from which pollutants are or may be discharged. (Public Law 92-500, Section 5014).

Pollutant - Pollutant includes but is not limited to sediment, dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water.

Porosity - The volume of pore space in soil or rock.

Porous Baffle - a pervious barrier installed in a sediment basin perpendicular to the flow path to redistribute energy, reduce turbulence, spread flow across the width, and establish laminar flow, for the purpose of promoting the settling of suspended solids.

Principal spillway - A dam spillway generally constructed of permanent material and designed to regulate the normal water level, provide flood protection and/or reduce the frequency of operation of the emergency spillway.

Qualified design professional - A person adequately trained, experienced and in some instances registered, to plan and/or design erosion and sediment control and stormwater measures applicable to site conditions where assistance is provided. Certified or registered professionals are bound by their ethics commitment to practice in only the areas that they have adequate expertise. Designing certain measures is restricted by state law to specific categories of professionals, i.e. structural measures can only be designed in Alabama by professional engineers registered in Alabama.

Rainfall intensity - The rate at which rain is falling at any given instant, usually expressed in inches per hour.

Rational method - A means of computing storm drainage flow rates, Q , by use of the formula

Appendix

$Q = CIA$, where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area.

Reach - The smallest subdivision of the drainage system consisting of a uniform length of open channel. Also, a discrete portion of river, stream or creek.

Receiving stream - The body of water into which runoff or effluent is discharged.

Retention - The permanent storage of stormwater to prevent it from leaving the development site; Storage for temporary periods is referred to as detention.

Revetment - A constructed face or wall.

Revised Universal Soil Loss Equation 2 – An equation developed by the USDA Agricultural Research Service (USDA-ARS) and partners that predicts sheet and rill erosion rates on sloping landscapes. The equation may be applied to various land uses as a tool for planners to evaluate the effects of various vegetative, structural and management practices.

Rhizome - A plant stem that grows horizontally underground and sends out roots and shoots from the nodes.

Rill - A small channel on a slope caused by soil detachment due to overland flow.

Riparian - Of, on, or pertaining to the banks of a stream, river, or pond.

Riparian rights - A principle of common law which requires that any user of waters adjoining or flowing through his lands must so use and protect them that he will enable his neighbor to utilize the same waters undiminished in quantity and undefined in quality.

Riser - The inlet portions of a drop inlet spillway that extend vertically from the pipe conduit barrel to the water surface.

Rolled erosion control product (RECP) – a temporary degradable or long-term non-degradable material manufactured or fabricated into rolls designed to reduce soil erosion and assist in the growth, establishment, and protection of vegetation. Sometimes referred to as erosion control blanket or mat.

Runoff - precipitation that is not infiltrated or intercepted within a watershed that flows over a surface, in open channels, and/or in stormwater conveyance systems.

Sand – a sand particle is defined by USDA as materials larger than 0.05 mm (No. 200 sieve) in diameter up to 2.0 mm (No. 10 sieve). A sandy soil is defined by the USDA as a soil textural class that contains 85% or more of sand sized particles.

Saturation - In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.

Scarified seed - Seed which has been subjected to abrasive treatment to encourage germination.

Scour - The clearing and digging action of flowing water, especially the downward erosion caused by stream water in sweeping away mud and silt from the stream bed and outside bank of a curved channel.

Sediment - soil particles transported or deposited by the action of wind, water, gravity, or ice, as a product of erosion.

Sediment delivery ratio - The fraction of the soil eroded from upland sources that actually reaches a stream channel or storage reservoir.

Sediment retention barrier – A measure constructed onsite on the contour similarly to a conventional silt fence to protect water quality by reducing turbidity of stormwater. It consists of two high-flow silt fences installed about 18” apart with straw loosely placed between the fences and either straw or a fabric such as jute placed on the ground surface downslope of the fences. An approved flocculant powder is added to the straw and straw/fabric prior to runoff events to remove fines from the runoff. A Buffer Zone must be downstream of the practice.

Sediment retention fiber roll (SRFR) - A manufactured device of a filler material encapsulated within a flexible containment material utilized in sediment and flow control applications such as sediment barriers and inlet protection. Also, referred to as a sediment log and as a wattle.

Sediment pool - The reservoir space allotted to the accumulation of sediment during the life of the structure.

Sedimentation - termination of settling process resulting in deposition.

Seedbed - The soil prepared by natural or artificial means to promote the germination of seed and the growth of seedlings.

Seedling - A young plant grown from seed, either planted or a volunteer.

Sensitive Waters - A non-regulatory term to describe waters of the state that have been classified, designated, or otherwise identified to have increased significance or recognized uses such as waters classified as suitable for swimming and other whole body water contact sports

(S), public water supply (PWS), etc., waters designated as outstanding national resource waters (ONRW) or outstanding Alabama water (OAW), and water designated as a Tier 1 (impacted

Appendix

water), CWA Section 303(d) listed water, etc. where specialized planning and an increased level of BMP implementation may be warranted.

Shear stress - The coplanar surface stress applied by concentrated flowing stormwater to a swale surface. Swale surfaces have a maximum shear strength that can be withstood without failure of the surface.

Silt - a silt soil is defined by the USDA as a soil textural class (category) that contains 80% or more silt particles (0.05 to 0.002 mm diameter) and less than 12% clay soil particles (less than 0.002 mm diameter).

Slope - Degree of deviation of a surface from the horizontal; measured as a numerical ratio or percent. Expressed as a ration, the first no. is the horizontal distance (run) and the second is the vertical distance (rise), e.g., 2:1. Slope can also be expressed as the rise over the run. For instance, a 2:1 slope is a 50 percent slope.

Sod - Grass and/or legumes held together by its root system and a thin layer of soil.

Soil - The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Soil horizon - A horizontal layer of soil that, through processes of soil formation, has developed characteristics distinct from the layers above and below.

Soil permeability - The attribute of a soil that enables water or air to move through it. Usually expressed in inches/hour or inches/day.

Soil profile - A vertical section of the soil from the surface through all horizons.

Soil Series - the name of horizons (profiles or layers) of soils that are similar and used to distinguish one soil profile from another by characteristics including biological, chemical, and physical properties.

Soil structure - The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; some types are crumb structure, block structure, platy structure, and columnar structure.

Soil texture - The physical structure or character of soil determined by the relative proportions of the soil separates (sand, silt and clay) of which it is composed.

Soil type - term used prior to 1975 to describe a subdivision of a Soil Series that identified both the soil series and features associated with the series such as slope, stoniness, rock or outcrop. Replaced by the USDA with the term Soil Map Unit.

Spillway - A passage such as a paved apron or channel for surplus water over or around or through a dam or similar structure. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of excess water.

Sprig - The section of plant stem material (rhizome, shoot, or stolon) used in vegetative planting referred to as sprigging.

Stolon – a plant stem that grows horizontally on the soil surface and produces new plants from its nodes or tips.

Storm frequency - the exceedance probability of a given depth of rainfall over a given duration typically expressed in return interval (years), such as a 10-yr, 24-hr storm event.

Storm sewer - A sewer that carries stormwater, surface drainage, street wash and other wash waters, but excludes sewage and industrial wastes, preferably called a storm drain.

Stormwater pollution prevention plan (SWPPP) – EPA description of a comprehensive site-specific plan of measures committed to address all water (pollutant) discharges and receiving waterbody quality related challenges and issues that are expected to be created by construction on a specific site. The ADEM Construction Best Management Practices Plan (CBMPP) is equivalent to SWPPP.

Streambanks - The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.

Subcritical flow - Flow at relatively high velocity where the wave from a disturbance can move upstream. Froude No. less than 1.

Subsoil - The B horizons of soils with distinct profiles. In soils with weak profile development the subsoil can be defined as the soil below which roots do not normally grow.

Subsurface drain - A pervious backfilled trench usually containing stone and perforated pipe for intercepting groundwater or seepage.

Subwatershed - A watershed subdivision of unspecified size that forms a convenient natural unit.

Supercritical flow - Flow at relatively high velocity where - the wave from a disturbance will always be swept downstream. Froude no. is greater than 1.

Surface runoff - Precipitation that falls onto the surfaces of roofs, streets, the ground, etc., and is not absorbed or retained by that surface, but collects and runs off.

Appendix

Swale – A shallow drainageway (natural or constructed).

Tailwater depth - The depth of flow immediately downstream from a discharge structure.

Temporary cover - Temporary vegetative cover of rapid growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed sites.

Toe of dam - The base or bottom of the sloping faces of a constructed dam at the point of intersection with the natural ground surface. A dam has an inside toe (the impoundment or upstream side) and an outside toe (the downgradient side).

Toe of slope - The base or bottom of a slope at the point where the ground surface abruptly changes to a significantly flatter grade.

Topography - General term to include characteristics of the ground surface such as plains, hills, mountains, degree of relief, steepness of slopes, and other physiographic features.

Topsoil - The dark-colored surface layer or A horizon of a soil. When present it ranges in depth from a fraction of an inch to 2 or 3 ft.; equivalent to the plow layer of cultivated soils.

Commonly used to refer to the surface soil layer(s), enriched in organic matter and having textural and structural characteristics favorable for plant growth.

Trash rack - A structural device used to prevent debris from entering a pipe spillway or other hydraulic structure.

Turbidity - Cloudiness of a liquid, caused by suspended particles (silt, clay, organic material, plankton etc.) that cause light rays to be scattered and absorbed rather than transmitted in straight lines through a sample. Small clay particles known as colloids remain in suspension for long periods of time and are a major contributor to turbidity where they exist.

Turf - Surface soil supporting a dense growth of grass and associated root mat.

Turf reinforcement mat (TRM) – a rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh and/or other elements, including degradable components, designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term erosion control by permanently reinforcing vegetation during and after establishment.

Unified soil classification system - A classification system based on the identification of soils according to their particle size, gradation, plasticity index, and liquid limit.

Uniform flow - A state of steady flow when the mean velocity and cross-sectional area remain constant in all sections of a reach.

Vegetative stabilization - Protection of erodible or sediment-producing areas with: permanent seeding, producing long-term vegetative cover, short-term seeding, producing temporary vegetative cover, or sodding, producing areas covered with a turf of a perennial sod-forming grass.

Watercourse - A definite channel with bed and banks within which concentrated water flows, either continuously or intermittently.

Water quality - A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Waters of the State - [of Alabama] means waters of any river, stream, watercourse, pond, lake, coastal, groundwater or surface water, wholly or partially within the State, natural or artificial. This does not include waters which are entirely confined and retained completely upon the property of a single individual, partnership or corporation unless such waters are used in interstate commerce", Code of Alabama 1975, § 22-22-1(b)(2), as amended. Waters "include all navigable waters" as defined in 33 U.S.C. § 1362(7), as amended, which are within the State of Alabama.

Watershed - The region drained by or contributing water to a stream, lake, or other body of water.

Watershed area - The area of all land and water within the confines of a drainage divide.

Wattle (also referred to as a sediment retention fiber roll) – a manufactured device of a filler material encapsulated within a flexible containment material such as natural fiber, straw, or recycled products. Wattles are utilized in sediment and flow control applications such as sediment barriers and inlet protection.

Weir - A device for measuring or regulating the flow of water.

Wetland - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (from Army Corps of Engineers 1987 Wetlands Delineation Manual).

References and Other Resources

Documents Used as Resources in Updating the Alabama Handbook

These documents were used by the authors in developing the handbook. Some drawings and sketches were copied without any changes except page numbers.

Erosion Control Technology Council. <http://www.ectc.org>.

Georgia Soil and Water Conservation Commission, Manual for Erosion and Sediment Control in Georgia, 2016 Edition.

Maryland Department of the Environment Water Management Administration, Maryland Stormwater Design Manual Volumes I & II, October 2000, Revised May 2009.

Mid-American Association of Conservation Districts, 1999. Protecting Water Quality – A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri and Kansas.

North Carolina Department of Environment, Health, and Natural Resources, Division of Land Resources. Erosion and Sediment Control Planning and Design Manual, March 2009.

Pirone, 1978. Tree Maintenance.

Pirone, 1979. Tree Maintenance.

U.S.D.A. – Natural Resources Conservation Service. Alabama Field Office Technical Guide.

Documents Available Electronically to Use in Designing Best Management Practices

Best Management Practices: An Owner's Guide to Protecting Archaeological Sites
<https://files.floridados.gov/media/30867/handbook.pdf>

Low Impact Development Handbook for the State of Alabama. Alabama Department of Environmental Management, Alabama Cooperative Extension System and Auburn University,
<https://adem.alabama.gov/programs/water/waterforms/LIDHandbook.pdf>

[TR-55, Urban Hydrology for Small Watersheds](#)

[Stream Corridor Restoration](#)

Other Related Documents Available Electronically

Alabama Department of Environmental Management Regulations
<http://adem.alabama.gov/alEnviroRegLaws/default.cnt>

Alabama Department of Environmental Management Construction General Permit
<http://adem.alabama.gov/programs/water/constructionstormwater.cnt>

Alabama Department of Environmental Management Coastal Program
<https://adem.alabama.gov/coastal>

Federal Highway Department Hydraulic Publications
<https://www.fhwa.dot.gov/engineering/hydraulics/>

Resource Agencies

The following agencies have a role in various aspects of land disturbances.

Alabama Department of Environmental Management Field Operations Division Offices

ADEM Montgomery Office
1400 Coliseum Boulevard
Montgomery, AL 36110-2400
(334) 271-7700
Mailing Address
P.O. Box 301463
Montgomery, AL 36130-1463

Central Laboratory/Field Operations
1350 Coliseum Boulevard
Montgomery, AL 36110-2412

Birmingham Field Office
110 Vulcan Road
Birmingham, AL 35209
(205) 942-6168

Decatur Field Office
2715 Sandlin Road, S.W.
Decatur, AL 35603
(256) 353-1713

ADEM Coastal Office
1615 South Broad Street
Mobile, AL 36605
(251) 450-3400

Alabama Historical Commission
468 South Perry Street
P.O. Box 300900
Montgomery, Alabama 36130-0900
334-242-3184
<https://ahc.alabama.gov>

Alabama Soil and Water Conservation Committee
P.O. Box 304800
Montgomery, Alabama 36130-4800
Phone: 334/242-2620
Fax: 334-242-0551
<https://alabamasoilandwater.gov/>

Geological Survey of Alabama
420 Hackberry Lane
Tuscaloosa, Alabama 35401
(205) 349-2852
<https://www.gsa.state.al.us/>

Soil and Water Conservation Districts

A Soil and Water Conservation District is located in each county and usually listed in the phone book with the other local government offices.

U.S. Army Corps of Engineers

Mobile District

109 St. Joseph St
Mobile, AL 36628-0001
[251-690-2505](tel:251-690-2505)
CESAM-PA@usace.army.mil
<https://www.sam.usace.army.mil>

Nashville District

110 9th Ave S
Nashville, TN 37203
[615-369-7500](tel:615-369-7500)
NashvilleRegulatory@usace.army.mil
<https://www.lrd.usace.army.mil/About/Districts/Nashville-District/>

U.S. Dept. of Agriculture – Natural Resources Conservation Service

Alabama State Office
3381 Skyway Drive
P. O. Box 311
Auburn, AL 36830
1-800-342-9893
<https://www.nrcs.usda.gov/wps/portal/nrcs/site/al/home/>

In addition, a Field Office of the Natural Resources Conservation Service is located in most counties (if not, a contact can be made through the local soil and water conservation district office)

U.S. Dept. of Interior - Fish and Wildlife Service
Daphne Ecological Services Field Office
P.O. Drawer 1190
1208-B Main Street
Daphne AL 36526
251-441-5181 phone
251-441-6222 fax
<http://www.fws.gov/daphne/>

US Environmental Protection Agency
Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW #9
Atlanta, GA 30303
404-562-9900
1-800-241-1754
<https://www.epa.gov/aboutepa/about-epa-region-4-southeast>

CAD Drawings

Drawings prepared using AutoCADD Civil 3D and located in related practices.

Check Dam – Wattle	
Inlet Protection – Block and Gravel 1	
Inlet Protection – Block and Gravel 2	
Inlet Protection – Sand Bag	
Inlet Protection – Silt Fence	
Inlet Protection – Wattle	
Figure BFB-1	Typical Brush Fabric Barrier
Figure CD-1	Profile and Cross-Section of Typical Rock Check Dams
Figure CD-2	Profile of Typical Rock Check Dams
Figure CD-3	Wattle Check Dam (ditch check)
Figure CD-5	Silt Fence Check Dam Cross-Section
Figure CD-6	Silt Fence Check Dam Plan View
Figure CD-8	Sand Bag Check Dam Cross-Section
Figure CD-9	Sand Bag Check Dam Plan View
Figure CEP-1	Gravel Construction Exit
Figure CEP-2	Construction Exit with Wash Rack
Figure DS-1	Straight Pipe Structure
Figure DS-2	Pipe Drop Structure
Figure DSF-1	Typical Dune Erosion Control System with Sand Fence
Figure DV-2	Typical Diversions Detail
Figure DW-1	Typical Dune Walkover System
Figure GS-1	(Vol. II) Typical Trapezoidal Grass-lined Channel
Figure GS-1	Typical Grass Swale Cross section
Figure OP-4	Paved Channel Outlet
Figure PP-1	Typical Section of Porous Pavement with Buried Stone Reservoir
Figure PP-2	Typical Porous Pavement Design
Figure PV-1	Fencing and Armoring
Figure PV-2	Tree Well
Figure PV-3	Tree Well Detail
Figure PV-4	Tree Wall Detail
Figure RD-1	Typical Front View of Rock Filter Dam
Figure RD-2	Typical Section of Rock Filter Dam
Figure SB-3	Silt Fence-Type A
Figure SB-4	Type A Silt Fence Overlap
Figure SB-5	Silt Fence - Type B
Figure SB-6	Silt Fence Installation Details for Type B
Figure SBN-1	Porous Baffle in a Sediment Basin
Figure SBN-2	Cross-Section of a Porous Baffle in a Sediment Basin
Figure SBN-5	Excavated Grass Spillway Views
Figure SBN-6	Example of a Sediment Basin with a Skimmer Outlet and Auxiliary Spillway
Figure SD-1	Details of Typical Subsurface Drain Construction
Figure SD-2	Details of Subsurface Drain Construction

Figure SDB-1	Typical Stormwater Detention Basin / Sediment Basin Components
Figure SDB-2	Typical Dry Stormwater Detention Basin Components
Figure SDB-3	Typical Wet Stormwater Detention Basin Components
Figure SDC-1	Typical Stream Diversion Channel Layout
Figure SOD-2	Typical Installation of Grass Sod
Figure SOD-3	Installation of Sod in Areas with Channel Flows
Figure SP-1	Vegetative Zones for Streambank Protection
Figure TP-1	Tree Planting Diagram
Figure TSC-1	Culvert Stream Crossing
Figure TSD-1	Typical Temporary Slope Drain Detail
Figure TSD-2	Flared End-Section Detail
Figure TSD-3	Flared End-Section Details (continued)

Local Information